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Essays in Generational, Labor and Development Economics

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To Hisham,
my anchor in rough waves,
my bliss.

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General introduction and summary

This doctoral thesis explores topics in three varying areas. Each topic stems from an interest that was cultivated by growing up in my home country, Bahrain, living and learning in Europe and the U.S. and witnessing the Arab Spring throughout. In many ways, the research questions tackled in this thesis are personal, enriched by the intellect and dedication of my colleagues. As my own knowledge and understanding of economics evolved throughout the years, so have these chapters.

The diversity of this thesis, however, is not only in the topics examined, but also in the methods used to answer their research questions. Whereas the first chapter uses a purely theoretical approach with analytic solutions, and the second calibrates and simulates a theoretical model, the third and final chapter relies only on empirics. While this was not a deliberate decision, this diversity has greatly increased my own understanding of economics, and hopefully enhanced the quality of the research in the process.

Chapter 1, titled “Intrahousehold transfers, inheritance and implications on inequality,” explains a change in the composition of private intergenerational transfers over time. Evidence from the National Transfer Accounts (NTA) of France during the period 1979-2011 shows that while these transfers have remained relatively stable as a share of Gross National Product, their composition has changed: from more intrahousehold transfers in the 1980s to more inheritance in the new millennium. This has consequently decreased the intrahousehold transfers-to-inheritance ratio over time.

My co-author, Nhung Luu, and I explain this trend utilizing a three-period overlapping generations (OLG) model, where individuals go through childhood, working-age and old age. Individuals can fall under one of two dynasties that capture an important heterogeneity in the model: an “altruistic” dynasty that prefers to bequeath and consequently saves and transmits inheritance to those in working-age, and an “egoistic” one that does not. Those that bequeath do so out of a “joy of giving” motive. However, both dynasties, transmit intrahousehold transfers, flowing from working-age to childhood, which in turn increases the human capital accumulation of the child and impacts future labor income. However, the human capital of the individual is not only a function of the intrahousehold transfers that he/she receives, but also the economy-wide human capital, which includes that of the other dynasty. This allows for a link between the two dynasties and emphasizes the fact that these two private intergenerational transfers have different roles to play.

The evolution of the economy can be expressed as a function of wealth inequality, which we define as the ratio of the altruistic dynasty's physical capital to that of the egoistic one. Wealth inequality, therefore, can be understood as one of two cases: (1) the altruistic dynasty holds more capital than the egoistic one, meaning inequality is greater than 1, or (2) the egoistic dynasty holds more capital than the altruistic one, meaning inequality is less than 1.

Solving this framework analytically allows us to make several propositions. Firstly, there is a unique steady-state value of inequality in the long-run such that capital saved by both dynasties is positive. However, whether this long-run inequality is greater than or less than one depends on the parameters of the model, and in particular the preference to bequeath and the share of intrahousehold transfers in the accumulation of human capital.

Secondly, there exists a threshold of bequest preference and of the share of intrahousehold transfers in human capital accumulation such that the long-run inequality is greater than 1, meaning that the altruistic dynasty holds more physical capital than the egoistic one. Otherwise, the opposite is true.

In the short-run, the decrease in the intrahousehold transfers-to-inheritance ratio that we see in the data can be attributed to a rise in wealth inequality between the two dynasties. Wealth inequality in France during the same time has in fact been rising, and the data shows that people that bequeath tend to have more capital than those that do not.

This chapter, therefore, argues that one potential explanation of the change in the composition of private intergenerational transfers in France is a process of increasing wealth inequality that is currently lower than that of the steady-state, given certain parameter values. However, we also argue that this is influenced by both the preference to bequeath and the role of intrahousehold transfers in human capital accumulation, and that a regime change of inequality is possible depending on these parameters.

Chapter 2, titled "The demographic boom and the rise of informality: The case for Egypt," examines the role that the demographic boom can play in the prevalence of informal employment, with the context of Egypt in mind. In the past couple of decades, Egypt has seen a rise in informal employment, defined as lacking social security, that was particularly higher for the young, and did not spare the better-educated. This demographic boom also came with a change in the skill composition of the workforce towards higher education.

Co-authored with Alexandre Ounnas and Bruno Van der Linden, we introduce a multi-sectoral model that consists of three distinct sectors: (1) an exogenous government sector that is preferred by all workers, in line with the literature on Egypt, (2) a private formal sector that incurs search-and-matching frictions, in addition to sluggish vacancy creation and taxes and, (3) a perfectly competitive informal sector that can absorb all those that want to work but are not employed by either of the first two sectors. The private formal and informal sectors together produce an aggregate consumption good and are consequently linked to each other.

Workers in the model belong to overlapping generations, and are either high- or low-skilled, determined exogenously. Each age has a certain survival probability, and all workers exit the market at a later stage. Workers can be in one of three states: (1) being employed in the government sector, (2) being employed in the private formal sector or, (3) being non-formal, which is a state that combines both informal work and home production.

We show that a temporary demographic boom of better-educated workers, like the one that Egypt has witnessed throughout the years, can have long-run effects on non-formality rates. These non-formality rates interact with output and prices.

The numerical analysis shows four main channels through which this size and compositional change operate. The first channel is a pure compositional effect, which shifts the population shares towards younger workers for which the prevalence of non-formality is higher. As these demographic boom generations exit the market, this channel disappears. The second channel comes as a congestion effect that originates from the search-and-matching assumption of the private formal sector. Large inflows of high-skilled workers decrease labor market tightness and the job-finding probability. This can have long-lasting effects that do not necessarily go back to pre-boom levels. The third channel relates to production, where more high-skilled workers raise their output in the production function, and consequently lower the prices of their high-skilled intermediate goods, which in turn lowers the private formal wage and reduces incentives to join the private formal sector. The fourth and final channel is the adjustment of vacancy creation, which is influenced by the fixed cost that entrepreneurs incur to open a vacancy.

Moreover, the results show that non-formality rates peak as the demographic boom generation gets older. This may indicate a potential "scarring effect," where young workers that experience higher non-formality rates at entry suffer from long-term negative effects related to this initial state.

We contrast this dynamic adjustment with several scenarios. We show that in the absence of the demographic boom, the economy-wide non-formality rate would have been slightly higher, but the non-formality rate of the high-skilled would have been markedly lower. In contrast, the non-formality rate of low-skilled workers would have been higher.

Simulating a demographic boom without a change in the skill composition would, on the other hand, have increased the economy-wide non-formality rate significantly, driven largely by the higher non-formality rate of the low-skilled. The change in the skill composition in favor of the high-skilled, therefore, was arguably an important element in reducing the average rate of non-formality in Egypt over the years, given the fact that the high-skilled face lower non-formality rates in general.

Finally, when we allow for more vacancy creation in the economy, the results show that the economy-wide non-formality rates would have been significantly lower, and in particular for the high-skilled.

This chapter shows, therefore, that a demographic boom and a change in the skill composition of the workforce due to better educated new entrants can have long-lasting effects on the labor market, and in particular on the non-formality rate. It also shows how these effects come into play and how easing vacancy creation could have had a significant impact on the reduction of non-formality.

Finally, Chapter 3 is titled "Exploring heterogeneity of micro and small enterprises in Morocco," and is single-authored. It examines the diversity of micro and small enterprises (MSEs), which constitute a significant share of firms in the country and employ the vast majority of the labor force.

To characterize this heterogeneity, I utilize and expand upon the empirical method proposed in similar literature. MSEs in Morocco are grouped into three categories: (1) "top performers," which excel in a chosen criteria, (2) "potential gazelles," which have similar entrepreneur and enterprise characteristics to the first group but are not performing as well, and (3) “others,” which differ in most, if not all, aspects and look more like survival-oriented firms. To group these firms, I use a relatively unique survey that includes more than 5,000 micro and small enterprises in the country, conducted in 2004.

To identify top performers, I choose a benchmark double-criteria of firms that have the highest number of workers and the highest value-added per worker, making up about 13% of the firms in the sample. I run a probit model on top performance using several predetermined and arguably exogenous regressors. However, recognizing that the sector of economic activity, which is one of the regressors, is potentially endogenous, I also regress sector choice on several variables and allow for the error term of this specification to be correlated with that of the top performance probit. This allows for the idea that there may be some unobservables that affect the probability of firms in one sector to be top performers, more than firms in other sectors. These steps can be captured through a conditional mixed process.

From the predicted probabilities of this empirical strategy, I identify the group of potential gazelles as one that has the same average predicted probability of being a top performer as the group of top performers. On the other hand, the group of “others” makes up the rest of the observations. This process means that, on average, the group of potential gazelles have similar predetermined characteristics (the regressors) to the group of top performers.

I then descriptively compare the three groups of firms based on various aspects: what relates to the entrepreneur, the enterprise, access to credit, management practices, network, and finally access to infrastructure.

The results show that the group of top performers tend to do favorably on almost all aspects, when compared to potential gazelles and “others.” Their entrepreneurs are better educated. Their enterprises are older, hire more workers, pay their workers wages that are on average higher and have in general better financial outcomes. A higher share of these top performers, compared to the other two groups, have access to credit, especially from formal institutions. They tend to keep records of their business activities. They tend to provide their workers with written contracts, paid vacations and training. Moreover, a higher share of them report being part of business associations, firm clusters and have links with other businesses. They also appear not to struggle when it comes to access to infrastructure.

Potential gazelles, which make up about a fifth of the firms, while similar in a number of entrepreneur and enterprise characteristics to top performers, appear to choose their sectors differently, and appear to be constrained along the lines of access to credit (and the type of credit), as well as linking with other businesses (what is deemed as “network”).

Moreover, they tend to pay their workers less wages on average, not only when compared to top performers but also to "others," which may indicate a propensity to retain earnings for business growth. They also appear to struggle in the other two areas that relate to management and access to infrastructure. However, despite these constraints, they still perform better than the group of "others" in almost all areas. These results are largely similar when the definition of top performance is changed using other criteria.

Going beyond the overall sample, I then exploit the existence of formal and informal firms in the survey. Defining formal firms as those that have a tax identification number, I run four regressions simultaneously that are inspired by the empirical strategy mentioned before. The first regression replicates the specification of top performance but this time restricted only to formal firms; the second regression replicates it for informal firms only; the third regression accounts for sector selection as mentioned above, while the fourth accounts for the choice to be formal or informal (i.e. the switching model). I group the firms based on their formality/informality status into top performers, potential gazelles and "others," as previously mentioned.

The results show that while sector selection was important when looking at the overall sample, it is insignificant when segregating the sample by formality/informality. This indicates that sector choice affects top performance because formal and informal firms choose their sectors differently.

While the characteristic differences between formal categories of firms are largely similar to what is seen in the overall sample, heterogeneity is much less apparent among informal firms. It is as if there is a small number of informal firms, an upper echelon, that appear to be able to compete with formal firms, but the rest of these informal firms are very different and more disadvantaged.

These results highlight some key policy implications. Firstly, not all top-performing firms are necessarily formal, but sector choice differs between formal and informal firms. Secondly, potential gazelles, if properly identified, can especially benefit from better access to credit and to networks, but also to infrastructure and to better management practices. Thirdly, there is a significant share of MSEs in Morocco that could benefit from social protection programs as opposed to business development, especially those that are informal, since they appear significantly disadvantaged.

Chapter 1

Intrahousehold transfers, inheritance and implications on inequality

Nhung Luu and Dalal Moosa

Abstract

Evidence from the National Transfer Accounts (NTA) during the period 1979-2011 shows a notable change in the composition of private transfers between generations in France, from more intrahousehold transfers to more inheritance. We explain the change in this composition through an overlapping generations model where two dynasties have different preferences to bequeath and where these two private transfers occur at different points in time and serve different purposes. In the short-run, the change in the composition can be attributed to a rise in wealth inequality. Using simple numerical illustrations, we show that an increase in either of the two key parameters of the model (the preference to bequeath and the elasticity of intrahousehold transfers in human capital accumulation) can lead to an increase in wealth inequality and consequently a change in the composition of transfers. In the long-run, wealth inequality persists in the economy, but the inequality regime can switch in favor of one dynasty over another depending on these parameters.

1.1 Introduction

Research interest in private transfers between generations over the past few decades has focused largely on two types of financial transfers: (1) bequest, which are post-mortem, and (2) sizeable inter-vivo gifts, often made by living individuals to younger generations at later points in life, such as the transfer of real estate ownership. Both of these transfers tend to be between households, meaning *interhousehold*, and are often lumped under the term "inheritance" - a term we also adopt in this paper.

Inheritance has been argued to play an important role in wealth accumulation. It has been estimated to contribute to about 80% of the stock of wealth in the U.S. in the 1970s (Kotlikoff and Summers (1981)),[1] and up to two-thirds of private wealth in France by 2010, with a rising share in other European countries such as Germany, Britain and Sweden post World War II (Piketty and Zucman (2015)).

We argue, however, that despite the importance of inheritance, there is a significant share of private intergenerational transfers that has received much less attention in the literature, which are *intrahousehold* transfers. These are transfers made within the household, often from older generations, such as parents, to younger ones, especially offspring during their childhood and teenage years. They include expenditure on children's food, clothing and even for shelter.

New data from the National Transfer Accounts (NTA) highlights the nontrivial size of these intrahousehold transfers in France over time. Moreover, thanks to the long series of inheritance data in the country, the NTA database uniquely combines these flows, giving for the first time a comprehensive view of private intergenerational transfers over time, which we exploit in this paper.

The results show an interesting trend. While the sum of these two transfers has remained relatively stable as a share of national income between 1979 and 2011, the composition has changed: from a dominant share of intrahousehold transfers in the 1980s and 1990s to a less dominant one in later years, leading to a decrease in the ratio of intrahousehold transfers to inheritance over time.

A change in fertility rates is unlikely to explain this trend for two reasons. Firstly, while total

[1] This share was estimated at only 20% by Modigliani (1988) due to the different treatment of areas such as durable goods, children's university fees and accrued interest on the stock of wealth (Gale and Scholz (1994))

fertility rate (TFR) has decreased from the 1960s to today, it was relatively stable during the period of interest, at about 1.8-2.0 children per woman. Secondly, the data shows that there was a general increase in received intrahousehold transfers per young person, namely 0-19 year-olds, that typically receive these transfers. This means that parents tended to increase transfers per child even when they had fewer children - a trend observed in the literature as well. However, despite the increase in per capita transfers for this typical age-group, inheritance increased much faster. This result remains the same even when we account for the rise in the population of those that typically make (and receive) inheritance, i.e. the older generations. This implies that even when we account for a demographic change, the trends remain relatively the same and the ratio of intrahousehold transfer to inheritance increases over time (Refer to Figure 1.12 in the Appendix).

Moreover, a change in inheritance tax is also unlikely to explain this trend. In fact, inheritance tax has increased significantly in France since the 1960s (Piketty (2011)), which would have theoretically discouraged inheritance rather than increased it.[2]

In this paper, we argue that the change in the intrahousehold transfers-to-inheritance ratio can be explained by a difference in individuals' saving behaviors in the context of rising inequality between agents. To make this argument, the paper introduces an overlapping generations model that includes both of these private transfers at the same time. We allow for heterogeneous preferences to bequeath, with one "altruistic" dynasty that transmits inheritance and another that does not. Moreover, we also allow for differences in the role that each of these two transfers play. Inheritance is modeled as additional income received during the middle of life, in line with the empirical evidence from the NTA, while intrahousehold transfers come to support children's consumption, modeled through the production of human capital - a set-up similar to Becker and Tomes (1986). These various sources of heterogeneity affect agents' savings behaviors. Inequality, seen as the ratio of capital accumulated by each of the "altruistic" and "egoistic" agents, can be shown to play a key role in the evolution of intrahousehold transfers-to-inheritance ratio in the short- and long-run.

The link between inequality and inheritance is not new. In fact, inheritance has been argued, from early on, to contribute to an increase in wealth inequality (Stamp (1926), Wedgwood (1929), Blinder (1976) and Harbury and Hitchens (1979)). Davies (1982) found that inheritance transferred from parents to children can have a "disequalizing" effect on current wealth, measured through an increase in the Gini coefficient for Canada. Gokhale et al.

[2] Further discussion on the role of taxation in the theoretical model and the latest change of the wealth tax in 2017/2018 can be found in Section 1.5

(2001) highlighted that bequest can propagate wealth inequality, even when accounting for several things such as skill heterogeneity, assortative mating and social security. Moreover, De Nardi (2004) showed through a quantitative general equilibrium model for both the U.S. and Sweden that bequests help explain the emergence of large estates and wealth accumulation, and consequently the inequality seen at the time. Davies and Shorrocks (2000) argued that bequest is a crucial element in accurately measuring wealth distribution and inequality.

These findings can be explained by the fact that when inheritance is treated as a luxury good, individuals and households with higher lifetime incomes tend to have higher savings rates and consequently leave more wealth to their offspring, who, in turn, tend to do the same for the following generations. In the long-run, wealth becomes accumulated and transmitted across generations through bequest, leading to persistent inequality.

At the same time, the link between intergenerational transfers, human capital and impact on inequality is also not new. Ishikawa (1975), for instance, argued that accounting for intergenerational transfers for education and bequest can lead to strongly or weakly stratified societies in the long run, with the rich accumulating capital through inheritance and higher education, and the poor having little of either. Becker and Tomes (1986) argued that the degree of intergenerational mobility, and consequently the rise and fall of families, depends on endowments transmitted from parents and investment opportunities for each generation. Chanda (2008) argued that human capital investments can crowd out physical capital due to a rise in returns to education, as seen in the US, which can potentially reduce inequality.

This paper recognizes these various elements. Its contribution is threefold. Firstly, it introduces new evidence from the National Transfer Accounts on the trend of inheritance and intrahousehold transfers in France in the period 1979-2011, emphasizing the change in the composition of these private intergenerational transfers over time. As far as we know, this trend has not been previously noted in the literature. Secondly, it explains this trend by using an overlapping generations model that mixes these two transfers at the same time, allowing them to serve different purposes and linking them to inequality, all of which have also not been combined in the OLG literature as far as we know. Thirdly, in setting up this framework and its consequences on the intrahousehold transfer-to-inheritance ratio, it also shows the conditions in which inequality is inverted between agents, with the richer becoming poorer and vice versa. This, too, is a novel feature of the paper.

The model shows that heterogeneity in the preference to bequeath and differences in the purpose of these two intergenerational transfers can lead to an increase in wealth inequality and a decrease in the ratio of intrahousehold transfers to inheritance in the short run. We show that given these differences, long-run inequality exists, but, more importantly, a change in the inheritance preference beyond a certain threshold and a change in the returns to intrahousehold transfers in human capital accumulation can lead to notable changes in long-run wealth accumulation and consequently the richness/poverty of agents.

The rest of the paper is structured as the following. Section 1.2 introduces the National Transfer Accounts (NTA) database and displays the main motivating facts for this research. Section 1.3 delves into the model set-up and its results regarding steady-state inequality and the dynamics of intrahousehold transfers-to-inheritance ratio, which help us explain what we see in the data. Section 1.4 shows some comparative statics. Section 1.5 further discusses these results and their assumptions. Finally, Section 1.6 concludes.

1.2 Motivating facts: Evidence from the National Transfer Accounts

The National Transfer Accounts (NTA), launched in the early 2000s, disaggregates economic flows seen in the System of National Accounts (SNA) into various ages. In doing so, it allows for a better understanding of how people earn, consume, share and save their income across time, on a macroeconomic level. This can be useful in shedding more light on intergenerational (re)allocations and various transfers.

Based on lifecycle theory, the NTA quantifies the lifecycle deficit (or surplus) for each age, which is the difference between consumption and labor income. Children, for example, have lifecycle deficits because they do not earn any labor income, whereas working-age adults often have lifecycle surpluses. At each age, an individual can bridge (reallocate) this deficit (surplus) through three main channels: (1) public transfers, both cash and in-kind; (2) private transfers, within and between households (which exclude the inheritance flows introduced in the paper); and (3) asset-based reallocations such as financial income and savings (NTA Manual (2013)). This can be seen through the NTA Identity below:

$$C_{a,t} - L_{a,t} = \underbrace{T_{a,t}^{+public} - T_{a,t}^{-public}}_{\text{net public transfers}} + \underbrace{T_{a,t}^{+private} - T_{a,t}^{-private}}_{\text{net private transfers}} + \underbrace{A_{a,t}^{+} - A_{a,t}^{-}}_{\text{net asset based reallocations}}$$

where a denotes age, t denotes time, $+$ stands for received and $-$ stands for given. Net transfers and reallocations are the difference between what is received and what is transferred.

Public transfers in the NTA includes what individuals give in terms of taxes and what they receive in various subsidies and social security support, for instance. Private transfers include what is transmitted for purposes such education, healthcare, imputed rent[3] and all other types of consumption. Asset-based reallocations are largely intertemporal and can be divided into capital income and property income, both public and private.[4] These various flows are calculated using administrative records, household surveys and various other surveys that may be country- and time-specific (United Nations (2013)).

Due to the growing use of the NTA methodology across countries, the database can offer some unique perspectives on how people earn, consume, and reallocate their resources (d'Albis and Moosa (2015) and Lee and Mason (2011)). In France, for example, the NTA data show that the age profile of per capita consumption, in real terms, has not changed drastically between 1979 and 2011, while the age profile of labor income shifted towards higher ages, in line with increasing years of education (d'Albis et al. (2015)).

However, more relevant to the purposes of this paper is the magnitude and trend of private transfers, which have often been difficult to quantify on an aggregate level prior to the NTA. These private transfers, more specifically, include two categories: (1) Intrahousehold transfers, i.e. those given and received within one household, which often mean a family; (2) Interhoushold transfers, i.e. between households, which include "regular" and "occasional" cash transfers, as well as "in-kind" transfers. Some of these transfers are estimated using survey data, but the majority is calculated as a residual after estimating the consumption of the individuals in the household and their incomes.

For children, who are the primary recipients of these transfers as will be shown below, these transfers come to bridge the gap between their private consumption and their (lack of) labor income. In France, the sweeping majority of children's private consumption is in areas other than private education expenditures and private healthcare (refer to Figure 1.13 in Appendix 1.7). Consequently, these transfers effectively serve to support children's food, shelter, clothing and everything else.

[3]Imputed rent is the use or consumption of owner-occupied housing. In the NTA it is calculated through the rental price of similar property at the time.

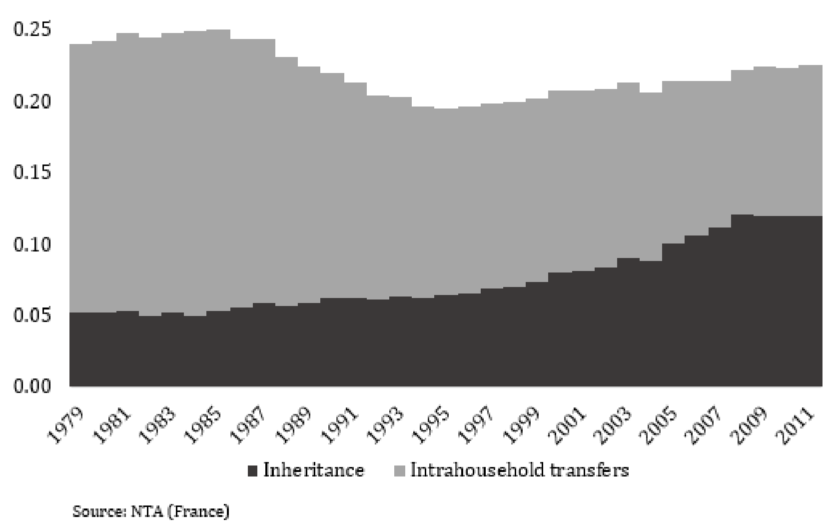
[4]While public capital income is quite negligible, public property income includes things such as public debt, sovereign wealth funds income and, in the special case of the U.S., student loan programs. Private capital income includes housing and consumer durables, while private property income includes consumer debt, land and subsoil minerals.

The data show that "interhousehold" transfers as captured by the NTA are generally small, making up at most a tenth of the total intra- and interhousehold transfers during the period 1979-2011. For ease of reference, they are dropped from the following analysis, where we focus on intrahousehold transfers and inheritance flows.

The NTA France database was also able to provide age-profiles of bequest and inter-vivo gifts, referred to here as "inheritance", utilizing estimates from a series of works on France by Thomas Piketty (Piketty (2011), Piketty et al. (2014) and Piketty (2014)). While they can also be categorized as "interhousehold", they are not typically included in the NTA database for various reasons, including a lack of data. The availability of this data for France allows us to expand the analysis and incorporate more holistically all (monetary) intergenerational flows.

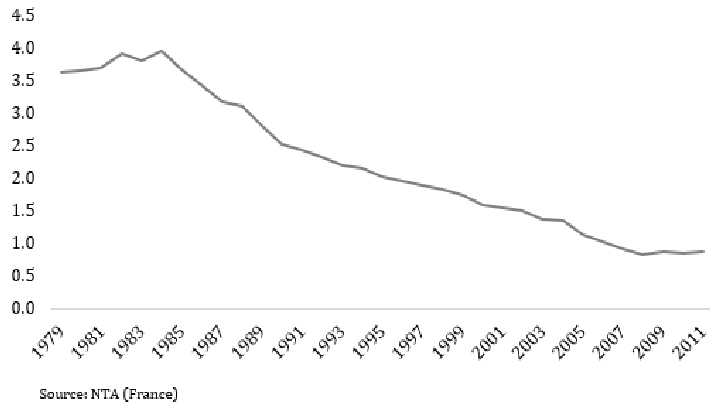
The trend and composition of these two types of private transfers show several important trends. The first is that the sum of these flows has remained a relatively stable share of Gross National Income in France, from about 25% in 1979 to a little over 22% in 2011, with a small dip in the late 1990s, as shown in Figure 1.1.

Figure 1.1: Received private transfers by type as a percentage of GNI



The second is that despite their relatively stable share, the composition of these transfers has changed over time, with a decrease in the share of intrahousehold transfers in overall private transfers. Consequently, the ratio of intrahousehold transfers-to-inheritance has declined, from about 3.6 in 1979 to less than 1 in 2011, as seen in Figure 1.2. This is a ratio of great interest to the purposes of this paper as it captures the change in the composition over time, which we can explain through the theoretical model.

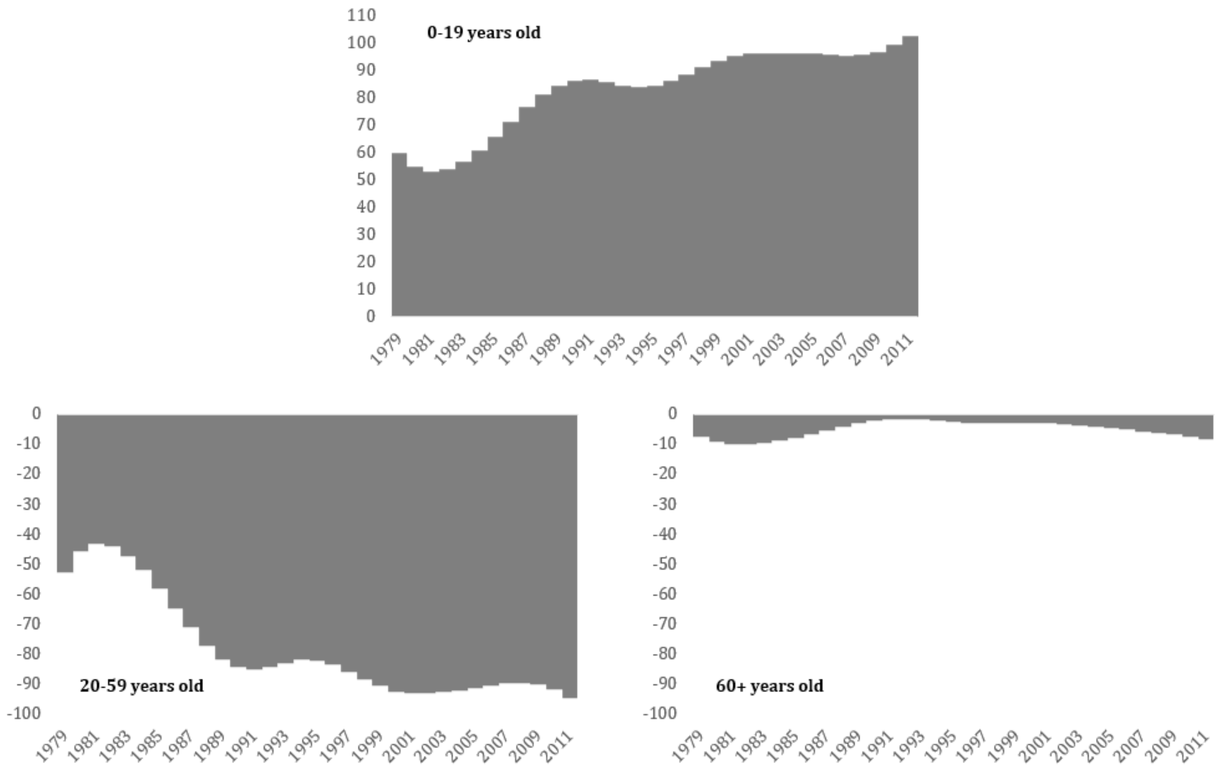
Figure 1.2: Ratio of intrahousehold transfers to inheritance



The NTA data also point to the directionality of intrahousehold transfers and inheritance. The working-age population, which is defined conservatively here as those 20-59 years old, is an important net giver of intrahousehold transfers, contributing an average of 93% between 1979 and 2011. Net recipients of these transfers are the younger age groups, mostly those that 0-19 years old, as shown in Figure 1.3. This directionality does not change if we look at net transfers in terms of per capita of each group to account for demographic changes of the groups (as shown in Figure 1.14).[5] The oldest age group, 60+ is a minor net giver of intrahousehold transfers.

[5]If we define the working-age group as those 30-59 years old, or even 20-49 years old, for instance, the same conclusion holds.

Figure 1.3: Net intrahousehold transfers by broad age-group (billion real euros)

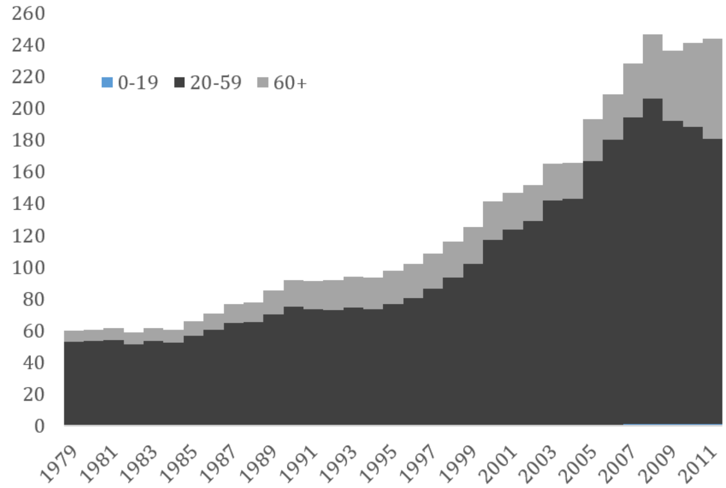


Source: NTA (France)

Inheritance, on the other hand, has been mostly received over the years by both the "working-age" population, in addition to a smaller share received by the oldest generation that is 60+ years old, as shown in Figure 1.4. In fact, over the years, the working-age population has received an average of about 80% of inheritance. The NTA profiles also show that the highest value of received inheritance has not only increased over time, but has also been delayed over time. This means that individuals are now receiving more money at later ages (the age profile of inheritance can be seen in Figure 1.15 in Appendix 1.7). This is in line, of course, with rising life expectancy. This does not change if we look at flows in terms of per capita of the recipient (as shown in Figure 1.16 in Appendix 1.7).[6]

[6]Unfortunately, the data does not include the age-profile of those transmitting inheritance flows.

Figure 1.4: Received inheritance by broad age-group (billion real euros)



Source: NTA (France)

The final stylized fact that we make use of relates to the evolution of wealth inequality in France over time. Data from the World Inequality Database (WID) show that the Gini coefficient of wealth inequality has increased during the period that we consider in this paper, from 0.66 in 1979 to 0.7, with some variation in between, as shown in Figure 1.5. The share of wealth by the top decile and the top percentile of the population has increased. This is a fact that we exploit in the theoretical model in the following section, where we link private intergenerational transfers to wealth inequality.

Figure 1.5: Gini coefficient of wealth in France

Source: World Inequality Database (WID)

1.3 The model

We consider an economy of overlapping generations in discrete time, akin to Diamond (1965). Economic growth is endogenous and driven by human capital accumulation. Generations are linked to each other through altruism for various transfers, and they make up “dynasties.” Production, on the other hand, is made through a representative firm, which operates in perfect competition and produces with constant returns to scale. Below, we set-up the model and show its main conclusions.

1.3.1 Model set-up

1.3.1.1 The individual

Each individual in this model lives for three periods: childhood, adulthood and old age. For ease of notation, we assume that children are born at time $(t-1)$. However, decisions are taken by adults for their children and their old age at time (t).

There exists in each period two types of dynasties in the economy indexed by $i = \{1, 2\}$, which differ in their desire for bequest. Dynasty $i = 1$, which makes up a fixed proportion p of the population, where $p \in (0, 1)$, is egoistic and, therefore, does not make any bequest, whereas dynasty $i = 2$, with a proportion $1 - p$ of the population, has a desire to bequeath. This heterogeneity in the desire to bequeath is also found in the data, pioneered by Laitner and Juster (1996), who found this heterogeneity when examining a sample of pension holders in the U.S. Kopczuk and Lupton (2007), using a similar method but a different dataset, also found this heterogeneity, with about three-quarters of the elderly population having a bequest motive that caused them to reduce their consumption and transfer inheritance to the following generation.[7]

We assume, for further simplicity, no population growth, and thus population size is normalized to 1 over time.

Besides decisions pertaining to consumption and savings, individuals also make decisions regarding two kinds of intergenerational transfers. The first are transfers in the form of inheritance, denoted (b), which are made at old age to the middle age-group (adulthood).

[7] Based upon their suggestion, in the following simulation part, we will choose $p = 0.3$ which represents the proportion of the egoistic family in the society.

The second are intrahousehold transfers made by adults for children, denoted (m). These transfers are used solely for the development of children's human capital, and they should be positively correlated with the child's future labor income.

We assume, however, that the human capital of the individual does not only depend on these parental intrahousehold transfers, which are specific to dynasty i, but also on the average stock of human capital in society. This assumption is in line with the "external effect" argued originally by Lucas Jr (1988) and later integrated into models as in Tamura (1991) and Bovenberg and van Ewijk (1997). These models suggest that the average stock of human capital in society does not only affect the individual's human capital, but also by extension the productivity of all factors of production.[8] It is also in line with the idea that individuals do not start with a clean slate, or zero human capital, when they are born, but that they are endowed from the beginning with a certain level of human capital that is best approximated by the average human capital in the economy (see, for example, Glomm and Ravikumar (1997) and de la Croix and Michel (2007)).

Therefore, the human capital, H, of an adult at time t of dynasty i can be expressed as a function of the previous period's average human capital and the intrahousehold transfers received at childhood, as the following:

$$H_{i,t} = m_{i,t-1}^{\lambda} H_{t-1}^{1-\lambda}, \quad \lambda \in (0,1) \tag{1.1}$$

where λ is the elasticity of human capital accumulation with respect to intrahousehold transfers - a crucial parameter in our model.

For every efficient unit of labor, an adult receives a wage w_t that entails a gross labor income of $w_t H_{i,t}$, as well as bequest from the older generation, $\beta_{i,t}$. From this inflow of income, he/she decides to consume $c_{i,t}$, to save $s_{i,t}$ and to invest in children $m_{i,t}$. At old age, the individual allocates from his/her capitalized savings, $R_{t+1}s_{i,t}$, how much to consume, ($d_{i,t+1}$), and how much to bequeath to the adult generation, $b_{i,t+1}$.

We denote V_t^i the utility of an adult of dynasty i and assume that it is a logarithmic function. The individual, therefore, maximizes the utility function, V_t^i, as the following:

$$\max_{c_{i,t},m_{i,t},d_{i,t+1},b_{i,t+1}} \ln(c_{i,t}) + \theta \ln(m_{i,t}) + \beta \ln(d_{i,t+1}) + \beta\gamma_i \ln(b_{i,t+1}) \tag{1.2}$$

[8] Note also that the average stock of human capital in society is found empirically to be significant and positive for productivities and incomes across countries (Benhabib and Spiegel (2005)).

where θ captures the preference to give intrahousehold transfers, β captures time preference, and γ_i captures the intergenerational degree of altruism of dynasty i. We assume that $\gamma_1 = 0$ for the egoistic dynasty, and $\gamma_2 = \gamma \in (0, 1)$ for the altruistic dynasty. Note that this formulation expresses the inheritance motive as a "joy of giving," as proposed by Yaari (1964). This is a common expression for altruism in the literature due to its tractability (Abel and Warshawsky (1987)).

The budget constraints for a type i individual are as follows:

$$c_{i,t} + s_{i,t} + m_{i,t} \leq w_t H_{i,t} + b_{i,t} \tag{1.3}$$

$$d_{i,t+1} + b_{i,t+1} \leq s_{i,t} R_{t+1} \tag{1.4}$$

where R_t and w_t are the rate of return on capital and wage per effective labor unit, respectively. We assume that at time 0, $s_{i,0}$ and $H_{i,0}$ are given.

From the first-order conditions we can derive optimal consumption, savings, intra-household transfers and inheritance for type i at time t as follows:

$$c_{i,t} = \frac{1}{1 + \theta + \beta(1 + \gamma_i)}(w_t H_{i,t} + b_{i,t}) \tag{1.5}$$

$$m_{i,t} = \frac{\theta}{1 + \theta + \beta(1 + \gamma_i)}(w_t H_{i,t} + b_{i,t}) \tag{1.6}$$

$$d_{i,t+1} = \frac{\beta R_{t+1}}{1 + \theta + \beta(1 + \gamma_i)}(w_t H_{i,t} + b_{i,t}) \tag{1.7}$$

$$b_{i,t+1} = \frac{\beta \gamma_i R_{t+1}}{1 + \theta + \beta(1 + \gamma_i)}(w_t H_{i,t} + b_{i,t}) \tag{1.8}$$

Given differences in the preference to bequeath, optimal inheritance for each dynasty can be more clearly expressed as the following:

$$b_{1,t+1} = 0 \tag{1.9a}$$

$$b_{2,t+1} = \frac{\beta \gamma R_{t+1}}{1 + \theta + \beta(1 + \gamma)}(w_t H_{2,t} + b_{2,t}) \tag{1.9b}$$

Note that given the logarithmic utility function, optimal inheritance and intrahousehold transfer will always be an interior solutions. This means that the set-up of the model does not allow for negative bequest and transfer.

The savings function for each dynasty can be derived as follows:

$$s_{1,t} = \frac{\beta}{1+\beta+\theta} w_t H_{1,t} \tag{1.10}$$

$$s_{2,t} = \frac{\beta(1+\gamma)}{1+\theta+\beta(1+\gamma)} (w_t H_{2,t} + b_{2,t}) \tag{1.11}$$

Due to our logarithm utility function, it is no surprise that the optimal level of our control variables is always proportional to the agent's wealth, $(w_t H_{i,t} + b_{i,t})$. Additionally, note that that:

$$\frac{\beta(1+\gamma)}{1+\theta+\beta(1+\gamma)} > \frac{\beta}{1+\beta+\theta}$$

which implies that the rate of savings of the altruistic household is always higher than that of the egoistic one.

1.3.1.2 Firms

Production in the economy, denoted by $F(K_t, H_t)$, occurs through a representative firm that operates according to constant returns to scale and uses two inputs: the aggregate stock of capital in the economy, K_t, and the aggregate stock of human capital, H_t, expressed as the following:

$$Y_t = K_t^{\alpha} H_t^{1-\alpha} \tag{1.12}$$

where α is the output elasticity of capital in the production function. To simplify the analysis, we assume that capital is fully depreciated after each period t.

We define new variables $\tilde{Y}_t \equiv \frac{Y_t}{H_t}$ and $\tilde{K}_t \equiv \frac{K_t}{H_t}$ the output and capital per effective worker, respectively. Then in intensive form, the production function can be written as $\tilde{Y}_t = \tilde{K}_t^{\alpha}$. In equilibrium, factors are paid their marginal products:

$$R_t = \alpha \tilde{K}_t^{\alpha-1} \tag{1.13}$$

$$w_t = (1-\alpha)\tilde{K}_t^{\alpha} \tag{1.14}$$

1.3.2 Equilibrium in the economy

Given an initial capital for each dynasty $K_{i,0}$ and an initial human capital for each dynasty $H_{i,0}$, a competitive equilibrium for this economy implies a sequence of prices $\{R_t, w_t\}_{t=0}^{\infty}$

and quantities for dynasty-i variables $\{c_{i,t}, d_{i,t}, s_{i,t}, m_{i,t}, b_{i,t}, H_{i,t}\}_{t=0}^{\infty}$, together with aggregate variables $\{Y_t, H_t, K_t\}$, such that:

(i) Households behave optimally, given by Equations (1.5)-(1.11).

(ii) Firms maximize their profit, given by Equations (1.13) and (1.14).

(iii) All markets clear.

The capital market clearing condition requires that the aggregate savings owned by members of both dynasties at time t are equal to the physical capital stock available at time $t+1$:

$$K_{1,t} = s_{1,t-1} \tag{1.15a}$$

$$K_{2,t} = s_{2,t-1} \tag{1.15b}$$

$$K_t = pK_{1,t} + (1-p)K_{2,t} = ps_{1,t-1} + (1-p)s_{2,t-1} \tag{1.15c}$$

The human capital market clearing condition requires that the aggregate human capital owned by both dynasties equals the human capital stock of the economy at time t:

$$H_t = pH_{1,t} + (1-p)H_{2,t} = pm_{1,t-1}^{\lambda} H_{t-1}^{1-\lambda} + (1-p)m_{2,t-1}^{\lambda} H_{t-1}^{1-\lambda} \tag{1.16}$$

Finally, the goods market clearing condition, which results from the individual budget constraints, requires that what is produced is consumed, shared or saved in the economy,[9] such that:

$$p\Big(c_{1,t} + d_{1,t} + m_{1,t} + s_{1,t}\Big) + (1-p)\Big(c_{2,t} + d_{2,t} + m_{2,t} + s_{2,t}\Big) = Y_t \tag{1.17}$$

From Equations (1.13) - (1.16), we can obtain the dynamic system which governs the equilibrium paths in the neighborhood of the steady state (K_1, K_2, H_1, H_2). We can easily see that this is a four-dimensional dynamic system with four pre-determined variables:

$$\frac{1+\theta+\beta}{\beta} K_{1,t+1} = w_t H_{1,t} \tag{1.18}$$

$$\frac{1+\theta+\beta(1+\gamma)}{\beta(1+\gamma)} K_{2,t+1} - \frac{\gamma}{\gamma+1} R_t K_{2,t} = w_t H_{2,t} \tag{1.19}$$

$$H_{1,t+1} = H_t^{1-\lambda}(\frac{\theta}{\beta} K_{1,t+1})^{\lambda} \tag{1.20}$$

[9]Note that the market clearing condition is essentially an economy-wide budget constraint. This includes all what is spent, saved and transferred to other generations, including intrahousehold transfers and inheritance in this model.

$$H_{2,t+1} = H_t^{1-\lambda}(\frac{\theta}{\beta(1+\gamma)}K_{2,t+1})^{\lambda} \tag{1.21}$$

where:

$$H_t = pH_{1,t} + (1-p)H_{2,t} \tag{1.22}$$

$$R_t = \alpha(\frac{pK_{1,t} + (1-p)K_{2,t}}{pH_{1,t} + (1-p)H_{2,t}})^{\alpha-1} \tag{1.23}$$

$$w_t = (1-\alpha)(\frac{pK_{1,t} + (1-p)K_{2,t}}{pH_{1,t} + (1-p)H_{2,t}})^{\alpha} \tag{1.24}$$

1.3.3 Transitional dynamics and steady state

In order to examine the evolution of the economy in the short-term as well as its steady state in the long-term, we will transform in what follows all variables to the intensive form, i.e. per efficient unit of labor H_t. We will then denote the new variables with the symbol (~) to mark this transformation.

We define a new variable $x_t \equiv \frac{\tilde{K}_{2,t}}{\tilde{K}_{1,t}}$ that captures the ratio of the capital intensity held by altruistic and egoistic dynasty, respectively, where $\tilde{K}_{2,t} \equiv \frac{K_{2,t}}{H_t}$ and $\tilde{K}_{1,t} \equiv \frac{K_{2,t}}{H_t}$. We view capital, K, as the only form of measurable physical wealth in our model. Consequently, we exploit x_t in later sections to measure wealth inequality in the economy. When this ratio is greater than 1, then wealth inequality appears in the sense that the altruistic family owns more capital than the egoistic one. When the ratio is less than 1, inequality still exists, but the egoistic family owns more capital than the altruistic one. Consequently, inequality increases when x moves further away from 1, in either the positive or the negative direction.

By dividing all variables of Equations (1.18)-(1.21) by the aggregate level of human capital, we can rewrite the equilibrium system in the intensive form which will then allow us to characterized the dynamic system of four dimensions $(K_{1,t}, K_{2,t}, H_{1,t}, H_{2,t})$ to the dynamics of only x_t.[10]

In this setting, we are interested in two particular parameters, λ and γ, which capture the share of intrahousehold transfer in the production of human capital accumulation and the preference for inheritance, respectively. We, therefore, characterize the transitional dynamics of wealth inequality x_t as:

$$x_{t+1} = G(x_t; \lambda, \gamma) \tag{1.25}$$

[10]Refer to Appendix 1.7.2.1 and 1.7.2.2 for more elaborate calculations.

where

$$G(x_t;\lambda,\gamma) \equiv \frac{(1+\beta+\theta)(1+\gamma)}{1+\theta+\beta(1+\gamma)}\Big[(\frac{x_t}{1+\gamma})^{\lambda} + \frac{\gamma\alpha}{(1+\gamma)(1-\alpha)}x_t\frac{p+(1-p)(x_t/(1+\gamma))^{\lambda}}{p+(1-p)x_t}\Big]$$

and $x_0 = \frac{\tilde{K}_{2,0}}{\tilde{K}_{1,0}}$ is given at time 0.

1.3.3.1 Steady state solution

Let $x_{t+1} = x_t$ in Equation(1.25). Since the equilibrium is fully characterized by the dynamics of x, the number of steady states in the economy is equal to the number of solutions of x computed from (1.25). Letting $x = G(x;\lambda,\gamma)$ gives us:

$$x = \underbrace{\frac{(1+\beta+\theta)(1+\gamma)}{1+\theta+\beta(1+\gamma)}\Big[(\frac{x}{1+\gamma})^{\lambda} + \frac{\gamma\alpha}{(1+\gamma)(1-\alpha)}\frac{p+(1-p)(x/(1+\gamma))^{\lambda}}{p+(1-p)x}x\Big]}_{\equiv G(x;\lambda,\gamma)} \tag{1.26}$$

Simplifying Equation (1.26) gives us:

$$\frac{1+\theta+\beta(1+\gamma)}{(1+\beta+\theta)(1+\gamma)} = \underbrace{\frac{x^{\lambda-1}}{(1+\gamma)^{\lambda}} + \frac{\gamma\alpha}{(1+\gamma)(1-\alpha)}\frac{p+(1-p)(x/(1+\gamma))^{\lambda}}{p+(1-p)x}}_{\equiv RHS(x)} \tag{1.27}$$

To determine the number of solutions of x, in what follows, we are going to study the shape of the function $RHS(x)$ given by (1.27). Clearly,

$$\frac{\partial RHS(x)}{\partial x} = \underbrace{\frac{x^{\lambda-2}}{(1+\gamma)^{\lambda}}}_{>0}\underbrace{(\lambda-1)}_{<0} + \underbrace{\frac{(1-p)x^{\lambda-1}(p+(1-p)x)}{(1+\gamma)^{\lambda}(p+(1-p)x)^2}}_{>0}\underbrace{(\lambda-1)}_{<0} < 0$$

Hence, $RHS(x)$ is a monotonically decreasing function of x.
Moreover, notice that

$$\lim_{x\to 0^+} RHS(x) = +\infty$$

Since the LHS function in (1.27) is independent of x. We can then conclude that there exists a unique positive steady state value denoted by x^* such that

$$\frac{1+\theta+\beta(1+\gamma)}{(1+\beta+\theta)(1+\gamma)} = RHS(x^*)$$

This allows us to make the following proposition.

Proposition 1 *The steady state value x^* is unique.*

This implies that, in steady state, capital in intensive form saved by each dynasty is positive. Since this x^* also serves as our wealth inequality measurement, this proposition also means that inequality exists in the long-run.

We are now in the position to study the key features of x^*. Recall that if $x^* > 1$, i.e. $\frac{\tilde{K}_2}{\tilde{K}_1} > 1$, we obtain a long-run wealth inequality that is driven by the altruistic dynasty. Alternatively, in the case $x^* < 1$, the long-run inequality is induced by the egoistic family. Thus, to study the value of x^* compared to 1, i.e. with complete equality, we compare the value of the function $G(1;\lambda,\gamma)$ to the value of 1 when $x = 1$. Note that $G(1;\lambda,\gamma) > 1$ infers that $x^* > 1$ while $G(1;\lambda,\gamma) < 1$ means that $x^* < 1$.

From (1.26), we can compute $G(1;\lambda,\gamma)$ as the following:

$$G(1;\lambda,\gamma) = \frac{(1+\beta+\theta)(1+\gamma)}{1+\theta+\beta(1+\gamma)}\Big[(\frac{1}{1+\gamma})^{\lambda} + \frac{\gamma\alpha}{(1+\gamma)(1-\alpha)}(p+(1-p)(\frac{1}{1+\gamma})^{\lambda})\Big] \tag{1.28}$$

Firstly, depending on our parameter choices of γ and λ, $G(1;\lambda,\gamma)$ can be greater or smaller than 1. Thus, we are going to determine the particular values of $\bar{\lambda}$ and $\bar{\gamma}$ such that $G(1;\bar{\lambda},\bar{\gamma}) = 1$.

Secondly, notice that the function $G(1;\lambda,\gamma)$ is a decreasing function of λ. Solving $G(1;\bar{\lambda},\bar{\gamma}) = 1$ gives us at most one solution of $\bar{\lambda}$. The solution $\bar{\lambda}$ lies in between the interval $(0,1)$ if the following conditions are satisfied:

$$\lim_{\lambda\to 0} G(1;\lambda,\gamma) > 1$$

$$\lim_{\lambda\to 1} G(1;\lambda,\gamma) < 1$$

We can see that the first condition always holds since:

$$\lim_{\lambda\to 0} G(1;\lambda,\gamma) = \underbrace{\frac{(1+\beta+\theta)(1+\gamma)}{1+\theta+\beta(1+\gamma)}}_{>1}\underbrace{\Big(1+\frac{\gamma\alpha p}{(1+\gamma)(1-\alpha)}\Big)}_{>1} > 1$$

The second condition holds if:

$$\lim_{\lambda\to 1} G(1;\lambda,\gamma) = \frac{1+\beta+\theta}{1+\theta+\beta(1+\gamma)}\Big(1+\frac{\gamma\alpha}{1-\alpha}(p+\frac{1-p}{1+\gamma})\Big) < 1$$

Simplifying it gives us the condition on γ compared to the critical value[11] defined by $\bar{\gamma}$ as follows:

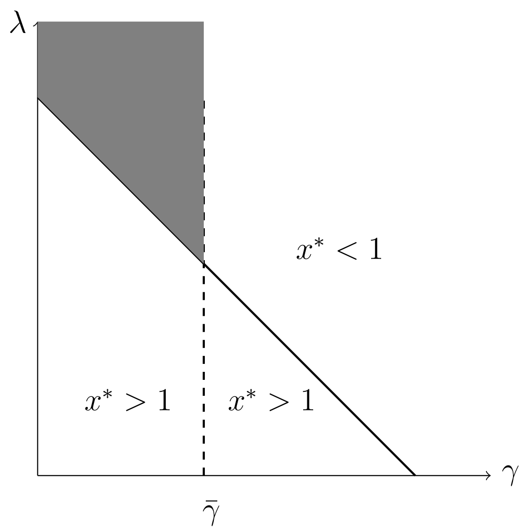
$$\gamma > \bar{\gamma} \equiv \frac{1-p}{\frac{1-\alpha}{\alpha}\frac{\beta}{1+\beta+\theta} - p} - 1$$

Therefore, we obtain the following scenarios:
(1) If $\gamma < \bar{\gamma}$, then $\lambda < \bar{\lambda}$ for all $\lambda \in (0,1)$ and $G(1;\lambda,\gamma) > 1$.
(2) if $\gamma \geq \bar{\gamma}$, then we can determine the value of $G(1;\lambda,\gamma)$ conditional on λ :

$$G(1;\lambda,\gamma) = \begin{cases} \geq 1, & \text{if } \lambda \leq \bar{\lambda} \\ < 1, & \text{if } \lambda > \bar{\lambda} \end{cases}$$

Figure (1.6) summarizes graphically these conditions. Notice that $\bar{\lambda}$ is a decreasing function[12] of γ.

Figure 1.6: Inequality conditional on choices of γ and λ



We then introduce the following proposition.

Proposition 2 *There exists a threshold of bequest preference, $\bar{\gamma}$, and of the share of intra-household transfers in human capital accumulation, $\bar{\lambda}$, where $G(1;\bar{\lambda},\bar{\gamma}) = 1$. Under the condition that $\gamma > \bar{\gamma}$ and $\lambda > \bar{\lambda}$, long-run inequality exists such that the egoistic family*

[11]Note that $\bar{\gamma}$ is independent of λ. The condition to have $\bar{\gamma} \in (0,1)$ is $\frac{1+p}{2} < \frac{1-\alpha}{\alpha}\frac{\beta}{1+\beta+\theta} < 1$. Using conventional parameter choices such as $\alpha = 0.3$, $\beta = 0.6$, $\theta = 0.3$ and $p = 0.3$, we obtain $\bar{\gamma} = 0.6$, which is clearly between $(0,1)$.
[12]Proof is given in the Appendix 1.7.2.3

accumulates more wealth than the altruistic family:

$$x^* < 1 \text{ and } \frac{\tilde{K}_2}{\tilde{K}_1} < 1$$

Otherwise, inequality in steady-state exists where the altruistic dynasty possesses more wealth than the egoistic dynasty:

$$x^* > 1 \text{ and } \frac{\tilde{K}_2}{\tilde{K}_1} > 1$$

This suggests that only if the degree of altruism (γ) is not too large, the altruistic dynasty would be able to accumulate higher long-run wealth than the egoistic dynasty, meaning $x^* > 1$. This is similar to the findings of Michel and Pestieau (2005), who argued that long-run wealth is only held by the most altruistic families.

Let us now discuss some intuitions of the findings. Understanding Proposition 2 necessitates understanding the effect of γ. From Equations (10), (11), (14a) and (14b) we can see that the steady state accumulated wealth of dynasty i, $\tilde{K}_i$, depends particularly on bequest preference γ, on inheritance given at time t and on the on their human capital accumulation as follows:

$$\begin{aligned}\tilde{K}_i &= \frac{\beta(1+\gamma)}{1+\theta+\beta(1+\gamma)}(w\tilde{H}_i + \tilde{b}_i)\\ &= \frac{\beta(1+\gamma)}{1+\theta+\beta(1+\gamma)}(w\tilde{m}_i^\lambda + \tilde{b}_i)\end{aligned}$$

To explain how these factors influence long-run capital for each dynasty, we can simplify this function to the following:

$$\tilde{K}_i = f(\gamma, \tilde{b}_i, \tilde{m}_i)$$

The impacts from a higher inheritance preference on $\tilde{K}_i$ can be untangled as follows:

$$\frac{\partial \tilde{K}_i}{\partial \gamma} = \underbrace{\frac{\partial f}{\partial \gamma}}_{>0} + \underbrace{\underbrace{\frac{\partial f}{\partial \tilde{b}_i}\frac{\partial \tilde{b}_i}{\partial \gamma}}_{>0}}_{Inheritance\ Effect} + \underbrace{\underbrace{\frac{\partial f}{\partial \tilde{m}_i}}_{>0}\underbrace{\frac{\partial \tilde{m}_i}{\partial \gamma}}_{?}}_{Income\ Effect}$$

One can see that an increase in the inheritance preference γ triggered two different effects which are called the inheritance effect and the income effect. Obviously, the inheritance effect in response to an increase in the degree of altruism has to be positive as people tend to leave more bequest for their offspring. We write: $\frac{\partial f}{\partial \tilde{b}_i}\frac{\partial \tilde{b}_i}{\partial \gamma} > 0$.

On the other hand, the income effect generated from changes in intrahousehold transfer is still ambiguous. Recall that individuals divide their savings between capital and intrahousehold transfer. When the motive to bequeath is rather small, inheritance responds little to a change in γ. Therefore, one does not have to increase their savings and, hence, capital formation at the expense of intrahousehold transfer. In this case, we have: $\frac{\partial H_{i,t}}{\partial \gamma} > 0$.

However, when the intensity of altruism is sufficiently strong, then whether it leads to a strong reduction in income and, as a result, a fall in capital stock depends on how much intrahousehold transfer contributes to human capital production, captured by the parameter λ. If the role of these transfers is significant, i.e: λ is great enough, then a reduction in intrahousehold transfer translates into a strong drop in human capital accumulation. In this case, the negative income effect will dominate the positive inheritance effect. Therefore, $\frac{\partial K_{i,t+1}}{\partial \gamma} < 0$ which means that the egoistic dynasty ends up accumulating more wealth in the long-run than altruistic one. If the role of these transfers is not significant, i.e. λ is small enough, the positive inheritance effect will dominate the negative income effect which leads to $\frac{\partial K_{i,t+1}}{\partial \gamma} > 0$. In this scenario, the altruistic dynasty will accumulate more capital in the long-run.

1.3.3.2 The transitional dynamics of the economy

In this part, we examine the stability of the steady state x^* that we found in the previous part. Noting the transitional dynamics of x_t, given by Equation (1.25), we can express the derivative of the function valued at the steady state value x^* and study its sign. We have:

$$G'(x^*) = \frac{(1+\beta+\theta)(1+\gamma)}{1+\theta+\beta(1+\gamma)}\Big[\frac{\lambda(x^*)^{\lambda-1}}{(1+\gamma)^{\lambda}} + \frac{\gamma\alpha}{(1+\gamma)(1-\alpha)}\frac{p^2+\frac{p(1-p)(1+\lambda)}{(1+\gamma)^{\lambda}}(x^*)^{\lambda}+\frac{(1-p)^2\lambda}{(1+\gamma)^{\lambda}}(x^*)^{\lambda+1}}{(p+(1-p)x^*)^2}\Big] \tag{1.29}$$

One can easily see that:

$$G'(x^*) > 0$$

Moreover, one can also prove that:[13]

$$G'(x^*) < 1$$

Therefore, one can conclude that x^* is an asymptotically stable equilibrium point.

[13] Refer to Appendix 1.7.2.4 for proof.

On the other hand, from the difference equation of x_t given by Equation (1.25), we obtain:

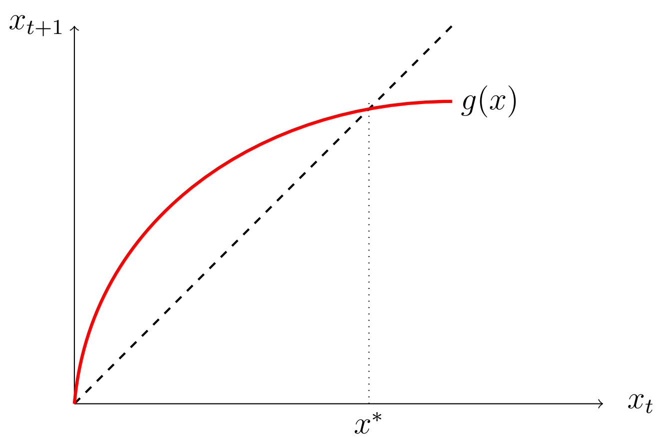
$$\lim_{x_t \to 0^+} G(x_t) = 0 \quad \text{and} \lim_{x_t \to 0^+} G'(x_t) = +\infty$$

$$\lim_{x_t \to +\infty} G(x_t) = +\infty \quad \text{and} \lim_{x_t \to +\infty} G'(x_t) = 0$$

These results allow us to draw the global dynamics of x_t, shown in Figure (1.7).

Proposition 3 *The steady state x^* is locally stable.*

Figure 1.7: Dynamics of wealth inequality, x_t



1.3.3.3 The balanced growth path

A balanced growth path is a steady equilibrium where all of the variables that characterize the economy in a dynamic model grow at a constant rate. Given that all of the variables of this economy can be expressed in intensive form per unit of human capital, we can consequently introduce the following proposition.[14]

Proposition 4 *In the long run, the economy follows a balanced growth path in which $\{c_{i,t}, d_{i,t}, m_{i,t}, b_{i,t}, H_{i,t}, K_{i,t}, K_t\}_{t=0}^{\infty}$ grow at the same rate as that of the aggregate human capital H_t, and $\{w_t, R_t\}$ remain constant.*

[14]Since human capital in this economy is a function of intrahousehold transfers, a predetermined variable, its growth is consequently a function of the growth of these transfers.

Proof of Proposition 4. In the long run, all the endogenous variables, which are measured in efficient unit of labor, can be rewritten as a function of x^*. Indeed, from Equations (1.20), (1.21), and (1.22), we can derive:[15]

$$\tilde{H}_1 = \frac{1}{p + (1-p)(\frac{x^*}{1+\gamma})^\lambda}$$

$$\tilde{H}_2 = \frac{(\frac{x^*}{1+\gamma})^\lambda}{p + (1-p)(\frac{x^*}{1+\gamma})^\lambda}$$

which are constant. Recall that, along the balanced growth path, $\tilde{H}_1 = \frac{H_{1,t+1}}{H_{t+1}}$ and $\tilde{H}_2 = \frac{H_{2,t+1}}{H_{t+1}}$. It means that $H_{1,t+1}$ and $H_{2,t+1}$ both grow at the same rate as the aggregate human capital H_{t+1} along the path. Moreover, from Equations (1.18) and (1.19), we can also derive $\tilde{K}_1$, $\tilde{K}_2$ and $\tilde{K}$ as a function of x^* as follows:

$$\tilde{K}_1 = \Big(\frac{(1-\alpha)\beta^{1/(1-\lambda)}}{(1+\theta+\beta)\theta^{\lambda/(1-\lambda)}} \frac{(p+(1-p)x^*)^\alpha}{(p+(1-p)(\frac{x^*}{1+\gamma})^\lambda)^{1/(1-\lambda)}}\Big)^{1/\alpha}$$

$$\tilde{K}_2 = x^* \tilde{K}_1$$

$$\tilde{K} = p\tilde{K}_1 + (1-p)\tilde{K}_2 = (p + (1-p)x^*)\tilde{K}_1$$

which show that aggregate capital $K_{1,t}$, $K_{2,t}$ and K_t move at the same rate as H_t. Similarly, from Equations (1.5)-(1.8), we can obtain the steady state values of $\tilde{c}_i$, $\tilde{d}_i$, $\tilde{m}_i$, $\tilde{b}_i$. These variables $\{c_{i,t}, d_{i,t}, b_{i,t}\}$ also grow at the same rate as H_t. ■

1.3.4 The intrahousehold transfers-inheritance ratio and wealth inequality

Since we are interested in the relative importance of intrahousehold transfers in comparison with inheritance over time, we construct their ratio denoted by $\frac{M_t}{B_t}$. In this section, we examine how the ratio evolves in the short- and long-run.

[15] Detailed proof is given in 1.7.2.5 in Appendix.

1.3.4.1 The evolution of $\frac{M_t}{B_t}$ in the long-run

Given Proposition (4), all the variables in the economy grow in the long-run at the same rate as that of the aggregate human capital, H_t. In other words, along the balanced growth path, the long-run inheritance and intrahousehold transfers, per efficient unit of labor, $\tilde{b}_i$ and $\tilde{m}_i$ respectively, are constant.

Since inheritance is only transmitted by the altruistic dynasty, we can express aggregate inheritance, B, at time t as the following:

$$B_t = (1-p)b_{2,t} = (1-p)\tilde{b}_2 H_t \tag{1.30}$$

Similarly, aggregate intrahousehold transfers, M, at time t can be expressed as the following:

$$M_t = pm_{1,t} + (1-p)m_{2,t} = p\tilde{m}_1 H_t + (1-p)\tilde{m}_2 H_t \tag{1.31}$$

Hence, the intrahousehold transfers to inheritance ratio in the long-run can be expressed as:

$$\frac{M_t}{B_t} = \frac{p\tilde{m}_1 H_t + (1-p)\tilde{m}_2 H_t}{(1-p)\tilde{b}_2 H_t} = \frac{p\tilde{m}_1 + (1-p)\tilde{m}_2}{(1-p)\tilde{b}_2} \tag{1.32}$$

which is a constant. This result suggests that in the long-run intrahousehold transfer and inheritance should grow at the same rate determined by the rate of human capital change and should the ratio should be constant.

1.3.4.2 The evolution $\frac{M_t}{B_t}$ in the short-run

In this section, we examine the transitional dynamics of the ratio of our interest in the short-run. We can construct the ratio at time t in the short-run as the following:

$$\frac{M_t}{B_t} = \frac{pm_{1,t} + (1-p)m_{2,t}}{(1-p)b_{2,t}} = \frac{p\tilde{m}_{1,t} + (1-p)\tilde{m}_{2,t}}{(1-p)\tilde{b}_{2,t}} \tag{1.33}$$

From Equations (1.6), (1.8), (1.15), (1.18) and (1.19), we can re-express optimal intrahousehold transfers and inheritance as the following:

$$m_{i,t} = \frac{\theta}{\beta(1+\gamma_i)} K_{i,t+1}$$

$$b_{i,t} = \frac{\gamma_i}{1+\gamma_i} K_{i,t} R_t$$

We can then rewrite $\frac{M_t}{B_t}$ as a function of x_t, our wealth inequality measure, as follows:

$$\begin{aligned}\frac{M_t}{B_t} = \frac{\theta}{1+\theta+\beta(1+\gamma)} + \frac{\theta p(1+\gamma)(1-\alpha)}{\alpha\gamma(1+\theta+\beta)(1-p)} \frac{\frac{p}{x_t}+1-p}{p+(1-p)(\frac{x_t}{1+\gamma})^\lambda} \\ + \frac{\theta(1+\gamma)(1-\alpha)}{\alpha\gamma(1+\theta+\beta(1+\gamma))} \frac{\frac{p}{x_t}+1-p}{p+(1-p)(\frac{x_t}{1+\gamma})^\lambda} (\frac{x_t}{1+\gamma})^\lambda\end{aligned} \tag{1.34}$$

Recall that this ratio is a forward-looking variable, whereas x_t, which is a function of capital, is a backward-looking one. Equation (1.34) allows to write the proposition below.

Proposition 5 *A higher x at time t contributes to a lower intrahousehold transfers-to-inheritance ratio.*

Proof of Proposition 5. Recall that x_t is a predetermined variable at time t. To prove that $\frac{M_t}{B_t}$ is a decreasing function of x_t, we first simplify Equation (1.34) as follows:

$$\begin{aligned}\frac{M_t}{B_t} =& \frac{\theta}{1+\theta+\beta(1+\gamma)} \\ &+ \frac{\theta(1-\alpha)(1+\gamma)}{\alpha\gamma(1+\theta+\beta(1+\gamma))} \frac{\frac{p}{x_t}+1-p}{p+(1-p)(\frac{x_t}{1+\gamma})^\lambda} \Big(\frac{p(1+\theta+\beta(1+\gamma))}{(1-p)(1+\theta+\beta)} + (\frac{x_t}{1+\gamma})^\lambda \Big)\end{aligned}$$

One can then derive $\frac{M_t}{B_t}$ with respect to x_t and obtain:

$$\begin{aligned}\frac{\partial M_t/B_t}{\partial x_t} = \underbrace{\frac{1}{p+(1-p)(x_t/(1+\gamma))^\lambda}}_{>0} \Big[-\underbrace{(Z+(\frac{x_t}{1+\gamma})^\lambda)\frac{p}{x^2})}_{>0} \\ - \underbrace{\lambda(\frac{p}{x_t}+1-p)\frac{x_t^{\lambda-1}}{(1+\gamma)^\lambda}}_{>0} \underbrace{\big((Z+(\frac{x_t}{1+\gamma})^\lambda)\frac{1-p}{p+(1-p)(\frac{x_t}{1+\gamma})^\lambda}-1\big)}_{>0} \Big] < 0\end{aligned} \tag{1.35}$$

where $Z \equiv \frac{p(1+\theta+\beta(1+\gamma))}{(1-p)(1+\theta+\beta)}$.

Since the first three underbraced terms are positive, we provide the proof to show that the last term is also positive. Indeed, we want to show that:

$$\big(Z+(\frac{x_t}{1+\gamma})^\lambda\big)\frac{1-p}{p+(1-p)\frac{x_t}{1+\gamma})^\lambda} > 1$$

which is true because it is equivalent to have:

$$\frac{p(1+\theta+\beta(1+\gamma))}{(1-p)(1+\theta+\beta)}+(\frac{x_t}{1+\gamma})^\lambda > \frac{p}{1-p}+(\frac{x_t}{1+\gamma})^\lambda$$

Then, it leads to have:

$$1+\theta+\beta(1+\gamma) > 1+\theta+\beta$$

which is always true for all choices of parameters. Therefore, we conclude that $\frac{\partial M_t/B_t}{\partial x_t} < 0$.
■

Note that while the relationship between intrahousehold transfers-to-inheritance ratio and x is negative, the relationship between this ratio and inequality depends on the value of x. As mentioned in Section 1.3.3, inequality exists when x is further away from 1, in the positive or negative directions. Consequently, when $x > 1$, meaning when the altruistic dynasty accumulates more capital than the egoistic one, then a rise in inequality leads to a decrease in the ratio $\frac{M_t}{B_t}$. On the other hand, when $x < 1$, meaning when the egoistic dynasty accumulates more capital than the altruistic one, then the relationship between x and the ratio tells us that a decrease in inequality (as x gets closer to 1) decreases the ratio. Where x depends, of course, on the parameters γ and λ.

If France, as mentioned in Section 1.2, the ratio has been decreasing over time. Meanwhile, wealth inequality has also been increasing in favor of those that bequeath, as has been shown in Piketty (2011) and Piketty and Zucman (2015) - indicating that France is more plausibly in the situation where $x > 1$.

To get a sense of how Equation (1.34) can emulate the intrahousehold transfers-to-inheritance ratio that is seen in the data, we run a simple exercise that compares the calculated ratio from the equation and with the NTA data. To do so, we take all the parameter values from the literature, as shown in Table 1.1, and we the Gini index of wealth as a close proxy to x, obtained from the World Inequality Database (WID). These values combined entirely represent the right-hand-side of the equation.[16]

Figure 1.8 below plots the intrahousehold-to-inheritance ratio obtained from the data and from the equation of our model. This exercise shows that the equation captures relatively well the overall decreasing trend of this ratio, albeit with wider variation. Interestingly, however, while the simulated ratio shows a significant upward kick in the ratio during the period of 2000-2007, which was the period of the housing boom and later bust, the data does

[16] This, consequently, is not a quantitative exercise, but simply a numerical illustration.

Table 1.1: Calibrated parameter values

Parameter	Value	Reference
Capital elasticity of production α	0.3	Ludwig and Vogel (2010), Cipriani (2014)
Discount factor β	0.6	de la Croix (2001), Chanda (2008)
Intrahousehold transfer preference θ	0.5	Bellettini et al. (2017)
Bequest preference γ	0.4	Han and Mulligan (2001), Bellettini et al. (2017)
Proportion of egoistic families p	0.3	Kopczuk and Lupton (2007)
INTRA transfer elasticity of output λ	0.5	de la Croix (2001)

not appear to capture this. This difference may come from the fact that while simulating the ratio, we assume that only wealth inequality changes while keeping other parameters constant. The data, on the other hand, would account for multiple other variations over time.

Figure 1.8: Intrahousehold transfers-to-inheritance ratio in the model and in the data

Source: Authors calculation, using the model and NTA (France)

1.4 Comparative statics

In this part, we investigate the response of our wealth inequality indicator x_t, expressed in Equation (1.25), when our key parameters λ and γ change. These are numerical illustrations that rely on the parameters in Table 1.1, not a quantitative exercise.

Consider an economy in steady-state. Suppose that at time t, a temporary shock occurs through an increase in either λ or γ. Figures 1.9 and 1.10 below show the response function of x_t after introducing such shocks. We distinguish two scenarios: the one that starts at a steady-state wealth greater than 1, i.e. $x^* > 1$, and another other that starts with $x^* < 1$. Before commenting on the results, it is worth noting that when $x_t > 1$, an increase in x_t means an increase in the gap between the two dynasties' wealth, and when $x_t < 1$ then an increase in x_t means a decrease in inequality.

Figure 1.9: Case 1: $x^* > 1$. Response function of wealth indicator x_t to a gain in γ (left) and to a gain in λ (right)

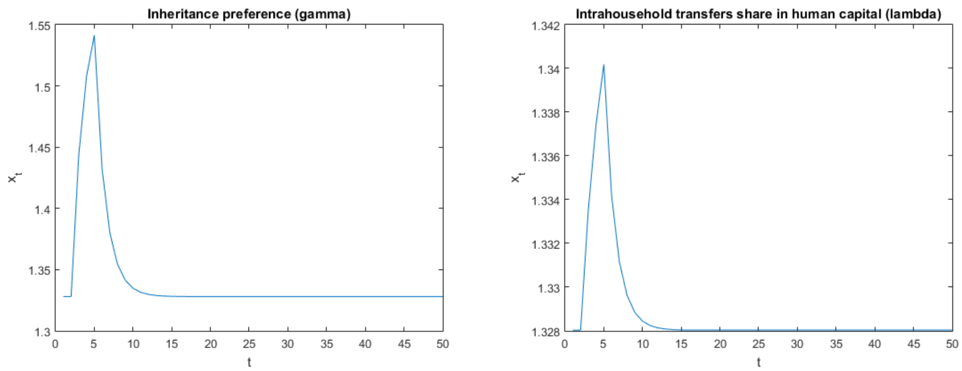
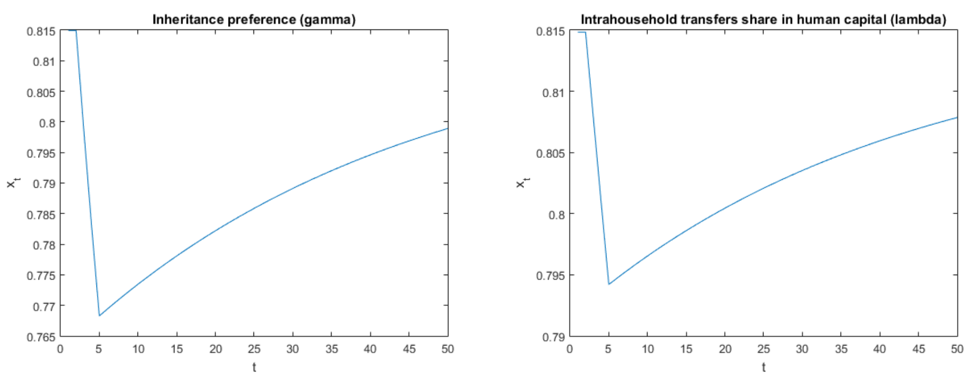


Figure 1.10: Case 2: $x^* < 1$. Response function of wealth indicator x_t to a gain in γ (left) and to a gain in λ (right)



The results show that an increase in the degree of altruism captured by γ leads to an increase in wealth inequality both when $x^* > 1$ and $x^* < 1$. A rise in γ at time t always increases the capital accumulation of the altruistic dynasty, which would widen the wealth gap between the two households if the altruistic family is already richer than the egoistic one. As a result, x_t increases in response to the shock in the case $x^* > 1$.

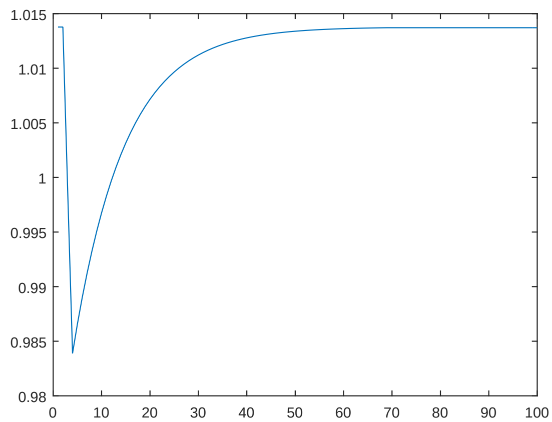
On the other hand, when $x^* < 1$ and thus γ is now above the threshold, further increases in the preference to bequeath decreases wealth accumulation of the altruistic dynasty through a larger decrease in their savings. This is the case when the preference to bequeath is already "too high." The decrease in capital accumulation of the altruistic dynasty, and given no changes for the egoistic dynasty that does not bequeath, decreases x_t, and thus further increases inequality.

Similarly, an increase in the elasticity of intrahousehold transfers in human capital formation, λ, increases wealth inequality in both cases. Indeed, an increase in λ at time t generates a higher return from an additional unit of intrahousehold transfer. Thus, the richer household would invest more in their children by giving more intrahousehold transfer than the relatively poorer household. It would, in return, lead to a higher income at time $t+1$ for children in the rich family and, as a result, widen the inequality gap. In the case of $x^* > 1$, the altruistic household becomes richer than the egoistic one. However, in the opposite case where $x^* < 1$, the egoistic family becomes even richer than the altruistic one and inequality also widens.

Finally, we illustrate the importance of taking into account the role of λ in Figure (1.11) below. We show that an increase in λ above the threshold defined by $\bar{\lambda}$, when γ is already above its threshold $\bar{\gamma}$, can cause a temporary switch of the inequality regime, from $x > 1$, where the altruistic dynasty has more capital than the egoistic dynasty, to $x < 1$ where it has lower capital.

This is an uncommon result that we show from our model. We argue that if the shock is more persistent, there can be a drastic change in inequality over time. It highlights the important role that the efficiency parameter of intrahousehold transfers in human capital accumulation can play in changing inequality and which dynasty holds more capital.

Figure 1.11: Change in the inequality regime: λ is shifted from 0.9 to 0.99 for 1 period.



1.5 Discussion

The theoretical results obtained here depend on the heterogeneity of agents beyond age, which is captured through the altruistic preference for inheritance, γ,[17] and the share of the population, p. Indeed, if we set $p = 0$ in Equation (1.34), then our ratio of interest becomes:

$$\frac{M_t}{B_t} = \frac{\theta}{1 + \theta + \beta(1+\gamma)} + \frac{\theta(1-\alpha)(1+\gamma)}{\alpha\gamma}$$

which is independent of wealth inequality. Consequently, $\frac{\partial M_t/B_t}{\partial x_t} = 0$. Moreover, since there parameters are not time-dependent, the ratio would also not be time-dependent.

In fact, even a representative agent model with endogenous growth, and assuming that the parameters we introduce in this model remain exogenous parameters, would always lead to an expression of our ratio of interest that is constant over time. This is regardless of the timing of the flows. Consequently, heterogeneity plays an important role in explaining these aggregate observations in the data, given this class of growth models.

Moreover, while an inheritance tax does not appear in the model, we can still think of its impact on transfers and consequently wealth accumulation. The introduction of these taxes in the literature are typically modeled as paid by the bequeathing generation. This would

[17] This is not contingent on one of the dynasties have zero inheritance preference. As long as $\gamma_1 < \gamma_2$, the results would hold - albeit with more complicated expressions.

modify the budget constraint of the older generation to the following:

$$d_{i,t+1} + b_{i,t+1}(1+\tau) \leq s_{i,t}R_{t+1}$$

Since the older generation divides its capitalized savings into consumption, $c_{i,t}$, and $b_{i,t+1}(1+\tau)$, it takes into account the amount it would pay on its inheritance transfer. If we assume that the revenue of this tax is not redistributed in any way, then an increase in this tax reduces optimal bequest made by the altruistic dynasty. Decreasing optimal bequest consequently reduces the income of the middle generation. Since this generation's consumption, intrahousehold transfers and savings are all a function of its income, the optimal level of these variables would decrease. This leads to a decrease in wealth accumulated by the altruistic dynasty. If inequality is greater than 1, then a decrease in this dynasty's wealth accumulation decreases inequality. If inequality is less than one, then a decrease in its wealth accumulation further exacerbates inequality.

If the tax revenue, however, is fully transmitted to the middle generation of the altruistic dynasty, such that its budget constraint becomes $c_{i,t} + si, t + m_{i,t} \leq w_t H_{i,t} + (1+\tau)b_{i,t}$, the optimal level of their consumption, savings and intrahousehold transfers would increase. This has repercussions on the dynasty's overall wealth accumulation through an increase in human capital accumulation and savings.

Should the tax be transmitted to both dynasties, the impact on wealth inequality would depend on the level of x. If $x > 1$, then taking part of the tax that is paid by the altruistic dynasty and transferring it to the egoistic one essentially decreases inequality by increasing the income of the egoistic one. If this tax is fully transmitted to the egoistic dynasty, inequality would theoretically decrease even more. However, if $x < 1$, then sharing this tax between the two dynasties exacerbates inequality by further subsidizing the egoistic dynasty, which already accumulates more capital.

In 2007, France eased wealth tax through *le loi pour le travail, l'emploi et le pouvoir d'achat (TEPA)*, which reduced the cost of transferring money to the surviving spouse and children, and in some cases and nephews and nieces in case of no direct descendants. Such a reduction in the tax burden, based on the argument mentioned above and the state of inequality in France as mentioned in Section 1.3.4.2, would theoretically increase inheritance. Ceteris paribus, this would increase the gap between the richer dynasty that bequeaths and the one that does not.

While the long-term trend of taxes in France appears to be an overall increase, we recognize that taxation could still be one of the important factors that affect the ratio of intrahousehold transfers to inheritance over time. This is in addition to several other factors, such as demographics and macroeconomic changes. Nevertheless, we argue that some key elements in our model can still help explain the trend of the ratio over time, including preferences to bequeath, the return to human capital from intrahousehold transfers and wealth inequality.

1.6 Concluding remarks

Data from the National Transfer Accounts in France show that the composition of private intergenerational transfers has changed in the period 1979-2011, from more intrahousehold transfers to more inheritance flows. This has occurred at a time when the sum of these private flows has remained at a relatively stable share of national income. Consequently, we observe a decrease in the intrahousehold transfers-to-inheritance ratio.

To explain this macro trend, we set up a three-period overlapping generations model with two dynasties that differ in their desire to bequeath; one being altruistic and bequeath to the following generation, and the other being egoistic and transferring only intrahousehold transfers to children. This difference captures not only empirical findings in the literature, but also allows us to link what we observe in the data to wealth inequality, which has long played an important role in understanding inheritance. In the model, intrahousehold transfers are made from the adult age-group to children, taking the form of an input to their human capital accumulation - which itself then serves as a multiplier for wages in the following period. Inheritance is made by the old age-group to the adult generation.

We show that in the long-run wealth inequality exists, defined as the ratio of accumulated capital of the altruistic dynasty to the egoistic one. However, which of the dynasties accumulates more capital depends on the inheritance preference and the share of intrahousehold transfers in the production of human capital. The interplay between these two parameters is important. If both of these parameters are higher than a threshold that we define in the model, then the egoistic dynasty ends up accumulating more capital - the altruism parameter causes "too much" inheritance. In all other cases, however, the altruistic dynasty ends up accumulating more.

We also show that while the long-run ratio of intrahousehold transfers to inheritance is constant because all variables grow along the balanced growth path, the short-run ratio responds negatively to an increase in wealth inequality. We argue that a potential explanation for the case of France is that what we observe in the data is the process of moving from an initial wealth inequality that is lower than that of the steady-state. However, we also show that changes in the share of intrahousehold transfers in capital accumulation can cause a change in short-run inequality, from a regime where the altruistic dynasty accumulates more capital to one where it accumulates less capital. This is not a common finding in the literature.

1.7 Appendix

1.7.1 Further evidence from the NTA

Figure 1.12: Received intrahousehold transfers and inheritance per capita of typical recipient (in real euros)

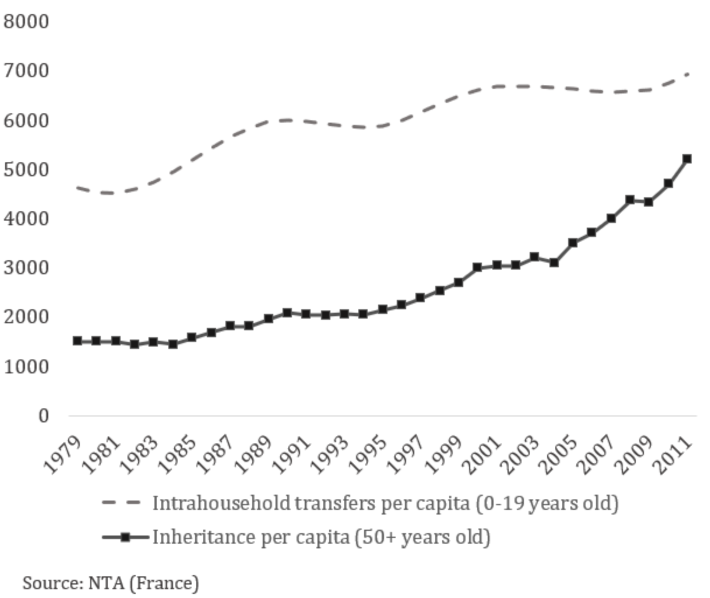


Figure 1.13: Aggregate and per capita private consumption by type for 0-19 year-olds (in real euros)

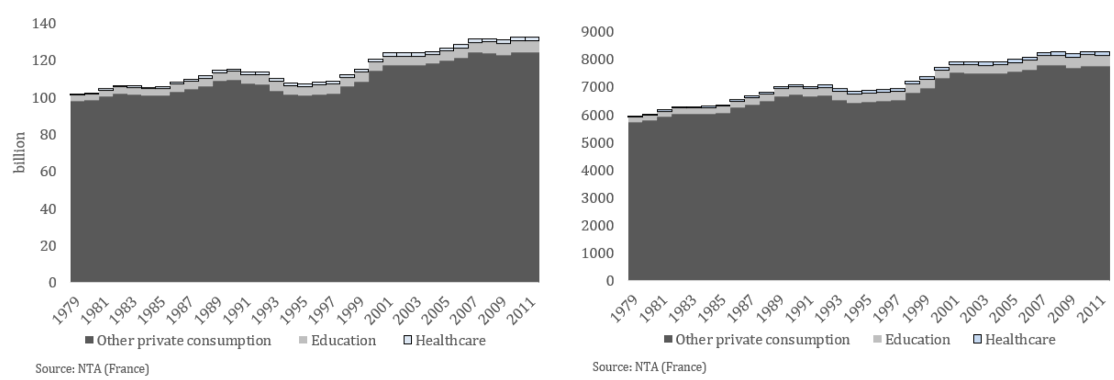
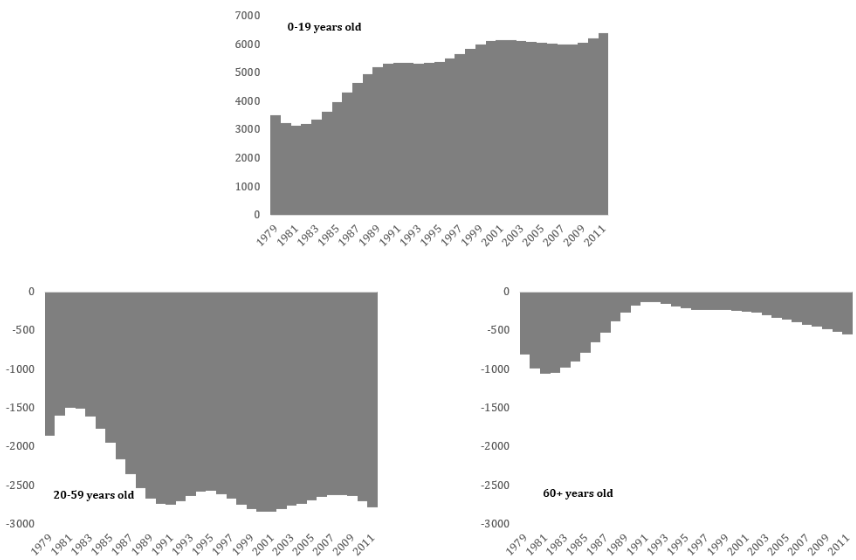
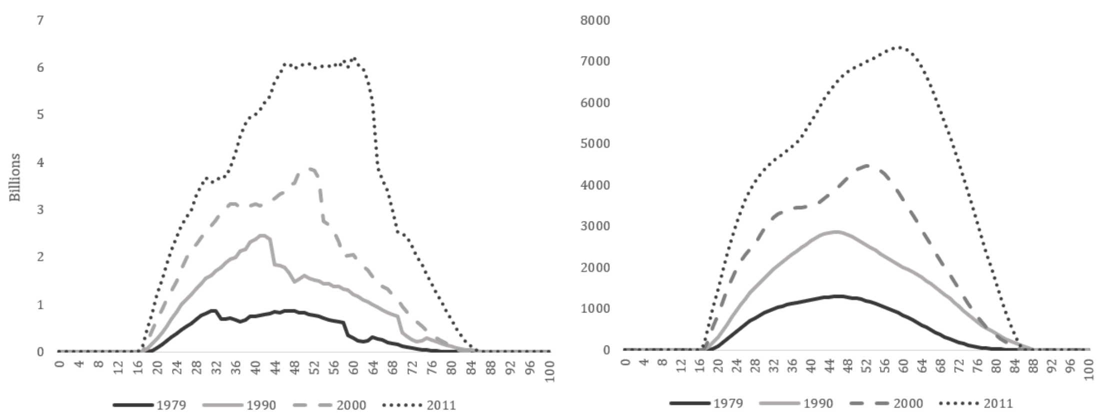


Figure 1.14: Net per capita intrahousehold transfers by braod age-group (in real euros)



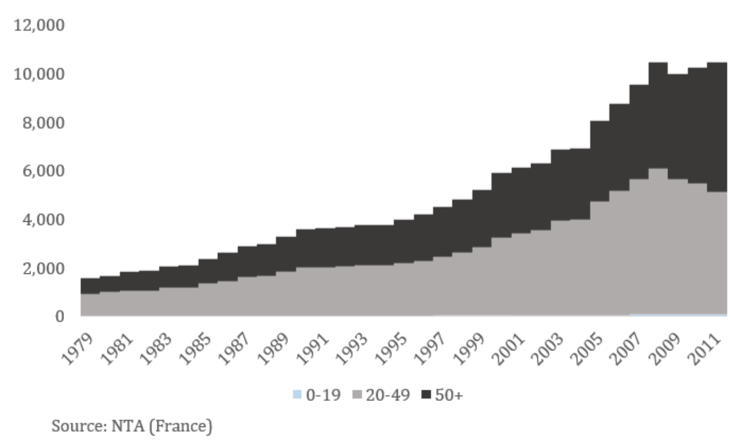
Source: NTA (France)

Figure 1.15: Age profile of received inheritance for selected years (in real euros)



Source: NTA (France)

Figure 1.16: Received inheritance per age-group capita (in real euros)



1.7.2 The model

1.7.2.1 Transform equilibrium in the economy in intensive form

Recall the following Equations (1.18) - (1.21) that are derived in the main text:

$$\frac{1+\theta+\beta}{\beta}K_{1,t+1} = w_t H_{1,t}$$

$$\frac{1+\theta+\beta(1+\gamma)}{\beta(1+\gamma)}K_{2,t+1} - \frac{\gamma}{\gamma+1}R_t K_{2,t} = w_t H_{2,t}$$

$$H_{1,t+1} = H_t^{1-\lambda}(\frac{\theta}{\beta}K_{1,t+1})^{\lambda}$$

$$H_{2,t+1} = H_t^{1-\lambda}(\frac{\theta}{\beta(1+\gamma)}K_{2,t+1})^{\lambda}$$

Also, we know that the aggregate capital is accumulated according to the following equation:

$$K_t = pK_{1,t} + (1-p)K_{2,t}$$

By dividing the LHS and RHS of these equations to H_t, we can characterize our equilibrium system in intensive form as follows:

$$\tilde{K}_{1,t+1}\frac{H_{t+1}}{H_t} = \frac{\beta}{1+\beta+\theta}w_t\tilde{H}_{1,t} \tag{1.36a}$$

$$\frac{1+\theta+\beta(1+\gamma)}{\beta(1+\gamma)}\tilde{K}_{2,t+1}\frac{H_{t+1}}{H_t} = \frac{\gamma}{1+\gamma}R_t\tilde{K}_{2,t} + w_t\tilde{H}_{2,t} \tag{1.36b}$$

$$(\frac{H_{t+1}}{H_t})^{1-\lambda}\tilde{H}_{1,t+1} = (\frac{\theta}{\beta}\tilde{K}_{1,t+1})^{\lambda} \tag{1.36c}$$

$$(\frac{H_{t+1}}{H_t})^{1-\lambda}\tilde{H}_{2,t+1} = (\frac{\theta}{\beta(1+\gamma)}\tilde{K}_{2,t+1})^{\lambda} \tag{1.36d}$$

where

$$\frac{H_{t+1}}{H_t} = p\tilde{m}_{1,t}^{\lambda} + (1-p)\tilde{m}_{2,t}^{\lambda}$$

$$w_t = (1-\alpha)(p\tilde{K}_{1,t} + (1-p)\tilde{K}_{2,t})^{\alpha}$$

1.7.2.2 Construct the variable x_t to measure wealth inequality and characterize the dynamics of x_t

Define a new variable x_t that captures the wealth disparities between altruistic and egoistic families. We have

$$x_t \equiv \frac{\tilde{K}_{2,t}}{\tilde{K}_{1,t}}$$

Dividing (1.36a) by (1.36b), we write:

$$\frac{\tilde{K}_{2,t+1}}{\tilde{K}_{1,t+1}} = \frac{(1+\gamma)(1+\theta+\beta)}{1+\theta+\beta(1+\gamma)}\Big(\frac{\tilde{H}_{2,t}}{\tilde{H}_{1,t}} + \frac{\gamma}{1+\gamma}\frac{R_t}{w_t}\frac{\tilde{K}_{2,t}}{\tilde{H}_{1,t}}\Big) \tag{1.37}$$

Moreover, by dividing (1.36c) by (1.36d), one can show that the human capital accumulation ratio is a function of inequality x_t:

$$\frac{\tilde{H}_{2,t}}{\tilde{H}_{1,t}} = (\frac{\tilde{K}_{2,t}}{(1+\gamma)\tilde{K}_{1,t}})^{\lambda} \equiv (\frac{x_t}{1+\gamma})^{\lambda} \tag{1.38}$$

On the other hand, we know that

$$\frac{R_t}{w_t}\tilde{K}_{2,t} = \frac{\alpha}{1-\alpha}\frac{\tilde{K}_{2,t}}{\tilde{K}_t}$$

Notice that $\tilde{K}_t = p\tilde{K}_{1,t} + (1-p)\tilde{K}_{2,t}$, thus

$$\frac{R_t}{w_t}\tilde{K}_{2,t} = \frac{\alpha}{1-\alpha}\frac{x_t}{p+(1-p)x_t}$$

Moreover, using the result provided in (1.38), we can rewrite $\tilde{H}_{1,t}$ as a function of x_t as follows:

$$\begin{aligned}
\tilde{H}_{1,t} &= \frac{H_{1,t}}{H_t} \\
&= \frac{H_{1,t}}{pH_{1,t} + (1-p)H_{2,t}} \\
&= \frac{1}{p + (1-p)\frac{\tilde{H}_{2,t}}{\tilde{H}_{1,t}}} \\
&= \frac{1}{p + (1-p)(\frac{x_t}{1+\gamma})^{\lambda}}
\end{aligned} \tag{1.39}$$

Replacing (1.38) and (1.39) into (1.37), we obtain the following dynamics of x_t:

$$x_{t+1} = \frac{(1+\gamma)(1+\theta+\beta)}{1+\theta+\beta(1+\gamma)}\Big[(\frac{x_t}{1+\gamma})^{\lambda} + \frac{\gamma\alpha}{(1+\gamma)(1-\alpha)}x_t\frac{p+(1-p)(\frac{x_t}{1+\gamma})^{\lambda}}{p+(1-p)x_t}\Big]$$

Thus, in intensive form, the equilibrium can be fully characterized by the dynamics of x_t.

1.7.2.3 Proof that $\bar{\lambda}$ is a decreasing function of γ

From (1.28), let $\lambda = \bar{\lambda}$. We already prove that there exists a unique solution of $\bar{\lambda}$ such that $G(1;\gamma,\bar{\lambda} = 1$. Put differently, one is able to derive $\bar{\lambda}$ as a function of γ as :

$$\bar{\lambda} = f(\gamma)$$

Indeed, by letting $G(1;\gamma,\bar{\lambda}) = 1$ one has:

$$\frac{(1+\beta+\theta)(1+\gamma)}{1+\theta+\beta(1+\gamma)}\Big[(\frac{1}{1+\gamma})^{\bar{\lambda}} + \frac{\gamma\alpha}{(1+\gamma)(1-\alpha)}\big(p+\frac{1-p}{(1+\gamma)^{\bar{\lambda}}}\big)\Big] = 1$$

Simplifying it gives us:

$$(1+\gamma)^{\bar{\lambda}} = \frac{1-\frac{\alpha\gamma p}{(1+\gamma)(1-\alpha)}+\frac{\beta\alpha}{1+\beta+\theta}}{1+\frac{\gamma\alpha(1-p)}{(1+\gamma)(1-\alpha)}}$$

Taking logarithm the both sides of the equations gives us:

$$\bar{\lambda} = \underbrace{\frac{\ln\big(1-\frac{\alpha\gamma p}{(1+\gamma)(1-\alpha)}+\frac{\beta\alpha}{1+\beta+\theta}\big)-\ln\big(1+\frac{\gamma\alpha(1-p)}{(1+\gamma)(1-\alpha)}\big)}{\ln(1+\gamma)}}_{\equiv f(\gamma)}$$

This expression shows that $f(\gamma)$ is a decreasing function of γ. This can be seen through a simple derivation of the expressions inside the natural logarithms. The derivative of the expression $\frac{\alpha\gamma p}{(1+\gamma)(1-\alpha)}$ to γ equals $\frac{\alpha p(1+\gamma)(1-\alpha)-(1-\alpha)\alpha\gamma p}{\big[(1+\gamma)(1-\alpha)\big]^2}$, which is positive. The same can be said about expression $\frac{\alpha\gamma(1-p)}{(1+\gamma)(1-\alpha)}$. This means that the numerator decreases with γ and the denominator increases with γ.

Hence, $\bar{\lambda}$ is also a decreasing function of γ.

1.7.2.4 Prove that $G'(x^*) < 1$

Recall the formula of $G'(x^*)$ given in the (1.29) in the main text:

$$G'(x^*) = \frac{(1+\beta+\theta)(1+\gamma)}{1+\theta+\beta(1+\gamma)}\Big[\frac{\lambda(x^*)^{\lambda-1}}{(1+\gamma)^{\lambda}}+\frac{\gamma\alpha}{(1+\gamma)(1-\alpha)}\frac{p^2+\frac{p(1-p)(1+\lambda)}{(1+\gamma)^{\lambda}}(x^*)^{\lambda}+\frac{(1-p)^2\lambda}{(1+\gamma)^{\lambda}}(x^*)^{\lambda+1}}{(p+(1-p)x^*)^2}\Big]$$

Thus, having $G'(x^*) < 1$ means that:

$$\frac{\lambda(x^*)^{\lambda-1}}{(1+\gamma)^{\lambda}}+\frac{\gamma\alpha}{(1+\gamma)(1-\alpha)}\frac{p^2+\frac{p(1-p)(1+\lambda)}{(1+\gamma)^{\lambda}}(x^*)^{\lambda}+\frac{(1-p)^2\lambda}{(1+\gamma)^{\lambda}}(x^*)^{\lambda+1}}{(p+(1-p)x^*)^2} < \frac{1+\theta+\beta(1+\gamma)}{(1+\beta+\theta)(1+\gamma)}$$

Since we obtain that:

$$\frac{\lambda}{(1+\gamma)^{\lambda}}(x^*)^{\lambda-1} < \frac{1}{(1+\gamma)^{\lambda}}(x^*)^{\lambda-1}$$

$$\frac{p^2+\frac{p(1-p)(1+\lambda)}{(1+\gamma)^{\lambda}}(x^*)^{\lambda}+\frac{(1-p)^2\lambda}{(1+\gamma)^{\lambda}}(x^*)^{\lambda+1}}{(p+(1-p)x^*)^2} < \frac{p+\frac{1-p}{(1+\gamma)^{\lambda}}(x^*)^{\lambda}}{p+(1-p)x^*}$$

Therefore, it leads to:

$$G'(x^*) < 1$$

1.7.2.5 Proof the Proposition 4

Dividing (1.36c) by (1.36d) and set the equation at steady state, we obtain:

$$\frac{\tilde{H}_2}{\tilde{H}_1} = (\frac{x^*}{1+\gamma})^{\lambda}$$

Moreover, knowing that:

$$p\tilde{H}_1 + (1-p)\tilde{H}_2 = 1$$

One can now write $\tilde{H}_1$ and $\tilde{H}_2$ as a function of x^* as follows:

$$\tilde{H}_1 = \frac{1}{p+(1-p)(\frac{x^*}{1+\gamma})^{\lambda}}$$

$$\tilde{H}_2 = \frac{(\frac{x^*}{1+\gamma})^{\lambda}}{p+(1-p)(\frac{x^*}{1+\gamma})^{\lambda}}$$

Moreover, noticing that at steady state, capital stock $\tilde{K}_1$ is measured as follows:

$$\tilde{K}_1 = \frac{\beta}{1+\beta+\theta} w\tilde{H}_1$$

Replace in the above equation the following formulae of $\tilde{H}_1$ and w:

$$\tilde{H}_1 = \frac{1}{p+(1-p)(\frac{x^*}{1+\gamma})^\lambda}$$

$$w = (1-\alpha)\tilde{K}_1^\alpha(p+(1-p)x^*)^\alpha$$

We obtain:

$$\tilde{K}_1 = \Big(\frac{(1-\alpha)\beta^{1/(1-\lambda)}}{(1+\theta+\beta)\theta^{\lambda/(1-\lambda)}}\frac{(p+(1-p)x^*)^\alpha}{(p+(1-p)(\frac{x^*}{1+\gamma})^\lambda)^{1/(1-\lambda)}}\Big)^{1/\alpha}$$

Moreover, knowing that $\frac{\tilde{K}_2}{\tilde{K}_1} = x^*$, we obtain the following formula to compute $\tilde{K}_2$:

$$\tilde{K}_2 = x^*\Big(\frac{(1-\alpha)\beta^{1/(1-\lambda)}}{(1+\theta+\beta)\theta^{\lambda/(1-\lambda)}}\frac{(p+(1-p)x^*)^\alpha}{(p+(1-p)(\frac{x^*}{1+\gamma})^\lambda)^{1/(1-\lambda)}}\Big)^{1/\alpha}$$

Finally, since $\tilde{K} = p\tilde{K}_1+(1-p)\tilde{K}_2$, we get the formula of aggregate capital stock per efficient worker as follows:

$$\tilde{K} = (p+(1-p)x^*)\tilde{K}_1$$

1.7.2.6 The model with population growth

To simplify the following analysis, note that we denote aggregate variables by capital letters, per capita variables by small letters, and per efficient capita (intensive form) by capital letters with tilde. For example, aggregate capital is denoted by K, capital saved by each individual denoted by $k = \frac{K}{L}$ and capital per efficient capita, or per efficient unit of labor, is denoted by $\tilde{K} = \frac{K}{hL}$.

The human capital, h, of an adult at time t of dynasty i can be expressed as a function of the previous period's average human capital and the intrahousehold transfers received at childhood, as the following:

$$h_{i,t} = m_{i,t-1}^\lambda h_{t-1}^{1-\lambda}, \quad \lambda \in (0,1) \tag{1.40}$$

While the utility function does not change, as in Equation (1.2), the budget constraints of individual in dynasty i now become:

$$c_{i,t} + s_{i,t} + (1+n)m_{i,t} \leq w_t h_{i,t} \tag{1.41}$$

$$d_{i,t+1} + (1+n)b_{i,t+1} \leq (s_{i,t} + b_{i,t})R_{t+1} \tag{1.42}$$

The first-order conditions do not change, except for how we now express income, and where the population growth rate appears, to the following:

$$c_{i,t} = \frac{1}{1+\theta+\beta(1+\gamma_i)}(w_t h_{i,t} + b_{i,t}) \tag{1.43}$$

$$(1+n)m_{i,t} = \frac{\theta}{1+\theta+\beta(1+\gamma_i)}(w_t h_{i,t} + b_{i,t}) \tag{1.44}$$

$$d_{i,t+1} = \frac{\beta R_{t+1}}{1+\theta+\beta(1+\gamma_i)}(w_t h_{i,t} + b_{i,t}) \tag{1.45}$$

$$(1+n)b_{i,t+1} = \frac{\beta \gamma_i R_{t+1}}{1+\theta+\beta(1+\gamma_i)}(w_t h_{i,t} + b_{i,t}) \tag{1.46}$$

Consequently, given differences in the inheritance preference, we get the following more explicitly expressed equations:

$$b_{1,t+1} = 0 \tag{1.47a}$$

$$b_{2,t+1} = \frac{\beta \gamma R_{t+1}}{(1+\theta+\beta(1+\gamma))(1+n)}(w_t h_{2,t} + b_{2,t}) \tag{1.47b}$$

The savings function for each dynasty can be derived as follows:

$$s_{1,t} = \frac{\beta}{1+\beta+\theta} w_t h_{1,t} \tag{1.48}$$

$$s_{2,t} + b_{2,t} = \frac{\beta(1+\gamma)}{1+\theta+\beta(1+\gamma)}(w_t h_{2,t} + b_{2,t}) \tag{1.49}$$

The production function of firm, as well as the rate of return on capital and wages now change to the following:

$$Y_t = K_t^{\alpha}(h_t L_t)^{1-\alpha}$$

$$R_t = \alpha \tilde{K}_t^{\alpha-1} \tag{1.50}$$

$$w_t = (1-\alpha)\tilde{K}_t^{\alpha} \tag{1.51}$$

Equilibrium in the economy now can be expressed with the following market clearing conditions:

$$K_{1,t+1} = pN_{t+1}k_{1,t+1} = pN_{t-1}s_{1,t} = \frac{pN_{t+1}}{(1+n)^2}s_{1,t} \tag{1.52}$$

$$K_{2,t+1} = (1-p)N_{t+1}k_{2,t+1} = (1-p)N_{t-1}(s_{2,t}+b_{2,t}) = \frac{pN_{t+1}}{(1+n)^2}\big(s_{2,t}+b_{2,t}\big) \tag{1.53}$$

$$K_{t+1} = pN_{t+1}k_{1,t+1} + (1-p)N_{t+1}k_{2,t+1} = \frac{pN_{t+1}}{(1+n)^2}s_{1,t} + \frac{(1-p)N_{t+1}}{(1+n)^2}\big(s_{2,t}+b_{2,t}\big) \tag{1.54}$$

where it is important to note that the individual savings (and inheritance) is multiplied by the cohort at the time it is born, to remain consistent with the timing convention of the rest of the paper. Recall that $k_{i,t+1} = \frac{K_{i,t+1}}{N_{i,t+1}}$. Also note that Equation (1.52), for instance, gives the classic three-period market clearing condition $(1+n)^2k_{1,t+1} = s_{1,t}$. This is the same for Equation (1.53). Also note that Equation (1.54) can be further simplified to look like the original market clearing condition $k_{t+1}(1+n)^2 = ps_{1,t} + (1-p)(s_{2,t}+b_{2,t})$.

The market clearing condition for labor remains the same. The human capital market clearing condition can be expressed as:

$$H_t = H_{1,t} + H_{2,t} = h_{1,t}pN_t + h_{2,t}(1-p)N_t \tag{1.55}$$

which can be further simplified to the original set-up as $h_t = ph_{1,t} + (1-p)h_{2,t}$.Finally, the good market clearing condition, which results from the individual budget constraints, requires that what is produced is consumed, shared or saved in the economy, such that:

$$p\Big(c_{1,t}+d_{1,t}+(1+n)m_{1,t}+s_{1,t}\Big)N_t+(1-p)\Big(c_{2,t}+d_{2,t}+(1+n)m_{2,t}+s_{2,t}+b_{2,t}\Big)N_{t-1} = Y_t \tag{1.56}$$

We can re-express the dynamics of our four predetermined variables as the following:

$$\frac{1+\theta+\beta}{\beta}(1+n)^2k_{1,t+1} = w_th_{1,t} \tag{1.57}$$

$$\frac{1+\theta+\beta(1+\gamma)}{\beta(1+\gamma)}(1+n)^2k_{2,t+1} - \frac{\gamma(1+n)}{1+\gamma}R_tk_{2,t} = w_th_{2,t} \tag{1.58}$$

$$h_{1,t+1} = h_t^{1-\lambda}(\frac{\theta}{\beta}(1+n)k_{1,t+1})^\lambda \tag{1.59}$$

$$h_{2,t+1} = h_t^{1-\lambda}(\frac{\theta}{\beta(1+\gamma)}(1+n)k_{2,t+1})^\lambda \tag{1.60}$$

where:

$$h_t = ph_{1,t} + (1-p)h_{2,t} \tag{1.61}$$

$$R_t = \alpha(\frac{pk_{1,t} + (1-p)k_{2,t}}{ph_{1,t} + (1-p)h_{2,t}})^{\alpha-1} \tag{1.62}$$

$$w_t = (1-\alpha)(\frac{pk_{1,t} + (1-p)k_{2,t}}{ph_{1,t} + (1-p)h_{2,t}})^{\alpha} \tag{1.63}$$

We can re-write Equations (1.57) and (1.58) as the following:

$$\frac{1+\theta+\beta}{\beta}(1+n)^2\tilde{K}_{1,t+1}\frac{h_{t+1}}{h_t} = w_t\tilde{H}_{1,t} \tag{1.64}$$

$$\frac{1+\theta+\beta(1+\gamma)}{\beta(1+\gamma)}(1+n)^2\tilde{K}_{2,t+1}\frac{h_{t+1}}{h_t} = \frac{\gamma(1+n)}{1+\gamma}R_t\tilde{K}_{2,t} + w_t\tilde{H}_{2,t} \tag{1.65}$$

where we make use of the following notation: $\tilde{K}_{1,t} = \frac{pk_{1,t}}{h_t}$, $\tilde{K}_{2,t} = \frac{(1-p)k_{2,t}}{h_t}$, $\tilde{K}_t = \tilde{K}_{1,t} + \tilde{K}_{2,t}$, $\tilde{H}_{1,t} = \frac{ph_{1,t}}{h_t}$ and $\tilde{H}_{2,t} = \frac{(1-p)h_{2,t}}{h_t}$. Dividing Equation (1.64) over (1.65) gives us the following familiar expression:

$$\frac{1+\theta+\beta(1+\gamma)}{(1+\theta+\beta)(1+\gamma)}\frac{\tilde{K}_{2,t+1}}{\tilde{K}_{1,t+1}} = \frac{\gamma(1+n)}{1+\gamma}\frac{R_t}{w_t}\frac{\tilde{K}_{2,t}}{\tilde{H}_{1,t}} + \frac{\tilde{H}_{2,t}}{\tilde{H}_{1,t}} \tag{1.66}$$

which can be further simplified using our notation to be a function of inequality x, as the following:

$$\frac{1+\theta+\beta(1+\gamma)}{(1+\theta+\beta)(1+\gamma)}x_{t+1} = \frac{\gamma(1+n)\alpha}{(1+\gamma)(1-\alpha)}\frac{x_t}{1+x_t}\left(1+(\frac{1-p}{p})^{1-\lambda}(\frac{x_t}{(1+\gamma)})^{\lambda}\right)+(\frac{1-p}{p})^{1-\lambda}(\frac{x_t}{(1+\gamma)})^{\lambda} \tag{1.67}$$

Chapter 2

The demographic boom and the rise of informal employment: The case for Egypt

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Abstract

In several MENA countries, young and better-educated workers entering the labor market often have a hard time finding quality jobs. This paper looks at the role of the demographic boom on the prevalence of informal employment, with the context of Egypt at the start of the new millennium. We introduce overlapping generations of heterogeneous education levels in a multi-sectoral model that consists of: (1) an exogenous government sector that is preferred by all workers; (2) a formal private sector that incurs taxes, search-matching frictions and sluggish job vacancy creation and; (3) a perfectly competitive informal sector. We calibrate the model using a unique panel survey for Egypt and simulate the demographic boom over time. We show that a temporary demographic boom of better-educated workers can have long-run effects on non-formality rates, interacting with output and prices. We contrast this actual dynamic adjustment with the counterfactual absence of the demographic boom as well as with an easing of vacancy creation to show the importance of demographics and private sector constraints on non-formality rates.

2.1 Introduction

Egypt stands today in the midst of its demographic boom. The birth and death rate differentials most evident in the 1980s have created a youth bulge that began entering the local labor market in the late 1990s. By the end of 2010, the sweeping majority of this demographic boom had joined the labor force. Preceded and followed by relatively high total fertility rates, the size of Egypt's population is arguably altered for decades to come.

At the same time, the nature of this demographic boom was not merely in numbers, but also in the education composition of the population and consequently its labor force. The generation of the 1980s, as well as the younger cohorts of the 1990s and onwards, arrive in the labor market better educated than their predecessors, with higher completion rates of high school and university degrees.

However, unlike previous cohorts in previous times, a less favorable jobs environment awaited these new entrants. The government, which had long been a significant employer of Egyptians with secondary and university education had lowered its hiring rate following a structural readjustment program in the 1990s (Alissa (2007)). Moreover, despite the overall economic growth of the new millennium, the link to job creation was much less evident, with many of the new jobs being informal (World Bank (2014), Nassar (2011), Eekelen et al. (2002) and Mahdi (2002)), which was a similar phenomenon seen in neighboring countries in the Middle East and North Africa region (Gatti et al. (2014)).

These observations are supported by a novel panel survey, the Egyptian Labor Market Panel Survey (ELMPS), conducted first in 1998 and followed by other rounds in 2006, 2012, and more recently in 2019. The data shows a notable rise in the size and share of the working-age population, particularly those with better education (high school and above). At the same time, the share of informal employment, defined as waged work that does not contribute to social security, has also significantly risen, and is particularly evident for younger cohorts and increasingly among the educated.

If the rising share of informality is an equilibrium outcome based on workers' own self-selection into the various sectors, according to their comparative advantage, then this rise should not be a cause of concern. In this equilibrium, workers are indifferent between the various options available to them (see Magnac (1991)). This is also true if informal jobs are to a large extent a stepping stone towards more advantageous positions. Instead, if informal sector jobs are a last resort for workers, and if mobility to better jobs is limited, then informality is arguably much less desirable, and should be a cause for concern. Understanding the mechanisms at work then becomes a prerequisite to envisage reforms.

In Egypt, the data points to a relatively disadvantaged informal sector, with a significant informal wage penalty for both men and women, even after accounting for unobservable characteristics (Tansel et al. (2015)[1]).[2] To the best of our knowledge, there is no evidence that such a penalty is compensated by other job amenities. Moreover, the data also shows that transitions between sectors are few, particularly when the worker is in government, while those from government and private formal jobs to informal jobs and unemployment (combined in this paper as "non-formality") have increased over time.[3] This is supported by results shown in Assaad et al. (2016), who looked at synthetic six-month panels from retrospective data from the surveys.

These facts suggest that the developments of the Egyptian labor market during the new millennium are worthy of closer examination. This paper aims at exploring the channels through which population growth and compositional changes in terms of skills can influence the size of informality, in the context of a restrained private formal sector and a significant but also relatively constrained government sector. Recognizing these facts, as well as some transitions between formal and informal states, we develop a modern equilibrium framework in the spirit of other research, such as e.g. Meghir et al. (2015) and Albrecht et al. (2019), where all types of workers can be found in various labor market states (along the Mortensen-Pissarides approach of frictional labor markets).

The impact of a population growth shock has been studied in the literature typically with a focus on the impact on the unemployment rate. Since the aggregate unemployment rate can be calculated as the weighted sum of age-specific unemployment rates, where the weights represent the size of various age cohorts in the labor force, changes in the demographic composition can affect the aggregate unemployment rate.[4]

[1] Note that the authors' definition of an informal waged worker is one who is not covered by social security or does not have a contract.

[2] This is not a particularity for Egypt. Informal employees tend to incur a wage penalty in most developing countries around the world (Grindling et al. (2016) for a global discussion on these wage gaps, and country examples such as Tansel and Kan (2012) for Turkey, Nguyen et al. (2013) on Vietnam, and Bargain and Kwenda (2011) for a cross-country comparison between Brazil, Mexico and South Africa).

[3] As will be shown in the following Subsection, we focus mainly on men of working age, bearing in mind the low labor force participation of women (20-25%), and a relatively different decision making process for entering and leaving the labor market.

[4] Blanchard and Summers (1986) and Biagi and Lucifora (2008) have argued that heterogeneity of the workforce along other dimensions should also be taken into account (in particular around the educational dimension).

To measure the impact of such a change, the literature has first assumed that demographic changes do not affect age-specific unemployment rates (see e.g. Perry et al. (1970), Gordon and Shimer (1998)). This assumption can be rationalized by several standard models under the assumption that the labor market is segmented along the age dimension.[5] However, this assumption turns out to be inadequate: Changes in demographics may affect the age-specific unemployment rates and according to several empirical analyses they do. For instance, Shimer (1998), Shimer (2001) and Biagi and Lucifora (2008) argue for the existence of an impact on the youth unemployment rates.[6] To rationalize this, Shimer (2001) develops an extension to the search and matching model where young workers need time to find the right match with a firm. While they are mismatched, they search on the job. This creates an externality: a larger proportion of the workforce searching for and accepting job offers lowers the expected cost of opening a vacancy. This stimulates job creation for all types of workers.

Our framework formulates a related idea since entrants in the labor market first occupy a position mixing unemployment and informal work during which they search for better formal (public or private) jobs. To the best of our knowledge, this extension that includes informality is new, and is particularly important for workers in countries where unemployment benefits are not a viable option.

As Shimer (2001), we assume random matching (implying that recruiters do not discriminate by age). However, we replace the standard infinitely elastic supply of vacancies by a more inelastic one (thanks to a formulation going back to Diamond (1982)). This alternative formulation turns out to be a convincing way of reconciling the Mortensen-Pissarides framework with key business cycle properties in occidental countries (see Coles and Kelishomi (2018) and Elsby et al. (2015)).

In the search and matching literature, a number of researchers have explicitly introduced some heterogeneity in the workforce. This is in particular true along the spatial and the skill

[5]Each segment of the labor market can then be seen as populated by homogeneous agents. In the traditional macroeconomic literature, where the labor market is imperfectly competitive and the workforce homogeneous, changing the size of the labor force leaves the unemployment rate unaffected (see e.g. Layard et al. (1991)): A growing workforce puts a downward pressure on wages and this eventually boosts labor demand until the economy is back to its initial level of unemployment. In the more recent basic matching model of Pissarides (2000), the workforce is again formally homogeneous and heterogeneities are implicitly encapsulated in a matching function. An increase in the size of the labor force, which enters the labor market first as unemployed, does not affect labor market tightness (i.e. the vacancy-unemployment ratio). This is because of the standard assumption of constant returns in the matching function between vacancies and job-seekers. Increasing the size of the unemployment pool reduces the expected length of time needed to fill a vacant position. This eventually leads to a compensating increase in the number of vacancies, so that the (un)employment rate remains unaffected in the long run.

[6]However, there is no agreement on the sign of this effect.

dimensions (see, respectively, e.g. Coulson et al. (2001) and Elsby et al. (2015)). Numerous papers intend to explain the unemployment pattern over the life cycle (see Hairault et al. (2019) for a recent paper and the references therein). However, to the best of our knowledge, the matching literature has not put much emphasis on the impact of demographic *shocks* on the labor market. Shimer 1998, Shimer (2001) and Lugauer (2012)[7] are exceptions as far as young workers are concerned. de la Croix et al. (2013) look at the problem of aging.

Several papers have introduced informal labor in the presence of labor market frictions. How the informal sector has been treated in the literature varies. Albrecht et al. (2009a), for instance, model it as a sector with exogenous job arrival and destruction rates. Ulyssea (2010), Bosch and Esteban-Pretel (2012) and Charlot et al. (2015), on the other hand, model the informal sector like the formal one with matching frictions, but different production technologies. For some others in the literature, informality is a last-resort sector that does not experience any frictions (e.g Zenou (2008), Charlot et al. (2013), Flórez (2017)). We opt in this paper to treat this sector as a competitive one, albeit with a worker productivity that differs from the private formal sector as will be shown later.

Given the importance of both the public and the informal sector in some countries, Yassin and Langot (2018) have studied, as we do, the interaction between the informal and formal private sectors and the public one. They look at an episode where, in Egypt, the public sector pay policy changed and employment protection in the formal private sector was reduced. Their representation of the economy differs from ours in several respects. They do not have an OLG structure. However, they endogenize job destruction and on-the-job search decisions while in our paper they are exogenous. They have a clear distinction between the unemployment and informal state while we consider that these two states should be merged. They assume free-entry on vacancies while we adopt the formulation due to Diamond (1982). They look at steady-state effects while we focus on the dynamic adjustment of the economy.

We construct an economy with three distinct sectors: (1) a government sector that is treated as exogenous in terms of job arrival and destruction rates and that is preferred by all workers (in line with evidence in Barsoum (2014) and Barsoum (2016)), (2) a private formal sector that faces matching friction, sluggish vacancy creation and taxation, and, (3) an informal sector that operates in perfect competition and can absorb all those that do not find job opportunities in the first two sectors.

As for the labor supply, we model a population of workers of various age-groups that each

[7] This paper focuses on the link between the youth share in the labor force and GDP volatility.

have an exogenous survival probability. These workers can have one of two skill levels: low and high (the latter being characterized by an education level of high school or above). The demographic boom can be seen as a labor supply shock of young workers entering the non-formal state, where their time can be split between informal work and home production. On the other hand, a change in the education composition of these workers can be seen in the share of young workers, in the non-formal state, that have either a high or a low skill level.

Finally, the economy produces a consumption good that uses intermediate goods, which are themselves produced by both formal and informal private firms, with both low- and high-skill workers. Thanks to this approach that dates back to Acemoglu (2001), the various labor markets are strongly interrelated. The demographic boom and the change in the skill composition that has come with it consequently affect the production of intermediate goods, and consequently their prices and the production of the aggregate consumption good.

The numerous parameters of the model are calibrated using mainly our structural model and various waves of the above-mentioned ELMPS survey. The demographic shock in Egypt manifests itself mainly through the arrival of young skilled labor. In the formal private sector, this labor supply shock increases the chances of meeting a partner. However, and as is Diamond (1982), the inflow of new vacancies adjusts only gradually to this shock. Moreover, the significant size of the high-skilled labor supply shock increases the quantity of high-skilled intermediate goods (both formal and informal). This induces a rise in aggregate output and a drop in the price of this intermediate good. These price and quantity adjustments have long-lasting effects on all sectors of the economy. In sum, our model leads to rich dynamics and interesting long-run properties.

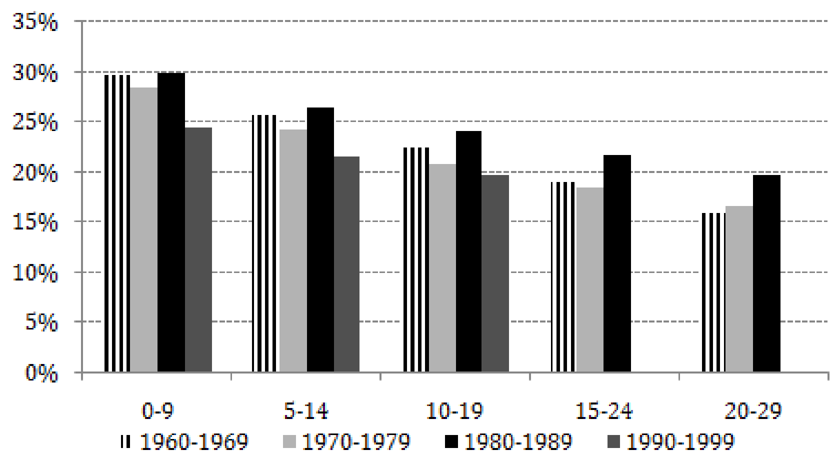
The rest of the paper is structured as follows. Section 2.2 introduces further evidence from international data and the ELMPS surveys that motivate this article. Section 2.3 presents the theoretical model, its assumptions and equilibrium conditions. Section 2.4 presents the calibration procedure and some simulation results. Finally, Section 2.5 concludes.

2.2 The institutional context and motivating facts

Egypt's demographic boom generation can be identified as that born in the 1980s. During this period, the country's crude birth and death rate differentials widened, producing a generation that has constituted throughout time a larger proportion of the population compared to those born earlier and later. Figure 2.1 shows, for instance, that the generation born in the 1980-1989 period represented about 30% of the population when it was 0-9 years old, 24% when it grew up to be 10-19 years old and about 20% at ages 20-29 years old. These proportions are larger than those of previous cohorts and the following one (1990-1999) when those cohorts were at similar ages.

This demographic boom, which comes after years of relatively high population growth in general, has altered the size of the population not only on a temporary basis, but a more permanent one. Total population in Egypt rose from an estimated 27 million people in 1960 to 96.7 million in 2016 (Figure 2.35 in Appendix 2.6.1.1). While total fertility rate has declined over time, it remains significant (Figure 2.36 in Appendix 2.6.1.1), emphasizing again the non-transitory nature of this shock for decades to come.

Figure 2.1: Share of the cohort in overall population at various age-groups



Source: World Bank (Health, Nutrition and Population Statistics)

The extent of the labor market insertion of this "youth bulge" has been an issue of concern in much of the research on Egypt. Assaad and Krafft (2013b) point to a general decline of its employment rates, an increase of its unemployment rates and an increase in under-employment in general seen through the rise of seasonal and part-time work. Moreover, a report by the World Bank (2014) has argued that job creation did not grow in line with the economic performance of the country, drawing particular attention to the fact that new jobs were "overwhelmingly" informal, where they define informality as the lack of contributions to social security (the reader is referred to Appendix 2.6.1.2 on the definition of informality and Appendix 2.6.1.3 for brief information about Egypt's social insurance system).

In order to look at the evolution of informality at the time of the demographic boom, this research relies on a dataset called the Egyptian Labor Market (Panel) Survey. It is carried out by the Economic Research Forum (ERF) based in Cairo, Egypt, and in close collaboration with the Central Agency for Public Mobilization and Statistics (CAPMAS) - the main government institution for statistics in the country.

The survey collected information on households and individuals at three sparse years over a 14-year period. The first round was in 1998, initially called the Egyptian Labor Market Survey (ELMS), followed by one in 2006 and another 2012, both of which came be called the Egyptian Labor Market Panel Survey (ELMPS), with a round carried out also in 2018 - the results of which have yet to be shared publicly.

The pilot round of 1998 interviewed an initial group of 23,997 individuals in 4,816 households. The following rounds interviewed three types of individuals: (1) those residing in households that appeared in the previous survey round(s); (2) those residing in the so-called "split" households, meaning the sons, daughters and others who left their 1998 household and created their own, and finally; (3) those interviewed from a "refresher" sample of households. With this survey design, the number of households and individuals have consequently increased over time. Refer to Appendix 2.6.1.4 for more information on the survey.

These surveys show a significant rise in the working-age population, capturing the demographic boom. Table 2.1 shows the increasing size of the working-age population from 1998 to 2012. This increase is particularly apparent for those aged 20-29 years old and 30-39 years old, both of which had a noticeably increasing share of the total population.

Moreover, the data shows the second feature of this demographic boom, which is a change in the skill composition of the working-age population, towards the better educated. The share of high-school graduates, for instance, increased from 23% in 1998 to 32% in 2012. The share of university graduates increased from 13% to 18%. This is largely because the younger cohorts have higher high school and university completion rates than their predecessors.

Table 2.1: Number of working-age population by sex, education groups and selected age groups (million persons)

	1998	2006	2012
All	36.76	44.99	48.48
By sex			
Male	18.39	22.25	23.94
Female	18.37	22.74	24.54
By age group			
20-29 years old	9.72	13.73	14.92
share of total	*26%*	*31%*	*31%*
30-39 years old	7.10	8.28	11.15
share of total	*19%*	*18%*	*23%*
40-49 years old	6.13	7.03	7.38
share of total	*17%*	*16%*	*15%*
50-59 years old	4.48	5.84	6.14
share of total	*12%*	*13%*	*13%*
By education group			
No degree	14.68	15.02	13.31
share of total	*40%*	*33%*	*27%*
Elementary & middle school	8.85	8.67	10.84
share of total	*24%*	*19%*	*22%*
General & vocational high school	8.44	14.36	15.74
share of total	*23%*	*32%*	*32%*
Post-secondary, university & above	4.70	6.93	8.54
share of total	*13%*	*15%*	*18%*

Source: ELMPS (1998-2012)

Note: Working-age population is defined as those aged 15-64 years old. Survey weights are used.

Focusing on men of age 15-64 years old[8] (henceforth referred to as the "population") who

[8]Women are excluded for two reasons: (1) they generally have very low participation rates, 20-25% throughout the survey rounds, and; (2) their decision-making to enter the labor market is often different from the men's. For instance, women often enter either with a guaranteed formal job (often in the public sector) or they are often observed as unpaid family workers, often at subsistence level. Egyptian women also tend to drop out of the labor force after getting married and having children. Men, on the other hand, have relatively high participation rates, around 80%, and they have a clear labor market attachment. Appendix

are waged-workers, these three rounds of the ELMPS tell us three important facts that the model in this paper takes into consideration, shown in Tables 2.2 and 2.3.

The first fact is that the government sector remains a significant employer for waged-workers in the economy. Distinguishing three types of employment sectors, i.e. government, private formal and an informal sector that designates a lack of social security contributions, the data shows that in 1998, 47% of waged-workers were in government - being the largest employer then - dropping to 41% in 2006 and 33% in 2012.

This decrease is part of a long-term trend of government downsizing, essentially begun with the Economic Reform and Structural Adjustment Programme of 1991. Funded by several international organizations[9], it came to alleviate the repercussions of the 1986-1990 period with the fall of oil prices, rising inflation and increasing external debt. It restricted government expenditure in particular, contributing to the end of the employment-guarantee program that was initiated during the era of President Gamal Abdul-Nasser (1950s) for university graduates. For more information and historical perspective, refer to a recent report by World Bank (2014).

The second fact is that overall informal employment expanded more than the private formal sector in light of weakening government employment. The proportion of waged-workers informally employed was 42% in 1998 and climbed to 52% in 2012. Formal private employment, on the other hand, increased as a proportion of waged-workers from 11% to 15% in the period, although still playing a meager part in the employment story of the country.

The third fact is that there are some education, age and cohort differences. The proportion of government employment increases with education level for all years of the surveys, meaning that higher shares of the better educated appear in government. Informality, by contrast, decreases with education level, as expected. However, it is important to note that even the better educated were not spared from the rise of informal employment throughout the 14-year period under consideration.

The data also shows that informal employment is much more prevalent among younger age-groups, and that this prevalence has increased throughout the years. This remark also applies at the cohort level. Younger cohorts have seen much higher informality rates, even at roughly similar age-groups to their predecessors. For example, Table 2.3 shows that when the cohort

2.6.1.7 provides additional information about men's participation rates.

[9] Mainly the International Monetary Fund (IMF), the World Bank (WB) and other donors such as the African Development Bank (ADB)

born in the 1960s was in late-20 to late-30 years old (1998), its overall informality was 36%. One cohort later, the one born in the 70s at roughly similar ages, had an informality rate of 53% (2006). These increases are seen across all education levels. Workers of the 1980s cohort, though some were still in university at the time of the 2012 survey saw even higher informality rates.

Note that, throughout the period under consideration, participation rates were either stable or increasing across age-groups and educational levels. This period also saw decreasing unemployment rates (see Table 2.12), despite the fact that Egypt had also suffered some repercussions of the financial crisis of 2009. However, the unemployment rate among the most educated men became the highest in 2006 and 2012, pointing again to growing difficulties for this sub-group (see Table 2.12).

As far as the institutional context is concerned, it should be stressed that unemployment benefits are negligible and restrictive in Egypt (refer to Appendix 2.6.1.6 for more information on unemployment benefits).

Table 2.2: Proportion of waged-workers by sector, age-group and educational level (men; in percent)

		1998	2006	2012
A. Overall				
	Government	47	41	33
	Private formal	11	14	15
	Informal	42	45	52
		100	100	100
B. By broad education level				
None	Government	28	25	18
	Private formal	8	11	9
	Informal	64	64	73
Elementary & middle school	Government	38	30	20
	Private formal	10	13	14
	Informal	52	57	66
General & vocational h.s.	Government	53.7	40	32
	Private formal	12.7	14	15
	Informal	33.6	46	53
Post-secondary, univ. & above	Government	75	65	55
	Private formal	14	18	21
	Informal	11	17	24
C. By age-group (years old)				
20-29	Government	26	17	14
	Private formal	13	15	15
	Informal	61	68	71
30-39	Government	52	41	31
	Private formal	14	18	19
	Informal	34	41	50
40-49	Government	67	65.4	51
	Private formal	11	13.2	16
	Informal	22	22.4	33
50-59	Government	72	74	66
	Private formal	7	11	12
	Informal	21	16	22

Source: ELMPS Panel (1998-2012)

Note: The Government category includes both public administration and public enterprises. Notes on the education categories: (1) These categories are observed for persons aged 10+ years old at the time of the survey; (2) The category of "None" under education levels includes those who are illiterate and those who are literate but have no formal degree (fewer in general); (3) Post-secondary encompass institutions that offer post-secondary diplomas that still do not rise to a Bachelor's degree or more; (4) There are a few missing values for education for those employed, but they do not exceed 10 observations for each survey year.

Table 2.3: Proportion of informal employment by cohort and education level (men; in percent)

	Cohort 1950-1959		
	1998	2006	2012
years old	*39-48*	*47-56*	*53-62*
Overall	23	20	26
By broad education level			
None	46	40	51
Elementary & middle school	31	29	29
General & vocational high school	3	4	13
Post-secondary, university & above	4	2	6
	Cohort 1960-1969		
	1998	2006	2012
years old	*29-38*	*37-46*	*43-52*
Overall	36	29	33
By broad education level			
None	70	59	62
Elementary & middle school	43	35	41
General & vocational high school	23	19	23
Post-secondary, university & above	15	11	11
	Cohort 1970-1979		
	1998	2006	2012
years old	*19-28*	*27-36*	*33-42*
Overall	68	53	48
By broad education level			
None	87	83	78
Elementary & middle school	81	61	57
General & vocational high school	66	53	46
Post-secondary, university & above	28	22	21
	Cohort 1980-1989*		
	1998	2006	2012
years old	*9-18*	*17-26*	*23-32*
Overall	95	81	69
By broad education level			
None	96	89	91
Elementary & middle school	99	89	81
General & vocational high school	87	78	68
Post-secondary, university & above	-	54	37

Source: ELMPS Panel (1998-2012)

* Employment and informality observations for the cohort of 1980-1989 are very few for the year 1998 as this cohort is still in its teenage years. The proportions become more accurate in 2006 and mostly in 2012 when the majority of this cohort is absorbed into the labor market.

Refer to Table 2.2 for information on the education levels.

Survey data on real wages show that over the 14-year-period wages of formal private, government[10] and informal sectors have increased, both in mean and median, as shown in Table 2.4. There was a peak for formal private wages in 2006 before a drop in 2012.[11]

Note that the official minimum wage in Egypt was hiked up from 700 Egyptian pounds in 2011 to 1,200 ($174) effective in January 2014, based on an eight-hour day, five-days-a-week work schedule. Since it is scarcely enforced in the private sector, it has no implications on our main research question. The interested reader can refer to World Bank (2014) for more details.

Table 2.4: Real net wages of men in working-age in Egyptian pounds (2012 prices)

	1998	2006	2012
Formal private sector			
Mean	1180	1758	1651
standard deviation	(944)	(2796)	(2215)
Median	917	1180	1083
Government sector			
Mean	846	1618	1382
standard deviation	(669)	(4118)	1499
Median	666	908	1003
Informal sector			
Mean	709	864	967
standard deviation	(450)	(1109)	(823)
Median	609	721	809

Source: ELMPS Panel 1998-2012
Government sector includes government civil servant jobs at various ministries and institutions, as well as so-called public enterprises, such as the Suez Canal Authority, but excludes military personnel.
Note: These are wages from primary jobs only. If we include all jobs (secondary for example) the means and medians increase but not by a large amount.

There has been no evidence in the research on the extent of the authorities' supervision of the informal sector, or the probability (or cases) of being caught and shut down. We can argue here that the burgeoning of the informal sector is evidence of a general tolerance of this sector.

However, recognizing the issue of informality, the Egyptian government introduced a labor

[10]About this phenomenon, see in particular Yassin and Langot (2018).

[11]Much of this is attributed to the effects of the financial crisis on the country. Yassine (2015) argues in her Ph.D. thesis that evidence of the effect of the 2009 global financial crisis on the labor market is far stronger than the revolution of 2011 by the survey round of 2012.

law in 2003 (Law No. 12 of 2003) that granted employers more ease when it comes to hiring, firing and contract duration. Effective in 2004, the law aimed at creating more dynamism in the market and shifting labor from the informal to the formal. Assaad and Wahba (2015) argue that there has been an increase in contracted jobs for regular waged workers, in non-agricultural sectors, in the short period after the law, compared to the one before. However, using synthetic retrospective data from the ELMPS 2006 and 2012, Langot and Yassine (2015) find that the law has had significant positive effects on the separation rate, increasing from about 0.8% in 2004 to about 1-1.2% in the following years (before the global financial crisis). On the other hand, there were no significant effects on job-finding rates. While this paper does not specifically incorporate a change in the law, the calibration of some model parameters focuses on the period 2002-2006, where this change has occurred, and is, consequently, able to account for this change.

As a final, and crucial, point of characterizing the labor market, Table 2.5 shows transition rates between survey years, for the overall labor force and for that by education level. In line with the theoretical framework presented in Section 2.3, we categorize waged-workers into three categories: government workers, formal private workers and non-formal workers - where the latter is a combination of the unemployed and informal waged workers. The table shows that:

1. It is very likely that a waged-worker remains in his state throughout the period, acknowledging of course that it is quite long. For instance, 94% of government workers in 1998 were still in government in 2006, and 89% of government workers in 2006 were in government in 2012. The proportion of workers staying in the same "state" (or sector) increases with education level for government and private formal, as would be expected. However, the proportion of stayers has decreased in the two periods under consideration.

2. Transitioning to the government sector is generally low, but it increases with skill level.

3. The proportion of workers transitioning to the non-formal state from either government or the private formal sector has increased in the second period. This is in line with our general finding of increased informalization. For instance, 15% of those who were in the private formal sector in 1998 was in the non-formal state in 2006. This proportion increased to 34% in the period 2006-2012. Increases are seen across all education levels.

Recognizing that the transition period in these tables is long, whereas a worker could have had multiple transitions in between the two dates of each period, Assaad et al. (2016)

used retrospective data from the same surveys and constructed synthetic panels to look at transition rates between market states (using a slightly different definition of informality), finding them to be low as well.

Table 2.5: Proportion of male workers (15-64 years old) transitioning between labor market states, by survey round (in percent)

	Overall	Education level			
		(1)	(2)	(3)	(4)
1998 to 2006					
Government - Government	94	93	88	92	97
Government - Private formal	3	3	5	4	1
Government - Non-formal	3	4	7	3	2
	100	100	100	100	100
Private formal - Government	14	4	20	18	15
Private formal - Private formal	71	76	63	64	76
Private formal - non-formal	15	20	17	18	9
Non-formal - Government	11	4	11	13	25
Non-formal - Private formal	13	7	21	15	15
Non-formal - Non-formal	76	89	68	72	60

	Overall	Education level			
		(1)	(2)	(3)	(4)
2006 to 2012					
Government - Government	89	78	81	93	92
Government - Private formal	5	6	9	3	5
Government - Non-formal	6	16	10	4	3
Private formal - Government	16	6	12	19	20
Private formal - Private formal	50	49	44	48	57
Private formal - non-formal	34	45	44	33	23
Non-formal - Government	10	4	8	11	20
Non-formal - Private formal	13	8	11	15	17
Non-formal - Non-formal	77	88	81	74	63

Source: ELMPS Panel 1998-2012

Education level are defined as following: (1) No formal degree, which include those who are illiterate; (2) Elementary and middle school degrees; (3) General and vocational high schools and finally; (4) Post-secondary, university and above which includes institutions that offer post-secondary diplomas that still do not rise to a Bachelor's degree or more

Government sector includes government civil servant jobs at various ministries and institutions, as well as so-called public enterprises, which includes, for instance, the Suez Canal Authority. However, the government sector, as all of the survey data, exclude military personnel.

Note that these are people who were in the original state of formal, informal or unemployment in 1998 for the 1998-2006 transition, and 2006 for the 2006-2012 transition, and who were still in the labor force and within the working-age limit for the relevant period.

2.3 The model

In this section, we set up and elaborate upon an expanded theoretical model to characterize the economy and to capture some of the main features that have been identified in the previous section, including the demographic boom and the skill composition of the labor supply. Before doing so, however, and in recognition of the complexity of this theoretical model, we first explore some of the analytic conclusions that a simple, yet similar, framework produces (in Subsection 2.3.1). Following this simple framework, we proceed to the more elaborate theoretical model (from Subsections 2.3.2 onwards).

2.3.1 A simple static framework under pure competition

Before developing a dynamic frictional framework, we here showcase a very stylized static framework that can help understand some of the mechanisms that we later find and deviate from. All markets are perfectly competitive. Unless indicated otherwise, the assumptions and characterizations made here are similar to those of the expanded model.

Assume a three-sector economy that consists of: (1) a private formal sector, denoted f, (2) a private informal sector, denoted n and, (3) an exogenous public sector, denoted g. By assumption, the public sector is the most attractive employer, paying high enough wages expressed as w^g. Only the private formal sector pays a payroll tax on its wages (whose rate is τ). Unlike the more elaborate theoretical model, both private sectors operate in a purely competitive environment.

The size of the workforce, denoted P, is exogenous. These workers are endowed with a skill s that is either low or high ($s \in \{l, h\}$). The labor market is segmented along the skill dimension. Unlike the more elaborate model, this workforce is not heterogeneous according to its age. At the beginning of the unique period, given numbers $P^s, s \in \{l, h\}$, of individuals are available to take a job. Their reservation wage is zero and workers supply one unit of labor where the pay is the highest. At the beginning of the period, everybody supplies labor to the public sector. A given number of them, $G^s < P^s$, is first instantaneously recruited in this sector. The remaining workers then supply labor to one of the private sectors.

Inspired by Acemoglu (2001), an aggregate private economy produces one consumption good (taken as the *numeraire*), that is made of four intermediate goods. Each intermediate good is characterized by the sector (private formal or informal) and the skill level of the labor force (low or high). We assume no capital input in the aggregate production function. The final consumption good, Y, is produced thanks to the input quantities $Y^{c,s}, c \in \{n, f\}, s \in \{l, h\}$ through the following constant elasticity of substitution function:

$$Y = [\alpha^{n,l}(Y^{n,l})^{\rho} + \alpha^{n,h}(Y^{n,h})^{\rho} + \alpha^{f,l}(Y^{f,l})^{\rho} + \alpha^{f,h}(Y^{f,h})^{\rho}]^{\frac{1}{\rho}} \quad -\infty < \rho < 1 \tag{2.1}$$

where the α's are the positive shifters that determines the weight, or share, of each intermediate good in the aggregate production function, and where ρ is the substitution parameter such that the elasticity of substitution between the four inputs is $\sigma = \frac{1}{1-\rho}$.

Note that this specification for the CES function implies equal elasticities of substitution between any pairs of input. This restriction can be relaxed to allow for different elasticities between formal/informal and high/low skill goods through the use of Nested CES functions (see Sato (1967)).

The producers of intermediate goods operate under constant returns to scale. Let $y^{c,s}, c \in \{n, f\}, s \in \{l, h\}$, denote the real marginal product of labor. Intermediate goods quantities verify:

$$Y^{n,s} = N^s\, y^{n,s} \quad \text{and} \quad Y^{f,s} = F^s\, y^{f,s} \quad s \in \{l, h\} \tag{2.2}$$

where N^s designates the number of workers in the informal sector, and F^s the number of those in the private formal sector.

The producer of the consumption good maximizes its profits with respect to intermediate inputs, at given prices $p^{n,s}$ and $p^{f,s}$ (refer to Section 2.6.2.1 in the Appendix for more details). The demand for inputs verify the following conditions:

$$p^{n,s} = \alpha^{n,s}\left[\frac{Y}{N^s y^{n,s}}\right]^{1-\rho} \quad \text{and} \quad p^{f,s} = \alpha^{f,s}\left[\frac{Y}{F^s y^{f,s}}\right]^{1-\rho} \quad s \in \{l, h\} \tag{2.3}$$

Since pure competition requires free entry of intermediate goods producers, they enter until profits are exhausted. Consequently, in equilibrium, and provided that the supply of labor is not nil, the following expressions hold :

$$p^{n,s}y^{n,s} = w^{n,s} \quad \text{and} \quad p^{f,s}y^{f,s} = (1+\tau)w^{f,s} \quad s \in \{l, h\} \tag{2.4}$$

Corner solutions where the supply of labor to some of the private sectors is zero can easily been ruled out. In equilibrium, each skill group is indifferent between supplying labor in either private sector, which in this simple framework means that $w^{n,s} = w^{f,s}$ for each skill type.

Let,

$$A^s \equiv \left[\frac{1}{1+\tau}\frac{\alpha^{f,s}}{\alpha^{n,s}}\right]^{\frac{1}{\rho-1}} \left[\frac{y^{f,s}}{y^{n,s}}\right]^{\frac{\rho}{\rho-1}} = \left[(1+\tau)\frac{\alpha^{n,s}}{\alpha^{f,s}}\right]^{\sigma} \left[\frac{y^{n,s}}{y^{f,s}}\right]^{\sigma-1} \qquad s \in \{l, h\} \tag{2.5}$$

The indifference conditions and the accounting identities $P^s = G^s + F^s + N^s$ can be rewritten as the following (see Appendix 2.6.2.2 for details):

$$N^s = \frac{A^s}{1+A^s}\left(P^s - G^s\right) \quad \text{and} \quad F^s = \frac{1}{1+A^s}\left(P^s - G^s\right) \quad s \in \{l, h\} \tag{2.6}$$

This means that, within a skill group s, the equilibrium informal to formal employment ratio $\frac{N^s}{F^s}$ is simply given by A^s. As expected, the latter rises with the payroll tax rate and the relative share $\frac{\alpha^{n,s}}{\alpha^{f,s}}$ in the CES aggregate production function. A rise in the relative real marginal productivity levels, $\frac{y^{n,s}}{y^{f,s}}$, has a net effect on the employment ratio whose sign depends on the magnitude of the elasticity of substitution σ.

Relatively more productive informal workers mean that the aggregate firm can reduce the corresponding input of workers for a given output level. In addition, the change in the relative marginal productivity levels induces the firm to change the mix of its inputs. This substitution effect induces a more intensive use of informal labor. Which effect dominates depends on whether σ is or not bigger than 1.

From Equation (2.6), everything else equal, a change in any population size P^s has a proportional effect on the corresponding equilibrium employment levels N^s and F^s. Since the equilibrium informal to formal employment ratio $\frac{N^s}{F^s}$ is simply given by A^s, it cannot be affected by changes in any population size. The employment ratio across skills, $\frac{N^l}{N^h}\frac{F^h}{F^l}$, is given by the ratio $\frac{A^l}{A^h}$. Hence, it is independent of both population size levels. These are very clear-cut predictions. By Equation (2.6), the equilibrium informal employment rate $\frac{N^s}{P^s}$ (respectively, formal employment rate $\frac{F^s}{P^s}$) would stay constant after a change in the corresponding population size, P^s, provided that the public employment share $\frac{G^s}{P^s}$ stays constant.

Turning to relative intermediate input prices, from Equations (2.3) and (2.6), the relative price level $p^{f,s}/p^{n,s}$ is also independent of the corresponding population size. The relative price level

$$\frac{p^{f,h}}{p^{f,l}} = \frac{\alpha^{f,h}}{\alpha^{f,l}}\left(\frac{F^l y^{f,l}}{F^h y^{f,h}}\right)^{1-\rho} \quad \text{with} \quad \frac{F^l}{F^h} = \frac{1+A^h}{1+A^l}\frac{P^l - G^l}{P^h - G^h} \tag{2.7}$$

is instead affected by population changes. A similar property holds for the relative price of informally produced goods $\frac{p^{i,h}}{p^{i,l}}$. By Equation (2.7), a rise in the skilled workforce P^h

leads, everything else equal, to a decline in the equilibrium price ratio $\frac{p^{f,h}}{p^{f,l}}$. The latter leads eventually to a substitution in intermediate inputs in favor of the less-skilled formal one.

Bearing these properties in mind, we proceed to characterize a more elaborate model in the sections below.

2.3.2 General set-up

As in the simple framework of Section 2.3.1, we think of an economy that produces one consumption good through four intermediate goods. These intermediate goods are both sector- and skill-specific (private formal low- and high-skilled, and informal low- and high-skilled). As previously mentioned, we assume no capital input in the aggregate production function. The technological frontier of production of the consumption good, as seen in Equation (2.1), is assumed here as well.

Unlike the simple model, however, labor comes from overlapping generations of working-age men that live finite lives. All of these workers participate in the labor market, entering the market with an initial (and unalterable) education level. We do not model retirement choices, nor do we model initial or further education choice. However, we assume that workers can accumulate human capital through experience which means productivity can exogenously increase with age. Finally, an exogenous government sector hires both kinds of workers, levying both payroll taxes on wages and profit taxes on firms in the private formal sector. However, it does not feature into the production of the consumption good.

Every worker in this economy can be in one of three states at each point in time: (1) working for the government sector; (2) working for the formal private sector; (3) being in the non-formal state.

The "non-formal state" combines both home production and being informally employed. We model the "non-formal state" as such for several reasons. First, unemployment pays almost nothing in terms of compensation/benefits, has very strict rules and a limited period of eligibility. Given the fact that the sweeping majority of the Egyptian population cannot afford to earn nothing, it is difficult to understand it without modeling family money (or non-labor income), which we deliberately avoid. Second, this mixed-state allows us to include irregular workers, who are often working in informal activities, and who spend some of their time in home production when not working informally. Finally, this state could also accommodate the fact that people could register as unemployed but still work informally due to the lack of unemployment benefits. A consequence of this modeling choice is that, contrary to Section 2.3.1 and, for example, Zenou (2008) and Charlot et al. (2016), in equilibrium the workforce will not be indifferent between being in the "non-formal" state and occupying a private formal job.

This model, therefore, has three levels of heterogeneity: (1) age of workers; (2) education level; (3) sectors of economic activity (government, private formal and informal). We assume an education-segmented labor market, where firms offer jobs for certain education levels but do not discriminate by age (and consequently productivity), as in Esteban-Pretel and Fujimoto (2014).[12]

The ultimate preference for each job seeker is a government job. This does not come from anecdotal evidence in the entire Middle East and North Africa region, but Egyptians, even youth, have continued to persistently prefer government jobs (Barsoum (2014) and Barsoum (2016)). Therefore, both formal private workers and those in the non-formal state would search for a government job opportunity, which arrives at an exogenous rate. We, therefore, assume that job-seekers for the government sector are all those in the non-formal state and those working in the private formal sector.

We assume search-matching frictions in the formal labor market. Private formal jobs can be destroyed or become vacant because workers either quit to the public sector or do not survive to the next period. Moreover, a private formal firm faces several costs: payroll taxes on wages; corporate tax on profits and, finally, a fixed cost upon entry that encompasses the physical and financial costs of start-up, and others such as corruption and red tape. Egypt, like other MENA countries, often scores low in international indices such as the Corruption Perceptions Index by Transparency International. In the World Bank Enterprise Survey for the country in 2013, close to 70% of firms reported corruption as a major constraint to their business. A significant share of them said that they are expected to give "gifts" in exchange for some facilities such as water, various licensing and construction permits.[13] Goedhuys et al. (2016) point to the impact this can have on firm innovation in the country.

These channels are not new, nor restrictive, in the literature. Ulyssea (2010), for instance, names two reasons why informal sectors exist. The first is high costs of entry into the formal market through fees, procedures and bureaucracy requirements. The second is the cost of

[12] This segmentation by education should be understood in the context of two broad skill groups. The labor markets, however, are interrelated through the aggregate production function.

[13] This can be found on the World Bank Enterprise Surveys link: https://www.enterprisesurveys.org/data.

staying in the formal sector which includes taxes and other regulation. Both of these types of costs are incorporated into the paper. We share with Albrecht et al. (2009b), Haanwinckel and Soares (2016) and Meghir et al. (2015) the introduction of payroll taxes on wages, and in the latter paper also with corporate tax on profits.

However, while some of these authors have also used other channels, such as minimum wage and employment protection legislation (EPL), we do not include them. In Section 2.2, we have explained that the minimum wage regulation is scarcely enforced in Egypt outside the public sector (in which in our framework wages are exogenously set). As far as EPL is concerned, as explained in the same section, a deregulation of formal contracts was effective in 2004. Incorporating this reform would require a framework that endogenizes firing decisions (like the one of Yassin and Langot (2018)). Given our interest in examining the dynamics of adjustment after a demographic shock, we leave this as a potential extension to our paper. As explained earlier, the calibration of the model using flows over the 1998-2006 period will be influenced by the observed change in labor market flows that occurred at that time.

Job creation in the private formal sector incurs a "Diamond-entry" type of cost (Diamond (1982), and later extended in papers such as Fujita and Ramey (2005)). An entrepreneur has to decide to invest, whereby incurring a sunk cost with a value randomly drawn from an exogenous distribution. While under the assumption of a deterministic common flow cost of posting a vacancy, the flow of new vacancies is infinitely elastic with respect to the lifetime value of a vacant position, here instead, the elasticity becomes finite since only entrepreneurs who draw a low enough start-up cost open a vacant position. This leads to a sluggish vacancy dynamics in the private formal sector that is interacting with the dynamics of the number of job-seekers in the "non-formal state". To the best of our knowledge, this approach is new in the development literature.

We assume that the informal production sector has a constant-returns to scale production function and operates under perfect competition. These assumptions are relatively standard in the literature (see e.g. Zenou (2008) for a justification and Charlot et al. (2016)). For the reasons provided in Section 2.2, we do not assume that being informal entails a fine, neither does it restrict the access to some public goods, if any.[14]

[14] Our model does not feature public goods.

2.3.3 Timing of events

During each unit of time, the following sequence of events take place:

> **Stage I:** At the very beginning of the period, a new generation of workers enter into the labor market (its level is exogenous).
>
> **Stage II:** For firm-worker matches from the previous period (in the private formal sector), wages are bargained over and production begins.
>
> **Stage III:** Entrepreneurs incur a cost to create new vacancies, which will enter the matching process during the next period.[15]
>
> **Stage IV:** In this stage, several things occur. Firstly, jobs arrive to job-seekers, wit an exogenous government job arrival probability (λ^g) for formal private workers and non-formal workers, and a job-arrival probability (λ) determined through matching in the private-formal sector for non-formal job seekers. When a worker is faced with a government offer, with or without a formal private offer at the same time, he chooses the government offer.[16] Secondly, with probability δ^g, an exogenous job-destruction occurs for government workers and for new matches to government. Thirdly, with probability δ, an exogenous job destruction occurs for existing private formal jobs and the new matches for the sector, and with probability $\tilde{\delta}$ occurs for unmatched vacancies. Fourthly and finally, a share x of workers survive to the next period.

Therefore, every agent and firm in this model has to endure a "state" for at least one period. Although a firm can post a vacancy in Stage III of the period and get matched in Stage IV of the same period, the employment relationship would only begin in the following period. The stock of workers in each of the three states is measured at the beginning of each period. Furthermore, we assume that new entrants begin at the non-formal market-state.

For simplicity, the equations presented below will have only the subscript of age, where a person ages throughout time. This means that age and time are measured in the same units. Since the labor market is fully segmented along the lines of education, we do not include the superscript of education.

[15] Instead in Coles and Kelishomi (2018), the newly created vacancies enter the matching process during the current period.

[16] This is the consequence of an assumption (and condition) we make that government jobs are always preferred over the private formal ones. Nash bargaining guarantees that the private formal offer is preferred to informal activity.

2.3.4 Demographics, effort and matching

The economy is characterized by a continuum of workers of overlapping generations who are hand-to-mouth consumers, risk-neutral and discounting the future at rate $r > 0$.

At age $a = 0$, people enter the labor market[17] and continue to be active until an exogenous age A, after which they exit. At any point in time, the population of workers of a certain age $a \in \{0, 1, ..., A\}$ (and education level) can be expressed as:

$$P_a = G_a + F_a + N_a \tag{2.8}$$

where P denotes the total population of workers, G denotes the number of government workers, F the formally employed in the private sector, N workers in the non-formal state, where $F_0 = G_0 = 0$.

After a cohort is born, i.e. $a \geq 0$, the population size evolves through time as the following:

$$P'_{a+1} = x_a P_a \tag{2.9}$$

where P' is the population of the next period, P is the current population and x_a is an exogenous, age-specific survival probability. While we do not explicitly express migration, x could implicitly include both death and net migration.[18] At the aggregate level, the evolution of the total population verifies: $P' = P_0 + \sum_{a=1}^{A} x_a P_a$, where P_0 is exogenous.

We assume that both non-formal workers and private formal ones devote maximal effort to searching for a government job, normalized to 1 for simplicity. The search effort of the non-formal workers aged a for the private formal job, denoted e_a, is a choice variable.

On the private formal labor market, we assume that job-seekers and vacancies are matched randomly. Recruiters do not discriminate by age. Hence, any change in the demographic composition of the pool of formal job-seekers affects the probability of matching for all age groups (which is a form of trading externality emphasized by e.g. Shimer (2001)). The matching function is assumed to exhibit constant-returns to scale - an assumption that is

[17]This assumption will be generalized in the numerical part where we let people enter the workforce also at age $a > 0$. However, this generalization introduces additional complexity into some of the following formulas. Therefore, for pedagogical reasons, we postpone it to the numerical analysis.

[18]While Egypt was a net immigrant country in the 1950s to the end of the 1960s, it has been a net emigrant nation since then. This is affirmed through data from The World Bank's database "Global Bilateral Migration" and Egypt's Central Agency For Population and Mobilization Statistics (CAPMAS).

not typically rejected in the literature. The matching function and labor market tightness θ are expressed as follows:

$$M = M(V, \tilde{N}) \qquad \theta = \frac{V}{\tilde{N}} \tag{2.10}$$

where V stands for the number of vacancies and $\tilde{N}$ designates the number of job-seekers in efficiency units, namely:

$$\tilde{N} = \sum_{a=0}^{A-1} e_a N_a, \tag{2.11}$$

We define the job-finding rate and the vacancy-filling rates as the following:

$$\frac{M(V, \tilde{N})}{\tilde{N}} = M(\theta, 1) \equiv \lambda \tag{2.12}$$

$$\frac{M(V, \tilde{N})}{V} = M(1, 1/\theta) \equiv q \tag{2.13}$$

Furthermore, we define the average effort in the economy as follows:

$$\bar{e} = \sum_{a=0}^{A-1} e_a \frac{N_a}{N} \tag{2.14}$$

It follows that $\bar{e}N = \tilde{N}$. Let M_a denote the number of matches in the formal private sector among workers of age a. The age-specific job-finding rate is:

$$\frac{M_a}{N_a} = \frac{e_a}{\bar{e}} \frac{M}{N} = e_a \lambda \tag{2.15}$$

The stock of workers in each state is measured at the beginning of each period, following the process of survival. We express the stock of workers in each period for the government sector, private formal sector and non-formal state as the following, respectively:

$$G'_{a+1} = x_a \Big[\underbrace{(1-\delta_a^g) G_a}_{\text{undestroyed stock}} + \underbrace{\lambda_a^g (1-\delta_a^g)(F_a + N_a)}_{\text{undestroyed new matches}} \Big] \tag{2.16}$$

$$F'_{a+1} = x_a \Big[\underbrace{(1-\delta_a)(1-\lambda_a^g) F_a}_{\text{stock unmatched with gov jobs \& undestroyed}} + \underbrace{(1-\lambda_a^g) e_a \lambda (1-\delta_a) N_a}_{\text{undestroyed new matches}} \Big] \tag{2.17}$$

$$N'_{a+1} = x_a \Big[\underbrace{\delta_a^g G_a}_{\text{destroyed gov jobs}} + \underbrace{[(1-\lambda_a^g)\delta_a + \lambda_a^g \delta_a^g] F_a}_{\text{destroyed priv form. jobs \& matches}} \\ + \underbrace{[1 - e_a\lambda(1-\delta_a)(1-\lambda_a^g) - \lambda_a^g(1-\delta_a^g)] N_a}_{\text{no matches}} \Big] \tag{2.18}$$

Summing these three relationships entails (2.9).

2.3.5 Workers' value functions

The inter-temporal value functions (looked at the beginning of each period) for government workers, $\mathcal{G}_a$, private formal workers, $\mathcal{F}_a$ and non-formal workers, $\mathcal{N}_a$, verify the following dynamic relationships, respectively, for all a such that $0 < a < A$:

$$\mathcal{G}_a = w_a^g + \beta x_a \big[\delta_a^g \mathcal{N}'_{a+1} + (1-\delta_a^g)\mathcal{G}'_{a+1}\big], \tag{2.19}$$

$$\begin{aligned} \mathcal{F}_a &= w_a - c_a + \beta x_a \Big[\lambda_a^g (1-\delta_a^g)\mathcal{G}'_{a+1} + (1-\lambda_a^g)(1-\delta_a)\mathcal{F}'_{a+1} \\ &+ [\delta_a(1-\lambda_a^g) + \lambda_a^g \delta_a^g] \mathcal{N}'_{a+1} \Big], \end{aligned} \tag{2.20}$$

$$\begin{aligned} \mathcal{N}_a &= \max_{e_a \geq 0} \Big\{ \Omega_a - c_a(e_a) - c_a + \beta x_a \Big[\lambda_a^g (1-\delta_a^g)\mathcal{G}'_{a+1} \\ &+ (1-\lambda_a^g) e_a \lambda (1-\delta_a) \mathcal{F}'_{a+1} + \big[1 - \lambda_a^g(1-\delta_a^g) - (1-\lambda_a^g) e_a \lambda(1-\delta_a)\big] \mathcal{N}'_{a+1} \Big] \Big\} \end{aligned} \tag{2.21}$$

where w_a^g is the government wage, $\beta = \frac{1}{1+r}$ is the discount factor, w_a is the private-formal bargained wage, c_a is the cost of maximal search effort that is normalized to a constant, $\Omega_a = h_a w_a^i + (1-h_a) z_a$, h_a is the (exogenous) number of hours spent in informal employment, earning w_a^i, z_a is the value of the time devoted to home production (since unemployment benefits are negligible), and $c_a(e_a)$ is the increasing and convex cost function of effort. In doing so, we assume that search effort is not measured in units of time. According to the available evidence (Krueger and Muller (2010), Manning (2011) (p.986) and Aguiar et al. (2013)), the time spent on job search time is very limited. Moreover, as studied by the spatial mismatch literature (Coulson et al. (2001)), job centers can be distant from the place of living and commuting cost matter (see for example Franklin (2018)). In addition, there is evidence of psychological cost of job search (Krueger and Muller (2010)).

We assume that the future value of a worker of age A is nil at any of the three states.[19] Note

[19] This is an assumption also made by Esteban-Pretel and Fujimoto (2014) and Menzio et al. (2013).

that these equations, at the current period and the future, are valued at the current level of tightness on the private formal labor market.

The optimal choice of effort for the non-formal workers is such that the marginal cost of effort equal to the future returns from being in the private-formal sector compared to the non-formal state:

$$c'(e_a) = \beta x_a \lambda(1-\lambda_a^g)(1-\delta_a)(\mathcal{F}'_{a+1} - \mathcal{N}'_{a+1}) \tag{2.22}$$

Finally, we assume that the acceptance rate of a job offer from the government or the private formal sector is equal to 1. In order to better formalize the pecking order of jobs (government then private formal sector then the non-formal state), we have to impose the following condition:

$$\mathcal{G}_a \geq \mathcal{F}_a \tag{2.23}$$

Nash bargaining in the private formal sector consequently assures that:

$$\mathcal{F}_a \geq \mathcal{N}_a \tag{2.24}$$

Equation (2.23) implies that the government wage, or its amenities through a low job destruction rate, for instance, must be sufficient to compensate for the value of being in the private formal sector. This condition can only be met given some parameter values. Similarly, Equation (2.24) also implies that the private-formal sector value has to compensate for certain costs and benefits in the non-formal state. The Nash bargaining rule allows for this.

2.3.6 Production

Like the simple framework in Section 2.3.1, the production of intermediate goods is carried out by two types of firms: private formal firms on the one hand, and informal firms on the other hand. The form of this production function is assumed to be exactly the same as Equation (2.1).

While informal firms are assumed to operate in a frictionless, perfectly competitive labor market under constant marginal returns to labor,[20] private formal firms are assumed to

Attributing a terminal value complicates the analysis and would be ad-hoc in practice. Its accuracy would depend on an in-depth understanding of the retirement system and benefits in Egypt, which is outside the scope of this research.

[20]Note that this implies that whether we talk about firms in the informal sector or the self-employed becomes immaterial in this set-up.

be created by entrepreneurs, making an expected non-negative profit such that they can recuperate a randomly drawn sunk cost, as will be further explained later. This non-negative profit also means that an endogenous decision to switch to the informal economy is not optimal.

Each of these two types of firms utilize either high-skill or low-skill workers for production of the corresponding intermediate good (the superscript for which we ignore for simplicity, as with the preceding subsections):

$$Y^f = \sum_{a=0}^{A} y_a^f F_a \tag{2.25}$$

$$Y^i = \sum_{a=0}^{A} y_a^i h_a N_a \tag{2.26}$$

where Y stands for production, f for formal private, i for informal, and y for the real (and constant) marginal productivity of the work per unit of labor that is sector-, skill- and age-specific.

Taking into account Equation (2.1), the prices, p, of these intermediate goods equal their marginal productivity in the aggregate production function (again we ignore the superscript of skill for simplicity):

$$p^f = \alpha^f \left[\frac{Y}{Y^f}\right]^{1-\rho} \tag{2.27}$$

$$p^i = \alpha^i \left[\frac{Y}{Y^i}\right]^{1-\rho} \tag{2.28}$$

Consequently, an adjustment in total output Y which is not the consequence of a proportional rise in the levels of all intermediate goods will influence the price of these goods in all sectors. This in turn will induce modifications in wages and in the functioning of all the frictional private labor markets.

2.3.6.1 Private formal firms value functions and vacancy creation

The value functions for firms depend on the state of their job position, be it filled, or still vacant. For a position filled with a worker of age a, the inter-temporal value $\mathcal{J}_a$ can be expressed as the following:

$$\mathcal{J}_a = \pi_a + \beta(1-\lambda_a^g)(1-\delta_a)\left[x_a \mathcal{J}'_{a+1} + (1-x_a)\mathcal{V}'\right] + \beta\lambda_a^g(1-\delta_a)\mathcal{V}', \tag{2.29}$$

where $\pi_a = (p^f y_a - w_a(1+\tau))(1-\tau^c)$, τ being payroll tax and τ^c being a corporate tax on profits. A job becomes vacant if the worker does not survive or quits to work in the public sector and if the job is not destroyed (at rate δ_a).

The inter-temporal value of a vacant position, $\mathcal{V}$, verifies:

$$\mathcal{V} = \beta q \sum_{a=0}^{7} \frac{e_a N_a}{\tilde{N}}(1-\delta_a)\Big[(1-\lambda_a^g)x_a\big(\mathcal{J}'_{a+1} - \mathcal{V}'\big) + \mathcal{V}'\Big] + \beta(1-q)(1-\tilde{\delta})\mathcal{V}' \tag{2.30}$$

An entrepreneur meets a worker of age a randomly, with a probability $\frac{e_a N_a}{\tilde{N}}$. If this worker survives to the next period and at the same time is not poached by the public sector nor has his job destroyed, the now-employer benefits from the value of a filled position $\mathcal{J}'_{a+1}$. Otherwise, the job is vacant at the start of the next period, (with lifetime value $\mathcal{V}'$). This can occur for several reasons. First, matched vacancies are not destroyed but either the matched worker received a public job offer and leaves the private formal firms (with probability λ^g) or if he does not receive this offer but still dies (an event whose probability is $(1-\lambda^g)(1-x_a)$). Second, the vacancies that are not matched with probability $1-q$ are not destroyed with probability $1-\tilde{\delta}$ (assuming that a vacant position disappears with an age-non-specific probability $\tilde{\delta}$).

The creation of vacancies in the private formal sector is a function of this inter-temporal value of a vacant position. In line with Coles and Kelishomi (2018), we assume a possibly time-dependent but exogenous number B of potential risk-neutral entrepreneurs.[21] Each entrepreneur is faced with a new "business opportunity" at the beginning of each period. Realizing this opportunity has a cost K, which is an idiosyncratic random draw at Stage III of our timeline (Subsection 2.3.3), from an exogenous distribution with a cumulative density function $H(.)$ defined on the support $[0, \bar{K}]$. Once the cost K is sunk, this business opportunity generates a single unfilled position. An entrepreneur creates the vacancy as long as $K \leq \mathcal{V}$, where $\mathcal{V}$ is the inter-temporal value of a vacancy, defined in a later section. This formulation necessitates no recall opportunity of an earlier business opportunity.

[21] Our model does not feature entrepreneurship and we do not delve into the creation of these entrepreneurial activities.

At the aggregate level, the flow of new vacancies created in every period is:

$$I = B \cdot H(\mathcal{V}') \tag{2.31}$$

Therefore, one can describe the law of motion of the stock of vacancies as:

$$\begin{aligned} V' = & \underbrace{V(1-q)(1-\tilde{\delta})}_{(1)} + \underbrace{Vq \sum_{a=0}^{7} \frac{e_a N_a}{\tilde{N}} (1-\delta_a)\big[1 - x_a(1-\lambda_a^g)\big]}_{(2)} \\ & + \underbrace{\sum_{a=1}^{8} (1-\delta_a)\big[1 - x_a(1-\lambda_a^g)\big] F_a}_{(3)} + \underbrace{I}_{(4)} \end{aligned} \tag{2.32}$$

where V' denotes the number of private formal vacancies at the beginning of the following period. The latter is the sum of four components. The right-hand side of the last equality can be explained as follows. (1) designates vacancies that are currently neither matched nor destroyed. Hence, they stay in the stock of vacancies in the next period. (2) measures vacancies that are matched and not destroyed but either the matched workers get a public job offer and leave the private formal firms (with probability λ^g) or they do not get such an offer but do not survive (an event whose probability is $(1-\lambda^g)(1-x_a)$). (3) quantifies formal private jobs that become vacant due to exactly the same channels as in case (2). Finally (4) is the inflow of new vacancies defined by Equation (2.31).

2.3.6.2 Wage bargaining in private formal firms

When private formal vacancies and job seekers are matched at the very end of each period, they bargain over the wages in Stage II of the following period. We assume that wages in the private formal sector are bargained over individually in each period through Nash bargaining. These wages are skill- and age-specific. The fall-back position is the outside position, namely $\mathcal{N}_a$ and $\mathcal{V}$ respectively. So,

$$w_a = \arg\max \Big(\mathcal{F}_a - \mathcal{N}_a\Big)^{\gamma} \Big(\mathcal{J}_a - \mathcal{V}\Big)^{1-\gamma} \tag{2.33}$$

where $\gamma \in [0, 1)$ is the exogenous bargaining power of the worker. The first-order condition of this maximization verifies:

$$\mathcal{F}_a - \mathcal{N}_a = \frac{\gamma}{1-\gamma} \frac{\mathcal{J}_a - \mathcal{V}}{(1+\tau)(1-\tau^c)} \tag{2.34}$$

If $\mathcal{S}_a$ denotes the ex-post surplus generated from a matched with a worker aged a, from (2.34), the share of the surplus accruing to the worker is a share γ of this surplus:

$$\mathcal{F}_a - \mathcal{N}_a = \gamma \Bigg[\underbrace{\mathcal{F}_a - \mathcal{N}_a + \frac{\mathcal{J}_a - \mathcal{V}}{(1+\tau)(1-\tau^c)}}_{\mathcal{S}_a} \Bigg] \tag{2.35}$$

Substituting the lifetime values into (2.35), the formal wage rate w_a can be rewritten as:

$$\begin{aligned} w_a = & \frac{\gamma p^f y_a}{1+\tau} + (1-\gamma)[\Omega_a - c(e_a)] - (1-\gamma)\beta x_a (1-\lambda^g)(1-\delta)(1-e_a\lambda)\left[\mathcal{F}'_{a+1} - \mathcal{N}'_{a+1}\right] \\ & + \frac{\gamma}{(1+\tau)(1-\tau^c)} \beta x_a (1-\lambda^g)(1-\delta)\left[\mathcal{J}'_{a+1} - \mathcal{V}'_{a+1}\right] \\ & + \frac{\gamma}{(1+\tau)(1-\tau^c)} \left[\beta(1-\delta)\mathcal{V}' - \mathcal{V})\right], \end{aligned} \tag{2.36}$$

As for the informal sector hourly wage, we can express it as the following:

$$w_a^i = p^i y_a^i \tag{2.37}$$

Before moving to the equilibrium conditions in the section below, it is worthwhile to note at this point the role that the government sector plays in the model. We have assumed that the arrival probability of public employment opportunities does not vary with the current position on the labor market. Therefore, the lifetime value of holding a public job $\mathcal{G}_a$ at whatever age and hence the public sector wage does not impact the difference $\mathcal{F}_a - \mathcal{N}_a$ at given tightness levels. Consequently, public sector wages have no direct impact on the chosen search effort, as expressed in Equation (2.22), nor on the bargained wage, as expressed in Equation (2.36). Nevertheless, the government sector has various “indirect” effects.

Firstly, and perhaps most simply, the probability of receiving a job offer in the public sector, λ_a^g, and the one of losing a public job, δ_a^g, affect the number of job seekers in the private informal sector (see Equation (2.18)), consequently affecting labor market tightness, which itself has an impact on the probability of finding a partner in the private formal sector and, hence, on the level of search effort and on the bargained wage. Secondly, the same parameters λ_a^g and δ_a^g affect how long the worker stays in the private formal sector (see Equation (2.17)), which consequently affects the firms' lifetime value of holding a private formal position (as in Equation (2.29)). This, in turn, affects vacancy creation. Finally, since λ_a^g and δ_a^g are age-specific, the previous channels can affect the skill-composition of those in the private sector, and consequently production in the economy as well.

2.3.7 Equilibrium conditions

An intertemporal equilibrium is characterized by the following:

- Effort e_a maximizes the worker lifetime utility in the non-formal state as in equations (2.21) and (2.22), upholding condition (2.23) and consequent condition (2.24) and using equations (2.19) and (2.20).

- The number of new matches M, the contact rate for the worker $e_a\lambda$ and for firm q satisfy the matching technology in equations (2.10), (2.12), (2.15) and (2.13), with the definition equations (2.11) and (2.14) and the law of motion of vacancies (2.32) and the laws of motions for non-formal job seekers in equation (2.18) as well as government and private formal workers in equations (2.16) and (2.17), respectively, given the overall population equations (2.8) and (2.9).

- Vacancies are posted so as to maximize the value of a vacant position as in equation (2.30) considering the value of a filled position in equation (2.29) and (25) and upholding the equation (2.31) of new vacancies.

- Wages in the private formal sector, w_a, are negotiated through Nash bargaining as in equation (2.34), (2.35) and (2.36).

- Intermediate goods production Y by education level satisfy equations (2.25) (2.26), which then determine aggregate production in equation (2.1). The price of these goods are determined through equations (2.27) and (2.28).

- Wages in the informal sector are determined through equation (2.37).

2.4 Numerical Analysis

In order to calibrate and simulate the model, we assume 9 age groups of four years each, such that $a \in [0, 8]$. The age-groups span effectively from 18 years old to 53 years old, as can be seen more clearly in Table 2.6. These age groups capture the ones with high participation rates, and range from post-high school to the age group where early retirement is typically allowed. As in Esteban-Pretel and Fujimoto (2014) and Menzio et al. (2013), for example, we assume for simplicity that workers above age $a = 8$ exit the labor market towards a position whose lifetime value is normalized to zero. Since our paper focuses on the young generations, this normalization should not have major effects on hand-to-mouth agents.

Table 2.6: Calibration age-groups

Notation	Years old	Notation	Years old
$a = 0$	18-21	$a = 5$	38-41
$a = 1$	22-25	$a = 6$	42-45
$a = 2$	26-29	$a = 7$	46-49
$a = 3$	30-33	$a = 8$	50-53
$a = 4$	34-37		

We also assume two skill levels: (1) the "low-skilled," which includes those who have completed a middle/intermediate level education at most, including the illiterate, and; (2) the "high-skilled," who have at least a high school education. Below, some mathematical expressions do not highlight the skill dimension (the matching function and the cost of job-search effort for instance). However, like the section on the theoretical model, it should be understood that these expressions are skill-specific.

We rely significantly on data from the Egypt Labor Market Panel Survey 1998-2012, in particular the 1998 and 2006 waves which are used to calibrate several parameters of the model. These data include, for instance, the stocks of workers in each of our model states (government, private formal and non-formal) and their transitions between these states from one year to another (namely 1998 to 2006). We also utilize the ELMPS data to characterize the wages as well as deduce some model parameters as will be explained below. Given our choice of fours years age group, we further complement the use of the ELMPS with the Labor Force Survey (LFS) for 2010 and 2014.

This section is divided into two subsections. Subsection 2.4.1 delves into the calibration of several important model parameters in four steps, while Subsection 2.4.2 simulates the demographic boom with the aim of better understanding the links between the rise in informality and the large inflow of new entrants.

2.4.1 Calibration

As is typically applied in the literature, we assume a Cobb-Douglas matching function that can be expressed as the following,[22]

$$M^s\left(V^s,\tilde{N}^s\right)=\phi^s\left(V^s\right)^{\mu}\left(\tilde{N}^s\right)^{1-\mu},\quad s\in\{l,h\},\tag{2.38}$$

where ϕ^s denotes the skill-specific matching efficiency and μ is the elasticity of vacancies to the number of matches. We calibrate the first parameter, while, in the absence of estimation of matching functions for Egypt, the second is set to a standard value, namely 0.5.

We calibrate the model in four stages. Firstly, as will be shown in Subsection 2.4.1.1, we exploit the longitudinal dimension of the ELMPS, and the laws of motion of the stocks of workers, Equations (2.16)-(2.18), to calibrate the following skill-specific parameters: δ_a, δ_a^g, λ_a^g and x_a.

Secondly, as will be shown in Subsection 2.4.1.2, we slightly manipulate Equations (2.8) and (2.18) and use some of the already-calibrated parameters mentioned above to introduce the demographic boom. This demographic boom takes the form of an increase in the number of new labor market entrants, bearing in mind the change in the skill composition - both of which can be computed from the EMLPS of 1998 and 2006.

Thirdly, we assign values to a number of parameters from the literature, from the ELMPS data, and from our own informed assumptions about the values to help us characterize some parts of the model, as will be shown in Subsection 2.4.1.3. We take from the literature the following parameters: β, γ, ρ and μ. We deduce from the ELMPS data the following skill-specific parameters: h_a, w_a and w_a^i. And finally, we assume, through other data and our general knowledge about Egypt, the following also skill-specific parameters: α^f, α^i, z_a, c_a, τ, τ^c. We also have to calibrate parameters related to the investment in vacancies, B and the cost distribution $H(.)$. Note that apart from the tax rates, τ and τ^c, external information to calibrate these parameters is rather scarce.

[22] Note that in discrete time, the Cobb-Douglas assumption does not guarantee that the M/V and $M/\tilde{N}$ ratios are < 1. In the numerical analysis, we impose this constraint.

Finally, as will be shown in Subsection 2.4.1.4, we make use all the parameters mentioned above to calibrate three types of parameters: (1) the skill-specific productivities of the workers in the private formal and informal activities, y_a^f and y_a^i, (2) the scale parameter of the cost of search effort, and, (3) the matching efficiency parameters, ϕ. We assume the following functional form for the cost of search effort, in line with Cockx et al. (2018):

$$c_a^s(e_a^s) = e^{\nu_a^s e_a^s} - 1, \ \ \nu_a^s > 0, \quad s \in \{l, h\}, \tag{2.39}$$

where ν_a^s is a scale parameter of the cost of search effort. Without entering too much into the details, we use the 1998 stocks as starting values and simulate the model for two periods (until 2006). We then look for parameter values that allow the model to reproduce some aspects of the 2006 data. The simulation of the model requires to calibrate all parameters but the ones of interest.

2.4.1.1 Using the worker laws of motion

Using the worker laws of motion, Equations (2.16) to (2.18), we calibrate the following age- and skill-specific parameters: λ_a^g, δ_a^g, δ_a, and the survival probabilities x_a. To do so, we use the survey year 1998 as the first position of the worker and the survey of 2006 as the final position for the calibration purposes, observed in both years.[23] Given the fact that we use four-year age-groups, the 1998-2006 period captures the individual as he moves up two age-groups.[24]

Due to the limited number of observations for some worker transitions, and in order to remain aligned with the age-specific parameters of the theoretical model, we aggregate the age groups such that we solve for three age-specific parameters δ, δ^g and λ^g. The subscript $0-2$ represents age-groups 0 to 2 (i.e. 18 to 29 years old); the subscript $3-5$ represents age-groups 3 to 5 (i.e. 30 to 41 years old); and the subscript $6-8$ for age-groups 6 to 9 (i.e. until 53 years old). This implies, for instance, that workers of ages 0, 1 and 2 are assumed to experience the same job separation rate in the private formal sector δ_{0-2}, government job arrival rate λ_{0-2}^g and government separation rate δ_{0-2}^g - and so forth for the other two broader age groups. This consequently means that we solve for 9 parameters for each of the two skill levels (a total of 18), in addition to the survival probabilities.

[23] We use the panel weight in the surveys to get an accurate transition between the years, taking into account attrition and other issues.

[24] A worker that is in age-group 0 in 1998 is part of age group 2 in 2006. In fact, the construction of the age-group bears in mind the 8-year difference between the surveys

In search and matching models, stock of workers evolve according to a first order Markov chain since transitions between labor market states in the following period only depends on the current state of the workers. It holds that:

$$S_{t+1}^{a+1} = D_t^a S_t^a \tag{2.40}$$

where S stands for the labor market state N, F and G, and D is the discrete time transition matrix[25] , such that:

$$D_t^a = \begin{bmatrix} p_a^{NN} p_a^{FN} p_a^{GN} \\ p_a^{NF} p_a^{FF} p_a^{GF} \\ p_a^{NG} p_a^{FG} p_a^{GG} \end{bmatrix} \tag{2.41}$$

and p_a^{ij} is the transition (flow) rate from age group a and state i to age group $a+1$ and state j. These flow rates can be computed by writing equations (2.16)-(2.18) in matrix form:

$$\begin{array}{ll} p_a^{NN} = x_a\left[1 - \lambda_a^g(1-\delta_a^g) - (1-\lambda_a^g)e_a\lambda(1-\delta^a)\right] & p_a^{FN} = x_a\left[(1-\lambda_a^g)\delta_a + \lambda_a^g\delta_a^g\right] \\ p_a^{GN} = x_a\delta_a^g & p_a^{NF} = x_a[(1-\lambda_a^g)e_a\lambda(1-\delta_a)] \\ p_a^{FF} = x_a\left[(1-\lambda_a^g)(1-\delta_a)\right] & p_a^{GF} = 0 \\ p_a^{NG} = x_a\lambda_a^g(1-\delta_a^g) & p_a^{FG} = x_a\lambda_a^g(1-\delta_a^g) \\ p_a^{GG} = x_a\left[1-\delta_a^g\right] & \end{array} \tag{2.42}$$

where $p_0^{Fi} = p_0^{Gi} = 0$ since we assume that new labor market entrants begin their career in the non-formal state only.

Bearing in mind the 8 years between the two data points of the survey (1998 and 2006) and the four-year age-groups, we express labor market transitions more explicitly as: $S_{2002}^{a+1} = D_{1998}^a S_{1998}^a$, and $S_{2006}^{a+2} = D_{2002}^{a+1} S_{2002}^{a+1}$. This leads to the following:

$$S_{t+2}^{a+2} = D_{t+1}^{a+1} D_t^a S_t^a \tag{2.43}$$

where we can define the two-period transition matrix as the following:

$$\tilde{D}_t^a = D_{t+1}^{a+1} D_t^a = \begin{bmatrix} \sum_{i=1}^3 p_{a+1,t+1}^{Ni} p_{a,t}^{iN} & \sum_{i=1}^3 p_{a+1,t+1}^{Ni} p_{a,t}^{iF} & \sum_{i=1}^3 p_{a+1,t+1}^{Ni} p_{a,t}^{iG} \\ \sum_{i=1}^3 p_{a+1,t+1}^{Fi} p_{a,t}^{iN} & \sum_{i=1}^3 p_{a+1,t+1}^{Fi} p_{a,t}^{iF} & \sum_{i=1}^3 p_{a+1,t+1}^{Fi} p_{a,t}^{iG} \\ \sum_{i=1}^3 p_{a+1,t+1}^{Gi} p_{a,t}^{iN} & \sum_{i=1}^3 p_{a+1,t+1}^{Gi} p_{a,t}^{iF} & \sum_{i=1}^3 p_{a+1,t+1}^{Gi} p_{a,t}^{iG} \end{bmatrix} \tag{2.44}$$

[25] The matrix D is not a proper Markov transition (stochastic) matrix since each column does not sum-up to one. This originates from the survival probability and a properly well defined Markov Chain would have to account for the death of workers. Since, we focus only on the state N, F, G and track individuals that are present in both 1998 and 2006 (that have therefore survived), ignoring exit due to death does not affect the derivation and results of this section.

such that i represents the states N, F, G. We can obtain 7 $\tilde{D}_t^a$ matrices, from age 0 to age 6 in 1998 (whereas groups 7 and 8 are dropped out of the dataset since they exit in the following periods).

Each matrix has 9 flow rates but only 6 of these can actually be used since $p_a^{ii} = x_a - \sum_j p_a^{ij}$. As a result, we have a total of 38 flow rates (6 from age-groups 1 to 6 and 2 from age-group 0) that we can compute from the ELMPS for each skill level.[26] From equations (2.42), we can also see that the product $e_a\lambda$ enter flow rates from non-formality p_a^{Ni}. We do not seek to calibrate these two endogenous variables and we define $\hat{\lambda}_a = e_a\lambda$ and look only for values of the product $\hat{\lambda}_a$. Furthermore, flow rates starting from non-formality in 1998 (the first column in (2.44)) are the only flow rates depending on $\hat{\lambda}_a$ in period t (or 1998). To avoid having to find values for $\hat{\lambda}_a$ in period t and $t+1$, we only consider flow rates starting from the Formal and Government states.

In total and for each skill level, we have 24 flow rates (4 from age groups 1 to 6) and we calibrate a total of 22 parameters: 3 for δ_a, 3 parameters for δ^g, 3 parameters for λ^g, 7 for the survival probabilities for age-groups of 1 to 7 assuming $x_0 = x_1$ and 6 for the product of $\hat{\lambda}_a$ for age-groups of 2 to 7.[27]

We then look for parameter values that minimize the distance between the model and the transition rates from the ELMPS data.

Table 2.7 shows the results of the calibrated parameters. The job destruction rate for the private formal sector, δ, generally decreases with age for the low-skilled, from 8.48% for age-groups 0-2 (i.e. 18-29 years old) to 8.36% for age-groups 3-5 (i.e. 30-41 years old) to finally 5.83% for age-groups 6-8 (i.e. 42-53 years old). For high-skilled, the trend is different. The job destruction rate increases for age groups 3-5 years old, before dropping again.[28] The weighted average job destruction for all of these age-groups, bearing in mind the share of the workers of various ages in the dataset, is 6.44% (over a four-year period), which means 1.57% annually (compounded). While it is difficult to compare these rates to other works, Yassine (2015) found job separation rates for male waged-workers in the private formal sector aged 15-49 years old to be between 0.5% to 1% annually during the period of 1998 and 2006.[29]

[26] Note that we smooth the data to capture the transitions, as explained in Section 2.6.3.1 in the Appendix.

[27] With (2.38), leaving the index s aside, $\hat{\lambda}_a = e_a\phi\theta^\mu$. The matching efficiency parameter ϕ is calibrated in Section 2.4.1.4.

[28] Note that the transitions that are calculated using the data do not distinguish between an exogenous job destruction rate, meaning being fired or the firm closing down, and the worker voluntarily separating. While there is a question in the survey about the reason for job change, there is a significant share of missing variables.

[29] She also found job-to-job transitions from the state of formal private waged work during this same

For both the low- and high-skilled, the job destruction rate of the government sector decreases with age, and it is, as expected, significantly smaller for the high-skilled. In fact, for the high-skilled, the rate is close to nil for older age-groups, which highlights the relative stability of a job in the sector. For young low-skilled, the job destruction rate is higher, at 15.49%. This may be related to the fact that government jobs tend to be generally occupied by the higher-skilled (or those with at least a high-school education). The weighted average of the government job destruction rate is 1.99% over a four-year period, which is equal to 0.49% annually. These results are largely in line with the separation rates estimated by Yassine (2015), of 0.25-1% over the period.

As for the government job arrival rate, the results show an opposite trend when comparing the low- and high-skilled. For the low-skilled, the job arrival rate decreases with age, from 11.55% for age-groups 0-2 years old (who also face a high job destruction rate as mentioned above), to a lower 5.12% for those 6-8 years old. For the high-skilled, the job arrival rate increases with age from 5.12% to 11.38%. The weighted average government job destruction rate is 2.39% over a four-year period, which amounts to 0.59% annually.

As for the survival probabilities, calibrated parameters show relatively high probabilities - largely in line with Egypt's life table.[30] Finally, it is worthy of noting that while the product of $e_a\lambda$ is accounted for in these calibrations, and shown in the table, they are endogenous variables that will be solved using the full model later.

period to be around 3-5.5%.

[30] Life tables can be easily accessed through the United Nations World Population Prospects - male life table survivors at exact ages - showing a survival rates of 0.95-0.99 for our age-groups of interest.

Table 2.7: Calibrated parameters and job finding rates by age-group and skill level

Parameter	l	h	Parameter	l	h
δ_{0-2}	8.48%	1.65%	x_0^*	0.95	0.96
δ_{3-5}	8.36%	9.59%	x_1	0.95	0.96
δ_{6-8}	5.83%	5.94%	x_2	0.95	0.98
			x_3	0.96	0.99
δ^g_{0-2}	15.49%	2.31%	x_4	0.98	0.99
δ^g_{3-5}	3.78%	0.57%	x_5	0.97	0.99
δ^g_{6-8}	3.37%	0.59%	x_6	0.96	0.99
			x_7	0.97	0.98
λ^g_{0-2}	11.55%	5.12%			
λ^g_{3-5}	5.56%	6.06%	$\hat{\lambda}_{2,t+1}$	0.09	0.06
λ^g_{6-8}	5.12%	11.38%	$\hat{\lambda}_{3,t+1}$	0.05	0.06
			$\hat{\lambda}_{,4t+1}$	0.07	0.07
			$\hat{\lambda}_{5,t+1}$	0.09	0.04
			$\hat{\lambda}_{6,t+1}$	0.07	0.05
			$\hat{\lambda}_{7,t+1}$	0.08	0.06

Note: For δ, δ^g and λ^g, calibrated parameters are for each age-group within the broader group over a four-year period. For x, calibrated parameters are for each four-year age-group. 1 stands for low-skilled, and h for high-skilled.
The asterisk * signifies an assumption that $x_0 = x_1$ and $x_7 = x_8$, where $x0$ and x_8 cannot be calibrated given the set-up.

2.4.1.2 Introducing the demographic boom

The demographic boom that we seek to incorporate manifests itself through a large increase in the number of new labor market entrants. This increase was already apparent in the survey year of 1998 as shown earlier in Section 2.2. We calibrate the path of this (exogenous) variable to be able to fully characterize the model and run the simulations. These new entrants can be computed using the population stocks obtained from the ELMPS in 1998 and 2006 and we further exploit the Labor Force Surveys (LFS) of 2010 and 2014 to quantify the number of new entrants for these two periods.

These survey data allow us to calibrate the demographic boom not only in terms of size, but also in terms of the education level, since we know completed education years of the new entrants at each of these four points in time. Consequently, we introduce both the demographic boom and the change in the education composition of the working-age population.

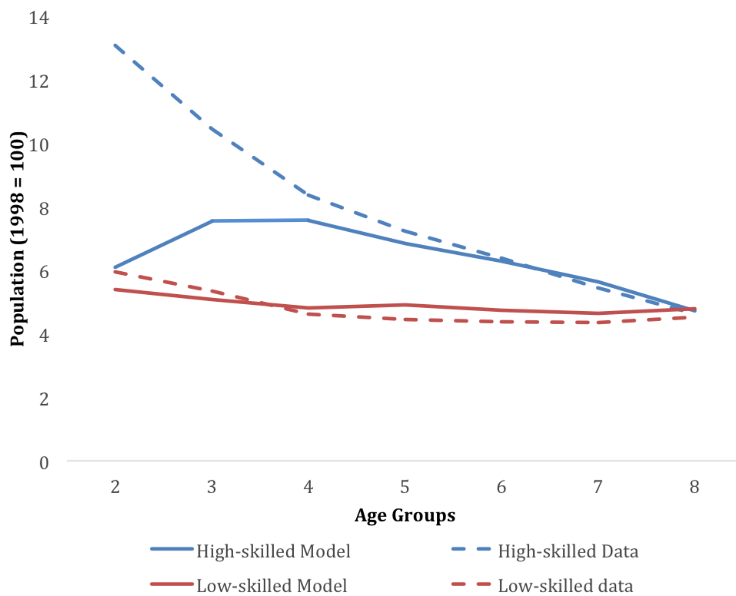
However, our assumption in Section 2.3.4 that new workforce entrants appear only in age $a = 0$ (i.e. 18-21 years old), does not allow us to match well the age profile of the population that we observe in the data. This is especially the case for high-skilled workers but is also valid for low-skilled age-groups, entering at age group 1. This is illustrated in Figure 2.2, where we compare the model-predicted population stocks in 2006 (starting from 1998 and using the survival probabilities x_a from Section 2.4.1.1) to the actual population stocks observed in the ELMPS data.[31] The figure shows that the model under-predicts the population stocks, especially for the younger age groups ($a \leq 3$ in 2006). The difference is particularly large for the high-skilled, which suggests a potential delayed entry to the labor market due to continuing education.

However, keeping in mind that we do not model a participation margin, the model produces population stocks which are fairly close to the data for age groups 4 and older in 2006 (i.e. age groups 2 and older in 1998).

Recognizing that the effect of the demographic is particularly felt by the younger cohorts, it is, therefore, necessary for the model to reproduce well the population dynamics for these specific age groups. To do so, we slightly adjust the framework presented in Section 2.3.2 to allow new entry into older age groups as opposed to just age-group 0. We assume that in each period a number, $N_{00,t}$, of individuals aged 18 to 29 enter the labor market (i.e. age groups 0, 1 and 2). A share ζ_0 of $N_{00,t}$ enter in age group 0, a share ζ_1 enter age group 1 and the remaining share $1 - \zeta_0 - \zeta_1$, enter at age group 2. In line with the theoretical model, we assume that all of these new entrants first appear in the non-formal state. We explain the details of this process in Section 2.6.3.2 in the Appendix.

[31] Note that the stocks that we compare to here are stocks from the data that are unmatched (i.e. not longitudinally linked).

Figure 2.2: Data vs model predictions of low- and high-skilled populations in 2006: New entrants only in age group 0



Source: ELMPS 1998-2012, Authors' calculations.
Note: The 1998 population is normalized to 100.

To calibrate the shock and the share parameters, we use data on high-skilled populations stocks for age groups 0 to 3 in 2006 (ELMPS), 2010 and 2014 (LFS) as well as the age group 0 population in 1998 (ELMPS) to find the actual value of new entrants for this specific period. For the low-skilled, we use data for age groups 0 to 2 in 2006, 2010 and 2014 since individuals enter only in age groups 0 and 1. We, therefore, have 23 data points and 13 parameters to find. We set up a minimum distance problem similar to Section 2.4.1.1 where we seek parameter values that minimize the difference between the model stocks and the data.

Table 2.8 shows the calibrated parameters that capture the demographic boom. The majority of low-skilled labor market entrants, more than 91%, enter, as expected, at age group 0, while the remainder at age-group 1. On the other hand, the results show that about 63% of new high-skilled labor market entrants enter at age group 0, followed by more than 27% at age group 1 and finally the remainder at age-group 2.

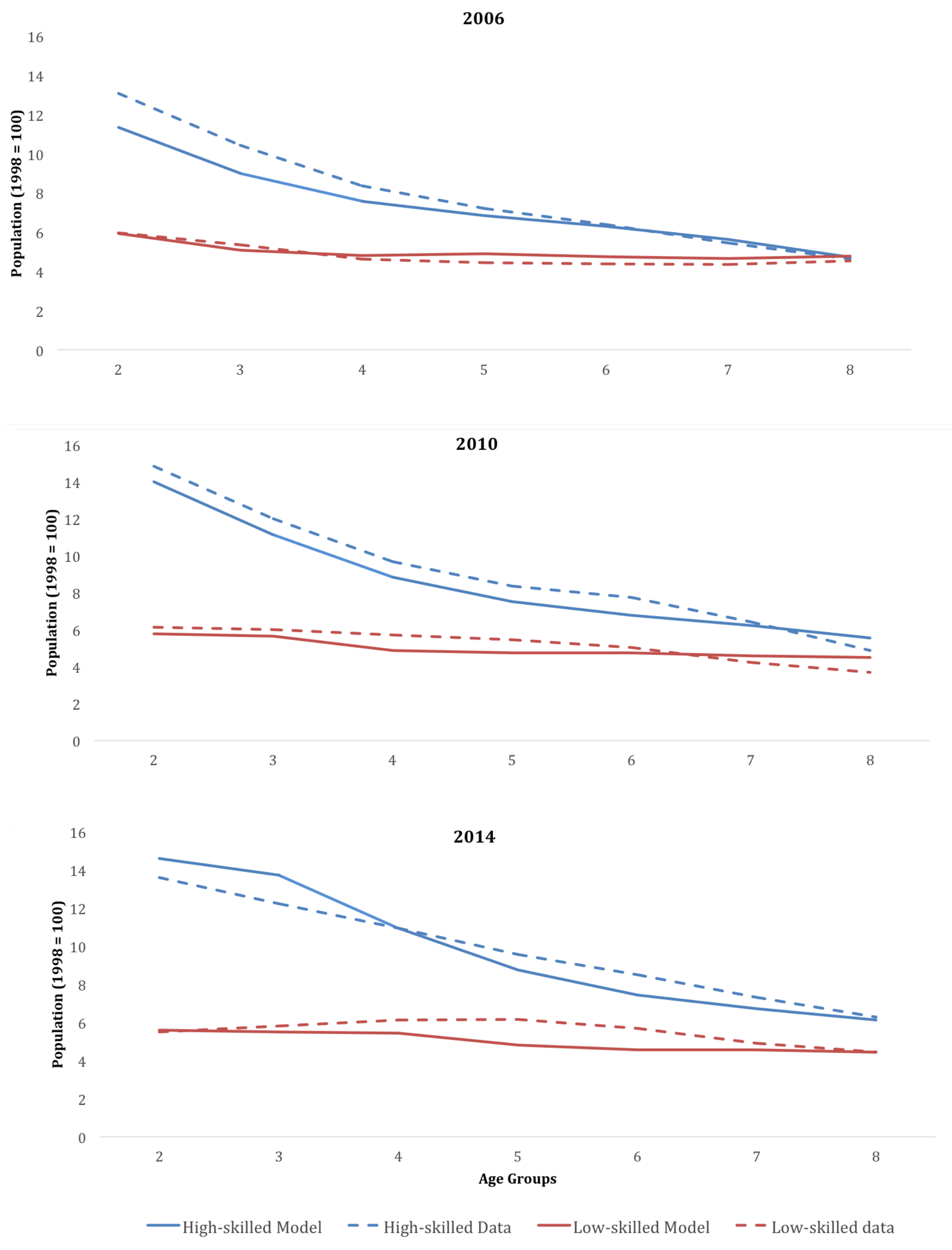
Figure 2.3 shows that starting from the 1998 population stocks, this method allows us to predict the population of 2006, 2010 and 2014 by age-group relatively well, especially when compared to Figure 2.2.

Table 2.8: Calibrated parameters for the demographic boom by age-group and skill level

Parameter	Definition	l	h
$N_{00,98}$	New entrants in 1998	6.60	11.84
$N_{00,02}$	New entrants in 2002	5.99	14.47
$N_{00,06}$	New entrants in 2006	6.04	15.32
$N_{00,10}$	New entrants in 2010	6.21	15.93
$N_{00,14}$	New entrants in 2014	7.44	15.64
ζ_0	Share entering at age 0	0.91	0.63
ζ_1	Share entering at age 1	-	0.27

Note: $N_{00,t}$ values are expressed as a share of the entire 1998 population.

Figure 2.3: Data vs model predictions of low- and high-skilled populations: New entrants in age group 0 and older



Source: ELMPS 1998-2012, Authors' calculations.
Note: The 1998 population is normalized to 100.

2.4.1.3 Setting some parameter values

Up to this point, we did not need to capitalize on the literature nor our assumptions to calibrate the parameters mentioned in the previous two subsections. However, to proceed to the next step and estimate the final number of parameters that are key (in the following section), we need to assume some parameter values. We do so by taking some values from the literature, some values from the data (ELMPS) and finally some from our own informed assumptions (all of which can be seen in Table 2.15 in the Appendix).

As is standard in the literature, we set the discount factor based on the average yearly real interest rate of 4.5%,[32] $\beta = \frac{1}{(1.045)^4}$. We also assume an elasticity of substitution parameter, ρ, in the aggregate production function of 0.3, inspired by the work of Glitz and Wissmann (2017) in Germany. Moreover, as in Yassin and Langot (2018), we assume a bargaining power of workers, γ, of 0.5 for both low- and high-skilled. The payroll tax, τ, in Egypt is about 25% and the corporate tax on profits, τ^c, is about 22%. Moreover, from the ELMPS we can compute the time spent in informal work, h. We also take from the ELMPS the age-specific value of informal wages, w_a^i, private formal wages w_a, and government wages, w_a^g such as informal wages, private formal wages and government wages.[33]

However, given the fact that evidence is scarce for many of the parameters, we make some informed assumptions. These are the shifters of the CES production function, α, the value of home production z_a, the effort cost of searching for a government job c_a, the number of entrepreneurs B and the distribution function of the cost that the entrepreneur draws, $H(.)$.

Given that our procedure seeks to calibrate productivities from observed wages, increasing one of the shifter parameters results in an increase in the price of the intermediate good which therefore lowers productivity (since wages are given) - as can be seen in Equations (2.27) and (2.28), and Equations (2.36) and (2.37). As a result, we try to set values for these shifters such that high-skilled (in)formal productivities are larger than low-skilled (in)formal productivities ($y_a^{f,h} > y_a^{f,l}$ and $y_a^{i,h} > y_a^{i,l}$, which will be estimated using the entire model in the next section). We also make sure that for a given skill level, formal productivities are larger than informal ones ($y_a^{f,h} > y_a^{i,h}$ and $y_a^{f,l} > y_a^{i,l}$). This allows us to set $\alpha^{f,l} = 0.15$,

[32] Real interest rate from the World Development Indicators database (World Bank).

[33] We opt for median, as opposed to average because wage distributions by age-groups are sometime skewed with a few set of high wage observation increasing the mean. The wage data are "smoothed" by regressing median wages on a constant, the age-group and age-group-squared and using the fitted values. This specification allows to capture potential non-linearities in the wage profile through age. This non-linearity is particularly evident for the informal sector. The result of this smoothing procedure is displayed in Figures 2.40 and 2.41.

$\alpha^{f,h} = 0.45$, $\alpha^{i,l} = 0.225$ and $\alpha^{i,h} = 0.175$.

As for the value of time in home production, z_a, for both low- and high-skill, we set it equal to 10% of 2006 age specific informal wages. In the literature, z_a is typically related to the unemployment benefit replacement rate. However, given the fact that unemployment benefits are practically non-existent (as explained in Appendix 2.6.1.6), it is not possible to estimate this replacement rate - a fact corroborated by Yassin and Langot (2018). For the purposes of this paper, we argue that it better seen as capturing home production.

For the effort cost of searching for a public job, c_a, we pick values that ensure that our assumed ranking for value functions, as seen in Inequality (2.23), holds. This leads us to set this effort cost to 50% of 2006 age specific government wages. Recall that the lifetime value of holding a public job has no direct effect on the difference in lifetime values $\mathcal{F}_a - \mathcal{N}_a$. This means that this cost does not directly affect bargained wages nor search effort for a private formal job (as explained at the end of Sub-section 2.3.6.2). Its main impact is a re-scaling of the levels of the value functions.

Last but not least, evidence on entrepreneuship in Egypt is scarce, and as far as we know there is no reference upon which we can rely. Therefore, we simply assume that the the cost K of realizing a business opportunity is uniformly distributed. We set the lower bound of the support to zero and we are then left with calibrating the upper bound $\bar{K}$ and the number of entrepreneurs B. Bearing in mind that the steady-state level of the population after the demographic shock is equal to 167.53, we set the number of low-skilled entrepreneur to 10 and the number for high-skilled to 20. Given the evidence on corruption and red tape costs faced in general by the population, and by entrepreneur, it is fair to assume that a share of these entrepreneurs is constrained and cannot invest. This implies that the upper bound of the support should be strictly greater than the value of a vacant job. We set the upper bound to 15000 for high-skilled and to 7500 for low-skilled. In the baseline scenario as will be explored later, these assumptions with the entire model in mind mean that around 71% of high-skilled entrepreneurs and 45% of low-skilled entrepreneurs can invest on average during the 2002-2074 period.

2.4.1.4 Using the model simulations

For the final set of parameters, we utilize the entirety of the theoretical model, given our calibrated parameters above in Subsections 2.4.1.1 and 2.4.1.2 and the fixed parameters in

Subsection 2.4.1.3. More precisely, we calibrate three sets of parameters in this step. We do so by minimizing the distance between the predicted values, given these parameters and the entirety of the model, and a set of observed values that the model tries to match.

The first set consists of 34 parameters that capture the productivities of the workers, by skill level and in each of the two sectors (private formal and informal): $y_a^{f,l}$ and $y_a^{f,h}$, where a spans from group 1 to group 8,[34] and $y_a^{i,l}$ and $y_a^{i,h}$, where a spans from 0 to 8. The second set consists of 16 parameters that relate to the scale of effort in the cost function, as seen in Equation (2.39). We denote these parameters as ν_a^l and ν_a^h, where a spans from age group 0 to 7.[35] The third set consists of the matching efficiency parameters, ϕ^l and ϕ^h, for low- and high-skill respectively in the Cobb-Douglas matching function (2.38).

We calibrate the productivities (the first set) using wages that are obtained from the data (Table 2.15). The second set of the parameters that relate to the effort in the cost function, ν, by using age specific non formality rates, $\frac{N_a}{N_a+F_a+G_a}$. The third set, which consists of matching efficiency parameter, is calibrated using aggregate informality rates by skills, $\frac{\sum_a N_a}{\sum_a N_a+F_a+G_a}$.

We simulate the model for two periods, from 1998 to 2006. We look for values of formal and informal productivities that minimize the distance between the values predicted by the model and the observed 2006 media formal and informal wages. Similarly, for the scale parameters of the cost of effort, we use the 2006 age- and skill-specific non-formality rates, and as the matching efficiency, we use aggregate skill-specific non-formality rates. The model is solved through linearization around the steady state.[36] Therefore, the solutions are expressed as linear functions of the previous period $(t-1)$ state variables and the current period (t) exogenous variables. The path for the exogenous variables (the number of new entrants) is computed in the previous section and the predetermined variables of the model are the stocks of workers as well as the stock of vacancies. The 1998 stocks computed from the ELMPS can be used as starting values. This means that we have to define the starting values for the two stocks of vacancies. To do so, we compute the steady state of the model assuming that the high- and low-skilled populations in 1998 are the steady state values for these two exogenous variables. While we acknowledge that 1998 is not a steady-state, using the population levels of this year allows us to best approximate the stock of vacancies, which may not be too far from the actual values.

[34] Remember that there are no workers in the formal private sector at age 0.

[35] Age-group 8 Non formal workers exit the market next period which implies that they do not make search effort.

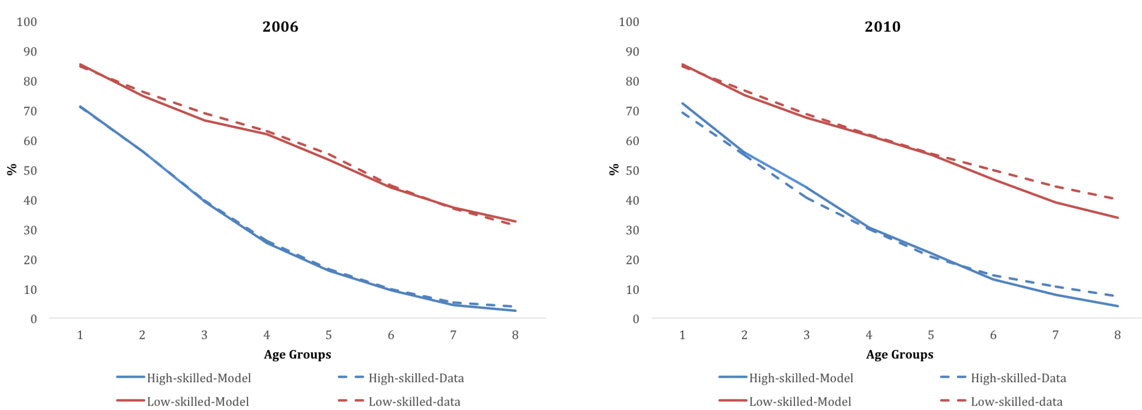
[36] The solutions are computed using Dynare which further allows us to check for the uniqueness of the solution around the steady state (Blanchard-Khan condition). This condition has been met in each of the simulations performed in this paper.

The results are shown in Table 2.9 below. Worker productivity levels in the private formal sector increase monotonically with age for both the high- and low-skilled (as of age 30 in the latter case). Productivity in the informal sector also increases with worker's age for the high-skilled until the age of 45 and it stagnates afterwards. For the low-skilled instead, the productivity level first increases but declines after the age of 37 years old. Moreover, as expected, the productivity of high-skilled workers are generally higher than those of the low-skilled workers. However, the younger high-skilled in the informal sector, ages 0 to 3, have lower productivity levels (and lower wages), although as they age they exceed their low-skilled peers.

As for the scale parameter of the cost of effort function, ν the results show that it varies by age. The general trend is an increase for the high-skilled, versus a decrease for the low-skilled. Finally, the results show that the matching efficiency for the high-skilled is higher than than of the low-skilled.

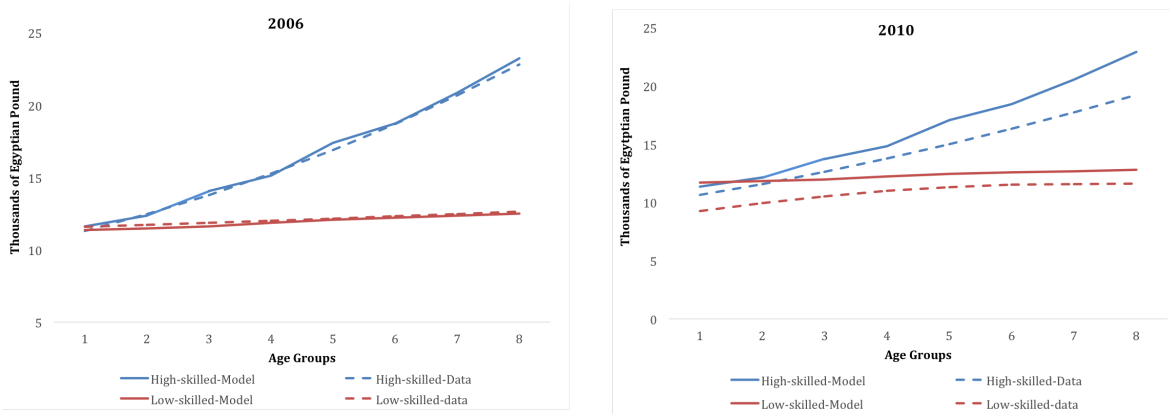
Figures 2.4-2.6 show that this calibration allows us to match well the data of the ELMPS of 2006. The age-profiles of non-formality rates by skill level, as well as private formal and informal wages, are very close to what is observed in the data. Moreover, simulating the model one period further, to 2010, shows that the model continues to match the data well - in this case the LFS of 2010, with very minor deviations for the older age groups' non-formality rates and some deviations in the private formal wage that also increase slightly with age. Note, however, that 2010 was one year after the Great Recession, from which Egypt has suffered. Given the fact that we keep productivity levels unchanged, the differences seen in wages are not unexpected.

Figure 2.4: Model vs data non-formality rates (%)



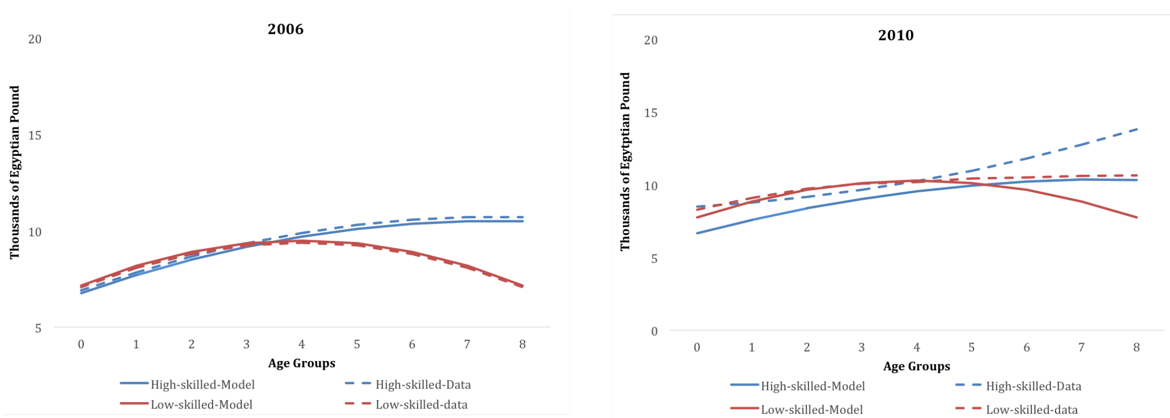
Source: ELMPS 1998-2012 and LFS 2010, Authors' calculations.

Figure 2.5: Model vs data formal wages



Source: ELMPS 1998-2012 and LFS 2010, Authors' calculations.

Figure 2.6: Model vs data non-formal wages



Source: ELMPS 1998-2012 and LFS 2010, Authors' calculations.

2.4.2 Simulations

In this section, we examine five main simulations. In the first scenario, we simulate the model through time to study how non-formality evolves as the demographic boom generation, given the change in the skill composition of new entrants, ages. We further look at the adjustments of the economy once this generation has exited the labor market. In the second scenario, we shut down the demographic boom (and the change in the skill composition) and compare the evolution of non-formality with our baseline simulation. This allows us to better understand the channels through which demography and non-formality interact. Thirdly, we simulate a scenario where there is a demographic boom, but it does not come with a change in the skill composition of workers, meaning that new entrants are not on average better educated

Table 2.9: Calibrated parameters

Parameter	h	l	Parameter	h	l
y_1^f	75,927	39,214	ν_0	4.44	6.10
y_2^f	84,171	38,444	ν_1	5.92	7.99
y_3^f	86,818	38,149	ν_2	7.97	8.00
y_4^f	94,789	38,492	ν_3	5.86	7.94
y_5^f	116,929	38,849	ν_4	7.61	4.92
y_6^f	126,551	40,614	ν_5	5.82	4.03
y_7^f	141,958	43,666	ν_6	8.00	4.02
y_8^f	168,971	47,899	ν_7	7.70	4.02
y_0^i	29,047	30,825	ϕ	0.38	0.22
y_1^i	33,069	35,225			
y_2^i	36,514	38,367			
y_3^i	39,382	40,252			
y_4^i	41,674	40,880			
y_5^i	43,388	40,250			
y_6^i	44,526	38,364			
y_7^i	45,087	35,221			
y_8^i	45,071	30,820			

Note: Productivities are expressed in Egyptian pounds.

than the existing workforce. This allows us to isolate the impact of the change in the skill composition.

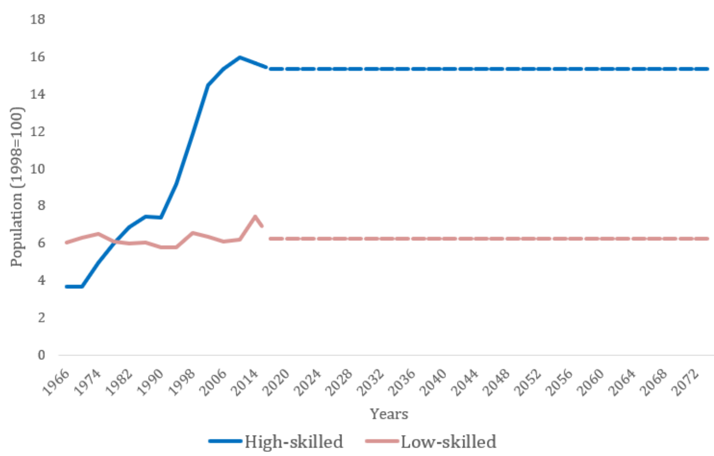
The fourth scenario eases the constraints faced by entrepreneurs and allows them to create more vacancies. The fifth and last scenario allows for an increase in the number of entrepreneurs in line with the growth of the population to also see the impact on vacancy creation and non-formality in the economy. During the time span of these simulations (1998-2074), the calibrated parameters, and in particular the marginal product of labor, remain at their calibrated values.

2.4.2.1 Baseline simulation

In this baseline simulation, we take the number of new entrants as available to us from the Egyptian labor force surveys of 2010 and 2014, and assume that the number of new entrants after the year 2014 is at the steady-state value computed in Section 2.6.3.2 in the Appendix. Note that this does not mean that the population of the workforce stops growing after 2014 but that the growth rate eventually decreases. More precisely, we start from a workforce whose total is 100, increasing a peak of about 169 and then decreasing to its steady-state level of 167.53.

The evolution of the high- and low-skilled stock of new entrants over the entire simulation period, therefore, can be seen in Figure 2.7, which is an extension of Figure 2.39. The dotted part of the stocks are the assumed steady-state values, which correspond to 6.25 for the low-skilled and 15.34 for the high-skilled, expressed relative to the 1998 population stock which is normalized to 100. In the whole workforce, the share of more educated h starts at 53.6% in 1998 and it increases to a steady-state share of 77.8%. This emphasizes the change in the skill composition of the workforce.

Figure 2.7: New entrants by skill level (relative to the 1998 population)



Note: The population of 1998 is expressed as 100.

The demographic boom and the evolution of the size of the various age groups over time can be seen in Figures 2.8 and 2.9 for the high- and low-skilled respectively. Recognizing that the sweeping majority of new entrants are among the high-educated, the demographic boom is mostly seen through these workers. Aggregating the age-groups for ease of reference to 0-2, 3-5 and 6-8 (as in Section 2.4.1.1), Figure 2.8 show that the youngest cohort represents the largest share of the high-skilled workers until the year 2018. By this year, the majority of the 1980s generation has graduated to older cohorts. The trend of the shares of the other two aggregate age-groups follows the coming of age of this demographic boom. The shares stabilize around the year 2050, when this demographic boom essentially leaves the labor market.

The more erratic behavior observed in Figure 2.9 for the low-skilled population can largely be traced down to the evolution of new entrants displayed in Figure 2.7. In particular, the new entrant level in 2014 is greater than the assumed steady-state level which explains why the age group 0-2 populations peaked between 2014 and 2022.

Like the high-skilled, the shares stabilize around the year 2050 when the 2014 generation has fully exited the labor market. It is worthy of noting here, however, that unlike the case of the high-skilled, the share of the youngest age group remains the highest in all of the simulation years. This comes from the fact that, in steady state, population shares are determined by the survival probabilities and new entrants through the ζ parameters. Since low-skilled workers have lower survival probabilities, as shown in Table 2.7, which raises the share of the young mechanically, especially various generations and the older ones exit faster.

Figure 2.8: Selected age groups of high-skilled workers (as a share of the total high-skilled population at the time)

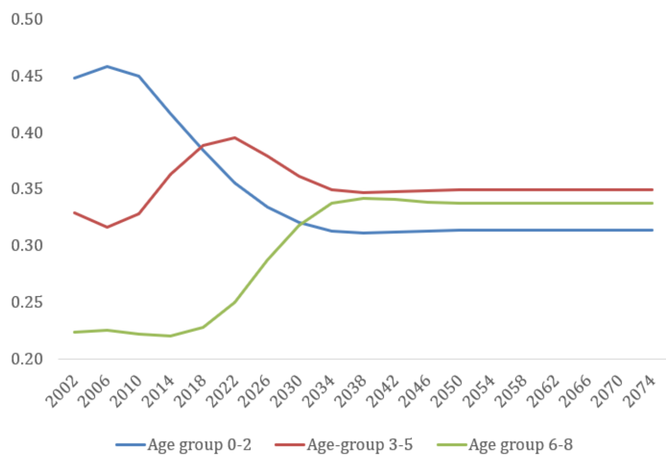


Figure 2.9: Evolution of selected age groups of low-skilled workers (as a share of the total low-skilled population at the time)

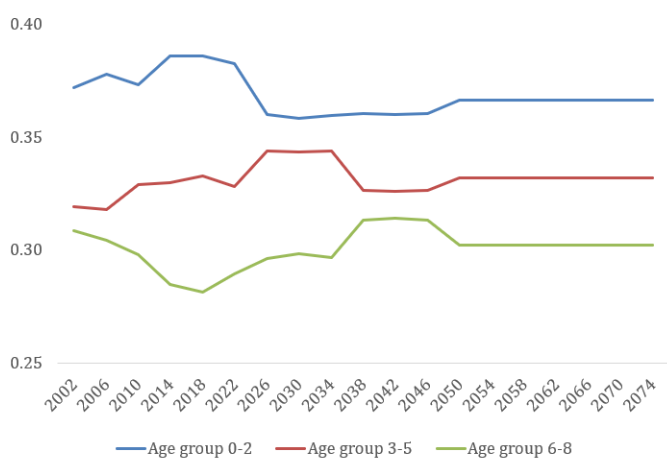


Figure 2.10 shows the evolution of non-formality over time for the high- and low-skilled. In line with the demographic boom, the share of non-formal high-skilled workers to total high-skilled workers increases from around 41.5% in 2002, to a peak of 46.9% in 2018 before slowly decreasing to a steady-state level of around 44%. This increase is not only significant in the short-term, but in the long-run, the simulations show the informality rate increases compared to the values in the first period of the simulation, and compared to the non-formality rate of 42.4% in 1998. For the low-skilled, who face higher non-formality rates in general, the share of non-formal workers increases from around 60% in 1998, the initial year, to 62.3% in 2002 to a peak of 65.8% in 2014, before gradually decreasing to a steady-state rate of around 64.4% - again, higher than those seen in the initial simulation period. Note that these peaks coincide with the periods in which the shares of the oldest workers is low.

The age-specific non-formality rates, by skill, as shown in Figure 2.11, all experience a rise throughout the simulation period, while maintaining the same order, or ranking, from highest to lowest throughout the years. The figure shows that the rise of non-formality is experienced by all age groups throughout the years.

In fact, the results appear to show that informality rates peak as the baby boom generation gets older and moves through these age groups. This may indicate a new channel of the so-called "scarring effect". According to this channel, young workers that experience higher informality rates at entry suffer from long-term negative effects related to this initial state. Previously, the literature has used the name "scarring effect" for the long-term effects (on wages and/or employment) of graduating in a recession (see for example Oreopoulos et al. (2012)). Our simulation exercise points to an additional scarring effect that is related to entering the labor market at the time of the demographic boom and in the midst of atypically large cohorts.

Figure 2.10: Aggregate non-formality (as a share of the total skill-specific population at the time)

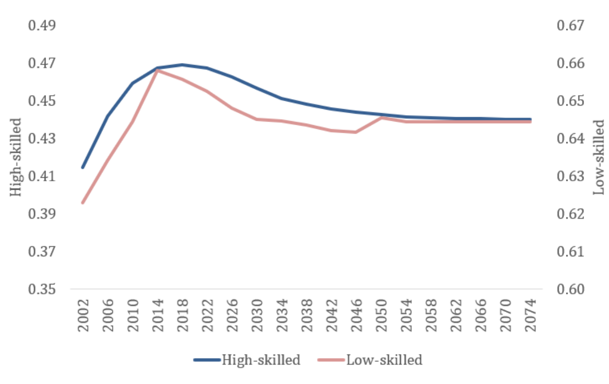
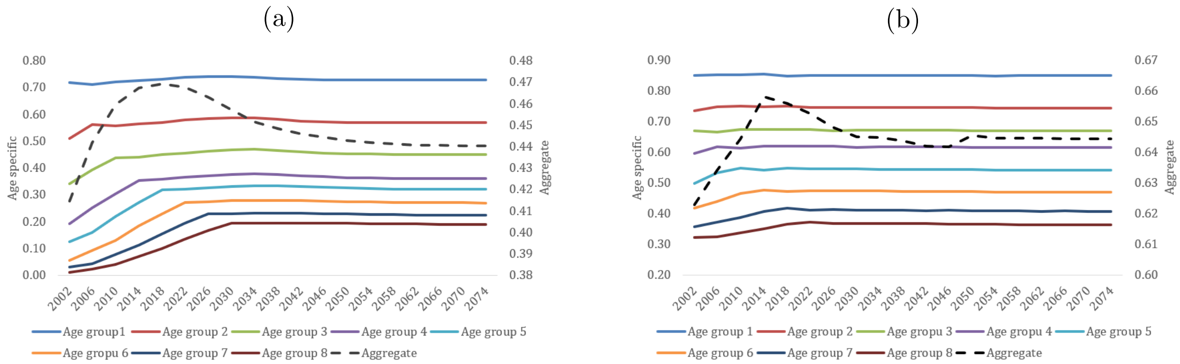


Figure 2.11: Aggregate and age-specific non-formality rate for high- (a) and low-skilled (b) respectively (as a share of the total skill-specific population)



Four main mechanisms explain how the demographic shock affect the non-formality rate: (1) a pure compositional effect, (2) a labor supply shock effect that alleviates search-matching frictions, (3) an induced effect on the prices of intermediate goods and (4) a response of labor demand (vacancies). All but the first channel operate simultaneously. However, for pedagogical reasons, we explain them sequentially. First, there is a composition effect that shifts the population shares towards younger workers for which the prevalence of non-formality is higher. This effect is highlighted in Figure 2.8 for the high-skilled workforce. In the long-run, this composition effect disappears and the population shares go back to their steady-state values, as shown in the aggregate line of Figure 2.11.

The second channel works through the congestion effect originating from the search and matching assumption in the formal labor market. The large inflow of high-skilled non-formal workers decreases labor market tightness and the job finding probability. By the time that the demographic boom generation exits the market, the results show that labor market tightness and the job finding probability gradually increase again but they never reach their pre-boom level, as can be seen in Figure 2.12. The evolution of tightness is of course also related to the dynamic adjustment of vacant jobs that we discuss just after the impact on prices.

The third mechanism to highlight relates to the aggregate production and the effect of the demographic boom on the prices of intermediate goods. The large increase in the level of high-skilled formal and non-formal workers raises their output which in turn lowers the prices for these two goods. These decreases persist in the long-run as the level of high-skilled workers has permanently increased (see Figure 2.17).

The decreases in the job finding probability and in the price of high-skilled formal goods have a negative effect on the surplus of a match. This lowers formal wages, as shown in Figure 2.14 and reduces the incentive of non-formal workers to search for a formal job. Consequently, effort decreases which then has positive effects on the high-skilled in terms of the non-formality rate. Note that because the drop in the price of the high-skill good is permanent, the new steady state levels for wages and effort are lower, which partly explains why the high-skilled non-formality rate is greater in the long-run. Moreover, the increase in aggregate production that is mainly due to the increase in the size of the high-skilled workers increases the price of low-skilled intermediate goods, as is seen in Figure 2.17, as expected and mentioned in Sections 2.3.1 and 2.3.6.

Figure 2.12: Labor market tightness, job finding and vacancy-filling rates for high- and low-skilled respectively

(a) (b)

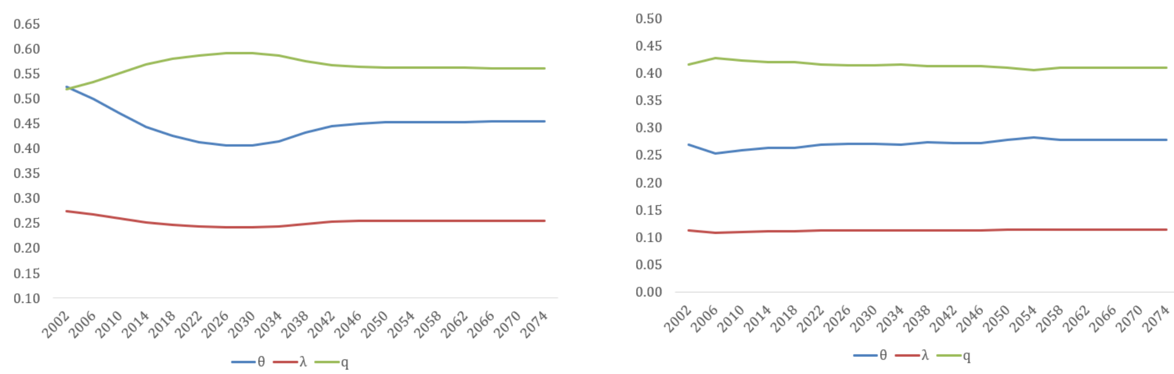
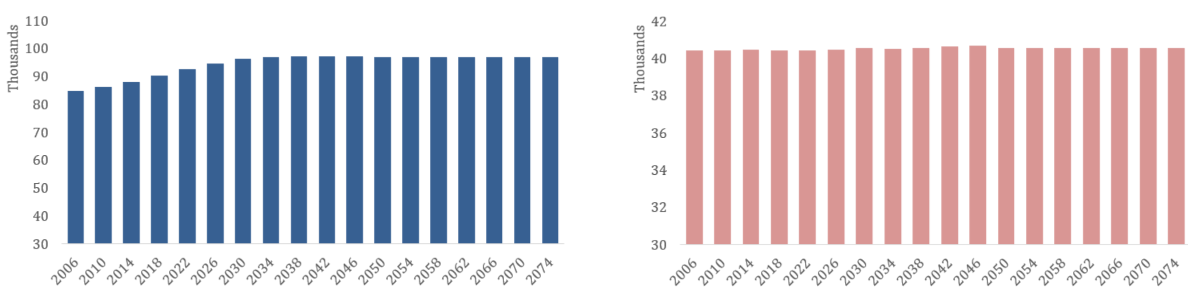


Figure 2.13: Aggregate productivity for high-skilled (a) and low-skilled (b) in private formal firms (in Egyptian pounds)

(a) (b)

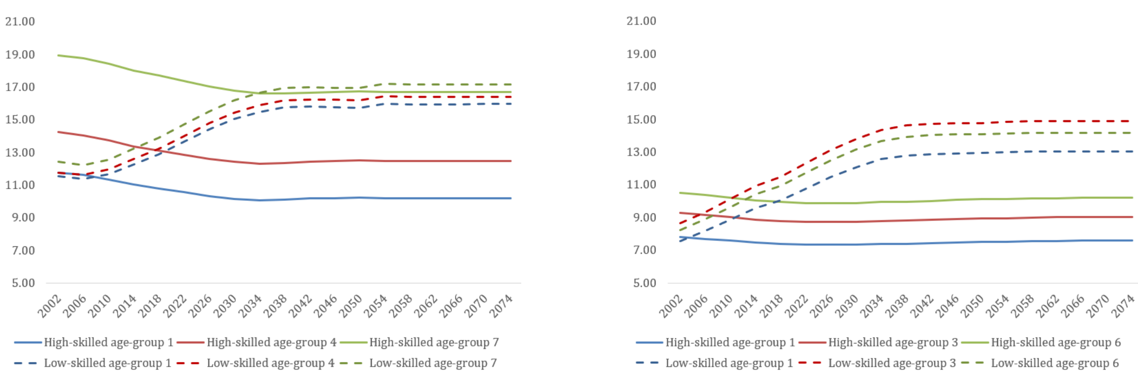


Note: This is the productivity of the age group-specific productivities weighed by their share in the population.

A fourth important channel is the adjustment of vacancy creation and of the stock of va-

Figure 2.14: Formal (a) and informal (b) wages for selected age groups (in thousands of Egyptian pounds)

(a) (b)



cancies. Here, Several forces are at work. First, the initial decrease in the price of the intermediate good produced by formal firms (observed for both skills) lowers the firm's flow profit which decreases the value of a filled and a vacant position. Next, the demographic boom and the large increase in the number of non-formal (mainly skilled) workers have a positive effect on the probability that a firm forms a match (Figure 2.12). However, reduced job-search effort levels as explained above counteract the positive labor-supply shock. The net effect is a non-negligible rise in the lifetime value of a high-skilled vacant position during the first periods (see Figure 2.15). The opposite net change is first observed for the low-skilled.

Contrary to a standard Mortensen-Pissarides model, the number of vacancies does not jump to reset the value of vacancies to zero. In our Diamond (1982) framework, the adjustment is more moderate. Nevertheless the pattern of Figure 2.15 induces some more entrepreneurs to implement their project and the stock of high-skilled vacancies increases (see Figure 2.16).[37] Since a worker's productivity strictly increases with age, the aging of the population raises the expected productivity of matching with skilled informal workers (see Figure 2.13).[38] The maximum value of the stock of skilled vacancies is reached in the period 2042-2046. This coincides with the exit of workers that entered in 2010 and 2014 (the last part of the demographic boom). When these cohorts exit, the probability of filling a vacancy, q, and the stock of vacancies, V, both decrease. Note that in the long-run, the rise in the stock of skilled vacancies is not enough to let labor market tightness go back to its pre-demographic boom level (while it approximately does for the low-skilled). This indicates that the negative

[37]For the low-skilled, there is first a little drop in the inflow of vacancies.
[38]For the low-skilled, this additional effect is negligible.

effect of the drop in the high-skilled formal good prices dominates in the long run.

Figure 2.15: Discounted lifetime value of a vacant position by level of skill

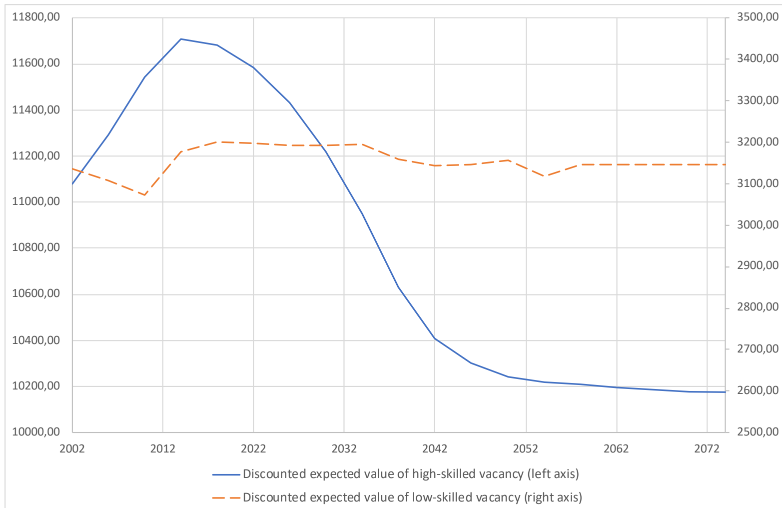
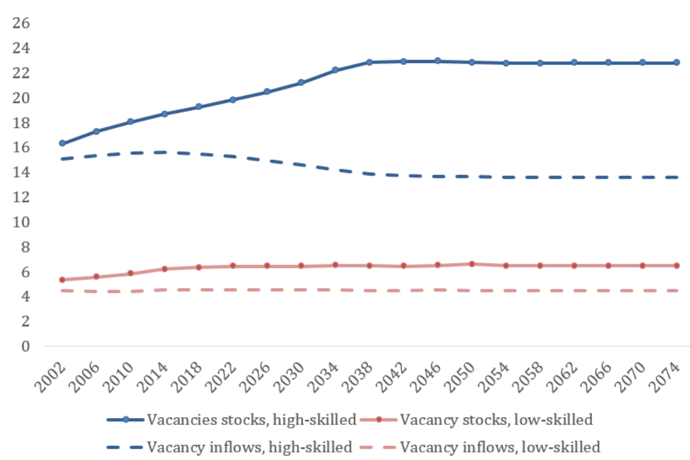


Figure 2.16: Stock of vacancies and the inflow of new vacancies - investments (as a share of 1998 population)

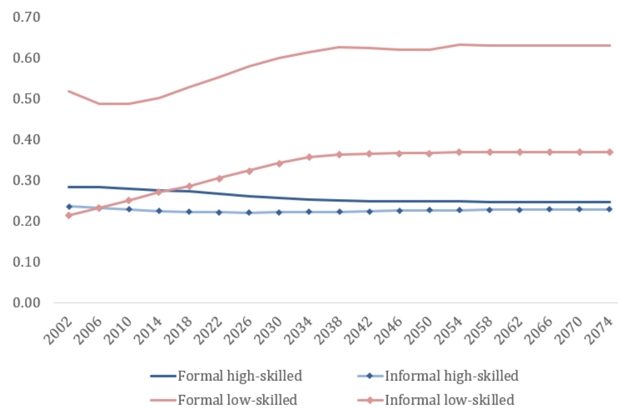


2.4.2.2 Non-formality without the demographic boom

To simulate the counterfactual non-formality rate in absence of the observed demographic boom, we assume that the number of new entrants stays fixed at its 1998 level for both high- and low- skilled.[39] Figure 2.18 displays the path for these exogenous variables. This

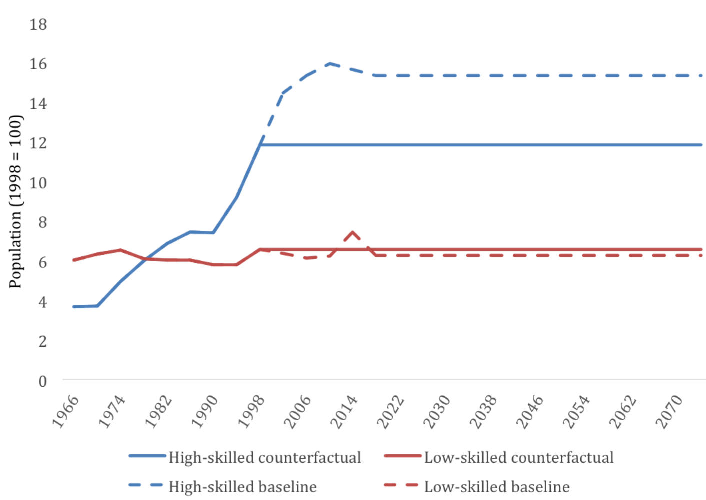
[39] We also assume that the 1998 level of new entrants is the new steady-state level.

Figure 2.17: Intermediate goods' prices relative to that of the final good (taken as the numeraire)



illustrates the fact that the key feature of the counterfactual simulation consists of shutting down the post-1998 rise in the high-skilled workforce. For the low-skilled, the baseline level of the workforce is instead slightly higher than the counterfactual in the medium- and long-run. In the next paragraphs, we compare the path of the economy in the baseline case to this counterfactual.

Figure 2.18: Evolution of new entrants by skill level (relative to the 1998 population): counterfactual without the demographic boom

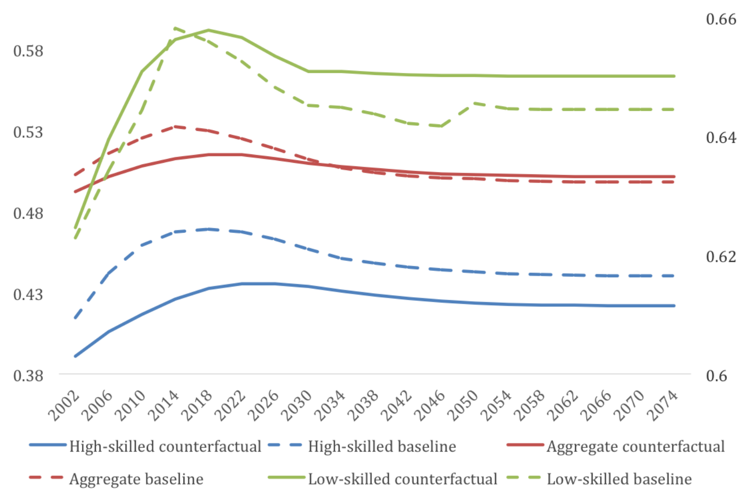


Note: The population of 1998 is normalized to 100.

Figure 2.19 shows that Egypt's demographic boom, which has come with a change in the skill composition, increases the non-formality rate of the high-skilled, both in the short- and long-run. Moreover, while it further increases the economy-wide rate, we can see that as the demographic boom generation ages, the rate decreases and reaches a level lower than in our counterfactual. This is different from what is seen for the low-skilled. The demographic boom, which again is largely a high-skilled phenomenon as mentioned earlier, decreases their non-formality rate compared to the counterfactual, where they would have experienced a higher non-formality rate without this boom.

The interactions between population growth and the mechanisms highlighted in the previous section explain the evolution in this scenario too. First, the higher is the number of new entrants the higher is the shift in the composition of the workforce towards younger workers (Figure 2.20).

Figure 2.19: Evolution of aggregate non-formality rates (low-skilled on the right vertical axis): counterfactual without the demographic boom



Note: The high-skilled and aggregate informality rates can be read on the left axis. The low-skilled rate on the right axis.

Second, the congestion effects on the formal private labor markets are less present in the counterfactual simulation. This can be in seen Figure 2.21, which shows that the decreases in tightness and in the job finding probability are larger in the baseline simulation. Third, the decrease in the price of the formal high-skill intermediate good is lower in the counterfactual simulation because the rise in the high skill population is smaller (Figure 2.22). It is interesting to note, also, that the increase in the low-skilled formal good price is larger in the baseline model. This effect comes from the fact that aggregate output increases less in the "absence" of the demographic boom leading to a lower increase in the low-skill intermediate price (see Equation (2.27)).

Therefore, the demographic boom has larger effects on these three mechanisms. This further implies that the induced impacts on the labor supply and demand explained in Section

Figure 2.20: Age groups composition in the counterfactual and baseline scenario for high-skilled (a) and low-skilled (b): counterfactual without the demographic boom

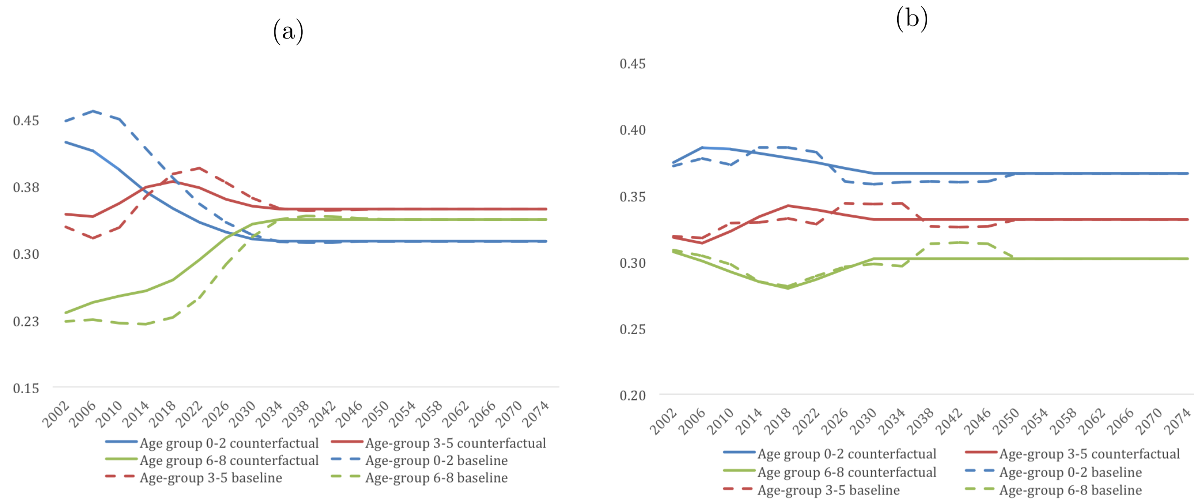
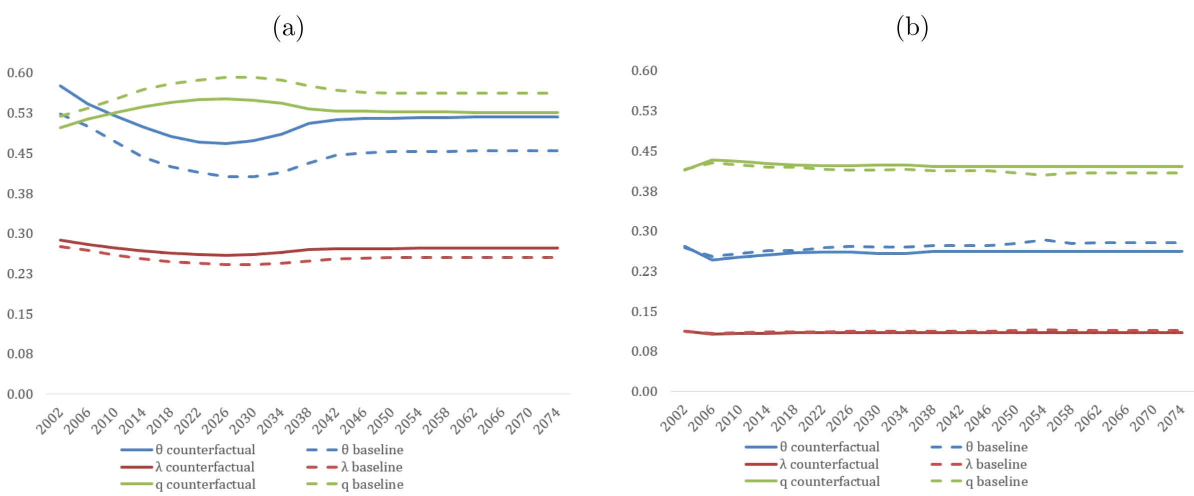


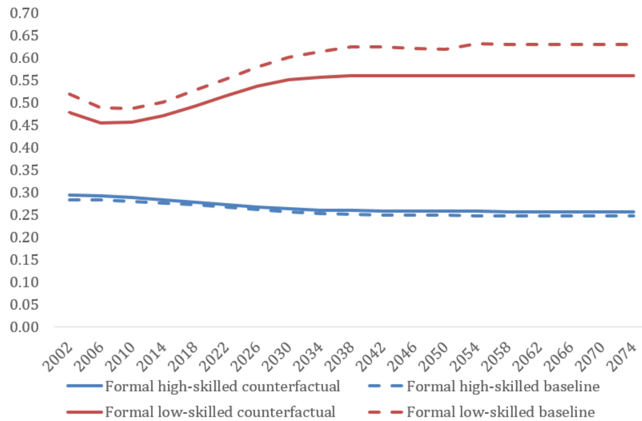
Figure 2.21: Labor market tightness, job finding and vacancy-filling rates for high-skilled (a) and low-skilled (b): counterfactual without the demographic boom



2.4.2.1 are lower when the number of new entrants is smaller. More precisely, the drop in effort and in wages is smaller, and the increase in the stock of vacancies is less pronounced.

Finally, the long-run evolution of non-formality rates in both scenarios can be understood from the comparison of prices (Figure 2.22). Under the demographic boom, the greater drop in the high-skilled prices lead to a decrease in effort and tightness, which in turn explains why the high-skilled non-formality rate is larger. The opposite effect holds for the low-skilled non-formality rate since the increase in the low-skilled prices leads to an increase in effort and

Figure 2.22: Intermediate goods' prices for the formal sector relative to that of the final good (taken as the numeraire): counterfactual without the demographic boom



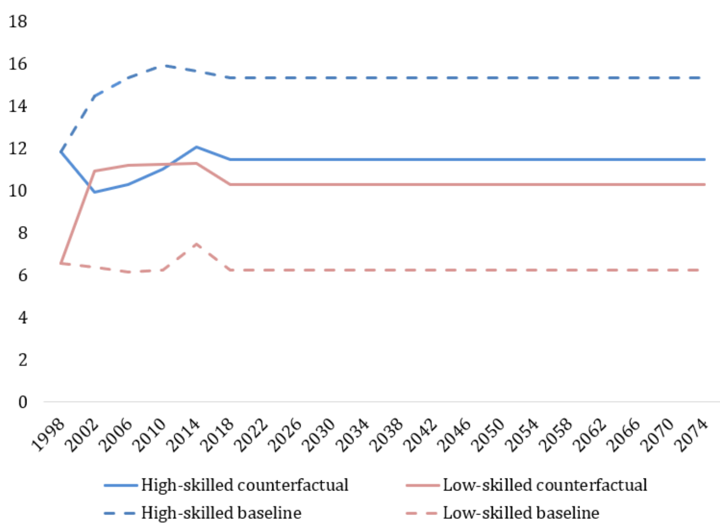
tightness in the long run. This highlights an indirect positive effect of the mainly high-skilled demographic boom, on low-skilled workers.

The effect of the boom on the aggregate non-formality rate results from the net effect of the decrease among low-skilled and the increase among the high-skill, as well as from the change in the composition of the workforce towards high-skill workers who have lower non-formality rates.

2.4.2.3 Non-formality without a change in the skill composition

Recognizing the fact that the demographic boom in Egypt has come with a significant change in the skill composition of the workforce, and namely the new entrants, we simulate another counterfactual of the demographic boom without a change in the skill composition. This means that we allow for the increase in the number of new entrants, provided that these new entrants do not change the overall skill composition of the workforce, such that the share of the high-skilled in the workforce remains at 53% (the 1998 share) throughout the entire period of the simulation. The flow of new entrants in this counterfactual scenario can be seen in Figure 2.23. The number of new high-skilled entrants is, therefore, assumed to be lower than in the baseline, and the number of new entrants of the low-skilled is assumed to be higher. Note that to maintain the share of the high-skilled and low-skilled of the population the same, we need to mechanically increase the new entrants of the low-skilled and decrease those of the high-skilled - consequently leading to the small peaks and troughs seen in the figure.

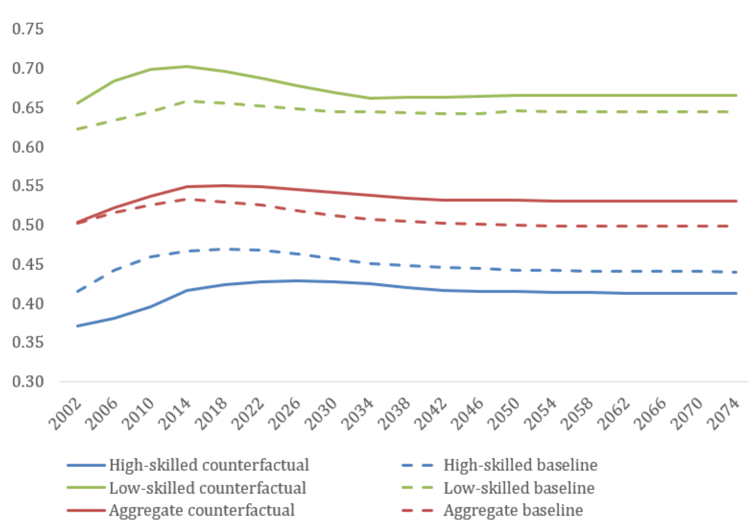
Figure 2.23: New entrants (relative to the 1998 population): counterfactual of same skill composition



Note: The population of 1998 is normalized to 100.

Figure 2.24 shows that without this change in the skill composition the non-formality rate of the high-skilled would have been lower, and the opposite for the low-skilled. However, the overall non-formality rate of the entire economy would have been higher, by a little more than 3 percentage points, driven largely by the higher non-formality rate of the low-skilled. The change in the skill composition in favor of the high-skilled, therefore, was arguably an important element in reducing the average rate of non-formality in Egypt over the years, given the fact that the high-skilled face lower non-formality rates in general.

Figure 2.24: Aggregate non-formality rates: counterfactual of same skill composition

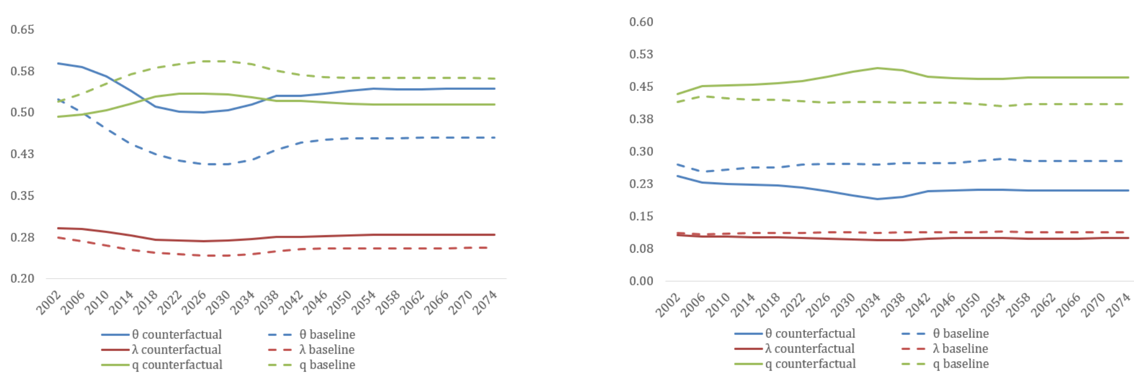


The lower rate of non-formality for the high-skilled in this counterfactual scenario is also reflected in a decrease in the congestion effects for this skill group. Fewer high-skilled new entrants increase labor market tightness and increase their probability of finding a job, as shown in Figure 2.25. Conversely, it reduces the private sector's vacancy filling rate. This has a negative effect on the value function of the firm and would have reduced the number of vacancies opened for the high-skilled compared to the baseline. These observations are the opposite for the low-skilled.

This scenario also shows that the price of the private formal intermediate good produced by high-skilled workers would have been higher, again affected by the small number of workers entering, as illustrated in Figure 2.26. The price of the private formal intermediate good produced by the low-skilled, on the other hand, would have been lower, and would have risen much less over the years. The price of the low-skilled intermediate good, like the previous scenarios, would have remained higher than that of the high-skilled.

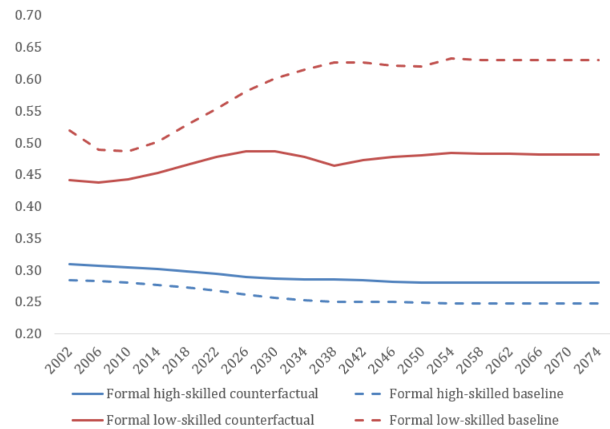
Figure 2.25: Labor market tightness, job finding and vacancy-filling rates for high-skilled (a) and low-skilled (b): counterfactual of same skill composition

(a) (b)



The skill composition that came with the demographic boom reduced Egypt's average non-formality rate. This is because the high-skilled, which entered the labor market in larger numbers, generally have lower non-formality rates compared to the low-skilled. However, for the high-skilled worker, coming into the labor market in a time of the demographic boom had a negative impact by increasing the non-formality rate that he would incur.

Figure 2.26: Intermediate goods' prices relative to that of the final good (taken as the numeraire): counterfactual of same skill composition



2.4.2.4 Non-formality with higher vacancy creation

We have seen in Section 2.4.2.1 that the demographic boom leads to a gradual increase in the stock of high-skilled and low-skilled vacancies. This gradual adjustment of vacancies contributes to the congestion effect through a drop in the job-finding rates. Moreover, in the long-run, the stock of vacancies never reaches a level that would lead to the pre-boom steady-state level of tightness due to the drop in prices.

The specification for the dynamics of vacancies was partly motivated by the constraint faced by entrepreneurs with regard to corruption and red tape. In the context of the demographic boom, alleviating such constraints could potentially reinforce the increase in the stock of vacancies through higher investments. This would then allow a reduction of the effects of congestion on informality. Furthermore, lowering the constraint on entrepreneurs would raise the steady-state level of vacancies, which partially offsets the decline in tightness due to the lower price of the intermediate formal high-skilled good.

To capture the loosening of constraints faced by entrepreneurs, we modify the investment decision (2.31) in the following way:

$$I = B\ H((1+\kappa)\mathcal{V}') \tag{2.45}$$

in which $\kappa > 0$ is a parameter that shifts upwards the threshold value below which entrepreneurs transform a business opportunity into a vacant position. Under the assumption that $H(\cdot)$ is the cumulative density function of a uniform distribution over $[0, \bar{K}]$, Equation

(2.45) can be rewritten as

$$I = \frac{B(1+\kappa)\mathcal{V}'}{\bar{K}}$$

Consequently, introducing $\kappa > 0$ can be reinterpreted as a permanent proportional upward shift of the number of entrepreneurs or of the probability of opening a vacancy

We set κ to 0.2 for both high- and low-skilled entrepreneurs,[40] and assume the same path for new entrants as displayed in Figure 2.7. This implies that the effects coming from the change in the age composition of the workforce are the same as the ones in the baseline scenario. In other words, the age group composition evolves as displayed in Figures 2.8 and 2.9.

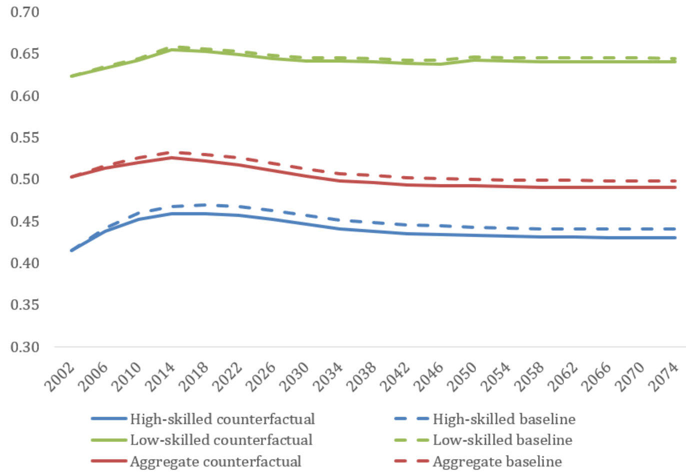
We produce a set of graphics similar to those in Section 2.4.2.2 where we compare the evolution of key variables with this new simulation against our baseline one. The results show that the general trend of the non-formality rate is similar in both scenarios, with a similar hump shape that appears as the demographic boom cohorts age. Both simulations have the demographic boom in common, which again highlight the role that this boom, and its age composition specifically, plays in shaping the dynamics of non-formality.

However, reducing entrepreneurs' constraints and easing new vacancy creation as we model it in this section leads to a lower non-formality rate than the baseline - as would be expected. In the long-run, the high-skilled and aggregate non-formality rates are around 1 percentage point smaller comparing the two simulations (and a percentage point smaller for the low-skilled informality rate). While these differences may appear small, it is worth pointing out that in the baseline scenario, around 71% of high-skilled entrepreneurs and 45% of low-skilled entrepreneurs invest on average during the 2002-2074 period ($H(\mathcal{V})$). Setting $\kappa = 0.2$ raises these average shares to 78% for the high-skilled and 49% for the low-skilled

Most of the positive effects brought by the increase in investment goes through a loosening of the congestion on the labor market. By allowing more entrepreneurs to invest, the stock of vacancies increases which increases tightness and the job finding probability (Figure 2.28). It is worthy of noting that the increase in the stock of high-skilled vacancies is still insufficient to fully absorb new entrants from the demographic boom. In fact, we still see that tightness decreases between 2002 and 2026-2030 (unlike low-skilled tightness which strictly increases). Furthermore, the increase in the job finding rate has a positive effect on formal wages and effort. Figure 2.29 confirms that increasing investment in vacancies has little effects on prices

[40] We have also tried other lower values of κ and the results remain largely in line with that is presented here

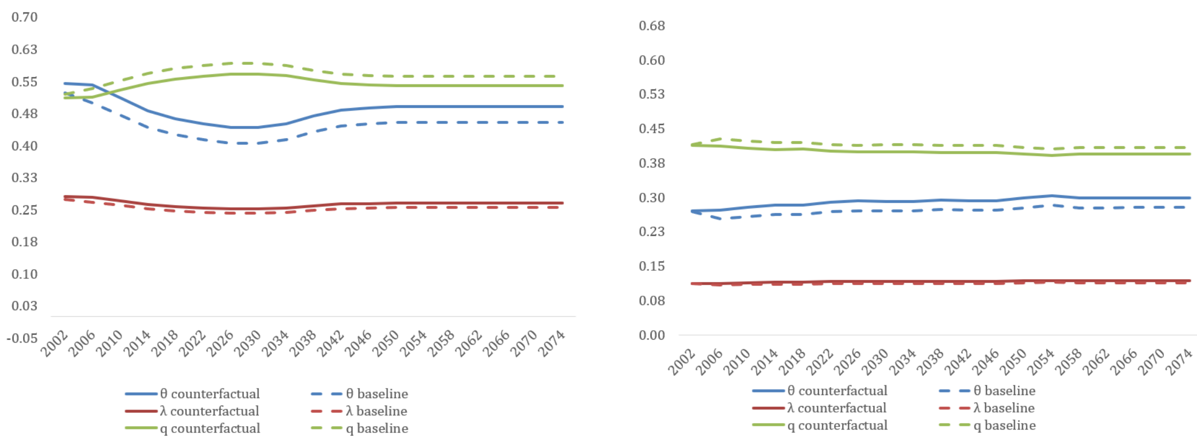
Figure 2.27: Aggregate non-formality rates: counterfactual of easing fixed cost constraints



of formal intermediate goods which appear to be driven by the demographic boom.

Figure 2.28: Labor market tightness, job finding and vacancy-filling rates for high-skilled (a) and low-skilled (b): counterfactual of easing fixed cost constraints

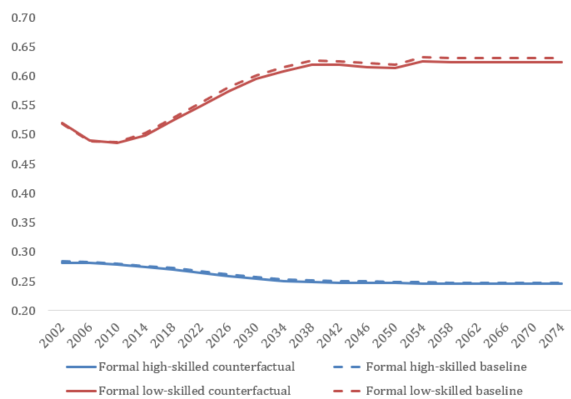
(a) (b)



2.4.2.5 Increasing the number of entrepreneurs

In the subsections above, we assumed that the number of entrepreneurs, B, does not change, even as the population grows. In this subsection, we allow for the increase of entrepreneurs, both low- and high-skilled, in line with the skill-specific population growth rate. Seeing that the high-skilled population grows much faster than that of the low-skilled, Figure 2.30 shows that the simulation increases the number of high-skilled entrepreneurs, B^h, by more than

Figure 2.29: Intermediate goods' prices relative to that of the final good (which is taken as the numeraire): counterfactual of easing fixed cost constraints



two-fold, while the low-skilled entrepreneurs remain more or less the same.

Figure 2.30: Number of entrepreneurs

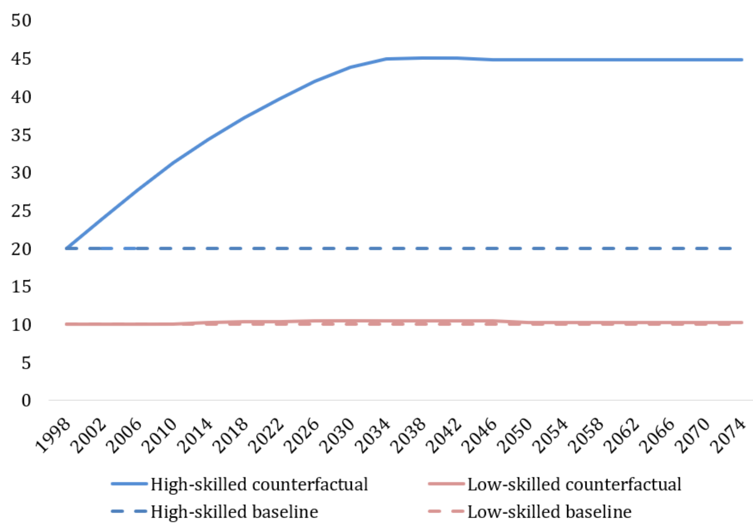


Figure 2.31 shows that the economy-wide non-formality rate would have been significantly lower, by more than 3 percentage points, driven by the decrease in the non-formality rate of the high-skilled, while that of the low-skilled remains more or less the same. This decrease is larger than that seen in the previous subsection mainly because the number of entrepreneurs continues to grow whereas κ is a constant.

The congestion effect seen in the private formal labor market is markedly lessened. Interestingly, labor market tightness for the high-skilled is not only higher (as vacancies increase shown in Figure 2.33), but the initial dip that is seen in most simulations is markedly softened, while the job finding probability also increases. Unlike previous simulations, and largely because of the increase in the number of potential entrepreneurs, the prices of intermediate goods do not change as much, as shown in Figure 2.34. The difference here, however, is not only in the decrease of the dip, but also in what appears to be a permanent increase in the level of tightness.

Figure 2.31: Aggregate non-formality rates: counterfactual of increasing entrepreneurs

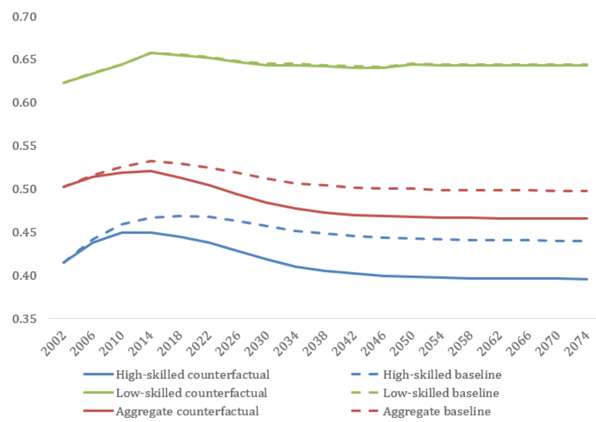


Figure 2.32: Labor market tightness, job finding and vacancy-filling rates for high-skilled (a) and low-skilled (b): counterfactual of increasing entrepreneurs

(a) (b)

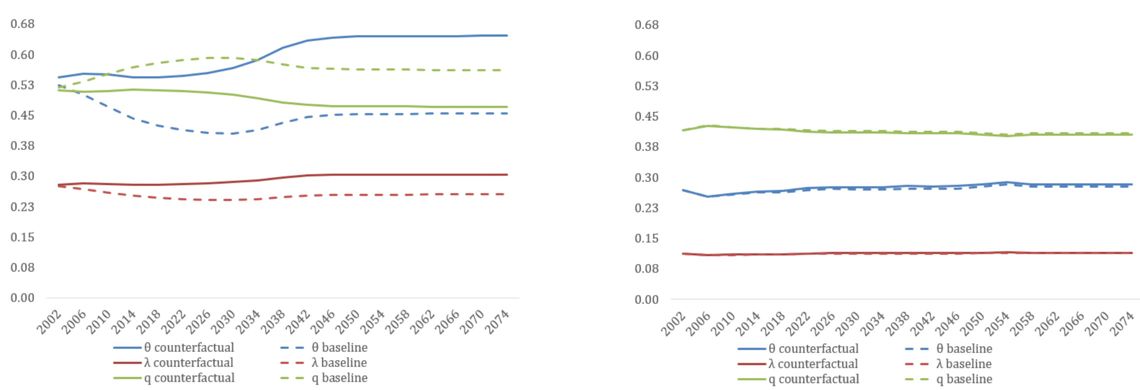


Figure 2.33: Stock of vacancies (as a share of the 1998 population): counterfactual of increasing entrepreneurs

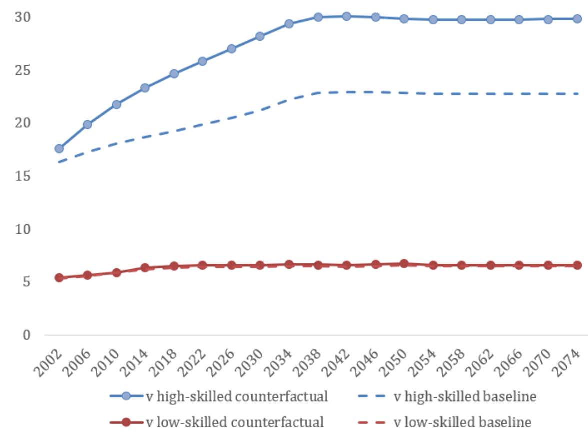
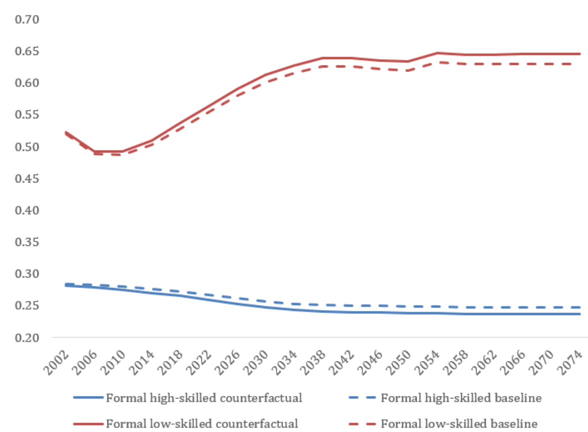


Figure 2.34: Intermediate goods' prices relative to that of the final good (which is taken as the numeraire): counterfactual of increasing entrepreneurs



2.5 Concluding remarks

Demographic shocks are frequent and often sizable. The waves of young workers entering the labor markets today are typically better educated, making the demographic shock a phenomenon that comes with a significant change in the skill composition of the workforce.

This paper examined the repercussions of Egypt's demographic boom on informal employment at a time when the public sector remained a major employer (albeit less than in the past) and a time when the private formal sector continued to be relatively constrained. This demographic boom manifested through a labor supply shock where notables waves of new workers that were also better educated arrived in the labor market in the late 1990s and well into the current millennium, consequently having long-lasting effects. The most striking of these effects is a large and permanent rise in the size of the workforce and the share of educated workers in non-formality. To examine the consequences of such a shock, we developed a dynamic model that accounts for a range of effects and mechanisms. This model incorporates workers in an overlapping generations structure, with two different skill groups. It features three economic sectors: an exogenous public sector, a private formal sector with search and matching frictions, and finally an informal one that operates in perfect competition and can absorb the rest of the workers. Workers can be in either of these three sectors. However, given the fact that Egypt has negligible unemployment allowances, we develop the model such that workers in the non-formal state effectively split their time between three activities: casual informal work, home production and the search for a formal public or private job. Consequently, people, in equilibrium, are not indifferent between the non-formal position and formal states. In fact, their access to formal jobs is rationed. This model has been carefully calibrated using various waves of labor force surveys in Egypt, the structure of the model and some information found in the literature.

The arrival of more and better-educated young workers has a mechanical and temporary effect, namely the shift in the composition of the workforce towards subgroups where the prevalence of non-formality is higher. A larger supply of (mainly educated) workers means that job vacancies are easier to fill. This generates a rise in the number of vacancies. However, as we do not assume the standard assumption of free-entry of vacancies, but rather an alternative endogenous mechanism going back to Diamond (1982), the dynamic adjustment of vacancies bears a degree of sluggishness that helps us better account for what we observe in Egypt.

In parallel, a second channel enters the scene, namely the change in the prices of the intermediate goods produced by firms. The compositional change in the skills of the workforce eventually leads to a decline in the prices of the intermediate good produced by skilled formal workers and a rise in the case of the less-educated ones. Other channels are at work through job-search effort and wages. Given the long-run path of adjustment that we assume for the size of the skill groups, we end up with long-run effects characterized by a bigger share of non-formal educated workers, and a lower share of non-formal less-educated workers.

The simulations conducted show several interesting features. For instance, without the demographic boom (both in size and skill composition), the non-formality rate of the high-skilled would have been less, both in the short- and long-run, and overall non-formality rate in the economy would have also been less. Moreover, allowing for higher vacancy creation by loosening the constraints faced by the entrepreneur (or increasing the number of potential entrepreneurs), would have also reduced the non-formality rate compared to what was observed in the data.

Several extensions are possible. For instance, we can allow for a sector-specific job arrival rate from the government sector. Some of the literature has pointed to a potentially easier transition to the government sector when the worker is engaged in the private formal sector, consequently being able to show his experience for example. Consequently, higher wages in the public sector could lead to higher wages in the private formal sector, with a negative impact on job creation in this sector. Other extensions include allowing for new entrants in our existing numerical analysis to occupy a government sector to better align with the data given our four-year age-group. Finally, a more detailed nested CES production function as opposed to our simpler four-input one, could further enrich the model. In this case, it could allow for different degrees of substitutability between formal and informal sectors as well as between skill levels.

2.6 Appendix

2.6.1 On the data and motivating facts

2.6.1.1 The population of Egypt

Figure 2.35: Total population

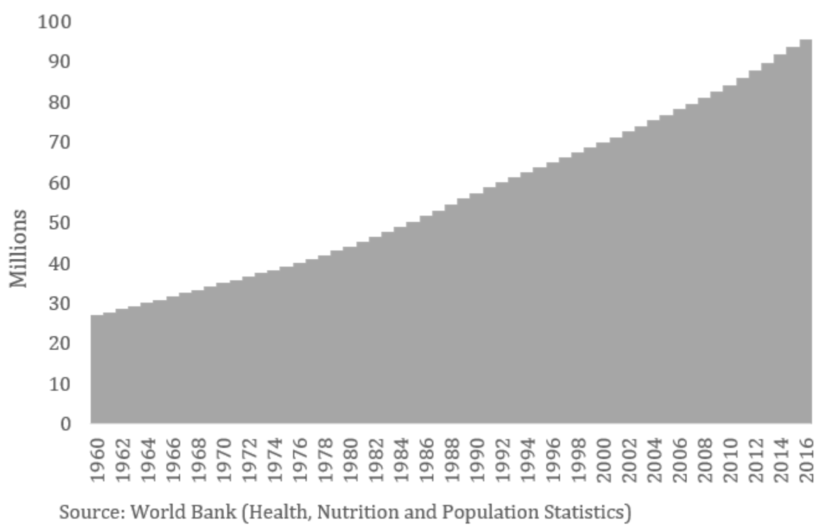
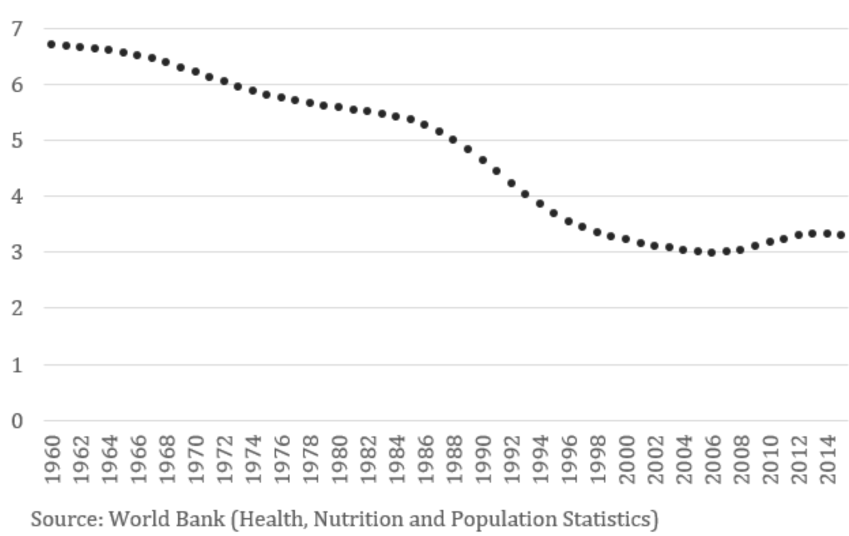


Figure 2.36: Total fertility rate (births per woman)



2.6.1.2 On the definition of informality

Informal employment is defined in this research as the lack of contribution to social insurance. There are a number of reasons why we choose this definition of informality over other definitions, particularly the lack of a work contract. Egyptian laws dictate that any formal work between an employer and an employee be regulated by a work contract and followed by registration for contributions to social security. Even the self-employed and employers, if their business is formally registered are required to contribute to social security.

Authors such as Tansel et al. (2015) and Tansel and Ozdemir (2015) have chosen a definition of informality of not having either a work contract and/or social contributions. Wahba (2009) analyses the Egyptian labor market assuming these definitions separately. For the case of Egypt, the choice of lack of social security is both practical and theoretical. From a practical perspective, we find that data on social insurance in the surveys are coherent and match to a very large extent the data on employment (a handfull of missing observation for those employed, in each of the survey rounds). The same cannot be said about the data on work contracts, because there are many missing observations, which some authors have interpreted as the lack of a contract all-together.

Moreover, Egyptian laws dictate that the existence of a work contract necessitates a social security contribution. We find in the data some individuals who have a contract but no social security, for instance, casting doubt on the veracity of this reporting. Consequently, this research sticks to the social security definition.

Finally one could argue that some of the employed individuals, particularly the less educated, could not know whether they contribute or not to social security, but they would know if they had signed a contract or not. Although this may be a valid reason for some, the social insurance measure is more comprehensive and trust-worthy.

2.6.1.3 Social insurance in Egypt

Egypt's social security system dates back to 1975 when the country introduced an all-encompassing system that includes both public and private sector workers. Public sector servants saw versions of social security protection (namely old-age pension) from 1963, while professors and imams in Al-Azhar University (for religious studies) enjoyed an earlier version of social protection dating back to 1954. While the first pension systems were fully-funded, they have become now a pay-as-you-go (PAYG) system.

The laws today cover four types of workers: (1) Law 79 of the year 1975 for waged workers, in both public and private sectors; (2) Law 108 of the year 1976 for employers and the self-employed; (3) Law 50 of the year 1978 for Egyptians working abroad and, finally; (4) Law 112 of the year 1980 for all other workers not included the previous laws. These laws cover not only old-age pensions, but also cases of handicap, pension for war survivors, sickness, maternity leave, work injuries and also unemployment.

Law 79 of 1975 stipulates contribution obligations, from both employer and employee sides, on both basic and variable wages, where variable wages include bonuses, incentives and other, as the table shows below:

Table 2.10: Social security contributions in Egypt

	Basic Wage	**Variable Wage**	**Total**
Employer contributions	26%	15%	41%
Employee contributions	14%	10%	24%
Total	40%	25%	

The wage is covered with a certain maximum bound for both kinds of wages. The maximum for the basic wage as of 2011 is 875 Egyptian pounds, and for the variable wage between 500 and 1050 Egyptian pounds. This means that the social security system in the country is regressive. There are some safeguards put in place for low-income workers, where a worker whose average wage is 70 Egyptian pounds, for instance, gets his maximum pension raised to 140.

The eligibility criteria for pension due to old-age, disability and survivors of war is 60 years or older provided 120 months (i.e. 10 years) of contributions, or 50 years and older provided 240 months (i.e. 20 years) of contributions. Finally, seeing that there are still other workers who may not be eligible for this social security system, the Sadat Pension Plan insures some coverage for them, and particularly for casual/irregular workers.

As for the social insurance covering the self-employed and employers, contributions are around 15% of monthly pay, and there is more flexibility on the maximum level of insured earnings. The eligibility criteria, however, is higher in age (65 years or older with 10 years of contributions). For more information on the system in general, refer to Selwaness (2012).

2.6.1.4 On the survey sample

The Egyptian Labor Market Survey (ELMS) of 1998 and its second and third rounds, the Egyptian Labor Market Panel Surveys (ELMPS) of 2006 and 2012, rely in its samples on the master samples of the Central Agency for Public Mobilization and Statistics (CAPMAS). This Master sample was originally prepared in 1995 and updated with the Census. Households are selected based on an urban/rural stratification, as well as a more detailed sub-stratification of governorates. To create the sample of the survey, 200 primary sampling units were selected from the master sample, representing 22 governorates that include both urban and rural areas. The sampling weights take into account over-representation of some strata such as urban areas (for further further information, refer to Assaad and Krafft (2013a)).

The 1998 pilot round interviewed an initial group of 23,997 individuals in 4,816 households[41]. The second and third rounds interviewed three types of individuals: (1) those residing in households that appeared in the previous survey round(s); (2) those residing in the so-called "split" households, meaning the sons, daughters and others who split to create their own households, and finally; (3) those interviewed from a "refresher" sample of households. With this survey design, the number of households and individuals have consequently increased over time - Table 2.11.

Table 2.11: Household numbers by survey round

	1998	2006	2012
New Sample	4,816	2,498	2,000
Previous Sample		3,685	6,752
Split Sample		2,168	3,308
Total Households	4,816	8,351	12,060
Total Individuals	23,997	37,140	49,186

Source: Assaad and Krafft (2013a)
These household details are difficult to replicate through the dataset itself, particularly when it comes to split households. The data presented here are taken from the field itself and not the public dataset.

As for attrition, several remarks must be made. Firstly, the original number of households that were interviewed in 1998 was 5,000 households. Due to the loss of identification data at CAPMAS, the data for 4,816 household were recovered, following some matching process and re-interviews. This initial attrition is argued to be random, Barsoum (2007) and Assaad and Roushdy (2009). Attrition in 2006 and 2012, however, were not random, as is the case in

[41]In fact, this first survey initially targeted 5,000 households. It aimed at assessing the changes in the labor market since the Labor Force Sample Survey (LFSS) of 1988 and its design replicated the latter. However, due to identification code losses, only 4,816 households were recovered in the data set.

most longitudinal surveys and is mainly due to not being able to locate and interview some individuals, with other reasons as well such as dying or emigrating (either internationally or to areas that are not outside the reach of the enumerators). This problem was corrected using attrition factors and sample weights for all years in order to insure the representativeness of the panel. Refer to Assaad and Krafft (2013a) for a more detailed explanation.

2.6.1.5 The effects of the 2011 Revolution in the data

The surveys ask individuals if their employment status (as well as other related questions) at the time of the interview in 2012 is different from the one they had before the revolution. Only 139 individuals answered yes to this question, and a significant proportion of them remained employed, but have quit their previous jobs voluntarily. This data suggests that the full-fledged economic repercussions on employment of the revolution were not completely materialized at the time of the survey round of 2012. Still, the analysis shown below excludes those who changed status - which still does not change the results.

2.6.1.6 Unemployment benefits in Egypt and the unemployed

Unemployment benefits in Egypt are stringent. They practically apply to persons who have been laid off due to liquidation/bankruptcy of the formal firm or clear downsizing. The unemployed must have been contributing to unemployment insurance (0.5% of gross salary on the part of the employee and 2% on the part of the employer) for 12 months, continuous or intermittent, prior to becoming unemployed, with the extra condition that the last three months are continuous (Law no. 135 of 2010, section 4)[42]. Nothing in the law indicates the duration of these benefits. The unemployment fund managed by the Ministry of Social Solidarity (moss.gov.eg) and is said to be have been accumulating significant surpluses over the past few years.

Since the procedures of liquidation and consequent layoffs are extremely bureaucratic and discouraged, the number of people who become eligible is very small.

[42]There is a dearth of information on unemployment benefits in Egypt in general, and it is ignored in most analyses. The most accurate information can be found on the Egyptian information website rawateb.org in Arabic.

2.6.1.7 Participation and unemployment rates

Egyptian men's labor force participation has actually increased throughout the survey rounds, from 75% in 1998 to 81% in 2012. As expected, those who are 20-29 years old, when education decisions are still at play, have lower participation rates than others. Those who have an education level of elementary and middle school have also lower participation rates mainly because they are still at school and have not completed higher levels (most of them are less than 19 years old by each survey round).

Table 2.12: Cross-sectional participation and unemployment rates for men (15-64 years old)

	Participation rate			**Unemployment rate**		
	1998	2006	2012	1998	2006	2012
By broad education level						
None	90	91	90	2	0.5	1
Elementary & middle school	54	61	62	3	1	2
General & vocational high school	71	72	81	12	7	4
Post-secondary, university & above	91	91	92	7	9	7
Overall	75	78	81	6	4	4
By age group						
20-29	71	80	82	13	10	8
30-39	99	97	99	2	2	2
40-49	97	98	98	1	1	1
50-59	90	91	91	1	1	1

Source: ELMPS Panel (1998-2012)
Note: on the education categories: (1) These categories are observed for persons aged 10+ years old at the time of the survey; (2) The category of "None" under education levels includes those who are illiterate and those who are literate but have no formal degree (fewer in general); (3) Post-secondary encompass institutions that offer post-secondary diplomas that still do not rise to a Bachelor's degree or more; (4) There are a few missing values for education for those employed, but they do not exceed 10 observations for each survey year.
Note: Survey weights are applied.

2.6.1.8 Employment status

The data gives us four categories of employment status: (1) waged-worker, the focus of this article; (2) employer; (3) self-employment and; (4) Unpaid family worker. We show them in the Table below.

Table 2.13: Cross-sectional participation rates for men (15-64 years old)

	1998	**2006**	**2012**
Waged-worker	73	67	73
Employer	11	16	12
Self-employed	9	9	10
Unpaid family worker	7	8	5

Source: ELMPS 1998-2012.
Note: Survey weights are applied.

2.6.2 Simple static model under pure competition

Assuming w^g to be the highest wage, everybody desires to work in this sector. To have a meaningful insight from this simple framework, we need to assume a rationing of labor by the public sector, G. Formally, there are $G^s < P^s$ positions available that are allocated randomly to this large number P^s of workers. So, during our unique period, there is an implicit timing that can be expressed as the following:

1. Everybody endowed with skill s supplies labor to the government sector.
2. With probability $\frac{G^s}{P^s}$ a worker is occupied in this sector and with probability $1 - \frac{G^s}{P^s}$ the same worker joins the supply of labor to the private sector.
3. Given the net wages, workers not employed by the government supply labor in one of two private sectors.

2.6.2.1 Labor demand

The aggregate firm maximizes (real) profits with respect to intermediate inputs levels, which are sector- and skill-specific, at given input prices:

$$Y - p^{i,l}Y^{i,l} - p^{i,h}Y^{i,h} - p^{f,l}Y^{f,l} - p^{f,h}Y^{f,h} \tag{2.46}$$

Consequently, bearing in mind the definition (2.1) of the CES production function and (2.2), the first-order conditions with respect to each intermediate input leads to Equations (2.3).

The supply of intermediate inputs depends on the demand for labor in each sector. At given intermediate good prices, $p^{i,s}$ and $p^{f,s}$, because of constant returns in production, each intermediate good producer is ready to supply any quantity of the good (or zero) and hence to recruit any amount of labor (or zero), depending on the following conditions:

- In the informal sector, at a given wage $w^{i,s}$, the supply of the intermediate good is unlimited (and so is the demand for the corresponding demand for labor), if $p^{i,s}y^{i,s} \geq w^{i,s}$. The supply is zero otherwise.

- In the formal sector, assuming a payroll tax rate τ that is not skill or wage specific, we have an unlimited supply if $p^{f,s}y^{f,s} \geq (1+\tau)w^{f,s}$. The supply is zero otherwise.

Free entry of firms imply that the above inequalities are in equilibrium equalities.

2.6.2.2 Labor supply: Arbitrage condition

For each $s \in \{l, h\}$, three cases are possible depending on the wage levels:

a. If $w^{i,s} > w^{f,s}$ nobody supplies labor to the formal sector: $F^s = 0, N^s = P^s - G^s$.

b. If $w^{i,s} < w^{f,s}$ nobody supplies labor to the informal sector: $F^s = P^s - G^s, N^s = 0$.

c. If $w^{i,s} = w^{f,s}$, everybody is indifferent between working in the informal or the formal sector.

However, Cases a and b can be ruled out since, in the aggregate production process, the marginal product tends to $+\infty$ when the input level tends to zero. So, only Case c needs to be discussed. Given (2.2) and (2.4), it can easily be checked that in equilibrium $w^{i,s} = w^{f,s}$ can be rewritten as

$$\alpha^{i,s}(y^{i,s})^{\rho}(N^s)^{\rho-1} = \frac{\alpha^{f,s}}{1+\tau}(y^{f,s})^{\rho}[P^s - G^s - N^s]^{\rho-1} \quad s \in \{l, h\}, \tag{2.47}$$

which leads to (2.6).

2.6.3 On the numerical Analysis

2.6.3.1 Smoothing the data

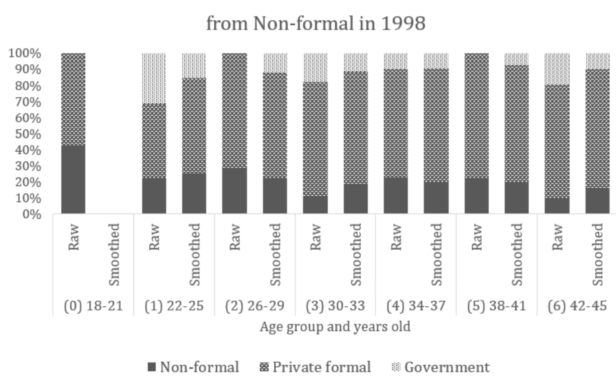
We use a simple technique to smooth the data, using the panel weights. We smooth the aggregate transition flows through a weighted average. For example, the smoothed transition flow from non-formal to private formal for age group 2 is the weighted average of the observed transition flow for age group 2, the transition flow from age 1 and age 3, such that age 2 is weighed by 0.5, whereas ages 1 and 3 are weighted by 0.25. The results hardly change if we use different weights, such as $\frac{1}{3}$ for each.

Figures 2.37 and 2.38, for low- and high-skilled respectively, show the share of workers in government, private formal and non-formal states in 2006 by their origin state in 1998, both smoothed and unsmoothed aggregate data. Since we assume that workers enter the labor market as non-formal, we do not smooth the transitions of age 0 in 1998 when the origin state is government or private formal.

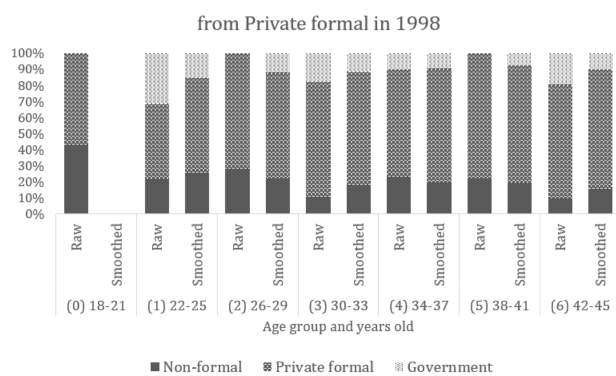
This smoothing appears to affect the low-skilled more than the high-skilled. This is because the transition flows tend to be more erratic from one age-group to the other other, and more so when looking at transitions from government to other sectors, and particularly to non-formality. Still, the smoothed profiles are not starkly different from the raw aggregates. Note also that the results of the calibration hardly change when using other smoothing weights.

Figure 2.37: Share of low-skilled workers in various states in 2006

(a)



(b)



(c)

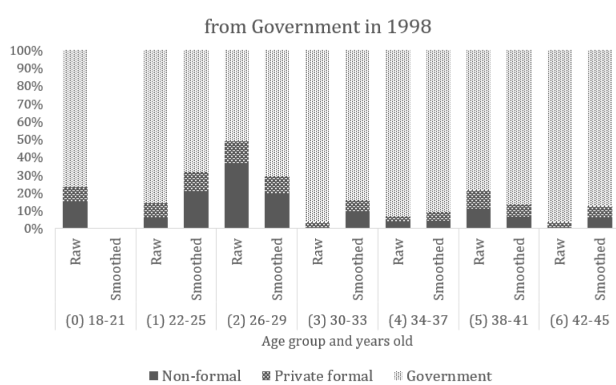
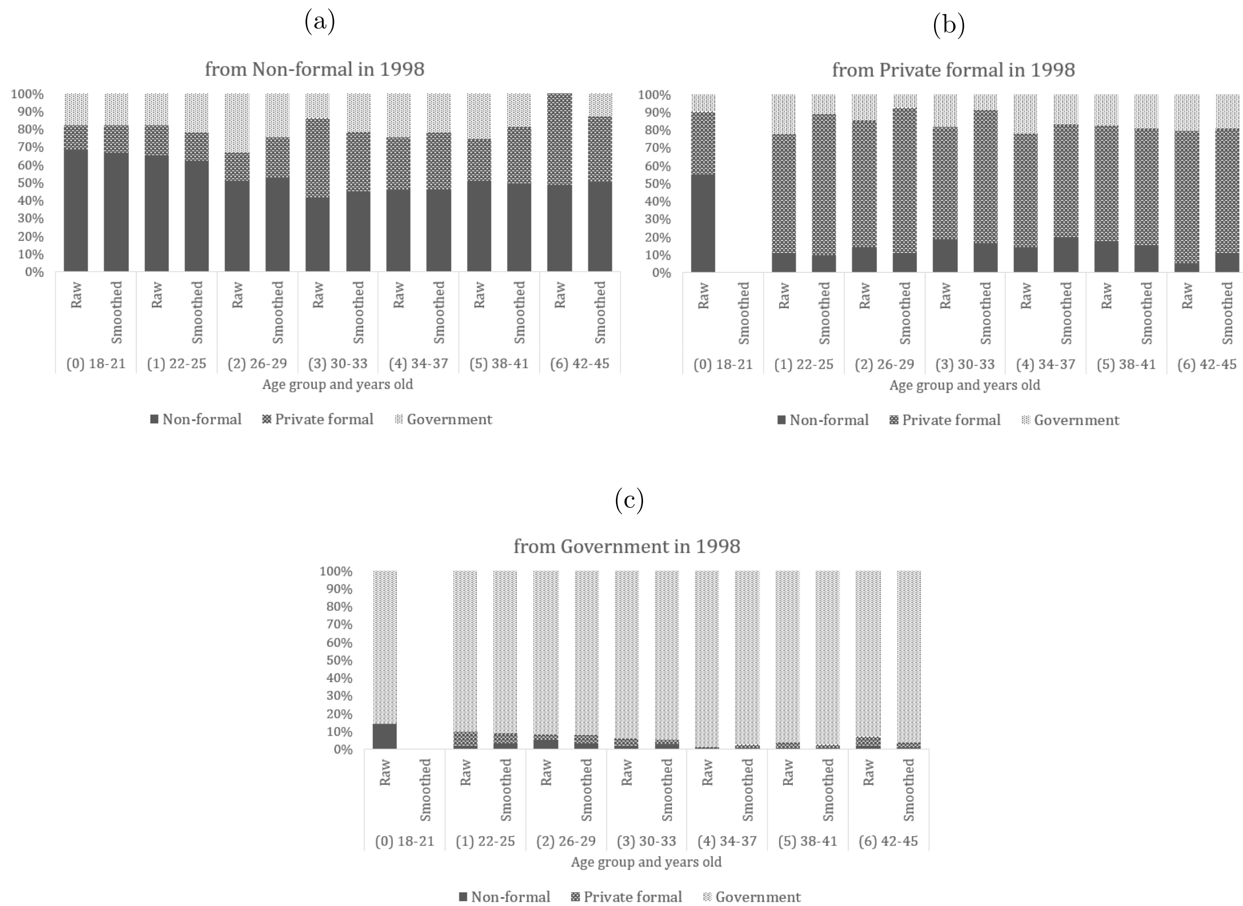


Figure 2.38: Share of high-skilled workers in various states in 2006



2.6.3.2 On introducing the demographic boom

In this section, e explain how we can capture the new labor market entrants that would allow the model to better predict the high- and low-skilled populations. Since the model is solved through linearization around the steady state, we further need to calibrate steady state populations. We do so by exploiting the results on new entrants

To allow entry in older age groups, we assume that in each period a number, $N_{00,t}$, of individuals aged 18 to 29 enter the labor market (i.e. age groups 0, 1 and 2). A share ζ_0 of $N_{00,t}$ enter in age group 0, a share ζ_1 enter age group 1 and the remaining share $1 - \zeta_0 - \zeta_1$, enter at age group 2. In line with the theoretical model, we assume that all of these new entrants first appear in non-formal state. The laws of motion for workers in age group 0 to

2 are consequently modified to the following:

$$\begin{aligned}
N_{0,t} &= \zeta_0 N_{00,t} \\
P_{0,t} &= N_{0,t} \\
N_{1,t} &= x_0 \left(1 - \lambda_{g,0}(1-\delta_{g,0}) - (1-\lambda_{g,0})e_{0,t-1}\lambda_{t-1}(1-\delta_0)\right) N_{0,t-1} + \zeta_1 N_{00,t} \\
P_{1,t} &= x_0 N_{0,t-1} + \zeta_1 N_{00,t} \\
N_{2,t} &= x_1 \Bigg(\left(1 - \lambda_1^g(1-\delta_1^g) - (1-\lambda_1^g)e_{1,t-1}\lambda_{t-1}(1-\delta_1)\right) N_{1,t-1} + (\lambda_1^g \delta_1^g + (1-\lambda_1^g)\delta_1) F_{1,t-1} \\
&\quad + \delta_1^g G_{1,t-1} \Bigg) + (1-\zeta_0-\zeta_1) N_{00,t} \\
P_{2,t} &= x_1 P_{1,t-1} + (1-\zeta_0-\zeta_1) N_{00,t}
\end{aligned}$$

We apply this extension to high-skill workers and we assume that low skill new entrants enter only in age group 0 and 1. The low skill laws of motion can be obtained from the above equations by setting $\zeta_1 = 1 - \zeta_0$.

In order to calibrate the number of new entrants $N_{00,t}$ and the share parameters ζ_0 and ζ_1, we exploit the fact that given the survival probabilities x_a, the population stocks at date t for all age groups can always be expressed in terms of current and past new entrants and the share parameters as the following:

$$P_{0,t} = \zeta_0 N_{00,t} \tag{2.48}$$

$$P_{1,t} = x_0 \zeta_0 N_{00,t-1} + \zeta_1 N_{00,t} \tag{2.49}$$

$$P_{2,t} = x_1 x_0 \zeta_0 N_{00,t-2} + x_1 \zeta_1 N_{00,t-1} + (1-\zeta_0-\zeta_1) N_{00,t} \tag{2.50}$$

and for older age groups ($a > 2$), it holds that,

$$P_{a,t} = \prod_{i=3}^{a} x_{i-1} \left(x_1 x_0 \zeta_0 N_{00,t-a} + x_1 \zeta_1 N_{00,t+1-a} + (1-\zeta_0-\zeta_1) N_{00,t+2-a} \right) \tag{2.51}$$

Using data on population stocks, we exploit the above relation to calibrate the number of new entrants $N_{00,t}$, for low- and high-skilled and for the periods 1998, 2002, 2006, 2010 and 2014.[43] This means a set of 10 values. The second set pertains to the share parameters, ζ, which are not time specific but are a total of 3 (two for the high-skilled and 1 for the

[43] Note that by the end of 2014, the generation of the demographic boom, meaning the one born in the 1980s as shown in Section 2.2 is between 24 and 34 years old and has arguably mostly entered the labor market.

low-skilled as explained above).

Finally, since the model is solved through a linearization around the steady-state, as mentioned before, we exploit the survival probabilities, the share parameters and the new entrants to calibrate steady state population. Total population can be expressed in terms of new entrants as:

$$
\begin{aligned}
P_t &= P_{0,t} + P_{1,t} + P_{2,t} + P_{3,t} + P_{4,t} + P_{5,t} + P_{6,t} + P_{7,t} + P_{8,t} \\
&= \underbrace{\zeta_0 N_{00,t}}_{P_{0,t}} + \underbrace{x_0\zeta_0 N_{00,t-1} + \zeta_1 N_{00,t}}_{P_{1,t}} + \underbrace{x_1 x_0 \zeta_0 N_{00,t-2} + x_1\zeta_1 N_{00,t-1} + (1-\zeta_0-\zeta_1)N_{00,t}}_{P_{2,t}} \\
&+ \underbrace{x_2 x_1 x_0 \zeta_0 N_{00,t-3} + x_2 x_1 \zeta_1 N_{00,t-2} + x_2(1-\zeta_0-\zeta_1)N_{00,t-1}}_{P_{3,t}} \dots \\
&+ \underbrace{x_3 x_2 x_1 x_0 \zeta_0 N_{00,t-4} + x_3 x_2 x_1 \zeta_1 N_{00,t-3} + x_3 x_2(1-\zeta_0-\zeta_1)N_{00,t-2}}_{P_{4,t}} + \dots \\
P_t &= N_{00,t} + \zeta_0 \sum_{i=0}^{7}\prod_{j=0}^{i} x_j N_{00,t-1-i} + \zeta_1 \sum_{i=1}^{7}\prod_{j=1}^{i} x_j N_{00,t-i} + (1-\zeta_0-\zeta_1)\sum_{i=2}^{7}\prod_{j=2}^{i} x_j N_{00,t+1-i}
\end{aligned}
$$

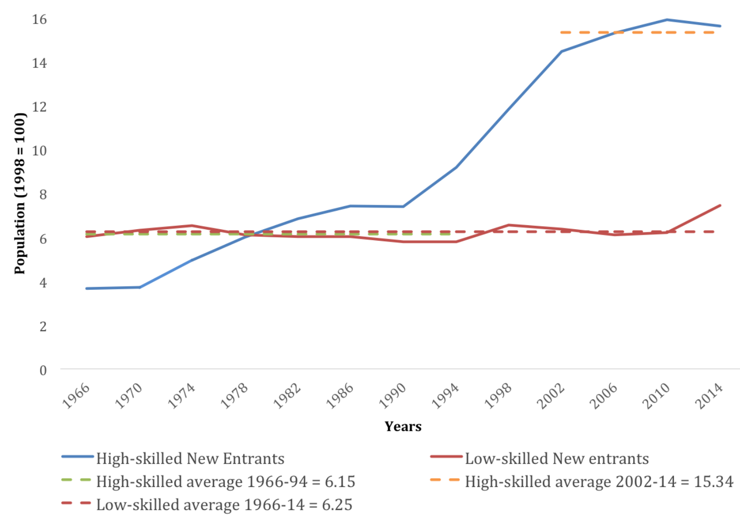
In steady state, $N_{00,t} = N_{00,t-1} = N_{00,t-2} = ..$ which leads to:

$$
\begin{aligned}
P_{ss} &= \left(1 + \zeta_0 \sum_{i=0}^{7}\prod_{j=0}^{i} x_j + \zeta_1 \sum_{i=1}^{7}\prod_{j=1}^{i} x_j + (1-\zeta_0-\zeta_1)\sum_{i=2}^{7}\prod_{j=2}^{i} x_j\right) N_{00,ss} \\
N_{00,ss} &= \frac{P_{ss}}{1 + \zeta_0 \sum_{i=0}^{7}\prod_{j=0}^{i} x_j + \zeta_1 \sum_{i=1}^{7}\prod_{j=1}^{i} x_j + (1-\zeta_0-\zeta_1)\sum_{i=2}^{7}\prod_{j=2}^{i} x_j}
\end{aligned}
$$

This expression shows that given only x and ζ, the share of new entrants among total high skill population $\frac{N_{00,ss}}{P_{ss}}$ can be computed in steady state without calibrating P_{ss} or $N_{00,ss}$. We start by retrieving values for new entrants from 1966 to 1994 by using the 1998 population stocks for age groups 1 and older. Assuming constant survival probabilities and share parameters through time, new entrants for these periods can be computed using equations (2.49), (2.50) and (2.51). Figure 2.39 displays the series that are obtained for high and low skills. We see that the number of low skill new entrants is quite stable over the 1966-2014 period while there is an upward trend in high skill new entrants. These two observations imply that we can model the number of low skill new entrants as the sum of a constant term, μ, and a random noise, ε, as the following:

$$N^l_{00,t} = \mu^l + \varepsilon^l_t$$

Figure 2.39: New entrants over the period 1966-2014 for low- and high-skilled (hare of 1998 population*)



Source: ELMPS 1998-2012, Authors' calculations.
Note: * The 1998 population is normalized to 100.

The constant being the long term average (from 1966 to 2014) of new entrants, we interpret it as the steady state values for low skill new entrants.

However, the constant mean assumption does not hold for high skills. We therefore model these new entrants with a change in mean occurring in 1998:[44]

$$N_{00,t}^{h} = \mu_0^h + X_t \mu_1^h + \varepsilon_t^h$$

where $X_t = 0$ for $t < 1998$ and $X_t = 1$ after. The results of the steady-state number of new entrants, and the overall population can be seen in the Table (2.14) below.

Table 2.14: Calibrated steady-state values

Parameter	h	l
$\hat{N}_{00,ss}$	15.34	6.25
P_{ss}	119.87	47.39

Note: These population values are expressed as a share of the entire 1998 population.

[44]Given our model assumptions, we argue that while the population may have continued to grow, it is reasonable to assume that the population slow down began to appear in 2002, which is the year we use to calibrate the steady state shares.

2.6.3.3 Calibration parameters

Table 2.15: Parameter values used for the final calibration

Parameter	Definition	Value	Source
Literature			
β	time discount factor	$\frac{1}{(1.045)^4}$	World Bank
ρ	substitution parameter	0.3	Inspired by Glitz and Wissmann (2017)
γ^h, γ^l	bargaining power of worker	0.5	Langot and Yassine (2015)
τ	Payroll tax	0.25	KPMG website
τ^c	Corporate tax	0.22	PWC website
Data			
B^l	Low-skilled entrepreneurs (as a share of population)		ELMPS 2006
B^h	High-skilled entrepreneurs (as a share of population)		ELMPS 2006
h_0^l	Time spent in informal work	0.91	ELMPS 1998
h_1^l	Time spent in informal work	0.97	ELMPS 1998
h_2^l	Time spent in informal work	0.95	ELMPS 1998
h_3^l	Time spent in informal work	0.94	ELMPS 1998
h_4^l	Time spent in informal work	0.94	ELMPS 1998
h_5^l	Time spent in informal work	0.97	ELMPS 1998
h_6^l	Time spent in informal work	0.97	ELMPS 1998
h_7^l	Time spent in informal work	0.97	ELMPS 1998
h_8^l	Time spent in informal work	0.97	ELMPS 1998
h_0^h	Time spent in informal work	0.53	ELMPS 1998
h_1^h	Time spent in informal work	0.61	ELMPS 1998
h_2^h	Time spent in informal work	0.62	ELMPS 1998
h_3^h	Time spent in informal work	0.87	ELMPS 1998
h_4^h	Time spent in informal work	0.90	ELMPS 1998
h_5^h	Time spent in informal work	0.71	ELMPS 1998
h_6^h	Time spent in informal work	0.86	ELMPS 1998
h_7^h	Time spent in informal work	0.99	ELMPS 1998

Parameter values (continued)

Parameter	Definition	Value	Source
h^h_8	Time spent in informal work	0.99	ELMPS 1998
$w^{i,l}_0$	Median informal wage	566	ELMPS 2006
$w^{i,l}_1$	Median informal wage	668	ELMPS 2006
$w^{i,l}_2$	Median informal wage	741	ELMPS 2006
$w^{i,l}_3$	Median informal wage	785	ELMPS 2006
$w^{i,l}_4$	Median informal wage	799	ELMPS 2006
$w^{i,l}_5$	Median informal wage	784	ELMPS 2006
$w^{i,l}_6$	Median informal wage	740	ELMPS 2006
$w^{i,l}_7$	Median informal wage	667	ELMPS 2006
$w^{i,l}_8$	Median informal wage	656	ELMPS 2006
$w^{i,h}_0$	Median informal wage	554	ELMPS 2006
$w^{i,h}_1$	Median informal wage	647	ELMPS 2006
$w^{i,h}_2$	Median informal wage	725	ELMPS 2006
$w^{i,h}_3$	Median informal wage	788	ELMPS 2006
$w^{i,h}_4$	Median informal wage	836	ELMPS 2006
$w^{i,h}_5$	Median informal wage	869	ELMPS 2006
$w^{i,h}_6$	Median informal wage	887	ELMPS 2006
$w^{i,h}_7$	Median informal wage	890	ELMPS 2006
$w^{i,h}_8$	Median informal wage	878	ELMPS 2006
w^l_1	Median private formal wage	962	ELMPS 2006
w^l_2	Median private formal wage	974	ELMPS 2006
w^l_3	Median private formal wage	986	ELMPS 2006
w^l_4	Median private formal wage	999	ELMPS 2006
w^l_5	Median private formal wage	1012	ELMPS 2006
w^l_6	Median private formal wage	1027	ELMPS 2006
w^l_7	Median private formal wage	1041	ELMPS 2006
w^l_8	Median private formal wage	1057	ELMPS 2006
w^h_1	Median private formal wage	980	ELMPS 2006

Parameter values (continued)

Parameter	Definition	Value	Source
w_2^h	Median private formal wage	1051	ELMPS 2006
w_3^h	Median private formal wage	1144	ELMPS 2006
w_4^h	Median private formal wage	1259	ELMPS 2006
w_5^h	Median private formal wage	1396	ELMPS 2006
w_6^h	Median private formal wage	1555	ELMPS 2006
w_7^h	Median private formal wage	1736	ELMPS 2006
w_8^h	Median private formal wage	1938	ELMPS 2006
$w_1^{g,l}$	Median government wage	616	ELMPS 2006
$w_2^{g,l}$	Median government wage	600	ELMPS 2006
$w_3^{g,l}$	Median government wage	601	ELMPS 2006
$w_4^{g,l}$	Median government wage	617	ELMPS 2006
$w_5^{g,l}$	Median government wage	649	ELMPS 2006
$w_6^{g,l}$	Median government wage	697	ELMPS 2006
$w_7^{g,l}$	Median government wage	760	ELMPS 2006
$w_8^{g,l}$	Median government wage	840	ELMPS 2006
$w_1^{g,h}$	Median government wage	720	ELMPS 2006
$w_2^{g,h}$	Median government wage	721	ELMPS 2006
$w_3^{g,h}$	Median government wage	750	ELMPS 2006
$w_4^{g,h}$	Median government wage	808	ELMPS 2006
$w_5^{g,h}$	Median government wage	894	ELMPS 2006
$w_6^{g,h}$	Median government wage	1009	ELMPS 2006
$w_7^{g,h}$	Median government wage	1152	ELMPS 2006
$w_8^{g,h}$	Median government wage	1324	ELMPS 2006
Authors			
$\alpha^{f,l}$	shifter in CES production	0.15	
$\alpha^{f,h}$	shifter in CES production	0.45	
$\alpha^{i,l}$	shifter in CES production	0.23	
z_a^l	value of time in home production	10% of informal sector wage	

Parameter values (continued)

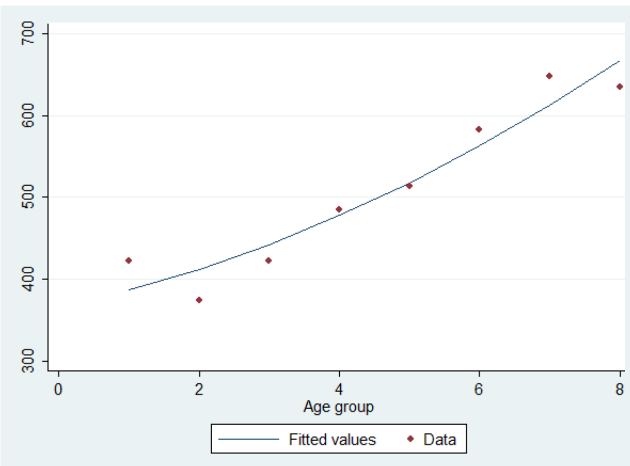
Parameter	Definition	Value	Source
c_a	cost of maximal search effort	50% of government wage	
$H(.)$	Distribution of entrepreneur's cost	uniform	
$H(.)$ minimum	lower bound of distribution	0	
$H(.)$ maximum	upper bound of distribution	7500 (low-skilled), 15000 (high-skilled)	
B^l	number of low-skilled entrepreneur	10	
B^h	number of high-skilled entrepreneur	20	

2.6.3.4 Fitted wages

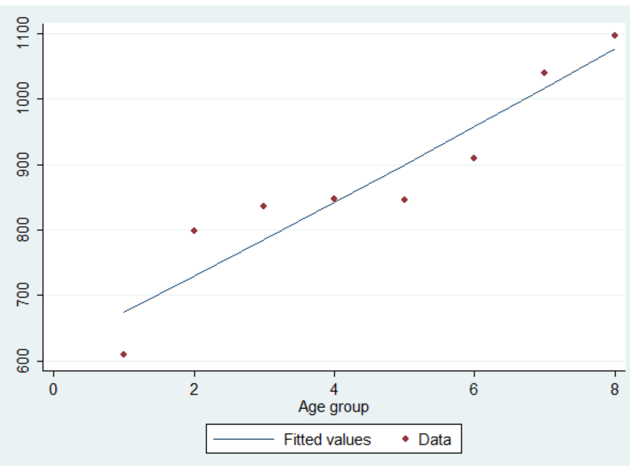
Figures 2.40 and 2.41 show the medians of low- and high-skilled workers in the three sectors of economic activity in 1998, with both data and fitted values. For the purposes of the calibration, we use the fitted values. Non-linearity is particularly evident for the wages of informal workers, and especially the low-skilled, whereas the wages of workers in the government and private formal sectors increase with age in a relatively linear manner. This trend is quite similar to what is seen in 2006 as well.

Figure 2.40: Smoothed median wages in 1998 for low-skilled workers in the government, private formal and informal sectors (monthly, real Egyptian pounds)

(a) Government



(b) Private formal



(c) Informal

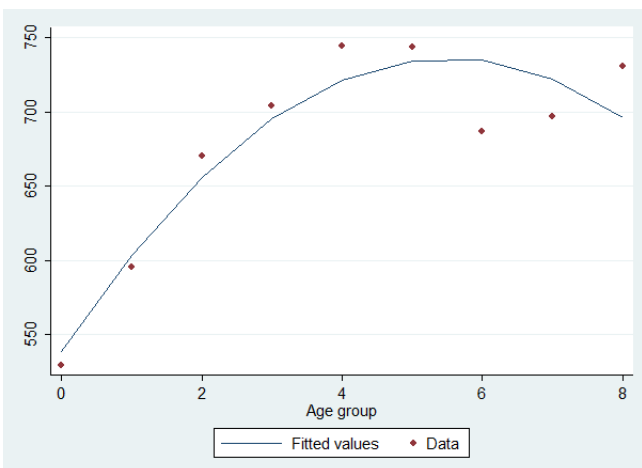
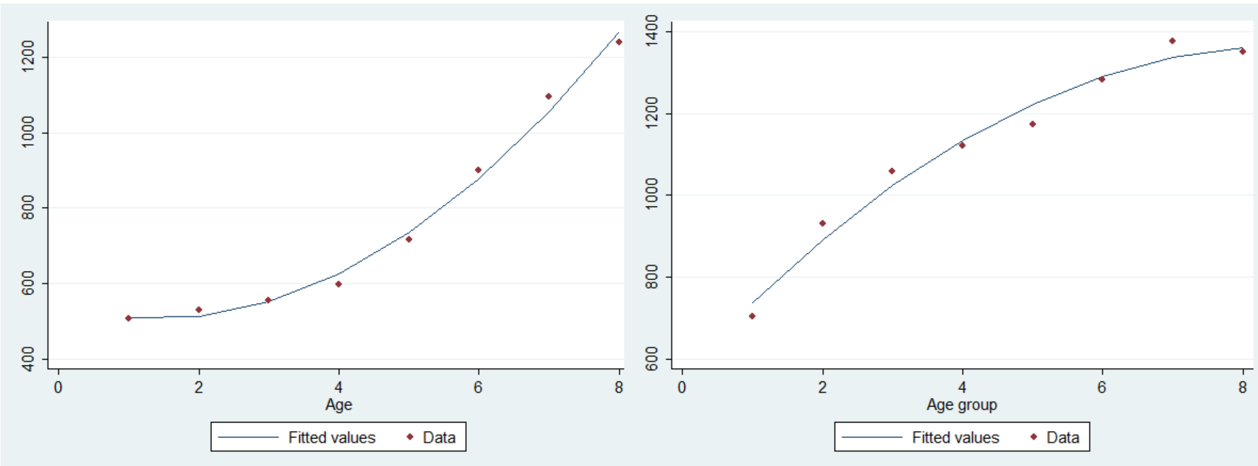


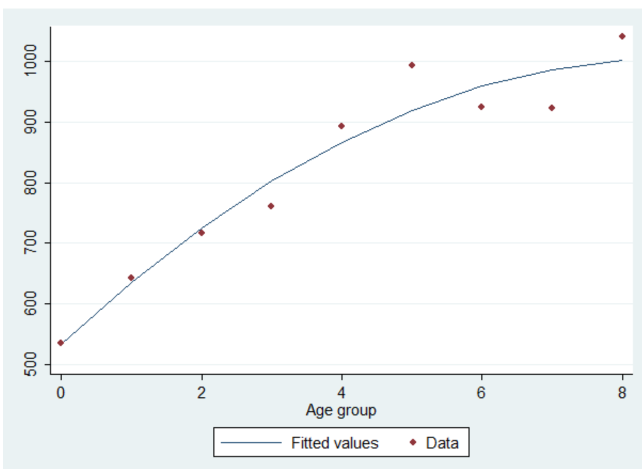
Figure 2.41: Smoothed median wages in 1998 for high-skilled workers in the government, private formal and informal sectors (monthly, real Egyptian pounds)

(a) Government

(b) Private formal



(c) Informal



Chapter 3

Exploring heterogeneity of micro and small enterprises in Morocco

Dalal Moosa

Abstract

This paper examines the heterogeneity of micro and small enterprises (MSEs) in Morocco, utilizing a nationally representative survey of more than 5,000 formal and informal enterprises. Based on a set of entrepreneur and enterprise characteristics, these Moroccan MSEs are grouped into three categories: top performers, potential gazelles and "others." The paper finds that top performers tend to do relatively well in all areas examined, which include business outcomes, access to finance, management of firm operations, network with other firms and access to infrastructure. Potential gazelles, on the other hand, appear to choose their sectors of economic activity differently and appear to face particular constraints when it comes to access to credit and the ability to link to other businesses. The paper also finds that while formal firms appear to exhibit significant heterogeneity, informal firms are less heterogeneous, showing a small upper echelon that can compete with formal firms and tend to do better than formal potential gazelles, while other informal firms are not starkly different from each other. Finally, the paper finds that almost all informal firms would theoretically increase their probability of being top performers should they have chosen to be formal, indicating a suboptimal informality choice. However, formal and informal potential gazelles are significantly different in almost all aspects.

3.1 Introduction

Micro and small enterprises (MSEs) constitute an important earning and living source for many workers and entrepreneurs around the world, and especially in low- and middle-income countries. In some Latin American countries like Brazil, Costa Rica and Chile, MSEs that employ less than 50 workers represent around 95% of enterprises in their respective countries. In India, Nepal and Pakistan, and in Cameroon, Ghana and Uganda, this share climbs to 99% of total enterprises, with a starkly similar picture for many countries in the Middle East and North African region (Gonzales et al. (2014)).

These enterprises and their entrepreneurs can play an important role in development. They can operate as coordinators of production and agents of innovation (Schumpeter (1950), Schumpeter (1961) and De Mel et al. (2009), for example). They can spot profitable business opportunities and facilitate adjustments to economic changes (Kirzner (1973)). They often take risks and bear the discovery of the cost function of production (Kanbur (1979), Hausmann and Rodrik (2003)). Consequently, they can significantly contribute to job creation and job destruction, as shown in the pioneering work by Mead and Liedholm (1998) for selected countries in Africa and Latin America. Even in more advanced economies, such as the U.S., small businesses, and younger ones are estimated to contribute the majority of net job creation (Neumark et al. (2011) and Haltiwanger et al. (2013)) - a conclusion also reached in a study of 99 countries by Ayyagari et al. (2011).

Still, not all entrepreneurs operate profitable businesses, nor do they always act as game-changers or risk-takers. Sometimes, they only serve as a means for survival, particularly for the poor in many less advanced economies (Schoar (2010)). Banerjee et al. (2011) estimated that close to half of the people living in extreme poverty in urban areas, and about a quarter of their counterparts in rural areas, tend to engage in nonagricultural business activities that earn very little. Gindling and Newhouse (2014) showed that only a tenth of entrepreneurs in the 74 countries they have examined tend to employ others and live in non-poor households.

This shows that there can be a significant dispersion of the type of MSEs that exists, and especially so in less advanced economies. This is not only in terms of productivity (Li and Rama (2015)), but also in terms of income and innovation (e.g. Maloney (2004), Bosch and Maloney (2007)) and De Soto et al. (1989)).

This dispersion means that development policy, particularly business development, must cater to the various types and needs of these enterprises and their entrepreneurs. Firstly, not all of MSEs face the same constraints. The challenges faced by more successful and more established enterprises differ from those of very small and younger ones. Secondly, not all of MSEs are created with the purpose of growth. For firms that aspire for growth, business development policies may be more appropriate, but those that are created to sustain a living, especially due to a lack of other opportunities, require more targeted social policies (Berner et al. (2012)).

The challenge, however, is how to distinguish between these various types of firms, and consequently the type of policy or program to provide. Between the "elephants", which are typically large enterprises, and the "mice," which are those that can barely survive, the literature has often searched for "gazelles" - i.e. those that may be small but have high growth potential and can quickly expand.[1]

This paper aims to characterize the heterogeneity of MSEs in Morocco, with a particular emphasis on examining the constraints of "potential gazelles." This characterization goes beyond identifying which is a possibly successful firm and which is not (i.e. the binary description), as was done in Gindling and Newhouse (2014), and instead produce a broader spectrum to better understand this heterogeneity.

To do so, the paper utilizes and expands upon the empirical method proposed by Grimm et al. (2012), whose work showed that "gazelles" in West Africa, more precisely what they called "constrained gazelles," differ from their more successful counterparts in aspects related to wealth, access to capital, access to utilities and location - later replicated for firms in the Democratic Republic of Congo by Adoho and Doumbia (2018).

MSEs in Morocco will be grouped intro three categories: (1) "top performers," which excel in a chosen criteria, (2) "potential gazelles," which have similar entrepreneur and enterprise characteristics to the first group but are not performing as well, and (3) "others," which differ in most if not all aspects and look more like survival-oriented firms. Note that I use the term "potential gazelles" as opposed to just "gazelles" so as to emphasize their potential, which they may or may not seize. The paper then compares these groups in a number of areas in order to identify their main characteristics and some of the constraints they face, especially among potential gazelles, which could consequently shed light on policy interventions. These comparisons are made along the following aspects: (1) the entrepreneur, (2) the enterprise, (3) access to finance, (4) management-related features, (5) business links (network) and, finally, (6) access to some infrastructure.

[1] MIT professor David Birch coined the term "gazelles" in the 1980s in his work on growth entrepreneurship in the US (Birch (1987))

The novelty of this paper is threefold. Firstly, it expands upon the method proposed by Grimm et al. (2012) by allowing for sector choice made by entrepreneurs. This selection into sectors is not only endogenous, but it arguably affects the extent of the enterprise's business performance. Secondly, this expanded method is applied not only to the overall sample of firms, but also to the formal and informal subsamples, where formal firms are defined as those with a tax registration number. Being able to distinguish formal and informal enterprises is a feature of this particular dataset that was not available to Grimm et al. (2012) nor to Adoho and Doumbia (2018). Thirdly, in exploiting this formal/informal feature, the empirical method is further expanded to also allow for the formality choice that is made by the firm (or the entrepreneur), which again is arguably both endogenous and potentially affects the extent of the firm's success.

To conduct this analysis, the paper uses a relatively unique survey that covered 5,210 micro and small enterprises in Morocco. The survey was first conducted in 2004. While it was followed by a similar survey a year later, the attrition due to several reasons make the follow-up data far less useful. The, analysis, therefore, relies on the enterprises captured in the year 2004 only. This stock sample has, undoubtedly, a number of limitations upon which I further elaborate in Section 3.2.1. Two main limitations are obvious. Firstly, the fact that the survey is conducted using existing firms at the time implies that short-lived firms could be underrepresented, while those that are longer-lived may be over-represented. Secondly, the fact that the sample utilized in this paper covers only one point in time, and not a panel, means the empirical specifications could suffer from omitted variable bias that would not be fully tackled by the empirical strategy proposed in this paper. These, however, are shortcomings that exist in many enterprise surveys around the world that do not trace firms across time. While a panel survey would help overcome some potential biases, the analysis of the firms that appear in a cross-sectional dataset can still be illuminating as will be shown in this paper.

When looking at all firms (both formal and informal), the results show that the group of top performers tend to do favorably on almost all aspects, when compared to potential gazelles and to "others." They have entrepreneurs that are better educated and older (and arguably have more experience). Their enterprises are also older, hire more workers, pay their workers wages that are on average higher, have higher revenues/sales, value-add and capital (both in aggregate and in per worker terms), and tend to work more hours during the week. A higher share of them has access to credit, especially from formal institutions. They tend to keep records of their business activities and a higher share of them provide their workers with written contracts, with paid vacations and with training. Moreover, more of them use modern equipment, and a higher share report being part of business associations, firm clusters and have links with other businesses. Finally, a notably higher proportion of them reports access to infrastructure like water, electricity, roads and a landline.

Potential gazelles, which make up about a fifth of the firms, while similar in a number of entrepreneur and enterprise characteristics, appear to choose their sectors differently, and appear to be constrained along the lines of access to credit (and the type of credit). Moreover, a smaller share of them appears to have links with other businesses (what this paper deems as “network”). These potential gazelles tend to be more concentrated in services, especially those that are related to business and social services and less so in manufacturing. They tend to pay their workers less wages on average, not only when compared to top performers but also to “others,” which may indicate a propensity to retain earnings for business growth. They also appear to struggle in two other areas: (1) management-related such as in keeping business records, using modern equipment and providing certain amenities to their workers, and (2) access to infrastructure. However, despite these constraints, they are still far less constrained than the group of “others” who appear to be significantly more female-led and at a higher disadvantage in almost all areas.

When utilizing the formal/informal aspect of the survey, the paper finds that many of the characteristics and possible constraints found in the overall sample are similar to those found among formal firms (which are the majority of MSEs in the survey). However, informal firms appear to have less heterogeneity. While a potential “upper-tier” exists among informal firms as seen in the share of top performers that are indeed informal, the rest of the informal firms are markedly similar to each other in various aspects. It is as if there is a small share of informal firms that do well and can compete with their formal counterparts, while the rest are at a significant disadvantage.

The results also show that while there are some informal firms among the group of top performers, they are still notably different from their formal counterparts, in entrepreneur characteristics, enterprise location, financial outcomes, access to credit and type of savings as well as access to infrastructure. Moreover, top-performing formal and informal firms choose their sectors differently. Where they appear to be similar is in areas related to network, such as having business links with other firms.

Finally, the results show that almost all informal firms would theoretically increase their predicted probability of being top performers should they choose to be formal, indicating that they may not be choosing informality optimally, or to their advantage. These results are robust to some modification of the top performance criteria.

The rest of the paper is structured as the following. Section (3.2) introduces the dataset and shows some descriptive statistics of these enterprises. Section (3.3) defines the empirical strategy to identify the groups of top performers, potential gazelles and "others." Section (3.4) shows the results of this group identification (3.4.1), the characteristic differences between the groups (3.4.2), the characteristic differences between the groups of formal firms, and those of informal firms separately (3.4.3) and the choice of formality/informality of the firms (3.4.4). Section (3.5) checks the robustness of these results by expanding the top performer group identification. Section (3.6) discusses some of the limitations of the research. Finally, Section (3.7) concludes.

3.2 Data and descriptives

3.2.1 The MSE Survey

Morocco's Micro and Small Enterprise (MSE) Survey was carried out in the early 2000s as part of a larger Mediterranean project that also covered Egypt, Turkey and Lebanon. The project, titled "Promoting Competitiveness in Micro and Small Enterprises in the MENA Region," was financed by the European Union and Canada's International Development Research Center. The surveys were effectively managed by the Economic Research Forum (ERF), a non-profit research organization based in Cairo, Egypt, with the collaboration of various country teams. All countries except for Lebanon had two rounds of the survey, a year apart, to follow the enterprise's performance.[2] For Morocco, the first round was conducted during May-October of 2002, and the follow-up survey, albeit with fewer enterprises, was conducted in October 2003. Only the first round is utilized in this work due to some attrition issues.

The final sample of enterprises of the first round consisted of 5,210 micro and small enterprises (less than 50 workers). It was based on a master sample that the country team had put together using three governmental datasets from the Moroccan Department of Statistics (DS): (1) a sample from the 2001-2002 Economic Census,[3] (2) a sample of industrial zones

[2]Lebanon was excluded from a second round due to political conflict at the time.

[3]The Census details and results were not yet complete by the time the country teams and the ERF embarked on these surveys.

that existed at the time, and, (3) a sample of firm clusters that existed at the time. The three samples put together allowed for a more comprehensive dataset on economic units in Morocco for the period of the survey, from which the final sample was selected. Enterprise data obtained from the combination of these three databases were later compared to the finalized Census results as well as to the National Survey of the Informal Sector for Households (ENSI) 1999-2000 for general verification.

From this constructed master sample, 11 out of 16 administrative regions[4] were selected and grouped into the following: 1) Greater Casablanca, 2) Rabat-Sala-Zemmour-Zaer, Gharb-Chrarda-Beni-Hsen and Tanger-Tetouan, 3) Marrakesh-Tansift-Al Houz, Meknes-Tafilalet, Fes-Boulemane and Taza-Al Hoceima-Taounate, 4) Oriental and, 5) Doukkala-Abda and Souss-Massa-Draa.

These administrative regions were home to about 87% of the population according to the 1994 and 2004 censuses, and were home to 89% of the total urban population of the country (refer to Table 3.14 in the Appendix).

The selected regions were divided into a number of primary sampling units (PSUs), from which 268 were randomly selected, consisting of 195 units from the Census data, 27 from the industrial zones and 46 units from the clusters. From these PSUs, a final stratified random sample of 5,210 enterprises was created. The strata were along the lines of gender, enterprise size (number of workers) and location. The authors of the explanatory note on the survey methodology and sampling mention an average non-response rate of 21%. Partial non-response rates to certain variables are relatively low at 0.5-1.2%. Probability weights were calculated to ensure national representation (Hamdouch et al. (2006)).

The survey asked 322 questions to each owner/manager of the enterprise (referred to henceforth as "entrepreneur"). The first type of questions involved details on the entrepreneur such as age, gender, education, marital status, previous labor force status, reason for being in this business and others. The second type of questions consisted of characteristics of the enterprise itself: date of establishment, registration status at start date and at the time of the interview, ownership structure, location, employees, and a set of questions pertaining to the firm's financials. The entrepreneur is asked not only to report the financial state of the business today, but also one year ago if the enterprise existed. In the last section of the questionnaire, the entrepreneur is also asked about future prospects for the firm.

Since this paper utilizes entrepreneur-reported financial outcomes, it is worth noting to what

[4] In 2015, these regions were reduced to 12.

extent we can take these responses for granted. While no accuracy test was conducted in Morocco specifically, de Mel et al. (2007) have conducted a number of experiments to test the accuracy of microenterprises reporting their financials in Sri Lanka during 2005 and 2006. They argued that while firms generally underestimate the value of their revenues and expenses (what they deem "recall error"), they generally do not do so for profits, indicating that these firms underestimate revenues and expenses relatively equally. Their experiment also showed that the use of books (diaries) did not have an effect on reported profits in general. However, they found that there is a difference with what might be deemed "true reporting" as firms deflate their profits during surveys.

For this survey in Morocco, it is difficult to ascertain from the data if there is a recall error, or whether there is deliberate underreporting. However, the results of this paper do not indicate out of the ordinary findings in terms of financials. It is also worthy of noting that the interviewers were careful to be consistent throughout the entire questionnaire. Repeated questions, for instance, calculated in different ways, were relatively consistent.

Last but not least, it is important to mention the limitations of the cross-sectional aspect of the survey that is used in this paper. The fact that the data is made up of a stock sample of enterprises, rather than flows, can have several implications.

Firstly, it under-represents short-lived firms. Firms may exit due to lower productivity, more significant constraints in access to capital, to networks or even more severe competition (or the lack of it in the case of powerful competitors). If this is the case, the range of productivity observed in the data may be truncated towards the more productive, and the extent of the constraints could be underestimated. The data is more likely to have older firms, which the case of this data set as will be shown in the following section.

Secondly, cross-sectional surveys are unable to eliminate the impact of unobservables on the results - for instance time-invariant entrepreneur and enterprise effects that may affect the firm's business outcomes. Such omitted variable bias would exist if these unobservables are correlated with both explanatory variables and the outcome of interest. A panel survey is better suited to reduce such bias. Moreover, a panel survey, if it captures firms from the very beginning of their creation, can also follow their growth and even exit, consequently also relieving some of the issues that relate to the sequence of outcome and causality. This cross-sectional data is unable to clearly identify this.

Nevertheless, panel enterprise surveys are rare. Despite the shortcoming and potential biases of cross-sectional surveys, they can still illuminate a number of important facts about enterprises in Morocco, especially in the absence of other alternatives.

3.2.2 Descriptive statistics

Tables (3.1) and (3.2) display some descriptive statistics about the entrepreneur and the enterprise, respectively, taking into account the whole sample.

Table (3.1) shows that the entrepreneurs of micro and small enterprises in Morocco in the survey are aged on average 37.6 years old and are predominantly male (80% of them). The majority are married or have been married, with an average of 2 children.[5] The data also shows that average years of educational attainment, i.e. completed years of education, is a little less than 6 years (which is primary education), and that 39% of entrepreneurs do not have any education at all, with only 5% having a university degree.[6] More than half of the entrepreneurs have also had an apprenticeship in an area related to their current business activities,[7] and a little over a tenth had some form of technical training, which is a track within secondary that focuses on vocational education.

When asked about their labor force participation prior to creating/joining the enterprise in the sample, more than 60% of entrepreneurs mentioned being employed in other enterprises, about 13% were unemployed and nearly 16% were students. A little over a quarter of the female entrepreneurs in the sample were housewives before their current employment (5% of all entrepreneurs). Finally, when asked about the reason for launching/managing this enterprise,[8] the reasons vary. A quarter of entrepreneurs mention having previous experience handling a business. More than 13% mentioned having the appropriate qualifications to run a business and a tenth mentioned the current business being a family enterprise. About 11.5% mentioned having a desire to set up a business as their primary motivation.

Table (3.2) shows some descriptive statistics of the enterprises themselves. Firms in the sample have an average age of about a decade. They tend to operate in wholesale and retail trade (44% of the firms in the sample), with about a quarter in manufacturing and close to a fifth in business, social and other services. As for regional distribution, the data shows that

[5] At the time, total fertility rate per woman in Morocco was 2.7 children (World Bank World Development Indicators database.)

[6] Note that I have constructed the education level from years of education. Morocco's primary school extends for 6 years, intermediate/middle school extends for 3 years, secondary school 3 years, and Bachelor's degree about 3 years and above.

[7] The share of apprenticeship is higher among those with primary education only.

[8] Answer options were given to the entrepreneur to choose from, not an open-ended question.

Table 3.1: Descriptive statistics of the entrepreneur

Variable		Variable	
Entrepreneur's age (years)	37.55	Reason for entrepreneurship	
	(0.20)	Suits qualification	14%
		Experience in business	25%
Share of male	80%	Reasonable capital requirements	4%
		Family business	10%
Years of educational attainment	5.83	Desire to set up new business	12%
	(0.08)	Improve living standards	15%
Education Level		Only option available	16%
No education	39%	Other	4%
Primary school	9%		100%
Intermediate school	34%		
Secondary school	13%	Previous labor force participation	
University & above	5%	Employed	63%
	100%	Unemployed	13%
		OLF - Student	16%
Had an apprenticeship	58%	OLF - housewife	6%
Had technical training	13%	OLF - no desire to work	1%
		OLF - disabled	0.4%
Ever married	63%	OLF - military service	1%
Number of children	1.94		100%
	(.032)		

Note: "OLF" stands for out of the labor force. Standard errors for averages are in parentheses.
Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

close to a fifth of firms operate in Casablanca and a seventh in the Rabat-Sale-Zemmour-Zaer area - both of them heavily urban. Finally, the data also shows that these firms are still small, with an average of 2.3 workers per firm.[9]

[9] Note also that that majority of the firms in the sample operate from a separate location outside of their homes, the majority of which being rented shops. The firms in the survey also tend to be sole proprietorships as opposed to limited liability firms (where even among formal firms, they only constitute a tenth

Table 3.2: Descriptive statistics of the enterprise

Variable		Variable	
Age	9.46	In urban area	54%
	(0.16)		
Sector of economic activity		Revenues (monthly, dirham)	19,506
Manufacturing	24%		(983)
Wholesale & retail trade	44%	Revenues per worker (monthly, dirham)	6,907
Food & accommodation	7%		(185)
Business, social and other services	19%	Value add (monthly, dirham)	7,952
Construction, repair and other	5%		(438)
	100%	Value add per worker (monthly, dirham)	2,644
			(79)
Region		Capital value (dirham)	134,708
Sous Massa Draa	7%		(8816)
Gharb Chrarda Ben Hssen	6%	Capital per worker (dirham)	40,579
Marrakech Tensift Al Haouz	7%		(1267)
Oriental	8%	Number of workers	2.28
Grand Casablanca	19%		(.035)
Rabat Salé Zemmour Zaer	14%		
Doukkala Abda	8%		
Meknes Tafilalet	10%		
Fes Boulmene	7%		
Taza Al Hoceima Taounate	5%		
Tanger Tetouan	8%		
	100%		

Note: "OLF" stands for out of the labor force. Standard errors for averages are in parentheses.
Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

3.3 Empirical strategy

To examine heterogeneity in micro and small enterprises, and to be able to identify potential gazelles in Morocco, I replicate the method introduced by Grimm et al. (2012) that analyzed a set of informal firms in some West African countries and later applied to some Congolese data in Adoho and Doumbia (2018). Enterprises in the entire sample are disaggregated into three groups: (1) *top performers*, which have highest business outcomes given a specified criteria; (2) *potential gazelles*, which have similar predetermined characteristics to top performers but do not perform as well, and; (3) *others*, which are those that are characteristically different from top performers and potential gazelles and have different business outcomes.

3.3.1 Defining top performers

Top performers are identified using a double criteria. The first criterion is the top 25% with the highest number of workers, including the entrepreneur. From this group, I choose the top 50% of firms with the highest value-added per worker - the second criterion. This consequently identifies top performers as the top 13% of the sample, with a dummy variable that takes the value of 1 if the firm has satisfied these two criteria and zero otherwise.[10] In Section (3.5), the share of firms identified as top performers is expanded to 20% as a robustness check, for which the findings are largely similar.

This double-criteria of identifying a top performer is different from the double-criteria chosen in Grimm et al. (2012) and Adoho and Doumbia (2018). These two papers define the group of top performers by first selecting the top 25% of firms with the highest value of capital, from which they select the top 40% with the highest value-added per unit of capital (or what they call "capital profitability"). This paper deviates away from the focus on capital. While capital is important for the growth of the firm and overall economic growth of the country, capital needs tend to differ by industry. Focusing on capital immediately biases towards less capital-intensive, but still potentially successful, economic activities.

In this paper, the double-criteria allows for both size and productivity elements, both of which are arguably better proxies for success. Firstly, the literature has often identified

[10] There two reasons why the final share of top-performing firms ends up being 13% as opposed to a "clean" 10%. First, since the number of workers is not a continuous but rather a discrete variable, it becomes difficult to partition into quintiles or deciles properly. Second, this is compounded by the fact that about 75% of firms (using survey weights) have at most 2 workers. This means that choosing the top 50% of the firms with highest number of workers, for example, always yields 25% as opposed to 50%.

MSE success and growth in terms of the ability to create employment for other workers (Mead and Liedholm (1998) and much of the World Bank work on MSMEs as in Aga et al. (2015) and Bank (2011)). Moreover, the role of MSEs that research has often recognized in terms of development includes its contribution to net job creation. For this reason, the number of workers is chosen as the first criterion.

Secondly, the criterion of value-added per worker, which is a proxy for firm productivity, albeit a simple one, recognizes the importance of productivity in the long-run survival and success of the firm. Bartelsman and Doms (2000), for example, showed that the probability of a manufacturing plant exiting the market is inversely related to productivity and size. This second criterion also emphasizes that not all "larger" firms are equally productive, nor are larger firms necessarily more productive than their smaller counterparts.

The combination of two criteria is an acknowledgment that there is more than merely one definition of a more successful firm, or in this case a "top-performing" one. Selecting one criterion, such as the number of workers alone, would arguably bias the analysis towards sectors that hire more workers - in this case the construction sector, food and accommodation, and manufacturing, which are not necessarily more productive. Similarly, selecting a financial outcome criterion, such as value-added per worker, may ignore the ability of the firm to employ other workers, which the literature emphasizes is important for development.

Admittedly, interacting the two criteria has its implications, particularly the choice of which criterion comes first. Choosing top value-added per worker then the top firms in terms of the number of workers is also a viable option.

Recognizing these various potential definitions of top performance, I show in Sections 3.4.1.2 and 3.4.2.2, in addition to the results of the benchmark double-criteria mentioned above, three other alternative criteria:

1. Top value-added per worker: a single criterion of highest value-added per worker, making up the top 10% of firms in the sample.

2. Top number of workers: a single criterion of highest number of workers, with 3 or more workers, making up the top 26% of firms in the sample[11].

3. Inverse double-criteria: a double-criteria that takes the inverse of the benchmark definition, this time choosing highest number of workers among the highest value-added

[11] I exclude the potential criterion of 2 workers because they represent more than 60% of the sample. More details on this can be found in Section 3.8 in the Appendix.

per worker , making up the top 15% of firms in the sample.

3.3.2 Identifying potential gazelles and "others"

In order to identify potential gazelles, which are those that have similar characteristics to top performers, a probit model is used following the approach in Grimm et al. (2012).[12] The probability of being a top performer is estimated through the following:

$$Pr(Y^{top} = 1|X) = \Phi(\beta_0 + X'\beta_1 + \beta_2 Z) \tag{3.1}$$

where Y^{top} is a dummy variable that takes the value of 1 if the firm is a top performer and 0 otherwise, X is a vector of regressors that are determined at or prior to the creation/management of the firm, Z is a categorical variable that indicates the firm's sector of economic activity (out of five) and is instrumented through Equation (3.2) as will be further explained below. β_1 and β_2 are the coefficients of these variables. Finally, Φ represents the transformation function that maps the regressors into $[0, 1]$, assumed to be a cumulative density function of the standard normal distribution. In line with probit model specifications, the error term of the equation that characterizes the latent variable of Equation (3.1) is assumed to be normally distributed and homoskedastic.[13]

The set of regressors, X is selected so as to avoid potential endogeneity issues. They are variables that are arguably "predetermined" before the success of the firm, which include the entrepreneur's demographic characteristics, experience prior to joining/managing the firm and some enterprise characteristics. More precisely, these regressors are: (1) the entrepreneur's age (and age-squared), (2) the entrepreneur's sex, (3) his/her years of education attained, (4) the region where the firm is located,[14] (5) the source of initial capital used to start the business as mentioned in Table (3.2); (6) the type of labor force participation of the entrepreneur prior to launching/managing the business (such as being employed, unemployed and out of the labor force for whatever reason, as shown in Table (3.1)), (7) having had an apprenticeship in a related sector and, finally, (8) "entrepreneurial motivation".[15]

[12] A linear probability model is not considered for the simple reason that the expectation of the dependent variable conditional on the set of regressors may lie outside of the boundary $[0, 1]$.

[13] The latent variable can be expressed as $y_i^* = \beta_0 + x_i'\beta_1 + \beta_2 z_i + \epsilon_i$, where i is the observation and $E(\epsilon_i) = 0$.

[14] About 71% of entrepreneurs operate in the same governorates (and consequently regions) where they are born.

[15] The entrepreneur's age is a discrete variable that takes values from 12 to 91 years old. The entrepreneur's sex is a binary variable that takes the value 1 if male, 2 if female. The entrepreneur's years of education

Entrepreneurial motivation is a dummy variable that takes the value of 1 if the entrepreneur answered the question regarding the reason for launching/managing this business as: (1) have previous experience in running businesses, or (2) enterprise is a family business, or (3) a desire to set up a new enterprise. It is zero otherwise, which include answers such as: the only option available, and to improve living standards. Entrepreneurial motivation is argued to be significant in enterprise growth and success (for instance, Delmar and Wiklund (2008)).

Entrepreneurs may select into specific sectors of economic activity, and some sectors tend to have a larger number of worker than others (such as construction), which is one of the criteria used to identify top performers. Recognizing that this indicates that sector selection could increase or decrease the probability of being a top performer rates, I instrument the sector, or economic activity, through a multinomial probit model as the following:

$$Pr(Z = h|X^{act}) = \Phi(\beta_0^{act} + X^{act\prime}\beta_1^{act}) \tag{3.2}$$

where Z is a categorical variable that has 5 distinct values, one for each of the five sectors of economic activity, such that $h = 1, 2, ...5$. These sectors are: (1) Manufacturing; (2) Wholesale and retail trade; (3) Food and accommodation; (4) Business, social and cultural services; (5) Construction, repair and other sectors.[16] β_0^{act} and β_1^{act} stand for the coefficients. X^{act} is a vector of regressors that include, similar to Equation (3.1): (1) entrepreneur's age (and age-squared); (2) entrepreneur's sex; (3) his/her years of education; (4) the region where the firm resides and finally; (5) its urban/rural location. In line with probit model specifications, the error term of the equation that characterizes the latent variable of Equation (3.2) is assumed to be normally distributed and homoskedastic.[17]

The exclusion restriction in this specification is the location of the firm in urban or rural areas. Arguably, the location of the entrepreneur in either of these two areas can sway

attained is a discrete variable that ranges from 0 to 24 years. The region where the firm is located is a categorical variable that consists of the 11 regions mentioned in Section (3.2.1). The source of initial capital is a categorical variable made up of 8 categories: inheritance, own savings, liquidation of assets, formal loan, informal loan, own remittances, others' remittances and other. The type of labor force participation is a categorical variable that consists of 7 categories: employed, unemployed, out of the labor force (full-time student), out of the labor force (housewife), out of the labor force (did not desire to work), out of the labor force (disabled) and out of the labor force (military service). Having had an apprenticeship is a binary variable that takes the value of 1 if the entrepreneur had an apprenticeship in a related field and 0 otherwise.

[16] Note that I have constructed these groupings of sectors based on more detailed economic activities. These broad sectors allows me to include a certain number of observations within each, in addition to be aligned with the general groupings of the System of National Accounts.

[17] The latent variable of the sector of economic activity equation can be expressed as $z_j^* = \beta_0^{act} + x_j^{act\prime}\beta_1^{act} + e_j$, where j is the observation and $E(e_j) = 0$.

the entrepreneur's choice of engaging in some sectors over others. The data shows that among enterprises that are engaged in "business, social and cultural services", more than 68% operate in rural areas, followed by construction, repair and other services. At the same time, simple probit models with different variables show that the urban/rural location is persistently insignificant in predicting top performers, especially when controlling for the region. Section 3.6 discusses some of the implications if this exclusion restriction is violated. However, in the absence of more and better data, it is difficult to replace with other variables.

Note that there is no overidentification issue, seeing that the variable of "activity" is a categorical variable with five categories. On the contrary, the specification suffers from underidentification. This means that explaining sector choice also relies on the non-linear function of the specification. Given the conditional mixed process of the paper's empirical strategy, it is difficult to test for both over- and underidentification (Roodman (2011)). However, underidentification tests can still be inaccurate, leading to a rejection of an instrument that is weak but not insignificant.

Instrumenting for the sector of economic activity in this way allows for a correlation between the error terms of the latent variables of Equations (3.1) and (3.2). This means that there may be some unobservables that affect the probability of firms in one sector to be top performers more than firms in other sectors.

A conditional mixed process that takes into account Equations (3.1) and (3.2) then allows for the prediction of the probability of being a top performer for every individual observation, including top performers, as the following:

$$\hat{Pr}(Y^{top} = 1|X) = \Phi(\hat{\beta}_0 + X'\hat{\beta}_1 + \hat{\beta}_2 Z) \tag{3.3}$$

where the "hat" signifies the estimated parameters.

To identify the groups of potential gazelles and "others," the following steps are taken. Firstly, using Equation (3.3) that provides the predicted probability of being a top performer for every individual observation, I calculate the average predicted probability of the group of top performers. These top performers have been defined and identified in Subsection 3.3.1, based on the double-criteria of number of workers and top value-added per worker. Secondly, excluding the group of top performers, I sort the predicted probabilities of all other observations (i.e. those with $Y^{top} = 0$) from highest to the lowest. Thirdly, from these sorted observations of non-top performers, I calculate a rolling average of predicted probabilities. This means that as we move from one observation to the next, an average probability of the preceding observations is calculated. Once this rolling average equals the average predicted probability of being a top performer, the group of potential gazelles is identified. They are, therefore, the MSEs whose average predicted probability of being a top performer, as a group, equals that of the group of top performers themselves. An example is illustrated for further clarity in Section 3.8 of the Appendix.

This process means, as Grimm et al. (2012) explain, that on average the group of potential gazelles have similar predetermined characteristics as those of top performers. The group of "others", on the other hand, are defined as the remaining observations, whose average predicted probability is different. At this point of the analysis, all three groups are identified.

However, it is worthy of noting that this process may not always hold. For example, if the empirical model predicts top performance very well such that the average predicted probability of top performance is very high, the process could yield no potential gazelles at all - meaning that it is possible not to find a group that has the same average predicted probability as these top performers. This is especially the case if the group of top performers are significantly different than all other observations (a case that I encounter in one of the alternative definitions of top performance as will be mentioned in Section 3.8 in the Appendix). In another polar case, if the empirical model poorly predicts top performance, such that their average predicted probability is very low, the process can yield all potential gazelles and no "others."

I then compare, descriptively, the three groups of firms based on average firm characteristics (those that are predetermined and others) that relate to: (1) entrepreneur basic characteristics; (2) enterprise characteristics such as sector of economic activity, location and business outcomes; (3) finance-related aspects such as access to credit and where this credit comes from; (4) management-related aspects such as keeping records, hiring family, providing workers with written contracts and others; (5) network-related aspects such as being a member in business associations, firm clusters and linking with other businesses, and finally; (6) access to infrastructure such as electricity, water and roads. These comparisons give a descriptive picture of the differences between top performers, potential gazelles and others and point to areas where firms may struggle, especially potential gazelles.

3.3.3 Exploiting the formality and informality of firms

Following this exercise, I then exploit the existence of formal and informal firms in the survey, an aspect that was not available in the 1-2-3 survey data utilized by Grimm et al. (2012) and Adoho and Doumbia (2018). Defining formal firms as those that have a tax identification number, I run four regressions simultaneously that are inspired by the empirical strategy mentioned above. The first regression replicates Equation (3.1) but restricted only to formal firms; the second regression replicates it for informal firms only; the third regression replicates Equation (3.2) to instrument for the formal/informal firm's choice of economic activity, and finally the fourth regression accounts for the choice to be formal or informal (i.e. the switching model). These equations can be expressed as the following:

$$Pr(Y^{top^f} = 1|X) = \Phi(\beta_0^f + X'\beta_1^f + \beta_2^f Z) \tag{3.4}$$

$$Pr(Y^{top^i} = 1|X) = \Phi(\beta_0^i + X'\beta_1^i + \beta_2^i Z) \tag{3.5}$$

$$Pr(Z = h|X^{act}) = \Psi(\beta_0^{act_{fi}} + X^{act'}\beta_1^{act_{fi}}) \tag{3.6}$$

$$Pr(Y^f = 1|X) = \Phi(\beta_0^{fi} + W'\beta_1^{fi} + \beta_2^{fi} Z) \tag{3.7}$$

where Y^{top^f} is a binary variable that takes the value of 1 if the firm is formal and is a top performer (as previously-defined), and zero if it is formal but not a top-performer; Y^{top^i} is a binary variable that takes the value of 1 if the firm is informal and a top performer, and zero if it is informal but not a top-performer; and Y^f is a binary variable that takes the value of 1 if the firm (regardless whether it is a top performer or not) is formal and zero if it is informal. Z, as in the initial set of equations is a categorical variable that indicates the firm's sector of economic activity.

The set of regressors, X and X^{act}, remain the same as the original model for the overall set of firms. W, on the other hand, is a set of regressors that can arguably determine the choice of formality and are determined at the beginning of the firm's existence. Many of them are common to X and X^{act}, namely: the entrepreneur's age, age-squared, sex, years of education, entrepreneurial motivation, source of initial capital and prior labor force participation, and the firm's location in an urban/rural area. However, W also includes variables that can arguably also relate to the choice of formality, namely having a commercial registration (CR) and having a license at the beginning of establishing the firm.[18]

[18]The survey, in fact, asks the entrepreneur whether a CR and/or a license was granted at the beginning of the firm, and whether it has one now. For the purposes of the regression, I use the question that asks

These last two regressors come from the idea that firms that obtain a commercial registration to begin or continue their existing operations, or the ones that have a license from the relevant government agencies, are more likely to also have a tax registration number as part of the entire process of registration. Given their commercial registration and license, they are more likely to be under the supervision of the authorities, consequently more likely to abide by tax requirements - starting with a simple ID at least. In fact, the correlation coefficient between having a tax identification number at the time of the survey and having a commercial registration is 0.52, and with having a license is 0.71.

At the same time, it can be argued that having a commercial registration or a license has a weaker relationship with being a top performer, especially informal ones. In fact, the correlation coefficient between having a commercial registration and being a formal top performer is only 0.29, and a meager -0.05 with informal top performer. The correlation between having a license and being a formal top performer is 0.24, and with being an informal top performer is -0.032.

Running these regressions in this manner also allows, as in the original model, for the error terms of the latent variables of the equations to be correlated.[19] This means that there may be some unobservables that could affect the firm's choice of formality/informality, their sector choice and whether or not they get to be top performers.

Based on these equations, I then predict the probability of being a top performer for all firms (i.e., formal and informal) using first Equation (3.4), which can be expressed as the following:

$$\hat{Pr}(Y^{top^f} = 1|X) = \Phi(\hat{\beta^f}_0 + X'\hat{\beta^f}_1 + Z'\hat{\beta^f}_2) \tag{3.8}$$

Isolating the firms that are formal only, I can categorize the formal firms subsample into formal top performers (already identified), formal potential gazelles, which have on average the same predicted probability as formal top performers, and formal "others" from the rest.[20]

Similarly, using Equation (3.5), I predict the probability of being a top performer for all

about the state of the firm at its very beginning.

[19]For instance, the latent variable for Equation (3.4) can be expressed as: $y_j^{top,f*} = \beta_0^f + x_i\beta_1^f + \beta_2^f z_j + e_j^f$ for observation j; the same can be expressed for Equation (3.5) by replacing f with i for informal. Equation (3.2) can be expressed, as previously, as the following: $z_j^{f,i*} = \beta_0^{act_{f,i}} + x_j^{act'_{f,i}}\beta_1^{act_{f,i}} + e_j^{act_{f,i}}$. Finally the latent variable for Equation (3.7) can be expressed as the following: $y_j^{f,i*} = \beta_0^{f,i} + W_j'\beta_1^{f,i} + \beta_2^{f,i}Z_j + e_j^{f,i}$

[20]Here, I order the predicted probabilities from highest to lowest of formal firms only.

firms, which can be expressed as the following:

$$\hat{Pr}(Y^{top^i} = 1|X) = \Phi(\hat{\beta^i}_0 + X'\hat{\beta^i}_1 + Z'\hat{\beta^i}_2) \tag{3.9}$$

Isolating the firms that are informal only, I can categorize the groups of informal firms into top performers (already identified), informal potential gazelles, which have on average the same predicted probability as informal top performers, and informal "others" from the rest of the observations.[21]

I then run a similar descriptive exercise comparing the characteristics of the groups of top performers, potential gazelles and others within each formal/informal subsample to explore heterogeneity between firms when they are formal or when they are informal.

However, since the predicted probabilities are estimated for all observations in each of the two equations, I can isolate the group of informal potential gazelles that have the same average predicted probability as formal top performers, using Equation (3.8), and the group of formal potential gazelles that have the same average predicted probability as the group of informal top performers using Equation (3.9). This allows me, more precisely, to compare some descriptive aspects of potential gazelles that are formal to those that are informal using either of the two equations. It also allows me to see if formal/informal firms have chosen their status "optimally", i.e. their predicted probability of being top performers is higher in their chosen status than in the counterfactual other.

3.4 Results

This section presents and examines the results of identifying the three groups, as shown in Section 3.4.1, as well as comparing them descriptively on the set of variables and factors of interest, as shown in Section 3.4.2. Section 3.4.3 shows and examines the results that exploit the formal/informal aspect of the survey.

For the first two sections, I present first the results of the benchmark double criteria, and then dedicate a more concise section to look at those same results when using the three other alternative criteria mentioned in Section 3.3.1.

[21] Here, I order the predicted probabilities from highest to lowest of informal firms only.

3.4.1 Identification of groups

3.4.1.1 The benchmark double-criteria

The results for Equation (3.1) while instrumenting for the sector of economic activity seen in Equation (3.2), are shown in Table (3.3). The majority of the regressors are significant. Ceteris paribus, the probability of being a top performer increases with age, with educational attainment and apprenticeship, with entrepreneurial motivation and with being a male.[22] This is similar to the findings of Grimm et al. (2012) and Adoho and Doumbia (2018).

The results also show that operating in the "food and accommodation" sector, as well as in the "business, social and other services" sector, increases this probability (compared to the reference sector of manufacturing). The results also show that beginning the business with capital that comes from personal savings, from informal loans or from remittances sent by others decreases the probability of being a top performer - whereas starting a business using formal loans increases this probability (compared to the reference group of inheritance). The source of initial capital can be indicative of the financial wellbeing of the entrepreneur at the start of the enterprise, his/her household and essentially the institutional framework that may support the business endeavor through financing.

The results also show that being unemployed prior to this entrepreneurial activity significantly decreases the probability of being a top performer compared to being previously employed. Being out of the labor force due to a lack of desire to work, on the other hand, increases the probability of being a top performer compared to being previously employed. This may be somewhat explained by looking at the reasons behind embarking on the entrepreneurial activity. Close to half of those that were previously unemployed cited "lack of other options" or "a desire to improve living standards" as reasons for being entrepreneurs. This may place them from the beginning at a disadvantage. On the other hand, a significant share of those that had no desire to work cited "family business" and "reasonable capital requirements" as reasons for embarking on the business, potentially implying that those that were out of the labor market joined the business after spotting an opportunity (Refer to Table (3.23) in the Appendix).

The results show some regional differences too. Only Casablanca, which had the largest share of the population at the time, has a positive and significant effect on being a top

[22] In fact, as the later analysis will show, lower performance is significantly associated with female-led enterprises.

performer when compared to Souss Massa Draa.[23] Many other regions have negative and significant effects.

Finally, the correlation coefficient ρ_{15} shows that there may be unobservable characteristics that increase the probability of firms in “business, social and other services” to become top performers compared to manufacturing (refer to Table 3.24 in the Appendix for the sector regressions). While this is the only sector that appears to have a significant correlation coefficient, this result emphasizes the importance of instrumenting for the sector of economic activity in the equation, as opposed to a simple probit model. The standard probit model that includes economic activity as an exogenous variable, the results of which are in Table 3.25 of the Appendix, shows that the coefficients and their significance are relatively similar for most variables except for the sector of economic activity. With the simple probit model, the coefficient of business, social and other services becomes insignificant although the same sign, while the coefficient of wholesale and retail trade becomes significant. Not instrumenting for the sector, therefore, affects the coefficient and significance of the sectors in the case where there is a correlation between the error terms of Equations (3.1) and (3.2).

[23] Souss-Massa-Draa was the second most populated region at the time after Casablanca, with 3.1 million people in 2004. Although it was not a heavily urban region (only 40% of the population lived in urban areas), it was known for its agriculture, food processing and tourism. Its capital, Agadir, is a major tourism destination.

Table 3.3: Probability of being a top performer (Benchmark double-criteria)

Variable	Coefficient		Standard error	Marginal effect
Entrepeneur age (years)	0.037	***	(0.12)	0.007
Entrepreneur Age squared	-0.000	*	(0.000)	-0.000
Female	(Ref.)			
Male	0.318	***	(0.113)	0.056
Education attainment (years)	0.054	***	(0.008)	0.010
Had apprenticeship	0.157	***	(0.057)	0.028
Entrepreneurial motivation	0.197	***	(0.052)	0.035
Economic activity				
Manufacturing	Ref.			
Wholesale & retail trade	-0.038		(0.215)	-0.007
Food & accommodation	1.005	*	(0.596)	0.178
Business, social and other services	0.680	***	(0.256)	0.120
Construction, repair and other	0.108		(0.405)	0.019
Initial capital				
Inheritance	Ref.			
Own savings	-0.249	***	(0.080)	-0.044
Liquidation of assets	0.061		(0.102)	0.011
Formal loan	0.233	*	(0.139)	0.041
Informal loan	-0.307	***	(0.106)	-0.055
Own remittances	0.058		(0.176)	0.010
Others' remittances	-0.557	***	(0.193)	-0.098
Other	-0.661	***	(0.122)	-0.117
Previous labor force participation				
Employed	Ref.			
Unemployed	-0.334	***	(0.087)	-0.059
OLF - student	-0.048		(0.076)	-0.008

Probability of being a top performer (continued)

Variable	Coefficient		Standard error	Marginal effect
OLF - housewife	-0.252		(0.187)	-0.045
OLF - no desire to work	0.446	*	(0.269)	0.079
OLF - disabled	0.230		(0.338)	0.041
OLF - military services	-0.345		(0.329)	-0.061
Regions				
Sous Massa Draa	Ref.			
Gharb Chrarda Ben Hssen	-0.549	***	(0.195)	-0.097
Marrakech Tensift Al Haouz	-0.138		(0.117)	-0.025
Oriental	-0.445	***	(0.166)	-0.079
Grand Casablanca	0.405	***	(0.104)	0.072
Rabat Salé Zemmour Zaer	-0.033		(0.101)	-0.006
Doukkala Abda	-0.618	***	(0.162)	-0.110
Meknes Tafilalet	-0.472	***	(0.154)	-0.084
Fes Boulmène	-0.343	**	(0.140)	-0.061
Taza Al Hoceima Taounate	-0.105		(0.138)	-0.019
Tanger Tetouan	-0.186	*	(0.124)	-0.033
Constant	-2.874	***	(0.312)	
Manufacturing (Ref., 2)				
ρ_{13}	-0.225		(0.159)	
ρ_{14}	-0.342		(0.342)	
ρ_{15}	-0.499	**	(0.170)	
ρ_{16}	-0.116		(0.251)	
Number of observations	5,039			

Note (1): The are the results to Equations (3.1) and (3.2).
Note (2): "OLF" stands for out of the labor force. Number 1 in ρ_1x stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

Using Equation (3.3) and the method explained in Section 3.3, Table 3.4 shows that top performers make up about 13% of firms, potential gazelles about 27% of firms and "others," which are the majority of firms, make up 60%. The Table also shows that while the sweeping majority of firms among top performers are formal, in the sense that they have a tax identification number, 6% of them that are informal. Although this share is not large, it is indicative of the fact that some informal firms can still be a top performer, even using the relatively stringent benchmark criteria. The share of informality increases among firms that perform less well - as expected. About 44% of "others" are informal.

Figure (3.1) shows the kernel density of the predicted probability of being a top performer of each of the three categories. There are some areas where the probabilities of the three groups overlap, but the figure shows that even among top performers, there is a number of firms that have low predicted probabilities of being top performers. While this speaks, perhaps, to the limited predictive power of the probit model,[24] it is worthy of noting that the probit model does not attempt to be comprehensive. What makes a firm successful undoubtedly stretches beyond these regressors and can be related to other aspects such as management, network, macroeconomic circumstances, household situation and others - all of which are difficult to include as exogenous in the empirical model. The role of this empirical model, however, is to be able to group firms based on these predetermined characteristics.

Note also from the Figure that the distribution of the predicted probability of being a top performer for potential gazelles overlaps partly with top performers but has a higher density at lower values. As for the group of "others," and as a result of the way they are defined and constructed, the distribution of their predicted probability is concentrated at the low probabilities.

Figures 3.2, 3.3 and 3.4 show the distribution of total monthly value-add, of assets value and of total monthly revenues (in Moroccan Dirhams) respectively. They illustrate the fact that potential gazelles are, as expected, quite similar to the "others" in these aspects, and especially value-added per worker given that its one of the criteria of top performance. This is despite the fact that they may be more similar to top performers in the entrepreneur and enterprise characteristics included in the model. The figures show, however, that when it comes to assets (or capital), the distribution flatter, emphasizing the heterogeneity of capital needs. For monthly revenues, top performers appear to be more concentrated in lower values, whereas potential gazelles appear to be more distributed. Still, the average as will be shown later is significantly higher for top performers.

[24]The simple probit model yields a pseudo R-squared that is a little more than 18%, as shown in Table (3.25) in the Appendix, which is certainly low, but higher than the regressions in Grimm et al. (2012) and Adoho and Doumbia (2018).

Table 3.4: Distribution of firms

	Observations	Weighted shares	Share of informal
Top performers	1,129	13%	6%
Potential gazelles	1,416	27%	23%
Others	2,494	60%	44%
	5,039	100%	

Note: informal firms are defined as those that do not have a tax identification number.
Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

Figure 3.1: Predicted probability of being a top performer by firm category

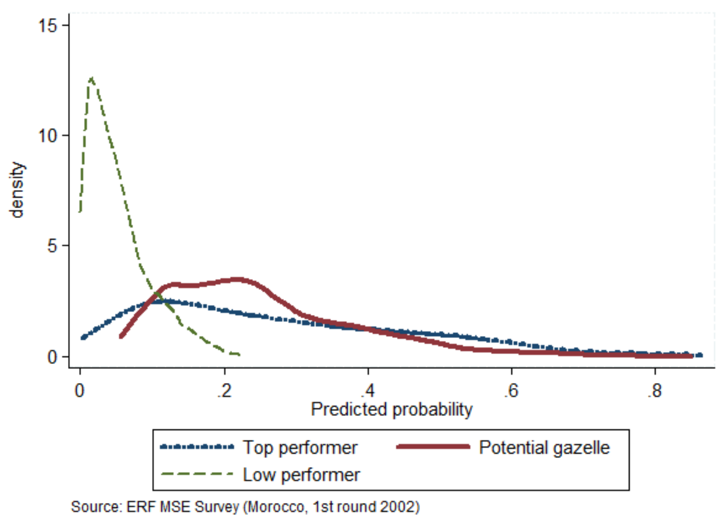


Figure 3.2: Distribution of value-added by firm category

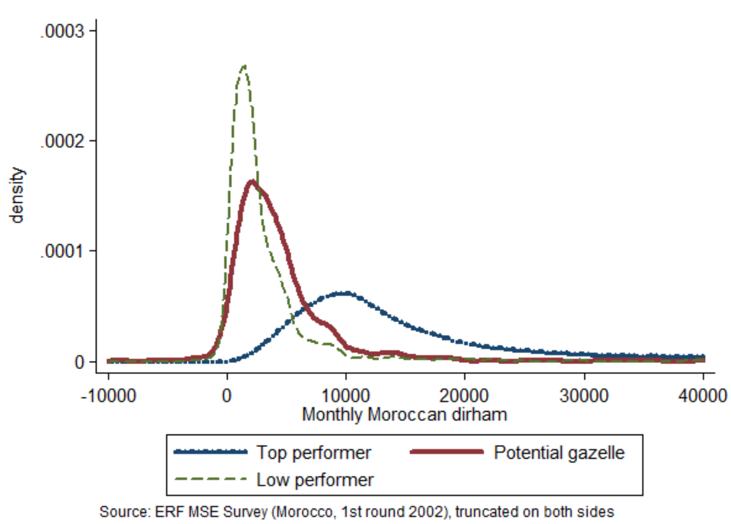


Figure 3.3: Distribution of the value of assets by firm category

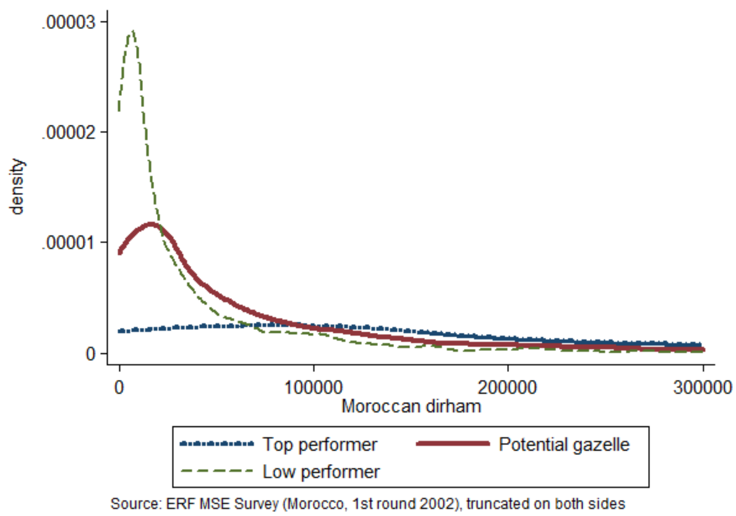
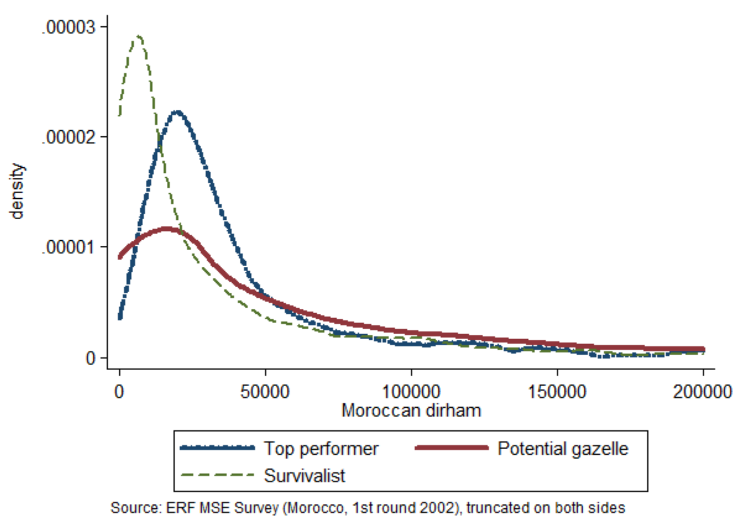


Figure 3.4: Distribution of the monthly revenues by firm category



3.4.1.2 Alternative definitions

The first alternative definition of top performance, i.e. the single criterion of top value-added per work, shows some differences as to the significance of certain variables (Table 3.17 in the Appendix). More specifically, it appears that neither age, nor the sex of the entrepreneur are important, whereas they were in the benchmark criteria. Types of initial capital are also not significant compared to inheritance. Most previous type of labor force participation is also not significant compared to being employed. However, educational attainment is still significant, and so is entrepreneurial motivation and being in certain regions over others.

These are interesting but not surprising results. The focus on value-added per worker only allows even the smaller firms, including 1-worker, to be part of top performance. Using this single criteria, more than 60% of top performers are in fact 1 or 2-person firms, compared to none in the benchmark double-criteria. This expands the range of entrepreneur and enterprise characteristics and in this case would include women and the young - rendering age and sex, for example, insignificant.

The conditional mixed process results in a significant and negative coefficient of correlation for Wholesale and retail trade (different from the benchmark), but significant and negative coefficient of correlation for Business, social and other services, which is similar to the benchmark. This again go to show the importance of allowing for this sector choice.

This criteria shows that while 10% are top performers, 51% can be categorized as potential gazelles, and 39% as "others," as shown in Table 3.18 in the Appendix.

For the second alternative definition, meaning the number of workers (3 or more), a slight modification is introduced in the specification for Equations (3.1) and (3.2) such that the variable "apprentice" appears in the sector selection equation and not in the top-performing equation. Arguably, having had an apprenticeship in the same sector of economic activity affects sector choice but not necessarily the number of workers in the the firm, especially since the top performance equation accounts for years of education.[25] Consequently, two variables are used as the exclusion restriction - having had an apprenticeship in the same sector, and being located in an urban or rural area. While this adds another exclusion restriction, the specification is still not overidentifed.

Table 3.19 in the Appendix shows the results of top performance probit model. Variables

[25] This formulation also allows for the estimation of standard errors of the coefficients of correlation.

that are significant in the benchmark double-criteria definition are also significant here in determining top performance. Moreover, sector choice appears to matter here as well, which are Business, social and other services (similar to the benchmark definition), and Construction, repair and others (different from the benchmark definition). This is an interesting result. Despite the fact that this sector has on average a higher number of workers (3.4 versus 2.5 for manufacturing), choosing this sector is negatively related to being a top performer, when accounting for uobservables. This alludes to the importance of accounting for these unobservables and the conditional mixed process.

Table 3.20 shows that while top performers make up about 26% of the sample, potential gazelles make up about a third, while the remaining are "others."

The third and final definition, which inverses the double criteria such that top performers are the firms with the highest number of workers among those with the highest value-added per worker, the results are starkly similar to the benchmark double-criteria, with barely any differences, as shown in Tables 3.21 and 3.22.

3.4.2 Characteristic differences between the groups

In this subsection, I show differences in some of the main characteristics between the groups of top performers, potential gazelles and "others," based on averages and proportions of different variables that relate to the following aspects: (1) the entrepreneur; (2) the enterprise; (3) finance; (4) management; (5) network and finally; (6) access to infrastructure. These are groupings that I have made based on the questions asked in the survey, which illuminate several aspects about the firms. Section 3.4.2.1 compares the groups that are based on the benchmark definition, whereas Section 3.4.2.2 describes how these characteristics are similar or different when using the other three alternative definitions of top performance.

3.4.2.1 The benchmark double-criteria

Table (3.5) shows some comparisons in averages and proportions between the groups of top performers, potential gazelles and others, also testing if the difference in the means and proportions are significant between the groups.

These results show that top performers and potential gazelles are on average similar when it comes to the majority of the regressors used in the probit model, which is expected:

average entrepreneur age, the share of male entrepreneurs in the group, average years of education, type of labor force participation (or not) prior to the current entrepreneurship activity, the source of initial capital used to start the business and the region in which the enterprise is located. Some differences exist, however, when it comes to the sector of economic activity. A smaller share of potential gazelles operate in manufacturing (12%) compared to top performers (24%) and the group of "others" (30%), and a higher share operate in business, social and other services (38%) compared to top performers (23%) and "others" (9%). It is interesting to see here that both groups of top performers and "others" tend to have significant shares of firms operating in manufacturing and wholesale and retail. It indicates that while these two sectors appear in both the high and low groups, their success can be significantly different. It is as if we have high-tier manufacturing sector and wholesale and retail trade, and low-tiered ones.[26]

However, the Table shows some significant differences between these two groups in a number of other areas. For instance, while average years of education are similar, the share of the various levels of education differ at higher levels.[27] Top performers have a higher share of university graduates than potential gazelles and a lower share of intermediate-school graduates. Top performers also appear to have a higher share of entrepreneurs who have had an apprenticeship in a related field, although a lower share of technical training. Technical training is a vocational path usually begun at secondary school level. The results also show that there is a higher share of entrepreneurs among top performers that have been married, although the average number of children per entrepreneur is not significantly different between the groups.

When looking at some enterprise-related characteristics, the results show significant differences in various business-related outcomes. Top performing firms are significantly older than potential gazelles (and others); they have a significantly larger number of workers (which was one of the criteria of top performance); they work longer hours per week; they pay their workers a higher wage on average; they have higher value-add, revenues and capital - both in total and in per worker terms.

The difference between top performers and potential gazelles in total monthly value-add, monthly revenues (sales) and aggregate value of capital is large. The average value of revenues

[26] For manufacturing, the group of "others" appear more heavily in textiles manufacturing, for example, whereas the group of top performers appear in clothing (higher-end) and food processing.

[27] These levels are constructed from years of educational attainment. Primary school in Morocco is 6 years, intermediate is 3 years and secondary is three years. University graduates are assumed to have 15 years of education attainment and above. This may not be fully accurate because some programs differ (for example 4-year Bachelor's programs as opposed to 3), but this classification is arguably reasonable.

among top performers is almost 7 times that of potential gazelles, while the average value of capital is almost six times. This tells us that there is a great dispersion of firms in Morocco in general, and that potential gazelles are significantly smaller in terms of business operations, even if they are still significantly larger than “others.” This also may indicate that there is a significantly more prosperous upper tier of micro and small enterprises that does markedly better than all the others.

Interestingly, however, average wage per worker among potential gazelles is not significantly different from the group of “others.” This means that while they may perform better than their “others” counterparts in revenues, value-add and the accumulation of capital, they do not pay their workers (including themselves) much better. This is reminiscent of the argument put forth by Michelacci and Quadrini (2009), where they find, through an equilibrium wage model, that financially constrained firms offer an increasing wage profile; as the firm grows and becomes unconstrained, wages increase, but are kept low in the beginning of the process so as to retain earnings. This consequently generates a positive relationship between firm growth (which they measure through size) and wages. “Others”, on the other hand, are firms that generally have a different purpose for operations and dimmer prospect for growth, using more firm revenues for consumption (Berner et al. (2012)).

There are also some significant differences in finance-related aspects of the firms. Table (3.5) shows that potential gazelles have a significantly smaller share of firms that enjoy a current line of credit, which is at the same time not significantly different from “others”. Of those that do borrow, they tend to do so significantly less from official institutions and significantly more from non-business relations (such as family and friends). In these finance-related aspects, potential gazelles are quite similar to the group of “others.” This indicates a significant credit constraint.

Difficulties in accessing credit, in fact, remains a major constraint in Morocco. Despite some reforms over the past couple of decades, a significant share of enterprises in the country remain, to this day, financially included, including small firms, the female-owned, new firms and innovative ones (The World Bank (2016)). This pertains to both short- and long-term credit, where firms are often required collateral for loans, and the value of this collateral is relatively high. Moreover, despite the increase of the role of microfinance in the country, banks remain the main provider of financial services.

Moreover, while potential gazelles appear to save, where they place their savings differs from that of top performers. Fewer potential gazelles save through formal institutions (such as banks), while more keep their savings in their own home.

When it comes to management-related aspects, Table (3.5) shows that a smaller proportion of potential gazelles keep records of their business activity (only a third); fewer of them hire family, which may speak more to availability of family members than the lack of family relations; far fewer provide their workers with written contracts or training or paid vacations; and significantly fewer say that they use modern equipment as a constant way of running their business. Still, in most of these aspects, potential gazelles appear to fare better than "others". This indicates yet again their potential to make the leap to being top performers.

As for network-related characteristics, the same can be said. A significantly smaller share of potential gazelles appear to be members in business associations, although the share is only a fifth among top performers. Fewer of them operate in firm clusters or have some form of a link to other businesses. The type of links with other businesses, when they exist, appear to be different. Top performers tend to do more business with other firms either by producing for them or outsourcing to them. More of them collaborate with other businesses to jointly-bid on projects and a bigger share use other businesses to market for their services.

Potential gazelles appear to be at a disadvantage with these network-related aspects, not only when compared to top performers, but also when compared to "others", who have higher shares of firms with business links to other firms and are in firm clusters. This may indicate a limited ability or a limited environment to connect to other businesses, and is an interesting finding of this paper. The social and business network of micro and small enterprises is argued to have significant impact on their performance (Nichter and Goldmark (2009)).

Finally, the table shows what entrepreneurs perceive as their access to infrastructure. A clear pecking order emerges here, where a significantly higher share of top performers persistently report having access to water, to electricity, to roads and to having a landline,[28] while a smaller share of potential gazelles, and even smaller among "others", report having access to these utilities.[29] These results indicate the importance of having access to infrastructure for firm growth.

It is worthy of noting at this point that the group of "others" differs from potential gazelles on most characteristics, as shown in the Table, both on what was included as a regressor in

[28]Given the time of the survey, the use of a landline was more prevalent than cellular phone technology at the time, although the survey also asked if the entrepreneurs and their enterprises had one.

[29]Note that this is, like all other questions, based on the perception of the entrepreneur. An entrepreneur is asked whether or not he/she has these different utilities.

the probit model - as expected - and on other aspects. The table shows that these firms tend to be operated by younger entrepreneurs, who have on average fewer years of educational attainment; they tend to have more female entrepreneurs, which is similar to what has been found by Grimm et al. (2012) and Adoho and Doumbia (2018); they operate more heavily in wholesale and retail trade and significantly less in food & accommodation and services; they also tend to operate more in rural areas. Moreover, they appear to have significantly different finance-related characteristics. Fewer of them have an existing line of credit, and those that do depend more on business relations (in the "other" category) to fund it. Fewer of them have a saving facility, and those that do overwhelmingly keep their savings at home. Finally, a significantly smaller share of them report having access to the different types of infrastructure.

Table 3.5: Difference in characteristics between groups

Variable	Top (1)	P. Gazelles (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Entrepreneur characteristics					
Age	40.4	39.8	35.9		***
Male	90%	89%	74%		***
Years of education	7.4	7.3	4.8		***
Education level					
None	23%	22%	46%		***
Primary	11%	8%	10%		
Intermediate	33%	40%	33%	***	***
Secondary	20%	21%	9%		***
University	13%	8%	3%	***	***
	100%	100%	100%		
Apprenticeship	67%	63%	54%	*	***
Technical training	14%	17%	10%	**	***
Ever married	73%	66%	60%	***	***
Number of children	1.8	1.9	2.0		
Previous labor force participation					
Employed	74%	71%	58%		***
Unemployed	6%	7%	16%		***
OLF - full-time student	16%	18%	15%		**
OLF - housewife	2%	1%	8%		***
OLF - no desire to work	1%	1%	1%		
OLF - disabled	1%	1%	0%		
OLF - military service	1%	1%	1%		
	100%	100%	100%		
Enterprise characteristics					
Sectors					
Manufacturing	24%	12%	30%	***	***
Wholesale & retail trade	30%	27%	55%		***

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Food & accommodation	15%	16%	1%		***
Business, social and other services	23%	38%	9%	***	***
Construction, repair and other	8%	6%	5%		*
	100%	100%	100%		
Regions					
Sous Massa Draa	7%	8%	7%		
Gharb Chrarda Ben Hssen	3%	3%	9%		***
Marrakech Tensift Al Haouz	6%	6%	8%		**
Oriental	4%	5%	10%		***
Grand Casablanca	39%	38%	6%		***
Rabat Salé Zemmour Zaer	17%	18%	13%		***
Doukkala Abda	2%	1%	12%		***
Meknes Tafilalet	3%	3%	13%		***
Fes Boulmene	5%	6%	8%		
Taza Al Hoceima Taounate	5%	5%	5%		
Tanger Tetouan	8%	7%	9%		
	100%	100%	100%		
Urban area	65%	63%	47%		***
Age	12.9	10.9	8.1	***	***
Number of workers	5.1	2.2	1.7	***	***
Hours per week	71.7	69.7	62.5	*	***
Wage per worker	1,368	714	700	***	
Value add (month, dirham)	37,048	4,298	3,158	***	***
Value add per worker (month, dirham)	6,159	2,305	2,043	***	**
Revenues/sales (month, dirham)	81,934	11,848	8,616	***	***
Revenues/sales per worker (month, dirham)	14,193	6,216	5,635	***	*
Capital value (dirham)	589,838	99,487	46,409	***	***
Capital value per worker (dirham)	92,605	45,527	26,331	***	***
Finance-related					
Source of initial capital					

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Inheritance	12%	12%	6%		***
Own savings	53%	55%	58%		*
Liquidation of assets	12%	11%	5%		***
Formal loan	7%	6%	1%		***
Informal loan	8%	8%	10%		
Own remittances	3%	2%	1%		*
Others remittances	1%	2%	3%		*
Other	4%	4%	15%		***
	100%	100%	100%		
Have a current line of credit	27%	16%	16%	***	
Sources of current credit					
Official institution	54%	22%	19%	***	
Non-business relations	8%	29%	36%	***	*
Other	38%	49%	45%	**	
	100%	100%	100%		
Have a saving facility	73%	70%	66%		**
Type of savings					
Formal	73%	40%	24%	***	***
Home	16%	51%	65%	***	***
Non-business relations	3%	4%	3%		
Others	8%	6%	7%	*	
Management-related					
Keep records	64%	34%	18%	***	***
Hire family	95%	89%	92%	***	**
Provide workers with written contracts	21%	6%	5%	***	
Provide workers with paid vacation	30%	10%	8%	***	**
Provide workers with training	82%	73%	59%	***	***
Use modern equipment all the time	73%	64%	55%	***	***

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Network-related					
In business association	21%	11%	6%	***	***
In a firm cluster	35%	25%	28%	***	**
Have links with other businesses	48%	32%	46%	***	***
Types of links with other businesses					
Firm is outsourced	23%	15%	20%	**	*
Firm outsources	11%	6%	12%	**	***
Joint-bid	14%	7%	7%	**	
Utilize equipment	26%	24%	12%		***
Utilize advanced equipment	3%	4%	2%	***	
Marketing services	31%	19%	26%	***	**
Access to infrastructure					
Have access to water	69%	59%	38%	***	***
Have access to electricity	99%	96%	88%	***	***
Have access to roads	92%	83%	74%	***	***
Have access to landline	50%	24%	12%	***	***

Note (1): Characteristics in categories, such as education level, economic activity, region, place of work and others show proportions that sum up to 100%. "OLF" stands for out of the labor force. Number 1 in $\rho_1 x$ stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
Note (2): Links to other businesses include producing for other firms, outsourcing to other firms, sharing equipment, jointly working on a project for a client and using other businesses for marketing purposes.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

3.4.2.2 Alternative definitions

These results are largely in line to those obtained when the definition of the top performer is the top 10% of value-added per worker (Table 3.26 in the Appendix). Like the benchmark double-criteria, top performers tend to have entrepreneurs that are older and with more years of experience, and more likely to be previously employed.

The financial outcomes of the enterprises have a similar "pecking order," where top performers tend to be older, with more workers, and where variables such as revenues, value-added and capital decrease from top performers to potential gazelles to "others." Moreover, despite the fact that potential gazelles appear to higher high revenues, higher capital and higher value-added per worker than "others", wage per worker is still not significantly different, emphasizing again their potential of retaining earnings.

Significant differences exist when it comes to the sectoral distribution firms within each of the groups. Firms that are the highest 10% of value-added per worker are overwhelmingly in the Wholesale and Retail Trade. Around a fifth of top performers are in Business, social and other services. On the other hand, "others" are overwhelmingly in the manufacturing sector. This emphasizes the fact that manufacturing firms are not among the highest value-added per worker, as the data clearly shows. It however misses the nuances within manufacturing, as the benchmark criteria shows, which is a higher value-added tier and a lower one.

Interestingly, however, this definition appears to heighten some of the challenges faced by potential gazelles, particularly when it comes to access to credit and network-related issues. These results are still largely in line with the main findings of the benchmark double-criteria.

Alternatively, if we define top performance as 3 or more workers, which in this case represent about 26% of the sample, the results are also to some extent maintained (Table 3.20 in the Appendix). Like the benchmark double-criteria, top performers also have entrepreneurs that are relatively older and better educated. When it comes to the sectoral distribution of the enterprises, top-performing firms tend to be relatively distributed across the three sectors, in a more or less similar way to the benchmark double-criteria. Like this benchmark criteria, potential gazelles in this case appear much more heavily in business, social and other services, and much less in manufacturing. The group of "others," on the other hand, appear heavily in wholesale and retail trade, while the remaining in manufacturing - the other sectors having no firms at all. This means that the group of firms that are markedly different in terms of predetermined characteristics from top performers tend to shy away from these sectors.

Unlike the benchmark criteria, the "pecking-order" is not clearly maintained. For instance, monthly value-add for potential gazelles is not significantly different from that of "others." Moreover, when it comes to value-added per worker, revenues and revenues per worker, potential gazelles are significantly inferior to both top performers and "others," even though they appear to have more capital. Potential gazelles given this particular criteria appear disadvantaged compared to both top performers and "others," casting doubt at their potential since they perform far less well than the other two groups on average. This consequently also casts doubt on the choice of this definition as a definition of top performance, emphasizing the importance of going beyond this one criterion. However, the results regarding access to credit and network are still in line with the other definitions.However, like the benchmark criteria, they also appear to struggle when it comes to credit constraints and network-related areas, compared to both top performers and sometimes also compared to "others."

The third and final alternative shows starkly similar characteristics as those observed in the benchmark model. This includes also the sectoral distribution to a large extent. The financial outcomes maintain the pecking order for the majority of the variables, with the exception of those variables that are measured per worker. This does not only include wage per worker, but also revenues and value-added. The potential gazelles in these cases do to appear to be significantly different from "others," which perhaps implies an issue with productivity with these firms and utilization of resources. However, potential constraints that relate to access to credit and network remain, even when compared to the group of "others," further emphasizing the robustness of the results when it comes to these challenges.

3.4.3 Formal and informal firms

This subsection examines heterogeneity among firms by looking at those that are formal and informal separately - a unique aspect of the data that was not available in the surveys utilized by Grimm et al. (2012) and Adoho and Doumbia (2018), which were informal.

The definition of formal firms differs in the literature. Grimm et al. (2012) and Adoho and Doumbia (2018), for instance, have defined an informal firm as one that does not have a tax identification number or does not keep records of its economic activity (or both). The lack of keeping records is also a categorization that has been used by the Statistics Directorate of Morocco at the time (Hamdouch et al. (2006)). A significant share of the research, however, has defined informal firms simply as those that are not registered with the authorities in some form. For some of the research, this registration is defined as having a legal status separate from the owner (such as a commercial registration), as in Demenet et al. (2016) and Rothenberg et al. (2016); for others it is having an official license to operate, as in Monteiro and Assunção (2012), or simply being registered at the country's Chamber of Commerce as in Benhassine et al. (2018).[30]

For a significant share of the literature, however, having a tax registration number (and

[30] The Chamber of Commerce is often a non-governmental body that collectively represent the interest of enterprises and businesses in the country.

ID), is the primary definition of a formal firm,[31] sometimes combined with another criterion, such as having social security. For instance, De Mel et al. (2013) use registration with the Divisional Secretariat of Sri Lanka for tax purposes as their definition of a formal firm. Rand and Torm (2012) use the availability of a tax code for the purposes of paying taxes in Vietnam. Fajnzylber et al. (2009) use tax registration and social security registration to define formal firms in the SIMPLES program in Brazil, and Williams et al. (2016) use a combination of commercial registration, tax registration and keeping records of economic activity for Lahore, Pakistan. This goes to illustrate the wide range of what is perceived, practically, as a formal/informal firm.

In this research, I define a formal firm simply as one that has a tax registration number (or a tax ID).[32] Table (3.16) in the Appendix shows that about two-thirds of firms had a tax registration number at the time of the survey, while a third reported not having one or not being required to have one - both of which are categorized in this paper as not having a tax ID.[33]

From the categorization of firms into the three groups in the previous subsection (the overall sample), Table 3.6 shows the share of formal firms within each group using various potential definitions of informality. Top performers tend to have higher shares of formal firms regardless of the definition, followed by potential gazelles and then "others." The table shows that 94% of top performers have a tax identification number (meaning 6% informal as shown in Table (3.4) earlier), while 77% of potential gazelles do and only 56% of "others" do.

The Table also shows that the share of firms that have registered at the social security agency (*La Caisse Nationale de la Sécurité Sociale*) is about a third for top performers, only 8% for potential gazelles and a meager 2% for "others." It is worthy of noting here that only 8% of all firms have registered for social security, as shown in Table (3.16) in the Appendix, and it is interesting to see that the sweeping majority of them are essentially top performers. The "pecking order" is also maintained when looking at firms that have a commercial registration (CR) or a license.[34]

[31] A tax number that is firm-specific and consequently separate from that of the owner's.

[32] The survey asked the entrepreneur if the enterprise is registered with the tax authority "Patente" at the time of the survey, as well as at the beginning of the enterprise. About 86% of firms that were registered at the time of the survey reported being registered from the start of the enterprise.

[33] It is unclear how an enterprise is "not required" to have a tax ID. Even those that are "sole proprietorships", where the entrepreneur is not necessarily separate from the enterprise, would theoretically have a tax ID that is attached to the entrepreneur. In fact, two-thirds of sole proprietorships in the survey have a tax ID, leaving the "not required" response rather unclear.

[34] Note that a license, "Autorisation officielle" as mentioned in the survey, is a separate document that

Table 3.6: Formality within the groups of MSEs

	Share of firms	Share of firms that has...			
		Tax ID	SS	CR	License
Top performers	13%	94%	34%	74%	91%
Potential gazelles	27%	77%	8%	49%	75%
Others	60%	56%	2%	27%	51%
	100%				

Note: Tax ID stands for tax identification card, SS stands for social security number, CR stands for commercial registration, and license pertains to specific ministry-related licenses often associated with the operation of some businesses.
Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

Table (3.29) in the Appendix shows the results of Equations (3.4) - (3.7) of the conditional mixed process. The results show, perhaps more interestingly, that the coefficient of correlation between the error terms of the various equations are not significant, meaning that there are no potential unobservable characteristics that affect the probability of firms of being top performers in the formal sector and informal sector when accounting for sector (activity) choice and formality/informality choice.

This is a particularly interesting result. It indicates that sector choice affects top performance, as seen through the coefficient of correlation in Table (3.3) because formal and informal firms choose their sectors differently. The coefficient of correlation that was seen in the overall sample, therefore, no longer exists when we account for formality/informality choice. The fact that formal and informal firms choose their sectors differently is further illustrated in Table (3.8) in the next subsection. For instance, only a quarter of top-performing formal firms operate in manufacturing, compared to more than a third of their informal counterparts. On the other hand, 16% of top-performing formal firms operate in food and accommodation, whereas only 3% of their informal counterparts do. Formal top performers also appear more in wholesale and retail trade, and less in "construction, repair and others."

Using the predicted probabilities of Equation (3.8), I categorize the subsample of formal firms into formal top performers (already identified), formal potential gazelles and formal "others." Formal potential gazelles in this case have on average the same predicted probability of being top performers as formal top performers. Similarly, using the predicted probabilities from Equation (3.9), I categorize informal firms into informal top performers (already identified),

firms obtain from relevant agencies to be able to operate. A restaurant, for example, needs to get a license from the health department, a nursery needs to get a license from the education ministry, a manufacturing firm needs to get a license from the ministry of industry, commerce and digital economy...etc. These licenses not only give permission to operate but also ensure following certain codes and regulations throughout the operation of the firm.

informal potential gazelles and informal "others".

Table (3.7) shows that formal potential gazelles that have on average the same average probability of being top performers as the group of formal top performers make up about 29% of formal firms, while "others" make up 53%. Similarly, informal potential gazelles that have on average the same probability of being top performers as the group of informal top performers make up 22% of informal firms, while a sweeping majority of 76% can be categorized as "others." These results speak to a relative heterogeneity of formal firms that is much less evident among informal firms, as will be further explored in the following subsection.

Table 3.7: Distribution of formal and informal firms

	Formal firms		Informal firms.	
	Obs.	Weighted shares	Obs.	Weighted shares
Top performer	1,067	18%	62	2%
Potential gazelles	1,163	31%	293	22%
Survivalists	1,607	51%	847	76%
	3,837	100%	1,202	100%

Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

3.4.3.1 Characteristic differences within formal and informal firms

Table (3.8) shows some characteristic differences between the groups of top performers, potential gazelles and "others" within each subsample (of formal and informal firms) and tests whether the difference in averages and proportions of the various aspects are significant or not.

For formal firms, columns (1-5), the results show that while top performers are not significantly different from their potential gazelle counterparts in the majority of the variables that were included in the probit model, as expected, they still differ on a number of other characteristics. These differences are starkly similar to what is found in Subsection 3.4.2. For instance, formal top performers are significantly older than their potential gazelle counterparts, who themselves are significantly older than "others"; the "pecking order" is maintained when looking at all other business outcomes such as value-add, revenues and capital, both in aggregate and per worker terms. Like the overall sample, formal potential gazelles appear to pay significantly less wage per worker than both their top performer and "others" counterparts, emphasizing the result found in Subsection 3.4.2.[35]

Other differences between the groups of formal firms are similar to what was noted for the overall sample. For example, formal potential gazelles are clearly at a disadvantage when it comes to having a line of credit, and those that have some form of credit rely more heavily on business relations. They tend to keep their savings at home, far fewer of them keep records, hire family, give written contracts, provide workers with training or paid vacation and use modern equipment. Fewer of them have links with other businesses and report having access to infrastructure.

However, while there appears to be significant heterogeneity between the groups of formal firms, which mirrors the heterogeneity seen in the overall sample, this heterogeneity is less apparent among informal firms (columns 6-10).

There are several observations that can be made. Firstly, the "pecking order" seen in many business outcomes of formal firms, is less apparent for informal firms. Top-performing informal firms are indeed significantly different from their potential gazelle counterparts, but those potential gazelles are hardly different from "others." It is as if there is a small number of informal firms that appear to be able to compete with formal firms, but the rest is starkly different from this group of top performers and similar to each other. Averages of value add, revenues and capital, for example, are not significantly different between informal potential gazelles and informal "others."

Heterogeneity also fades when looking at the share of firms that has current lines of credit and saving facilities, although the sources of credit and savings differ between the informal groups. The same can be said about most management-related aspects examined, network-related and access to infrastructure. Top-performing informal firms do not report significantly higher shares of these variables in general. But there are a few interesting exceptions such as keeping records, being in firm clusters, having links to other businesses and access to electricity, for example. Again, it appears that network-related aspects are quite important in distinguishing top performers, even among the informal enterprises, as well as access to infrastructure.

Finally, column (11) of the Table tests whether the difference in the averages and proportions between formal top performers and informal top performers are significantly different from each other. The results show that formal top performers, although in the same group as

[35]It is also reasonable to say that the results found in the overall sample may be driven by the results found among the formal enterprises, particularly that regarding differences in average wage per worker.

informal top performers, have significantly higher years of education (and a smaller share of entrepreneurs in lower education levels). They generally operate in different sectors, tend to be located more in urban areas and have significantly higher business outcomes. They depend more on inheritance and formal loans to start their business; a higher share of them has current lines of credit and they tend to have more favorable management-related aspects of running their business (for example, keeping records, offering written contracts, paid vacation and training). They also have significantly higher shares of firms reporting access to water, roads and landlines. Where they do not differ much is in network-related aspects, highlighting yet again the importance of network in this analysis and in potentially understanding the success of some firms.

The results of Table (3.8) also shows that when it comes to business outcomes, informal top performers appear to be in the middle, between formal top performers and formal potential gazelle, while still suffering from lower access to credit and infrastructure.

In the same vein, the results also show that informal "others" appear to be at a particularly disadvantaged position. They tend to be significantly female-led (47% of them); the average years of educational attainment of the entrepreneurs is less than 4 years (primary level); a significant share was previously unemployed; they operate significantly in rural areas and the share of them that report access to various types of infrastructure is remarkably lower than all other types of firms.

Table 3.8: Difference in characteristics between groups of formal and informal firms

	Formal firms					**Informal firms**					
Variable	TP.	PG.	O.	1 v 2	2 v 3	TP	PG.	O	6 v 7	7 v 8	1 v 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Entrepreneur characteristics											
Age	40.47	40.20	36.60		***	38.59	36.97	35.59		*	
Male	90%	89%	88%			90%	91%	53%		***	
Years of education	7.53	7.63	5.60		***	5.35	5.57	3.91		***	***
Education level											
None	22.3%	17.8%	35.3%	*	***	42%	37%	59%		***	**
Primary	10.7%	8.5%	10.5%			16%	10%	8%			
Intermediate	33.5%	41.7%	39.1%	***		25%	36%	25%		**	
Secondary	20.4%	23.1%	11.7%		***	11%	12%	6%		**	*
University	13.1%	8.8%	3.5%	**	***	7%	4%	2%			
	100%	100%	100%			100%	100%	100%			
Had an apprenticeship	66%	62%	51%		***	86%	78%	55%		***	***
Had technical training	14%	17%	12%		***	7%	13%	9%			**
Ever married	73%	68%	58%	**	***	71%	65%	60%			
Number of children	1.82	1.95	1.97			1.98	1.98	1.99			
Prior labor force participation											
Employed	74%	73%	61%		***	75%	73%	52%		***	
Unemployed	6%	6%	16%		***	6%	5%	19%		***	

Difference in characteristics between groups of formal and informal firms (continued)

	Formal firms					Informal firms					
Variable	TP.	PG.	O.	1 v 2	2 v 3	TP	PG.	O	6 v 7	7 v 8	1 v 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
OLF - full-time student	16%	18%	18%			9%	9%	12%			*
OLF - housewife	1%	1%	2%		**	7%	9%	15%		*	
OLF - no desire to work	1%	1%	0%	***		2%	2%	1%			
OLF - disabled	0%	1%	0%			2%	1%	0%			
OLF - military service	1%	1%	2%		***	0%	0%	1%			*
	100%	100%	100%			100%	100%	100%			
Enterprise characteristics											
Sectors											
Manufacturing	23%	23%	10%		***	36%	41%	41%			*
Wholesale & retail trade	31%	29%	64%		***	20%	13%	44%		***	*
Food & accommodation	16%	16%	3%		***	3%	3%	4%			***
Business, social and other services	23%	25%	18%		***	22%	30%	9%		***	
Construction, repair and other	7%	7%	5%		*	19%	13%	2%		***	**
	100%	100%	100%			100%	100%	100%			
Regions											
Sous Massa Draa	7%	8%	8%			5%	5%	5%			
Gharb Chrarda Ben Hssen	3%	3%	7%		***	0%	10%	9%	***		***
Marrakech Tensift Al Haouz	6%	6%	8%		***	11%	11%	8%			
Oriental	4%	3%	12%		***	8%	6%	8%			
Grand Casablanca	39%	39%	4%		***	43%	34%	10%		***	
Rabat Salé Zemmour Zaer	16%	19%	9%		***	18%	16%	17%			

Difference in characteristics between groups of formal and informal firms (continued)

Variable	Formal firms					Informal firms					
	TP.	PG.	O.	1 v 2	2 v 3	TP	PG.	O	6 v 7	7 v 8	1 v 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Doukkala Abda	2%	0%	13%	**	***	0%	7%	10%	***		***
Meknes Tafilalet	4%	2%	14%		***	0%	0%	13%		***	***
Fes Boulmene	6%	6%	9%		***	2%	0%	9%		***	
Taza Al Hoceima Taounate	5%	5%	5%			7%	5%	4%			
Tanger Tetouan	8%	8%	9%			6%	6%	8%			
	100%	100%	100%			100%	100%	100%			
In urban area	66%	67%	54%		***	45%	51%	38%		***	***
Age	13.05	11.54	9.47	**	***	9.86	7.14	6.90			*
Number of workers	5.15	2.40	1.87	***	***	3.81	1.75	1.44	***	***	***
Hours per week	72.13	69.83	69.36	**		65.23	58.61	55.89	**		**
Wage per worker (month, dirham)	1,391	701	806	***	***	1,021	651	577	***		***
Value add (month, dirham)	38,630	4,713	4,104	***	**	13,057	2,534	2,017	***	**	***
Value add/worker (month, dirham)	6,343	2,450	2,516	***		3,371	1,546	1,484	***		***
Revenues (month, dirham)	85,544	13,853	11,368	***	***	27,188	5,239	5,113	***		***
Revenues/worker (month, dirham)	14,634	6,948	7,153	***		7,511	3,260	3,781	***		***
Capital (dirham)	619,750	122,286	65,695	***	***	136,170	24,820	23,615	***		***
Capital/worker (dirham)	96,457	51,379	37,896	***	***	34,177	13,191	14,974	**		***
Finance-related											
Source of initial capital											

Difference in characteristics between groups of formal and informal firms (continued)

	Formal firms					**Informal firms**					
Variable	TP.	PG.	O.	1 v 2	2 v 3	TP	PG.	O	6 v 7	7 v 8	1 v 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Inheritance	13%	13%	8%		***	4%	4%	5%			***
Own savings	52%	54%	57%			69%	65%	57%		**	**
Liquidation of assets	13%	12%	5%		***	8%	9%	5%		*	
Formal loan	7%	7%	1%		***	1%	1%	1%			***
Informal loan	8%	8%	10%		*	11%	13%	9%		*	
Own remittances	3%	2%	2%			3%	3%	1%		*	
Others remittances	1%	2%	3%			0%	2%	3%			
Other	4%	2%	14%		***	3%	3%	19%		***	
	100%	100%	100%			100%	100%	100%			
Has a current line of credit	28%	18%	18%	***		17%	13%	12%			*
Sources of current credit											
Official institution	55%	24%	23%	***		36%	4%	13%	**	*	
Non-business relations	8%	24%	33%	***	**	10%	64%	38%	***	**	*
Other	37%	52%	44%	***		54%	33%	49%			
	100%	100%	100%			100%	100%	100%			
Has a saving facility	73%	72%	67%		**	70%	64%	67%			
Type of savings											
Formal	74%	46%	35%	***	***	58%	13%	12%	***		

Difference in characteristics between groups of formal and informal firms (continued)

	Formal firms					Informal firms					
Variable	TP.	PG.	O.	1 v 2	2 v 3	TP	PG.	O	6 v 7	7 v 8	1 v 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Home	15%	44%	54%	***	***	25%	79%	77%	***		
Non-business relations	3%	4%	3%			12%	3%	4%			
Others	8%	6%	7%			5%	5%	8%			
	100%	100%	100%			100%	100%	100%			
Management-related											
Keep records	66%	39%	23%	***	***	38%	16%	13%	***		***
Hire family	95%	89%	93%	***	***	95%	91%	90%			
Provide workers with written contracts	22%	6%	5%	***		8%	6%	4%			***
Provide workers with paid vacation	30%	11%	9%	***		17%	8%	6%			*
Provide workers with training	81%	75%	58%	**	***	91%	73%	59%	***	***	**
Use modern equipment all the time	74%	66%	56%	***	***	61%	62%	55%		**	
Network-related											
In business association	22%	12%	8%	***	***	14%	9%	4%		**	
In a firm cluster	34%	28%	29%	***		38%	21%	26%	**		
Have links with other businesses	47%	35%	46%	***	***	57%	35%	43%	***	**	
Access to infrastructure											
Has access to water	71%	58%	43%	***	***	33%	41%	36%			***
Has access to electricity	99%	99%	96%		***	98%	87%	76%	***	***	
Has access to roads	92%	86%	81%	***	***	81%	74%	65%		**	*

Difference in characteristics between groups of formal and informal firms (continued)

	Formal firms					**Informal firms**					
Variable	TP.	PG.	O.	1 v 2	2 v 3	TP	PG.	O	6 v 7	7 v 8	1 v 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Has access to a landline	53%	27%	16%	***	***	18%	7%	8%	**		***

Note (1): TP stands for top performer, PG stands for potential gazelle and O for "others". T-tests are run to compare top performers and potential gazelles, potential gazelles and "others" for each subsample of formal and informal firms, as well as formal and informal top performers.
Characteristics in categories, such as education level, economic activity, region, place of work and others show proportions that sum up to 100%. "OLF" stands for out of the labor force.
Note (2): Links to other businesses include producing for other firms, outsourcing to other firms, sharing equipment, jointly working on a project for a client and using other businesses for marketing purposes.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

3.4.4 Choice of formality/informality

Comparing firms' predicted probability of being formal top performers, using Equation (3.8), to the predicted probability of being informal top performers, using Equation (3.9), the results show that almost all firms (99% using survey weights) have higher predicted probabilities of being top performers when using the formal firms equation.[36] While this may reflect the relatively few informal firms that make it to top performance in the first place, it may also reflect the fact that being formal, as defined through tax ID, rewards the entrepreneur and enterprise characteristics that are accounted for in the probit model better. The fact that predicted probabilities are always higher in the formal status, including firms that have chosen to be informal, hints at the idea that firms may not be choosing informality/formality optimally. This means that almost all of informal firms would have a higher probability of being top performers should they have chosen formality.

Bearing this in mind and honing onto the set of informal firms, I ask: what proportion of informal potential gazelles identified through the informal firms equation (3.9) are also potential gazelles under the formal firms equation (3.8), as opposed to "others"? Put differently, what proportion of informal potential gazelles that have chosen informality would also be potential gazelles should they have chosen formality using the counterfactual groups, and what proportion would be "others"?

This question can be answered by creating a group of counterfactual potential gazelles that are informal using the formal firms equation.[37] More precisely, I create a group of informal potential gazelles using the formal firms Equations (3.4) and (3.8) that have on average the same probability of being a top performer as the formal top performers. This means that we can have two groups of potential gazelles using these equations that have the same probability of being top performers as formal top performers - one formal (identified in Table (3.7)) and one counter-factual informal. Then I can ask, what proportion of informal potential gazelles, identified using Equation (3.9) are also "counterfactual" potential gazelles using Equation (3.8)?

Table (3.9) shows that 52% of informal firms that were categorized as potential gazelles

[36] The average difference in the predicted probability is about 0.12, with a minimum of -0.1 and a maximum of 0.69.

[37] Up until this part, the results that use the predicted probability of formal firms, Equation (3.8), was restricted to formal firms only. Similarly, the results that use the predicted probability of informal firms, Equation (3.9), was restricted to informal firms only. Here I utilize the fact that predicted probabilities are calculated for all firms, regardless of their status, in each of these two equations.

using the informal firms equation[38] make it to the counterfactual potential gazelle group using the formal firms equation. This indicates that should these informal potential gazelles have chosen to become formal, they would have as a group the same predicted probability of being a top performer as the formal top performers. On the other hand, there is a significant 48% of these informal potential gazelles that would be grouped under "others" should they have chosen to be formal.

This is indicative of a difference in the predicted probabilities of firms of being top performers given their formal/informal choice. We could say, therefore, that about half of informal potential gazelles might be better off staying informal as their probability of becoming formal top performers is much smaller compared to being informal top performers. This may also be indicative of the fact that formal top performers have a much higher predicted probability on average and that informal firms appear to be characteristically different from their formal counterparts - at least in the regressors of the probit model. As for informal "others", the Table also shows that only 9% would become potential gazelles should they choose formality and the majority would stay as "others."

Table 3.9: Firm categories and share of informality, by formal/informal equation

		Formal firms equation* (counterfactual)		
		Potential gazelle	Others	
Informal firms equation*	Potential gazelles	52%	48%	100%
	Others	9%	91%	100%

Note: Formal firms equation corresponds to Equations (3.4) and (3.8), whereas the informal firms equation corresponds to Equations (3.5) and (3.9).
Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

As a final exercise, I look at the characteristic differences between formal potential gazelles and informal potential gazelles (counterfactual) identified using Equations (3.4) and (3.8). Each of these two groups have on average the same predicted probability of being a top performer as the group of formal top performers, except that one has chosen formality and one has chosen to be informal.

Table (3.10) shows some of these differences between formal and informal potential gazelles along the lines of entrepreneur, enterprise, finance, management, network and access to infrastructure. Note that column (1) in this Table is the same as column (2) found in Table (3.8). The results show that formal potential gazelles and their informal counterfactuals, while they have the same probability on average of being top performers, differ on almost

[38] Note that this group uses the subsample of informal firms only, without accounting for the predicted probabilities of formal firms when ordering the probabilities and creating the group

every aspect explored. For instance, the entrepreneurs of informal potential gazelles, while they have roughly the same age as their informal counterpart, they tend to be more female-led, with fewer years of education (although a larger share of them have had apprenticeships). Informal potential gazelles, like other informal firms, tend to operate much more heavily in manufacturing and far less in wholesale and retail trade, food and accommodation and other services. However, much more of them appear to be located in Grand Casablanca - a highly dense area in terms of population and consequently competition.

When it comes to business outcomes such as revenues, value-add and capital (both in aggregate value and in per worker terms), informal potential gazelles are at a much less advantageous position. Average value add per worker is 1.4 times less than their formal counterparts, average revenue per worker is 1.8 times less, and capital per worker is 3 times less. And while they do not appear to be more likely to have an on-going credit line, the source of their credit, and the place where they save, is significantly less likely to come from, or be in, an official institution.

Interestingly, however, they are not starkly different when it comes to management-related and network-related aspects. Formal potential gazelles tend to be more likely to keep records, provide workers with paid vacation and use modern equipment, but not more likely to hire family, to train their worker or to provide them with written contracts. They also do not tend to be more likely to have business links, for example - a feature that appeared to be different between top performers and potential gazelles in general.

However, there are significant differences in access to various types of infrastructure. Informal firms, it appears, regardless whether they are top performers or potential gazelles, always report less access to water and roads, and in this case electricity and landlines as well. This is regardless of the fact that there are not very large differences or concentrations in the regions they locate or the urban/rural setting they choose.

This goes to further illustrate the idea that although these two formal and informal groups have on average the same probability of being top performers as the formal top performers, informal potential gazelles are still significantly different from their formal counterparts.

Table 3.10: Difference in characteristics between formal and informal potential gazelles

Variable	Formal (1)	Informal (2)	t-test 1 v. 2
Entrepreneur characteristics			
Age	40.20	40.68	
Male	89%	73%	***
Years of education	7.63	5.92	***
Education			
None	17.8%	38%	***
Primary	8.5%	10%	
Intermediate	41.7%	28%	***
Secondary	23.1%	16%	*
University	8.8%	8%	
	100%	100%	
Had an apprenticeship	62%	71%	**
Had technical training	17%	15%	
Ever married	68%	70%	
Number of children	1.95	1.83	
Previous labor force participation			
Employed	73%	73%	
Unemployed	6%	7%	
OLF - full-time student	18%	11%	***
OLF - housewife	1%	6%	
OLF - no desire to work	1%	2%	
OLF - disabled	1%	1%	
OLF - military service	1%	0%	***
	100%	100%	
Enterprise characteristics			
Sectors			
Manufacturing	23%	46%	***
Wholesale & retail trade	29%	14%	***

Difference in characteristics between formal and informal potential gazelles (continued)

Variable	Formal (1)	Informal (2)	t-test 1 v. 2
Food & accommodation	16%	10%	**
Business, social and other services	25%	20%	*
Construction, repair and other	7%	10%	
	100%	100%	
Regions			
Sous Massa Draa	8%	7%	
Gharb Chrarda Ben Hssen	3%	1%	***
Marrakech Tensift Al Haouz	6%	9%	
Oriental	3%	1%	**
Grand Casablanca	39%	49%	**
Rabat Salé Zemmour Zaer	19%	23%	**
Doukkala Abda	0%	0%	
Meknes Tafilalet	2%	1%	
Fes Boulmene	6%	2%	***
Taza Al Hoceima Taounate	5%	2%	**
Tanger Tetouan	8%	5%	
	100%	100%	
In urban area	67%	63%	
Age	11.54	8.95	***
Number of workers	2.40	1.81	***
Hours per week	69.83	55.85	***
Wage per worker (month, dirham)	701	597	**
Value add (month, dirham)	4,713	3129	***
Value add/worker (month, dirham)	2,450	1730	***
Revenues (month, dirham)	13,853	6902	***
Revenues/worker (month, dirham)	6,948	3836	***
Capital (dirham)	122,286	38373	***
Capital/worker (dirham)	51,379	17107	***
Finance-related			
Source of initial capital			

Difference in characteristics between formal and informal potential gazelles (continued)

Variable	Formal (1)	Informal (2)	t-test 1 v. 2
Inheritance	13%	5%	***
Own savings	54%	61%	*
Liquidation of assets	12%	15%	
Formal loan	7%	1%	***
Informal loan	8%	10%	
Own remittances	2%	2%	
Others remittances	2%	2%	
Other	2%	4%	
	100%	100%	
Has a current line of credit	18%	15%	
Sources of current credit			
Official institution	24%	8%	***
Non-business relations	24%	41%	
Other	52%	51%	
	100%	100%	
Has a saving facility	72%	65%	*
Type of savings			
Formal	46%	18%	***
Home	44%	74%	***
Non-business relations	4%	4%	
Others	6%	4%	
	100%	100%	
Management-related			
Keep records	39%	17%	***
Hire family	89%	90%	
Provide workers with written contracts	6%	7%	
Provide workers with paid vacation	11%	5%	***
Provide workers with training	75%	77%	
Use modern equipment all the time	66%	56%	**

Difference in characteristics between formal and informal potential gazelles (continued)

Variable	Formal (1)	Informal (2)	t-test 1 v. 2
Network-related			
In business association	12%	10%	
In a firm cluster	28%	19%	***
Have links with other businesses	35%	36%	
Access to infrastructure			
Has access to water	58%	50%	**
Has access to electricity	99%	87%	***
Has access to roads	86%	77%	**
Has access to a landline	27%	10%	***

Note (1): Characteristics in categories, such as education level, economic activity, region, place of work and others show proportions that sum up to 100%. "OLF" stands for out of the labor force. Number 1 in $\rho_1 x$ stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
Note (2): Links to other businesses include producing for other firms, outsourcing to other firms, sharing equipment, jointly working on a project for a client and using other businesses for marketing purposes.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

3.5 Robustness check: Expanding top performance identification

In this section, I expand the share of firms that are identified as top performers, from about 13% to 20% of the overall sample. More precisely, out of the top 25% of firms with the largest number of workers, I select the top 80% with the highest value-add per worker. This identifies the top 20% of firms in the sample with the highest number of workers and productivity. Using the same method outlined in Section (3.3), I run Equations (3.1) - (3.3) and categorize consequently the group of firms that are top performers (already identified), potential gazelles that have the same predicted probability of being top performers as the group of top performers and the remaining observations as "others." The results of the Equations can be found in Tables (3.30) and (3.31) in the Appendix.

Similar to the benchmark identification of the 13% top performers, the coefficient of correlation between the top-performers probit and that of the sectors of economic activity are significant - in this case for both “business, social and other services” and with “construction, repair and others.” This means that there are some unobservable characteristics that affect the choice of these sectors and the firm’s probability of being a top performer (when compared to the reference sector of manufacturing). Previously it was only the business, social and other services sector.

Partitioning the firms into the groups of top performers, potential gazelles and “others” shows, as Table (3.11) illustrates, that while top performers make up 20% of firms, potential gazelles make up 29% and “others” make up about 51%. In fact, of the potential gazelles that were originally identified in the benchmark top 13% model, about 14% of them end up becoming top performers when the group is expanded to 20%, 75% end up remaining potential gazelles and 11% move to being “others.” On the other hand, of the group of “others” that were originally identified in the benchmark top 13% model, about 6% end up moving to the group of top performers, 14% move to the group of potential gazelles and 80% remain as “others.” While this shows that there is some movement when the identification is expanded, it is arguably limited.

Table 3.11: Distribution of firms

	Observations	Weighted shares	Share of informal
Top performer	1,612	20%	11%
Potential gazelles	1,406	29%	28%
Survivalists	2,021	51%	45%
	5,039	100%	

Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

Table (3.30) shows the characteristic differences between these different groups. Interestingly, when the group of top performers is expanded to 20% of the observations, average business outcomes such as revenues, value-add and capital (be they in total or in per worker) decrease compared to the top 13%. This highlights the fact that the additional firms that are now part of this top performers group are notably weaker in these aspects. It may be that there exists a very distinct upper tier of firms that do well and others that do notably less well.

The other observations that were marked given the benchmark top 13% model when it comes to potential gazelles remain largely the same. Potential gazelles in this case are slightly less educated, and face some visible constraints when it comes to having a current line of credit, the source of that credit (coming from business and non-business relations), and in being able to link to other business (network). They differ, like the benchmark observations, in management-related aspects and they are far less likely to report access to different types of infrastructure compared to top performers.

Table 3.12: Difference in characteristics between groups (robustness check)

Variable	Top (1)	P. Gazelles (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Entrepreneur characteristics					
Age	39.88	38.53	36.05	***	***
Male	90%	87%	72%		***
Years of education	6.77	6.68	4.90		***
Education					
None	27%	25%	47%		***
Primary	10%	10%	9%		
Intermediate	35%	40%	32%	**	***
Secondary	17%	19%	9%		***
University	11%	6%	3%	***	**
	100%	100%	100%		
Had an apprenticeship	68%	66%	50%		***
Had technical training	14%	18%	9%	***	***
Ever married	71%	64%	59%	***	**
Number of children	1.91	1.95	1.98		
Prior labor force participation					
Employed	73%	69%	57%	*	***
Unemployed	7%	9%	17%		***
OLF - full-time student	16%	18%	15%		*
OLF - housewife	2%	2%	9%		***
OLF - no desire to work	1%	1%	1%		
OLF - disabled	1%	0%	0%		
OLF - military service	1%	1%	1%		
	100%	100%	100%		

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Enterprise characteristics					
Sectors					
Manufacturing	28%	19%	25%	***	***
Wholesale & retail trade	25%	15%	69%	***	***
Food & accommodation	16%	14%	0%		***
Business, social and other services	22%	40%	6%	***	***
Construction, repair and other	10%	12%	0%		
	100%	100%	100%		***
Regions					
Sous Massa Draa	6%	6%	8%		*
Gharb Chrarda Ben Hssen	4%	5%	8%		***
Marrakech Tensift Al Haouz	7%	8%	8%		
Oriental	7%	7%	9%		**
Grand Casablanca	32%	27%	9%	***	***
Rabat Salé Zemmour Zaer	15%	16%	14%		
Doukkala Abda	4%	4%	12%		***
Meknes Tafilalet	6%	8%	11%		**
Fes Boulmene	7%	7%	7%		
Taza Al Hoceima Taounate	5%	5%	5%		
Tanger Tetouan	8%	8%	9%		
	100%	100%	100%		
In urban area	63%	60%	46%		***
Age	11.96	10.01	8.19	***	***
Number of workers	4.64	1.89	1.51	***	***
Hours per week	71.27	67.12	62.42	***	***
Wage per worker (month, dirham)	1151	696	695	***	
Value add (month, dirham)	25142	3353	3292	***	
Value add/worker (month, dirham)	4363	2054	2274	***	*
Revenues (month, dirham)	55777	8801	9606	***	
Revenues/worker (month, dirham)	10025	5144	6601	***	
Capital (dirham)	414629	76148	45485	***	***
Capital/worker (dirham)	68263	38974	29028	***	***

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Finance-related					
Source of initial capital					
Inheritance	13%	11%	5%		***
Own savings	53%	54%	59%		**
Liquidation of assets	10%	9%	6%		***
Formal loan	6%	5%	1%		***
Informal loan	9%	10%	9%		
Own remittances	3%	2%	1%		**
Others remittances	1%	2%	3%		
Other	5%	6%	16%		***
Has a current line of credit	24%	14%	17%	***	*
Sources of current credit					
Official institution	48%	23%	16%	***	
Non-business relations	14%	37%	33%	***	
Other	38%	40%	50%		*
Has a saving facility	73%	67%	67%	***	
Type of savings					
Formal	63%	35%	23%	***	***
Home	26%	56%	66%	***	***
Non-business relations	3%	4%	3%		
Others	8%	5%	8%	**	**
Management-related					
Keep records	52%	27%	19%	***	***
Hire family	95%	90%	91%	***	
Provide workers with written contracts	15%	5%	5%	***	
Provide workers with paid vacation	23%	9%	8%	***	
Provide workers with training	79%	72%	57%	***	***
Use modern equipment all the time	71%	64%	53%	***	***

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Network-related					
In business association	18%	10%	6%	***	***
In a firm cluster	34%	26%	27%	***	
Have links with other businesses	47%	36%	45%	***	***
Access to infrastructure					
Has access to water	66%	55%	35%	***	***
Has access to electricity	98%	94%	87%	***	***
Has access to roads	89%	80%	74%	***	***
Has access to a landline	39%	19%	12%	***	***

Note (1): Characteristics in categories, such as education level, economic activity, region, place of work and others show proportions that sum up to 100%. "OLF" stands for out of the labor force. Number 1 in $\rho_1 x$ stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
Note (2): Links to other businesses include producing for other firms, outsourcing to other firms, sharing equipment, jointly working on a project for a client and using other businesses for marketing purposes.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

Similar to Subsection (3.4.3), I look at the characteristic differences between the groups of firms within the formal and informal subsamples separately, using Equations (3.4)-(3.7), comparing also the differences within the group of top performers between formal and informal firms. The results, shown in Table (3.13), are also largely similar, with some differences when it comes to the sector choice of formal and informal groups of firms. Informal firms appear to have less heterogeneity than formal ones between the groups, especially when it comes to finance, management and network-related aspects between informal top performers and informal potential gazelles. Like the original observation made in a prior subsection, informal top performers appear to be somewhat between formal top performers and their potential gazelle counterparts in most areas.

Interestingly, also, is what appears to be differences between the sectors that formal firms excel in (making them top performers for example), and the ones that informal firms do. Among formal firms, top performers and potential gazelles appear to have significantly higher shares of MSEs that appear in manufacturing compared to their "others" counterpart. For informal firms, however, the group of "others" appears to be highly concentrated in manufacturing, at about 64% of informal "other". It is as if there are multiple tiers of successful manufacturing firms. The firms that choose manufacturing and formality do well, appearing in groups of top performers and potential gazelles, but the firms that choose manufacturing and do not register appear to be mostly grouped in “others” at lower business outcomes.

It is also worthy of noting that expanding the top performers to be top 20% of the firms leaves informal “others” as a group that is much more heavily female-led, previously unemployed or previously housewives. This emphasizes a particular disadvantage of informality.

The results also show that for the majority of the firms, the predicted probability of being a top performer is higher using the formal equation (3.8) than those using the informal equation (3.9) - similar to the previous finding. In fact, for 93% of the observations, using survey weights, this is true. Formality, therefore, almost always yields higher predicted probabilities of being among the group of top performance. Comparing formal potential gazelles and their informal counterparts identified through Equation (3.8), as was done in Subsection (3.4.4), the results are somewhat different in terms of averages and proportions, but the main differences between formal and informal firms are largely similar.

Table 3.13: Difference in characteristics between groups of formal and informal firms (robustness check)

	Formal firms					**Informal firms**					
Variable	TP.	PG.	O.	1 v 2	2 v 3	TP	PG.	O	6 v 7	7 v 8	1 v 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Entrepreneur characteristics											
Age	40.23	39.23	36.54	*	***	36.96	36.21	35.59			***
Male	90%	87%	88%	*		86%	87%	35%		***	
Years of education	6.97	6.87	6.04		***	5.11	4.90	3.63		***	***
Education											
None	26%	23%	32%		***	42%	46%	62%		***	**
Primary	10%	9%	10%			14%	13%	5%		***	
Intermediate	36%	40%	40%	*		29%	28%	26%			
Secondary	18%	21%	13%		***	8%	10%	5%		**	***
University	11%	6%	5%	***		7%	4%	2%		*	
	100%	100%	100%			100%	100%	100%			
Had an apprenticeship	67%	62%	46%	**	***	72%	51%	69%	***	***	
Had technical training	14%	19%	10%	**	***	10%	8%	12%		**	*
Ever married	72%	66%	57%	**	***	62%	61%	62%			*
Number of children	1.90	1.96	1.94			1.97	1.99	1.99			
Previous labor force participation											
Employed	73%	72%	60%		***	70%	69%	44%		***	
Unemployed	7%	8%	16%		***	9%	13%	19%		**	

Difference in characteristics between groups of formal and informal firms (continued)

	Formal firms					**Informal firms**					
Variable	TP.	PG.	O.	1 v 2	2 v 3	TP	PG.	O	6 v 7	7 v 8	1 v 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
OLF - full-time student	16%	16%	20%		**	14%	13%	10%			
OLF - housewife	2%	2%	2%			5%	3%	24%		***	
OLF - no desire to work	1%	1%	0%		*	1%	1%	2%			
OLF - disabled	1%	0%	0%			1%	1%	0%		**	
OLF - military service	1%	1%	2%		***	0%	1%	1%	*		***
	100%	100%	100%			100%	100%	100%			
Enterprise characteristics											
Sectors											
Manufacturing	27%	26%	2%		***	34%	17%	64%	***	***	
Wholesale & retail trade	25%	15%	85%	***	***	18%	57%	20%	***	***	
Food & accommodation	17%	14%	0%		***	7%	6%	1%		***	***
Business, social and other services	22%	33%	13%	***	***	27%	14%	13%	**		
Construction, repair and other	9%	12%	0%		***	14%	6%	2%		***	
	100%	100%	100%			100%	100%	100%			
Regions											
Sous Massa Draa	6%	6%	10%		***	5%	7%	3%		**	
Gharb Chrarda Ben Hssen	4%	5%	6%			4%	2%	16%		***	
Marrakech Tensift Al Haouz	6%	7%	8%			12%	12%	4%		***	**
Oriental	7%	7%	10%		**	10%	13%	2%		***	
Grand Casablanca	32%	29%	7%	*	***	26%	21%	10%		***	
Rabat Salé Zemmour Zaer	15%	16%	11%		***	15%	18%	15%			

Difference in characteristics between groups of formal and informal firms (continued)

	Formal firms					Informal firms					
Variable	TP.	PG.	O.	1 v 2	2 v 3	TP	PG.	O	6 v 7	7 v 8	1 v 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Doukkala Abda	4%	4%	12%	***	***	0%	.	19%		***	***
Meknes Tafilalet	6%	8%	11%		**	10%	8%	11%			
Fes Boulmene	7%	6%	9%		*	8%	7%	7%			
Taza Al Hoceima Taounate	5%	4%	6%		*	4%	5%	4%			
Tanger Tetouan	8%	7%	10%		**	6%	7%	8%			
	100%	100%	100%								
In urban area	66%	63%	54%		***	43%	45%	37%			***
Age	12.47	10.68	9.63	***	**	7.74	6.42	7.50			***
Number of workers	4.75	2.05	1.64	***	***	3.71	1.44	1.38			***
Hours per week	71.77	68.68	69.75	***		67.14	64.47	47.74			*
Wage per worker (month, dirham)	1,188	709	801	***	***	840	642	535	***	***	***
Value add (month, dirham)	27,209	3,794	4,390	***	*	7,923	2,501	1,518	***	***	***
Value add/worker (month, dirham)	4,635	2,227	2,909	***	***	2,096	1,868	1,149		***	***
Revenues (month, dirham)	60,514	10,312	13,339	***	***	16,327	6,977	2,905	***	***	***
Revenues/worker (month, dirham)	10,683	5,892	8,726	***	***	4,545	5,266	2,179		***	***
Capital (dirham)	451,863	91,072	71,326	***	**	104,512	26,605	15,619	***	***	***
Capital/worker (dirham)	73,326	45,568	43,525	***		26,093	17,906	10,710	*	***	***
Finance-related											
Source of initial capital											

Difference in characteristics between groups of formal and informal firms (continued)

	Formal firms					**Informal firms**					
Variable	TP.	PG.	O.	1 v 2	2 v 3	TP	PG.	O	6 v 7	7 v 8	1 v 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Inheritance	13%	11%	8%		*	10%	7%	2%		***	
Own savings	52%	56%	56%			62%	66%	52%		***	*
Liquidation of assets	11%	9%	7%		*	5%	3%	8%		***	***
Formal loan	6%	6%	1%		***	3%	1%	0%		**	
Informal loan	9%	9%	9%			10%	10%	10%			
Own remittances	2%	2%	2%			4%	2%	0%		***	
Others remittances	2%	2%	3%			0%	5%	1%		***	
Other	5%	5%	13%		***	6%	5%	27%		***	
	100%	100%	100%			100%	100%	100%			
Has a current line of credit	25%	14%	20%	***	***	14%	14%	11%			***
Sources of current credit											
Official institution	50%	25%	20%	***		22%	9%	13%			***
Non-business relations	13%	33%	29%	***		31%	37%	52%			*
Other	37%	41%	51%			47%	54%	35%		*	
	100%	100%	100%			100%	100%	100%			
Has a saving facility	74%	69%	67%	**		67%	61%	72%		***	
Type of savings											
Formal	65%	40%	37%	***		51%	13%	8%	***	**	**

Difference in characteristics between groups of formal and informal firms (continued)

	Formal firms					**Informal firms**					
Variable	TP.	PG.	O.	1 v 2	2 v 3	TP	PG.	O	6 v 7	7 v 8	1 v 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Home	25%	50%	53%	***		38%	79%	79%	***		*
Non-business relations	3%	4%	3%			5%	4%	3%			
Others	8%	6%	7%			7%	4%	9%		**	
	100%	100%	100%			100%	100%	100%			
Management-related											
Keep records	55%	32%	26%	***	***	26%	15%	11%	**		***
Hire family	95%	89%	92%	***	**	94%	90%	90%			
Provide workers with written contracts	16%	6%	5%	***		5%	4%	5%			***
Provide workers with paid vacation	24%	11%	9%	***		15%	6%	6%	*		**
Provide workers with training	79%	71%	57%	***	***	78%	57%	65%	***	**	
Use modern equipment all the time	73%	68%	51%	**	***	57%	52%	61%		**	***
Network-related											
In business association	19%	12%	7%	***	***	10%	4%	5%	**		***
In a firm cluster	35%	27%	28%	***		27%	23%	27%			*
Have links with other businesses	47%	38%	44%	***	**	41%	37%	46%		**	
Access to infrastructure											
Has access to water	69%	57%	38%	***	***	36%	33%	41%		**	***
Has access to electricity	99%	98%	96%		**	92%	74%	81%	***	**	***
Has access to roads	90%	84%	81%	***		73%	70%	64%		*	***

Difference in characteristics between groups of formal and informal firms (continued)

	Formal firms					Informal firms					
Variable	TP.	PG.	O.	1 v 2	2 v 3	TP	PG.	O	6 v 7	7 v 8	1 v 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Has access to a landline	43%	23%	17%	***	***	10%	7%	8%			***

Note (1): TP stands for top performer, PG stands for potential gazelle and O for "others". T-tests are run to compare top performers and potential gazelles, potential gazelles and "others" for each subsample of formal and informal firms, as well as formal and informal top performers.

Characteristics in categories, such as education level, economic activity, region, place of work and others show proportions that sum up to 100%. "OLF" stands for out of the labor force.

Note (2): Links to other businesses include producing for other firms, outsourcing to other firms, sharing equipment, jointly working on a project for a client and using other businesses for marketing purposes.

* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.

Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

3.6 Discussion

The identification and comparison of the various groups show significant and noteworthy differences between top performers, potential gazelles and "others." While these differences are not argued as causality, the fact that some of the observations made are robust to various checks highlight the importance of these differences in enterprise formation and growth.

Some of the results come to emphasize what others in the literature have already known, such as the importance of the entrepreneur's education, his/her access to credit and access to infrastructure for the firm's success and growth. However, other aspects are arguably less known in the literature, namely the difference between top performers and potential gazelles when it comes to network-related aspects, as well as to what appears to be retained earning in the form of lower wage per worker among potential gazelles.

These results, naturally, rely on the precision and plausibility of the empirical specification, and in this particular case the exclusion restriction of sector choice. This paper includes the location of the firm in an urban or rural area as the exclusion restriction, arguing that while it affects sector choice, it affects top performance much less. This, of course, can be criticized. One can argue that being in a rural area, for instance, reduces the firm's access to clients and markets, which could consequently affect its success. If the exclusion restriction is violated, the instrumental variable estimators become inconsistent. This would affect the coefficient estimates, including the coefficient of correlation between the error terms.

However, there are two deterrents from improving this specification in a markedly better way. The first relates to the availability of data. There is little in the survey that can be used to explain sector choice that is at the same time not obviously endogenous. The survey does not ask, for instance, why the entrepreneur has chosen this sector of economic activity (aside from it being a family business and consequently not a choice). Secondly, there is remarkably little that the literature can say about sector choice at all. We may know that female entrepreneurs in some countries are more likely to engage in cooking or sewing activities, but this says little about sector choice besides the sex of the entrepreneur and cultural norms - the first accounted for in the paper's specification and the second difficult to measure. This means that little can be learned from other research and what might affect sector choice. Note also that the identification of Equations (3.1) and (3.2) do not necessarily rely an exclusion restriction. It is still possible to rely on the non-linearities of the specifications. The results of these equations without the exclusion restriction to those of the benchmark specification are significantly similar, in terms of coefficients and significance

(Table 3.34), with the exception of significant coefficient of correlation for the Wholesale and retail trade sector as well. The sweeping majority of firms fall into the same categories of potential gazelles and “others” as in the benchmark specification.

In any case, this issue highlights the importance of better and more detailed survey data for micro and small enterprises - all over the world and even more so for low- and middle-income countries. Better data, especially in the form of panel surveys, are needed to trace the beginning of enterprises, their growth and their potential exit from the market. Survey in the future must delve deeper into issues related to enterprise formation, its various production inputs and methods, entrepreneur history and motivation, links to household characteristics, to the community, to infrastructure and much more. This also includes further financial information about initial capital, working-capital, the ability and type of credit and finance facilities...etc. While these various elements are admittedly burdensome for the surveyors, both in terms of financial resources and administrative procedures, they would illuminate an essential part of growth and development in countries. With big data analytics, such burdens may also be alleviated in the near future.

Ultimately, the challenge of micro and small enterprises is a challenge of development.

3.7 Concluding remarks

Morocco, like many other low- and middle-income countries, has a significant share of firms that are considered micro and small enterprises (MSEs) and that employ a large share of the labor force. Despite their small size, these enterprises are not all necessarily at a disadvantage. This paper examines some aspects of heterogeneity of these Moroccan MSEs utilizing a nationally representative survey of 5,210 enterprises.

Using some success criteria and a conditional mixed process where the determinants of top performance are jointly estimated with the sector choice of the firm, the enterprises in the sample are categorized into three groups: (1) Top performers, based on a double criteria of number of workers and value-add per worker; (2) Potential gazelles that have as a group the same average predicted probability of being top performers as the group of top performers, based on a number of entrepreneur and enterprise characteristics, and finally; (3) “Others” that are characteristically different in those aspects.

The paper finds that there is a significant share of firms (more than a quarter) that could be categorized as potential gazelles that appear to be constrained in number of areas, namely: access to credit (and the type of credit) and the ability to have various types of links to other businesses (network). These potential gazelles tend to be more concentrated in services, especially those that relate to business and social services and less so in manufacturing. They tend to pay their workers less wages on average, not only when compared to top performers but also to "others," which may indicate an inclination to retain earnings for business growth. They also appear to struggle in two other areas: management-related such as in keeping business records, using modern equipment and providing certain amenities to their workers, and access to infrastructure.

Moreover, utilizing the fact that the survey includes both registered (formal) and non-registered (informal) firms, as defined by having a tax identification number, the paper examines heterogeneity within each subsample, categorizing the firms again into groups of top performers, potential gazelles and "others." It finds that many of the characteristics and potential constraints found in the overall sample are similar to those found among formal firms (which are the majority of MSEs in the survey). However, informal firms appear to have less heterogeneity. While a potential "upper-tier" exists among informal firms as seen in the share of top performers that are indeed informal, the rest of informal firms are markedly similar to each other in various aspects. It is as if there is a small share of informal firms that appear to do well and can compete with their formal counterparts, while the rest are at a significant disadvantage.

The results also show that while there are some informal firms among the group of top performers, they are markedly different from their formal counterparts, in entrepreneur characteristics, enterprise location and business outcomes, access to credit and type of savings as well as access to infrastructure. Moreover, top-performing formal and informal firms choose their sectors differently. Where they appear to be similar is in areas related to network, such as having business links with other firms. This further emphasizes the importance of network to improve business outcomes.

Finally, the results show that almost all informal firms would theoretically increase their predicted probability of being top performers should they choose to be formal, indicating that the choice of informality may not be to their advantage.

These results are robust to an increase in the share of firms that can be identified as top performers. They highlight some policy implications, particularly in areas that relate to credit and to networks. They also emphasize the importance of access to infrastructure and to the link of management practices to better business performance.

3.8 Appendix

3.8.1 General information on Morocco

Table 3.14: Population in Morocco by census year (in persons)

	Overall		Urban	
	1994	2004	1994	2004
Country	26,073,717	29,891,708	13,421,026	16,463,634
Selected regions				
Grand Casablanca	3,126,785	3,631,061	2,953,224	3,325,539
Rabat-Sala-Zemmour-Zaer	1,985,602	2,366,494	1,565,290	1,919,322
Gharb Chrarda Beni-Hsen	1,625,082	1,859,540	623,958	780,971
Tanger-Tetouan	2,036,032	2,470,372	1,137,963	1,441,921
Meknes Tafilalet	1,903,790	2,141,527	965,682	1,202,487
Fes Boulemane	1,322,473	1,573,055	917,058	1,133,684
Taza Al Hoceima Taounate	1,719,844	1,807,113	371,043	436,663
Oriental	1,768,691	1,918,094	975,978	1,183,355
Doukkala Abda	1,793,458	1,984,039	616,106	713,996
Marrakesh Tansift AlHouz	2,724,204	3,102,652	948,640	1,216,713
Souss Massa Draa	2,635,522	3,113,653	899,239	1,270,961
Total (selected regions)	22,641,483	25,967,600	11,974,181	14,625,612
Proportion of selected to country	*87%*	*87%*	*89%*	*89%*

Source: High Planning Commission, Kingdom of Morocco, General Population and Habitat Census (2004).
Note: These figures cover residents with legal status.

3.8.2 On the top performance definition of number of workers

In their paper, Gindling and Newhouse (2014) defined a successful firm as one that employs more than the entrepreneur him/herself. In this case, 61% of the enterprises in the dataset would qualify as a successful firm. While this may be sufficient for a descriptive binary discussion on successful and unsuccessful firms, this paper aims to delve deeper into the heterogeneity of firms beyond the binary outcome. Such a binary outcome is arguably misleading. Moreover, such a criterion does not only ignore the importance of financial outcomes, but essentially equates a 2-worker firm with a 10-worker firm, for instance, as successful. While they may both be successful, it is much less plausible to think that they are both equally well-performing.

Alternatively, a potential indicator could be hiring at least one-waged worker that is not a family member. While the survey does not ask if each of the additional workers are family member or not, it does ask if the firm hires a family member at all - a binary response of no or yes. The MSEs with at least 2 workers, including the entrepreneur, that do not hire a family member at the same time represent less than 5% of the sample. If these enterprises are defined as the top performers, running the probit and multinomial probit model in Equations (3.1) - (3.3) shows several things. Firstly, the predicted probability of being a top performer that the model can produce drops from nearly 25% in the benchmark model to merely 14% in this case. The correlation coefficients of sector choice and being a top performer are no longer significant, in any of the sectors. The coefficients of variables like age, the sex of the entrepreneur and average years of education become insignificant. The sign of the coefficient of the types of initial capital also significantly change.

Secondly, and more importantly, using this definition, the firms can only be categorized into top performers and "others." This means that no group can be found within the other 95% of the sample that has a similar average probability of being a top performer as the identified group of top performers. This indicates that not only is this definition of top performer far less plausible, but that in the off chance that it is, this model is not a best fit for it.

It is important to note, however, that even the largest and most successful firms respond "yes" to hiring a family worker. Of the firms that hire at least 10 workers in the sample, for instance, about 95% say that they hire family workers. Of the enterprises with the highest 10% of value-added in the sample, about 94% say that they also hire family workers, and so on when it comes to the enterprises with the highest revenues or assets. This indicates that family workers are an important aspect of running micro and small enterprises in Morocco, but that these workers may be part-time or come in occasionally.

If, alternatively, we define top performers as micro and small enterprises that have at least 3 workers, including the entrepreneur, then the share of top-performing firms gets to about 26%. Note that the benchmark double-criteria, in first choosing the top 25% of firms with the highest number of workers essentially isolates the same observations as in this definition - but follows it up with choosing the firms with the highest value-added per worker.

3.8.3 Empirical strategy - illustrative example

Table 3.15 below shows an example of 20 observations. Assume that based on the criteria of number of workers and value-added per worker, the first 5 observations are categorized as top performers, with a binary value of 1 if top performer, and 0 others - as shown in column (2). Assume, then, that Equations (3.1)-(3.3) produce the predicted probability of being a top performer for each individual observation, as shown in column (3). From these predicted probabilities, we can calculate the average of predicted probability of the group of top performers, i.e. for observations 1-5, as 0.46, as shown in column (4).

Then, sorting the rest of the predicted probabilities for the observations that are not top performers from highest probability to lowest (column (3) after the horizontal line), we can calculate a rolling average, as shown in column (4). Once this rolling average hits 0.46, highlighted in blue, we can say that the group of potential gazelles is identified. These are observations numbered 6-12 - which have been sorted for illustrative convenience. Finally, column (5) categorizes the firms into the three types such that: 1/ is the group of top performers, 2/ is the group of potential gazelles, and 3/ is the group of “others”. In this case, the group of “others” has an average predicted probability of 0.14 (not shown in the table, but simply calculated).

Table 3.15: Illustrative example of identifying potential gazelles and “others”

(1) Observation number	(2) Top performer	(3) Predicted Probability (Equation 3)	(4) Rolling average	(5) Firm type
1	1	0.40		1
2	1	0.60		1
3	1	0.10	0.46	1
4	1	0.50		1
5	1	0.70		1
6	0	0.70	0.70	2
7	0	0.66	0.68	2
8	0	0.50	0.62	2
9	0	0.49	0.59	2
10	0	0.33	0.54	2
11	0	0.32	0.50	2
12	0	0.22	0.46	2
13	0	0.21	0.43	3
14	0	0.20	0.40	3
15	0	0.18	0.38	3
16	0	0.16	0.36	3
17	0	0.10	0.34	3
18	0	0.09	0.32	3
19	0	0.08	0.30	3
20	0	0.07	0.29	3

3.8.4 Registration and informality

The survey asks a number of questions to ascertain the formality/informality of the firm. The first type of questions pertains to the class of registration that a firm currently holds (if any), which are:

1. Commercial registration (q84).
2. Official authorization (q87).
3. Official tax card (q91).
4. Registered under social security - CNSS (q94).

Further to registration, the survey asks if the enterprise keeps records of its business transactions and financials (q98).

The tables below show the proportions that commercial registration (CR) concerns persons or companies that operate a number of defined activities. Under the Moroccan Commercial Law (15-95) published in official journals on the 3rd of October, 1996, Section (2), Article (6), these commercial activities are defined as the following:

- The purchase of tangible or intangible property for resale in kind or after having worked and implemented or for the purpose of renting.
- The rental of tangible or intangible furniture for the purpose of subletting.
- The purchase of immovable property for resale in the state or after processing.
- Research and exploitation of mines and quarries.
- Industrial or craft activity.
- Transportation.
- Banking, credit and financial transactions.
- Fixed premium insurance operations.
- Brokerage, commission and all other brokerage transactions.
- The operation of warehouses and general stores.
- Printing and publishing whatever form and medium.
- Building and public works.
- Offices and agencies for business, travel, information and advertising.
- The supply of products and services.
- The organization of public spectacles.
- Public auction.
- Distribution of water, electricity and gas.
- Posts and telecommunications.

Official authorization, however, relates to the authorization of exercising the specific economic activity of the firm, which may be obtained from various government institutions that regulate the specific industry/economic activity.

Table 3.16: Proportions by types of registration and keeping records

	(1*)	(2*)		(1*)	(2*)
Commercial/industrial registration			**Social security**		
No	41.20%	41.17%	No	71.74%	71.64%
yes	38.68%	38.65%	Yes	7.65%	7.64%
Not required	20.11%	20.10%	Not required	20.60%	20.57%
Missing		0.08%	Missing		0.14%
	100%	100%		100%	100%
No. of observations	5,206	5,210	No. of observations	5,200	5,210
Official license			**Keeping records**		
No	21.5%	21.5%	No	71.1%	70.5%
Yes	62.5%	62.4%	Yes	28.9%	28.7%
Not required	16.0%	16.0%	Missing		0.9%
Missing		0.2%	No. of observations	5,160	5,210
	100%	100%		100%	100%
No. of observations	5,201	5,210			
Tax registration					
No	19.3%	19.2%			
Yes	67.1%	66.9%			
Not required	13.6%	13.6%			
Missing		0.3%			
	100%	100%			
No. of observations	5,197	5,210			

Source: MSE Survey, 2002 (ERF - Morocco).
Note: Column (1) displays proportions eliminating the missing observations, while Column (2) includes missing observations. Survey weights are used.

3.8.5 Results

3.8.5.1 Identification of the groups: Alternative definitions

Table 3.17: Probability of being a top performer (Definition: top 10% of value-added per worker)

Variable	Coefficient	Variable	Coefficient
Entrepreneur's age	0.003	Region	
Entrepreneur's age-squared	0.000	Souss Massa Draa	
		Gharb chrarda ben hssen	-0.362**
Female	Ref.	Marrakech tensift al haouz	-0.456***
Male	0.214	Oriental	-0.315**
		Grand casablanca	0.225*
Education attainment (years)	0.025***	Rabat salé zemmour zaer	-0.054
Had an apprenticeship	0.020	Doukkala abda	-0.691***
Entrepreneurial motivation	0.104*	Méknès tafilalet	-0.598***
		Fès boulmène	-0.184
Economic Activity		Taza al hoceima taounate	-0.076
Manufacturing	Ref.	Tanger tétouan	-0.161
Wholesale & retail trade	1.319***		
Food & accommodation	0.684	Previous labor force participation	
Business, social and other services	1.531***	Employed	
Construction, repair and other	-0.064	Unemployed	0.068
		OLF - full time student	-0.050
Initial capital		OLF - housewife	-0.257
Inheritance	Ref.	OLF - did not desire to work	0.101
Own savings	-0.078	OLF - disabled	0.000
Liquidation of assets	0.140	OLF - military service	-0.524 *
Formal loan	0.155		
Informal loan	-0.088	Constant	-2.481***
Own remittances	-0.020		
Others remittances	-0.139	ρ_{13}	-0.538
Other	-0.273	ρ_{14}	-0.215
		ρ_{15}	-0.768***
		ρ_{16}	-0.046

Note (1): The are the results to Equations (3.1) and (3.2).
Note (2): "OLF" stands for out of the labor force. Number 1 in $\rho_1 x$ stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

Table 3.18: Distribution of firms (Definition: top 10% of value-added per worker)

	Observations	Weighted shares
Top performers	700	10%
Potential gazelles	2,480	51%
Others	1,859	39%
	5,039	100%

Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

Table 3.19: Probability of being a top performer (Definition: number of workers)

Variable	Coefficient	Variable	Coefficient
Entrepreneur's age	0.042***	Region	
Entrepreneur's age-squared	0.000**	Souss Massa Draa	
		Gharb chrarda ben hssen	0.100
Female	Ref.	Marrakech tensift al haouz	0.087
Male	0.439***	Oriental	-0.041
		Grand casablanca	0.247**
Education attainment (years)	0.030***	Rabat salé zemmour zaer	0.014
		Doukkala abda	-0.175
Entrepreneurial motivation	0.291***	Méknès tafilalet	0.082
		Fès boulmène	0.035
Economic Activity		Taza al hoceima taounate	-0.028
Manufacturing	Ref.	Tanger tétouan	-0.083
Wholesale & retail trade	-1.023***		
Food & accommodation	0.514	Previous labor force participation	
Business, social and other services	0.583***	Employed	
Construction, repair and other	0.931***	Unemployed	-0.301***
		OLF - full time student	-0.016
Initial capital		OLF - housewife	-0.448***
Inheritance	Ref.	OLF - did not desire to work	0.351
Own savings	-0.334***	OLF - disabled	0.095
Liquidation of assets	-0.089	OLF - military service	-0.337
Formal loan	0.010		
Informal loan	-0.329***	Constant	-1.888***
Own remittances	-0.016		
Others remittances	-0.632***	ρ_{13}	0.162
Other	-0.546***	ρ_{14}	-0.114
		ρ_{15}	-0.672***
		ρ_{16}	-0.577***

Note (1): The are the results to Equations (3.1) and (3.2).
Note (2): "OLF" stands for out of the labor force. Number 1 in ρ_1x stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

Table 3.20: Distribution of firms (Definition: Number of workers)

	Observations	Weighted shares
Top performers	1,935	26%
Potential gazelles	1,483	33%
Others	1,621	41%
	5,039	100%

Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

Table 3.21: Probability of being a top performer (Definition: inverse double-criteria)

Variable	Coefficient	Variable	Coefficient
Entrepreneur's age	0.031**	region	
Entrepreneur's age-squared	0.000	Souss Massa Draa	
		Gharb chrarda ben hssen	-0.596 ***
Female	Ref.	Marrakech tensift al haouz	-0.102
Male	0.304***	Oriental	-0.416**
		Grand casablanca	0.360***
Education attainment (years)	0.048***	Rabat salé zemmour zaer	-0.044
Had an apprenticeship	0.177	Doukkala abda	-0.506***
Entrepreneurial motivation	0.194***	Méknès tafilalet	-0.394***
		Fès boulmène	-0.337**
Economic Activity		Taza al hoceima taounate	-0.100
Manufacturing	Ref.	Tanger tétouan	-0.210
Wholesale & retail trade	-0.157		
Food & accommodation	1.326	lfp_prev	
Business, social and other services	0.713***	Employed	
Construction, repair and other	0.269	Unemployed	-0.338***
		OLF - full time student	-0.049
Initial capital		OLF - housewife	-0.198
Inheritance	Ref.	OLF - did not desire to work	0.309
Own savings	-0.375***	OLF - disabled	0.445
Liquidation of assets	-0.083	OLF - military service	-0.451
Formal loan	0.187		
Informal loan	-0.406***	Constant	-2.465***
Own remittances	-0.053		
Others remittances	-0.682***	ρ_{13}	-0.538
Other	-0.740***	ρ_{14}	-0.215
		ρ_{15}	-0.768***
		ρ_{16}	-0.046

Note (1): The are the results to Equations (3.1) and (3.2).
Note (2): "OLF" stands for out of the labor force. Number 1 in $\rho_1 x$ stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

Table 3.22: Distribution of firms (Definition: Inverse criteria)

	Observations	Weighted shares
Top performers	1,265	15%
Potential gazelles	1,429	28%
Others	2,345	57%
	5,039	100%

Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

3.8.6 Characteristic differences

3.8.6.1 The benchmark double-criteria

Table 3.23: Motivation for starting a business by the previous status with respect to the labor market

			Out of labor force				
	Employed	Unemployed	Student	Housewife	No desire to work	Disabled	Military
Suits qualifications	14%	11%	19%	8%	8%	5%	3%
Has experience in business	33%	13%	10%	20%	9%	11%	10%
Capital requirements reasonable	3%	5%	2%	6%	23%	-	5%
Family business	6%	13%	26%	7%	27%	42%	2%
Desire to set up new enterprise	14%	8%	6%	7%	4%	4%	17%
To improve living conditions	14%	19%	9%	37%	15%	-	33%
Only option available	12%	27%	24%	11%	12%	17%	13%
Other	4%	4%	3%	4%	1%	22%	18%

Note: LFP stands for labor force participation.
Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

Table 3.24: Sector regressions (compared to Manufacturing) in the conditional mixed process

	Trade		Food & Acc.		Business, social & other services		Construction, repair & others	
Variable	Coefficient	St. Error	Coefficient	St. Error	Coefficient	St. Error	Coefficient	St. Error
Entrepreneur's age	-0.023	(0.017)	0.018	(0.025)	-0.063***	(0.019)	-0.028	(0.022)
Entrepreneur's age-squared	0.000*	(0.000)	0.000	(0.000)	0.001***	(0.000)	0.000	(0.000)
Female	Ref.		Ref.		Ref.		Ref.	
Male	1.528***	(0.095)	1.296***	(0.129)	0.681***	(0.096)	2.151***	(0.237)
Years of education	0.058***	(0.009)	0.069***	(0.011)	0.106***	(0.010)	0.016	(0.012)
Region								
Sous Massa Draa	Ref.		Ref.		Ref.		Ref.	
Gharb Chrarda ben Hssen	-0.594***	(0.213)	0.052	(0.271)	-0.189	(0.233)	0.229	(0.266)
Marrakech Tensift Al Haouz	-0.469***	(0.179)	-0.022	(0.221)	-0.616***	(0.201)	0.026	(0.228)
Oriental	-0.268	(0.187)	0.398	(0.231)	-0.261	(0.211)	0.310	(0.228)
Grand Casablanca	-0.734***	(0.154)	-0.075	(0.195)	-0.323*	(0.170)	0.165	(0.191)
Rabat Salé Zemmour Zaer	-0.362**	(0.166)	-0.031	(0.206)	0.013	(0.181)	0.158	(0.207)
Doukkala Abda	-0.524***	(0.193)	-0.268	(0.245)	-0.515***	(0.220)	-0.433	(0.266)
Méknès Tafilalet	-0.776***	(0.178)	-0.117	(0.233)	-0.630***	(0.206)	-0.072	(0.238)
Fès Boulmène	-0.101	(0.194)	0.586**	(0.237)	0.026	(0.216)	-0.255	(0.292)
Taza Al Hoceima Taounate	-0.265	(0.204)	0.316	(0.254)	-0.332	(0.227)	-0.016	(0.277)
Tanger Tétouan	-0.005	(0.188)	0.337	(0.233)	0.075	(0.208)	0.161	(0.259)
Rural	Ref.		Ref.		Ref.		Ref.	
Urban	0.252***	(0.082)	0.301***	(0.103)	-0.066	(0.092)	-0.021	(0.105)
Constant	-0.424	(0.397)	-2.741***	(0.550)	0.064	(0.420)	-2.375***	(0.563)

* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

Table 3.25: Probability of being a top performer (simple probit model)

Variable	Coefficient		St. error	Marginal effect
Entrepreneur's age	0.033	***	(0.012)	0.006
Entrepreneur's age-squared	0.000		(0.000)	0.000
Female	Ref.			
Male	0.400	***	(0.086)	0.069
Years of education attained	0.068	***	(0.006)	0.012
Entrepreneurial motivation	0.202	***	(0.053)	0.035
Had an apprenticeship	0.159	***	(0.058)	0.027
Initial Capital				
Own savings	-0.255	***	(0.083)	-0.044
Liquidation of assets	0.066		(0.105)	0.011
Formal loan	0.246	*	(0.143)	0.042
Informal loan	-0.316	***	(0.109)	-0.054
Own remittances	0.049		(0.179)	0.008
Others remittances	-0.569	***	(0.198)	-0.098
Other	-0.684	***	(0.126)	-0.118
Economic activity				
Wholesale & retail trade	-0.364	***	(0.069)	-0.063
Food & accommodation	0.503	***	(0.099)	0.087
Business, social and other servi..	-0.044		(0.076)	-0.008
Construction, repair and other	-0.010		(0.103)	-0.002
Region				
Gharb Chrarda ben Hssen	-0.591	***	(0.186)	-0.102
Marrakech Tensift Al Haouz	-0.201	*	(0.113)	-0.035
Oriental	-0.480	***	(0.162)	-0.083
Grand Casablanca	0.378	***	(0.090)	0.065
Rabat Salé Zemmour Zaer	-0.032		(0.097)	-0.005
Doukkala Abda	-0.685	***	(0.165)	-0.118

Probability of being a top performer (simple probit model, continued)

Variable	Coefficient		St. error	Marginal effect
Méknès Tafilalet	-0.553	***	(0.147)	-0.095
Fès Boulmène	-0.335	**	(0.134)	-0.058
Taza Al Hoceima Taounate	-0.131		(0.133)	-0.023
Tanger Tétouan	-0.183		(0.123)	-0.032
Prior labor force participation				
Employed	Ref.			
Unemployed	-0.347	***	(0.089)	-0.060
OLF - full time student	-0.052		(0.078)	-0.009
OLF - housewife	-0.279		(0.192)	-0.048
OLF - did not desire to work	0.466	*	(0.276)	0.080
OLF - disabled	0.253		(0.349)	0.044
OLF - military service	-0.374		(0.337)	-0.064
Constant	-2.636	***	(0.302)	
Number of observations	5,039			
Pseudo R-squared	0.182			

Note: "OLF" stands for out of the labor force. Prior labor force participation means the type of participation before joining/launching the entrepreneurial activity.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

3.8.6.2 Alternative definitions

Table 3.26: Difference in characteristics between groups (top performer as 10% of value-added per worker)

Variable	Top (1)	P. Gazelles (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Entrepreneur characteristics					
Age	37.7	37.5	37.6		
Male	91%	87%	68%	**	***
Years of education	7.5	6.6	4.3	***	***

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Education					
None	23%	28%	52%	**	***
Primary	11%	10%	9%		
Intermediate	35%	39%	29%		***
Secondary	21%	16%	8%	**	***
University	11%	7%	2%	**	***
Had an apprenticeship	54%	49%	71%		
Had technical training	11%	13%	12%		
Ever married	0.6	0.6	0.7		***
Number of children	1.7	1.9	2.1	***	**
Previous labor force participation					
Employed	66%	65%	62%		*
Unemployed	13%	14%	11%		*
OLF - full-time student	18%	18%	12%		***
OLF - housewife	1%	2%	11%		***
OLF - no desire to work	1%	1%	1%		
OLF - disabled	.	0%	1%	**	
OLF - military service	0%	1%	2%		***
Enterprise characteristics					
Sectors					
Manufacturing	8%	0%	60%	***	***
Wholesale & retail trade	61%	64%	14%		***
Food & accommodation	7%	4%	12%	**	***
Business, social and other services	22%	32%	1%	***	***
Construction, repair and other	2%	.	13%	***	***
Regions					
Sous Massa Draa	11%	9%	3%		***
Gharb Chrarda Ben Hssen	4%	6%	7%	**	

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Marrakech Tensift Al Haouz	4%	7%	9%	***	
Oriental	6%	9%	7%	**	*
Grand Casablanca	30%	18%	17%	***	
Rabat Salé Zemmour Zaer	18%	17%	11%	***	
Doukkala Abda	2%	4%	15%	*	***
Meknes Tafilalet	2%	5%	16%	***	***
Fes Boulmene	7%	9%	5%		***
Taza Al Hoceima Taounate	6%	6%	3%		***
Tanger Tetouan	10%	10%	6%		***
In urban area	61%	56%	48%	*	***
Age	10.9	9.4	9.2	***	
Number of workers	3.4	2.0	2.3	***	***
Hours per week	72	70	59	**	***
Wage per worker (month, dirham)	1508	703	718	***	
Value add (month, dirham)	44,856	3,744	3,642	***	
Value add/worker (month, dirham)	11,701	1,832	1,390	***	***
Revenues (month, dirham)	98,299	11,311	8,472	***	***
Revenues/worker (month, dirham)	27,276	5,668	3,295	***	***
Capital (dirham)	548,444	90,669	74,989	***	
Capital/worker (dirham)	130,339	37,890	19,719	***	***
Finance-related					
Source of initial capital					
Inheritance	10%	9%	7%		***
Own savings	54%	58%	55%		
Liquidation of assets	11%	8%	6%	*	**
Formal loan	5%	4%	1%		***
Informal loan	9%	9%	10%		
Own remittances	2%	2%	1%		*
Others remittances	2%	2%	3%		
Other	6%	8%	16%		***

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Has a current line of credit	26%	18%	14%	***	***
Sources of current credit					
Official institution	52%	22%	22%	***	
Non-business relations	14%	27%	39%	***	***
Other	34%	51%	39%	***	***
Has a saving facility	70%	65%	72%	*	***
Type of savings					
Formal	75%	37%	24%	***	***
Home	19%	53%	65%	***	***
Non-business relations	2%	3%	3%		
Others	4%	7%	8%	**	
Management-related					
Keep records	63%	29%	19%	***	***
Hire family	92%	90%	93%		***
Provide workers with written contracts	18%	5%	7%	***	
Provide workers with paid vacation	25%	11%	9%	***	**
Provide workers with training	69%	61%	71%	***	***
Use modern equipment all the time	70%	53%	66%	***	***
Network-related					
In business association	15%	9%	9%	***	
In a firm cluster	32%	25%	31%	***	***
Have links with other businesses	41%	36%	51%	*	***
Access to infrastructure					
Has access to water	60%	44%	48%	***	*
Has access to electricity	98%	91%	91%	***	
Has access to roads	92%	77%	77%		
Has access to a landline	48%	21%	12%	***	***

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)

Note (1): Characteristics in categories, such as education level, economic activity, region, place of work and others show proportions that sum up to 100%. "OLF" stands for out of the labor force. Number 1 in $\rho_1 x$ stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
Note (2): Links to other businesses include producing for other firms, outsourcing to other firms, sharing equipment, jointly working on a project for a client and using other businesses for marketing purposes.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

Table 3.27: Difference in characteristics between groups (top perform as 3 workers or more)

Variable	Top (1)	P. Gazelles (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Entrepreneur characteristics					
Age	39.3	37.6	36.4	***	**
Male	88%	80%	75%	***	**
Years of education	6.5	6.5	4.8		***
Education					
None	29%	27%	48%		***
Primary	10%	10%	9%		
Intermediate	34%	41%	30%	***	***
Secondary	16%	17%	9%		***
University	10%	5%	3%	***	*
Had an apprenticeship	68%	64%	47%		***
Had technical training	14%	21%	5%	***	***
Ever married	69%	61%	60%	***	
Number of children	1.9	1.9	2.0		
Previous labor force participation					
Employed	73%	66%	57%	***	***
Unemployed	8%	12%	16%	***	***
OLF - full-time student	15%	18%	15%		**
OLF - housewife	2%	3%	10%		***

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
OLF - no desire to work	1%	1%	1%		
OLF - disabled	1%	0%	0%		
OLF - military service	1%	1%	1%		
Enterprise characteristics					
Sectors					
Manufacturing	30%	28%	17%		***
Wholesale & retail trade	23%	13%	83%	***	***
Food & accommodation	15%	10%	0%	***	***
Business, social and other services	22%	40%	0%	***	***
Construction, repair and other	10%	8%	0%	*	***
Regions					
Sous Massa Draa	5%	6%	9%		***
Gharb Chrarda Ben Hssen	7%	8%	5%		**
Marrakech Tensift Al Haouz	7%	7%	8%		
Oriental	7%	8%	9%		
Grand Casablanca	28%	23%	10%	***	***
Rabat Salé Zemmour Zaer	14%	15%	14%		
Doukkala Abda	4%	6%	12%		***
Meknes Tafilalet	8%	8%	10%		
Fes Boulmene	7%	8%	7%		
Taza Al Hoceima Taounate	5%	4%	6%		*
Tanger Tetouan	7%	7%	10%		**
In urban area	61%	60%	43%		***
Age	11.4	9.1	8.6	***	
Number of workers	4.6	1.6	1.4	***	***
Hours per week	69.7	64.4	64.0	***	
Wage per worker (month, dirham)	1,010	719	708	***	
Value add (month, dirham)	20,374	3,354	3,537	***	
Value add/worker (month, dirham)	3,571	2,109	2,488	***	***
Revenues (month, dirham)	46,237	7,934	10,601	***	***

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Revenues/worker (month, dirham)	8,352	4,976	7,515	***	***
Capital (dirham)	363,381	54,899	45,364	***	**
Capital/worker (dirham)	59,678	35,051	31,589	***	
Finance-related					
Source of initial capital					
Inheritance	12%	10%	5%		***
Own savings	54%	53%	61%		***
Liquidation of assets	10%	9%	5%		***
Formal loan	5%	4%	1%		***
Informal loan	9%	11%	8%		*
Own remittances	2%	2%	1%		
Others remittances	1%	3%	3%		
Other	6%	9%	15%		***
Has a current line of credit	21%	14%	17%	***	**
Sources of current credit					
Official institution	47%	26%	12%	***	***
Non-business relations	17%	39%	31%	***	
Other	37%	35%	57%		***
Has a saving facility	72%	66%	68%	***	
Type of savings					
Formal	57%	32%	24%	***	***
Home	32%	59%	66%	***	***
Non-business relations	3%	4%	3%		
Others	9%	5%	7%	**	
Management-related					
Keep records	47%	26%	19%	***	***
Hire family	94%	91%	94%	***	***
Provide workers with written contracts	14%	5%	5%	***	

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Provide workers with paid vacation	20%	11%	9%	***	
Provide workers with training	77%	71%	61%	***	***
Use modern equipment all the time	69%	66%	49%		***
Network-related					
In business association	17%	9%	5%	***	***
In a firm cluster	34%	24%	28%	***	*
Have links with other businesses	47%	37%	44%	***	***
Access to infrastructure					
Has access to water	65%	52%	32%	***	***
Has access to electricity	98%	94%	85%	***	***
Has access to roads	86%	78%	75%	***	
Has access to a landline	36%	17%	12%	***	***

Note (1): Characteristics in categories, such as education level, economic activity, region, place of work and others show proportions that sum up to 100%. "OLF" stands for out of the labor force. Number 1 in $\rho_1 x$ stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
Note (2): Links to other businesses include producing for other firms, outsourcing to other firms, sharing equipment, jointly working on a project for a client and using other businesses for marketing purposes.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

Table 3.28: Difference in characteristics between groups (top performer as the inverse of the benchmark criteria)

Variable	Top (1)	P. Gazelles (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Entrepreneur characteristics					
Age	40.2	39.4	36.0		***
Male	89%	87%	74%		***
Years of education	7.2	7.0	4.8		***
Education					
None	25%	23%	46%		***
Primary	11%	9%	9%		

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Intermediate	35%	40%	32%	**	***
Secondary	18%	21%	9%		***
University	12%	7%	3%	***	***
Had an apprenticeship	68%	64%	53%	*	***
Had technical training	14%	18%	10%	***	***
Ever married	72%	65%	60%	***	**
Number of children	1.9	1.9	2.0		
Previous labor force participation					
Employed	74%	70%	58%		***
Unemployed	7%	8%	17%		***
OLF - full-time student	15%	18%	15%		**
OLF - housewife	2%	2%	8%		***
OLF - no desire to work	1%	1%	1%		
OLF - disabled	1%	1%	0%		
OLF - military service	1%	1%	1%		
Enterprise characteristics					
Sectors					
Manufacturing	25%	12%	30%	***	***
Wholesale & retail trade	29%	23%	59%	***	***
Food & accommodation	16%	16%	0%		***
Business, social and other services	23%	41%	7%	***	***
Construction, repair and other	8%	8%	4%		***
Regions					
Sous Massa Draa	1%	7%	7%		
Gharb Chrarda Ben Hssen	3%	3%	9%		***
Marrakech Tensift Al Haouz	6%	7%	8%		
Oriental	5%	5%	10%		***

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Grand Casablanca	37%	34%	7%		***
Rabat Salé Zemmour Zaer	16%	17%	13%		***
Doukkala Abda	3%	2%	12%		***
Meknes Tafilalet	4%	4%	12%		***
Fes Boulmene	6%	7%	8%		
Taza Al Hoceima Taounate	5%	5%	5%		
Tanger Tetouan	8%	7%	9%		**
In urban area	65%	63%	46%		***
Age	12.7	10.7	8.1	***	***
Number of workers	4.9	2.1	1.7	***	***
Hours per week	72.1	68.7	62.4	***	***
Wage per worker (month, dirham)	1,301	697	701	***	
Value add (month, dirham)	32,857	3,858	3,214	***	***
Value add/worker (month, dirham)	5,544	2,151	2,125	***	
Revenues (month, dirham)	72,979	10,671	8,803	***	***
Revenues/worker (month, dirham)	12,789	5,750	5,906	***	
Capital (dirham)	524,588	93,636	45,610	***	***
Capital/worker (dirham)	83,201	44,006	26,779	***	***
Finance-related					
Source of initial capital					
Inheritance	13%	12%	6%		***
Own savings	52%	55%	58%		*
Liquidation of assets	11%	11%	5%		***
Formal loan	7%	5%	1%		***
Informal loan	8%	9%	10%		
Own remittances	3%	2%	1%		*
Others remittances	1%	2%	3%		**
Other	4%	4%	16%		***
Has a current line of credit	26%	16%	16%	***	

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)
Sources of current credit					
Official institution	51%	23%	18%	***	
Non-business relations	9%	32%	36%	***	
Other	40%	45%	46%		
Has a saving facility	72%	70%	67%		*
Type of savings					
Formal	70%	38%	24%	***	***
Home	18%	52%	65%	***	***
Non-business relations	3%	4%	3%		
Others	8%	6%	7%		
Management-related					
Keep records	60%	32%	18%	***	***
Hire family	95%	89%	92%	***	**
Provide workers with written contracts	19%	6%	5%	***	
Provide workers with paid vacation	27%	10%	8%	***	**
Provide workers with training	81%	73%	58%	***	***
Use modern equipment all the time	73%	64%	55%	***	***
Network-related					
In business association	21%	11%	6%	***	***
In a firm cluster	34%	25%	28%	***	*
Have links with other businesses	47%	34%	46%	***	***
Access to infrastructure					
Has access to water	69%	59%	36%	***	***
Has access to electricity	99%	95%	88%	***	***
Has access to roads	91%	83%	74%	***	***
Has access to a landline	47%	22%	12%	***	***

Difference in characteristics between groups (continued)

Variable	Top (1)	P. Gazelle (2)	Others (3)	t-test (1 v. 2)	t-test (2 vs. 3)

Note (1): Characteristics in categories, such as education level, economic activity, region, place of work and others show proportions that sum up to 100%. "OLF" stands for out of the labor force. Number 1 in $\rho_1 x$ stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
Note (2): Links to other businesses include producing for other firms, outsourcing to other firms, sharing equipment, jointly working on a project for a client and using other businesses for marketing purposes.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

3.8.7 Formal and informal firms

Table 3.29: Results of conditional mixed process for formal and informal firms

Variable	Coefficient		Standard error	Marginal effect
Formal Firms (Outcome 1)				
Entrepreneur's age	0.026	*	(0.014)	0.005
Entrepreneur's age squared	0.000		(0.000)	0.000
Female	Ref.			
Male	0.175		(0.112)	0.036
Years of education	0.054	***	(0.008)	0.011
Entrepreneurial motivation	0.180	***	(0.060)	0.037
Initial capital				
Inheritance	Ref.			
Own savings	-0.195	**	(0.088)	-0.040
Liquidation of assets	0.112		(0.113)	0.023
Formal loan	0.191		(0.147)	0.039
Informal loan	-0.253	**	(0.122)	-0.052
Own remittances	0.048		(0.197)	0.010
Others remittances	-0.482	**	(0.221)	-0.099
Other	-0.591	***	(0.141)	-0.121
Sector of economic activity				
Manufacturing	Ref.			
Wholesale & retail trade	-0.529	**	(0.206)	-0.109

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
Food & accommodation	0.324		(0.660)	0.067
Business, social and other servi..	-0.239		(0.310)	-0.049
Construction, repair and other	-0.173		(0.458)	-0.036
Region				
Souss Massa Draa	Ref.			
Gharb Chrarda Ben Hssen	-0.541	**	(0.214)	-0.111
Marrakech Tensift Al Haouz	-0.172		(0.130)	-0.035
Oriental	-0.539	***	(0.185)	-0.111
Grand Casablanca	0.392	***	(0.107)	0.080
Rabat Salé Zemmour Zaer	0.031		(0.110)	0.006
Doukkala Abda	-0.667	***	(0.178)	-0.137
Méknès Tafilalet	-0.586	***	(0.161)	-0.120
Fès Boulmène	-0.348	**	(0.150)	-0.071
Taza Al Hoceima Taounate	-0.173		(0.154)	-0.036
Tanger Tétouan	-0.186		(0.135)	-0.038
Prior labor force participation				
Employed	Ref.			
Unemployed	-0.333	***	(0.101)	-0.068
OLF - full time student	-0.074		(0.084)	-0.015
OLF - housewife	-0.176		(0.251)	-0.036
OLF - did not desire to work	0.607	*	(0.354)	0.125
OLF - Disabled	0.202		(0.456)	0.041
OLF - military service	-0.454		(0.357)	-0.093
Constant	-1.799	***	(0.378)	
Informal Firms (Outcome 2)				
Entrepreneur's age	0.036		(0.038)	0.0023
Entrepreneur's age squared	0.000		(0.000)	0.0000
Female	Ref.			
Male	1.116	***	(0.416)	0.0717
Years of education	0.052	**	(0.022)	0.0033
Entrepreneurial motivation	0.262	*	(0.155)	0.0168

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
Initial capital				
Inheritance	Ref.			
Own savings	-0.025		(0.315)	-0.0016
Liquidation of assets	-0.009		(0.383)	-0.0006
Formal loan	0.203		(0.473)	0.0130
Informal loan	-0.005		(0.351)	-0.0003
Own remittances	0.307		(0.534)	0.0197
Others remittances	0.000		-	-
Other	-0.546		(0.398)	-0.0350
Sector of economic activity				
Manufacturing	Ref.			
Wholesale & retail trade	-0.650		(1.176)	-0.0418
Food & accommodation	-0.442		(1.340)	-0.0284
Business, social and other servi..	-0.056		-	-
Construction, repair and other	0.269		(0.784)	0.0172
Region				
Souss Massa Draa	Ref.			
Gharb Chrarda Ben Hssen	0.000		-	0.0000
Marrakech Tensift Al Haouz	0.057		(0.326)	0.0037
Oriental	0.153		(0.446)	0.0098
Grand Casablanca	0.585	*	(0.347)	0.0376
Rabat Salé Zemmour Zaer	0.135		(0.332)	0.0086
Doukkala Abda	0.000		-	-
Méknès Tafilalet	-1.205	***	(0.423)	-0.0774
Fès Boulmène	-0.400		(0.451)	-0.0257
Taza Al Hoceima Taounate	0.325		(0.331)	0.0208
Tanger Tétouan	0.086		(0.376)	0.0055
Prior labor force participation				
Employed	Ref.			
Unemployed	-0.313		(0.258)	-0.0201
OLF - full time student	-0.092		(0.254)	-0.0059

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
OLF - housewife	0.705		(0.485)	0.0453
OLF - did not desire to work	0.858	*	(0.475)	0.0551
OLF - Disabled	0.350		(0.636)	0.0225
OLF - military service	0.000		-	-
Constant	-3.997	***	(0.932)	
Wholesale & retail trade (Outcome 3_4)				
Entrepreneur's age	0.002		(0.026)	
Entrepreneur's age squared	0.000		(0.000)	
Female	Ref.			
Male	0.824	***	(0.103)	
Years of education	0.007		(0.009)	
Region				
Souss Massa Draa	Ref.			
Gharb Chrarda Ben Hssen	-0.460	**	(0.208)	
Marrakech Tensift Al Haouz	-0.222		(0.168)	
Oriental	-0.246		(0.165)	
Grand Casablanca	-0.517	***	(0.142)	
Rabat Salé Zemmour Zaer	-0.312	**	(0.151)	
Doukkala Abda	-0.227		(0.184)	
Méknès Tafilalet	-0.447	**	(0.174)	
Fès Boulmène	-0.166		(0.174)	
Taza Al Hoceima Taounate	-0.185		(0.188)	
Tanger Tétouan	-0.100		(0.164)	
Urban	Ref.			
Rural	0.174	**	(0.079)	
Constant	-0.765		(0.501)	
Food & Accommodation (Outcome 3_5)				
Entrepreneur's age	0.038		(0.029)	
Entrepreneur's age squared	0.000		(0.000)	
Female				

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
Male	0.403	***	(0.111)	
Years of education	0.016		(0.010)	
Region				
Souss Massa Draa	Ref.			
Gharb Chrarda Ben Hssen	0.283		(0.262)	
Marrakech Tensift Al Haouz	0.265		(0.218)	
Oriental	0.452	**	(0.226)	
Grand Casablanca	0.249		(0.188)	
Rabat Salé Zemmour Zaer	0.104		(0.197)	
Doukkala Abda	0.094		(0.237)	
Méknès Tafilalet	0.296		(0.226)	
Fès Boulmène	0.532	**	(0.222)	
Taza Al Hoceima Taounate	0.414	*	(0.249)	
Tanger Tétouan	0.249		(0.225)	
Urban	Ref.			
Rural	0.163		(0.100)	
Constant	-2.921	***	(0.577)	
Business, social & other services (Outcome 3_6)				
Entrepreneur's age	-0.039		(0.028)	
Entrepreneur's age squared	0.001	**	(0.000)	
Female	Ref.			
Male	-0.176	*	(0.102)	
Years of education	0.056	***	(0.009)	
Region				
Souss Massa Draa	Ref.			
Gharb Chrarda Ben Hssen	0.076		(0.238)	
Marrakech Tensift Al Haouz	-0.283		(0.205)	
Oriental	-0.163		(0.214)	
Grand Casablanca	0.038		(0.171)	
Rabat Salé Zemmour Zaer	0.178		(0.180)	
Doukkala Abda	-0.154		(0.226)	

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
Méknès Tafilalet	-0.185		(0.211)	
Fès Boulmène	0.035		(0.210)	
Taza Al Hoceima Taounate	-0.179		(0.232)	
Tanger Tétouan	0.030		(0.205)	
Urban	Ref.			
Rural	-0.179	*	(0.093)	
Constant	-0.296		(0.539)	
Construction, repair & others (Outcome 3_7)				
Entrepreneur's age	-0.004		(0.029)	
Entrepreneur's age squared	0.001		(0.000)	
Female	Ref.			
Male	1.162	***	(0.128)	
Years of education	-0.033	***	(0.011)	
Region				
Souss Massa Draa	Ref.			
Gharb Chrarda Ben Hssen	0.450	*	(0.256)	
Marrakech Tensift Al Haouz	0.313		(0.219)	
Oriental	0.369	*	(0.219)	
Grand Casablanca	0.481	***	(0.181)	
Rabat Salé Zemmour Zaer	0.281		(0.195)	
Doukkala Abda	-0.035		(0.245)	
Méknès Tafilalet	0.352		(0.226)	
Fès Boulmène	-0.217		(0.254)	
Taza Al Hoceima Taounate	0.112		(0.264)	
Tanger Tétouan	0.103		(0.252)	
Urban	Ref.			
Rural	-0.131		(0.101)	
Constant	-2.563	***	(0.594)	
Formality/Informality (Outcome 8)				
Entrepreneur's age	0.028	*	(0.014)	
Entrepreneur's age squared	0.000		(0.000)	

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
Female	Ref.			
Male	0.581	***	(0.080)	
Years of education	0.004		(0.009)	
Entrepreneurial motivation	0.141	**	(0.065)	
Initial capital				
Inheritance	Ref.			
Own savings	-0.480	***	(0.126)	
Liquidation of assets	-0.271		(0.171)	
Formal loan	-0.058		(0.345)	
Informal loan	-0.474	***	(0.150)	
Own remittances	-0.314		(0.286)	
Others remittances	-0.226		(0.208)	
Other	-0.451	***	(0.156)	
Region				
Souss Massa Draa				
Gharb Chrarda Ben Hssen	-0.402	**	(0.196)	
Marrakech Tensift Al Haouz	-0.404	**	(0.165)	
Oriental	-0.416	**	(0.165)	
Grand Casablanca	-0.458	***	(0.144)	
Rabat Salé Zemmour Zaer	-0.450	***	(0.145)	
Doukkala Abda	0.007		(0.157)	
Méknès Tafilalet	-0.111		(0.166)	
Fès Boulmène	-0.520	***	(0.173)	
Taza Al Hoceima Taounate	-0.436	**	(0.189)	
Tanger Tétouan	-0.448	***	(0.159)	
Prior labor force participation				
Employed	Ref.			
Unemployed	-0.113		(0.097)	
OLF - full time student	0.177	*	(0.104)	
OLF - housewife	-0.541	***	(0.174)	
OLF - did not desire to work	-0.227		(0.274)	

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
OLF - Disabled	-0.059		(0.298)	
OLF - military service	0.267		(0.367)	
Urban	Ref.			
Rural	-0.167	**	(0.071)	
Current license	1.773	***	(0.069)	
Current commercial registration	1.278	***	(0.104)	
Constant	-1.285	***	(0.370)	
rho_14	-0.023		(0.132)	
rho_15	-0.033		(0.380)	
rho_16	-0.027		(0.204)	
rho_17	-0.007		(0.275)	
rho_18	-0.140		(0.093)	
rho_24	-0.034		(0.893)	
rho_25	-0.010		(0.899)	
rho_26	0.009		(0.157)	
rho_27	0.002		(0.507)	
rho_28	-0.144		(0.124)	
rho_48	0.041		(0.068)	
rho_58	-0.011		(0.106)	
rho_68	-0.022		(0.075)	
rho_78	0.011		(0.079)	

Note (1): "OLF" stands for out of the labor force. Number 1 in $\rho_1 x$ stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
Note (2): Links to other businesses include producing for other firms, outsourcing to other firms, sharing equipment, jointly working on a project for a client and using other businesses for marketing purposes.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

3.8.8 Robustness check: Expanding top performance identification

Table 3.30: Probability of being a top performer (robustness check)

Variable	Coefficient		Standard error	Marginal effect
Entrepreneur's age (years)	0.039	***	0.014	0.009
Entrepreneur's age squared	0.000	*	0.000	0.000
Female	Ref.			
Male	0.366	***	0.121	0.082
Educational attainment (years	0.041	***	0.008	0.009
Had an apprenticeship	0.153	***	0.052	0.034
Entreprneurial motivation	0.271	***	0.052	0.061
Initial capital				
Inheritance	Ref.			
Own savings	-0.360	***	0.080	-0.081
Liquidation of assets	-0.116		0.100	-0.026
Formal loan	0.170		0.143	0.038
Informal loan	-0.364	***	0.104	-0.081
Own remittances	0.003		0.175	0.001
Others remittances	-0.618	***	0.179	-0.138
Other	-0.678	***	0.117	-0.152
Economic activity				
Manufacturing	Ref.			
Wholesale & retail trade	-0.483	**	0.217	-0.108
Food & accommodation	1.574		1.440	0.352
Business, social and other services	0.512	***	0.196	0.115
Construction, repair and other	0.853	***	0.267	0.191
Region				
Sous Massa Draa	Ref.			
Gharb Chrarda Ben Hssen	-0.303	*	0.159	-0.068

Probability of being a top performer (continued)

Variable	Coefficient		Standard error	Marginal effect
Marrakech Tensift Al Haouz	0.032		0.115	0.007
Oriental	-0.105		0.147	-0.023
Grand Casablanca	0.354	***	0.117	0.079
Rabat Salé Zemmour Zaer	0.015		0.099	0.003
Doukkala Abda	-0.252	*	0.136	-0.056
Meknes Tafilalet	-0.109		0.137	-0.024
Fes Boulmene	-0.070		0.140	-0.016
Taza Al Hoceima Taounate	-0.042		0.143	-0.009
Tanger Tetouan	-0.083		0.122	-0.018
Prior labor force participation				
Employed	Ref.			
Unemployed	-0.271	***	0.083	-0.061
OLF - full-time student	0.010		0.069	0.002
OLF - housewife	-0.281	*	0.161	-0.063
OLF - did not desire to work	0.217		0.230	0.049
OLF - disabled	0.333		0.351	0.074
OLF - military service	-0.523	*	0.275	-0.117
Constant	-2.416	***	0.379	
Manufacturing (Ref., 2)				
ρ_{13}	-0.117		0.166	
ρ_{14}	-0.721		0.880	
ρ_{15}	-0.458	***	0.125	
ρ_{16}	-0.481	***	0.150	

Note (1): "OLF" stands for out of the labor force. Number 1 in ρ_1x stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.

* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.

Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

Table 3.31: Sector regressions, compared to Manufacturing (robustness check)

	Trade		Food & Acc.		Business, social & other services		Construction, repair & others	
Variable	Coefficient	St. Error	Coefficient	St. Error	Coefficient	St. Error	Coefficient	St. Error
Entrepreneur's age (years)	-0.022	0.017	0.015	0.027	-0.062	0.019	-0.029	0.022
Entrepreneur's age squared	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
Female	Ref.		Ref.		Ref.		Ref.	
Male	1.537	0.095	1.287	0.138	0.680	0.096	2.144	0.232
Educational attainment (years	0.058	0.009	0.068	0.012	0.105	0.010	0.013	0.012
region								
Sous Massa Draa	Ref.		Ref.		Ref.		Ref.	
Gharb Chrarda Ben Hssen	-0.596	0.213	0.051	0.270	-0.179	0.233	0.211	0.266
Marrakech Tensift Al Haouz	-0.461	0.179	-0.012	0.219	-0.604	0.201	0.002	0.229
Oriental	-0.265	0.187	0.413	0.230	-0.269	0.211	0.304	0.227
Grand Casablanca	-0.731	0.154	-0.080	0.198	-0.324	0.170	0.156	0.191
Rabat Salé Zemmour Zaer	-0.366	0.167	-0.033	0.204	0.011	0.181	0.150	0.205
Doukkala Abda	-0.528	0.193	-0.260	0.244	-0.514	0.220	-0.446	0.266
Meknes Tafilalet	-0.773	0.178	-0.112	0.228	-0.626	0.207	-0.085	0.238
Fes Boulmene	-0.092	0.194	0.600	0.235	0.030	0.216	-0.262	0.295
Taza Al Hoceima Taounate	-0.263	0.204	0.329	0.249	-0.324	0.227	-0.002	0.274
Tanger Tetouan	0.013	0.189	0.366	0.231	0.092	0.210	0.185	0.258
Urban	Ref.		Ref.		Ref.		Ref.	
Rural	0.253	0.083	0.265	0.139	-0.078	0.094	-0.035	0.105
Constant	-0.443	0.396	-2.672	0.623	0.067	0.419		

* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE Survey (Morocco, round 1 2002), using survey weights.

Table 3.32: Results of conditional mixed process for formal and informal firms (robustness check)

Variable	Coefficient		Standard error	Marginal effect
Formal Firms (Outcome 1)				
Entrepreneur's age	0.018		0.019	0.005
Entrepreneur's age squared	0.000		0.000	0.000
Female				
Male	0.113		0.191	0.033
Years of education	0.029		0.024	0.008
Entrepreneurial motivation	0.216	***	0.056	0.063
Initial capital				
Inheritance				
Own savings	-0.212	**	0.085	-0.062
Liquidation of assets	0.005		0.111	0.001
Formal loan	0.101		0.146	0.030
Informal loan	-0.201	*	0.118	-0.059
Own remittances	-0.019		0.173	-0.005
Others remittances	-0.473	**	0.203	-0.139
Other	-0.473	***	0.124	-0.139
Sector of economic activity				
Manufacturing				
Wholesale & retail trade	-0.949		0.653	-0.279
Food & accommodation	0.184		.	0.054
Business, social and other servi..	-0.346		1.353	-0.101
Construction, repair and other	0.544		1.688	0.160
Region				
Souss Massa Draa	-0.119		0.236	-0.035
Gharb Chrarda Ben Hssen	0.136		0.197	0.040
Marrakech Tensift Al Haouz	-0.095		0.192	-0.028
Oriental	0.432	*	0.234	0.127
Grand Casablanca	0.181		0.152	0.053
Rabat Salé Zemmour Zaer	-0.128		0.167	-0.038

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
Doukkala Abda	-0.205		0.224	-0.060
Méknès Tafilalet	0.021		0.136	0.006
Fès Boulmène	0.021		0.169	0.006
Taza Al Hoceima Taounate	-0.001		0.130	0.000
Tanger Tétouan				
Prior labor force participation				
Employed				
Unemployed	-0.254	***	0.088	-0.075
OLF - full time student	-0.052		0.079	-0.015
OLF - housewife	0.058		0.207	0.017
OLF - did not desire to work	0.380		0.312	0.112
OLF - Disabled	0.504		0.452	0.148
OLF - military service	-0.655	**	0.292	-0.192
Constant	-0.949		0.696	
Informal Firms (Outcome 2)				
Entrepreneur's age	0.061		0.071	0.008
Entrepreneur's age squared	-0.001		0.001	0.000
Female				
Male	0.351		0.471	0.046
Years of education	0.003		0.020	0.000
Entrepreneurial motivation	0.316		0.201	0.041
Initial capital				
Inheritance				
Own savings	-0.425	*	0.243	-0.056
Liquidation of assets	-0.659	**	0.316	-0.086
Formal loan	0.376		0.566	0.049
Informal loan	-0.427	*	0.233	-0.056
Own remittances	0.170		0.480	0.022
Others remittances	0.000		(omitted)	0.000
Other	-0.683	**	0.285	-0.090

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
Sector of economic activity				
Manufacturing				
Wholesale & retail trade	0.320		0.617	0.042
Food & accommodation	0.707		0.975	0.093
Business, social and other servi..	0.136		1.359	0.018
Construction, repair and other	0.138		4.358	0.018
Region				
Souss Massa Draa				
Gharb Chrarda Ben Hssen	-0.197		0.581	-0.026
Marrakech Tensift Al Haouz	0.245		0.298	0.032
Oriental	0.316		0.372	0.041
Grand Casablanca	0.494		0.358	0.065
Rabat Salé Zemmour Zaer	0.187		0.386	0.025
Doukkala Abda	-1.187	***	0.452	-0.156
Méknès Tafilalet	0.255		0.345	0.034
Fès Boulmène	0.135		0.394	0.018
Taza Al Hoceima Taounate	0.111		0.350	0.015
Tanger Tétouan	0.129		0.357	0.017
Prior labor force participation				
Employed				
Unemployed	-0.126		0.188	-0.017
OLF - full time student	0.192		0.195	0.025
OLF - housewife	-0.029		0.301	-0.004
OLF - did not desire to work	0.142		0.406	0.019
OLF - Disabled	0.222		0.527	0.029
OLF - military service	0.000		(omitted)	
Constant	-3.162	*	1.640	
Wholesale & retail trade (Outcome 3_4)				
Entrepreneur's age	-0.013		0.017	
Entrepreneur's age squared	0.000		0.000	
Female				

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
Male	1.522	***	0.095	
Years of education	0.059	***	0.009	
Region				
Souss Massa Draa				
Gharb Chrarda Ben Hssen	-0.581	***	0.211	
Marrakech Tensift Al Haouz	-0.452	**	0.178	
Oriental	-0.258		0.185	
Grand Casablanca	-0.723	***	0.152	
Rabat Salé Zemmour Zaer	-0.350	**	0.165	
Doukkala Abda	-0.516	***	0.192	
Méknès Tafilalet	-0.761	***	0.176	
Fès Boulmène	-0.086		0.193	
Taza Al Hoceima Taounate	-0.260		0.202	
Tanger Tétouan	0.006		0.188	
Urban				
Rural	0.274	***	0.081	
Constant	-0.662	*	0.391	
Food & Accommodation (Outcome 3_5)				
Entrepreneur's age	0.025		0.026	
Entrepreneur's age squared	0.000		0.000	
Female				
Male	1.283	***	0.134	
Years of education	0.070	***	0.011	
Region				
Souss Massa Draa				
Gharb Chrarda Ben Hssen	0.072		0.269	
Marrakech Tensift Al Haouz	-0.006		0.221	
Oriental	0.402	*	0.233	
Grand Casablanca	-0.065		0.196	
Rabat Salé Zemmour Zaer	-0.020		0.206	
Doukkala Abda	-0.260		0.245	

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
Méknès Tafilalet	-0.113		0.233	
Fès Boulmène	0.609	**	0.235	
Taza Al Hoceima Taounate	0.328		0.252	
Tanger Tétouan	0.353		0.233	
Urban				
Rural	0.323	***	0.106	
Constant	-2.906	***	0.554	
Business, social & other services (Outcome 3_6)				
Entrepreneur's age	-0.054	***	0.019	
Entrepreneur's age squared	0.001	***	0.000	
Female				
Male	0.682	***	0.098	
Years of education	0.107	***	0.010	
Region				
Souss Massa Draa				
Gharb Chrarda Ben Hssen	-0.175		0.234	
Marrakech Tensift Al Haouz	-0.594	***	0.202	
Oriental	-0.270		0.210	
Grand Casablanca	-0.308	*	0.172	
Rabat Salé Zemmour Zaer	0.031		0.184	
Doukkala Abda	-0.508	**	0.221	
Méknès Tafilalet	-0.615	***	0.214	
Fès Boulmène	0.043		0.216	
Taza Al Hoceima Taounate	-0.321		0.227	
Tanger Tétouan	0.094		0.212	
Urban				
Rural	-0.043		0.095	
Constant	-0.139		0.419	
Construction, repair & others (Outcome 3_7)				
Entrepreneur's age	-0.019		0.026	
Entrepreneur's age squared	0.000		0.000	

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
Female				
Male	2.101	***	0.224	
Years of education	0.015		0.013	
Region				
Souss Massa Draa				
Gharb Chrarda Ben Hssen	0.199		0.299	
Marrakech Tensift Al Haouz	0.019		0.274	
Oriental	0.289		0.229	
Grand Casablanca	0.150		0.199	
Rabat Salé Zemmour Zaer	0.136		0.221	
Doukkala Abda	-0.446		0.279	
Méknès Tafilalet	-0.097		0.263	
Fès Boulmène	-0.258		0.298	
Taza Al Hoceima Taounate	-0.026		0.288	
Tanger Tétouan	0.156		0.263	
Urban				
Rural	-0.024		0.138	
Constant	-2.482	***	0.665	
Formality/Informality (Outcome 8)				
Entrepreneur's age	0.027	*	0.014	
Entrepreneur's age squared	0.000		0.000	
Female				
Male	0.586	***	0.078	
Years of education	0.001		0.009	
Entrepreneurial motivation	0.160	**	0.065	
Initial capital				
Inheritance				
Own savings	-0.440	***	0.123	
Liquidation of assets	-0.248		0.165	
Formal loan	-0.050		0.320	

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
Informal loan	-0.423	***	0.149	
Own remittances	-0.262		0.273	
Others remittances	-0.179		0.207	
Other	-0.406	***	0.153	
Region				
Souss Massa Draa				
Gharb Chrarda Ben Hssen	-0.362	*	0.195	
Marrakech Tensift Al Haouz	-0.377	**	0.163	
Oriental	-0.408	**	0.160	
Grand Casablanca	-0.427	***	0.142	
Rabat Salé Zemmour Zaer	-0.422	***	0.142	
Doukkala Abda	0.014		0.156	
Méknès Tafilalet	-0.073		0.162	
Fès Boulmène	-0.491	***	0.170	
Taza Al Hoceima Taounate	-0.429	**	0.187	
Tanger Tétouan	-0.434	***	0.156	
Prior labor force participation				
Employed				
Unemployed	-0.109		0.094	
OLF - full time student	0.201	*	0.105	
OLF - housewife	-0.543	***	0.167	
OLF - did not desire to work	-0.147		0.273	
OLF - Disabled	0.013		0.324	
OLF - military service	0.260		0.356	
Urban				
Rural	-0.150	**	0.070	
Current license	1.754	***	0.068	
Current commercial registration	1.298	***	0.100	
Constant	-1.313	***	0.365	
rho_14	-0.023		0.508	
rho_15	-0.065		0.069	
rho_16	-0.122		0.923	

Results of conditional mixed process for formal and informal firms (continued)

Variable	Coefficient		Standard error	Marginal effect
rho_17	-0.410		0.950	
rho_18	-0.489	***	0.075	
rho_24	-0.795	*	0.240	
rho_25	-0.469		0.467	
rho_26	-0.119		1.020	
rho_27	-0.037		2.831	
rho_28	-0.394	***	0.103	
rho_48	0.199	***	0.059	
rho_58	0.074		0.084	
rho_68	-0.003		0.073	
rho_78	0.172	**	0.075	

Note (1): "OLF" stands for out of the labor force. Number 1 in $\rho_1 x$ stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
Note (2): Links to other businesses include producing for other firms, outsourcing to other firms, sharing equipment, jointly working on a project for a client and using other businesses for marketing purposes.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

Table 3.33: Difference in characteristics between formal and informal potential gazelles (robustness check)

Variable	Formal (1)	Informal (2)	t-test 1 v. 2
Entrepreneur characteristics			
Age	39.23	37.81	*
Male	87%	56%	***
Years of education	6.87	4.37	***
Education			
None	23%	54%	***
Primary	9%	8%	
Intermediate	40%	25%	***
Secondary	21%	9%	***
University	6%	3%	**
	100%	100%	

Difference in characteristics between groups (continued)

Variable	Formal (1)	Informal (2)	t-test 1 v. 2
Had an apprenticeship	62%	77%	***
Had technical training	19%	13%	**
Ever married	66%	67%	
Number of children	1.96	1.94	
Previous labor force participation			
Employed	72%	58%	***
Unemployed	8%	10%	
OLF - full-time student	16%	11%	***
OLF - housewife	2%	17%	***
OLF - no desire to work	1%	3%	*
OLF - disabled	0%	1%	
OLF - military service	1%	0%	**
	100%	100%	
Enterprise characteristics			
Sectors			
Manufacturing	26%	62%	***
Wholesale & retail trade	15%	4%	***
Food & accommodation	14%	7%	***
Business, social and other services	33%	18%	***
Construction, repair and other	12%	9%	
	100%	100%	
Regions			
Sous Massa Draa	6%	3%	**
Gharb Chrarda Ben Hssen	5%	8%	
Marrakech Tensift Al Haouz	7%	10%	*
Oriental	7%	4%	**
Grand Casablanca	29%	27%	
Rabat Salé Zemmour Zaer	16%	18%	
Doukkala Abda	4%	6%	
Meknes Tafilalet	8%	5%	*
Fes Boulmene	6%	7%	
Taza Al Hoceima Taounate	4%	5%	

Difference in characteristics between groups (continued)

Variable	Formal (1)	Informal (2)	t-test 1 v. 2
Tanger Tetouan	7%	7%	
	100%	100%	
In urban area	63%	48%	***
Age	10.68	8.41	***
Number of workers	2.05	1.76	***
Hours per week	68.68	51.81	***
Wage per worker (month, dirham)	709	1,370	***
Value add (month, dirham)	3,794	1,370	***
Value add/worker (month, dirham)	2,227	1,370	***
Revenues (month, dirham)	10,312	4,609	***
Revenues/worker (month, dirham)	5,892	2,609	***
Capital (dirham)	91,072	27,525	***
Capital/worker (dirham)	45,568	13,004	***
Finance-related			
Source of initial capital			
Inheritance	11%	6%	***
Own savings	56%	62%	**
Liquidation of assets	9%	8%	
Formal loan	6%	1%	***
Informal loan	9%	10%	
Own remittances	2%	1%	
Others remittances	2%	3%	
Other	5%	9%	
	100%	100%	
Has a current line of credit	14%	12%	
Sources of current credit			
Official institution	25%	13%	*
Non-business relations	33%	51%	**
Other	41%	36%	
	100%	100%	

Difference in characteristics between groups (continued)

Variable	Formal (1)	Informal (2)	t-test 1 v. 2
Has a saving facility	69%	68%	
Type of savings			
Formal	40%	12%	***
Home	50%	77%	***
Non-business relations	4%	4%	
Others	6%	7%	
	100%	100%	
Management-related			
Keep records	32%	14%	***
Hire family	89%	90%	***
Provide workers with written contracts	6%	7%	
Provide workers with paid vacation	11%	6%	***
Provide workers with training	71%	73%	
Use modern equipment all the time	68%	64%	
Network-related			
In business association	12%	8%	**
In a firm cluster	27%	24%	
Have links with other businesses	38%	38%	
Access to infrastructure			
Has access to water	57%	47%	***
Has access to electricity	98%	88%	***
Has access to roads	84%	70%	***
Has access to a landline	23%	10%	***

Note (1): Characteristics in categories, such as education level, economic activity, region, place of work and others show proportions that sum up to 100%. "OLF" stands for out of the labor force. Number 1 in $\rho_1 x$ stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
Note (2): Links to other businesses include producing for other firms, outsourcing to other firms, sharing equipment, jointly working on a project for a client and using other businesses for marketing purposes.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

3.8.9 Benchmark specification without the exclusion restriction

Table 3.34: Probability of being a top performer - without the exclusion restriction

Variable	Coefficient	Variable	Coefficient
Entrepreneur's age	0.037***	region	
Entrepreneur's age-squared	0.000*	Souss Massa Draa	
		Gharb chrarda ben hssen	-0.536***
Female	Ref.	Marrakech tensift al haouz	-0.133
Male	0.283***	Oriental	-0.442***
		Grand casablanca	0.421***
Education attainment (years)	0.054***	Rabat salé zemmour zaer	-0.023
Had an apprenticeship	0.157***	Doukkala abda	-0.611***
Entrepreneurial motivation	0.196***	Méknès tafilalet	-0.456***
		Fès boulmène	-0.339**
Economic Activity		Taza al hoceima taounate	-0.104
Manufacturing	Ref.	Tanger tétouan	-0.185
Wholesale & retail trade	0.057		
Food & accommodation	1.077**	Previous labor force participation	
Business, social and other services	0.669***	Employed	
Construction, repair and other	0.163	Unemployed	-0.333***
		OLF - full time student	-0.048
Initial capital		OLF - housewife	-0.251
Inheritance	Ref.	OLF - did not desire to work	0.445*
Own savings	-0.249***	OLF - disabled	0.233
Liquidation of assets	0.061	OLF - military service	-0.349
Formal loan	0.235*		
Informal loan	-0.307***	Constant	-2.893***
Own remittances	0.056		
Others remittances	-0.553***	ρ_{13}	-0.538
Other	-0.660***	ρ_{14}	-0.215
		ρ_{15}	-0.768***
		ρ_{16}	-0.046

Note (1): The are the results to Equations (3.1) and (3.2).
Note (2): "OLF" stands for out of the labor force. Number 1 in $\rho_1 x$ stands for the first equation (the probit model), whereas number 2 stands for manufacturing, 3 for wholesale and retail trade, 4 for food and accommodation, 5 for business, social and other services, and 6 for construction, repair and others.
* $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.
Source: ERF MSE data (Morocco, round 1 2002), using survey weights.

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A short summary

The first chapter notes a change in the composition of private intergenerational transfers in France over time, from more intrahousehold transfers in the 1980s to more inheritance in the new millennium. Using a three-period overlapping generations model, we show that a rise in wealth inequality can influence the composition of these transfer. However, the share of intrahousehold transfers in human capital accumulation and the extent of the preference to bequeath can influence this inequality.

The second chapter looks at the role of the demographic boom on the prevalence of informal employment, with the context of Egypt. We introduce overlapping generations of heterogeneous education levels in a multi-sectoral model. After calibrating and simulating the model, we show that a temporary demographic boom of better-educated workers can have long-run effects on non-formality rates, interacting with output and prices. We contrast this actual dynamic adjustment with counterfactuals, emphasizing the importance of demographics and private sector constraints on non-formality rates.

The third chapter examines the heterogeneity of micro and small enterprises (MSEs) in Morocco. These enterprises are grouped into three categories: top performers, potential gazelles and "others." The paper finds that top performers tend to do relatively well in all areas examined. Potential gazelles, on the other hand, appear to choose their sectors of economic activity differently and appear to face particular constraints when it comes to access to credit and the ability to link to other businesses. Moreover, while formal firms appear to exhibit significant heterogeneity, informal firms are less heterogeneous, showing a small upper echelon that can compete with formal firms, while others are not starkly different from each other.

Key words: Overlapping generations, inheritance, intrahousehold transfers, inequality, informality, vacancy creation, private sector, micro and small enterprises, entrepreneurship

Un résumé

Le premier chapitre remarque l'évolution de la composition des transferts privés intergénérationnels en France au fil du temps, passant d'une plus grande proportion des transferts intra-ménages dans les années 1980 à une plus grande proportion d'héritage dans le nouveau millénaire. En utilisant un modèle de générations imbriquées sur trois périodes, nous montrons qu'une augmentation de l'inégalité de la richesse peut influencer la composition de ces transferts. Cependant, la part des transferts intra-ménages dans l'accumulation du capital humain et l'étendue de la préférence à léguer peuvent influer sur cette inégalité.

Le deuxième chapitre examine le rôle du boom démographique sur la prévalence de l'emploi informel dans le contexte égyptien. Nous introduisons des générations de niveaux d'éducation hétérogènes imbriquées dans un modèle multisectoriel. Après avoir calibré et simulé le modèle, nous montrons qu'un boom démographique temporaire de travailleurs plus instruits peut avoir des effets à long terme sur les taux de non-formalité, en interaction avec la production et les prix. Nous comparons cet ajustement dynamique réel avec des scénarios contrefactuels, en soulignant l'importance des contraintes démographiques et du secteur privé sur les taux de non-formalité.

Le troisième chapitre examine l'hétérogénéité des micro et petites entreprises (PME) au Maroc. Ces entreprises sont regroupées en trois catégories: les entreprises les plus performantes, les gazelles potentielles et les "autres." Le document constate que les entreprises les plus performantes ont tendance à se débrouiller relativement bien dans tous les domaines examinés. En revanche, les gazelles potentielles semblent choisir leurs secteurs d'activité économique différemment et se heurtent à des contraintes particulières en ce qui concerne l'accès au crédit et la possibilité de se lier à d'autres entreprises. De plus, alors que les entreprises formelles semblent présenter une hétérogénéité significative, les entreprises informelles sont moins hétérogènes, montrant un petit échelon supérieur pouvant rivaliser avec les entreprises formelles, alors que d'autres ne sont pas très différentes les unes des autres.

Mots clés: Générations imbriquées, héritage, transferts intra-ménages, inégalités, informalité, création des postes vacants, secteur privé, micro et petites entreprises, entrepreneuriat

Un résumé élaboré

Le chapitre 1, co-écrit avec Nhung Luu et intitulé “Transferts entre ménages, héritage et conséquences sur les inégalités”, utilise une approche théorique pour expliquer une tendance observée dans les données françaises de 1979 à 2011. Cette tendance montre un changement dans la composition des transferts financiers privés entre générations, allant d’une plus grande proportion des transferts intra-ménages dans les années 1980, à une plus grande proportion d’héritage dans le nouveau millénaire.

De nouvelles preuves tirées des comptes de transfert nationaux (NTA) de la France ont permis de quantifier les transferts intra-ménages au fil du temps, montrant ainsi sa part non négligeable (des) dans les transferts privés intergénérationnels. Les transferts intra-ménages sont ceux effectués au sein du ménage, souvent entre les membres de la famille et plus particulièrement des parents aux enfants. Ces transferts permettent de combler le déficit du cycle de vie des enfants, qui représente la différence entre ce que l’individu consomme et ce qu’il gagne en revenus du travail.

Dans le même temps, le NTA-France a (également été capable) permis de créer une base de données sur l’héritage par profils d’âges grâce au travail effectué par des chercheurs. Ces transferts sont constitués (de dons) de legs (post-mortem) et de donations (souvent des transferts importants intervenant à un stade ultérieur de la vie). Nous soutenons que la littérature s’est principalement concentrée sur l’héritage négligeant dans une certaine mesure, le rôle joué par les transferts intra-ménages. Ces preuves combinées et relativement nouvelles du NTA mettent en évidence trois faits importants.

Premièrement, la somme des flux privés intergénérationnels est restée relativement stable en pourcentage du revenu national brut en France, passant d’environ 25% en 1979 à un peu plus de 22% en 2011, avec un léger repli à la fin des années 90. Deuxièmement, malgré leur part relativement stable, la composition de ces transferts a évolué avec le temps, avec une diminution de la part des transferts intra-ménages dans les transferts privés globaux. En conséquence, le rapport entre les transferts intra-ménages et les héritages a diminué, passant d'environ 3,6 en 1979 à moins de 1 en 2011. Il s'agit d'un rapport qui présente un grand intérêt pour les objectifs de ce chapitre, car il rend compte de l'évolution de la composition des transferts financiers privés entre générations dans le temps, que nous sommes en mesure d'expliquer au travers de notre modèle théorique.

Troisièmement, les données du NTA indiquent également la direction de ces transferts. La population en âge de travailler, par exemple, qui est définie ici de manière conservatrice comme celle des 20 à 59 ans, est un important donneur net de transferts intra-ménages, représentant en moyenne 93% des transferts intra-ménages donnés au cours de la période. Les bénéficiaires nets de ces transferts sons les plus jeunes, principalement ceux âgés de 0 à 19 ans. Cette direction ne change pas si nous examinons les transferts nets en termes de revenu par habitant de chaque groupe afin de prendre en compte les changements démographiques de la population. En revanche, l'héritage a été reçu principalement par la population en âge de travailler. En fait, au fil des ans, la population en âge de travailler a reçu en moyenne 80% de ces transferts privés intergénérationnels.

Le dernier fait stylisé dont nous nous servons concerne l'évolution de l'inégalité de la richesse en France au fil du temps. La base de données mondiale sur les inégalités (WID) montre que le coefficient d'inégalité de Gini a augmenté au cours de la période, passant de 0,66 en 1979 à 0,7 en 2011, avec des écarts variables. La part de la richesse du décile supérieur et du centile supérieur de la population ont augmenté. C'est un fait que nous exploitons dans le modèle théorique, dans lequel nous établissons un lien entre les transferts privés intergénérationnels et les inégalités des richesses.

Pour expliquer l'évolution de la composition des transferts privés, et en particulier la diminution du rapport entre les transferts intra-ménages et les héritages, nous utilisons un modèle à générations imbriquées (OLG), dans lequel les individus passent par l'enfance, l'âge de travail et la vieillesse. Les individus peuvent appartenir à l'une des deux types de ménages qui traduisent une hétérogénéité importante dans le modèle : un type "altruiste" qui préfère léguer et par conséquent sauvegarder et transmettre l'héritage, et un autre "égoïste" qui ne le fait pas. Ceux qui lèguent le font par souci d'"offrir par plaisir". Cependant, les deux dynasties effectuent des transferts intra-ménages à leurs descendants, ce qui augmente l'accumulation de capital humain et par conséquent augmente leurs revenus du travail futur. Ce cadre théorique souligne le fait que ces deux types de transferts ont des rôles différents à jouer.

De plus et conformément à la littérature, les transferts d'héritage et intra-ménages interviennent à différents moments. L'héritage est modélisé comme un transfert des individus âgés vers ceux d'âge de travailler, tandis que les transferts intra-ménages sont modélisés comme des transferts de ceux d'âge en travailler vers les enfants. Enfin, les deux dynasties sont liées par une fonction d'accumulation de capital humain telle que le niveau du capital humain de l'enfant dépend des transferts intra-ménages qu'il reçoit pendant son enfance, mais également du capital humain à l'échelle de l'économie, qui inclut celui de l'autre dynastie.

Nous pouvons exprimer l'évolution de cette économie à travers les variables qui capturent le capital physique et le capital humain. Ces variables peuvent être transformées en une forme intensive et exprimées en fonction de l'inégalité de la richesse, qui est notre variable d'intérêt. L'inégalité de la richesse est définie dans ce chapitre comme le rapport entre le capital physique de la dynastie altruiste et celui de la dynastie égoïste. L'inégalité de la richesse peut donc être comprise comme l'un des deux cas suivants : (1) si le type de ménage altruiste détient plus de capital que la société égoïste, l'inégalité est supérieure à 1, (2) si type de ménage égoïste détient plus de capital que l'un altruiste, l'inégalité est inférieure à 1.

La résolution analytique de ce modèle nous permet de faire plusieurs propositions. Premièrement, il existe une valeur unique d'inégalité à l'état d'équilibre sur le long terme, de sorte que le capital accumulé par les deux dynasties est positif. Toutefois, le fait que cette inégalité à long terme soit supérieure ou inférieure à 1 dépend des paramètres du modèle, en particulier, de la préférence pour les legs et de la part des transferts intra-ménages dans la fonction de capital humain.

La deuxième proposition est donc qu'il existe un seuil de préférence pour les legs et pour la part des transferts intra-ménages dans l'accumulation de capital humain, tel que l'inégalité à long terme est supérieure à 1, ce qui signifie que la dynastie altruiste détient plus de capital physique que la dynastie égoïste. Sinon, le contraire est vrai. En fait, le modèle montre qu'une augmentation de la préférence pour l'héritage peut déclencher deux types d'effets. L'un est ce que nous appelons "l'effet d'héritage", qui signifie que la dynastie altruiste épargnera davantage et transmettra par conséquent davantage d'héritage aux jeunes générations. Le second est ce que nous appelons un "effet de revenu", qui reflète l'impact de l'épargne, de la transmission et de la réception des legs sur les revenus des personnes âgées et d'âge en travailler.

Lorsque la préférence en matière de legs est significativement élevée et que la part des transferts intra-ménages dans l'accumulation de capital humain est également suffisamment élevée, la dynastie égoïste finira par accumuler plus de capital que celle altruiste. Ce résultat est une découverte unique, à notre connaissance.

De manière tout aussi importante, le modèle nous permet d'exprimer le rapport entre les transferts intra-ménage et les héritages en fonction de l'inégalité de la richesse. Nous montrons que si l'inégalité de la richesse est déjà supérieure à 1, une augmentation de l'inégalité peut entraîner une diminution de ce ratio à court terme. Si l'inégalité de la richesse est inférieure à 1, son augmentation à 1 (égalité) conduira également à une diminution de ce ratio. Comme les données en France font apparaître une inégalité de richesse déjà supérieure à 1, où ceux qui lèguent son plus riches que ceux qui ne le font pas, le premier cas est plus pertinent. En utilisant certaines valeurs des paramètres trouvées dans la littérature, notre modèle permet de simuler le rapport entre les transferts intra-ménages et l'héritage et ainsi comparer ces simulations avec ce que nous observons dans les données NTA. Ceci nous montre que le modèle est capable de reproduire la tendance à la baisse dans ce ratio au fil du temps.

Enfin, nous exécutons quelques exercices de statiques comparatives, dans lesquelles nous modifions les valeurs des paramètres qui capturent la préférence pour les legs et la part des transferts intra-ménages dans l'accumulation de capital humain pour effectuer de nouvelles simulations. L'impact de la modification de ces paramètres sur l'inégalité de la richesse dépend de l'inégalité initiale à l'état stationnaire, qu'elle soit supérieure ou inférieure à 1. Cependant, nous montrons que l'augmentation de la part des transferts intra-ménages dans l'accumulation de capital humain au-delà d'un certain seuil et à préférence en matière de legs donnée, peut faire passer le régime d'inégalité de plus de 1 à moins de 1, en faveur de la dynastie égoïste.

Par conséquent, le présent chapitre soutient que l'une des explications possibles de l'évolution de la composition des transferts privés intergénérationnels en France est un processus d'accroissement de l'inégalité de la richesse qui est actuellement inférieur à celui de l'état stationnaire, compte tenu de certaines valeurs paramétriques. Cependant, nous affirmons également que cela est influencé à la fois par la préférence pour le legs et par le rôle des transferts entre ménages dans l'accumulation de capital humain.

Le deuxième chapitre, co-écrit avec Alexandre Ounnas et Bruno Van der Linden, s'intitule "Le boom démographique et la montée (de l'informalité) du travail informel: le cas de l'Égypte". Il examine le rôle que le boom démographique peut jouer sur la prédominance de l'emploi informel, en tenant compte du contexte égyptien, mais également celui de nombreux autres pays à divers stades de développement économique.

L'Égypte se trouve au beau milieu de son boom démographique. Les écarts de taux de natalité et de mortalité particulièrement important dans les années 1980 ont entrainés une forte augmentation de la population jeune qui a commencé à entrer sur le marché du travail local à la fin des années 1990. En fin d'année 2010, la grande majorité de la population issue de ce boom démographique avait rejoint la population active. Précédée et suivie par des taux de fécondité totaux relativement élevés, la taille de la population égyptienne est probablement modifiée pour les décennies à venir. Dans le même temps, ce boom démographique s'est accompagné d'un changement dans la composition de la population puisque la grande majorité des nouveaux entrants étaient éduqués. En effet, la génération des années 80, ainsi que les générations les plus jeunes des années 90 et suivantes, sont arrivées sur le marché du travail plus instruites que leurs prédécesseurs, avec des taux d'achèvement plus élevés des diplômes d'études secondaires et universitaires.

Cependant, contrairement aux générations précédentes, un environnement de travail moins favorable attendait ces nouveaux venus. Le gouvernement, qui était depuis longtemps un employeur important des Égyptiens ayant suivi des études secondaires et universitaires, avait réduit son taux de recrutement à la suite d'un programme d'ajustement structurel de ses dépenses mis en place dans les années 90. De plus, malgré la croissance économique globale du nouveau millénaire, le lien avec la création d'emplois était beaucoup moins évident et beaucoup des nouveaux emplois dans le secteur informel, c'est-à-dire des emplois sans paiements de cotisations de sécurité sociale. Ces observations sont corroborées par une nouvelle enquête par panel, l'enquête par panel sur le marché du travail en Égypte (ELMPS), d'abord menée en 1998 et suivie par d'autres séries en 2006, 2012 et plus récemment en 2019. Les données montrent une augmentation notable de la taille et de la part de la population en âge de travailler, en particulier celle ayant une meilleure éducation (lycée et plus). Dans le même temps, la part de l'emploi informel a également considérablement augmenté et est particulièrement visible chez les cohortes les plus jeunes et en augmentation parmi les personnes instruites.

En Égypte, les données indiquent que le secteur informel est relativement défavorisé, avec une pénalité salariale informelle importante pour les hommes et les femmes, même après prise en compte de caractéristiques non observables. À notre connaissance, rien ne prouve qu'une telle pénalité soit compensée par d'autres avantages liés à l'emploi. De plus, les données montrent également que les transitions entre les secteurs sont rares, en particulier vers le secteur gouvernemental, tandis que les travailleurs employés dans les secteurs du gouvernement et du privé formel transitionnent de plus en plus vers des emplois informels et le chômage (combinées dans ce chapitre comme “non-formalité”). Ces faits suggèrent que l'évolution du marché du travail égyptien au cours du nouveau millénaire mérite un examen plus approfondi.

Pour examiner ce lien entre le boom démographique et les divers faits mentionnés ci-dessus, nous développons un modèle multisectoriel composé de trois secteurs : (1) un secteur gouvernemental exogène préféré par tous les travailleurs, conformément à la littérature sur l'Égypte (2) un secteur privé formel qui souffre des frictions en matière de recherche et d'adéquation d'emploi, en plus d'une création d'emplois lente et des taxes et (des) impôts et, (3) un secteur informel parfaitement compétitif pouvant absorber tous ceux qui veulent travailler mais ne sont employés par aucun des deux premiers secteurs.

Les secteurs privés formel et informel produisent ensemble un bien de consommation globale, ce qui permet d'établir un lien important entre leurs marchés du travail. Le secteur privé formel, caractérisé par des frictions sur le marché du travail, offre un salaire négocié avec le travailleur. Le salaire du secteur informel, en revanche, est égal à la productivité marginale du travailleur puisque ce secteur opère en concurrence parfaite.

Les travailleurs du modèle appartiennent à des générations imbriquées, avec des niveaux de compétences hétérogènes et exogènes. Chaque groupe d'âge a une certaine probabilité de survie et tous les travailleurs quittent le marché à un stade ultérieur. Les travailleurs peuvent être dans un des trois états : (1) travaillant dans le secteur gouvernemental, (2) travaillant dans le secteur privé formel, (3) état non formel, une situation qui combine à la fois le travail informel et la production domestique. Être dans le secteur gouvernemental est préféré par tous les travailleurs et introduit comme une condition dans le modèle. Les travailleurs du secteur privé formel continuent de rechercher des emplois au sein du gouvernement, tandis que les travailleurs de l'état non-formel recherchent des emplois aussi bien dans le secteur privé formel que dans le secteur gouvernemental.

Le secteur gouvernemental est supposé avoir des taux d'arrivée et de destruction d'emplois exogènes. Le secteur privé formel a un taux de création d'emplois qui dépend de la tension sur le marché du travail et un taux de destruction d'emplois exogène qui s'applique non seulement aux emplois existants, mais également aux postes vacants créés par le secteur. Cela nous permet d'officialiser plusieurs lois de mouvement pour les travailleurs lors de la transition entre les trois états.

Les postes vacants dans le secteur privé formel, qui constitue une caractéristique importante de ce cadre, sont créés par des entrepreneurs. Nous supposons que l'économie compte un certain nombre d'entrepreneurs (en dehors de la population de travailleurs). Chaque entrepreneur est confronté à une nouvelle "opportunité commerciale" au début de chaque période. La réalisation de cette opportunité a un certain coût fixe, qui est tiré au sort (idiosyncratique) d'une distribution exogène. Une fois le coût (est) absorbé, cette opportunité commerciale génère un poste vacant. (Une embauche) Un poste est crée tant que ce coût est égal ou inférieur à la valeur inter-temporelle d'un poste vacant. Par conséquent, le stock de postes vacants dans l'économie est une fonction des : (1) postes vacants de la période précédente qui n'ont pas engendré d'embauches et qui n'ont pas été détruits entre les deux périodes, (2) les postes vacants pour lesquels les travailleurs ont également reçu une offre du gouvernement ou ceux qui décèdent, (3) les postes occupés lors de la période précédente et qui deviennent vacants à la suite d'une offre du gouvernement ou du décès des travailleurs et (4) la création de nouveaux postes vacants.

Dans cette configuration, et compte tenu du fait que nous introduisons un modèle en temps discret, la chronologie des événements est cruciale. La séquence d'événements suivante a lieu pendant chaque période. Premièrement, au tout début de la période, une nouvelle génération de travailleurs entre sur le marché du travail (son niveau est exogène). Deuxièmement, les salaires sont négociés pour les travailleurs ayant rencontré un poste vacant lors de la période précédente et la production commence. Troisièmement, les entrepreneurs tirent un coût pour déterminer si ils peuvent ouvrir un poste vacant qui s'ajoutera au stock lors de la période suivante.

Quatrièmement, plusieurs événement interviennent. Premièrement, les demandeurs d'emploi cherchent (et certains trouvent) du travail. Cela inclut la probabilité exogène de trouver un travail dans le secteur gouvernemental pour les travailleurs du secteur privé formel et non formel, et la probabilité de trouver un emploi dans le secteur privé formel pour les demandeurs d'emploi informels qui est déterminée par le processus d'appariement (dans le secteur privé formel des demandeurs d'emploi informels). Lorsqu'un travailleur est confronté à une offre du gouvernement, avec ou sans offre privée formelle (en même temps), il choisit l'offre du gouvernement. Deuxièmement, selon un certain taux exogène, il y a destruction des emplois pour les employés et les nouvelles embauches du gouvernement (de nouveaux appariements avec le gouvernement). Troisièmement, une part des emplois existants et des nouvelles embauches sont détruites selon une probabilité exogène de destruction d'emplois. Ce taux de destruction affecte également les postes vacants non pourvus. Enfin, une partie des travailleurs survivent et entrent dans la période suivante alors que le reste sort du marché du travail.

À l'équilibre, les travailleurs choisissent un effort optimal pour maximiser leur utilité sur l'ensemble de leur vie. Les postes vacants sont ouverts de manière à maximiser la valeur d'un poste vacant. Les salaires dans le secteur privé formel sont négociés, tandis que ceux du secteur informel sont égaux au productivité marginal du travailleur. Les biens intermédiaires sont produits à la fois par les secteurs privés formel et informel, en utilisant des travailleurs hautement et faiblement qualifiés.

Nous résolvons ce cadre théorique numériquement. Pour ce faire, nous supposons 9 groupes d'âge pour les travailleurs, chaque groupe d'âge correspondant à quatre années. Nous supposons deux niveaux de compétences tels que les moins qualifiés sont ceux qui ont un niveau d'instruction inférieur au lycée et les plus qualifiés sont ceux qui ont un niveau d'enseignement égale ou supérieur au lycée. Nous nous appuyons largement sur les données de l'enquête par panel sur le marché du travail en Égypte 1998-2012, en particulier sur les vagues de 1998 et 2006, qui servent à calibrer plusieurs paramètres du modèle. Ces données incluent, par exemple, les stocks de travailleurs dans chacun des états du modèle et leurs transitions d'une année à l'autre entre ces États (à savoir de 1998 à 2006). Nous utilisons également les données ELMPS pour caractériser les salaires et en déduire certains paramètres du modèle, comme expliqué ci-dessous. Étant donné que nous avons choisi le groupe d'âge des quatre ans, nous complétons (encore) l'utilisation du ELMPS avec les enquêtes sur la force du travail de 2010 et de 2014.

Pour résoudre le modèle, nous calibrons un ensemble de paramètres importants en quatre étapes. Premièrement, nous exploitons la dimension longitudinale du ELMPS et les lois du mouvement des stocks de main-d'œuvre pour calibrer un ensemble de paramètre spécifiques en terme de niveau d'éducation et d'âge : le taux de destruction d'emplois dans le secteur public, le taux de destruction d'emplois dans le secteur privé formel, le taux d'arrivée dans l'emploi dans le secteur gouvernemental et enfin la probabilité de survie des travailleurs.

Deuxièmement, nous utilisons les paramètres calibrés de cette première étape pour introduire le boom démographique dans le modèle. Cet essor démographique prend la forme d'une augmentation du nombre de nouveaux venus sur le marché du travail et tient compte de l'évolution dans la composition des compétences. Les nouveaux entrants par niveaux de compétences peuvent être calculés à partir des données EMLPS de 1998 et 2006.

Troisièmement, nous attribuons des valeurs à un certain nombre de paramètres en nous basant sur la littérature, des données ELMPS et nos propres hypothèses. Nous tirons de la littérature des valeurs relatives au taux d'actualisation, au pouvoir de négociation du travailleur dans le secteur formel privé, ainsi qu'à l'élasticité des postes vacants dans la fonction d'appariement et de l'élasticité de substitution dans la fonction de production globale. Nous déduisons des données ELMPS plusieurs paramètres importants, tels que les différents salaires dans les secteurs. Enfin, nous utilisons des hypothèses (bien informées) pour attribuer des valeurs à un certain nombre de paramètres difficiles à trouver dans la littérature. Finalement, nous utilisons ces valeurs pour les paramètres afin de calibrer le reste des paramètres en utilisant l'intégralité du modèle et en minimisant la distance entre les valeurs observées et les valeurs prédites.

Nous examinons l'impact du boom démographique et de l'évolution dans la composition des compétences des travailleurs en Égypte, au travers de cinq simulations principales.

La première, notre simulation de référence, examine l'effet du boom démographique (réel) et de l'augmentation de la part des travailleurs hautement qualifiés sur le marché du travail égyptien au fil du temps. L'essor démographique entraine ainsi une hausse du taux travailleurs non formels hautement qualifiés qui passe d'environ 41,5% en 2002 à un sommet de 46,9% en 2018 avant de diminuer lentement pour atteindre un niveau stable d'environ 44%.

Cette augmentation n'est pas seulement significative à court terme. À long terme, les simulations montrent que le taux de non-formalité augmente par rapport aux valeurs de la première période de la simulation et par rapport au taux de non-formalité agrégé de 42,4% en 1998. Pour les travailleurs peu qualifiés, qui font face à des taux de non-formalité plus élevés en général, la part des travailleurs non formels passe d'environ 60% en 1998 à un sommet de 65,8% en 2014, avant de diminuer progressivement pour atteindre un taux à l'état stationnaire de 64,4% environ.

Les résultats semblent montrer que les taux de non-formalité atteignent leur paroxysme à mesure que la génération du boom démographique vieillit et évolue dans ces groupes d'âge. Cela pourrait indiquer un nouveau canal que l'on pourrait nommer "l'effet cicatriciel". Selon ce canal, les jeunes travailleurs qui connaissent des taux de non-formalité plus élevés à l'entrée souffrent d'effets négatifs à long terme liés à cet état initial. Auparavant, la littérature a utilisé le nom "d'effet cicatriciel" pour les effets à long terme (sur les salaires et / ou l'emploi) de l'obtention d'un diplôme en période de récession. Notre exercice de simulation met en évidence un effet cicatriciel supplémentaire lié à l'intégration sur le marché du travail au moment de l'essor démographique et au milieu de cohortes exceptionnellement importantes.

Quatre mécanismes principaux expliquent comment le choc démographique affecte le taux de non-formalité. Premièrement, il existe un effet de composition qui déplace les parts de la population vers les travailleurs plus jeunes pour lesquels la prévalence de la non-formalité est plus élevée. À long terme, cet effet de composition disparaît et les parts de la population retrouvent leurs valeurs d'équilibre.

Deuxièmement, il existe un effet de congestion qui découle de l'hypothèse de recherche et d'appariement dans le secteur privé formel. L'afflux important de travailleurs non formels hautement qualifiés diminue les tensions sur le marché du travail et la probabilité de trouver un emploi. Au moment où la génération du boom démographique quitte le marché du travail, les résultats montrent que la tension sur le marché du travail et la probabilité de trouver un emploi augmentent à nouveau, mais ils ne retrouvent jamais leur niveau d'avant le boom. L'évolution de la tension du marché du travail est liée à l'ajustement dynamique des emplois vacants.

Troisièmement, il y a un effet prix des biens intermédiaires. La forte augmentation du nombre de travailleurs hautement qualifiés dans les secteurs de production privés formels et informels augmente leurs productions de biens intermédiaires, ce qui abaisse les prix de ces deux biens. Ces baisses persistent à long terme, le nombre de travailleurs hautement qualifiés ayant augmenté de façon permanente. En conséquence, les salaires formels privés diminuent, ce qui réduit l'incitation des travailleurs non formels à rechercher un emploi formel. À son tour, l'effort diminue. Notez que, comme la baisse du prix des biens hautement qualifiés est permanente, les nouveaux niveaux à l'état stationnaire des salaires et des efforts sont plus bas, ce qui explique en partie pourquoi le taux de non-formalité des travailleurs hautement qualifiés est plus élevé à long terme.

Quatrièmement, il y a un effet d'ajustement de la création de postes vacants et du stock de postes vacants. Ici, plusieurs forces sont à l'œuvre. Premièrement, la baisse initiale du prix du bien intermédiaire produit dans les entreprises formelles (observée pour les deux compétences) réduit le bénéfice en flux de l'entreprise, ce qui diminue la valeur d'un poste pourvu et d'un poste vacant. Ensuite, l'essor démographique et la forte augmentation du nombre de travailleurs non formels (principalement qualifiés) ont un effet positif sur la probabilité qu'une entreprise rencontre un travailleur en recherche d'emplois. Toutefois, la réduction des niveaux d'effort de recherche d'emploi, comme expliqué ci-dessus, compense le choc positif de l'offre de main-d'œuvre. L'effet net est une augmentation non négligeable de la valeur intertemporelle d'un poste vacant hautement qualifié au cours des premières périodes. Un effet net opposé est (d'abord) observé chez les travailleurs peu qualifiés. Contrairement à un modèle standard Mortensen-Pissarides, le nombre de postes vacants ne s'ajuste pas pour réinitialiser la valeur intertemporelle d'un poste vacant à zéro.

Nous comparons cet ajustement dynamique à plusieurs autres scénarios. Nous montrons qu'en l'absence de boom démographique, le taux de non-formalité dans l'ensemble de l'économie aurait été légèrement supérieur, mais le taux de non-formalité des personnes hautement qualifiées aurait été nettement inférieur. En revanche, le taux de non-formalité des travailleurs peu qualifiés aurait été plus élevé. L'effet de congestion sur le secteur formel privé aurait été moins présent que dans le scénario de référence, et l'effet du changement de prix du bien intermédiaire formel privé peu qualifié auraient également été moins importants. Cela tient au fait que la production globale augmente moins en l'"absence" du boom démographique, ce qui entraîne une augmentation plus faible du prix de ce bien intermédiaire.

Nous montrons également au travers d'une simulation, qu'un boom démographique qui n'aurait pas entrainer de modification dans la composition du niveau d'éducation de la population totale, aurait entrainé des résultats relativement similaires. Le taux de non-formalité des personnes hautement qualifiées aurait été beaucoup plus faible par rapport (au niveau) à notre simulation de référence. Cependant, le taux agrégé de non-formalité de l'ensemble de l'économie aurait été supérieur d'un peu plus de 3 points de pourcentage, en raison du taux de non-formalité plus élevé chez les personnes peu qualifiées. La modification de la composition des compétences vers des personnes hautement qualifiées a donc sans doute été un élément important dans la réduction du taux moyen de non-formalité en Égypte au fil des années, et ce principalement car les personnes hautement qualifiées font face à des taux de non-formalité plus bas en général.

Enfin, nous réalisons deux dernières simulations qui facilitent la création de postes vacants. Une où nous modifions le support de la distribution des coûts fixes qui sont tirés par les entrepreneurs, et une autre qui simule une augmentation du nombre d'entrepreneurs qui accompagnerait le boom démographique. Dans ces deux cas, les taux de non-formalité à l'échelle de l'économie auraient considérablement diminué, en particulier pour les travailleurs hautement qualifiés. La plupart des effets positifs induits par la hausse des investissements passent par un assouplissement de la congestion sur le marché du travail formel privé.

Ce chapitre a donc examiné comment le boom démographique, accompagné d'une modification de la composition des compétences similaire à celle observée en Égypte, peut avoir des effets à long terme sur le marché du travail, en particulier sur le taux de non-formalité. Il a montré comment ces effets entrent en jeu et comment le fait de faciliter la création de postes vacants aurait pu avoir un impact significatif sur la réduction de la non-formalité.

Le troisième et dernier chapitre est intitulé “Explorer l’hétérogénéité des micros et petites entreprises marocaines”. Les micros et petites entreprises (MPE) constituent une source de revenus et de subsistance importante pour de nombreux travailleurs et entrepreneurs dans le monde, et en particulier dans les pays à revenu faible ou intermédiaire. Dans certains pays d’Amérique latine tels que le Brésil, le Costa Rica et le Chili, les MPE employant moins de 50 travailleurs représentent environ 95% des entreprises dans leurs pays respectifs. En Inde, au Népal et au Pakistan, ainsi qu’au Cameroun, au Ghana et en Ouganda, cette part atteint 99% du nombre total d’entreprises, avec des nombres similaires pour les pays du Moyen-Orient et d’Afrique du Nord. Au Maroc, au début du nouveau millénaire, environ 96% des entreprises non agricoles sont des micro-entreprises employant moins de 5 travailleurs (y compris l’entrepreneur). Ensemble, ils employaient environ 65% de la population active.

La littérature a souvent mis l’accent sur une dispersion de ces MPE dans divers résultats commerciaux et financiers. Cette dispersion signifie que la politique de développement, en particulier le développement des entreprises, doit répondre aux divers types et besoins de ces entreprises et de leurs entrepreneurs. Premièrement, toutes les MPE ne sont pas confrontées aux mêmes contraintes. Les défis auxquels font face les entreprises les plus performantes et les plus établies diffèrent de ceux des très petites et des plus jeunes. Deuxièmement, toutes les MPE ne sont pas créées dans un but de croissance. Pour les entreprises qui aspirent à la croissance, les politiques de développement des entreprises sont peut-être plus appropriées, mais celles qui sont créées pour gagner leur vie, en raison notamment du manque d’autres opportunités, exigent des politiques sociales plus ciblées.

Le défi consiste toutefois à distinguer ces différents types d’entreprises et, partant, le type de politique ou de programme à mettre en place. Entre les “éléphants”, qui sont généralement de grandes entreprises, et les “souris”, qui peuvent difficilement survivre, la littérature a souvent recherché les “gazelles”, c’est-à-dire celles qui peuvent être petites mais qui ont un potentiel de croissance et peut se développer.

Ce chapitre décrit l’hétérogénéité des MPE au Maroc, en insistant plus particulièrement sur les contraintes des “gazelles potentielles”. J’utilise le terme “gazelles potentielles” par opposition à simplement “gazelles” afin de souligner leur potentiel, pas nécessairement leurs situations actuelles. Cette caractérisation va au-delà de l’identification d’une entreprise potentiellement prospère et de celle qui n’est pas faite (c’est-à-dire de la description binaire) dans une partie de la littérature, mais produit plutôt un spectre plus large pour mieux comprendre cette hétérogénéité.

Pour ce faire, le chapitre utilise et développe la méthode empirique proposée dans une littérature similaire. Les MPE marocaines sont regroupées dans trois catégories : (1) “les plus performants”, qui excellent dans un critère choisi, (2) “les gazelles potentielles”, qui présentent des caractéristiques d’entrepreneur et d’entreprise similaires à celles du premier groupe mais ne sont pas performantes ; et (3) “les autres”, qui diffèrent dans la plupart des aspects, sinon tous, et ressemblent davantage à des entreprises axées sur la survie. Pour regrouper ces entreprises, le chapitre utilise une enquête relativement unique portant sur 5 210 micros et petites entreprises au Maroc. L’enquête a été réalisée pour la première fois en 2004. Bien qu’elle ait été suivie d’une enquête similaire un an plus tard, l’attrition due à plusieurs raisons rend les données de suivi beaucoup moins utiles. L’analyse repose donc uniquement sur les entreprises saisies en 2004.

Pour identifier les entreprises les plus performantes, j’ai choisi un double critère de référence pour les entreprises ayant le plus grand nombre de travailleurs et la plus forte valeur ajoutée par travailleur, représentant environ 13% des entreprises de l’échantillon. Je gère un modèle probit sur un certain nombre de régresseurs prédéterminés et exogènes, notamment: l’âge de l’entrepreneur (et son âge equarri), son sexe, ses années d’études, la région où l’entreprise est située, la source de capital initial utilisé pour créer l’entreprise, le type de participation de l’entrepreneur au marché du travail avant de lancer / gérer l’entreprise (par exemple, être employé, sans emploi et sans emploi, pour quelque raison que ce soit, après avoir effectué un apprentissage dans un secteur connexe et enfin “motivation entrepreneuriale”.

Un régresseur final est le secteur de l’activité économique. Cependant, reconnaissant que la sélection du secteur est relativement endogène, je l’instrumente d’une équation multinomiale probit à plusieurs régresseurs. Je permets que le terme d’erreur de cette spécification soit corrélé à celui de la première spécification qui détermine les meilleures performances. Cela signifie qu’il peut exister des éléments non observables qui affectent davantage la probabilité que les entreprises d’un secteur soient les plus performantes par rapport aux entreprises d’autres secteurs. Cela peut être capturé par un processus mixte conditionnel.

À partir de ces spécifications, je peux prédire, pour chaque observation, la probabilité d’être le plus performant. Alors que le groupe des entreprises les plus performantes est déjà défini selon le double critère, le groupe de gazelles potentielles est identifié comme celui des entreprises qui ont la même probabilité moyenne prédite d’être les plus performantes que le groupe des entreprises les plus performantes. Cela se fait par un simple processus de tri des probabilités prédites des non performants et du calcul d’une moyenne glissante jusqu’à ce que cette moyenne soit similaire à celle des plus performants. Le groupe des “autres”, en revanche, représente toutes les autres observations. Ce processus signifie qu'en moyenne, le groupe de gazelles potentielles présente des caractéristiques prédéterminées similaires (les régresseurs) au groupe des plus performants.

Je compare ensuite, de manière descriptive, les trois groupes d'entreprises en fonction de leurs caractéristiques moyennes: 1) caractéristiques de base des entrepreneurs; (2) les caractéristiques de l'entreprise telles que le secteur d'activité économique, l'emplacement et les résultats commerciaux; (3) des aspects financiers tels que l'accès au crédit et l'origine de ce crédit; (4) des aspects liés à la gestion tels que la tenue de registres, le recrutement de la famille, la fourniture de contrats écrits aux travailleurs et autres; (5) les aspects liés au réseau, tels que le fait d'être membre d'associations professionnelles, des grappes d'entreprises et d'établir des liens avec d'autres entreprises, et enfin; (6) l'accès à des infrastructures telles que l'électricité, l'eau et les routes. Ces comparaisons donnent une image descriptive des différences entre les entreprises les plus performantes, les gazelles potentielles et les "autres", et indiquent les domaines dans lesquels les entreprises peuvent être en difficulté, en particulier les gazelles potentielles.

Les résultats montrent que le groupe des plus performants a tendance à se comporter favorablement sur presque tous les aspects, par rapport aux gazelles potentielles et aux "autres". Ils ont des entrepreneurs plus éduqués et plus âgés (et ont probablement plus d'expérience). Leurs entreprises sont également plus anciennes, engagent plus de travailleurs, versent des salaires plus élevés à leurs travailleurs, ont des revenus / ventes plus élevés, valeur ajoutée et capital (à la fois globalement et par travailleur), et ont tendance à travailler plus d'heures au cours de la semaine. Une plus grande proportion d'entre eux ont accès au crédit, en particulier auprès d'institutions officielles. Ils ont tendance à tenir des registres de leurs activités commerciales. Une plus grande proportion d'entre eux fournissent à leurs travailleurs des contrats écrits, des congés payés et une formation, un plus grand nombre d'entre eux utilisent des équipements modernes et un pourcentage plus élevé indique appartenir à des associations d'entreprises, à des grappes d'entreprises et entretenir des liens avec d'autres entreprises. Enfin, une proportion nettement plus élevée d'entre elles indiquent avoir accès à des infrastructures telles que l'eau, l'électricité, des routes et une ligne terrestre.

Les gazelles potentielles, qui représentent environ un cinquième des entreprises, bien que similaires en ce qui concerne un certain nombre de caractéristiques d'entrepreneurs et d'entreprises, semblent choisir leurs secteurs de manière différente et semblent limitées en termes d'accès au crédit (et du type de crédit). En outre, une proportion plus petite d'entre elles semble avoir des liens avec d'autres entreprises (ce qui est considéré comme un "réseau"). Ces gazelles potentielles ont tendance à être plus concentrées dans les services, en particulier ceux liés aux entreprises et aux services sociaux. Ils ont tendance à verser à leurs travailleurs moins de salaires en moyenne, non seulement par rapport aux entreprises les plus performantes, mais également aux "autres", ce qui peut indiquer une propension à conserver les bénéfices pour la croissance des entreprises. Ils semblent également avoir des difficultés dans deux autres domaines : (1) liés à la gestion, tels que la tenue des registres de l'entreprise, l'utilisation d'équipements modernes et la fourniture de certaines commodités à leurs travailleurs, et (2) l'accès à l'infrastructure. Cependant, malgré ces contraintes, ils sont encore beaucoup moins plus restreints que le groupe des "autres" qui semblent être nettement plus dirigés par les femmes et plus défavorisés dans presque tous les domaines.

Ces résultats sont largement similaires lorsque la définition des performances optimales est modifiée aux autres critères.

Allant au-delà de l'échantillon global, j'exploite ensuite l'existence d'entreprises formelles et informelles dans l'enquête - un aspect qui n'était pas disponible dans la littérature pertinente. Définissant les entreprises formelles comme celles qui possèdent un numéro d'identification fiscale, j'effectue simultanément quatre régressions liées à la stratégie empirique susmentionnée. La première régression reproduit la spécification des plus performances, mais cette fois limitée aux seules sociétés formelles ; la seconde régression le reproduit uniquement pour les entreprises informelles ; la troisième régression tient compte de la sélection sectorielle, comme mentionné ci-dessus, tandis que la quatrième explique que le choix soit formel ou informel (c'est-à-dire le modèle de commutation).

Le modèle de commutation comporte un certain nombre de variables prédéterminées similaires à celles exprimées ci-dessus, mais en ajoute d'autres qui se rapportent à l'enregistrement commercial et à la licence. L'exécution simultanée de ces équations permet de corréler les termes d'erreur des variables latentes. Cela signifie qu'il peut exister des éléments non observables susceptibles d'affecter le choix de l'entreprise en matière de formalité / d'informalité, de choisir son secteur d'activité et de déterminer s'il doit ou non être performant. Dans ce cas aussi, je calcule la probabilité prédite d'être un performant pour chaque observation, formelle ou informelle, en fonction de son statut.

En isolant les entreprises qui ne sont que formelles, je peux catégoriser le sous-échantillon d'entreprises formelles en fonction des performances les plus performantes formelles (déjà identifiées), des gazelles potentielles formelles, qui ont en moyenne la même probabilité prédite que les performances les plus performantes formelles, et des "autres". Je fais la même chose pour les entreprises informelles. J'ai ensuite lancé un exercice descriptif similaire en comparant les caractéristiques des groupes de sociétés les plus performantes, de gazelles potentielles et d'autres au sein de chaque sous-échantillon formel / informel, afin d'explorer l'hétérogénéité entre les entreprises lorsqu'elles sont formelles ou informelles.

Les résultats montrent, peut-être plus intéressant, que le coefficient de corrélation entre les termes d'erreur des différentes équations n'est pas significatif, ce qui signifie qu'il n'y a pas de caractéristiques non observables potentielles affectant la probabilité que les entreprises obtiennent les meilleures performances dans les secteurs formel et informel lors de la comptabilisation du choix du secteur et du choix formalité / informalité. Cela indique que le choix du secteur a une incidence sur les meilleures performances, car les entreprises formelles et informelles choisissent leurs secteurs différemment. Le coefficient de corrélation observé dans l'ensemble de l'échantillon n'existe donc plus lorsque l'on tient compte du choix formalité / informalité.

En examinant les différences caractéristiques entre les groupes, les résultats pour les entreprises formelles montrent que, même si les entreprises les plus performantes ne diffèrent pas de manière significative de leurs équivalentes potentielles en gazelle dans la majorité des variables incluses dans le modèle probit, comme prévu, elles diffèrent encore de manière significative de nombre d'autres caractéristiques. Ces différences sont très semblables à ce que l'on trouve dans l'ensemble de l'échantillon. Par exemple, les entreprises les plus performantes du secteur formel sont nettement plus âgées que leurs homologues potentiels de la gazelle, elles-mêmes beaucoup plus âgées que les "autres" ; cet "ordre hiérarchique" est maintenu lorsque tous les autres résultats commerciaux tels que la valeur ajoutée, les revenus et le capital, à la fois globalement et par travailleur. À l'instar de l'échantillon global, les gazelles potentielles formelles semblent payer beaucoup moins de salaire par travailleur que leurs meilleures performances et les "autres".

Cependant, s'il semble exister une hétérogénéité significative entre les groupes d'entreprises formelles, qui reflète l'hétérogénéité observée dans l'ensemble de l'échantillon, cette hétérogénéité est moins apparente parmi les entreprises informelles. La "hiérarchie" observée dans de nombreux résultats commerciaux des entreprises formelles est moins apparente pour les entreprises informelles. Les entreprises informelles les plus performantes diffèrent considérablement de leurs homologues en gazelles potentielles, mais ces dernières ne diffèrent guère des "autres". C'est comme si un petit nombre d'entreprises informelles semblaient être en mesure de concurrencer les entreprises formelles, mais le reste est très différent de ce groupe. Les moyennes de la valeur ajoutée, des revenus et du capital, par exemple, ne sont pas significativement différentes entre les gazelles potentielles informelles et les “autres” informelles.

L’hétérogénéité s’estompe également lorsque l’on examine la proportion d’entreprises disposant de lignes de crédit et de facilités d’épargne actuelles, bien que les sources de crédit et d’épargne diffèrent entre les groupes informels. On peut en dire autant de la plupart des aspects liés à la gestion examinés, liés au réseau et à l’infrastructure. Les entreprises informelles les plus performantes ne déclarent pas des parts significativement plus élevées de ces variables en général. Toutefois, il existe quelques exceptions intéressantes, telles que la tenue de registres, la constitution de grappes d’entreprises, l’établissement de liens avec d’autres entreprises et l’accès à l’électricité, par exemple. Là encore, il apparaît que les aspects liés au réseau sont assez importants pour distinguer les entreprises les plus performantes, même parmi les entreprises informelles, ainsi que pour l’accès à l’infrastructure.

Enfin, en utilisant les mêmes probabilités prédites, j’examine la proportion d’entreprises informelles qui auraient théoriquement augmenté leur probabilité prédite d’être le plus performant si elles avaient choisi la formalité. Les résultats montrent que la majorité l’aurait, indiquant un choix potentiellement non optimal d’informalité.

Ces résultats mettent en évidence certaines implications politiques clés. Premièrement, toutes les entreprises les plus performantes ne sont pas nécessairement formelles, mais le choix du secteur diffère entre les entreprises formelles et informelles. Deuxièmement, les gazelles potentielles, si elles sont correctement identifiées, peuvent bénéficier d’un meilleur accès au crédit, aux réseaux, aux infrastructures et à la formation à la gestion. Troisièmement, au Maroc, une part importante des PME pourrait bénéficier de programmes de protection sociale par opposition au développement des entreprises.