REAL DISEQUILIBRIUM AND FINANCIAL EQUILIBRIUM

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ABSTRACT

Over the last years several attempts have been made to explain the behavior of the Uruguayan economy with the help of "disequilibrium theory". Most notably, these studies have shown that capacity constraints have a significant influence on production, and that Tobin's q is an important factor in the explanation of investment. But how do we explain stock market prices? The central point in our framework is to combine financial equilibrium (the Capital Asset Pricing Model) and real disequilibrium (the Malinvaud Model), through expectations: in the financial markets the expectations about risk and returns depend on the expectations about the variables that characterize the disequilibrium on the real markets. The theoretical set-up is developed in Licandro (1989) and should be seen as a first step towards the integration of real disequilibrium models in financial equilibrium analysis.

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1 INTRODUCTION

Over the last years several attempts have been made to explain the behavior of the Uruguayan economy with the help of "disequilibrium theory". Most notably, these studies have shown that capacity constraints have a significant influence on production, and that Tobin's q is an important factor in the explanation of investment, that is, in the explanation of the evolution of capacity.

Both the two-sector model estimated by Rama (1986a) –with a sheltered sector and an exposed sector– and the production and employment model estimated by Licandro (1987) provide evidence that the very low levels of investment after the 1982 crisis have led to the capacity constraints observed in the mid- and late 1980s.

According to Rama (1986b), the low levels of investment can be explained by financial restraint on the part of highly indebted firms and by poor stock market performance. Using Tobin's q-theory, Rama shows the strong influence of the stock market on investment behavior.

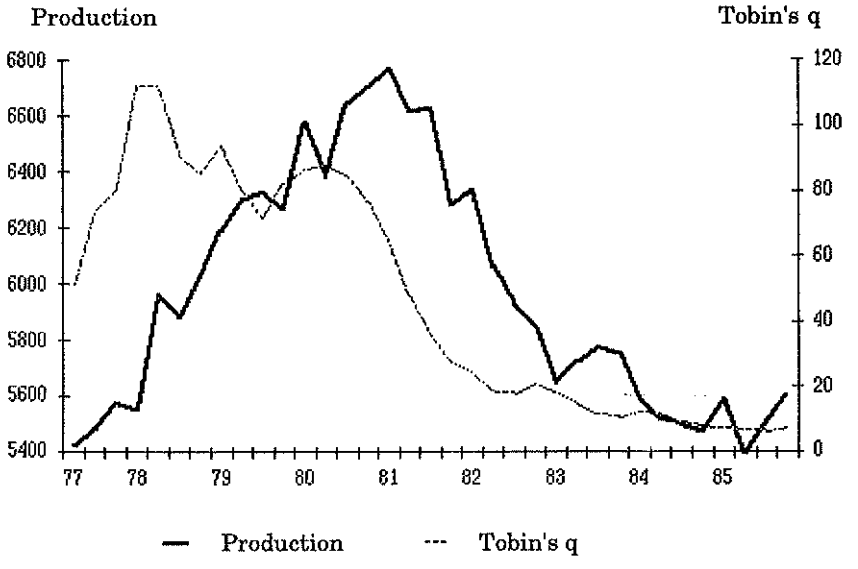
Tobin's q-theory is based on the assumption that a firm looks to the stock market for an evaluation of its future revenue flows: the value of a firm's common stock is seen as the best indicator of its future revenues[1].

Rama's (1986b) result is new, but it comes as no surprise given the theoretical framework he chooses. In a very unstable economy, investment is guided by expectations rather than costs of financing. Keynes was already stressing this point when he insisted on the instability of the marginal efficiency of capital.

But how do we explain stock market prices? When we look at Figure 1 we can see that the stock market price in real terms –Tobin's

[1] In the paper by Yoshikawa (1980) on q-theory, the key element of the proof is the substitution of the stock market value for the present value of revenues in the first-order condition for optimal investment.

FIGURE 1



average q– seems to anticipate very well the evolution of production, indicating that the financial agents seem to forecast the influence of the business cycle on the stock market. This feature of the data leads us to think that the definition of the real markets used in the disequilibrium macromodels is appropriate for building a pricing model for Tobin's q.

The theoretical point is to combine financial equilibrium hypothesis with real disequilibrium analysis. In Malinvaud's (1977) disequilibrium model the real economy can be in different macroeconomic regimes depending on what are the main macroeconomic constraints (aggregate demand or profitability). In Section 2 we develop a simple version of this type of model.

For the capital markets it is more plausible to assume financial equilibrium than financial disequilibrium, at least for stock markets[2]. Thus the CAPM (Capital Asset Pricing Model) is a good representation of

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[2] Financial market disequilibrium can be formalized in different ways. In particular, for banking behavior, "credit rationing theory" has shown the importance of imperfect information. See Stiglitz and Weiss (1981) and Jaffee (1971).

financial prices. The central point in our framework is the process of expectation formation, which is compatible with disequilibrium in the real sector: the economic agents form both return and risk expectations over the different "macroeconomic regimes" and they associate a probability of realization to each "regime". The theoretical set-up is developed in Licandro (1989) and should be seen as a first step towards the integration of real disequilibrium models in financial equilibrium analysis. Section 3 is devoted to the specification of the CAPM and the process of expectation formation. The characteristics of the complete macroeconomic model are exposed in Section 4.

The main purpose of this paper is to close the disequilibrium model implicit in Rama (1986a) and (1986b) by adding an equation for Tobin's q. Nevertheless, we do not claim that our approach is unified, since the various parts of the model were constructed originally to answer several distinct questions. The specification and estimation of a simultaneous model have yet to be carried out. Our main goal will be to explain Tobin's q in an economy which is in disequilibrium. This will allow us, at a second stage, to explore the salient features of the complete model. Sections 5 to 7 outline the specification and the estimation of the model.

2 REAL MARKETS

To describe the real part of the economy, we use a two-regime disequilibrium model in which there is only one commodity and in which the "short side rule" applies. This rule implies that only one side of the market is constrained, i.e. transactions are equal to the minimum of supply and demand[3] . This type of model can be defined as

(1) $$YD = \beta_1' X_1 + u_1$$

(2) $$YS = \beta_2' X_2 + u_2$$

[3] This type of model was suggested by Barro and Grossman (1971) and by Malinvaud (1977). The model we use here is taken from Quandt (1988), chapter 1.

(3) $$Y = min(YD, YS)$$

$$where \quad (u_1, u_2) \sim N(0, \Sigma)$$

YD is real aggregate demand and YS is real aggregate supply; X_1 and X_2 are vectors of variables explaining demand and supply, respectively; β_1 and β_2 are vectors of coefficients; and (u_1, u_2) are error terms.

Following Malinvaud (1977) we say that the economy is in the "potential regime" (P) if the firms are not constrained, i.e., if $YD>YS$. We say that the economy is in the "Keynesian regime" (K) if the firms are demand constrained, i.e., $YD<YS$.

In this disequilibrium model agents formulate expectations of demand, supply and regime probabilities:

$$E(YD) = \beta_1' X_1$$

$$E(YS) = \beta_2' X_2$$

$$\Phi_P = Pr(YD>YS) = Pr(u_2 - u_1 < y) = F(\frac{y}{\sigma})$$

$$where \quad y = E(YD) - E(YS)$$

σ^2 is the variance of (u_2-u_1) and $F(x)$ is the cumulative standard normal distribution.

3 TOBIN'S Q AND EXPECTATION FORMATION

Suppose a world in which financial agents maximize a mean-variance utility function, expectations about the future are homogeneous, and the supply of assets is given. In such a world, the equilibrium prices of the assets can be written as[4]

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[4] See Mossin (1977), pp.112-115.

$$q_j = (1/r)\ (\mu_j^* - R \sum_i \sigma_{ji}) \tag{4}$$

where q_j is the price of asset j, μ_j^* is its expected value, σ_{ji} is the covariance of the future values of j and i, $(1/r)$ is the discount factor at the riskless rate, and R is absolute risk aversion.

Equation (4) says that the equilibrium price of any asset is equal to its expected value discounted at the riskless rate, minus a risk premium. The risk premium depends on the agents' risk aversion and on the sum of the covariances of j, that is, its contribution to total market variance.

This financial market equilibrium model assumes that all expectations and covariances are exogenous. Different processes of expectation formation can be used. In particular, expectations about activity in the short run can be shown to have an influence on expected asset values, and hence on the equilibrium prices of assets. In an earlier paper[5], we expressed the future asset values as a function of expectations on the two macroeconomic regimes, i.e., the "potential regime" (P) and the "Keynesian regime" (K). Under these assumptions we showed that

$$\mu_j^* = \mu_{Kj} + x_j \Phi_P \tag{5}$$

$$\sum_i \sigma_{ji} = \sum_i \delta_{ji} + \Phi_P \sum_i (\gamma_{ji} - \delta_{ji}) + \Phi_P \Phi_K\ x_j \sum_i x_i \tag{6}$$

$$where \quad x_j = \mu_{Pj} - \mu_{Kj}$$

$$\Phi_P + \Phi_K = 1$$

and μ_{Pj} and μ_{Kj} are the expected values of asset j conditional on the potential and Keynesian regime, respectively; x_j is the gain in expected value on asset j when the economy switches from the Keynesian regime to the potential regime; Φ_P and Φ_K are the probabilities of realization of the

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5 See Licandro (1989).

potential and the Keynesian regime, respectively; δ_{ji} are the conditional covariances between the future asset values of j and i in the Keynesian regime; and γ_{ji} are the conditional covariances between j and i in the potential regime.

Equation (5) says that the expected future value of asset j is equal to the conditional value in the Keynesian regime, plus the gain in expected value of a switch from the Keynesian to the potential regime weighted by the probability of the potential regime. If $\Phi_P = 1$ the expected value is equal to the conditional expected value in the potential regime, and if $\Phi_P = 0$ the expected value is equal to the conditional expected value in the Keynesian regime[6] .

In the context of the two-period financial equilibrium and two-regime real disequilibrium model, the conditional future values of an equity are defined, for the Keynesian and potential regimes, as

$$\mu_{Kj} = \left[p - A(.)\, w\right] YD^*$$
$$where \quad YD^* = E(Y \mid YD<YS)$$

and

$$\mu_{Pj} = \left[p - A(.)\, w\right] YS^*$$
$$where \quad YS^* = E(Y \mid YD>YS)$$

where $A(.)$ is the technical coefficient for labor.

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6 The interesting feature of the model is that it describes how the expected values of the variables pertaining to real disequilibria influence financial equilibria. In particular, if $\delta_{ji} = \gamma_{ji}$ for all i and j, it is shown in Licandro (1989) that

$$\partial q_j / \partial \Phi_P = (1/r)\, x_j \left[1 + R(1 - 2\Phi_P) \sum_i x_i\right]$$

for all $\Phi_P \in [0,1]$ if $R<(1-2\Phi_P)$ and $x_j > 0$.

Let q_j be the current value of the equity portfolio, or the stock market index. Then this equation says that the probability of the potential regime has a positive influence on current equity prices if the expected future value of the equities increases when the economy switches from the Keynesian to the potential regime.

Regardless of the relative prices, the technology and the covariance terms δ_{ji} and γ_{ji}, we can write the equilibrium solution as

$$q_j = q_j(YS^*, YD^*, \Phi_P)$$

Let us now use the model to explain Tobin's q, that is, the ratio of the stock market value to the replacement cost of the real assets. To do so we must first rewrite equation (4) in real terms:

(7)
$$q = (1/r)\ (\mu^* - R \sum_i \sigma_i)$$

$$\mu^* = \mu_K + x\ \Phi_P$$

$$\sum_i \sigma_i = \sum_i \delta_i + \Phi_P \sum_i (\gamma_i - \delta_i) + \Phi_P \Phi_K\ x\ \sum_i x_i$$

where q is Tobin's q, $(1/r)$ is the discount factor at the real rate, and μ^* and σ_i are expected values at constant prices. To simplify notations we omit the subscript j.

The model assumes, although this is not explicit, that the portfolio of agents contains equities –whose equilibrium prices we are analyzing here– but also other risky assets such as government bonds, foreign assets, and bank assets and liabilities. The advantage of Mossin's version of the CAPM equilibrium condition is that the equilibrium price of an asset depends only on the expectations specific to that asset.

4 THE MACROECONOMIC MODEL

A simplified version of the macroeconomic model underlying this paper is represented in Table I. Supply is made to depend exclusively on capacity, since we are interested only in the effects of investment. Demand is also a function of investment. Other variables have been omitted. The level of output is determined either by supply or by demand, depending on which of the two constraints is binding. Tobin's q is determined on the financial markets, as described in the previous sections.

In macroeconomic models investment has two aspects: (a) it serves to accumulate capacity and (b) it is a component of aggregate demand. Of course, in an economy like that of Uruguay, most capital goods are imported, so that the principal effect of investment is to increase productive capacity. Thus we will limit ourselves to the analysis of the supply-constrained or "potential regime".

Take the extreme case of a potential regime in which demand is sufficiently high to lead to a probability of excess demand close to unity. For such a regime the relevant equations are

(8)
$$Y = YS(K,.)$$
$$K = K_{-1}\,(1-\delta) + I(q)$$
$$q = \mu - RP$$
$$\mu = \mu_P\,(YS^*, YD^*, .)$$
$$RP = \sum_i \gamma_i$$

where RP is the risk premium.

Under these conditions, a change in exogenous variables which only increases supply has a multiplier effect through expectations. Any increase in production will make financial agents more optimistic about the future, and asset prices will rise. Thus Tobin's q will increase,

yielding a positive effect on investment, capacity and hence production itself. A simple exercise in comparative statics shows that

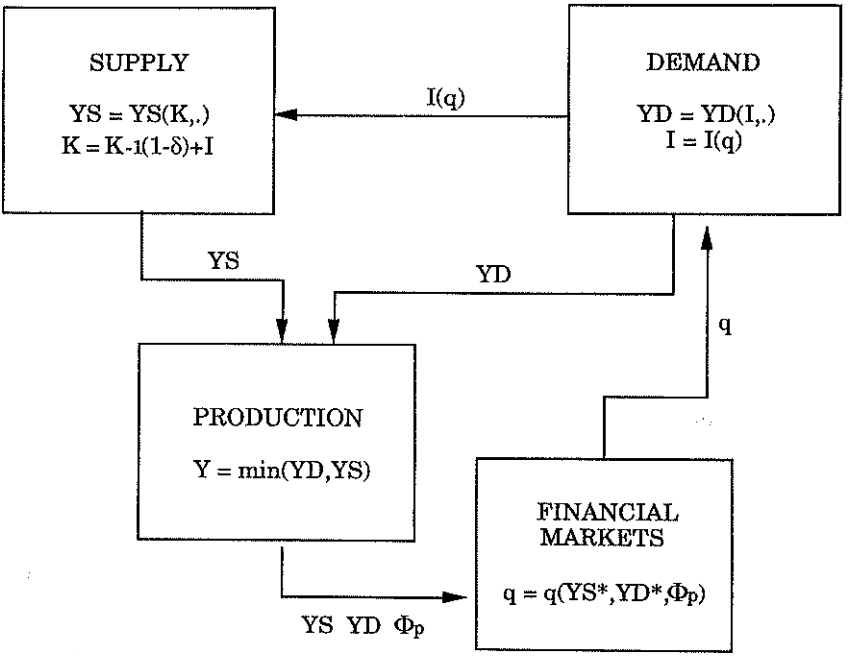
(9) $$dY = (1-\gamma)^{-1}\, dYSE$$

$$where \quad \gamma = \left(\delta YS / \delta K\right)\left(\delta I / \delta q\right)\left(\delta \mu_P / \delta YS\right)$$

where $dYSE$ is the change in supply in response to a change in the exogenous variables.

TABLE I

MACROECONOMIC MODEL



5 ESTIMATION FOR THE GOODS MARKET

This part of the model is taken from Rama (1986a), who estimated a two-sector disequilibrium model for Uruguay using quarterly data. We re-estimate Rama's model for a single market (that is, we aggregate the two sectors), keeping the same specification:

$$(10) \qquad yd = \alpha_0 + \alpha_1 sal + \alpha_2 ibi + \alpha_3 dmu + \alpha_4 tcr + v_1$$

$$(11) \quad ys = \beta_0 + \beta_1 ska + \beta_2 end + \beta_3 w/p + \beta_4 tcr + \beta_5 ppm + \beta_6 tse + v_2$$

$$y = min(yd, ys)$$

$$(v_1, v_2) \sim N(0, \Sigma) \quad and \quad \sigma_{12} = 0$$

Lower-case letters denote logarithms: yd for goods demand; ys for goods supply; sal for the wage bill; ibi for investment; dmu for world imports; tcr for the real exchange rate; ska for the capital stock (machines and equipment); end for the ratio of firm debt to GNP; w/p for the real product wage; ppm for the price of imports; and tse for the rate of export subsidies. v_1 and v_2 are error terms with a bivariate normal distribution of zero mean and covariances. Y is observed production (excluding agriculture); YD and YS are demand and supply, respectively.

This specification was estimated by maximum likelihood, following Maddala and Nelson (1974). The results are shown in Table II[7] . The estimates of demand YD, supply YS and the potential regime probability Φ_P are presented in the appendix.

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[7] The reader interested in the details of Rama's estimations is referred to Rama (1986a). Here we will only be interested in re-using Rama's estimates of demand, supply and regime probabilities.

TABLE II

Estimation period 1976:1 to 1985:4

	DEMAND			SUPPLY	
	Estimate	t-Stat.		Estimate	t-Stat.
α_0	5.43468	.7452	β_0	-1.5337	-.80186
α_1	0.1714	3.4001	β_1	1.2289	6.1943
α_2	0.14491	9.2915	β_2	-0.21883	-3.2906
α_3	0.21511	3.6648	β_3	0.13286	2.2980
α_4	0.10522	2.12	β_4	-0.13197	-2.7380
			β_5	-0.12559	-2.9945
σ_1	0.013165	3.2864	β_6	0.00395	0.2912
			σ_2	0.011029	2.6134

$R^2 = .97453$

LLF = 121.36

DW = 2.2012

6 SPECIFICATION OF THE MODEL

The asset pricing model of section 3 does not impose any conditions on μ_K and μ_P. We can thus specify them as functions of *E(YD)* and *E(YS)*. In particular, we will assume that when estimating the future value of the equity portfolio financial agents look at future profits. To make this

evaluation, they predict $E(YD)$ and $E(YS)$ and the relationship between costs and expected prices. We will use the following functional forms:

$$\mu_P = a_0 + a_1 E(YD) + a_2 E(W/P) \tag{12}$$

$$\mu_K = b_0 + b_1 E(YS) + b_2 E(W/P) \tag{13}$$

where W/P is the real wage.

We can say more about equations (12) and (13) by introducing a simple definition of firms' profits. Let us suppose that [8]

$$\mu_K = \left[p - A(.)\, w\right] E(YD)$$

$$\mu_P = \left[p - A(.)\, w\right] E(YS)$$

The technical coefficient $A(.)$ depends on the production function and on the first-order conditions of the optimization problem. In each regime the firm faces different constraints, and $A(.)$ has a different functional form. In that case, we should not expect the coefficients to be the same in the two regimes, even for such a simple specification as that given by equations (12) and (13).

In that context, the only restrictions we will impose a priori are sign conditions: $a_2 < 0$, $b_2 < 0$, $a_1 > 0$ and $b_1 > 0$.

Equation (7) above expresses Tobin's q as a function of its own expected value plus a risk premium. Equations (12) and (13) establish a link between that expected value and the expectations of aggregate

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[8] In fact it would be more rigorous to use the conditional expectations YD^* and YS^* instead of $E(YD)$ and $E(YS)$ in equations (12) and (13). We can rewrite the conditional expectations as functions of the non-conditional expectations. In particular for demand, if u_1 is independent of u_2, we have:

$YD^* = E(YD)\,[1 - \int_{-\infty}^{\infty} F(z) f_1(u_1)\, du_1] - \int_{-\infty}^{\infty} u_1 F(z) f_1(u_1)\, du_1$

where $z = [E(YD) - E(YS) + u_1] / \sigma_2$; $F(z)$ is the standard normal distribution; and $f_1(u_1)$ is the normal density with zero mean and variance σ^2_1.

demand, aggregate supply and regime probabilities as defined in a disequilibrium model. We now attempt to specify Tobin's q as a function of the estimates of demand, supply and probabilities derived from the disequilibrium model we just estimated. Some preliminary remarks are in order.

1. The riskless rate. In an economy with strong inflation and with a large proportion of assets held in dollars, there might not be a riskless asset. One might contend that dollar investments can be considered as riskless, since they provide a hedge against devaluation and, indirectly, against inflation. But inflation and devaluation do not go hand in hand, so that a change in the dollar position might lead to gains or losses. A second possibility would be to look for an indexed asset or a real asset, such as real estate. But even such an asset could not be considered riskless from the point of view of the agents, since it carries a risk of a change in relative prices. In a highly inflationary economy, relative price changes are very substantial, especially in the short run. For that reason we take as a reference a hypothetical real discount factor, which we assume constant and normalize to unity.

2. Concerning the future values of the firms, we keep the assumptions made in previous sections. The specification retained for μ is:

$$(14) \quad \mu = (a_0 + a_1 YD + a_2 W/P) + \Phi_P (c_0 + c_1 YS - a_1 YD + c_2 W/P)$$

$$\text{where} \quad c_i = b_i - a_i \qquad \text{for } i = \{0,1,2\}$$

The sign restrictions become $a_1 > 0$, $c_1 > 0$, $a_2 < 0$, $c_2 < -a_2$. YD, YS and Φ_P are the time series estimated in the disequilibrium model for the goods market.

In the valuation model, μ is an expected value while YD, YS, W/P and Φ_P are contemporaneous variables. Some assumption is necessary for

the process of expectation formation on μ. Specifically, we assume that the expected value of firms is defined as

$$\mu^* = \lambda_0 \mu + \lambda_1 \mu_{-1} + \lambda_2 \mu_{-2} + \lambda_3 \mu_{-3} \quad (15)$$

$$where \quad \sum_i \lambda_i = 1$$

3. Although financial agents try to evaluate the expected value of the assets by using their own evaluation of future revenue flows, they are aware that the short-run valuation of the stock market can differ from their own long-term projection. As a result, they seek to dampen the differences between their own long-run evaluation of the firm and the short-run evaluation of the equity. Let q^* be defined as

$$q^* = q_{-1} (1 + \Delta q^*)$$

$$1+\Delta q^* = 1 + \alpha_0 \Delta q_{-1} + \alpha_1 \Delta q_{-2} + \alpha_2 \Delta q_{-3} + \alpha_3 \Delta q_{-4}$$

$$where \quad \sum_i \alpha_i = 1$$

where q^* is the expected path of the stock market value in the absence of new informations. News are incorporated in μ^* and in the risk premium RP but not in q^*, which depends only on past values of q. We suppose here that stock market does not adjust instantaneously, so that

$$q = \eta \left((1/r) (\mu^* - RP)\right) + (1-\eta) q^* \quad (16)$$

Financial agents behave as if they use a weighted average of their own evaluation of the equity, i.e. the long-run evaluation $\left((1/r) (\mu^* - RP)\right)$, and the q^* path of the market.

4. We will write the risk premium as it is defined in the model:

$$(17) \qquad RP = R\left[\beta_0 + \Phi_P \beta_1 + \Phi_P \Phi_K x^2\right]$$

$$if \quad \sum_i x_i = x$$

$$where \quad \beta_0 = \sum_i \delta_i$$

$$\beta_1 = \sum_i (\gamma_i - \delta_i)$$

The term μ^* already contains the constant α_0 . This implies that α_0 and β_0 are not identified simultaneously. We impose $\beta_0 = 0$ for the estimation, which implies that RP measures the variation of the risk premium with respect to the risk premium conditional to the Keynesian regime, i.e., β_0.

The constancy of β_0 and β_1 implies that the variance of the portfolio is modified only by changes in the expectations of μ_P, μ_K and Φ_P. This means, in particular, that the coefficients δ_i and γ_i remain constant over time.

7 ESTIMATION OF TOBIN'S Q

In our basic model q is defined by equation (16) and the risk premium by equation (17), μ^* is given by equations (14) and (15), and r is assumed to be constant and is normalized to unity. The constant β_0 is put equal to zero to allow for the identification of parameter α_0 . Since β_0 must be positive, we know that estimates of μ^* and RP will be biased; the bias is positive and constant over time. This does not affect the statistical properties of the model.

The estimation results are given in Table III.

TABLE III

Estimation period 1977:2 to 1985:4

Parameter	Estimate	t-Stat.
η	0.48073	4.4636
λ_0	0.25816	(1)
λ_1	0.26925	3.1391
λ_2	0.27124	3.2676
λ_3	0.201352	0.1487
a_0	-498.77	-6.6865
a_1	0.11209	6.9722
a_2	-1.5316	-4.2733
c_0	149.61	2.1398
c_1	0.037174	2.7956
c_2	3.7073	3.8535
R	0.16291	2.6867
β_1	0	(2)

$R^2 = 0.95596$

Log of LF = -120.025

D-W Stat. = 2.02780

Durbin AR1 t-Stat. = .41540

(1) constraint $\Sigma_i \lambda_i = 1$

(2) constraint tested and accepted

From a statistical viewpoint, the parameters are significant and the fit of the equation is good. We have tried several specifications and kept the one that seemed best to reflect the generation process of the data. In

particular, the α_i's are not significantly different from the λ_i's and the restrictions $\alpha_i = \lambda_i$, for all $i = /0,1,2,3/$, are tested and accepted.

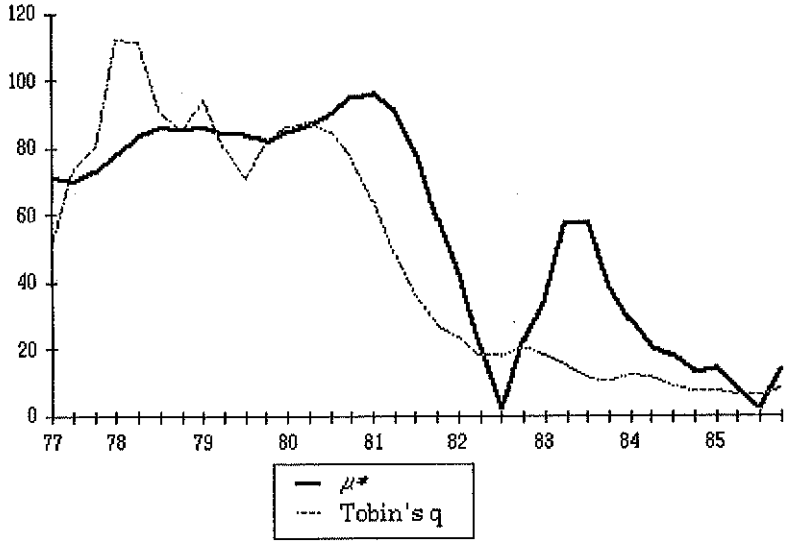
From an economic viewpoint, the coefficient values fit the imposed constraints. There is only one exception: since the estimate of c_2 is larger than $-\alpha_2$, the real wage has a positive coefficient for μ_P . But the most interesting aspect is the assessment of the estimates of μ^*, q^* and RP, which are presented in the appendix.

As was pointed out earlier, RP here represents the variation of the risk premium around β_0. This variation is zero when $\Phi_P = 0$ or $\Phi_K = 0$, essentially because the hypothesis that $\beta_1 = 0$ is not rejected by the data. This implies that the risk premium increases in periods where Φ_P is close to 1/2, that is, in periods where the two regimes are equiprobable. In particular, we observe that in the period of sustained growth, capacity restrictions and demand contractions were equally likely, fundamentally from 1979 to 1981. During that period Φ_P was far from its extreme values, which implied increased risk and thus a higher risk premium. In 1982, when demand restrictions become quite significant, Φ_P approaches unity and causes the risk premium to decrease in the middle of the recession.

The estimated expected value of the firms, i.e., the estimated value of their real income flows or of their future real profits, follows the same trend as Tobin's q. This can be seen in Figure 1 At the beginning of the period the stock market grew faster than the expectations, probably because of the enthusiasm inherent in a period of expansion. After the over-evaluation observed in 1978, it appears that the stock market became less enthusiastic and stayed in line with the expectations of future profits, more important differences being accounted for by variations of the risk premium. In that sense, the model seems to provide an explanation of the process of expectation formation, and of the influence of expectations about the future state of the economy on stock market equilibrium.

The model also provides an estimate of absolute risk aversion. If we consider that μ^* has an estimated average value of 60, then relative risk aversion has an average value of 9.

FIGURE 2



It is noteworthy that the model, using the macroeconomic variables of the disequilibrium model, is able to generate estimates of the expected value of the firms that follow the same trend as the expected value of Tobin's q.

8 THE MACROECONOMIC EFFECTS

From the estimations of Rama (1986a) (1986b) and ours, coefficient γ in equation(9) should be around .1 in the long run and below .01 in the short run.

Some implications can be drawn for the Uruguyan economy:

1. As shown by Rama (1986b), investment seems to be guided by Tobin's q rather than by interest rates. This confirms the hypothesis that expectations about the future are more important to the investor than the sole evaluation of the cost of financing.

2. The process of expectation formation in the stock market appears to be driven by agents who consider the real economy to be in disequilibrium.

3. The stock market is procyclical, in the sense that any change in exogenous variables which modifies supply is likely to have a multiplier effect through investment.

4. In the short run, however, this effect is not significant because of (a)the long lag required for the implementation of investments, which according to Rama (1986b) is of 2 to 3 years; and (b)the limited influence of current values on expectations, with a coefficient estimated around .125.

9 CONCLUSIONS

With the aim of modeling financial equilibrium in a real disequilibrium context, we have adapted the CAPM to allow for an explicit treatment of the process of expectation formation.

The expected value of the firms is a weighted average of potential and Keynesian expected values, the weights being the regime probabilities. A real disequilibrium model is used to generate these probabilities as well as the expectations of demand and supply. The model fits the data well, and the theoretical variables are all significant with well-defined coefficients. It gives a good deal of information about the effects of disequilibrium variables on Tobin's q.

In the real world the economic agents do not know this information, but they can compute, or have access to, forecasts about other disequilibrium variables such as demand, vacancies, the degree of capacity utilization, and so on. It would be more rigorous, both from a theoretical and from an empirical point of view, to model the problem

taking into account these sources of information[9].Despite this fact, the model developed in this paper is a good approximation of financial behavior in non-market-clearing economies.

Finally, it is possible to integrate this estimation in the more general model synthesized in Table I. In that model, expectations create a feedback between production and investment, on the one hand, and financial markets, on the other hand. Rama's (1986a) (1986b) and our estimations show that there is no significant short-run feedback, while in the long run financial equilibrium is affected by expectations of disequilibria on the goods market and investment is guided by Tobin's q.

[9] Disequilibrium models in the "aggregation over micro-markets" set-up are able to explain these variables. See in particular the CES-disequilibrium model of Lambert (1989) and Sneessens and Drèze (1986), and their application to a ten-country econometric model in Drèze (1989).

APPENDIX

ESTIMATES FOR THE FINANCIAL MODEL

	μ^*	PR	q^*	q
1977:2	71.2	0.0	55.9	50.9
:3	69.9	0.0	58.0	73.5
:4	72.9	0.0	90.6	80.2
1978:1	78.2	0.0	97.2	112.2
:2	83.6	0.1	140.8	111.6
:3	86.2	0.1	136.2	90.8
:4	85.5	3.9	97.8	85.5
1979:1	86.2	4.1	86.7	94.0
:2	84.2	4.2	90.1	80.0
:3	83.8	3.2	74.8	70.9
:4	82.1	0.2	67.1	82.1
1980:1	85.3	0.2	81.3	86.6
:2	87.1	1.5	86.2	87.9
:3	90.5	5.4	91.3	84.5
:4	95.4	14.9	87.9	76.4
1981:1	96.3	27.3	74.9	64.1
:2	90.9	25.9	59.3	48.1
:3	78.5	20.5	41.3	36.1
:4	58.7	9.8	29.1	27.3
1982:1	42.9	0.1	21.0	23.7
:2	21.0	0.0	18.5	18.2
:3	2.4	0.0	14.3	17.7
:4	23.0	0.0	15.0	20.9
1983:1	34.8	14.1	19.9	18.1
:2	57.6	15.3	17.4	14.6
:3	57.8	17.9	14.0	11.3
:4	38.5	17.8	10.1	10.4
1984:1	28.7	6.8	8.7	12.5
:2	20.6	5.7	11.6	11.6
:3	17.9	2.8	11.2	9.0
:4	13.3	0.0	8.7	7.6
1985:1	14.4	0.0	7.0	7.6
:2	8.2	0.0	6.7	6.4
:3	2.4	0.1	5.6	6.2
:4	14.2	0.4	5.7	8.0

ESTIMATES FOR THE DISEQUILIBRIUM MODEL

	E(YD)	*E(YS)*	Φ_P
1976:1	5788.60	5387.30	100.00
:2	5877.80	5254.50	100.00
:3	5914.20	5377.30	100.00
:4	6015.90	5473.00	100.00
1977:1	5799.30	5426.70	100.00
:2	5957.50	5362.60	100.00
:3	6090.40	5561.50	100.00
:4	6058.60	5657.30	100.00
1978:1	6105.60	5646.20	100.00
:2	6206.90	5875.10	99.85
:3	6232.50	5969.10	99.99
:4	6137.80	5990.70	89.82
1979:1	6393.60	6176.70	98.30
:2	6367.40	6327.70	64.83
:3	6367.50	6535.30	1.25
:4	6347.80	6472.80	2.28
1980:1	6630.40	6586.00	65.53
:2	6463.00	6480.00	40.46
:3	6632.80	6610.60	60.05
:4	6600.30	6677.30	42.91
1981:1	6758.70	6871.20	19.52
:2	6642.50	6908.60	0.04
:3	6544.80	7273.20	0.00
:4	6310.60	7033.00	0.00
1982:1	6523.70	7039.50	0.00
:2	6010.30	6992.20	0.00
:3	5870.20	6893.80	0.00
:4	6267.40	5848.40	100.00
1983:1	5728.10	5592.70	87.12
:2	5935.20	5782.80	97.55
:3	5666.40	5894.30	4.77
:4	5711.90	5766.00	40.62
1984:1	5711.40	5547.10	93.52
:2	5612.00	5710.70	1.73
:3	5429.10	5830.10	0.00
:4	5557.50	5742.20	0.02
1985:1	5927.60	5619.20	100.00
:2	5461.10	5755.60	0.00
:3	5500.40	5735.50	0.05
:4	5849.20	5670.90	99.34

REFERENCES

R. BARRO and S. GROSSMAN (1971), "A General Disequilibrium Model of Income and Employment". *American Economic Review*, 61, 82-93.

J. DREZE (1989), "European Unemployment: Lessons from a Multi-Country Econometric Exercise". Mimeo, CORE, Louvain-la-Neuve.

F. HAYASHI (1982), "Tobin's Marginal and Average q: A Neoclassical Interpretation". *Econometrica*, 50, 213-224.

D. JAFFEE (1971), *Credit Rationing and the Commercial Loan Market.* John Wiley & Sons.

J. P. LAMBERT (1988), *Disequilibrium Macroeconomic Models: Theory and Estimation of Rationing Models Using Business Survey Data.* Cambridge UP.

O. LICANDRO (1987), "Uruguay: un modèle de déséquilibre pour le marché de travail". M.A. Thesis, Catholic University of Louvain.

O. LICANDRO (1989), "Le Modèle de Portefeuille dans le Cadre d'une Economie en Déséquilibre: Le Cas d'Attentes Exogènes". Department of Economics, Working Paper 8902, Catholic University of Louvain.

MADDALA and NELSON (1974), "Maximum Likelihood Methods for Markets in Disequilibrium". *Econometrica*, 42, 1013-1030.

E. MALINVAUD (1977), *Réexamen de la théorie du chômage.* Calman-Levy.

J. MOSSIN (1977), *The Efficiency of Financial Markets.* Levington Books.

R. QUANDT (1988), *The Econometrics of Disequilibrium.* Basil Blackwell.

M. RAMA (1986a), "Recesión y Reactivación". *SUMA*, n°1.

M. RAMA (1986b), "Por qué no se Invierte? Una Aplicación de la 'Teoria q' al Caso Uruguayo". *Revista de Economia*, 1. Banco Central del Uruguay.

H. SNEESSENS and J. DREZE (1986), "A Discussion of Belgian Unemployment, Combining Traditional Concepts and Disequilibrium Econometrics". *Economica*, 53, S89-S119.

J. STIGLITZ and A. WEISS (1981), "Credit Rationing in Markets with Imperfect Information". *American Economic Review*, 71, 393-410.

J. TOBIN (1969), "A General Equilibrium Approach to Monetary Theory". Journal of Money, *Credit and Banking*. 15-29.

H. YOSHIKAWA (1980), "On the q Theory of Investment". *American Economic Review*, 70, 739-743.