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Business cycles in a small open economy with a banking sector

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BUSINESS CYCLES IN A SMALL OPEN ECONOMY WITH A BANKING SECTOR

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Abstract

This paper studies the interest-rate-driven business cycles of a small open economy (SOE). For than end a costly operated banking system is added to the standard real-business-cycles model. Banks are the only domestic agents considered worthy of credit in international capital markets. They borrow from the rest of the world and lend domestically in a competitive credit market. Existent quantitative models of business cycles in SOE's indicate that interest-rate shocks are unable to cast the kind of output variability produced by productivity or terms-of-trade shocks. Contrary to this finding, it seems that the macroeconomic performances of several SOE's are tightly related to international interest rates and capital flows. Neumeyer and Perri (1999) points out that the introduction of working capital needs may close the gap between the standard model's predictions and the observed consequences of interest-rate shocks. This paper shows that a more careful analysis of the microfoundations of working capital may give rise to an intermediate position where working capital matters in explaining output fluctuations, but not as much as Neumayer and Perri suggest. For that end, the model is calibrated to the Argentinean economy.

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1 Introduction

This paper investigates the quantitative importance of interest-rate shocks for the business cycles of a small open economy (SOE). For that end a competitive banking system is added to the standard neoclassical general equilibrium model. The inclusion of banks constitutes an attempt to provide an analytical framework to study the interactions between the financial and non-financial sectors in SOE's. It also helps to improve the model representation of the process of channeling funds from surplus-spending to deficit-spending units in actual developing economies.

Typical financial phenomena with possible impacts on other sectors in the economy are sometimes treated without explicitly modeling the behavior of central players like banks. That is the case of models with imperfect information (see for example Aghion, Bacchetta and Banerjee (2000)) or working capital needs (see Neumeyer and Perri (1999)). The exclusion of banks from macroeconomic analysis reflects the domination that the Arrow-Debreu paradigm has had in macroeconomics (See for example Gertler (1988) and Freixas and Rochet (1997)).

However, as Diamond (1984) has shown, financial intermediation is the endogenous device for carrying out borrowing and lending in the presence of asymmetric information. And working capital loans are the typical financing provided by commercial banks.

The case of working capital is particularly interesting because it permits to address the importance of international interest-rate fluctuations for domestic output variability. In the standard real-business-cycles model a change in the international interest rate affects production through the supply of factor inputs. Labor supply decisions are affected by the price of future consumption (interest rate) on one side. At the same time, a change in bond prices makes households reallocate their savings between capital and international bonds. In this framework Mendoza (1991) points out that interest-rate fluctuations are unable to cast the output variance observed in the Canadian economy. Correia, Neves, and Rebelo (1995) showed that the responses of output, consumption and labor supply to interest rate shocks were also small in the Portuguese economy.

Contrary to these results, it seems that changes in the cost of international financing may severely affect the evolution of output in emerging economies. In the 90's several developing countries faced sudden capital outflows with devastating consequences for their real economies. After the Mexican devaluation of 1994 and the Russian default of 1997, many countries viewed how the capital inflows that shrank interest rates and fueled economic expansions, flew out giving rise to recessions and unemployment.

Figure 1 shows the 3-months Argentinean interest rate, and a GDP index for the period 1981-1999. The contemporaneous correlation between the two variables is equal to -0.781. A similar pattern seems to relate interest rate and output in other countries like Mexico and Brazil. It is not less surprising the existent co-movement between banks total loans and GDP as it can be seen in Figure 2. The correlation observed between the latter two variables is equal to 0.64.

In another context Calvo, Leiderman, and Reinhart (1993) studied the capital inflows to Latin America at the beginning of the 90's. These flows are associated with the decreasing interest rate in Latin American economies (for an example see Figure 1). Two conclusions emerge from the work of Calvo et.al. First, much of capital inflows are result of factors external to the analyzed Latin American economies. Second, these flows have affected the economies in several ways, for example increasing the availability of capital, facilitating the smooth of consumption over time and giving investors the opportunity of reacting to expected changes in profitability.

Neumeyer and Perri (1999) introduced working-capital needs in the standard model in an attempt to increase the impact of interest-rate shocks on domestic output. This is because the model now allows for an additional source of output variability. In this setting not only factor supplies react to interest-rate shocks but also factor demands do as the interest rate is part of the cost of employing inputs. The introduction of working capital permits Neumeyer and Perri to account for 55% of output variance in Argentina. However, they model working capital as another input factor coming directly from overseas.

A subtle analysis of the nature of working capital reveals that its introduction in a macroeconomic model deserves a deeper analysis. First, working capital is associated with short-term loans, the typical financial service banks offer to firms, and not with a long-term international bond. Second, these loans are monitoring-intensive and so less plausible to be granted for institutions different from domestic banks. Additionally, the assumption that the amount of working capital is equal to total factor costs means that the stock of credit is much larger than what actual economies have. In such case, total financing is at least as high as national income even without counting households borrowing. This is at odds with the empirical evidence since the stock of total credit is seldom as high as the GDP in developing economies (See for example the database in Beck, Demirüç-Kunt, and Levine).

Modeling interest-rate shocks as if they were completely independent of domestic economic developments may sound unrealistic since much of the variation in interest rates is due to country risk, as Neumeyer and Perri show. However, there are several factors (e.g. political events) affecting interest-rate differentials. Recently the Argentinean replacement of its Finance Secretary made country risk first decrease and then rocket as the new secretary could not get political support for his "plan". Additionally as Calvo et.al. (1993) documented, much of the beginning-of-nineties capital flows have responded to external factors to emergent economies as mentioned above.

In the model of section 3 banks are the only financial intermediaries in the economy and the only domestic agents creditworthy in international capital markets[1]. They issue an internationally traded bond and the proceeds are lent to other agents in the economy: firms and households. Firms must pay factors of production before realizing their sales and hence have a demand for working capital. Households use bank loans to smooth consumption and to change the stock of capital they are renting to firms and banks. Thus from the standpoint of households, bank loans play the role international bonds do in the standard model.

The banking sector is perfectly competitive and banks are modeled to have their two actual constraints, a financial or balance sheet constraint, and a technology constraint (Sealey and Lindley (1977)). The latter indicates that real resources are used up in the process of granting a loan. Banks demand labor and capital services for loans production and maximize profits, with revenues coming from the intermediation margin. Adding deposits production is straightforward in this context although it does not provide any extra insight to the working capital problem addressed later on. The balance sheet constraint assures that what banks are lending is what they are borrowing from other agents. Thus banks are modeled following Freixas and Vives (1997, Ch.2) .

The model fits in what Baltensperger (1980) calls "real resource models" of banks because a prominent role is assigned to the (real) production aspect of financial activities. Thus, financial or portfolio decisions are not independent from production decisions but they are taken jointly. [2]

A banking system is a more accurate description of the financial system vis-à-vis a bond

[1] Alternatively one can assume that banks can monitor domestic agents more efficiently than any other foreign lender.

[2] Hancock (1991) mentions some problems associated with the alternative view where "the neoclassical theory of the firm has been supplanted by portfolio theory in analyzing the behavior of financial institutions": there is a tendency to omit production and cost constraints and their role in determining banks output and input mix.

market in some developing economies. Domestic capital markets play an almost nil role compared to banks in the borrow-lending process in these countries, a fact early remarked by Gurley and Shaw (1955). As they stated, in the earlier stages of financial development, commercial banking is the main form of intermediation. As can be seen in Beck et. al (1999), while private bonds market capitalization is around 4% of the GDP, total private credit from financial institutions is equal to 20% of the GDP in low and lower-middle income countries. In high income countries these ratios are equal to 20 and 60%, respectively.

Several papers have studied the relationship between financial intermediaries and firms. Williamson (1987), constructs a business cycle model of overlapping generations in which financial intermediation plays a central role in output fluctuations. Williamson's banks are the optimal solution to asymmetric information and costly monitoring problems. King and Plosser (1984) include a banking sector in the economy. They study money-output correlations and their approach implies that banks only provide transaction services. Agénor (1997) introduces banks in a model of SOE to study the effect of an increase in the risk premium on international markets induced by a contagion effect. However banks are modeled as a costless technology and the interest-rate margin arises only due to the imposition of reserve requirements. None of these works offers a quantitative analysis of the issues addressed in their models. By emphasizing the importance of banks in the credit supply process the paper is related to Gurley and Shaw (1955).

Christiano (1992) and Christiano and Eichenbaum (1992) have investigated how working-capital needs along with an asymmetric distribution of money inflows among firms and households give rise to a liquidity effect. This effect opens a new channel through which monetary shocks affect business cycles. In the model of section 3, the mechanism through which interest-rate shocks impact on the SOE is similar to that in Cristiano, and Christiano and Eichenbaum. On one side, a change in the domestic interest rate (due to the liquidity effect in one case and the international interest-rate shock in the other) affects input supplies through both assets and intertemporal substitution. On the other side, the demand for inputs is also affected. This is because the interest rate is part of the gross cost of employing factors of production[3].

The paper follows with other four sections. Section two elaborates on the method for incorporating banks in the standard SOE model. Section three presents the model and section four

[3] In the papers cited above Christiano and Eichenbaum assume that the use of working capital is only associated to one input factor: labor.

contains its quantitative properties. The model is calibrated to Argentina in order to evaluate the role of working capital in the business cycles of that economy. The final section contains concluding remarks and some avenues that could be explored in future research. The employed solution method is discussed in an appendix.

2 Banks in a SOE

The existence of institutions providing financial services has been commonly justified based on the incomplete information paradigm. This approach has been extensively used to study how the inclusion of financial constraints may amplify business cycles (see for example Aghion, Bacchetta and Banerjee (2000) , Bacchetta and Caminal (2000), , Bernanke, Gertler, and Gilsrist (1999), (Bernanke and Gilchrist, 1999) and the literature cited therein).

Alternatively, the industrial organization approach stresses the importance of transaction costs. Banks provide an array of services and the financial transactions are the only tangible counterpart of these services. The natural question that arises is then, why don't firms and households do what banks are doing for them? One possible answer is linked to the presence of transaction costs. The transformation of financial securities and the access to international financial markets are the services that banks provide in the model of the next section.

The assumption that only banks are worthy of credit in international financial markets provides a reason for banks to exist. Although not modeled explicitly, it is assumed that there exists information problems that make bank credit special for domestic agents. This assumption implicitly extends Fama (1985)'s idea that for certain class of borrowers bank credit is special. These borrowers are interpreted as all agents in the economy.

The characterization made for banks disregards several aspects of the banking system. In particular it does not address risk management in none of its variants (credit risk, liquidity risk), insolvency costs and equity capital considerations among other things.

On the other side, the model offers an alternative to have a well defined steady state where all variables are stationary, independent of the value of the international interest rate and the rate of intertemporal preference.

It is well known that the standard macroeconomic model produces unsatisfactory results when it is extended to an open economy. The fact that both the interest rate factor, $1 + r$, and the intertemporal discount factor, β, are given from the standpoint of a small open economy casts unplausible results. Particularly, a finite interior solution for the marginal utility of wealth forces to preset the value of the mentioned parameters so that their internal product is equal to one in the nonstochastic steady state. However that presetting cannot avoid a non-stationary solution for some variables in the model. In all cases consumption, the trade balance, and the stock of net foreign assets are non-stationary. In other words, the steady state is independent on the initial conditions. And once the economy is shocked, it never reaches the initial steady state, except by chance.

Several devices has been introduced in the literature to deal with this problem. Obstfeld (1981), extending the work of Uzawa (1968), endogeneized the discount factor and made it dependent on the level of utility reached at a given point in time. Turnovsky (1985) distinguished between domestic and international bonds by introducing a friction in the process of accumulating foreign bonds. Mendoza (1991) introduced a stationary cardinal utility function with includes an impatient effect. This effect alters the standard intertemporal marginal rate of substitution in consumption: actual consumption makes individuals discount future consumption heavily, as in Obstfeld (1981) . In Mendoza's paper the endogenous rate of time preference is used to determine a stable *stochastic* steady state. All these approaches assure the existence of an interior solution for the marginal utility of wealth.

Modeling banks assuming that their (physical) capital is fixed at business cycle frequencies permits to have stationary variables. The market domestic interest rate for loans is $r_{L,t}$. In equilibrium, $r_{L,t}$ is equal to the sum of the cost of funds in international markets plus the marginal operative costs of the financial system. Operative costs depend on the activity of the banking sector, increase with the level of loans, and make $r_{L,t}$ an endogenous variable. This contrasts with the standard model where r_t is taken as given. The fact that the marginal cost of a loan depends on the amount of financing is central for the dynamic properties of the model.

3 The Model

There are three agents in the economy, banks, firms and households. They interact in four markets, labor services, capital services, loans and final output. All agents are price takers in every market.

This section characterizes the agents and markets in the economy and it also defines the competitive equilibrium. Since the model economy is growing at a constant rate, g, all non-price variables except labor supply, have been detrended using that rate.

3.1 Households

The representative household (RH) has an infinite life and wants to maximize its objective function given by:

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t, 1 - n_t) \tag{1}$$

where c_t is total consumption and n_t is the total labor supplied. The time endowment is normalized to one and household's leisure is the time not spent working. $\beta(< 1)$ is the intertemporal discount factor and E_0 indicates expectations as of time t=0[4]. In solving its program the household faces a budget constraint. The flow-version of the latter is:

$$\begin{aligned} &w_t n_t + k^s_{y,t} r_{ky,t} + \overline{k}^s_b r_{kb,t} + \pi_{b,t} + \pi_{y,t} - (1+g)L^d_{h,t+1} = \\ &c_t + (1+H_t)i_t - L^d_{h,t}(1 + r_{L,t}) \end{aligned} \tag{2}$$

The RH's total income is given by the sum of labor and property income. Labor income depends on both, the wage rate, w_t, and the labor services supplied to banks, $n_{b,t}$, and firms, $n_{y,t}$. So $n_t = n_{b,t} + n_{y,t}$. Property income has three components. First, net financial income coming from net interest earnings on household loans, $(1 + r_{L,t})L^d_h$. Second, as the RH is the owner of both banks and firms it receives profits from these two sectors, π_i: (i=b, y). Third, the RH also counts on income coming from renting capital to banks, $\overline{k}^s_b$, and firms, k^s_y, at their market rates, r_{kb}, and r_{ky}.

On the other hand, the RH spends its income buying consumption and investment goods, including installation costs, $(H_t i_t)$. Any excess of expenditures over income is covered increasing the stock of bank debt.

Investment (net of transaction costs) and the law of motion of capital are defined by:

$$i_t = (1+g)k^s_{y,t+1} - k^s_{y,t}(1-\delta) + \overline{k_b}(g+\delta) \tag{3}$$

[4]The true discount factor, B, is different from β since the latter also depends on g and preference parameters

where δ is the depreciation rate assumed to be same across sectors.

Adjusting the stock of capital is not free. Adjustment costs are assumed to be equal to zero only at the steady state. They are defined by:

$$H_t = H\Big(\frac{k_{t+1}}{k_t}\Big) = h_1\Big\{exp\Big[h_2\Big(\frac{k_{t+1}}{k_t} - 1\Big)\Big] + exp\Big[-h_2\Big(\frac{k_{y,t+1}}{ky_t} - 1\Big)\Big] - 2\Big\} \tag{4}$$

The introduction of these distortion implies the existence of two more prices. One is the Tobin's Q, and it represents the consumption value-cost of a marginal unit of new capital, P_t^q. The other is the ex-rental value of a marginal unit of installed capital, P_t^k. Thus[5]:

$$P_t^q = 1 + H_t + H_t' \frac{1}{k_t} i_t \tag{5}$$

$$P_t^k = (1-\delta)(1 + H_t) + H_t' \frac{k_{t+1}}{k_t^2} i_t \tag{6}$$

The transversality and the no Ponzi scheme condition, dictate that, respectively:

$$lim_{t\to\infty} \quad \beta^t E_0\, u_{c,t}(k_t - L_{h,t}) = 0 \quad \text{where} \quad k = k_y + k_b \tag{7}$$

$$lim_{t\to\infty} \quad E_0 \frac{k_t - L_{h,t}}{\prod_{v=0}^{t-1}(1 + r_{L,v})} \geq 0 \tag{8}$$

An initial condition for the capital stock and household loans complete the description of the RH's problem.

$$(L_{h,0}, k_0) = (L_h 0, k0) \tag{9}$$

The RH's Optimality Conditions

The RH chooses sequences $\{c_t, n_t, L_{h,t+1}^d, k_{y,t+1}^s\}_{t=0}^{\infty}$, so as to maximize eq. (1) subject to eqs. (2) to (4) and (7) to (9). The information set on which the RH is choosing its actions at time t is Ω_t^h. The set includes the historic values of all variables until time $t-1$, the value of the state variables at time t, $L_{h,t}^d$, and $k_{y,t}$, and the value of two shocks buffeting the economy, $\epsilon_{r,t}$, and $\epsilon_{z,t}$ (described below). At time t, the RH takes saving, and inputs-supply decisions based on prices $\{r_{L,t}, w_t, r_{ky,t}\}$ and the expected values of the shocks in the economy.

[5]By construction these two prices are highly correlated.

The following optimality conditions along with eq. (2) characterize the optimal RH's decision process for $t = 0, \dots \infty$.

$$\frac{u_{n,t}}{u_{c,t}} = -w_t \tag{10}$$

$$(1+g)u_{c,t} = \beta E_t \Big[u_{c,t+1}(1 + r_{L,t+1}) \Big] \tag{11}$$

$$(1+g)u_{c,t}P_t^q = \beta E_t \Big[u_{c,t+1}(P_{t+1}^k + r_{ky,t+1}) \Big] \tag{12}$$

where the prices defined in eqs. (5) and (6) have been substituted accordingly. In principle the mentioned set of equations plus the constrains in eqs. (7) and (8) could be solved for $\{c_t,\ n_t,\ L_{h,t+1},\ k_{y,t+1}\}_{t=0}^{\infty}$, once the sequences for $r_{L,t}$ and $r_{ky,t}$ are known.

Eq. (10) equates the marginal rate of substitution of consumption for leisure to the wage rate. Eq. (11) governs the accumulation of bank debt. The optimal borrowing behavior indicates that the RH demands bank loans until the benefits in terms of actual utility, equals the discounted expected cost. This cost is the future utility that will be resigned to repay the loan.

Eq. (12) characterizes the optimal saving behavior in capital goods. The utility (gross) cost of having installed a unit of (new) capital good is given by the left hand side of (12). The expected discounted benefits, in utility terms, are on the right hand side and have two components. The future rental income from an extra unit of capital, $(r_{ky,t+1})$, and the future (after depreciation) value of capital, P_{t+1}^k. The latter includes the benefit of future reductions in adjustment costs (see eq. (4)).

3.2 Firms

The representative firm (RF) faces an atemporal problem. It wants to maximize its profits choosing a combination of labor, capital and working capital, given input prices and final output price (normalized to one). Working capital is required since the RF must pay a fraction of labor and capital services before selling its output. Thus the RF also cares about the value of the domestic interest rate because it affects input costs. The RF takes supply decisions in the output market and demand decisions in inputs and loans markets.

The RF's objective function is:

$$\pi_{y,t} = e^{z_t} f(k_{y,t}^d, n_{y,t}) - (w_t n_{y,t} + r_{ky,t} k_{y,t}^d)(1 + \tau r_{L,t}) \tag{13}$$

where $n_{y,t}$ is labor demanded and τ is the fraction of factor costs paid in advance. The importance of τ resides in the fact that assuming its value is equal to one, as it is common in the literature, produces a level of working capital incompatible with the amount of credit available in actual economies. In that case the stock of credit is at least as high as national income.

The term e^{z_t} is a productivity factor. The temporal evolution of z_t is given by:

$$z_t = \rho_z \, z_{t-1} + \varepsilon_{z,t} \tag{14}$$

where $\varepsilon_{r,t}$ is a mean zero i.i.d. process with $Var[\varepsilon_r] = \sigma^2_{\varepsilon_r}$.

The FOC's of the RF's problem are standard. For each input the marginal revenue product is equal to its unit cost. The cost is the sum of the market price and the *financing* cost:

$$e^{z_t} f_{n_y}(k^d_{y,t}, n_{y,t}) = w_t(1 + \tau r_{L,t}) \tag{15}$$

$$e^{z_t} f_{k_y}(k^d_{y,t}, n_{y,t}) = r_{ky,t}(1 + \tau r_{L,t}) \tag{16}$$

The working capital demanded (a component of bank loans), $L_{y,t}$, is equal to

$$L^d_{y,t} = (k^d_{y,t} \, r_{ky,t} + n_{y,t} \, w_t)\tau \tag{17}$$

At each instant t, the RF observes prices $r_{L,t}$, w_t, and $r_{ky,t}$, and chooses the amount of labor and capital services according to eqs. (15) and (16). It is obvious from these conditions how interest-rate shocks impact on production. When $r_{L,t}$ is positively correlated with the international rate, a fall in the latter depresses the gross cost of employing inputs and makes firms produce more. Since τ=0 in the standard model the interest rate has no effect on the demand side of input markets.

3.3 Banks

The representative bank (RB) is the only domestic agent borrowing and lending in international capital markets. It faces two constraints. One is a balance sheet constraint and it dictates that the RB lends what it borrows from someone else. The other is a technological constraint, since loans production imposes administrative costs. The costs are modeled as requirements of capital and labor services. A typical commercial bank hires labor (as tellers, managers, etc.) and capital (like computers, buildings, ATM's, etc.) for their operations. As it was described above, the bank's capital is assumed to be fixed at business cycle frequencies, leaving labor as the only choice variable.

The RB's problem can be set up in two different ways. The RB may choose how much labor to hire for loans production so as to maximize profits. Alternatively, one can see the RB's problem as two steps one. In the first step the RB solves for a cost function. This function gives the minimum (administrative) cost per unit of loan. In the second step, the bank observes the market interest rates and decides its optimal amount of loans to supply[6]. Under both approaches however the RB must observe its balance sheet constraint. The second approach is followed in the paper.

The production function for loans can be stated as:

$$L_t = af(k_{b,t}, n_{b,t}) \tag{18}$$

where $n_{b,t}$ is labor demanded by the RB. For a given level of L_t, one can solve for the *conditional* factor demands, and from there for the bank cost function, BCF_t,

$$BCF_t = BCF(L_t, \overline{k}_b, w_t, r_{kb,t}) = w_t n^d_{b,t} + \overline{k_b} r_{kb,t} \tag{19}$$

where $n^d_{b,t}$ is the conditional labor demand. Replacing $k_{b,t}$ with $\overline{k_b}$ implies recognizing the fixed supply of bank capital and it simplifies the problem.

The balance sheet constraint dictates that the amount of loans should be equal to the amount of bonds placed in international capital markets, that is:

$$b_t = L_t \tag{20}$$

The RB's profit function is then:

$$\pi_{b,t} = (r_{L,t} - r_t)L_t - BCF(L_t, \overline{k_b}, w_t, r_{kb,t})$$

where r_t is the international interest rate, that evolves according to:

$$r_t = \rho_0 + \rho_r \, r_{t-1} + \varepsilon_{r,t} \tag{21}$$

$\epsilon_{r,t}$ is an *i.i.d.* mean zero process with $Var(\epsilon_{r,t}) = \sigma_{\epsilon_r}$.

[6]Of course it can be shown that both approaches drive to the same solution once the market interest rates and prices are specified.

The optimal level of bank loans is determined maximizing $\pi_{b,t}$ with respect to L_t. This representation of the bank problem can be easily extended to other setups where the banks are also producing deposits and other services. At the optimal level of L_t, the intermediation spread is equal to the marginal operative cost, that is:

$$r_{L,t} - r_t = \frac{\partial BCF_t}{\partial L_t} \tag{22}$$

For an alternative interpretation of eq. (22), notice that the marginal revenue, $(r_{L,t})$, is equal to the marginal cost. The marginal cost is the sum of the marginal financial cost, r_t, and the marginal operative costs, $\frac{\partial BCF_t}{\partial L_t}$.

The optimal level of L_t determines the bank's net position in international capital markets through the balance sheet constraint, and the labor demanded through the conditional labor demand.

Before discussing the market clearing conditions, notice that given that $k_{b,t}$=$\overline{k}_b$ for all t, the RB's marginal cost function has a finite elasticity. This is particularly important for the dynamic of the model. It implies that the financial system acts as a buffer when the economy is affected by an interest-rate shock. Observe that when the slope of the marginal cost approaches to zero the marginal cost of a loan is constant. This implies that the domestic and international interest rate vary by the same amount. In other words, the absolute interest-rate margin is constant for all levels of L_t. In this case the economy always reaches an steady-state that is consistent with any initial level of loans.

3.4 Market Clearing Conditions

Markets for labor services, capital services, final goods and loans must clear in every period. Some of the market clearing conditions do not impose additional restrictions other than recognizing that quantities supplied and demanded should be equal. Thus,

$$k_{y,t}^s = k_{y,t}^d \qquad \overline{k_b}^s = k_{b,t}^d \tag{23}$$

is imposed hereafter. Additionally, the labor and loans market clearing conditions imply that:

$$n_{y,t} + n_{b,t}^d = n_t \tag{24}$$

$$L_t = L_{y,t}^d + L_{h,t} = (k_{y,t} r_{ky,t} + n_{y,t} w_t)\tau + L_{h,t} \tag{25}$$

The system of equations that characterize the behavior of the model economy are: the four household optimality conditions, eq. (2), and eqs. (10) to (12); the RF's two optimality conditions, eqs. (15) and (16); the RB's optimality condition, eq. (22); and the loans and labor market clearing conditions, eqs. (24), and (25). Eqs. (14), and (21) govern the temporal evolution of the the two shocks buffeting the economy. The system has 9 (5 dynamic and 4 atemporal) equations that holds for $t = 0, 1, ..., \infty$. In principle the system could be solved for the following sequence of 9 variables $\{c_t,\, n_t,\, n_{y,t},\, n_{b,t},\, L^d_{h,t+1},\, k_{y,t+1},\, w_t,\, r_{L,t+1},\, r_{ky,t}\}_{t=0}^{\infty}$ given the initial conditions stated in eq. (9) and the forcing processes for r_t and z_t. However it is not possible to solve the system analytically and a numerical method is required instead.

The competitive equilibrium for this economy is defined as a sequence of contingent allocations $\{c_t,\, n_{y,t},\, n_{b,t},\, L_{h,t},\, L_t,\, k_{y,t}\}_{t=0}^{\infty}$, and a sequence of contingent prices $\{r_{L,t}, r_{ky,t}, w_t\}_{t=0}^{\infty}$, such that all agents solve their optimization problems and markets clear.[7] The RH maximizes its expected lifetime utility, eq. (1), subject to: a) the resource and time constraints; b) the no Ponzi scheme and the transversality conditions; and c) the initial conditions for loans and capital. Firms and banks maximize their respective profits at each time t subject to their respective productive constraints. Banks must also observe the balance sheet constraint. In every period t the four markets in the economy (goods, labor services, capital services, and loans) must clear.

4 Quantitative Analysis

The calibration of the model to Argentina and the numerical simulations are shown here. The employed solution method is discussed in the appendix. Starting with the functional forms, the argument of the utility index in eq. (1) and the production functions in eqs. (13) and (18) are all Cobb Douglas,

$$u(c_t, 1 - n_t) = \frac{\left(c_t^{1-\mu}(1 - n_t)^{\mu}\right)^{1-\sigma}}{1 - \sigma} \tag{26}$$

$$y_t = e^{z_t} k_{y,t}^{1-\alpha} n_{y,t}^{\alpha} \tag{27}$$

$$L_t = a\bar{k}_b^{1-\alpha b} n_{b,t}^{\alpha b} \tag{28}$$

[7] Allocations and prices are contingent since the model is stochastic. Therefore, allocations and prices are dependent on the sequence of shocks

where e^{z_t} and a are specific sector productivity factors, only the former being stochastic; α and αb are labor shares in final output and loans production, respectively. The parameter σ is the risk aversion parameter.

Going back to the shape of the RB's marginal cost function, notice the dependency of that function on the parameter αb once $k_{b,t}$ is fixed. As it can be seen in Figure 3, the slope of the marginal cost curve decreases with αb.

4.1 Model Calibration

In the model, the value of firms final output is different from their added value. This is due to the use of working capital that enters into production as an intermediate input. Firms output is measured from income sources. Banks output in turn is measured as the product of the intermediation spread and total loans granted. In the calibrated economy banks output is equal to 0.5% of national income. Argentinean National Accounts indicate that the output of the financial sector is equal to 4% of GDP (in the period 1993-1999). However banks output in the model comprises just a fraction of the services the financial system provides in the actual economy.

Argentina has grown at approximately 2.6% per year during the last 25 years, so g=0.026 on annual basis. Following Neumeyer and Perri (1999), r is equal to 14% on annual basis[8]. The series for r_t is calculated using the US-Treasure T-bills rate and the risk premium measured by JP Morgan (Emerging Markets Bonds Index) for Argentina. Beck, Demirgüç-Kunt and Levine (1999)'s database defines interest rate margins as the ratio of net interest income and total assets. These authors estimate the Argentinean banks interest margin equal to 4.25% on annual basis. Since deposits are not considered in the model the margin is set to 2.12%.

Eq. (11) implies that β is equal to 0.9693 on quarterly basis. Therefore, the true subjective discount factor B arises from $B(1+g)^{(1-\mu)(1-\sigma)} = 0.9693$. It implies B=0.9764 (see below for the value of μ). The parameter σ is set equal to 5. The labor share in firms output α is equal to 0.50 following Argentinean National accounts. Labor share in the banking industry is difficult to calculate since what the model measures as financial activity is different from what national accounts do, although it is known that the financial industry is labor intensive. The model was simulated fixing αb=0.85. A tentative measure of αb however may come from financial data.

[8]Andrés Neumeyer generously provided the interest rate series to the author.

Notice that the capital share may be written as:

$$1 - \alpha b = \frac{r_k \hat{i} \hat{K}}{(r_L - r)L}$$

where $\hat{i}$ is the inmovability ratio, that is the share of non-financial capital in total bank capital; $\hat{K}$ is banks' total capital. According to model data $r_k/(r_L - r) = 9.55$. Ignoring risk adjustments, Argentinean banks have a capital/assets ratio equal to 0.11. With $\hat{i}$=0.8, the implied capital share in the banking industry is equal to 0.84.

For y denoting national income, Argentinean national accounts indicate that c/y=0.79, and i/y=0.19. The RH's budget constrain in steady state implies that L/y takes different values depending on the value of τ. When just 50% of the working capital must be financed in advance it implies that L is equal to 0.96 of the national income. The value of τ=0.5 guarantees that approximately half of banks credit is commercial credit.

As it is standard in the business cycle literature, it is assumed that 20% of the time is employed in final output production (n_y=0.2). Given banks output (defined above) and firms added value, optimal conditions for the use of labor in both sectors imply that n_b is equal to 0.026. Thus 1.29% of the market time is allocated to the banking sector. This is a little lower than the actual labor share in banks in Argentina (around 4%) although again it should be noted that actual banks provide more services than what model banks do.

Eqs. (3), (12), (16), and k/y=$k_y/y + k_b/y$, along with the assumption that banks earn zero profits in steady state, give a solution for δ, r_k, and both types of capital. Hence on annual basis δ is equal to 6.03% and r_k to 23%. k_y/y is equal to 2.5, and k_b/y=0.02. L_h, the amount of loans going to the RH arises from the loans market clearing condition and it is equal to 0.46 of national income and it represents a share of 48% of total loans. The labor market clearing condition makes n=$n_b + n_y$. Finally, the value of μ comes from eq. (10) in steady state, and it is equal to 0.7164.

4.2 Numerical Results

In this subsection the model discussed in section 3 is compared to the standard model with and without working capital. Both interest-rate and productivity shocks are considered. From the estimation of an AR(1) for the Argentinean interest rate, the persistence parameter, ρ_r is fixed to 0.918. The standard deviation of the quarterly interest rate is equal to 0.0135 (0.0608 on annual basis).

Notice that the statistical properties of the interest rates differs from those used by Mendoza (1991). Mendoza considers a value of ρ_r equal to 0.356 and the standard deviation of r equal to 0.0118.

Other models are nested in the discussed one. Observe that, as the interest rate margin, $r_{L,t} - r_t$, approaches zero, banks play no role in the economy. Essentially it makes banks output equal to zero. Therefore, domestic agents obtain financing placing bonds in the international capital market. The case without working capital is obtained setting τ equal to zero. Hence the loans market clears when households loans demand equals banks credit supply.

4.2.1 Banks Versus Direct Financing

The introduction of a banking system into the standard model of a SOE demands a re-interpretation of the optimality and market clearing conditions. An *interest-rate shock* still produces the three known results, i.e. the wealth effect, the intertemporal substitution in consumption and labor, and the re-allocation of assets between capital and loans. However domestic interest rates are less volatile than the international rate.

Figures 4 and 5 display the impulse response functions that follow a interest-rate shock (r_t rises). The shock raises the financial cost of the banking system and cuts down the supply of loans. The domestic interest rate goes up and so both the production and consumption paths are affected, as in the standard model. However the domestic interest rate, $r_{L,t}$, rises less than the international rate. Since the equilibrium level of loans is lower when the interest rate increases, banks marginal operative costs are lower than otherwise. The importance of the last effect depends on: a) the interest-rate elasticity of the supply of loans (affected by the value of αb); and b) the share of operative costs on the banks interest rate.

The larger the interest-rate margin the lower the output variability. A larger interest-rate margin is equivalent to a larger component of operative costs in determining the domestic interest rate. Hence shocks affecting the financial marginal cost of the banking system are less important for the variance of domestic rate and then for the output variance.

When banks intermediate in the loans market, $r_{L,t}$, and not r_t, is the relative price of future consumption. Since r_t is more volatile than $r_{L,t}$ the economy without banks observes too much volatility vis-à-vis the economy with financial intermediaries. Of course, the result depends on how banks were introduced in the economy, and the assumption of a fixed stock of bank physical capital.

An interest-rate shock affects both, the demand and the supply for labor at a given wage rate. On the demand side, higher financing costs makes firms slow down production cutting down the demand for labor services. On the supply side, as the price of future leisure decreases, households substitute present for future labor, increasing the actual labor supply. The fact that the equilibrium amount of labor jumps on impact indicates that the latter effect dominates initially .

For a quantitative measure of the implied volatilities some moments conditions of the calibrated model are compared to those of the Argentinean economy. It should be noted that the Argentinean national accounts (NA) have several deficiencies. One problem is the truncation of the series. Macroeconomics series have small number of observations. The maximum number is 80 observations on quarterly basis (20 years). Series bases change very often. The last edition of the NA measures macroeconomic variables at 1993 prices and its sample goes from 1993.1 to the present. However this edition has several differences with the NA's at 1986 prices. Indeed these two editions show differences with the NA's at 1970 prices[9]. For these reasons it may be preferable to make explicit the differences instead of presenting a simple average. Business cycles statistics for the main macroeconomic variables are in Table 1.

Table 2 shows model statistics comparing the economy with banks with another under direct financing. Before commenting on the comparison, notice that some standard results arise in both cases. The (direct or indirect) access to capital markets to smooth out consumption makes household loans highly volatile. This is the other side of a volatile trade balance.[10] On the other side, consumption shows a low standard deviation. The low variability of consumption is due to the Cobb-Douglas utility index as it is discussed in Correia et al. (1995).[11] The trade balance is of course countercyclical because all effects operate in the same direction for a debtor country. A higher interest rate increases the debt burden reducing net wealth, and also leads to substitute

[9]The NA's at 1993 prices have 24 observations, between 1993.1 and 1999.4; the NA's at 1986 prices have 64 observations between 1980.1 and 1996.4; and the NA's at 1970 prices have 80 observations between 1970.1 and 1990.4

[10]The trade balance reported in the tables is measured relative to domestic output.

[11]Correia et al. state that after having experienced with several parameter values, they could not raise the volatility of consumption above 25% of output.

future for present consumption and leisure.

Results differ from one model to the other because of the difference between the domestic and international interest rate. For the same level of adjustment costs, the banking economy shows a slightly higher investment volatility relative to output. The relative volatility of consumption is also lower when banks intermediate in credit markets. As the domestic rate responds to change in domestic variables, there is an extra source of variability.

The effect of interest-rate shocks on output in the previous cases contrast with those found by Mendoza (1991). Experimenting with different interest-rate shocks, Mendoza concludes that the effect of these shocks on output is not significative. Results shown above depend on the autocorrelation coefficient. Mendoza sets ρ_r equal to 0.356. When the same value is adopted in the model of section 3 results are comparable to those in Mendoza (1991). Particularly, keeping constant the variance of interest rate shocks, the standard deviation of output falls below 0.3.

Now consider the case of a positive *productivity shock* and see Figures 6 and 7. The existence of the banking system breaks the separation between consumption and investment decisions that is present in the standard model. The shock makes firm demand more capital making the Tobin's Q higher than 1. This induces households to accumulate capital. In the standard model the trade balance becomes coutercyclical when the pro-borrowing effect dominates the pro-saving effect. But since the interest rate is constant in that model the price of future consumption does not induce additional effects on intertemporal decisions.

However in the model of section 3, investment decisions also place a higher demand for loans and induce an equilibrium rise in the domestic interest rate. This in turns makes agents substitute future for present consumption and hence there is a an extra incentive to work that reinforces the previous one. But there are other two additional effects operating in the opposite direction. One is given by the fact that the gross cost of factor inputs also rises, discouraging production. The other operates through the substitution of assets since the higher interest rate induces agents to substitute loans for capital goods as the saving vehicle. Figure 5 illustrates the net effect of the productivity shock on the economy and dotted lines identify again the economy without banks.

The last two commented effects of productivity shocks make the the banking economy observes lower volatility in its macroeconomic variables. Quantitative comparisons of both models indicate that GDP is three times more volatile in the absence of banking intermediation, although the first order autocorrelation of output is approximately the same. Because of the separation between consumption and investment decisions, consumption is less volatile in the standard model.

4.2.2 The Effect of Working Capital

The second set of results compares the importance of different values of τ, that is the size of working capital needs. See Figures 8 and 9, and Table 3. In the figures τ was set equal to 1, 0.5 and 0.0001. Table 3 reports the results for τ equal to 1 and 0.0001. The latter value illustrates the economy without working capital.

As expected, output variability depends on the value of τ. However there are no significative changes in going from τ=.5 to τ=1. Domestic interest rate varies less when firms need no working capital. The standard deviation of output rises from 3.009 to 4.218. This result indicates that for increasing the effect of interest rate shocks on output, the value of the autocorrelation coefficient, ρ_r, is as important as the introduction of working capital.

5 Concluding Remarks

The standard neoclassical model of a SOE predicts that interest rate shocks do not generate significative output variance. Thus, country-specific (international free rate plus risk premium) interest rate would not be an important determinant of business cycles in actual economies. However there is a remarkable contrast between this prediction and the stress that economists in the private sector put on financial variables, including interest rates.

Modifying the model to introduce working capital needs seems to close the gap between the practical economists point of view and the predictions of the theory. However the nature of working capital, a short-term loan typically provided by commercial banks, implies that the modification deserves a deeper analysis. Therefore the paper includes a banking system that borrows from the rest of the world and lends to both households and firms in a domestic credit market.

Having a banking system however reduces the impact of interest rate fluctuations on output although leaving enough variability to maintain the alignment between model predictions and actual business cycles. Also, there are additional interactions between the financial and non financial sectors when the economy is buffeted by a productivity shock. The separability between consumption and investment decisions does not hold once the domestic interest rate reacts to a higher demand for loans.

As for the agenda for future research, first, as King and Plosser (1984) suggest, it could be interesting to have the financial industry holding claims on the probability distribution of output and deposits.

The model presented here could be extended to make firms face credit limits due to some agency costs. The borrowing constraints could be set according to firms real wealth. This would permit to study quantitatively how firms' wealth interact with other variables to determine output and the demand for factor inputs. Also, it could open the possibility of explaining the credit condition of firms of different sizes (as measured by wealth). This would imply extending the paper along the lines suggested by Bernanke and Gertler (1989).

Appendix: The Solution Method

The optimal behavior of the economy was characterized by 9 equations (see section 3). Now another equation must be added to include a dummy variable $K_t = E_t k_{y,t+1}$. This permits to reduce the system to a first order one. After substituting $n_t - n_{y,t}$ for $n_{b,t}$ a system of 9 equations in 9 variables arises again. Finally the model has two forcing processes one for z_t and another for r_t.

As can be deduced from the initial conditions of the RH's problem, both the capital stock and the stock of household loans have an exogenous (initial) value. Thus at any time t, the value of these two variables are known. Assume the vector $\mathbf{k}_t$ contains these variables. There are seven variables whose values are non-predetermined at time t, and it is assumed they are contained in the vector $\mathbf{u}_t$[12]. The two exogenous variables, r_t and z_t, are included in the vector $\mathbf{z}_t$.

Log-Linearizing the system of equations around the non stochastic steady state solution of the model, produces another system, now of linear exptectational difference equations, that can be expressed as:

$$A\begin{pmatrix} \mathbf{k}_{t+1} \\ E_t\mathbf{u}_{t+1} \end{pmatrix} = B\begin{pmatrix} \mathbf{k}_t \\ \mathbf{u}_t \end{pmatrix} + C\mathbf{z}_t \quad t = 0, 1, ... \tag{29}$$

where A and B are (9×9) square matrices, and C is a (9×2) matrix. This is the typical expectational difference equations arising from the linearization of a rational expectations model.

Since some of the equations just involve atemporal relationships, the matrix A is singular. The solution method used for solving the model dynamic is the one suggested by Klein (1998) . It is based on the Schur decomposition of the coefficient matrices A and B. As Klein discusses, when the shocks buffeting the economy follow a **VAR**(1) process, the equations in (29) can be rewritten as:

$$\widetilde{A}\begin{pmatrix} \widetilde{\mathbf{k}}_{t+1} \\ E_t\mathbf{u}_{t+1} \end{pmatrix} = \widetilde{B}\begin{pmatrix} \widetilde{\mathbf{k}}_t \\ \mathbf{u}_t \end{pmatrix} \tag{30}$$

where a tilde indicates the respective matrices (vectors) are being modified to include the evolution of the exogenous processes. Now $\widetilde{A}$ and $\widetilde{B}$ are of (11×11) and $\widetilde{k}$ is of (4×1).

[12]Non-predetermined variables are K_t, c_t, n_t, $n_{y,t}$, $r_{L,t}$, $r_{ky,t}$, and w_t.

By the definition of the Schur decomposition, and given the matrices $\widetilde{A}$ and $\widetilde{B}$, there exist *unitary* (11×11) matrices Q and Z such that, $Q\widetilde{A}X = S$ and $Q\widetilde{B}Z = T$. Both S and T are upper triangular and for each i, s_{ii} and t_{ii} not both zero, $\lambda(A, B) = \{t_{ii}/s_{ii} : s_{ii} \neq 0\}$ are the generalized eigenvalues. The pairs (s_{ii}, t_{ii}) can be arranged in any order.

Define:

$$y_t = Z^H x_t \qquad \text{where} \quad x_t = \begin{pmatrix} \widetilde{\mathbf{k}}_t \\ \mathbf{u}_t \end{pmatrix}$$

where Z^H is the Hermitian transpose of Z.

Consider, an arrangement of S and T such that: a) the n_s stable generalized eigenvalues of the decomposition come first[13]; and b)the following partition of Z. The upper left-hand block is of n_s by n_k, where n_s is the number of stable eigenvalues and n_k the number of variables in $\widetilde{\mathbf{k}}_t$. The lower right-hand block of Z has n_u rows, where n_u is the number of unstable generalized eigenvalues of the decomposition. The the number of columns in that block is the number of variables in $\mathbf{u}_t$. The other two blocks follow the described two.

Making a partition of y_t into $y_{s,t}$ and $y_{u,t}$, according to the one made for Z, and premultiplying the system by Q,

$$\begin{pmatrix} S_{11} & S_{12} \\ 0 & S_{22} \end{pmatrix} E_t \begin{pmatrix} y_{s,t+1} \\ y_{u,t+1} \end{pmatrix} = \begin{pmatrix} T_{11} & T_{12} \\ 0 & T_{22} \end{pmatrix} \begin{pmatrix} y_{s,t} \\ y_{u,t} \end{pmatrix} \tag{31}$$

S_{11} and T_{22} are invertible by construction. The system (30) is thus decoupled into (31). Since the generalized eigenvalues of the sub-system $S_{22}\ E_t y_{u,t+1} = T_{22}\ y_{u,t}$ are all unstable, the unique solution for $y_{u,t}$ is found solving forward. Once the solution for $y_{u,t}$ is gotten, the result along with the other subsystem in (31) permits to have the solution for $y_{s,t}$. Under a set of assumptions, Klein (1988) proves that the *unique* solution to system (29) is (after going back from the auxiliary variable y to the original system) given by:

$$\mathbf{u}_t = Z_{21} Z_{11}^{-1} \widetilde{\mathbf{k}}_t \tag{32}$$

and

$$\widetilde{\mathbf{k}}_{t+1} = Z_{11} S_{11}^{-1} T_{11} Z_{11}^{-1} \widetilde{\mathbf{k}}_t + \xi_{t+1} \tag{33}$$

[13] Unstable generalized eigenvalues are those larger or equal to one, including infinite eigenvalues.

which is the recursive representation of the stable solution to the system of linear difference equation (30). ξ_{t+1} is the mean-zero *iid* shock to the state variables in the system (30). It accounts for the shocks affecting the temporal evolution of productivity and interest-rate shocks.

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Table 1

Argentina: Business Cycles Statistics

National Accounts at 1993, 1986 and 1970 prices

	NA's at 1993Prices			NA's at 1986 Prices			NA's at 1970 Prices		
Variable*	σ_x/σ_y	$\rho_{x_t,x_{t-1}}$	ρ_{x_t,y_t}	σ_x/σ_y	$\rho_{x_t,x_{t-1}}$	ρ_{x_t,y_t}	σ_x/σ_y	$\rho_{x_t,x_{t-1}}$	ρ_{x_t,y_t}
Output**	3.002	0.828	1.000	4.343	0.780	1.000	3.121	0.675	1.000
Cons.	1.157	0.826	0.911	1.197	0.794	0.959	3.374	0.716	0.693
Inv.	2.673	0.800	0.959	3.031	0.809	0.929	4.954	0.762	0.594
N.Exp.	1.056	0.762	-0.884	2.286	0.836	-0.830	2.922	0.779	-0.649
Fin.Syst.	1.549	0.702	0.809	0.487	0.739	-.—	-.—	-.—	-.—
r in Pes.	0.681	0.185	-0.235	-.—	-.—	-.—	-.—	-.—	-.—
r in $	0.473	0.446	-0.235	-.—	-.—	-.—	-.—	-.—	-.—
Loans	1.638	0.813	0.555	14.636	0.923	-.—	-.—	-.—	-.—
Hours	1.220	0.486	0.521	-.—	-.—	-.—	-.—	-.—	-.—

*y represents GDP and x is used for all the remaining variables.

*σ_x/σ_x is the standard deviation of each variable relative to $GGDP$ except for the own GDP where its standard deviation has been reported

Table 2. Model with and without Banks

Interest-Rate Shock

Variable	Model with Banks			Model without Banks		
	$\frac{\sigma_x}{\sigma_{GDP}}$	ρ_{x_{t-1},GDP_t}	ρ_{x_t,GDP_t}	$\frac{\sigma_x}{\sigma_{GDP}}$	ρ_{x_{t-1},GDP_t}	ρ_{x_t,GDP_t}
GDP*	4.92	0.81	1.00	7.10	0.87	1.00
Consumption	0.19	0.94	0.87	0.17	0.96	0.81
Investment	2.42	0.47	0.01	2.07	0.44	0.02
Trade Bce.	1.18	-0.19	0.32	1.04	-0.11	0.33
Intnal. r	1.14	-0.89	0.62	0.81	-0.78	-0.46
Domestic r	0.86	-0.83	-0.50	0.81	-0.78	-0.45
HH Loans	14.47	0.85	0.99	20.90	0.91	0.99
Capital	0.67	0.85	0.99	0.64	0.91	0.98
Labor	0.28	0.70	0.97	0.26	0.72	0.96
r_{ky}	0.23	-0.89	-0.97	0.20	-0.96	-0.95
Wages	0.25	0.92	0.94	0.22	0.97	0.92
Work. Cap.	0.50	0.82	1.00	0.50	0.88	1.00
P_t^q	0.07	0.36	-0.14	0.09	0.30	-0.13
Saving	0.79	0.73	0.99	0.77	0.77	0.98

The standard deviation of the GDP is in absolute terms.

Table 3. Model with and without Working Capital

Interest-Rate Shock

Variable	Models with WK			Model without WK		
	$\frac{\sigma_x}{\sigma_{GDP}}$	ρ_{x_{t-1},GDP_t}	ρ_{x_t,GDP_t}	$\frac{\sigma_x}{\sigma_{GDP}}$	ρ_{x_{t-1},GDP_t}	ρ_{x_t,GDP_t}
GDP*	4.22	0.79	1.00	3.00	0.76	1.00
Consumption	0.22	0.92	0.91	0.21	0.90	0.91
Investment	2.68	0.46	-0.02	2.98	0.45	-0.05
Trade Bce.	1.53	-0.22	0.30	1.67	-0.24	0.30
Intnal. r	1.14	-0.90	-0.70	1.59	-0.90	-0.72
Demestic r	0.82	-0.85	-0.57	1.02	-0.81	-0.4800
HH Loans	16.93	0.82	0.99	21.23	0.80	0.99
Capital	0.80	0.82	0.99	0.80	0.80	0.99
Labor	0.33	0.70	0.98	0.33	0.66	0.98
r_{ky}	0.27	-0.86	-0.98	0.28	-0.86	-0.96
Wages	0.29	0.88	0.96	0.28	0.86	0.96
Work. Cap.	0.50	0.80	1.00	00.00	0.76	1.00
P_t^q	0.05	0.37	-0.14	0.06	0.37	-0.16
Saving	0.78	0.72	0.99	0.79	0.68	0.99

The standard deviation of the GDP is in absolute terms.

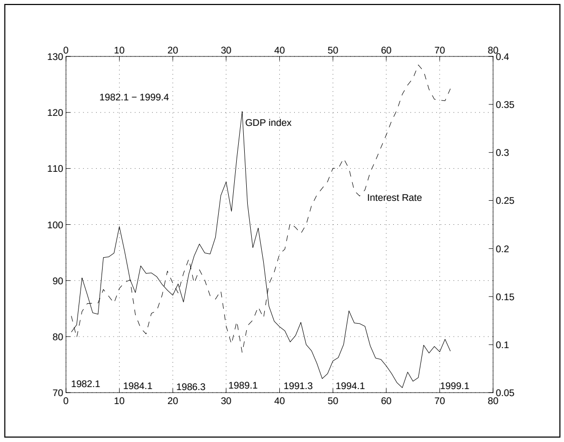

Figure 1

Argentina GDP index and Country-Specific Interest Rate. 1982-1999

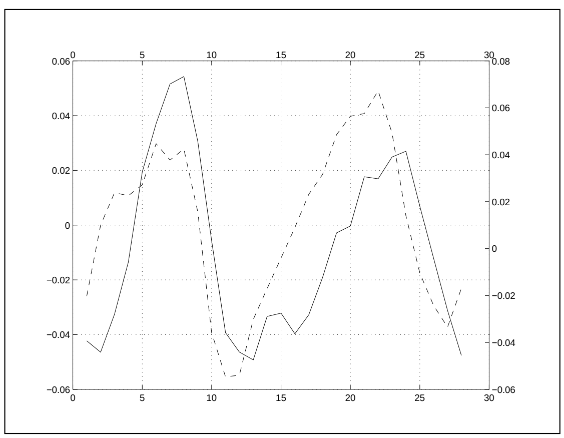

Figure 2

Argentina GDP index and Country-Specific Interest Rate. 1993-1999

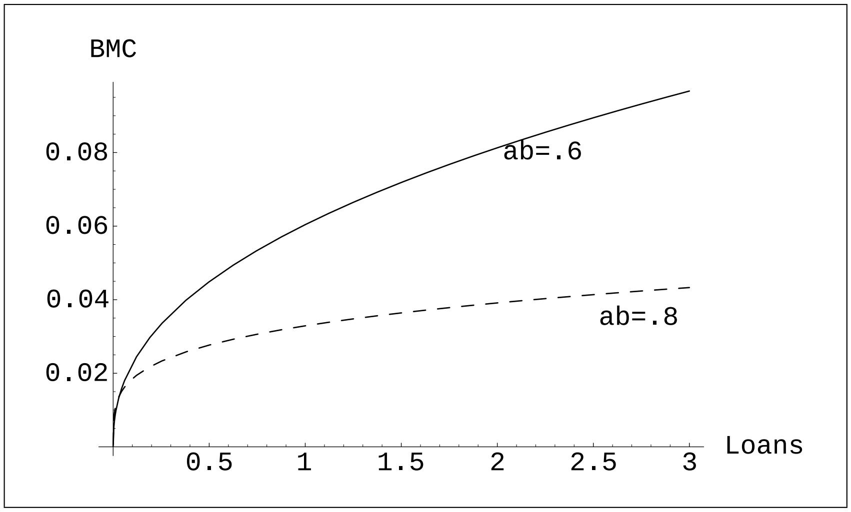

Figure 3

Marginal Cost of Loans for αb equal to 0.6 and 0.85

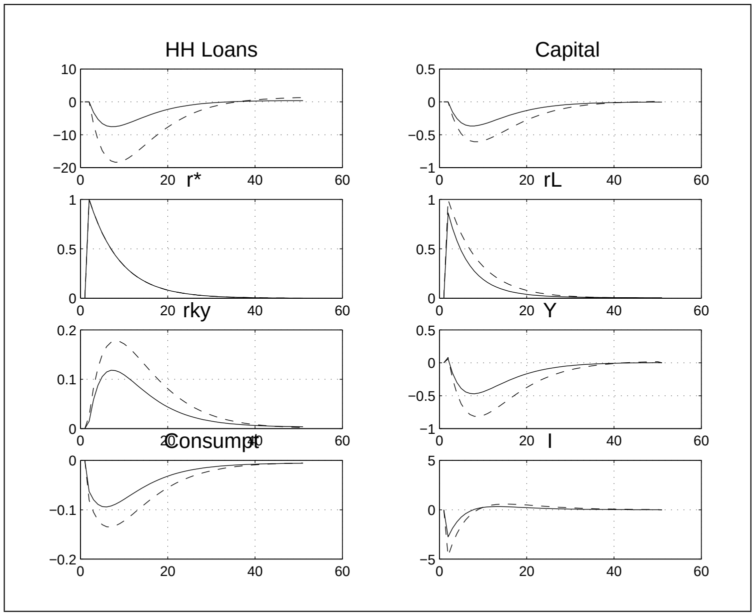

Figure 4

Models with and without Banks. Interest-rate shock.

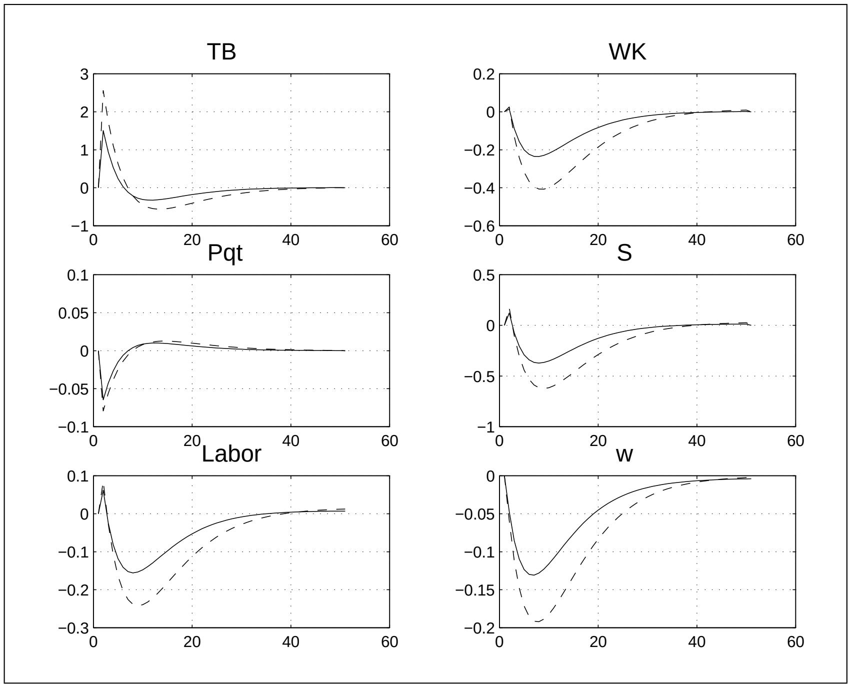

Figure 5

Model with and without Banks. Interest-rate shock.

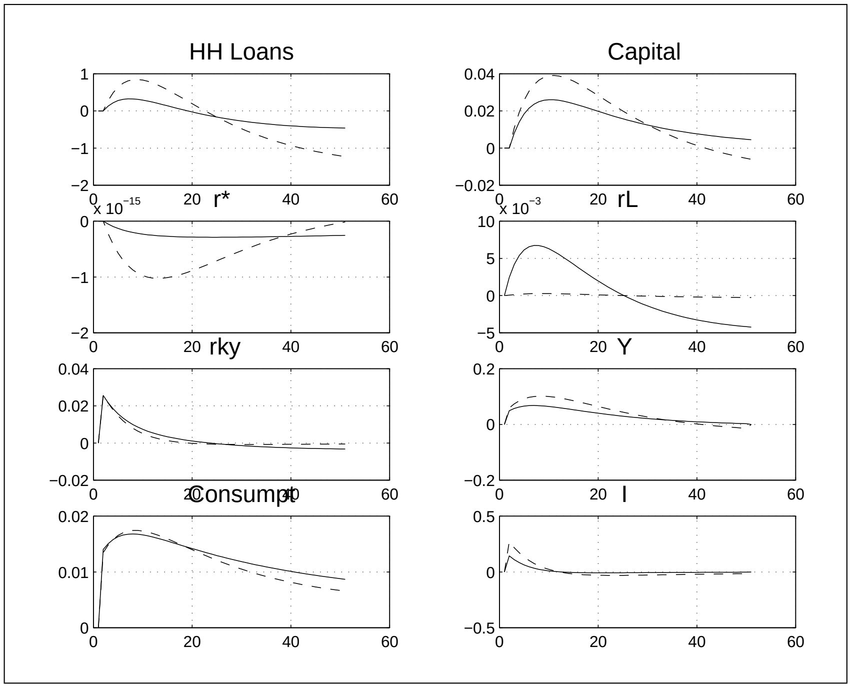

Figure 6

Model with and without Banks. Productivity shock.

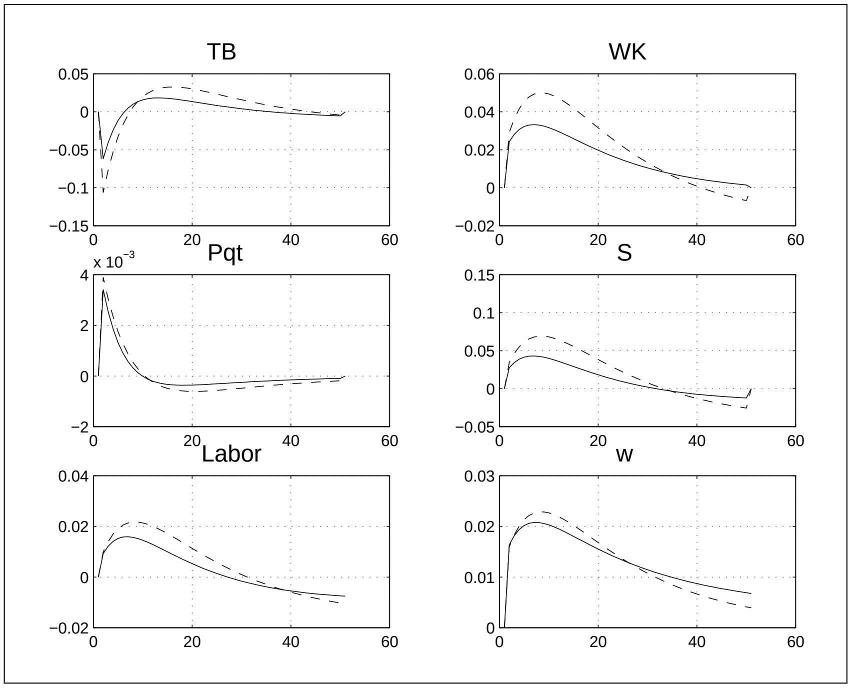

Figure 7

Model with and without Banks. Productivity shock.

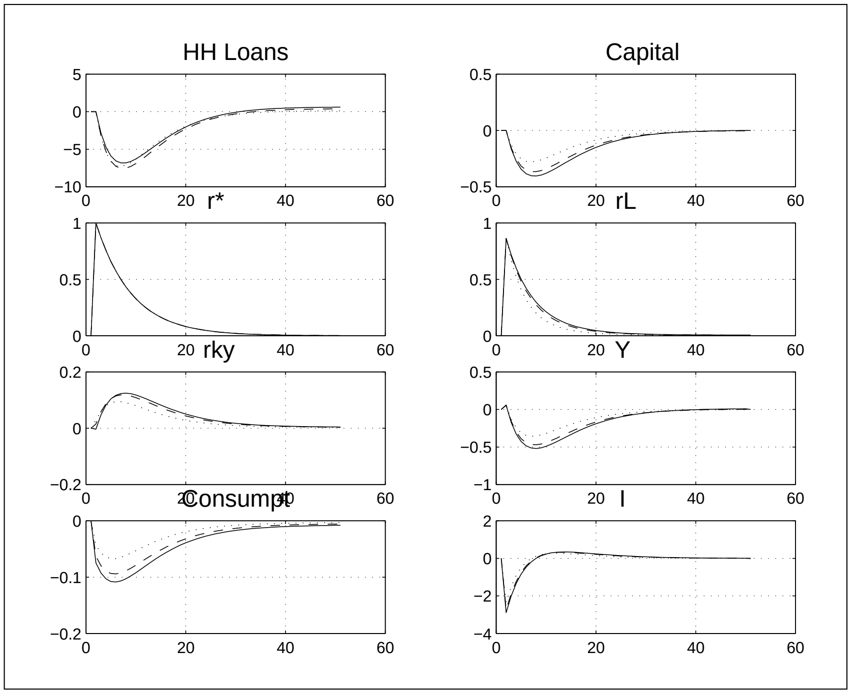

Figure 8

Model with and without working Capital. Interest-rate shock.

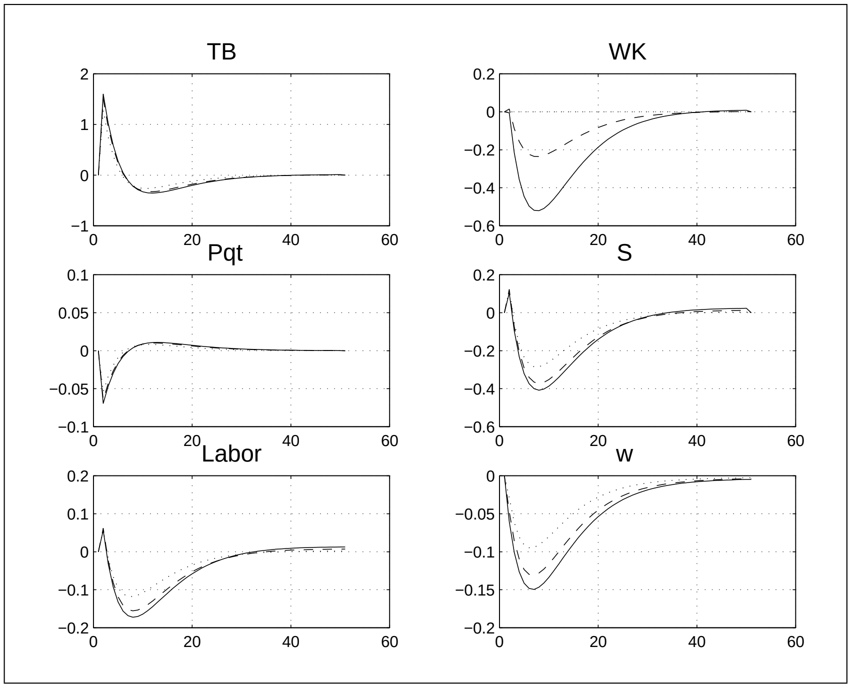

Figure 9

Model with and without working Capital. Interest-rate shock.