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BUSINESS CYCLES: A ROLE FOR IMPERFECT COMPETITION IN THE BANKING SYSTEM.

a dissertation

by

FEDERICO SAMUEL MANDELMAN

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- DISSERTATION ABSTRACT -

BUSINESS CYCLES: A ROLE FOR IMPERFECT COMPETITION IN THE BANKING SYSTEM

by

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My doctoral dissertation studies the effects of countercyclical bank markups on macroeconomic performance. The countercyclical pattern of bank markups constitutes a bank-supply channel that extends the credit channel to reinforce the same vicious circle: Credit is more expensive during recessions, so that firms and households postpone investment and work decisions, thereby deepening the recession.

In the first chapter, I construct a bank balance-sheet data set across 124 countries for 1991-2000. I show that ex-post bank markups are strongly countercyclical, even after controlling for financial development, bank concentration, operational costs, inflation, and reverse causation.
The countercyclical pattern is explained by the highly pro-cyclical entry of foreign banks that occurs mostly at the wholesale level, and signals the intention to spread to the retail level. My hypothesis is that wholesale entry triggers incumbents' limit-pricing strategies aimed at deterring entry in retail niches that in turn reduce bank markups. In the second chapter, I develop a DSGE setup in which the modeling of the banking system captures several of the features of the data. I find that market power in the financial system increases the volatility of all real variables, amplifies the business cycle, and reduces welfare.

In the third chapter, I use a variant of the New Keynesian model for a SOE and add the bank-supply channel to the standard balance-sheet channel, which links the condition of the borrower balance sheets to the default risk and the external finance premium. I show that bank markup increments, as a consequence of sudden capital outflows, end up increasing borrowing costs for firms, as well as damaging the financial position of firms. The bank-supply channel helps to explain the relatively large investment volatility typically experienced in emerging economies. These conclusions are robust to different monetary regimes. Results hold even with floating exchange rates, slow pass-through, and liabilities fully denominated in local currency.
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Chapter 1


1.1 Introduction

A variety of theoretical models and ample empirical evidence support the existence of countercyclical markups in real goods markets. In turn, these countercyclical markups constitute an important internal propagation mechanism in business cycle models. This paper is concerned with financial markets, for which practically no work on the cyclicality of the markups exists. The questions this study addresses are:

1- Is there a countercyclical pattern in financial markups?

2- If yes, what generates this pattern?

3- What are the implications of these countercyclical markups for the real economy?


2 While writing this dissertation, the existent literature on countercyclical bank markups was significantly benefited by new contributions. Olivero (2005) develops a model where countercyclical bank markups provide a potential solution to the “consumption-output” and “quantity” anomaly observed in the international transmission of business cycles. Aliaga-Diaz and Olivero (2005) provide evidence that supports the presence of countercyclical margins in the US banking system.
To test the first assertion, I use bank data across 124 countries for the years 1991-2000. I use dynamic panel techniques to confront the potential bias induced by simultaneity or reverse causation, and examine whether the exogenous component of GDP growth negatively affects bank markups. Since past work shows that long-run economic growth is a good predictor of financial development that enhances competition and thus erodes markups, I control for a three-year average of financial development to isolate the business cycle component.

To assess the strength of an independent link between the markups and the business cycle, I use various conditioning variables that include a proxy for concentration, overhead costs (operative and administrative costs), inflation volatility, and changes in real interest rates. The results remain robust to any of these factors. The countercyclical behavior of the markups vanishes, however, when controlling for the entry of foreign banks, which happens to be highly procyclical.

I rely on this last result to support my hypothesis regarding the second question. In the last decade, banks have expanded internationally by establishing foreign subsidiaries and branches or by taking over established banks. It is well-documented that foreign entry initially occurs at the wholesale level, but with the final intention to spread to the retail niches. Therefore, we can predict that the threat of foreign banks encroaching on retail markets may induce greater efficiency of the established banks at the retail level. The penetration into the retail sector is obstructed, however, by the need to incur large sunk entry costs (for instance, large advertisement expenditures or the construction of a network of branches and ATMs required to accommodate small transactions). This implies that

\[^3\text{See Claessens et al (2001).}\]
banks need to enter at a minimum-efficient-scale (MES) to justify the sunk costs incurred. In turn, it follows that right after entering they must capture a large enough fraction of the market to make the constructed network profitable. This is particularly difficult in the banking industry since the markets are highly segmented into regional or sectorial niches (Rajan and Petersen, 1994). In this scenario, the size of the market constitutes a barrier to entry. If the relevant financial market is small or underdeveloped there is space for only few incumbents working at an efficient scale. Thus, boom periods lead to an expansion of the financial system that attracts potential competitors who can operate at an efficient scale. In this situation, contestable markets force incumbents to charge markups well below short-run profit maximizing levels to avoid entry. In contrast, during recessions, the banks in the local financial system are able to exert their monopolistic power by charging high markups. As shown in Bain (1956), pricing decisions strongly influence firms contemplating entry and justify limit-pricing strategies that are counter to short run profit maximization.

With this idea in mind, I extend the empirical analysis to show that the competitive pressure of entry is short-lived. The aim is to show that foreign entry affects markups by triggering pricing strategies among incumbents rather than by transforming an existent monopolistic market structure. I also show that entry exerts a significant impact only in developing economies, for which financial development is restricted and more concentrated markets are subject to bothersome regulations that inhibit competition in normal circumstances.

Regarding the third question, the cyclicality of the markups may help to explain evidence that suggests an important role for financial development in the magnitude of the
business cycle. If bank markups are countercyclical, then there is a bank-supply channel that extends the credit channel to reinforce the same vicious circle: Credit is more expensive during recessions, and firms and households postpone investment and work decisions and make the recession deeper. But while the standard version of the credit channel relies on an external finance problem that induces banks to charge a premium to cover the increasing expected bankruptcy costs during recessions, the bank-supply channel is solely the result of imperfect competition in the banking system. This channel may be particularly relevant in developing countries, in which bank credit remains the primary source of funds for entrepreneurs. The second chapter of this dissertation develops a dynamic stochastic general equilibrium model that is designed to highlight the macro implications of the limit pricing scheme that constitutes the bank-supply channel. The microfoundations of the banking system embedded in the general equilibrium setup account for several features of the data.

The first chapter is organized as follows. In section 2, I discuss the methodology to measure bank markups and provide a literature review. In section 3, I present the empirical results. The theoretical model and concluding remarks are in Chapter 2.

1.2 Markups Measurement and Literature Review

The first step in answering the three questions posed is to find a proper measure for markups in the banking industry data. A simple approach is to consider the ex-ante (posted) spreads or the difference between lending and deposits rate, as a proxy for financial markups. The

\footnote{For a Survey, see Gertler and Hubbard (1988).}
difficulty here is that the spreads include a risk premium to cover expected borrowers' bankruptcy costs that increase during recessions and cause the spread to be countercyclical.

Thus, we expect that, in the long run, aggregate bank income obtained from such risk premium charges match banks' loan default costs. Therefore, I use annual bank balance sheet ex-post data that accounts for defaulted loans to proxy for net markups. In particular, I use net interest margins (NIM), equal to bank's total interest income minus interest expense over total assets after subtracting defaulted loans. Other issues remain though. Some of the loan contracts are settled for even longer periods of time and at predetermined rates. It may be the case that during recessions, riskier entrepreneurs facing liquidity constraints are more prone to demand credit. Higher margins would reflect the premium obtained for new riskier loans that would not necessarily fall in default during the year in consideration. However, defaults are much more likely to occur in recessions. Following this line of argument, if a particular bank liked to enter into long-term contracts at predetermined rates, one would expect that the default frequency for all its loans would significantly increase during recessions, driving down its net interest income and offsetting any positive effect from the new loans. To sum up, evidence of increasing margins in bad times would provide support to my idea of countercyclical markups. As explained in Demirgüç-Kunt and Huizinga (1998), bank interest margins can be seen as an indicator of the pure inefficiency of the banking system.

Practically all the existent literature is focused on ex-ante spreads. Related to this paper, Hannan and Berger (1991) find that after a monetary contraction ex-ante spreads tend to increase more in regional U.S. markets in which the banking industry is more concentrated.\footnote{See also Edwards and Vegh (1997) and Olivero (2004) for additional references.}
In addition, Angellini and Cetorelli (2003) consider the growth of GDP as an additional control variable in the estimation of Lerner indexes for the Italian banking industry, finding a negative association. However, they do not settle the issues of causality and endogeneity.

Although the cyclicality of the markups does not receive particular attention, there is an enormous literature on bank structure and efficiency. This literature contains ambiguous results. In a survey Rhoades (1977) expresses “disbelief and frustration” in the overall inability to link concentration and efficiency. New surveys and studies reach the same conclusions. Contradictory results must be preceded by contradictory theories. The intuition of the Structure-Conduct-Performance (S-C-P) hypothesis is straightforward: A more concentrated market lowers the costs of collusion and fosters tacit or explicit collusion on the part of the banks. In contrast, the Efficient-Structure (E-S) hypothesis predicts efficiency gains from market consolidation. Firms possessing a comparative advantage in production become large and, as a natural consequence, the market becomes more concentrated. Such cost differences may be due to differences in technological or managerial skills. The effect is amplified because of large economies of scale existent in the bank industry. They are derived from risk diversification, lower average administrative costs (Demsetz 1973), and the efficient use of large sunk costs like the construction of large networks of branches and ATM’s (Cerasi et al, 1997). Additionally, Gilligan et al (1984) provide evidence that banking is characterized by economies of scope from joint production of financial services. Finally, in the absence of restrictions on entry, excessive inefficient profits are precluded (Baumol, 1953).

6More contradictory results are found in Berger and Hannan (1989); Neumark and Sharpe (1992); Smirlock (1985); Grady and Kyle (1979); Keeley and Zimmerman (1985). For a new survey, see Bank for International Settlements 2001. In a worldwide analysis Demirguc-Kunt et al (2003) found, at the same time, high net interest margins associated with both small banks and banks with a large market share.
1982). These conclusions led to a new literature aimed at finding evidence of efficiency gains resulting from mergers and acquisitions. The results are, once again, ambiguous and inconclusive.\(^7\)

Results regarding bank entry deregulation and efficiency are instead mostly unambiguous and conclusive. Several surveys hold that new legislations that remove substantial entry barriers and expose national banking markets to potential new entrants produce pro-competitive effects and reduce margins. Besides, banks lose market power following financial liberalization even if the banking industry remains highly concentrated.\(^8\)

A more interesting result about deregulation is related to the timing of the efficiency gains. In a study of over 80 countries, Claessens et al (2001) find that foreign bank entry is significantly associated with a reduction in domestic bank profitability. However, the impact of foreign bank entry on local bank competition is "felt immediately upon entry decision is taken rather after they have gained substantial market share." Angelini and Cetorelli (2000) find that net interest margins declined sharply immediately after a banking reform was made effective in Italy. Similarly, Shaffer (1993) analyzes the impact of the Bank Act Revisions in Canada and finds evidence of an "unexpected supercompetitive state" right after entry deregulation, with negative bank markups observed. The author concludes that such atypical outcome "is not consistent with long run equilibrium behavior under known static or dynamic models of profit maximization; and it may simply reflect a temporary disequilibrium...(which) may warrant further study." These last three studies resemble my


\(^8\)For a survey see Vives (1991) and Demirgüç-Kunt (2003). Also Spiller and Favaro (1987) focus on the pro-competitive impact of the relaxation of entry restrictions in the Uruguayan industry, concluding that collusive strategic interactions across banks significantly decrease after the regulatory reform. Ribon and Yosha (1999) reach similar conclusions for the Israeli banking industry.
hypothesis of limit pricing.

To summarize, the evidence fits well with my limit-pricing hypothesis: a) Bank spreads are more countercyclical in concentrated markets; b) When bank systems are exposed to potential competition, efficiency gains are immediately observed and occur long before any change in the market structure is registered c) There exists an ambiguous and contradicting relationship between concentration and efficiency. That is, my hypothesis predicts that incumbents experience periods of monopolistic markups followed by periods in which the efficiency gains from consolidation (and exploitation of economies of scale and scope) prevail.

1.3 Evidence on Markups and Foreign Entry

I construct an unbalanced panel from several data sources. The resulting sample covers 124 countries during the years 1991-2000. Bank structure information is taken from Scope Database provided by IBCA, which contains data for 137 countries. To ensure reasonable coverage, only countries with at least three banks in a given year are included. Coverage by IBCA is comprehensive, accounting for roughly 90% of the assets of banks in each country. Each country has its own data template that allows for differences in account conventions. However, these are converted to a format which is a globally standardized template derived from the country-specific templates. In the regressions, I control for unobserved time-invariant country-specific effects to account for the minor differences in the valuation of assets that necessarily remain.

Measures of the activity of financial intermediaries are taken from the Levine-Loayza-Beck Data Set. Macroeconomic data comes from the Penn World Table 6.1 (PWT 6.1).
Data on real interest rates is taken from the World Development Indicators 2002. Institutional data is taken from both the International Country Risk Guide and Dollar and Kraay (2001). Variable definitions and a few descriptive statistics are provided in the statistical appendix. The degree of financial development captured by the ratio of Private Credit/GDP is significantly larger in developed countries than in developing ones. On average, margins are 571 bp for developing countries and 268 bp for developed ones. Besides, these are much more volatile in developing economies. Poorer countries also have a relatively high degree of concentration and foreign penetration.

**Econometric Methodology** The aggregation of time series would obscure underlying microeconomic dynamics, whereas panel data techniques allow for the investigation of heterogeneity in adjustment dynamics between different types of countries.

The estimation procedure needs to tackle some important issues. As mentioned, I must allow for the presence of unobserved country-specific effects that are correlated with the regressors. Besides, most of the explanatory variables in the specifications to be used (e.g. GDP growth rates, private credit, etc.) are determined jointly with the dependent variable (i.e. net interest margins). Therefore, I must also allow and control for joint endogeneity. To confront these issues I use a GMM in differences specification that controls for endogeneity by using internal instruments (i.e. instruments based on lagged values of the explanatory variables).

However, other concerns remain. I need to use a dynamic specification to allow for the inertia in the dependent variable that is likely to be present in the annual balance-sheet information. In addition, non-time-varying institutional covariates will be part of the
control sets. Therefore, I start from an auto-regressive dynamic model and use a relatively efficient GMM system specification that adds equations in levels to the ones in differences.

Finally, the small sample size raises a concern for overfitting bias. For robustness, I alternate the number of lags used as instruments and restrict the quantity of explanatory variables in the estimations. In addition, I report results of an equivalent system estimator based in a combination of orthogonal deviations and regressions in levels. A detailed explanation of the econometric methodology to be used in this study can be found in Appendix A.

The dynamic specification consists on an autoregressive-distributed lag model:

$$y_{it} = \alpha y_{i,t-1} + \beta x_{it} + (\eta_i + \varepsilon_{it}) \quad | \alpha | < 1 \quad i = 1, 2, \ldots, N; \quad t = 2, 3, \ldots, T. \quad (1.1)$$

Where $y_{it}$ denotes net interest margins (NIM) for country $i$ in period $t$. $x_{it}$ is a vector of current and lagged values of additional explanatory variables and is assumed to be endogenous. $\eta_i$ is an unobserved country-specific time-invariant effect. $\varepsilon_{it}$ is a disturbance term that is assumed to be serially uncorrelated and independent across individuals. For robustness, time dummies are included to account for time-specific effects.

**Net interest Margins -Time Series Properties**  I first consider a very simple AR(1) specification. The first two columns of Table 1 report OLS levels and Within Group estimates of the auto-regressive parameter $\alpha$, along with heteroskedasticity-consistent estimates of the asymptotic standard errors. As shown in Appendix A, the OLS estimate is
likely to be biased upwards and the within groups estimate is likely to be biased downwards if AR(1) provides a good representation for the series. However, the differenced GMM estimator is found to be significantly below the lower bound indicated by the within groups estimator. These downward biases in differenced GMM estimates of the AR(1) are consistent with the finite sample biases expected in the case of highly persistent series. The preferred specification is clearly the GMM system estimator. With the introduction of the equations in levels, I obtain a remarkable improvement in the precision of the parameter estimates. The results indicate a large degree of persistence in the net interest margins (.728-.759). The inertia may arise from lagged effects of the explanatory variables, which is to be expected in balance sheets data with annual frequency. We can also observe that the assumption that the disturbances are serially uncorrelated cannot be rejected. As this model is overidentified, I use the Sargan statistic to test the validity of the overidentifying restrictions. In this case, I obtain a chi-square statistic, which gives the reported p-value of 0.123. The null hypothesis that these moment conditions are valid is not rejected at any conventional level, consistent with the first and second order serial correlations tests for first-differenced residuals.

**Basic Model** A simple approach, and a first step, in studying the pattern of the margins throughout the business cycle is to include GDP growth in the AR(1) model. Prior to presenting the results, I would like to clarify the interpretation. To the extent that the assumptions regarding the instruments employed are correct, the econometric methodology is designed to isolate the effect of the exogenous component of the explanatory variable on the interest margins. Hereafter, when I mention the impact or effect of a given variable on
the margins, I am referring to this isolated exogenous component and not merely describing the association between them. In Table 2, $GROWTH$ has a highly significant and negative effect on the margins despite their persistence. According to the preferred system specification, an increase in income of 10% causes the margins to fall by approximately 1% (100 bp) on impact.

The literature presents extensive evidence of a strong link between long-run economic growth and financial development. It may be that financial development that enhances competition explains the negative relationship mentioned above. In order to assess and control for financial development, I include a three-year-overlapping average of private credit offered by commercial banks ($PRIV.CRED$ (avg)) in the conditional set.\footnote{Three-year-overlapping averages are calculated as: $x_{it(avg)} = \frac{x_{i(t+t_l-1)} + x_{i(t-2)}}{3}$.} Notice that by computing averages of this dependent variable we are artificially constructing a persistent series that should not be affected by short-run fluctuations. Finite sample bias is therefore expected in the differenced specification. In contrast, the preferred system specification shows this variable to have a significant and sizeable negative effect on the margins.\footnote{The coefficient can be interpreted as follows: If the $Priv.Credit/GDP$ ratio increases by 50%, margins fall by approximately 150 basis points on impact.} $GROWTH$ remains significantly at a 10% level though with a slightly lower coefficient. This result supports the hypothesis of fluctuating margins at a business cycle frequency. Moreover, the statistical significance of these results will improve when controlling for other relevant covariates.

**Sensitivity analysis** I use various conditioning information sets to assess the strength of the countercyclical nature of the margins depicted in the basic model. I start by introduc-
ing a proxy for concentration as a control variable, the assets of the three largest banks as a share of the assets of all the commercial banks in the system. The variable is significant and again enters with a negative sign. Refer to table 2. These results support the implications of the E-S hypothesis which predicts operational efficiency gains from banking consolidation. The large number of explanatory variables accompanied by a relative large p-value for the Sargan test estimates raises a concern about overfitting bias. However, no clear pattern in the coefficient estimates is observed when reducing or increasing the number of instruments. I also report results for an equivalent system estimator based in a combination of orthogonal deviations and level equations. No significant changes are registered, results appear to be robust regardless the estimation method used.

If the negative effect of concentration on margins is explained by efficiency gains, I would expect this impact to vanish when controlling for operating costs. Therefore, I expand the conditioning set and include overhead costs (OVERCOSTS). They are defined as personnel expenses (mostly wages) and other non interest expenses divided by the total bank assets in the local bank system. Refer to Table 3.

As expected, large operating costs cause margins to increase. The variable enters significatively and with a sizeable positive coefficient. In support to the E-S hypothesis, the inclusion of this variable causes the concentration coefficient to become insignificant and small in sign. Although the size of PRIV.CRED (avg) is marginally reduced, the cyclical component (i.e. GROWTH) remains mostly unaffected and significant at a 5% level.

Saunders and Shumacher (2000) show that interest rate volatility, usually observed in a context of high and variable inflation, is positively related to margins. Thus, I proceed by adding inflation and real interest rates to the conditioning set. None of these variables
turns out to be significant. See Table 3 again.\textsuperscript{11}

The Role of Foreign Entry Up to this point, I have shown that the exogenous cyclical component of economic growth is negatively associated with net interest margins. Moreover, this link is not due to potential biases induced by omitted variables (including that derived from unobserved country specific effects), simultaneity, or reverse causation. In the next step, I test the main hypothesis proposed in the paper. That is, countercyclical markups are the result of a limit pricing strategy aimed at deterring highly procyclical entry of competitors in a segmented local financial system. As I explained in the introduction, although the threat of entry is a non-measurable concept, foreign penetration can be considered a good proxy for it. Consequently, I would expect the negative association between margins and economic growth to vanish when controlling for foreign entry.

Thus, I introduce foreign entry in the conditioning set. Refer to Table 4. The covariate $\text{Foreign Banks}$ refers to the number of foreign banks divided by the total number of banks in a given country. Foreign bank entry is measured as a change in foreign bank presence (i.e. $\Delta \text{Foreign Banks}_{it}$). The first experiment, not reported here, consisted in introducing $\Delta \text{Foreign Banks}_{it}$ into the extended model presented in the last subsection. Its influence turns out to be negligible and statistically insignificant. The results are different when I consider $\Delta \text{Foreign Banks}_{i,t-1}$. Therefore, if limit pricing exists, it occurs one year after the entry decision is effectively taken. This lagged variable not only exerts a significant

\textsuperscript{11}It is puzzling to observe that the coefficients for $\text{GROWTH}$ and $\text{PRIV.CRED (avg)}$ actually increase when these covariates are included to the conditioning set. It may be the result of money-based disinflation programs being accompanied by short-lived recessions. These events would imply, at the same time, higher margins due to the recession but lower margins and credit availability resulting from stable and low inflation. Thus, if we do not control for inflation, we would expect margins to be less countercyclical and less sensible to variables linked with growth indicators.
negative effect on the margins, but also breaks down the independent impact of GROWTH by turning it small and insignificant. It may be the case that the beginning of wholesale operations occurs some time after the official entry registration occurs. These results may also provide support for the supposition that entry occurs at a wholesale level and then spreads to retail niches with a time lag.

To assess the strength of this last finding, I would like to eliminate the possibility that the lower margins are a consequence of pro-efficiency gains from a larger presence of foreign banks in the local financial structure.

Notice that the proposed model here is:

\[ y_{it} = \alpha y_{i,t-1} + \beta x_{it} + \gamma \Delta \text{ForeignBanks}_{i,t-1} + (\eta_i + \varepsilon_{it}) \quad i = 1, 2, ..., N; \ t = 2, 3, ..., T. \quad (1.2) \]

where \( y_{it} \) is the dependent variable, \( x_{it} \) any of the controlling sets already introduced, and \( \Delta \text{ForeignBanks}_{i,t-1} = \text{ForeignBanks}_{i,t-1} - \text{ForeignBanks}_{i,t-2} \).

Alternatively, (1.2) can be expressed as:

\[ y_{it} = \alpha y_{i,t-1} + \beta x_{it} + \gamma_1 \text{ForeignBanks}_{i,t-1} + \gamma_2 \text{ForeignBanks}_{i,t-2} + (\eta_i + \varepsilon_{it}). \quad (1.3) \]

Where \( \gamma_1 = -\gamma_2 \).
Thus, if the results are driven by entry we expect the coefficients, \( \gamma_1 \) and \( \gamma_2 \), preceding \( \text{ForeignBanks}_{i,t-1} \) and \( \text{ForeignBanks}_{i,t-2} \) to be significant and of the same magnitude, but with opposite signs (i.e. the first one negative and the second one positive). In contrast, if the results are driven by the presence of foreign banks, \( \gamma_2 \), must either be negative or at least small. In other words, the long-run or steady state effect \( (\gamma_1 + \gamma_2)/(1 - \alpha) \) should significantly differ from zero.

Once again, the results do not reject my hypothesis. The coefficients are opposite in sign and do not significantly differ in absolute value. Thus, the pro-competitive effect of entry in the local banking system is short-lived and vanishes after one year.

**Regional Analysis** To assess the robustness of the results shown in the previous subsections, I test whether the cyclical pattern of the margins and the effect of entry differ across different groups of countries. I distinguish between developing countries and developed ones. This simplification is intended to restrict the number of covariates, reduce the number of instruments, and avoid any risk of overfitting bias. I adopt the convention of the World Development Indicators 2002, which divides all the displayed countries in four different income groups. I regard the first quarter as developed countries and all the other groups as developing countries. I add the dummy variable \( \text{POOR} \) to the equation, with \( \text{POOR} \) equal to one if the country belongs to the latter group and zero otherwise. In what follows, the estimated model will be:

\[
y_{it} = \delta_1 \left[ z_{it} \times \text{POOR} \right] + \delta_2 \left[ z_{it} \times (1 - \text{POOR}) \right] + (\eta_i + \varepsilon_{it}). \tag{1.4}
\]
where $z_{it}$ is the vector including the lag dependent variable plus any conditioning set of current or lagged covariates, and $\delta_1$ and $\delta_2$ are the estimated parameters for developing and developed countries respectively.\textsuperscript{12}

I present the results for the basic model at a regional level in Table 5. I control for financial development and, subsequently, I add concentration as previously done in the extended model. For robustness, I also report the model with orthogonal deviations. The negative effect of $GROWTH$ in margins is relatively larger and more significant for developing countries.\textsuperscript{13}

The next step is to consider the effect of entry. Since the estimates of the extended model do not significantly differ, I group them again (so as to reduce the number of explanatory variables and gain efficiency), and look for each group’s reaction to foreign bank penetration. The results are in Table 6. Again the introduction of foreign entry breaks down the effect of growth. Nonetheless, entry significantly lowers margins only in developing countries. Pro-efficiency gains from entry are not observed in developed countries. For this group of countries, the coefficient associated with entry is positive and low, and only marginally significant. In other words, if my hypothesis is valid, it only applies to entry in developing countries.

These results are in accordance with the predictions of Claessens et al (2001). They argue that banking markets in developed countries tend to be competitive with sophisticated participants. If there is any technical advantage foreign banks possess at the time of entry,

\textsuperscript{12}Rearranging terms, we can interpret (1.4) as follows. For a developing country, $POOR = 1$ and $y_{it} = \delta_1 \varepsilon_{it} + (\eta_t + \varepsilon_{it})$; for a developed one $POOR = 0$, so that: $y_{it} = \delta_2 \varepsilon_{it} + (\eta_t + \varepsilon_{it})$.

\textsuperscript{13}The Two-step estimates of $GROWTH$ for developed countries appear to be biased. Since this group of countries is small, the usual asymptotic distribution approximation seems not to be reliable in this case.
they are not significant enough to overcome the information disadvantages they face relative to domestic banks. In developing countries, pervasive market inefficiencies and outmoded banking practices allow international banks to overcome such information disadvantages. Their implicit threat of competition is significantly larger.

One last question remains to be addressed in the empirical analysis. All the conclusions I outlined rely on the assumption that entry of foreign banks occurs in booming periods. Since the effect of entry is sizeable only in developing countries, I restrict the sample to include only them. The results are in Table 7.

In the first three columns we can observe that the state of the economy significantly affects the entry decision, even after controlling for institutional variables. Entry is highly procyclical and $GROWTH$ remains significant at the 5% level. Again, we rule out this result being drive by simultaneity or reversed causation. Under the assumption that institutional variables do not significantly vary in a the short time span considered in this panel, we can include non-time varying covariates in the regressions. For robustness, I also include financial development, market concentration and the level of GDP in the conditional setting. The last control variable is meant to capture the size of the local financial sector. Again, I do not have evidence to reject the hypothesis that only the current state of the economy, and not institutional factors, triggers entry decision. It seems that the size of the economy plays a role, however. My explanation is that the larger the economy, the larger the size of the financial market and, thus, the more room available for additional competitors.
Appendix A: Econometric Methodology.

The first dynamic specification consists of a simple AR(1) model:

\[ y_{it} = \alpha y_{i,t-1} + (\eta_i + \varepsilon_{it}) \quad | \alpha | < 1 \quad i = 1, 2, \ldots, N; \quad t = 2, 3, \ldots, T. \]  

Since I treat the individual effects, \( \eta_i \), as being stochastic, they are necessarily correlated with the lagged dependent variable, \( y_{i,t-1} \). I further assume that the disturbances are serially uncorrelated. These jointly imply that the OLS estimator of \( \alpha \) is inconsistent.

The within groups estimator eliminates this source of inconsistency by obtaining mean values across the \( T - 1 \) observations in order to remove \( \eta_i \). Nonetheless, for panels (like this one) in which the number of time periods available is small, this transformation induces a non-negligible negative correlation between the transformed lagged dependent variable \( y_{i,t-1} - \frac{1}{T-1} (y_{i1} + \ldots + y_{iT} + \ldots + y_{i,T-1}) \) and the transformed error term \( \varepsilon_{i,t-1} - \frac{1}{T-1} (\varepsilon_{i2} + \ldots + \varepsilon_{i,t-1} + \ldots + \varepsilon_{iT}) \). Standard results for omitted variable bias indicate that the OLS estimator is biased upwards and the within groups one is biased downwards. Therefore, a consistent candidate estimator must lie between the OLS and within groups estimates.

The first-difference transformation of (1.5) also eliminates \( \eta_i \) from the model, but the dependence of \( \Delta \varepsilon_{it} = \varepsilon_{it} - \varepsilon_{i,t-1} \) on \( \varepsilon_{i,t-1} \) implies that the OLS estimates are inconsistent. Nonetheless, consistent estimates of \( \alpha \) can be obtained using two step least square estimations (2SLS) with instruments that are both correlated with \( \Delta y_{i,t-1} \) and orthogonal to \( \Delta \varepsilon_{it} \). The GMM estimator is asymptotically efficient since the set of all available
instruments is used. Specifically, the GMM difference specification is obtained from the following moment conditions:

\[ E[y_{t,s} \Delta \varepsilon_{it}] = 0 \quad \text{for } s \geq 2; \quad t = 3, \ldots, T. \] (1.6)

Under the homoskedasticity assumption of the disturbances, \( \Delta \varepsilon_{it} \), we can construct a one-step estimator based on a weighting matrix that does not depend on any estimated parameters. Otherwise we can proceed in two-steps and use consistent estimates of the first differenced residuals previously obtained from a preliminary consistent estimator. I report results for both since there is no a clear preference between these two estimators in the applied work literature.  

If \( T > 3 \) the model is overidentified, and the validity of the assumptions used in the estimation can be tested using the standard GMM Sargan test of overidentifying restrictions (under the null that these moment conditions are valid). The key identifying assumption that there is no serial correlation in the \( \varepsilon_{it} \) disturbances can also be tested. If the pattern of serial correlation in the first-differenced disturbances is consistent with this assumption; \( \Delta \varepsilon_{it} \) should have significative negative first-order serial correlation but not significant second-

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14 Maximum likelihood estimators for the AR(1) exist, but with the awkward characteristic that different assumptions about the nature of the initial conditions, \( y_{i1} \), lead to different likelihood functions that result in inconsistent estimators for \( \alpha \) if the initial condition is mispecified. The shorter is the time length of the panel, the more serious is the problem.

15 In the two-step estimator, the dependence of the weighting matrix on estimated parameters makes the usual asymptotic distribution approximation less reliable for small samples. See Blundell, Bond and Windmeijer(2000). Therefore, I follow Windmeijer (2000) and use a finite sample correction for the asymptotic variance of the resulting GMM estimators.
order serial correlation.

The difference GMM estimators for autoregressive models outlined above can be extended to models that include a vector of current and lagged values of additional explanatory variables, $x_{it}$. Since $x_{it}$ is assumed to be endogenous, it is treated symmetrically with the dependent variable $y_{it}$. In this case, the lagged values $x_{i,t-2}, x_{i,t-3}$ and longer lags are valid instruments in the first-differenced equations for periods $t = 3, 4, ..., T$. The proposed panel estimator controls for endogeneity by using internal instruments (i.e. instruments based on lagged values of the explanatory variables.) Specifically, all the explanatory variables are assumed to be weakly exogenous. This means that the explanatory variables are uncorrelated with future realizations of the error term and thus are not affected by future realizations of the dependent variable. The explanatory variables, however may be affected by current and past realizations of the dependent variable. This assumption permits for the possibility of simultaneity and reverse causality.

There are, however, several serious econometric shortcomings with the difference estimator in the presence of inertia in the dependent variable. In particular, if the lagged dependent variable is persistent over time (i.e. near unit root), lagged levels of the variables are weak instruments for the regressions in differences.\textsuperscript{16} To improve upon and solve this concern, Blundell and Bond (1997) propose an alternative system estimator, that combines the regression in differences with the regression in levels. The instruments and moment conditions for the regression in differences are the same as above.

\textsuperscript{16}Other serious problems exist. First differences of the explanatory variables are often less correlated over time than levels. As noted by Barro (1997), this may produce biased estimates if the dynamic structure of the differenced equation model differs from the true model. Simulation studies show that the difference estimator has a large finite-sample bias and poor precision, particularly in samples with a small time series dimension. Finally, by first differencing we end up losing the cross-country dimension and exploit only the time series dimension within countries.
For the second part of the system (the regression in levels) the instruments are given by the lagged differences of the corresponding variables. These instruments are valid when the stationarity assumption is suitable. In this scenario, the resultant non-redundant linear moment conditions for the second part of the system are:

\[
E[\Delta y_{i,t-1}(\eta_{i} + \varepsilon_{it})] = 0 \quad i = 1, 2, \ldots, N; \quad t = 3, 4, \ldots, T. \tag{1.7}
\]

\[
E[\Delta x_{i,t}(\eta_{i} + \varepsilon_{it})] = 0 \quad i = 1, 2, \ldots, N; \quad t = 2, 3, \ldots, T.
\]

It is possible to include non-time varying predetermined covariates in the mentioned set of explanatory variables. Institutional indicators can be assumed to be time invariant in the short time period considered in this study. There are \(T - 1\) non-redundant moment conditions that allow for the computation of estimates despite the implausibility of considering equation in differences. These can be written as:

\[
E[x_{i}(\eta_{i} + \varepsilon_{it})] = 0 \quad i = 1, 2, \ldots, N; \quad t = 2, 3, \ldots, T. \tag{1.8}
\]

The use of the full instrument set described in either the system or the difference estimator results in the number of moment conditions tested growing rapidly as \(T\) increases. It

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\footnote{Under this assumption there might be a correlation between \(\eta_{i}\) and the levels of the variables, but this correlation is constant over time. That is, \(E[y_{i,t+p}/\eta_{i}] = E[y_{i,t+p}\eta_{i}]\) and \(E[x_{i,t+p}/\eta_{i}] = E[x_{i,t+p}\eta_{i}]\) for all \(p\) and \(q\). The validity of the stationarity assumptions about the initial conditions \(y_{i1}\) requires \(E\{[y_{i1} - (\frac{a_{0}}{1-a_{0}})\eta_{i}]\} = 0.\)
has been shown that the size properties of the Sargan test are less sensitive to the number of moment conditions becoming large for a given cross-sectional sample size \( N \) (Bowsher, 2000). Although, this does not necessarily imply that the GMM estimator is biased or that the standard errors are unreliable, I have to test whether the use of a large number of instruments make the estimator itself subject to a serious overfitting bias. The usual way to proceed is either to restrict the set of explanatory variables, or, if necessary, to consider only the three closest lags to the regression period (for each variable) as instruments.\(^{18}\) Finally, if the results of an equivalent system estimator based in a combination of orthogonal deviations and level equations significantly differs from the standard system, it may indicate that small biases are important.\(^{19} \quad 20\)

\(^{18}\)The loss of relevant information caused by omitting the more distant lags as instruments is often modest (Bond, 2002). For robustness, I also proceed by adding and subtracting instruments in sequential stages, and find no relevant differences.

\(^{19}\)An orthogonal deviation \( z_{it}^* \) is the deviation of an observation from the average of future observations in the sample and is given by: \( z_{it}^* = [x_{it} - (x_{it+1} + ... + x_{iT})/(T-t)](T-t)^{1/2}/(T-t+1)^{1/2} \) If the original errors are IID, so are the errors using orthogonal deviations.

\(^{20}\)For robustness, I calculated this alternative system for all the regressions. However, since the results do not significantly differ I chose not always to report them. The unreported results are available by request.
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Chapter 2

Business Cycles: A Role for Imperfect Competition in the Banking System.

2.1 Introduction

In this chapter I present a simple general equilibrium model designed to highlight the role of the proposed bank-supply channel in the economy. I start from a standard DSGE Real Business Cycle model with variable labor supply in the spirit of Hansen (1985). Then, I introduce imperfect competition with limit pricing in the financial system. This modification creates a disintermediation between borrowers and entrepreneurs that amplifies the response of the real variables to technology shocks.
2.2 Households

The household sector is conventional. There is a continuum of households of unit mass. Each household works, consumes, and invests its savings in regular deposits.

The representative household maximizes:

\[ E_t \sum_{i=0}^{\infty} \beta^t \left[ \frac{1}{1 - \gamma} C_t^{1-\gamma} - \frac{a_n}{1 + \gamma_n} N_t^{1+\gamma_n} \right]. \] (2.1)

Subject to the budget constraint:

\[ C_t + D_{t+1} = W_t N_t + (1 + r_t) D_t + \Pi_t. \] (2.2)

Where \( C_t \) is consumption; \( N_t \) is labor supply; \( W_t \) denotes the real wage; \( D_t \) are deposits (in real terms) held at commercial banks and \((1 + r_t)\) is the gross real interest rate paid to depositors. \( \Pi_t \) are real dividends payments received from ownership of these financial intermediaries.

2.2.1 Optimality Conditions

Household behavior obeys:

consumption and saving intertemporal allocation:
where \( Y \) is aggregate output, \( K_{t-1} \) is the aggregate amount of capital constructed by entrepreneurs in period \( t - 1 \), \( N_t \) is the labor input, and \( A_t \) is an exogenous technology shock.

Thus labor demand satisfies:

\[
(1 - \alpha) \frac{Y_t}{N_t} = W_t. \tag{2.6}
\]
Demand for New Capital  The construction of new capital is determined by the level of investment $I_t$. Thus, the capital stock obeys:

$$K_t = I_t + (1 - \delta)K_{t-1},$$  \hspace{1cm} (2.7)

where $\delta$ is the depreciation rate.

The gross return to holding one additional unit of capital from $t$ to $t+1$, can be written as:

$$(1 + r^k_{t+1}) = E_t \left\{ \frac{\alpha Y_{t+1}}{K_t} + (1 - \delta) \right\}.$$ \hspace{1cm} (2.8)

Supply for New Capital  In equilibrium, the allocation for capital satisfies the following optimality condition:

$$(1 + r^k_{t+1}) = (1 + \Xi_{t+1}) (1 + r_{t+1})$$ \hspace{1cm} (2.9)

where the real interest rate, $(1 + r_{t+1})$, is the gross cost of funds absent imperfect competition in the financial system and $(1 + \Xi_{t+1})$ is the gross markup charged by the intermediary bank. I assume that new equity and bond issues are prohibitively expensive, or not available for local firms, so that all investment finance is done with bank credit. I will ignore the presence of the bank multiplier and the existence of reserves. Therefore,
the overall amount of credit in the economy must be equal to the overall amount of new household deposits:

\[ D_{t+1} = I_t. \] 

\[ \text{(2.10)} \]

2.4 The Resource Constraint

The resource constraint for the economy is:

\[ Y_t = C_t + I_t. \] 

\[ \text{(2.11)} \]

2.5 The Banking System

I assume that the banking system is highly segmented into a large number, \( n \), of sectors or regions (niches).

The size of each niche is the same, and each of them is served by an established bank (incumbent), \( i \), that possesses a local monopoly and therefore finances an equal fraction \( \frac{k}{n} \) of the total investment. Each incumbent can serve only its own niche because of an implicit collusion agreement that is described later.

This intermediary chooses a net markup for its niche, \( \Xi_{t+1} \), at the beginning of period \( t \). I assume that the cost of serving the niche for each bank \( i \) is:

\[ v_t \left( \frac{I_t}{n} \right)^{1-\tau}. \] 

\[ \text{(2.12)} \]
The constant \( u_i \) is the cost-efficiency level, and captures any idiosyncratic operational (in)efficiency and information (dis)advantages any bank may have. I assume that \( u_i \) is drawn from a common uniform distribution \( U(u) \) with support on \([0, \lambda]\), at the beginning of the bank operations. \( u_i \) is private information and is unknown to banks outside the niche.

The cost of serving the niche for each bank \( i \) depends on the amount of credit financed (the size of the market). In addition, the banking system possesses operational economies of scope and scale over operating costs. Thus, I assume that \( 0 < \tau < 1 \).

In period \( t+1 \) the bank obtains the following ex-post real profits for carrying the bank contract at period \( t \):

\[
\pi_{i,t+1} = (1 + \Xi_{t+1})(1 + r_{t+1}) \left( \frac{I_t}{n} \right) - \left[ (1 + r_{t+1}) \left( \frac{D_{t+1}}{n} \right) + u_i \left( \frac{I_t}{n} \right)^{1-\tau} \right].
\] (2.13)

The first term are entrepreneur payments and the term in brackets captures the cost of funds (i.e. payments to depositors) plus operating costs. Using the fact that \( D_{t+1} = I_t \), and that \( \Xi_{t+1}r_{t+1} \approx 0 \) for the parameter values I consider here, we can express (3.33) as:

\[
\pi_{i,t+1} = \Xi_{t+1} \left( \frac{I_t}{n} \right) - u_i \left( \frac{I_t}{n} \right)^{1-\tau}.
\] (2.14)

**Entry and mergers** I assume that entry is possible in this banking system, but that it occurs in successive stages. Entrants in the “banking system” at time \( t \) only start
competing in the “niche” at time $t + 1$, which introduces a one-period time-to-build lag in the model. Right after the entry decision is effectively taken (i.e. when the sunk costs are incurred), the entrant is already inside the banking system, but only at the “wholesale level.” Hence, during period $t$ it is able to temporarily serve any of the $n$ niches until it is finally established in one of them in $t + 1$. The aim is to capture the idea of entry taking place in the wholesale market first with the ultimate goal of spreading later to the retail segment (niches).  

The entry stages are as follows:

(A) At the beginning of period $t$, a potential competitor, $j$, attempts to enter the banking system. At no cost, it draws its cost-efficiency level, $v_j$, from the same common uniform

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1In addition, we could say that entrants need to incur in a one-period learning process to make their idiosyncratic cost-efficiency level at the regional level effective.
distribution \( U(\nu) \).

(B) After learning its own \( \nu_j \), the potential competitor chooses whether to enter the banking system and fight for one of the niches next period or withdraw from the banking system. The closer \( \nu_j \) is to zero, the more efficient the potential entrant is, and the easier to take over a niche. I will assume that the number of total draws is large enough that at least some potential competitors enter the banking system every period.

(C) To enter the banking system (and eventually fight for one of the niches) an outsider has to incur fixed sunk entry costs, \( z_t \), at the beginning of period \( t \). \(^2\) \( z_t \) is exogenous and measured in real output units. We can also interpret changes in \( z_t \) as changes in entry regulations.

(D) In principle, during period \( t \), entrants are able to serve any (or even all) of the \( n \) niches at the wholesale level until finally established in one of them. The cost of serving other niches at the wholesale level is:

\[
\lambda \left( \frac{I}{n} \right)^{1-\tau},
\]

(2.15)

where \( \lambda \geq \nu_i \) for every \( i \); given the common uniform distribution \( U(\nu) \) with support on \([0, \lambda]\). As in Petersen and Rajan (1994), I assume that retail banks that are physically closer to their customers have lower costs of transacting with both firms and depositors.

\(^2\) As I said, we can include in them advertisement costs or the construction of a network of branches and ATMs.
(E) For simplicity, I assume that any entrant is able to enter only one niche (i.e. multi-sectorial entry is not possible). The collusion agreement implies that the potential competitor knows the cost-efficiency level distribution of the banking system, $U(\nu)$, but cannot infer the particular $\nu_i$'s of each incumbent. Hence, entrants are indifferent about the particular niche to fight for. I assume that once inside the banking system they randomly choose which niche to enter at the end of period $t$.

(F) At the very beginning of period $t+1$, the entrant is inside the niche and is able to learn the incumbent’s $\nu_i$. Bertrand competition occurs and the following proposition holds:

**PROPOSITION 1** Under Bertrand competition, only two possible outcomes are possible. If $v_j > v_i$, the entrant fails and is forced to merge. If $v_j < v_i$ the entrant successfully displaces the incumbent and forces it to merge. The optimal strategy for the loser is to merge immediately and not to compete. The only visible outcome is the possible change of the incumbent at the very beginning of $t + 1$.\(^3\)

*Proof.* See Appendix A.

(G) If successful the new incumbent keeps the niche until it is hit by an exit-inducing shock that occurs with probability $\delta_D \in (0,1)$ in every period. For simplicity, I do not model endogenous exit that is not driven by the aforementioned Bertrand competition. The “death” shock is independent of the bank’s efficiency level. I assume that an entrant immediately fills the empty niche left by every dead bank. Right after drawing an efficiency level, the entrant is able to use the network left by the dead bank (avoiding any sunk costs

\(^3\)By definition the point likelihood of $v_j = v_i$ is null.

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as well as the time-to-build lag). The number of banks and the frequency of "death" is high enough so that \( E(u_i) = \frac{1}{2} \), and \( U(v) \) nests the cost-efficiency distribution of all incumbents in the financial system.

**Implicit Collusion Agreement and Limit Pricing** I assume that entrants are liquidity constrained and cannot make losses after incurring sunk costs. In these circumstances, the pricing strategy, \( \Xi_{t+1} \), must ensure that none of the new competitors at the wholesale level can obtain any expected positive profits if they decide to offer a net markup below \( \Xi_{t+1} \) and serve the niche.\(^4\) That is:

\[
\Xi_{t+1} \left( \frac{I_t}{n} \right) \leq \lambda \left( \frac{I_t}{n} \right)^{1-\tau}.
\]  

(2.16)

Notice, however, that low cost-efficiency incumbents have the incentive to "signal" their idiosyncratic efficiency to new entrants by offering a markup below the level that makes (2.16) hold as an equality (hereafter, the binding limit). From (2.14), entrants in the banking system know that only more efficient incumbents can offer a markup, \( \Xi_{t+1} \), well below \( \lambda \left( \frac{I_t}{n} \right)^{-\tau} \) and still make profits. Therefore, these incumbents have incentives to offer markups levels somewhat below the binding limit in (2.16) to influence and redirect entrants' decisions toward less-efficient niches. The higher is the amount of entry in the banking system, the higher the incentives to protect the niche by lowering current markups and profits. In this scenario, incumbents "compete" to deter entry in their own niches. Instead,\(^4\)

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\(^4\)By assumption, the customers remain loyal to the local incumbent bank if the level of the markup offered is the same.
I assume that there exists an implicit collusion agreement among the incumbents that enforces the secrecy of the idiosyncratic cost-efficiency levels.

I assume that the implicit collusion agreement must necessarily satisfy all the incumbents to be possible. Consequently, a cartel markup below the binding level in (2.16) does not work. The uniform distribution with support on \([0, \lambda]\), and the assumption that \(n\) is very large, implies that such cartel markup level can result in losses for members with cost-efficiency levels in the neighborhood of \(\lambda\). The negative profits force defections from the agreement; defections that actually reveal the high cost-efficiency level of those defectors.\(^5\) Therefore, the arrangement must consist of markup equal to the binding level in (2.16):

\[
\Xi_{t+1} \left( \frac{I_t}{n} \right) = \lambda \left( \frac{I_t}{n} \right)^{1-r} \tag{2.17}
\]

If some of the banks attempt to charge a markup below the binding limit, one of the members of the cartel immediately serves such niche at the wholesale level. The punishment consists of establishing a price just below the one chosen by the defector, \(\Xi_{t+1}^{def} - \varepsilon\) (such that \(\varepsilon\) is negligible in size). The resulting negative profits for serving the niche under this condition are equally distributed among the members of the cartel. That is,

\[
\left( \frac{\Xi_{t+1}^{def} - \varepsilon}{n-1} \right) \left( \frac{I_t}{n} \right) - \lambda \left( \frac{I_t}{n} \right)^{1-r} < 0. \tag{2.18}
\]

I assume that, in principle, such punishment would take place only if there is a single defector.

---

\(^5\) I assume that a single defector can transform the tacit agreement into an explicit one. As in Rotemberg and Woodford (1992), I assume that such scenario carries incommensurable legal sanctions for the members of the cartel.
monopolistic bank serving the niche (so that Proposition 1 holds). In other words, the cartel allows Bertrand competition to occur inside the niche to guarantee a monopolistic structure in which the number of banks in the banking system never exceeds \( n \) (one bank per niche). Finally, I assume that the amount of entry and the exogenous exit inducing shock (positively associated with the discount factor) is high enough so that incumbents are better off when committing to the collusive level in (2.17).

Therefore, the pricing decision is the same in all niches. Since all the niches are of the same size, we can interpret this relationship as the pricing decision taken by the representative bank of this economy. Hence, for every period \( t \), expected profits for each incumbent \( i \) are:

\[
\pi_{i,t+1} = (\lambda - u_i) \left( \frac{I_t}{n} \right)^{1-\tau} > 0. \tag{2.19}
\]

Equations (2.17) and (2.19) can be interpreted as follows: The greater the aggregate investment, the bigger the size of all niches, and the higher the competitive pressure of the new entrants. In turn, this forces the incumbent to offer lower markups. These countercyclical markups constitute the bank-supply channel that propagates and amplifies shocks to the economy.

**Entry decision** Banks are forward looking and correctly anticipate their expected stream of profits. After drawing a \( u_j \), a potential entrant decides to enter the banking system only if the expected post-entry present discounted net value of the expected stream of profits \( \{\pi_{j,t}\}_{t=1}^{\infty} \) is positive:
\[ V_{j,t} = \left\{ E_{t} \sum_{k=t}^{\infty} \beta(1 - \delta D)^{s-t} \left( \frac{C_{s+1}}{C_{s}} \right)^{-\gamma} \pi_{j,s+1} \right\} \left( 1 - \frac{v_{j}}{\lambda} \right) - z_{s} > 0. \] (2.20)

Banks discount future profits using the household's stochastic discount factor, adjusted for the probability of survival. The pre-entry probability of "defeating" the incumbent and taking-over the niche is \( 1 - \frac{v_{j}}{\lambda} = \text{Pr}(v_{j} < E(u_{j})) \). Equations (2.20) and (2.19) imply that entry is procyclical (i.e. entry increases when the amount of credit, purchase of new capital and the economic activity are high). The larger the discount factor and the probability of the exit-inducing shock, the stronger the procyclicality.

Entry is affected by market regulation that alters the value of \( z_{t} \).\(^6\) Equation (2.20) implies that the higher is \( z_{t} \), the lower the resulting entry threshold value of \( v_{j} \), and thus the lower the amount of entry in the banking system (and vice versa). But then, the higher is \( z_{t} \), the more likely entries are successful when fighting for the niche. These results are in line with the empirical evidence that entry exerts a sizable impact in small, underdeveloped, and regulated markets.

The government can effectively prohibit entry in the banking system by setting \( z_{t} \rightarrow \infty \). In this case, countercyclical limit pricing is not necessary, and incumbents are able to establish a standard collusive agreement.

\(^6\)As in Ghironi and Melitz (2005), changes in sunk entry costs alter the free-entry condition.
2.6 Model Parametrization

The only distinctive aspect of the general equilibrium model relative to a benchmark RBC setup is the limit pricing scheme in the financial system, characterized by equations (2.9) and (2.17). The former characterizes how imperfect competition in the financial system influences capital demand. The latter describes the limit pricing strategy chosen by the representative incumbent bank. If we restrict the net financial markup \( \Xi_{t+1} \) to zero in equation (2.9), we effectively shut off the bank-supply channel and the model reverts to a conventional RBC model.

I set the quarterly discount factor \( \beta \) to 0.99 (which also pins down the steady state quarterly real interest rate depositors receive since \( R = \beta^{-1} \)). Average hours worked relative to total hours available are set equal to \( \frac{1}{3} \). I set the elasticity of intertemporal-substitution, \( \frac{1}{\gamma} \), equal to one, and \( \gamma_n \) equal to zero. Following Hansen (1985), I set the standard deviation of the productivity innovations to 0.712. The capital share, \( \alpha \), is 0.36. The quarterly depreciation, \( \delta \), is assigned the value of 0.025. From the descriptive statistics for developing countries, I set the quarterly steady-state net financial markup equal to 142 basis points and choose \( \tau = 0.70 \).

2.7 A Negative Technology Shock

I consider an unanticipated one percent decrease in technology to stress the role of the bank-supply channel deepening a recession. I assume further that the shock obeys a first order auto-correlation process that persists at the rate of 0.95 per quarter. In Figure 2,
I plot the response of the eight endogenous variables under both perfect and imperfect competition in the financial system. As I said, the former exactly resembles the basic RBC specification. In this case, there are no financial markups and the natural or wicksellian interest rate depositors and entrepreneurs face are the same.

In the competitive model, a negative technology shock reduces output, factor productivity, and consumption today by more than in future periods. Output and consumption fall today and return later to their original levels. Households want to smooth their consumption and attempt to shift resources away from future periods to the current period. For this reason, we would expect the natural real interest rate to increase.

Investment demand goes down because the technology shock has decreased production. By itself, this pushes down the natural interest rate, offsetting the pressure that comes from households' desire to substitute consumption away from future periods. The net effect of these counteracting pressures is to slightly decrease the natural interest rate by just 7 basis points.

The results change with imperfect competition. The monopolistic intermediary has the possibility of providing credit after charging a markup over the interest rate paid to depositors. The intermediary banks allow households to substitute consumption away from other periods toward this period by substantially decreasing the interest rate paid on deposits. As a result, consumption does not initially fall as much as in the competitive model. But this relatively higher consumption lowers the marginal utility of income and reduces work effort even more.

A decrease in the labor input negatively affects production and the productivity of capital. This is the cause for an even lower demand for investment relative to the baseline case.
Under perfect competition, a resulting lower investment demand and lower interest rates paid to depositors would be reflected in a sharp decrease in the interest rate entrepreneurs face. The fact that investment falls and the financial market shrinks causes the threat of entry to decline, and higher markups are compatible with the limit pricing scheme. The financial markup increases 9.42% (13 bp) on impact. The higher markup does not allow the costs of borrowing for entrepreneurs to fall much, and thus, the optimal capital stock is smaller than in the competitive case and the volatility of all real variables is higher.

2.8 Volatility and Welfare

Macroeconomic Variability and Sensitivity Analysis  Quantitative results presented in Tables 1 and 2 confirm that the presence of monopoly power and countercyclical markups in the banking sector ends up increasing the volatility of all real variables relative to the simple RBC model. In the RBC model, the standard deviation of output, consumption and investment is 1.80, 0.52 and 5.74 respectively. With a monopolistic banking system, the corresponding values for the same variables are 2.31, 0.70 and 12.08.

The role of $\tau$ is critical for the countercyclical nature of the markups. The larger $\tau$, the larger the banking economies of scale and the higher (lower) the probability of outsiders operating at an efficient scale in a booming (recessionary) economy. In turn, this causes the incumbent to set relatively lower (higher) markups. As expected, in Table 3 we can observe how the volatility of real variables monotonically increases when $\tau$ increases.

Welfare Results  To measure how the welfare of the representative household is affected by the presence of monopolistic power in the banking system, I solve the model using
a second-order approximation as in Collard and Juilliard (2001). Otherwise, conventional linearization can generate approximation errors that may be the cause of possible welfare reversals (see Kim and Kim, 2003 for details). The welfare criterion considered here is based on a second-order Taylor expansion of the representative household’s expected utility function (3.1), around the deterministic steady-state values.

\[ W_t = \frac{1}{1 - \gamma} \tilde{C}^{1-\gamma} - \frac{\alpha_n}{1 + \gamma_n} \tilde{N}^{1+\gamma_n} + \bar{C}^{1-\gamma} E(\hat{\theta}_t) \]

\[
- \alpha_n \tilde{N}^{1+\gamma_n} E(\hat{n}_t) - \frac{1}{2} \gamma \bar{C}^{1-\gamma} E(\hat{\theta}_t^2) - \frac{1}{2} \gamma_n \alpha_n \tilde{N}^{1+\gamma_n} E(\hat{n}_t^2),
\]

Where \( \bar{C} \) and \( \tilde{N} \) are the steady-state values of consumption and labor and hats denote percentage deviations from the steady state. In evaluating the welfare criterion, I find that the percent increase in steady-state consumption that would make the household as well off as it would be with perfect competition in the banking system is 10.23%. A monopolistic environment affects welfare of the household through two different channels. Firstly, the financial markup generates a permanent disintermediation between borrowers and entrepreneurs that results in lower steady-state levels of capital accumulation, output, and consumption. Secondly, the countercyclical pattern of such markups increases the volatility of real variables and thus reduces welfare.
2.9 Conclusions

The contestability of the retail banking sector is restricted by the requirement that entrants must incur large sunk entry costs in highly segmented markets. This implies that the banks must capture a significant fraction of the market right after entering to make the entry profitable. The idea of this paper is that limit pricing strategies aimed at deterring competition in banking retail niches are adopted when incumbents face an entry threat. During recessions the actors in the local banking system are more able to exert their monopolistic power, but boom periods lead to an expansion of the financial system that allows potential entrants to operate at an efficient scale. Contestable markets force incumbents to lower markups so as to deter entry. In turn, this generates countercyclical financial markups.

Using annual aggregate bank data for a large set of countries for the period 1990-2001, I find that financial markups are strongly countercyclical even after controlling for simultaneity, financial development, banking concentration, operating costs, and inflation. Since the threat of entry is not a measurable concept, I use foreign penetration as a proxy. I exploit the evidence that foreign bank entry initially takes place in the wholesale market with the intention to expand later to the retail niches. I find that the entry (and not the presence) of foreign banks is the omitted variable that disentangles the cyclicality of the markups in the empirical models. Using a regional analysis, I find that the efficiency gains resulting from foreign entry are significant only in developing countries, in which banking systems are usually small, riskier, and subject to considerable regulation. I interpret this to mean that if entrants decide to participate in these local markets despite all these impediments, the resulting threat of competition for retail niches is significantly larger.
The modeling of the banking system captures several of the features of the empirical evidence. In the theoretical model, entry occurs at the wholesale level and then spreads to the retail level. The retail market is highly segmented into niches and the more efficient entrants end up taking over current incumbents. Entry is procyclical and more likely to occur in deregulated markets, but is more effective and successful if markets are regulated. Changes in the market structure do not affect the markups. Instead, the markups change because the threat of entry forces incumbents to set rates that deter entry. Finally, economies of scale facilitate entry in boom periods, and vice versa, generating countercyclical markups.

At a general equilibrium level, the behavior of this imperfectly competitive financial system generates a bank-supply channel that increases the volatility of real variables, amplifies the business cycle, and reduces welfare. Credit is more expensive during recessions, and firms and households postpone investment and work decisions, thereby deepening the recession.

There are several extensions of the analysis that can be pursued in future work. Not having access to bank-level disaggregated data was a considerable handicap for this study. For instance, it would be interesting to study whether the regional markets that are more concentrated, or have a lower degree of financial development, or are more regulated, have different cyclical patterns. Additionally, the model could be extended to capture the consequences of long-term relationships between banks and customers. Efficiency gains from financial liberalization and market de-segmentation may be offset by some important negative effects not considered in this study. An example is that regional banks are engaged in long-term relationships with small domestic entrepreneurs that otherwise would have no access to the credit market. Entry threats that force low margins can increase the degree of banking fragility and disrupt these relationships.
Appendix A: Proof of proposition 1.

Define the break-even level of margins $\theta_i$ and $\theta_j$ for the incumbent and the entrant. The break-even level is equal to the value of the net margin that provides them zero profits when serving the niche. That is:

$$\theta_i \left( \frac{L_i}{n} \right) - u_i \left( \frac{L_i}{n} \right)^{1-\tau} = 0, \quad \text{and} \quad \theta_j \left( \frac{L_j}{n} \right) - u_j \left( \frac{L_j}{n} \right)^{1-\tau} = 0. \quad (A.1)$$

Now, let's analyze the case in which $v_j > v_i$, and thus $\theta_j > \theta_i$.

Consider for example, $\Xi_{t+1}^j > \Xi_{t+1}^i > \theta_j$. The bank $i$ has no demand and its profits are zero. If bank $i$ charges $\Xi_{t+1}^i = \Xi_{t+1}^j - \varepsilon$ (where $\varepsilon$ is positive but nil), it gets the entire niche and has a positive profit $\Xi_{t+1}^j - \varepsilon - \theta_i > 0$.

Therefore bank $j$ cannot be acting in its own interest by charging $\Xi_{t+1}^j$. Now suppose $\Xi_{t+1}^j = \Xi_{t+1}^i > \theta_j$. In that case they share the niche, and each one serves half of it. But if bank $j$ reduces its price slightly to $\Xi_{t+1}^j - \varepsilon$, it gets all the niche. Nonetheless, bank $j$ will never charge $\Xi_{t+1}^j < \theta_j$, because it would make a negative profit. It follows that bank $i$ can charge $\Xi_{t+1}^i = \theta_j - \varepsilon$ and guarantee for itself all the niche while obtaining a positive profit $\theta_j - \varepsilon - \theta_i > 0$.

Therefore bank $j$ is indifferent between staying or leaving the niche, since will not be able to serve it. If bank $i$ offers bank $j$ a negligible but positive amount of output $\varepsilon$ so as to merge, it is in the best interest of bank $j$ to accept it. A symmetric analysis holds when $v_j < v_i$. $\blacksquare$
Appendix B: Alternative Modeling Strategies

Here, I introduce monopolistic competition and endogenous cartel creation in the financial system. This is the only novelty of this setup. Again, this modification creates a disintermediation between borrowers and entrepreneurs that amplifies the response of the real variables to technology shocks. Now I assume that the banking system is highly segmented into a continuum \([0, 1]\) of regions, each one served by a local branch, which is owned by a commercial bank. Since the geographical distance provides them with some market power, I assume that each one faces its own downward sloping investment demand curve. In addition, banks are assumed to be monopolistically competitive.

Let \(I_t(z)\) be the amount to be financed by the bank located in region \(z\). Hence, aggregate investment, \(I_t\), is a CES composite of the capital acquisition that is financed by every regional branch:

\[
I_t = \left[ \int_0^1 I_t(z) \frac{z^{-1}}{\varepsilon} \, dz \right]^{\frac{\varepsilon}{\varepsilon-1}}. \tag{2.22}
\]

Cost minimization among entrepreneurs results in an isoeelastic investment demand for each regional branch:

\[
I_t(z) = \left( \frac{1 + r_{t+1}^k(z)}{1 + r_{t+1}^k} \right)^{-\varepsilon} I_t. \tag{2.23}
\]

Where \(r_{t+1}^k(z)\) is the net interest rate charged by each regional branch. Households do
not face any transaction cost, and they are indifferent when choosing a financial institution. Thus, I assume that banks are perfectly competitive when collecting households’s deposits.\footnote{For instance, households may open saving accounts through national online financial operators with negligible transaction costs. Nonetheless, it is unquestionable that the proliferation of ATM’s provides the local institutions with monopsony power at the time of collecting deposits. I postpone this case for future research.}

**Bank Cartel** Let’s assume that exists a finite number of bank cartels. Each cartel behaves as a conglomerate and owns a fraction, e.g. \([\zeta, \zeta + \phi]\), of the continuum of regional branches. Members of the cartel jointly maximize profits. For simplicity, I assume that all cartels are of the same size and owns the same fraction of branches at any time. In this case, the static maximization problem for each cartel is:

\[
\max_{r^k_t(z)} \int_{\zeta}^{\zeta + \phi} (1 + r^k_{t+1}(z))I_t(z)dz - (1 + r_{t+1}) \int_{\zeta}^{\zeta + \phi} I_t(z)dz
\]

(2.24)

In a symmetric equilibrium defined as \(r^k_{t+1}(z) = r^k_{t+1}\), I find that each of the regional banks that belongs to the cartel, i.e. \(z \in [\zeta, \zeta + \phi]\), chooses a common gross markup, \((1 + \Xi_{t+1})\), over the cost of funds, \((1 + r_{t+1})\), given by:

\[
(1 + r^k_{t+1}) = (1 + \Xi_{t+1})(1 + r_{t+1}).
\]

(2.25)

Where
\[ (1 + \Xi_{t+1}) = \frac{\int_{\zeta}^{\zeta+\phi} \epsilon_{z,x} d_x + \epsilon}{\int_{\zeta}^{\zeta+\phi} \epsilon_{z,x} d_x + \epsilon - 1} \] (2.26)

\[ \epsilon_{z,x} = -\frac{r_t(x) \partial l_t(x)}{l_t(x) \partial r_t(x)} \] is the cross-elasticity of substitution, and \( \epsilon \) is the constant own-elasticity of substitution defined by the CES functional form in (2.22). For completeness, I assume that \( \int_{\zeta}^{\zeta+\phi} \epsilon_{z,x} d_x + \epsilon > 1 \).

From (2.26) we can observe that the larger the fraction of branches each cartel owns, the higher the optimal markup to be charged in every regional branch. If the cartel did not exist, the optimal non-collusive gross markup, \( (1 + \Xi_{t+1}^{nc}) \) would be:

\[ (1 + \Xi_{t+1}^{nc}) = \frac{\epsilon}{\epsilon - 1} < \frac{\int_{\zeta}^{\zeta+\phi} \epsilon_{z,x} d_x + \epsilon}{\int_{\zeta}^{\zeta+\phi} \epsilon_{z,x} d_x + \epsilon - 1} = (1 + \Xi_{t+1}) \] (2.27)

As a result, in this case of monopolistic competition, members of the cartel are always better off when colluding. There are no incentives to walk out of the cartel and therefore no need for punishment. The larger the fraction of regional banks that belong to the cartel, the larger the profits for each of its member. The intuition for this result comes from the theory of multi-product firms (i.e. conglomerates) in the field of industrial organization. Financial intermediaries know that if interest rates are increased, some of the migrating entrepreneurs will end up borrowing from members of the cartel rather than seeking funds in the competition.

**Distant lending** As in Rajan and Petersen (1995), transactions through regional branches allow banks to develop a credit relationship that ease the acquisition of "soft" (or tacit)
information about borrowers' status. Moreover, advertisement and commercial costs may be significantly reduced when a branch is nearby.

Nonetheless, banks also have access to publicly available or "hard" information. However, handling "hard" information demands larger monitoring costs, and costly updates at the time of foreclosing loan renewals. Although banks may not require a branch to have access to entrepreneurs, banks may need to incur in transactional and advertisement costs in order to lend at "a distance". I assume that for any bank, the cost of serving a regional niche \( z \) at "a distance" is:

\[
I^*_t(z)^{1-\tau},
\]

the larger the pool of potential borrowers to serve at "a distance", the higher the economies of scale, \( \tau \), when gathering regional information and incurring in advertisement costs.

To summarize, in period \( t+1 \), the distant bank obtains the following ex-post real profits for carrying the bank contract in region \( z \) at period \( t \):

\[
\pi_{d,t+1} = (1 + \Xi_{t+1})(1 + \tau_{t+1})I^*_t(z) - [(1 + \tau_{t+1})D_{t+1}(z) + I^*_t(z)^{1-\tau}] .
\]

The first term are entrepreneur payments, and the term in brackets captures the cost of funds (i.e. payment to depositors) plus the operating costs of serving at "a distance".

Using the fact that in a symmetric equilibrium, \( D_{t+1}(z) = I^*_t(z) \), and that \( \Xi_{t+1}\tau_{t+1} \approx 0 \), for the parameter values I consider here, we can express (2.29) as:
Optimal size of the cartel  In the baseline scenario, the incentive for the regional banks is always to increase the size of the cartel. As mentioned before, the larger the fraction of branches each cartel owns, the higher the implicit markup. To the contrary, the possibility of "distant" lending imposes constraints on the cartel size. From equation (2.30), we observe that if $\Xi_{t+1} > I_t(z)^{1-\tau}$, outsiders may be able to serve at "a distance" any of the regional branches that belong to the cartel, oust the local bank, and still get a profit.

Investment demand increases in booms, and leads to expansion of the financial system that allows outsiders to operate "at a distance" with an efficient scale. Therefore, the sustainable size of the cartel and its implicit level markup decrease. Regional banks are forced to walk out from large cartels and form relatively small ones in order to protect the niches from "distant" competitors. A symmetric equilibrium implies that the markup level that deters distant competition is given by the log-linear expression:

$$\hat{\Xi}_{t+1} = -\tau \hat{I}_t$$

(2.31)

Where hats denote percent-deviations from steady-state. Finally, this markup pins down the sustainable number of cartels in (2.26).

The last result reminds the one in Rotemberg and Woodford (1999). Namely, a cartel
with high markups may not be sustainable in economic expansions. Besides, the number of competing cartels decreases during recessions. This implication coincides with the empirical evidence reflecting a decreasing number of players in the banking system, as well as, an increasing degree of bank consolidation during bad times.
References


Chapter 3

Business Cycles and Monetary Regimes in Emerging Economies with a Monopolistic Banking Sector.

3.1 Introduction

Although there is a vast literature on monopolistic power in product and factor markets, and also credit market imperfections, practically there is no research that considers the possibility of monopoly power in financial markets in a business cycle context. This possibility is particularly relevant in developing economies, for three reasons. Firstly, banking remains
a primary source of funds for entrepreneurs in those countries.\footnote{See, for instance, empirical evidence in Rojas-Suárez and Weisbrod (1994) and Catena (1996).} Secondly, consolidation of the banking sector has been spurred by the liberalization of financial markets worldwide in the last decades. Making use of large economies of scale, international banks have taken over established banks in relatively small financial markets. Finally, empirical evidence in real goods markets shows that markups are countercyclical. \footnote{For instance, see Rotemberg and Woodford (1992) and Chevallier and Sharfstein (1996) among others. Pigou (1927) and Keynes (1939) were the first ones to suggest that markups were countercyclical in real goods markets.} If bank markups are also countercyclical, this gives rise to a bank-supply channel that extends the credit channel to reinforce the same vicious circle: Credit is more expensive during recessions, so that firms and households postpone investment, work, and consumption decisions and thereby deepen the recession. But while the standard version of the credit channel relies on the external finance problem that induces banks to charge a premium to cover the increase in expected bankruptcy costs during recessions, the bank-supply channel is solely the result of imperfect competition in the banking system.

In this last chapter, I set up a New Keynesian small open economy model with imperfect competition in the banking system and countercyclical bank markups that amplifies and propagates both real and nominal external shocks. Following empirical evidence in Mandelman (2005), limit pricing strategies are the origin of these countercyclical bank markups. Limit pricing is the practice of setting prices at the limit level that deters entry. As shown in Bain (1956), the price level in an industry strongly influences firms contemplating entry. Thus, temporary low interest rates may not be the result of changes in the banking structure but just the optimal entry-deterrence strategy for the incumbents. In this scenario,
the threat of entry is the only reason to avoid profit maximization.

It is well-documented that bank penetration commonly takes place in the wholesale banking market initially and then expands to the retail market.\(^3\) The penetration into the retail sector is obstructed, however, by the requirement of incurring large sunk entry costs (for instance, large advertising expenditures or the construction of a network of branches and ATMs required to accommodate small transactions). This implies that banks need to enter at a minimum-efficient-scale (MES) to justify the sunk costs incurred. Also, they must capture a large enough fraction of the market right after entering to make the constructed network profitable. This is particularly difficult in the banking industry, in which the markets are segmented into regional or sectorial niches.\(^4\) In this scenario, the size of the market constitutes a barrier to entry. If the financial market is small or underdeveloped there is space for only a few incumbents operating at an efficient scale. Thus, boom periods lead to an expansion of the financial system that attracts potential competitors who see the possibility of operating at an efficient scale. In this situation, contestable markets force incumbents to charge markups well below short-run profit maximizing levels so as to avoid entry. In contrast, the competitive pressure decreases during recessions and the banks in the local financial system are able to exert their monopolistic power by charging high markups.

To judge the empirical relevance of the setup, I conduct a quantitative exercise aimed at replicating the volatility in real variables for a set of emerging economies in which bank markups are sizable. The model succeeds at accounting for the high volatility of investment registered in these countries, even in a context of flexible exchange rates and liabilities.

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\(^4\)See evidence in Petersen and Rajan (1994).
denominated in local currency. Such "safeguards" are able to absorb the impact of external shocks in models that have only the standard credit channel (i.e. balance-sheet effect), which fails to deliver any amplification mechanism.

This last chapter is organized as follows. In section 2, I discuss the empirical evidence and proceed with a literature review. In section 3, I introduce the model. In section 4, I present the parameterization of the model and the solution method. I then describe the transmission mechanism and undertake a welfare analysis. Concluding remarks are in section 5.

3.2 Literature Review and Empirical Evidence

There exists a lengthy literature on the effect of balance sheets on borrower spending that works to propagate external shocks as well as financial crises in emerging economies. Examples include: Aghion et al (2000), Céspedes et al (2000), Caballero and Krishnamurty (2000), Devereux and Lane (2003), Faia and Monacelli (2002), Christiano et al (2002). These contributions aim to capture an old idea of Keynes and Fisher who originally recognized the imperfect nature of financial markets. This is that, deteriorating credit market conditions like deflation-originated real debt burden increments and collapsing asset prices (that alter collateral valuations and default costs) are not only simply consequences of a declining economy, but actually a major cause of the decline. My baseline model is closer to Gertler et al (2003), who extend the standard New Keynesian small open economy framework to include the credit channel as originally developed by Bernanke et al (2000). In addition, the introduction of nominal rigidities allows for exchange rate policy evaluation.
Nonetheless, the internal propagation mechanism in these papers relies on either fixed exchange rate regimes or the presence of firms' liabilities denominated in foreign currency. With fixed exchange rates, the rise in either the country risk premium or foreign interest rates causes an immediate rise in domestic interest rates. As a consequence, asset (and collateral) values plummet and external finance risk premia rise, leading to a fall in investment that propagates the shock to the economy. A different approach to the role of leverage positions is based on the "fear of floating" perspective that argues in favor of fixed exchange rates schemes. Liabilities are assumed to be mostly dollarized and the exchange rate pass-through rapid.\(^5\) Although flexible exchange rates offset the macroeconomic impact through an immediate depreciation of the local currency, liabilities denominated in foreign currency and revenues denominated in domestic currency boost firms' leverage ratio and increase the risk premia.

Regarding the study of the bank-supply channel to be introduced here, the first step is to find a proper measure for markups in the banking industry data. A simple approach is to consider the ex-ante (posted) spread or difference between lending and deposit rates, as a proxy for financial markups. The difficulty here is that the spread also includes a premium to cover the expected borrowers' bankruptcy costs, which is the core of the standard credit channel.

The so-called risk premium has the sole intention of covering these expected bankruptcy costs. We expect that, in the long run, aggregate bank income obtained from such risk premia charges actually match banks' loan default costs. Therefore, I consider annual banks' balance sheet ex-post data that accounts for defaulted loans to proxy for net markups. In

\(^5\)See for instance Calvo and Mendoza (2000), and Calvo and Reinhart (2002).
particular, I will use net interest margins (NIM), equal to bank’s total interest income minus interest expense divided by total assets after subtracting defaulted loans. As explained in Demirguc-Kunt and Huizinga (1998), bank interest margins can be seen as an indicator of the pure inefficiency of the banking system.\(^6\) Table 1 presents some descriptive statistics on ex-post margins for a selected group of emerging and developed economies. A lower degree of financial development not only results in much greater average interest margins for the former group (as expected) but also in more volatile margins both in absolute and relative terms.

Practically all the evidence on cyclicality is focused on ex-ante spreads.\(^7\) An exception is Mandelman (2005), in which dynamic panel estimates show that in emerging countries ex-post margins are strongly countercyclical, even after controlling for financial development, banking concentration, operating costs, inflation, and simultaneity or reverse causation. In emerging economies, this countercyclical pattern is explained by the entry of foreign banks that occurs during booms. Entry, which mostly happens at wholesale level, signals the intention to enter later into the retail niches and, as I understand, triggers limit pricing strategies in concentrated financial markets. This evidence motivates the modeling of the banking system presented in Mandelman (2005), and is the source of the bank-supply channel in this paper.

\(^6\) For more details, see Mandelman (2005).

\(^7\) See, for instance, Hannan and Berger (1991) and Edwards and Vegh (1997) and Olivero (2004). Similarly, Angelini and Cetorelli (2000) use GDP growth as a control variable in the estimation of Lerner indexes. However, none of these studies settles the issue of causality and endogeneity.
3.3 The Model

I start from a standard small open economy framework with monopolistic competition and nominal rigidities, in the spirit of Obstfeld and Rogoff (1999) and Svensson (2000), and include the financial accelerator mechanism that links the condition of the borrower balance sheets to the terms of credit as developed in Gertler et al (2003). The novel feature of my setup is the inclusion of an imperfectly competitive domestic banking system, which acts as an intermediary between the households' savings and the wholesalers' financial requirements.

Within the home economy there are households, firms, a banking sector and a monetary authority. Foreign variables are considered to be exogenous. Households work, save, and consume two groups of tradable goods that are produced at home and abroad and are imperfect substitutes.

There are three types of home firms: wholesalers, capital producers and retailers. Due to imperfections in financial markets, the wholesalers' demand for capital depends on their respective financial positions. This capital is used with labor to produce raw output. Banks serve as the sole source of funds to finance capital acquisition.Competitive capital producers manufacture new capital and adjustment costs lead to a variable price of capital. Finally, retailers package wholesale goods together to produce final output. They are monopolistically competitive and set nominal prices on a staggered schedule. The role of the retail sector is simply to provide the source of nominal price stickiness.
3.3.1 Households

The household sector is conventional. There is a continuum of households of unit mass. Each household works, consumes, and invests its savings in regular deposits and foreign bonds denominated in foreign currency.

The representative household maximizes:

$$
E_t \sum_{i=0}^{\infty} \beta^i \left[ \frac{1}{1-\gamma} C_t^{1-\gamma} - \frac{\alpha_n}{1+\gamma_n} H_t^{1+\gamma_n} \right]
$$

(3.1)

Subject to the budget constraint:

$$
C_t = \frac{W_t}{P_t} H_t + \Pi_t - \frac{D_{t+1} - (1+i_{t-1})D_t}{P_t} - \frac{S_t B_t^{*+1} - S_t \Phi_t (1+i_{t-1}) B_t^*}{P_t}.
$$

(3.2)

With $\gamma > 0$, and $\gamma_n \geq 0$. $C_t$ is a composite of tradable final consumption goods; $H_t$ is labor supply; $W_t$ denotes the nominal wage; $P_t$ is the consumer price index (CPI); $\Pi_t$ are real dividend payments (from ownership of commercial banks and retail firms); $D_t$ are deposits in local currency held at commercial banks; $B_t^*$ are foreign nominal bonds denominated in foreign currency; $S_t$ the nominal exchange rate. $(1 + i_t)$ and $(1 + i_t^*)$ are the gross domestic and foreign nominal interest rates. $\Phi_t$ is the gross borrowing premium that domestic residents must pay to obtain funds from abroad. I assume that the country’s borrowing premium depends on foreign indebtedness, that is $\Phi_t = f(-B_t^*)$. The elasticity of $\Phi_t$ with respect to $-B_t^*$ is positive to avoid non-stationarity of the stock of foreign liabilities. However, it is set close to zero to avoid altering the high-frequency dynamics.
of the model. Since I assume that the intermediary cannot distinguish a household from a risky entrepreneur, all household deposits are redirected to entrepreneurs. The household can dissave by holding negative positions of foreign bonds.

Consumption Composites The household's preferences over home consumption, $C_t^H$, and foreign consumption, $C_t^F$, are defined by a CES index:

$$C_t = \left( \gamma_c \left( C_t^H \right)^{\frac{\rho - 1}{\rho}} + (1 - \gamma_c) \left( C_t^F \right)^{\frac{\rho - 1}{\rho}} \right)^{\frac{\rho}{\rho - 1}}. \quad (3.3)$$

The corresponding consumer price index, $P_t$, is:

$$P_t = \left[ \gamma_c \left( P_t^H \right)^{1 - \rho} + (1 - \gamma_c) \left( P_t^F \right)^{1 - \rho} \right]^{\frac{1}{1 - \rho}}. \quad (3.4)$$

Optimality Conditions Household behavior obeys:

Consumption allocation:

$$\frac{C_t^H}{C_t^F} = \frac{\gamma_c}{1 - \gamma_c} \left( \frac{P_t^H}{P_t^F} \right)^{-\rho}. \quad (3.5)$$

Labor allocation:

$$\frac{W_t}{F_t} C_t^{-\gamma} = a_n H_t^n. \quad (3.6)$$
Consumption and saving intertemporal allocation:

\[ 1 = \beta E_t \left\{ \left( \frac{C_t}{C_{t+1}} \right)^\gamma (1 + i_t) \frac{P_t}{P_{t+1}} \right\}. \]  \hspace{1cm} (3.7)

Finally, the optimality condition governing the choice of foreign bonds, combined with (3.7), yields the following uncovered interest parity condition:

\[ E_t \left\{ C_{t+1}^{-\gamma} \frac{P_t}{P_{t+1}} \left[ (1 + i_t) - \Phi_t (1 + i_t^*) \frac{S_{t+1}}{S_t} \right] \right\} = 0. \]  \hspace{1cm} (3.8)

### 3.3.2 Firms

**Wholesalers**

Wholesalers are risk neutral and acquire capital in each period for use in the subsequent period. I assume that they have a finite expected horizon. This assumption is aimed to capture the phenomenon of ongoing births and deaths of firms, as well as to discard the possibility that wholesalers will ultimately accumulate enough wealth to be fully self-financing. The probability of surviving to the next period is $\zeta$. In other words, the expected horizon is $\frac{1}{1-\zeta}$. I assume the birth rate of wholesalers to be such that the fraction of agents who are wholesalers is constant. To ensure that new wholesalers have funds available when starting out, I follow Bernanke et al (2000) and assume that each wholesaler is endowed with $H_t^w$ units of labor which is supplied inelastically as a managerial input to production. $W_t^w$ is
received in compensation. Capital is used in combination with labor to produce wholesale goods. The labor input $L_t$ is assumed to be a composite of household and managerial labor:

$$L_t = H_t^{1-\Omega} H_t^{\Omega (1-\Omega)}.$$  

$(1 - \Omega)$ is positive but negligible in size. I normalize $H_t^\omega$ to unity.

The project is subject to an idiosyncratic shock, $\omega_t$, that affects both the production of new goods and the effective quantity of the capital in use. The shock $\omega_t$ may be regarded as a measure of the overall quality of the capital investment. I assume that $\omega_t$ is an i.i.d. random variable, distributed continuously with $E \{\omega_t\} = 1$. I also assume Cobb-Douglas technology. The last two assumptions allow me to express the aggregate production function as:

$$Y_t = A_t K_{t-1}^\alpha L_t^{1-\alpha}, \quad (3.9)$$

where $Y_t$ is the aggregate output of wholesale goods, $K_{t-1}$ is the aggregate amount of capital purchased by wholesalers in period $t - 1$, $L_t$ is labor input, and $A_t$ is an exogenous technology shock.

Let $P_{W,t}$ be nominal price of wholesale goods. Then, labor demand satisfies,

$$(1 - \alpha)\Omega \frac{Y_t}{H_t} P_{W,t} = W_t, \quad (3.10)$$

and

$$(1 - \alpha)(1 - \Omega) \frac{Y_t}{H_t^e} P_{W,t} = W_t^e. \quad (3.11)$$
Demand of New Capital  The wholesalers finance the acquisition of capital partly with their own net worth available at the end of period \( t \) and partly with the bank credit redirected from household deposits, \( D_{t+1} \). Capital financing is split between net worth, \( N_t \), and credit:

\[
Q_t K_t = N_t + \frac{D_{t+1}}{P_t}.
\]

(3.12)

\( Q_t \) is the real market price of capital in units of the household consumption composite. Net worth may be interpreted as the equity of the firm. I assume that new equity and bond issues are prohibitively expensive, or not available for local firms, so that all external finance is done with bank credit. I ignore the possible existence of retained reserves, so that the overall amount of credit in the economy must be equal to the overall amount of household deposits. As previously remarked, all credit is in units of domestic currency.

Due to constant returns to scale, the marginal return to capital equals its average return. Jointly with the assumptions on the idiosyncratic shock, \( \omega_t \), we can write the expected gross return to holding a unit of capital from \( t \) to \( t+1 \) as:

\[
E_t (1 + r_{t+1}^k) = E_t \left[ \frac{P_{Y_{t+1}} \alpha_{Y_{t+1}} K_{t+1}}{P_t K_t} + \frac{Q_{t+1} (1 - \delta)}{Q_t} \right].
\]

(3.13)

Supply of New Capital  The marginal cost of funds to the wholesaler depends on the financial conditions and the banking structure. Following Bernanke et al (2000), I assume the existence of an external finance problem that makes uncollateralized external finance
more expensive. As in Gale and Hellwig (1985), I assume the existence of a costly state verification problem. In this case, the idiosyncratic shock \( \omega_t \), is private information for the entrepreneur. A detailed explanation of the agency problem for a monopolistic bank is in Appendix A. It is shown there that the external finance risk premium, \( \psi_t \), may be expressed as an increasing function of the leverage ratio. Essentially, the external finance risk premium varies inversely with the wholesaler’s net worth. The greater the share of capital that can be self-financed, the smaller the expected bankruptcy costs, and thus the smaller the risk premium:

\[
\psi_t(\cdot) = \psi \left( \frac{D_{t+1}}{N_t} \right),
\]

\( \psi'(\cdot) > 0, \ \psi(0) = 0, \ \psi(\infty) = \infty. \)

Notice that \( \psi_t(\cdot) \) depends exclusively on the aggregate leverage ratio and not on any wholesaler-specific variable. In equilibrium, all entrepreneurs choose the same leverage ratio, which is the result of both constant returns to scale in production and risk neutrality (for details, see Carlstrom and Fuerst, 1997). Equation (3.14) is the basis of the standard credit channel (also referred to as the balance-sheet-effect). It links movements in the wholesalers’ balance sheet positions to the marginal cost of credit and, thus, to the demand of capital. As stressed in Kiyotaki and Moore (1997), endogenous fluctuations in the price of capital, \( Q_t \), may have significant effects on the leverage ratio, \( \frac{D_{t+1}}{K_t} / N_t = \frac{D_{t+1}}{K_t} / \left( Q_t K_t - \frac{D_{t+1}}{K_t} \right) \).

Finally, in equilibrium, the allocation of new capital satisfies the following optimality
condition:

\[ E_t \left( 1 + r^k_{t+1} \right) = (1 + \Xi_{t+1}) \psi_t(.) \left( 1 + i_t \right) \frac{P_t}{P_{t+1}} \]. \quad (3.15)

Equation (3.15) is the critical component of my model. The wholesalers’ overall marginal ex-ante cost of funds is the product of three different terms. \( E_t \left( 1 + i_t \right) \frac{P_t}{P_{t+1}} = (1 + r_{t+1}) \) indicates the bank’s gross cost of funds (i.e. the real interest rate paid to depositors), \( \psi_t(.) \) is the premium aimed to cover expected bankruptcy costs, and \( (1 + \Xi_{t+1}) \) is the gross financial markup an intermediary bank with monopoly power charges for carrying and executing the contract. If such markup were zero, the bank would earn a return equal to the safe rate that households receive for their deposits (see Appendix A for details). Net interest margins proxy for \( \Xi_{t+1} \) in the data and reflect the disintermediation generated by the banking system. The bank spread proxies for the combined effects of \( \psi_t(.) \) and \( (1 + \Xi_{t+1}) \).

To define the evolution of entrepreneurial aggregate net worth, let \( V_t \) denote the value of the ex-post real return on capital net of ex-post borrowing costs:

\[ V_t = (1 + r^k_t) Q_{t-1} K_{t-1} - \left[ (1 + \Xi_t) \psi_{t-1}(.) (1 + i_{t-1}) \frac{P_{t-1}}{P_t} \right] \frac{D_t}{P_{t-1}}. \quad (3.16) \]

While unforecastable variation in assets prices, \( Q_t \), is the main source of unanticipated returns, unexpected CPI variation plays the same role for the liabilities. Finally, aggregate net worth is the result of a linear combination of \( V_t \) and the managerial wage:

\[ N_t = \zeta V_t + W^f_t/P_t. \quad (3.17) \]
Exiting wholesalers in period $t$ consume their remaining resources: $C_t^w = (1 - \zeta)V_t$. I assume that wholesalers have preferences over domestic and foreign goods identical to household’s preferences.

**Capital Producers**

The construction of new capital requires as input an investment good, $I_t$, that is a composite of domestic and foreign final goods:

$$I_t = \left[ (\gamma_I)^{\frac{1}{\rho_I}} \left( I_t^H \right)^{\frac{\rho_I - 1}{\rho_I}} + (1 - \gamma_I)^{\frac{1}{\rho_I}} \left( I_t^F \right)^{\frac{\rho_I - 1}{\rho_I}} \right]^{\frac{\rho_I}{\rho_I - 1}}. \quad (3.18)$$

Competitive capital producers choose the optimal mix of foreign and domestic inputs according to the intra-temporal first-order-condition:

$$\frac{I_t^H}{I_t^F} = \frac{\gamma_I}{1 - \gamma_I} \left( \frac{P_t^H}{P_t^F} \right)^{\rho_I}. \quad (3.19)$$

Therefore, the investment price index, $P_{I,t}$, is given by

$$P_{I,t} = \left[ \gamma_I \left( P_t^H \right)^{1 - \rho_I} + (1 - \gamma_I) \left( P_t^F \right)^{1 - \rho_I} \right]^{-\frac{1}{1 - \rho_I}}. \quad (3.20)$$

I assume that there are increasing marginal adjustment costs in the production of capital. Capital producers operate a constant returns to scale technology that yields a gross output of new capital goods $\Psi \left( \frac{I_t}{K_{t-1}} \right) K_{t-1}$, for an aggregate investment expenditure of $I_t$. $\Psi(\cdot)$ is
increasing and concave. \( K_{t-1} \) is the second input in capital production. Capital producers rent this capital after it has been used to produce final output within the period. Let \( r_t^I \) denote the rental rate for the existent capital. Then profits equal:

\[
Q_t \Psi \left( \frac{I_t}{K_{t-1}} \right) K_{t-1} = \frac{P_{t,t}}{P_t} I_t - r_t^I K_t. \tag{3.21}
\]

In order to capture the delayed response of investment observed in the data, I follow Bernanke et al (2000) and assume that capital producers make their plans to produce new capital one period in advance. Therefore, the optimality conditions for the choices of \( I_t \) and \( K_{t-1} \) yields:

\[
E_{t-1} \left\{ Q_t \Psi' \left( \frac{I_t}{K_{t-1}} \right) - \frac{P_{t,t}}{P_t} \right\} = 0, \tag{3.22}
\]

\[
E_{t-1} \left\{ Q_t \left[ \Psi \left( \frac{I_t}{K_{t-1}} \right) - \Psi' \left( \frac{I_t}{K_{t-1}} \right) \frac{I_t}{K_t} \right] \right\} = r_t^I. \tag{3.23}
\]

There are no adjustment costs in the steady state, so that \( \Psi \left( \frac{I}{K} \right) = \frac{I}{K} \) and \( \Psi' \left( \frac{I}{K} \right) = 1 \). It also follows that \( Q \) is normalized to one and, hence, rental payments are second order and negligible in terms of both steady-state and model dynamics. Equation (3.22) implies that \( Q_t \) increases in \( \frac{I_t}{K_{t-1}} \) as predicted by standard \( Q \) theory of investment. The adjustment costs generate a variable price of capital, crucial for the balance-sheet-effect.

The resulting economy wide capital accumulation is:
The Retail Sector and Price Setting

Monopolistic competition occurs at the retail level. Retailers buy wholesale goods and differentiate products by packaging them together and adding a brand name.

Let \( Y_t^H(z) \) be the good sold by retailer \( z \). Final good domestic output is a CES composite of individual retail goods:

\[
Y_t^H = \left[ \int_0^1 Y_t^H(z) \frac{\xi}{\xi} dz \right]^\frac{1}{\xi}.
\]  \hspace{1cm} (3.25)

The price of the composite final domestic good, \( P_t^H \), is given by:

\[
P_t^H = \left[ \int_0^1 P_t^H(z)^{1-\xi} dz \right]^\frac{1}{1-\xi}.
\]  \hspace{1cm} (3.26)

Domestic households, capital producers, and the foreign country buy final goods from retailers. Cost minimization results in an isoelastic demand for each retailer:

\[
Y_t^H(z) = \left( \frac{P_t^H(z)}{P_t^H} \right)^{-\xi} Y_t^H.
\]  \hspace{1cm} (3.27)
To introduce price inertia, I assume that the retailer is free to change its price in a given period only with probability $1 - \theta$, following Calvo (1983). Let $P_{o,t}^H$ denote the home production price set by retailers that are able to change prices at $t$, and $Y_{o,t}^H(z)$ the resulting demand at this price level. Retailer $z$ chooses her price to maximize expected discounted profits, given by:

$$
\sum_{k=0}^{\infty} \theta^k E_t \left[ \Lambda_{t,k} \frac{P_{o,t}^H - P_{W,t+k}^H}{P_{t+k}^H} Y_{o,t+k}^H(z) \right]. 
$$

(3.28)

The discount rate $\Lambda_{t,k} = \beta^k \left( \frac{C_{t}}{C_{t+k}} \right)^{\gamma}$ is the household or "shareholder" intertemporal marginal rate of substitution. Because the price may be fixed for some time, retailers set prices based on the expected future path of marginal cost. The optimal price, $P_{o,t}^H$ satisfies:

$$
\sum_{k=0}^{\infty} \theta^k E_t \left\{ \Lambda_{t,k} \left( \frac{P_{o,t}^H}{P_{t+k}^H} \right)^{-\xi} Y_{o,t+k}^H(z) \left[ P_{o,t}^H - \left( \frac{\xi}{\xi - 1} P_{t+k}^H \right) \right] \right\} = 0, 
$$

(3.29)

where $\frac{\xi}{\xi - 1}$ is the retailers' desired gross markup over wholesale prices. Given that a fraction $\theta$ of retailers do not change their price in period $t$ the domestic price index evolves according to:

$$
P_{t}^H = \left[ \theta \left( P_{t-1}^H \right)^{1-\xi} + (1 - \theta) \left( P_{o,t}^H \right)^{1-\xi} \right]^\frac{1}{1-\xi}.
$$

(3.30)

By combining the last two equations, and then log-linearizing, it is possible to obtain
the familiar optimization-based Phillips curve that arises from an environment of time-dependent staggered price setting.

I assume that the law of one price holds for foreign goods sold in the domestic market:

\[ P_t^F = S_t P_t^*. \] (3.31)

Then, it is possible to obtain an economy-wide inflation, combining equation (3.4) with the results above.

In Appendix B, I consider the case in which local currency pricing results in a delay in the exchange rate pass-through mechanism. There, I simply assume that imported goods prices are adjusted in the same manner as prices in the domestic sector.

### 3.3.3 The Banking System

I assume that the banking system is highly segmented into a large number, \( n \), of sectors or regions (niches). The size of each niche is the same, and each of them is served by an established bank (incumbent), \( l \), that possesses a local monopoly and therefore finances an equal fraction \( \frac{D_{t+1}}{Pt} \) of the total entrepreneurial capital acquisition. Each incumbent can serve only its own niche because of an implicit collusion agreement that is described later. This intermediary chooses a net markup for its niche, \( \Xi_{t+1} \), at the beginning of period \( t \). I assume that the cost of serving the niche for each bank \( l \) is:

\[ u_l \left( \frac{D_{t+1}}{Pt} \right)^{1-\tau}. \] (3.32)
The constant $u_1$ is the cost-efficiency level, and captures any idiosyncratic operational (in)efficiency and information (dis)advantages any bank may have. I assume that $u_1$ is drawn from a common uniform distribution $U(u)$ with support on $[0, \lambda]$ at the beginning of the bank operations. $u_1$ is private information and is unknown to banks outside the niche. The cost of serving depends on the amount of credit financed (the size of the market). In addition, the banking system possesses operational economies of scope and scale over operating costs. Thus, I assume that $0 < \tau < 1$.

For notational ease, I assume that the operational costs depend on the real amount of credit financed at $t$ (i.e. $\frac{D_{t+1}}{P}$), but are effectively incurred at the time profits are realized. Therefore in period $t + 1$ the bank obtains the following ex-post real profits for carrying and monitoring the bank contract (between depositors and entrepreneurs) at period $t$:

$$
\pi_{t,t+1} = (1 + \Xi_{t+1})(1 + i_t) \left( \frac{D_{t+1}}{P_{t+1}} \right) - \left[ (1 + i_t) \left( \frac{D_{t+1}}{P_{t+1}} \right) + u_1 \left( \frac{D_{t+1}}{P} \right)^{1-\tau} \right]. \tag{3.33}
$$

The first term are the entrepreneur payments net of bankruptcy costs and the term in brackets captures the cost of funds (i.e. payments to depositors) plus operating costs. Using the fact that the ex-post real rate is $(1 + \tau_{t+1}) = (1 + i_t) \frac{P}{P_{t+1}}$, and that $\Xi_{t+1}\tau_{t+1} \approx 0$ for the parameter values I consider, we can express (3.33) as:

$$
\pi_{t,t+1} = \Xi_{t+1} \left( \frac{D_{t+1}}{P} \right) - u_1 \left( \frac{D_{t+1}}{P} \right)^{1-\tau}. \tag{3.34}
$$
Entry and mergers  I assume that entry is possible in this banking system, but that it occurs in successive stages. Entrants in the “banking system” at time $t$ only start competing in the “niche” at time $t + 1$, which introduces a one-period time-to-build lag in the model. Right after the entry decision is effectively taken (i.e. when the sunk costs are incurred), the entrant is already inside the banking system, but only at the “wholesale level”. Hence, in principle, during period $t$ it is able to temporarily serve any of the $n$ niches until it is finally established in one of them in $t + 1$. The aim is to capture the idea of entry taking place in the wholesale market first with the ultimate goal of spreading later to the retail segment (niches).\footnote{Additionally, we could say that entrants need to incur in one-period learning process to make their idiosyncratic cost-efficiency level effective at the regional level.}

The entry stages are as follows:

(A) At the beginning of period $t$, a potential competitor, $j$, attempts to enter the banking
system. At no cost, it draws its cost-efficiency level, \( v_j \), from the same common uniform distribution \( U(v) \).

(B) After learning its own \( v_j \), the potential competitor chooses whether to enter the banking system and fight for one of the niches next period or to withdraw from the banking system. The closer \( v_j \) is to zero, the more efficient the potential entrant is, and the easier to take over a niche. I assume that the number of total draws is large enough that at least some potential competitors enter the banking system every period.

(C) To enter the banking system (and eventually fight for one of the niches) an outsider has to incur fixed sunk entry costs, \( m_t \), at the beginning of period \( t \).\(^9\) \( m_t \) is exogenous and measured in units of the consumption composite. We can also interpret changes in \( m_t \) as changes in entry regulations.

(D) In principle, during period \( t \), entrants are able to temporarily serve any (or even all) of the \( n \) niches at the "wholesale level" until finally established in one of them. The cost of serving other niches at the wholesale level is:

\[
\lambda \left( \frac{\Delta t + \tau}{\kappa} \right)^{1-\tau},
\]

(3.35)

where \( \lambda \geq v_l \) for every \( t \); given the common uniform distribution \( U(v) \) with support on \([0, \lambda]\). As in Petersen and Rajan (1994), I assume that retail banks that are physically

\(^9\) As mentioned above, we can include in them advertisement costs or the costs of constructing a network of branches and ATMs.
closer to their customers have lower costs of transacting with both firms and depositors.

(E) For simplicity, I assume that any entrant is able to enter only one of the niches (i.e. multi-sectorial entry is not possible). The collusion agreement implies that the potential competitor knows the cost-efficiency distribution of the banking system, $U(v)$, but cannot infer the particular $v'/s$ of each incumbent. So that, entrants are indifferent about the niche to fight for. I assume that once inside the banking system they randomly choose which particular niche to enter at the end of period $t$.

(F) At the very beginning of period $t + 1$, the entrant is inside the niche and is able to learn the incumbent’s $v_i$. Bertrand competition occurs and the following proposition holds:

**PROPOSITION 1**  
Under Bertrand competition, only two possible outcomes are possible. If $v_j > v_i$, the entrant fails and is forced to merge. If $v_j < v_i$ the entrant successfully displaces the incumbent and forces it to merge. The optimal strategy for the loser is to merge immediately and not to compete. The only visible outcome is the possible change of the incumbent at the very beginning of $t + 1$.\(^{10}\)

**Proof.** See Appendix C.

(G) If successful the new incumbent keeps the niche until it is hit by an exit-inducing shock that occurs with probability $\delta_D \in (0, 1)$ in every period. For simplicity, I do not model endogenous exit that is not driven by the afore mentioned Bertrand competition. The “death” shock is independent of the bank’s efficiency level. I assume that the empty niche left by every dead bank is immediately filled by an entrant. Right after drawing an

\(^{10}\)By definition the point likelihood of $v_j = v_i$ is null.
efficiency level, the entrant is able to use the existent network left by the dead bank (avoiding any sunk costs as well as the time-to-build lag). The number of banks and the frequency of “death” is high enough so that \( E(u_t) = \frac{1}{2} \), and \( U(u) \) describes the cost-efficiency distribution of all incumbents in the financial system.

**Implicit Collusion Agreement and Limit Pricing** I assume that entrants are liquidity constrained and cannot make losses after incurring sunk costs. In these circumstances, the pricing strategy, \( \Xi_{t+1} \), must ensure that none of the new competitors at the wholesale level can obtain any expected positive profits if they decide to offer a net markup below \( \Xi_{t+1} \) and serve the niche.\(^{11}\) That is:

\[
\Xi_{t+1} \left( \frac{D_{t+1}}{P_t} \right) \leq \lambda \left( \frac{D_{t+1}}{P_t} \right)^{1-\tau} \tag{3.36}
\]

Notice, however, that low cost-efficiency incumbents have the incentive to “signal” their idiosyncratic efficiency to new entrants by offering a markup below the level that makes (3.36) hold as an equality (hereafter, the binding limit). From (3.34), entrants in the banking system know that only more efficient incumbents can offer a markup, \( \Xi_{t+1} \), well below \( \lambda \left( \frac{D_{t+1} / P_t}{n} \right)^{1-\tau} \) and still make profits. Therefore, these incumbents have incentives to offer markups levels somewhat below the binding limit in (3.36) to influence and redirect entrants’ decisions toward less-efficient niches. The higher is the amount of entry in the banking system, the higher the incentives to protect the niche by lowering current markups and profits. In this scenario, incumbents “compete” to deter entry in their own niches.

\(^{11}\)By assumption, the customers remain loyal to the local incumbent bank if the level of the markup offered is the same.
Instead, I assume that there exists an implicit collusion agreement among the incumbents that enforces the secrecy of the idiosyncratic cost-efficiency levels.

I assume that any implicit collusion agreement must necessarily satisfy all the incumbents to be possible. Consequently, a cartel markup below the binding limit in (3.36) does not work. The uniform distribution with support on \([0, \lambda]\), and the assumption that \(n\) is very large, implies that such cartel markup level can result in losses for members with cost-efficiency levels in the neighborhood of \(\lambda\). The negative profits force defections from the agreement; defections that actually reveal the high cost-efficiency level of those defectors.\(^{12}\)

Therefore, the arrangement must consist of a markup equal to the binding limit in (3.36):

\[
\Xi_{t+1} \left( \frac{D_{t+1}}{P_t} \right) = \lambda \left( \frac{D_{t+1}}{P_t} \right)^{1-\tau}
\]

(3.37)

If any of the banks attempt to charge a markup below the binding limit, one of the members of the cartel immediately serves such niche at the wholesale level. The punishment consists of establishing a markup just below the one chosen by the defector, \(\Xi_{t+1}^{def} - \varepsilon\) (\(\varepsilon\) is negligible in size). The resulting negative profits for serving the niche under this condition are equally distributed among the members of the cartel. That is,

\[
\frac{\left( \Xi_{t+1}^{def} - \varepsilon \right) \left( \frac{D_{t+1}}{P_t} / n \right) - \lambda \left( \frac{D_{t+1}}{P_t} / n \right)^{1-\tau}}{n - 1} < 0.
\]

(3.38)

I assume that, in principle, such punishment would take place only if there is a single defector.

\(^{12}\)I assume that a single defector can transform the tacit agreement into an explicit one. As in Rotemberg and Woodford (1992), such scenario carries incommensurable legal sanctions for the members of the cartel.
monopolistic bank serving the niche (so that Proposition 1 holds). In other words, the cartel allows Bertrand competition to occur inside the niche to guarantee a monopolistic structure in which the number of banks in the banking system never exceeds \( n \) (one bank per niche). Finally, I assume that the amount of entry and the exogenous exit inducing shock (positively associated with the discount factor) is high enough so that incumbents are better off when committing to the collusive level in (3.37).

As a result, the pricing decision is exactly the same in all niches. Since all the niches are of the same size, we can interpret this relationship as the pricing decision taken by the representative bank of this economy.

Hence, for every period \( t \), expected profits for each incumbent \( l \) are:

\[
\pi_{t+1} = (\lambda - \nu_I) \left( \frac{P_{t+1}}{P_t} \right)^{1-\tau} > 0.
\]  

Equations (3.37) and (3.39) can be interpreted as follows: The greater the aggregate investment, the bigger the size of all niches, and the higher the competitive pressure of the new entrants. In turn, this forces the incumbent to offer lower markups. These countercyclical markups, jointly with the standard balance-sheet-effect, constitute the “broad” financial accelerator at work in equation (3.15). Relative to the standard credit channel, this “broad” accelerator magnifies the propagation and amplification of shocks to the economy.

**Entry decision** Banks are forward looking and correctly anticipate their expected stream of profits. After drawing a \( \nu_j \), a potential entrant decides to enter the banking system only if the expected post-entry present discounted net value of the expected stream
of profits \( \{ \pi_{j,t} \}_{t=1}^{\infty} \) is positive:

\[
V_{j,t} = \left\{ E_t \sum_{s=t}^{\infty} \left[ \beta (1 - \delta_D) \right]^{s-t} \left( \frac{C_{s+1}}{C_s} \right)^{-\gamma} \pi_{j,s+1} \right\} \left( 1 - \frac{v_j}{\lambda} \right) - m_s > 0. \tag{3.40}
\]

Banks discount future profits using the household’s stochastic discount factor, adjusted for the probability of survival. The pre-entry probability of defeating the incumbent and taking-over the niche is \( 1 - \frac{v_j}{\lambda} = \Pr(v_j < E(v_l)) \). Equations (3.40) and (3.39) imply that entry is procyclical (i.e. entry increases when the amount of credit, purchase of new capital and the economic activity are high). The larger the discount factor and the probability of the exit-inducing shock, the stronger the procyclicality.

Entry is affected by market regulation that alters the value of \( m_t \).\(^{13}\) Equation (3.40) implies that the higher is \( m_t \), the lower the resulting entry threshold value of \( v_j \), and thus the lower the amount of entry in the banking system (and vice versa). But, the higher is \( m_t \), the more likely entries are successful when fighting for the niche. These results are in line with the empirical evidence that entry exerts a sizable impact in small, underdeveloped, and regulated markets.

The government can effectively prohibit entry in the banking system by setting \( m_t \to \infty \). In this case, countercyclical limit pricing is not necessary, and incumbents are able to establish a standard collusive agreement.

\(^{13}\)As in Ghironi and Melitz (2005), changes in sunk entry costs alter the free-entry condition.
3.3.4 The Foreign Sector

The small open economy takes all foreign variables as given. I use a very simple foreign demand for the home tradable, or exports, $C_{t}^{H^{*}}$ with an inertia component given by $[C_{t-1}^{H^{*}}]^{1-\omega}$. Following Gertler et al (2003), I postulate an empirically sensible reduced-form export demand curve:

$$C_{t}^{H^{*}} = \left( \frac{P_{f}^{H}}{S_{t}P_{t}^{*}} \right)^{-\chi} Y_{t}^{*} \left[ C_{t-1}^{H^{*}} \right]^{1-\omega}, \quad 0 \leq \omega \leq 1, \quad (3.41)$$

$P_{t}^{*}$ is the nominal price of the foreign tradable good (in units of the foreign currency) and $Y_{t}^{*}$ is real foreign output. I assume balanced trade in the steady state and normalize the steady-state terms of trade at unity.

3.3.5 The Resource Constraint

The resource constraint for the domestic traded good sector is:

$$Y_{t}^{H} = C_{t}^{H} + C_{t}^{wH} + C_{t}^{H^{*}} + I_{t}^{H}. \quad (3.42)$$
3.3.6 Monetary Policy Rules

I first consider shocks to the economy under a floating exchange rate regime, in which the central bank manages the nominal interest rate according to a Taylor rule. In this case, the policy instrument is the nominal interest rate. The central bank adopts a flexible inflation targeting rule that has the nominal interest rate adjust to deviations of CPI inflation and domestic output from their respective target values. Let $Y^0$ denote the steady-state level of output. The feedback rule is given by:

\[(1 + i_t) = (1 + r) \left( \frac{P_t}{P_{t-1}} \right)^{\gamma_p} \left( \frac{Y_t^H}{Y^0} \right)^{\gamma_y} \]  \hspace{1cm} (3.43)

with $\gamma_p > 1$ and $\gamma_y > 0$, and where $(1 + r)$ is the steady-state gross real interest rate.

The target net rate of inflation is assumed to be zero. The central bank therefore adjusts the interest rate to ensure that over time the economy meets the inflation target, but with flexibility in the short run so as to meet stabilization objectives. I assume that the central bank is able to credibly commit to the Taylor rule.

I then consider a pure fixed exchange rate regime in which the central bank simply keeps the nominal exchange rate pegged at a predetermined level, i.e.

\[S_t = \bar{S}, \text{ for all } t. \] \hspace{1cm} (3.44)

With the description of the monetary policy, the specification of the model is complete. The distinctive aspect of this general equilibrium model relative to a benchmark small open economy (SOE) setup with nominal rigidities and monopolistic competition in real goods
markets is characterized by equations (3.37), (3.17) and (3.15). The first one determines the limit pricing strategy chosen by the incumbent banks, the second one characterizes the evolution of net worth, and the last one describes how the combined feedback effect of these two events influences capital demand. If we restrict the net financial markup, $\Xi_{t+1}$, to zero in (3.15), we effectively shut off the bank-supply channel and the model reverts to a SOE model with the conventional financial accelerator included (i.e. with only the standard balance-sheet-effect). Similarly, this last effect may be turned off by restricting $\psi_t$ to one in (3.15).

### 3.4 Solution of the Model

#### 3.4.1 Model parameterization

The quantitative analysis aims to capture the broad features of a representative emerging economy for which financial frictions are relevant. I set the world interest rate to 4 percent annually, a number commonly used in the literature, which also pins down the quarterly discount factor $\beta$ at 0.99. I follow Galí and Monacelli (2005) and set the Frisch intertemporal elasticity of substitution in labor supply, $\frac{1}{\gamma}$, at 3. Average hours worked relative to total hours available are fixed at $\frac{1}{3}$ in steady state, which is the standard value in the Real Business Cycle (RBC) literature. Empirical evidence establishes low sensitivity of expected consumption growth to real interest rates in emerging economies. Therefore I fix $\gamma = 4$, which is in line with intertemporal elasticity estimates found in Reinhart and Vegh (1993) and Uribe (1997).

I set the intratemporal elasticity of substitution for the consumption composite, $\rho$, at
0.5. Since consumption goods are thought to have a higher degree of substitution than intermediate or investment goods, I mimic Gertler et al (2003) and fix the intratemporal elasticity of substitution for the investment composite, \( \rho_I \), at 0.25. Finally, I follow Céspedes et al (2000) and assume that the share of domestic goods in the consumption and investment tradable composites, \( \gamma_C \) and \( \gamma_I \), are both 0.6, consistent with observed shares.

I assign the conventional values of 0.35 and 0.025 to the capital share, \( \alpha \), and the steady state quarterly depreciation rate, \( \delta \), respectively. As in Gali and Monacelli (2005), I set the steady-state markup in the tradable goods markets at 1.2. The elasticity of the price of capital with respect to the investment capital ratio is taken to be 2, which is the estimate that King and Wolman (1996) found using aggregate data. As common in the literature on Calvo pricing, I assume that the probability of the price not adjusting, \( \theta \), is 0.75. The ratio of capital to net worth in the steady state is set at 2 (or equivalently, a leverage ratio of 0.5). This steady-state leverage ratio is the one chosen in Bernanke et al (2000) and is also in line with new estimations Kamil (2004) found for a set of emerging economies. I assume a low degree of financial development with high bankruptcy and monitoring costs, therefore I set the steady-state annual external finance risk premium at 4.5%, roughly 250 basis points higher than U.S. historical data. Following, Bernanke et al (2000), I choose the elasticity of the external finance premium with respect the leverage ratio, \( \eta \), to be 0.051 and the entrepreneurs' death rate, \( (1 - \zeta) \) equal to 0.0272. I also fix the entrepreneurial labor share of the total wage bill at a negligible 0.01%. In order to assess the quantitative relevance of the monopolistic banking setup, I replicate the data in Table 1. Thus, I set the steady-state annual value of the net financial markup at 380 basis points and then calibrate \( \tau \) so that its standard deviation (as a percent deviation from the steady-state value) is around 23%.
Regarding the parameters of the reduced-form export demand function, I set the elasticity $\chi$ equal to 0.3 and the inertia parameter, $\tau$, equal to 0.25 which is the same value as in Gertler et al (2003). The steady-state ratio of exports to domestic output is set equal to 0.3.

The Taylor Rule coefficients on CPI inflation and domestic output gap, $\gamma_\pi$ and $\gamma_y$, are set equal to 2 and 0.75, respectively, in line with a range of standard estimates.

### 3.4.2 Foreign interest rate shock

I first analyze the transmission mechanism of this setup. In order to capture a sudden capital outflow, I consider an unanticipated one hundred basis point increase in the foreign nominal interest rate that obeys a first order auto-correlation process that persists at the rate of 0.9 per quarter.

The model cannot be solved analytically so I employ numeric methods. I find the rational expectations equilibrium of the log-linear approximation around the steady state and obtain the recursive equilibrium law of motion using the method of undetermined coefficients.

In Figure 2, I plot the response of twelve key variables assuming perfect competition in the banking system under flexible exchange rates. I consider both the standard SOE model (dashed line) and the same model with the conventional financial accelerator included (solid line). In other words, bank markups remain at zero throughout the experiment. In this case, the domestic nominal interest rate is not tied to the foreign interest rate, and is instead governed by the feedback rule in equation (3.43). The rise in the foreign interest rate produces an immediate depreciation in the domestic currency which in turn prompts an increase in the foreign demand for home production. Household consumption
falls owing to the increased cost of imported goods following the depreciation. Incomplete substitution causes consumption in domestic goods to fall, as well as the price of domestic goods. However, consumption of domestic goods falls by less than consumption of imported goods which, jointly with higher exports, moderates the overall effect on local output. The counteracting effects of lower domestic prices but more expensive imports causes the overall CPI inflation rate to increase only slightly. Given the Taylor rule specification, a small output drop jointly with moderate inflation dictates a negligible change in the real interest rate. Negligible changes in real rates and modest changes in the inflation rate imply that neither asset prices nor the real value of the liabilities are significantly altered. With the critical assumption of liabilities exclusively denominated in local currency, such behavior of the balance sheets implies that the balance-sheet-effect is negligible and the external finance premium wholesalers face is insignificant. Consequently, the drop in investment is moderate, and reflects only a lower price for capital as a result of the recessive outlook and a relatively more expensive foreign investment good composite.\textsuperscript{14}

Therefore, the standard financial accelerator fails to deliver any amplification and propagation mechanism in this context. In principle, flexible exchange rates and liabilities fully denominated in local currency allow the economy to isolate itself from foreign interest rate shocks. Existent models are forced to include liabilities mostly denominated in foreign currency to improve upon their empirical performance.

The results are different if we also recognize the presence of monopoly power in the banking system. See Figure 3. The fall in investment causes the financial market to shrink

\textsuperscript{14}The elasticity of substitution for the investment good is relatively low. Therefore it becomes significantly more expensive after the depreciation of the local currency.
and the banking markups to increase. Higher financial markups are reflected not only in a direct increment in the real cost of borrowing for entrepreneurs, but also in lower asset prices that deteriorate the position of balance sheets (and indirectly increase borrowing costs). Therefore, investment is significantly affected. The "broad" financial accelerator propagates financial disturbances, amplifies the business cycle, and alters the evolution of the capital stock throughout the experiment. As a result, real wages fall significantly, for two reasons. Firstly, a less capital intensive technology affects the marginal productivity of labor. Secondly the recessive pattern of the cycle increase ex-post markups in the real goods market and thus affects wages. Lower wages are associated with lower labor effort and output. Permanent income theory applies: The combined effect of lower wages and work effort affects household income and causes consumption to remain relatively lower. To ameliorate the negative impact these events have on domestic output, the central bank is forced to be less aggressive when increasing the interest rates. Lower rates moderate the fall in consumption and deliver a more robust depreciation that improves the international position of the economy.

In Figure 5, I plot the response of key variables in a scenario in which the monetary authority is committed to defend a fixed nominal exchange rate peg. In the baseline scenario with the bank-supply channel turned-off (dashed line), the domestic nominal interest rate rises to match the increase in the foreign interest rate so that (3.8) holds. Due to nominal price rigidities, there is also a significant increase in the real interest rate that in turns induces a contraction in output. The fall in the demand for domestic goods causes domestic prices to fall, but in this case foreign goods prices remain unaffected. The economy enters a deflationary spiral in which much higher real interest rates generate a sharp fall in household
consumption and asset valuation. The dual presence of a negative debt-deflation impact on the liability side on the one hand, and lower assets prices on the other hand, severely damage the financial position of firms. Hence, immediately after the shock, the conventional financial accelerator starts working by raising the leverage ratio and the external finance premium, thereby magnifying the investment drop. Even if the nominal exchange rate does not change in this experiment, the economy improves its international position (with higher exports and greater import substitution) as a result of the local recession and the deflationary spiral.

With monopolistic competition in the banking sector, the amplification mechanism is even more robust (see the solid line). A shrinking financial market causes bank markups to increase and asset prices to fall, contributing to a further deterioration of balance sheets. The feedback mechanism behind the two channels of this “broad” financial accelerator increases borrowing costs for entrepreneurs, amplifying the response of investment and other real variables.

For completeness, in Fig 6 and 7, I show the balance-sheet and the bank-supply channels acting independently. In both figures, the dashed line refers to the SOE model without financial frictions. In this baseline setup the real cost of borrowing for wholesalers is just the real interest rate paid to depositors. We can observe, that the two channels work in the same direction and contribute independently to the same phenomenon. However, the internal propagation mechanism is more robust when they interact together in the complete model. See Figure 8.
3.4.3 Macroeconomic Variability

To assess the quantitative relevance of the model, in Table 2 I display theoretical second moments (as percent deviations from steady state values) obtained through the frequency domain technique depicted in Uhlig (1999) for the parametrization already described. To get the estimates, I set the standard deviation of the productivity innovations at 0.00712, in line with the RBC literature, and the standard deviation of the foreign interest rate shock equal to 0.0065, which is also well within the range used in the literature (see Batini et al 2001, and Nelson and Neiss, 2001). The empirical moments for the relevant variables are taken from the series used in Aguiar and Gopinath (2004). Output is real GDP, investment is gross fixed capital formation and household consumption is private consumption. These series are deseasonalized. For comparison purposes, both empirical and theoretical series are HP filtered with a smoothness parameter of 1600 so that only the cyclical component remains.

Notice that I purposely selected countries that de facto kept their exchange rates fixed during most of the span of the data available. Following Reinhart and Rogoff (2002), I consider periods in which there is either a de facto peg or at least a de facto crawling band that never exceeds the +/- 5% range. I proceed in this way for two reasons. Although some countries effectively allowed the exchange rate to float, it is difficult to determine whether they actually committed to a Taylor Rule in the period under consideration. Besides, the model assumes that liabilities are denominated in domestic currency, but in fact, most of the emerging economies have at least a fraction of firms' liabilities denominated in foreign
currency. In principle, it could be the case that some of the accounted volatility simply reflects firms' leverage ratios responding to changes in the exchange rate. In summary, the specification that assumes a floating exchange rate may not be suitable for making historical comparisons with the data available.

Sample averages of the empirical moments for the eight emerging economies depicted in Table 1 are reported in the last column of Table 2. The standard deviations for output, consumption and investment are 2.79, 3.60 and 10.75 respectively. The first four columns report four different theoretical scenarios: baseline SOE model, only monopolistic banking sector added, only balance-sheet-effect added, and both interacting together. Neither the standard credit channel nor the sole presence of a monopolistic banking can capture the historic investment volatility. In each case, the standard deviation for investment is 6.79 and 6.41 respectively. The fourth column displaying the results of the complete model with the "broad" financial accelerator shows that the richer model is actually the best one at replicating the actual volatility of real variables found in the data. In this case, the output and investment standard deviations are 2.28 and 10.90, respectively.

3.4.4 Welfare Analysis

Now I consider how the welfare of the representative household is affected by the presence of monopoly power in the banking system. The welfare criterion is based on a second-order Taylor expansion of the representative household's expected utility function (3.1), around the deterministic steady-state:

\[ \text{The model can be easily extended to consider the case of liabilities heavily denominated in foreign (hard) currency. Depending on the calibration, the impact of a exchange rate depreciation under flexible exchange rates maybe less or more damaging than the contraction in asset prices under fixed exchange rates.} \]
Variables with hats denote the percent deviation from the steady state, and variables without time subscripts denote steady-state values. The welfare results for the main scenarios previously discussed are listed in Table 3. In each case, I report the percent increase in steady-state consumption that makes the household as well off as it would be in a baseline scenario with flexible exchange rates and perfect competition in the banking system. The results confirm that the representative household is better off in the baseline scenario. In principle, households would be willing to accept a monopolistic banking system if steady-state consumption is 6.43% higher. If they are also forced to accept fixed exchange rates, the required increment is 7.20%. Monopolistic financial intermediaries affect welfare through two different channels. First, the bank markup generates a permanent disintermediation between borrowers and entrepreneurs that results in lower steady-state levels of capital accumulation, output, and hence consumption. Second, the countercyclical pattern of such markups increases the volatility of real variables, amplifies the business cycle, and thus reduces welfare. Finally, the transmission mechanism implies a much larger propagation of external shocks under a fixed exchange rate regime.

\[ W_t = \frac{1}{1-\gamma} C^{1-\gamma} - \frac{a_n}{1+\gamma_n} H^{1+\gamma_n} - \frac{1}{2} \gamma C^{1-\gamma} \text{var}(\hat{C}_t) - \frac{1}{2} \gamma_n a_n N^{1+\gamma_n} \text{var}(\hat{H}_t). \]  

(3.45)
3.5 Conclusions

The modeling of the banking system captures several features of the empirical evidence observed in emerging economies. Entry occurs at the wholesale level and spreads later into a highly segmented retail market. If banking markets are underdeveloped, small, and regulated, only lower-cost banks attempt to enter the market and compete. However, their chances of a successful take over are higher than in a highly developed banking system. Although changes in the market structure do not affect the markups, entry threats force incumbents to set lower markups to deter the competitive pressure. Economies of scale facilitate entry in boom periods, and vice versa, generating countercyclical markups.

At a general equilibrium level, I show that this behavior of the banking system generates a bank-supply channel that interacts with the evolution of the firms’ balance sheets to reinforce the credit channel: Credit is more expensive during recessions, and firms and households postpone investment and work decisions, leading to a deeper recession. Thus, market power in the banking system increases the volatility of real variables, amplifies the business cycle, and reduces welfare.

In the calibration of the model for a representative small open developing economy, I showed that the inclusion of imperfect competition in the banking system helps to explain the relatively large investment volatility typically experienced in these countries. These conclusions are robust to different monetary regimes. First, I consider the case of a monetary authority able to commit to a Taylor-type rule under floating rates. Then, I allow for the possibility of a central bank in a position of having to defend a fixed exchange rate peg. In either case, I show that the monetary authority is unable to avoid a sizable decrease in
investment after a negative external shock. The results hold even if the speed with which exchange rate adjustments feed through to the consumer price index is slow and liabilities are fully denominated in local currency. In contrast, the sole presence of the standard balance-sheet channel fails to deliver any internal propagation mechanism in this context.

There are several extensions of the analysis that can be pursued in future work. The model may contribute to explaining the observed decline in real variables during financial crisis episodes. It could be easily modified to study the impact of currency depreciation when liabilities are heavily denominated in foreign currency. Additionally, the model may also be extended to capture the consequences of long-term relationships between banks and their customers. Regional banks in developing economies are usually engaged in long-term relationships with small domestic entrepreneurs who otherwise would have no access to the credit markets. Therefore, entry threats, which force low profit margins, can increase the degree of financial fragility and disrupt these relationships.
Appendix A: The Monopolistic Bank Contract.

In this appendix, I add monopoly power to the partial equilibrium contracting problem in the non-stochastic steady-state developed in Bernanke et al (2000).

Let profits per unit of capital equal \( \omega R^k \), where \( \omega \in (0, \infty) \) is an idiosyncratic shock with \( E(\omega) = 1 \). I assume \( F(x) = \Pr[\omega < x] \) is a continuous probability distribution with \( F(0) = 0 \). I denote \( f(\omega) \) the pdf of \( \omega \). Let variables without time subscripts denote steady-state values.

The entrepreneur borrows \( QK - N \) to invest \( K \) units of capital in a project. The total return on capital is thus \( \omega R^k QK \). I assume that \( \omega \) is unknown to both the entrepreneur and the lender prior to the investment decision. After the investment decision is made, the lender can only observe \( \omega \) by paying monitoring costs \( \mu \omega R^k QK \), where \( 0 < \mu < 1 \). The “required” return on lending for the bank equals the cost of funds (deposit rate), \( R \), times the steady-state gross bank markup, i.e. \( (1 + \Xi)R \).

The optimal bank contract specifies a cutoff value \( \bar{\omega} \) such that if \( \omega \geq \bar{\omega} \), the borrower pays the lender the fixed amount \( \omega R^k QK \), and keeps the equity \( (\omega - \bar{\omega}) R^k QK \). If \( \omega < \bar{\omega} \), the borrower receives nothing, while the bank monitors the borrower and receives \( (1 - \mu) \omega R^k QK \) in residual claims net of monitoring costs. In equilibrium, the bank earns an expected return equal to the “required” return \( (1 + \Xi)R \), implying:

\[
\left( \int_0^{\bar{\omega}} \omega f(\omega) d\omega + \bar{\omega} \int_{\bar{\omega}}^{\infty} \omega f(\omega) d\omega - \mu \int_0^{\bar{\omega}} \omega f(\omega) d\omega \right) \bar{R}^k QK = (1 + \Xi)R(QK - N). \tag{3.46}
\]

The optimal contract maximizes the payoff to the entrepreneur subject to the bank
earning the “required” rate of return:

\[
\max_{K, \bar{\omega}} \left( \int_{\bar{\omega}}^{\infty} \omega f(\omega) d\omega \right) R^k Q K
\]  \hspace{1cm} (3.47)

subject to equation (3.46).

Given constant returns to scale, the cutoff \( \bar{\omega} \) determines the division of expected gross profits \( R^k Q K \) between the bank and lender. The expected gross share of profits going to the bank, \( \Gamma(\bar{\omega}) \), is:

\[
\Gamma(\bar{\omega}) = \int_{0}^{\bar{\omega}} \omega f(\omega) d\omega + \bar{\omega} \int_{\bar{\omega}}^{\infty} \omega f(\omega) d\omega.
\]  \hspace{1cm} (3.48)

Similarly, I define the expected monitoring costs, \( \mu G(\bar{\omega}) \) as:

\[
\mu G(\bar{\omega}) = \mu \int_{0}^{\bar{\omega}} \omega f(\omega) d\omega.
\]  \hspace{1cm} (3.49)

The net share of profits going to the bank is \( \Gamma(\bar{\omega}) - \mu G(\bar{\omega}) \), and the share going to the entrepreneur is \( 1 - \Gamma(\bar{\omega}) \). By definition, \( \Gamma(\bar{\omega}) \) satisfies 0 \( \leq \Gamma(\bar{\omega}) \leq 1 \).

The optimal contracting problem with non-stochastic monitoring may now be written as:

\[
\max_{K, \bar{\omega}} (1 - \Gamma(\bar{\omega})) R^k Q K
\]  \hspace{1cm} (3.50)

subject to:
\[ (\Gamma(\bar{\omega}) - \mu G(\bar{\omega})) R^k Q K = (1 + \Xi) R (QK - N). \] (3.51)

Let \( s = \frac{R^k}{(1 + \Xi) R} \), denote the risk premium on external funds and \( k = \frac{QK}{N} = \frac{K}{N} \), the steady-state ratio of capital to net worth. Defining \( \iota \) as the Lagrange multiplier on the constraint that the banks earn their “required” rate of return in expectation, the first order conditions for an interior solution to the contracting problem imply that:

\[ s(\bar{\omega}) = \frac{\iota(\bar{\omega})}{\Upsilon(\bar{\omega})}, \] (3.52)

\[ k(\bar{\omega}) = \frac{\Upsilon(\bar{\omega})}{1 - \Gamma(\bar{\omega})}, \] (3.53)

and

\[ \iota(\bar{\omega}) = \frac{\Gamma'(\bar{\omega})}{\Gamma'(\bar{\omega}) - \mu G'(\bar{\omega})}. \] (3.54)

Where

\[ \Upsilon(\bar{\omega}) = 1 - \Gamma(\bar{\omega}) + \iota(\bar{\omega}) [\Gamma(\bar{\omega}) - \mu G(\bar{\omega})]. \] (3.55)

Equations (3.52) and (3.53) provide an implicit relationship between capital expenditures per unit of net worth \( k(\bar{\omega}) \) and the risk premium on external funds that is the basis of equation (3.14).
\[ k(\tilde{\omega}) = \kappa(s(\tilde{\omega})) \quad \kappa'(s) > 0. \quad (3.56) \]

Notice, finally, that the set up of this contracting problem allows us to express \( V_t \) in equation (3.16) as:

\[
V_t = R_t^k Q_{t-1} K_{t-1} - R_t (1 + \Xi_t) \frac{D_t}{P_{t-1}} + \mu \int_{\tilde{\omega}}^{\bar{\omega}} \omega R_t^k Q_{t-1} K_{t-1} f(\omega) d\omega. \quad (3.57)
\]

The first term in the right hand side, \( R_t^k Q_{t-1} K_{t-1} \), is the average return on capital and the expression in brackets is the aggregate ex-post costs of borrowing for the entrepreneurs. That is, \( R_t (1 + \Xi_t) \frac{D_t}{P_{t-1}} \) is the net payment banks receive and \( \mu \int_{\tilde{\omega}}^{\bar{\omega}} \omega R_t^k Q_{t-1} K_{t-1} f(\omega) d\omega \) are aggregate default costs paid by the entrepreneurs. The default costs are captured by the external finance risk premium. (3.57) may be used in order to express (3.17) in log-linear form as:

\[
\dot{N}_t = \zeta (1 + \Xi) \frac{K}{N} (\dot{R}_t - \dot{R}_t) + \zeta (1 + \Xi) (\dot{R}_t + \dot{N}_{t-1}) + \zeta \Xi \left( 1 - \frac{K}{N} \right) \dot{\Xi}_t + \xi \dot{N}_t. \quad (3.58)
\]

Where hats denote percent deviations from the steady-state and \( \xi \dot{N}_t = \frac{(1-\alpha)(1-\Omega)}{N} \frac{d}{y} (\dot{Y}_t - \dot{P}_{t+1} - \dot{P}_{W,t}) \) a collection of terms of second order importance.
Appendix B: Local Currency Pricing and Incomplete Pass-through.

The speed by which exchange rate adjustments feed through to the consumer price index in emerging markets has received widespread attention in the last few years. The aim of this section is both to highlight the importance of this issue in the construction of monetary policy rules and to proceed with a sensitivity analysis. In the baseline model, I assumed complete pass-through; here I allow for the possibility that there is some delay between movements in the exchange rate and the adjustment of imported good prices. To introduce price inertia, I consider the case in which monopolistic competition also occurs among foreign goods retailers that face the same degree of price rigidity as domestic goods retailers.

In this case, the law of one price holds only at the wholesale level. Let $P^F_{W,t}$ be the wholesale price of foreign goods in the domestic currency. The law of one price then implies $P^F_{W,t} = S_t P^*_t$. Instead, the optimal price set by retailers that are able to change prices at $t$, $P^F_{o,t}$, is:

$$
\sum_{k=0}^{\infty} \theta^k E_t \left\{ \Lambda_{t,k} \left( \frac{P^F_{o,t}}{P^F_{o,t+k}} \right)^{-\xi} Y^F_{o,t+k}(z) \left[ P^F_{o,t} - \left( \frac{\xi}{\xi - 1} P^F_{W,t} \right) \right] \right\} = 0. \quad (3.59)
$$

Therefore, the foreign price index evolves according to:

$$
P^F_t = \left[ \theta \left( P^F_{t-1} \right)^{1-\xi} + (1 - \theta) \left( P^F_{o,t} \right)^{1-\xi} \right]^{1/\xi}, \quad (3.60)
$$

---

16See for instance, Calvo and Reinhart (2002) and Devereaux and Lane (2003).
which replaces (3.31) in the baseline setup. As a sensitivity analysis, I analyze the transmission mechanism of this alternative setup. As before, I consider an unanticipated one hundred basis point increase in the foreign nominal interest rate.

In the baseline case with full-pass-through, the Taylor rule specification dictates that the central bank must always prevent a large exchange rate depreciation in order to control CPI inflation. See Figure 3 again. Although the nominal interest rate is not tied to the foreign interest rate (as in the case of fixed exchange rates), a large depreciation is prevented through a moderate increment in the nominal interest rate. The policy prescription in this scenario resembles the case of a "dirty" float exchange rate regime.

Results differ in the case of incomplete-pass-through. See Figure 4. Here, the monetary authority is able to decrease nominal interest rates while permitting a large currency depreciation. However, CPI inflation reacts very sluggishly because of the price rigidities among foreign goods retailers. The lower real interest rates, together with a large exchange rate depreciation, improves both the country's ability to absorb the negative shock and its international position. Therefore, the decrease in output is even more moderate and very short lasting.

Nonetheless, even in this scenario, which resembles a "pure" floating exchange rate regime, the decline in investment is sizeable in the presence of imperfect competition in the banking system.
Appendix C: Proof of Proposition 1.

Define the break-even level of markups \( \theta_l \) and \( \theta_j \) for the incumbent and the entrant. The break-even level is equal to the value of the net markup that provides them zero profits when serving the niche. That is:

\[
\pi_{l,t} = \theta_l \left( \frac{D_{l,t+1}}{P_l} \right) - \psi_l \left( \frac{D_{l,t+1}}{P_l} \right)^{1-\tau} = 0, \quad \text{and} \quad \pi_{j,t} = \theta_j \left( \frac{D_{j,t+1}}{P_j} \right) - \psi_j \left( \frac{D_{j,t+1}}{P_j} \right)^{1-\tau} = 0.
\]

(A.1)

Now, let's analyze the case in which \( \psi_j > \psi_l \), and thus \( \theta_j > \theta_l \). Consider for example, \( \Xi_{l,t+1}^j > \Xi_{l,t+1}^j > \theta_j \). The bank \( l \) has no demand and its profits are zero. But, if bank \( l \) charges \( \Xi_{l,t+1}^j = \Xi_{l,t+1}^j - \varepsilon \) (where \( \varepsilon \) is positive but nil), it gets the entire niche and has a positive profit \( \Xi_{l,t+1}^j - \varepsilon - \theta_l > 0 \).

Therefore bank \( j \) cannot be acting in its own interest by charging \( \Xi_{l,t+1}^j \). Now suppose \( \Xi_{l,t+1}^j = \Xi_{l,t+1}^j > \theta_j \). In that case they share the niche, and each one serves half of it. But if bank \( j \) reduces its price slightly to \( \Xi_{l,t+1}^j - \varepsilon \), it gets all the niche. Nonetheless, bank \( j \) will never charge \( \Xi_{l,t+1}^j < \theta_j \), because it would make a negative profit. It follows that bank \( l \) can charge \( \Xi_{l,t+1}^j = \theta_j - \varepsilon \) and guarantee for itself all the niche while obtaining a positive profit \( \theta_j - \varepsilon - \theta_l > 0 \).

Therefore bank \( j \) is indifferent between staying or leaving the niche, since will not be able to serve it. If bank \( l \) offers bank \( j \) a negligible but positive amount of output \( \varepsilon \) so as to merge, it is in the best interest of bank \( j \) to accept it. A symmetric analysis holds when \( \psi_j < \psi_l \).
References


Addendum

Tables and Graphs

CHAPTER 1

STATISTICAL APPENDIX

Descriptive Statistics - Mean (M) and Standard Deviation (SD):

<table>
<thead>
<tr>
<th></th>
<th>NET INTEREST MARGINS</th>
<th>PRIVATE CREDIT</th>
<th>CONCENTRATION</th>
<th>No. of Foreign Banks</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing countries</td>
<td>M 0.0571 SD 0.0351</td>
<td>M 0.2532 SD 0.2125</td>
<td>M 0.6645 SD 0.2280</td>
<td>M 0.3226 SD 0.1839</td>
<td>91</td>
</tr>
<tr>
<td>Developed countries</td>
<td>M 0.0268 SD 0.0119</td>
<td>M 0.7653 SD 0.3331</td>
<td>M 0.5751 SD 0.2206</td>
<td>M 0.2769 SD 0.2144</td>
<td>33</td>
</tr>
</tbody>
</table>

Table 1: Time Series Properties.
Dependent Variable: Net Interest Margins (NIM)

<table>
<thead>
<tr>
<th></th>
<th>OLS LEVELS</th>
<th>WITHIN GROUPS</th>
<th>GMM DIF 1STEP</th>
<th>GMM DIF 2STEPS</th>
<th>GMM SYS 1STEP</th>
<th>GMM SYS 2STEPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIM_{t-1}</td>
<td>0.835</td>
<td>0.423 (0.000)</td>
<td>0.296 (0.021)</td>
<td>0.292 (0.020)</td>
<td>0.728 (0.000)</td>
<td>0.759 (0.000)</td>
</tr>
<tr>
<td>m1</td>
<td></td>
<td></td>
<td>-2.24 (0.025)</td>
<td></td>
<td>-3.34 (0.001)</td>
<td></td>
</tr>
<tr>
<td>m2</td>
<td></td>
<td></td>
<td>-0.675 (0.500)</td>
<td></td>
<td>0.428 (0.672)</td>
<td></td>
</tr>
<tr>
<td>Sargan</td>
<td></td>
<td></td>
<td></td>
<td>0.178</td>
<td>1.23</td>
<td></td>
</tr>
</tbody>
</table>

- Year Dummy included in all models.
- m1 and m2 are test for first and second order serial correlation for first-differenced residuals, asymptotically N (0, 1). They are reported from the first-step estimations.
- The Sargan Test for over-identifying restrictions for the GMM estimators is asymptotically $\chi^2$. It is reported from the two-step estimations.
- P-values are reported in parentheses.
Table 2: Basic Model

Dependent Variable: Net Interest Margins \((NIM_{t})\)

<table>
<thead>
<tr>
<th></th>
<th>GMM DIF 2STEPS</th>
<th>GMM SYS 1STEP</th>
<th>GMM DIF 2STEPS</th>
<th>GMM SYS 1STEP</th>
<th>GMM DIF 2STEPS</th>
<th>GMM SYS 1STEP</th>
<th>GMM DIF 2STEPS</th>
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<tr>
<td>(NIM_{t-1})</td>
<td>0.013 (0.927)</td>
<td>.678 (0.000)</td>
<td>.720 (0.000)</td>
<td>0.040 (0.804)</td>
<td>0.574 (0.000)</td>
<td>.573 (0.000)</td>
<td>0.071 (0.598)</td>
<td>0.540 (0.000)</td>
<td>0.543 (0.000)</td>
<td>0.556 (0.000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(GROWTH)</td>
<td>-0.159 (0.005)</td>
<td>-0.108 (0.009)</td>
<td>-0.095 (0.014)</td>
<td>-0.130 (0.029)</td>
<td>-0.074 (0.090)</td>
<td>-0.077 (0.088)</td>
<td>-0.095 (0.055)</td>
<td>-0.083 (0.027)</td>
<td>-0.081 (0.030)</td>
<td>-0.071 (0.036)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(PRIV.CRED(\text{avg}))</td>
<td>-0.033 (0.316)</td>
<td>-0.031 (0.000)</td>
<td>-0.030 (0.000)</td>
<td>-0.033 (0.325)</td>
<td>-0.030 (0.000)</td>
<td>-0.034 (0.000)</td>
<td>-0.033 (0.000)</td>
<td>-0.034 (0.000)</td>
<td>-0.032 (0.000)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CONCENTRATION)</td>
<td>-0.015 (0.547)</td>
<td>-0.019 (0.066)</td>
<td>-0.017 (0.084)</td>
<td>-0.018 (0.062)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(m1)</td>
<td>-2.795 (0.063)</td>
<td>-3.19 (0.001)</td>
<td>-2.543 (0.011)</td>
<td>-3.04 (0.002)</td>
<td>-2.60 (0.009)</td>
<td>-3.117 (0.003)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(m2)</td>
<td>-1.591 (0.112)</td>
<td>-2.198 (0.826)</td>
<td>-1.553 (0.121)</td>
<td>-1.457 (0.607)</td>
<td>-1.387 (0.166)</td>
<td>-1.496 (0.620)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sargan</td>
<td>0.117</td>
<td>0.103</td>
<td>0.141</td>
<td>0.271</td>
<td>0.251</td>
<td>0.885</td>
<td>0.860</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
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</table>

Sample: 109 Countries (1991-2000). For further information, see notes to Table 1.
Table 3: The Role of Inflation, Real Rates, and Operating Costs.

Dependent Variable: Net Interest Margins ($NIM_1$)

<table>
<thead>
<tr>
<th>Variable</th>
<th>GMM Sys 1STEP</th>
<th>GMM Sys 2STEPS</th>
<th>GMM Sys 1STEP</th>
<th>GMM Sys 2STEPS</th>
<th>GMM Sys 1STEP</th>
<th>GMM Sys 2STEPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$NIM_{-1}$</td>
<td>0.388</td>
<td>0.394</td>
<td>0.393</td>
<td>0.378</td>
<td>0.394</td>
<td>0.462</td>
</tr>
<tr>
<td>$GROWTH_1$</td>
<td>-0.078</td>
<td>-0.077</td>
<td>-0.092</td>
<td>-0.094</td>
<td>-0.092</td>
<td>-0.095</td>
</tr>
<tr>
<td>$PRIV.CRED.(avg)_1$</td>
<td>-0.022</td>
<td>-0.021</td>
<td>-0.023</td>
<td>-0.050</td>
<td>-0.048</td>
<td>-0.040</td>
</tr>
<tr>
<td>$CONCENTRATION_1$</td>
<td>-0.009</td>
<td>-0.010</td>
<td>-0.010</td>
<td>-0.021</td>
<td>-0.024</td>
<td>-0.013</td>
</tr>
<tr>
<td>$OVERCOSTS_1$</td>
<td>0.460</td>
<td>0.454</td>
<td>0.438</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>$INFLATION_1$</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>-0.015</td>
<td>-0.016</td>
<td>-0.012</td>
</tr>
<tr>
<td>$REALRATE_1$</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0002</td>
</tr>
<tr>
<td>m1</td>
<td>-2.934</td>
<td>-2.452</td>
<td>-2.452</td>
<td>-2.452</td>
<td>-2.452</td>
<td>-2.452</td>
</tr>
<tr>
<td>m2</td>
<td>0.678</td>
<td>1.137</td>
<td>1.137</td>
<td>1.137</td>
<td>1.137</td>
<td>1.137</td>
</tr>
<tr>
<td>Sargan</td>
<td>0.725</td>
<td>0.784</td>
<td>0.975</td>
<td>0.977</td>
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</tbody>
</table>

Sample: 109 Countries, 1991-2000. For further information, see notes to Table 1.
Table 4: Entry and the counter-cyclicality of the net interest margins.

Dependent Variable: Net Interest Margins ($NIM_1$)

<table>
<thead>
<tr>
<th>Variable</th>
<th>GMMSYS 2STEPS</th>
<th>GMMSYS 1STEP</th>
<th>GMMSYS 2STEPS</th>
<th>GMMSYS 1STEP</th>
<th>GMMSYS 2STEPS</th>
<th>GMMSYS 1STEP</th>
<th>GMMSYS 2STEPS</th>
<th>GMMSYS 1STEP</th>
<th>GMMSYS 2STEPS</th>
<th>GMMSYS 1STEP</th>
<th>GMMSYS 2STEPS</th>
<th>GMMSYS 1STEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>$NIM_{t-1}$</td>
<td>0.479 (0.001)</td>
<td>0.499 (0.000)</td>
<td>0.510 (0.000)</td>
<td>0.503 (0.000)</td>
<td>0.505 (0.000)</td>
<td>0.348 (0.001)</td>
<td>0.389 (0.005)</td>
<td>0.342 (0.020)</td>
<td>0.351 (0.000)</td>
<td>0.390 (0.005)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$GROWTH_t$</td>
<td>-0.029 (0.186)</td>
<td>-0.024 (0.389)</td>
<td>-0.026 (0.343)</td>
<td>-0.029 (0.302)</td>
<td>-0.032 (0.213)</td>
<td>0.023 (0.695)</td>
<td>-0.021 (0.683)</td>
<td>0.013 (0.825)</td>
<td>-0.010 (0.869)</td>
<td>-0.030 (0.586)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$PRIV.CRED._{avg}$</td>
<td>-0.033 (0.000)</td>
<td>-0.032 (0.000)</td>
<td>-0.028 (0.001)</td>
<td>-0.029 (0.001)</td>
<td>-0.028 (0.001)</td>
<td>-0.012 (0.150)</td>
<td>-0.015 (0.265)</td>
<td>-0.013 (0.069)</td>
<td>-0.011 (0.115)</td>
<td>-0.014 (0.033)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$CONCENTR._t$</td>
<td>-0.007 (0.621)</td>
<td>-0.003 (0.248)</td>
<td>-0.003 (0.833)</td>
<td>-0.003 (0.799)</td>
<td>-0.004 (0.763)</td>
<td>-0.016 (0.251)</td>
<td>-0.014 (0.265)</td>
<td>-0.015 (0.311)</td>
<td>-0.012 (0.398)</td>
<td>-0.012 (0.383)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$INFLATION_t$</td>
<td>0.022 (0.275)</td>
<td>0.016 (0.436)</td>
<td>-0.022 (0.233)</td>
<td>-0.024 (0.231)</td>
<td>-0.026 (0.268)</td>
<td>-0.016 (0.251)</td>
<td>-0.014 (0.265)</td>
<td>-0.015 (0.311)</td>
<td>-0.012 (0.398)</td>
<td>-0.012 (0.383)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$REALRATE_t$</td>
<td>0.0002 (0.360)</td>
<td>0.0002 (0.312)</td>
<td>0.0002 (0.260)</td>
<td>0.0002 (0.238)</td>
<td>0.0002 (0.248)</td>
<td>-0.004 (0.009)</td>
<td>-0.003 (0.009)</td>
<td>-0.002 (0.005)</td>
<td>-0.002 (0.006)</td>
<td>-0.002 (0.006)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$OVERCOSTS_t$</td>
<td>-0.033 (0.188)</td>
<td>-0.031 (0.214)</td>
<td>-0.030 (0.214)</td>
<td>-0.029 (0.213)</td>
<td>-0.028 (0.213)</td>
<td>-0.012 (0.150)</td>
<td>-0.015 (0.265)</td>
<td>-0.013 (0.311)</td>
<td>-0.012 (0.398)</td>
<td>-0.012 (0.383)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$Foreign.Banks_{t-1}$</td>
<td>-0.033 (0.188)</td>
<td>-0.031 (0.214)</td>
<td>-0.030 (0.214)</td>
<td>-0.029 (0.213)</td>
<td>-0.028 (0.213)</td>
<td>-0.012 (0.150)</td>
<td>-0.015 (0.265)</td>
<td>-0.013 (0.311)</td>
<td>-0.012 (0.398)</td>
<td>-0.012 (0.383)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$Foreign.Banks_{t-2}$</td>
<td>0.025 (0.032)</td>
<td>0.026 (0.037)</td>
<td>-0.032 (0.066)</td>
<td>-0.033 (0.063)</td>
<td>-0.033 (0.063)</td>
<td>-0.033 (0.093)</td>
<td>-0.031 (0.115)</td>
<td>-0.033 (0.094)</td>
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</tr>
<tr>
<td>$\Delta Foreign.Banks_{t-1}$</td>
<td>-0.033 (0.188)</td>
<td>-0.031 (0.214)</td>
<td>-0.030 (0.214)</td>
<td>-0.029 (0.213)</td>
<td>-0.028 (0.213)</td>
<td>-0.012 (0.150)</td>
<td>-0.015 (0.265)</td>
<td>-0.013 (0.311)</td>
<td>-0.012 (0.398)</td>
<td>-0.012 (0.383)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sample: 95 Countries (1991-2000. For further information, see Table 1.
Table 5 - Regional Analysis

Dependent Variable: Net Interest Margins ($NIM$)

<table>
<thead>
<tr>
<th></th>
<th>GMM SYS 1STEP</th>
<th>GMM SYS 2STEPS</th>
<th>GMM SYS 1STEP</th>
<th>GMM SYS 2STEPS</th>
<th>GMM SYS 1STEP</th>
<th>GMM SYS 2STEPS</th>
<th>GMM SYS 1STEP</th>
<th>GMM SYS 2STEPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$NIM_{t-1} \times POOR$</td>
<td>.664 (0.000)</td>
<td>.678 (0.000)</td>
<td>.556 (0.000)</td>
<td>.576 (0.000)</td>
<td>.590 (0.000)</td>
<td>.584 (0.000)</td>
<td>.630 (0.000)</td>
<td>.588 (0.000)</td>
</tr>
<tr>
<td>$NIM_{t-1} \times (1 - POOR)$</td>
<td>0.403 (0.001)</td>
<td>0.441 (0.002)</td>
<td>0.504 (0.000)</td>
<td>0.547 (0.000)</td>
<td>0.540 (0.000)</td>
<td>0.562 (0.000)</td>
<td>0.613 (0.000)</td>
<td>0.568 (0.000)</td>
</tr>
<tr>
<td>$GROWTH \times POOR$</td>
<td>-0.113 (0.013)</td>
<td>-0.111 (0.030)</td>
<td>-0.064 (0.082)</td>
<td>-0.066 (0.101)</td>
<td>-0.052 (0.056)</td>
<td>-0.075 (0.103)</td>
<td>-0.074 (0.037)</td>
<td>-0.080 (0.037)</td>
</tr>
<tr>
<td>$GROWTH \times (1 - POOR)$</td>
<td>-0.078 (0.081)</td>
<td>-0.076 (0.105)</td>
<td>-0.055 (0.115)</td>
<td>-0.015 (0.078)</td>
<td>-0.059 (0.099)</td>
<td>-0.067 (0.092)</td>
<td>-0.019 (0.674)</td>
<td>-0.072 (0.383)</td>
</tr>
<tr>
<td>PRIV.CRED(avg) \times POOR</td>
<td>----</td>
<td>----</td>
<td>-0.032 (0.067)</td>
<td>-0.029 (0.081)</td>
<td>-0.028 (0.051)</td>
<td>-0.033 (0.021)</td>
<td>-0.022 (0.036)</td>
<td>-0.030 (0.006)</td>
</tr>
<tr>
<td>PRIV.CRED(avg) \times (1 - POOR)</td>
<td>----</td>
<td>----</td>
<td>-0.025 (0.004)</td>
<td>-0.027 (0.011)</td>
<td>-0.023 (0.003)</td>
<td>-0.025 (0.009)</td>
<td>-0.025 (0.007)</td>
<td>-0.025 (0.006)</td>
</tr>
<tr>
<td>CONCENTR. \times POOR</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>-0.043 (0.608)</td>
<td>-0.053 (0.469)</td>
<td>-0.058 (0.456)</td>
</tr>
<tr>
<td>CONCENTR. \times (1 - POOR)</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>-0.011 (0.259)</td>
<td>-0.063 (0.541)</td>
<td>-0.012 (0.234)</td>
</tr>
<tr>
<td>.m1</td>
<td>-3.18 (0.001)</td>
<td>-3.041 (0.002)</td>
<td>-3.015 (0.001)</td>
<td>-3.195 (0.001)</td>
<td>0.2084 (0.835)</td>
<td>0.5090 (0.611)</td>
<td>0.5798 (0.562)</td>
<td>1.000 (1.000)</td>
</tr>
<tr>
<td>.m2</td>
<td>0.773</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
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</table>

Sample: 115 Countries (1991-2000). For further information, see Table 1.
Table 6: Entry and the countercyclical margins (Regional Analysis)
Dependent Variable: Net Interest Margins ($NIM_t$)

<table>
<thead>
<tr>
<th></th>
<th>GMM SYS 1STEP</th>
<th>GMM SYS 2STEPS</th>
<th>GMM SYS ↓ DEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>$NIM_{t-1}$</td>
<td>0.253 (0.087)</td>
<td>0.274 (0.078)</td>
<td>0.385 (0.005)</td>
</tr>
<tr>
<td>$GROWTH_t$</td>
<td>-0.012 (0.673)</td>
<td>-0.028 (0.368)</td>
<td>-0.006 (0.800)</td>
</tr>
<tr>
<td>PRIV.CRED.(avg),</td>
<td>-0.039 (0.001)</td>
<td>-0.037 (0.002)</td>
<td>-0.033 (0.000)</td>
</tr>
<tr>
<td>$CONCENTR_t$</td>
<td>-0.0009 (0.951)</td>
<td>0.024 (0.251)</td>
<td>-0.001 (0.913)</td>
</tr>
<tr>
<td>$\Delta Foreign Banks_{t-1} \cdot POOR$</td>
<td>-0.044 (0.023)</td>
<td>-0.041 (0.067)</td>
<td>-0.033 (0.073)</td>
</tr>
<tr>
<td>$\Delta Foreign Banks_{t-1} \cdot (1 - POOR)$</td>
<td>0.020 (0.102)</td>
<td>0.018 (0.099)</td>
<td>0.032 (0.006)</td>
</tr>
<tr>
<td>.m1</td>
<td>-2.369 (0.018)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>.m2</td>
<td>1.667</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sargan</td>
<td>0.992 (0.096)</td>
<td></td>
<td>0.984</td>
</tr>
</tbody>
</table>
Table 7: Determinants of entry in the local financial system (Sample: 67 Developing Countries -1991-2000)
Dependent Variable: ΔForeign Banks

<table>
<thead>
<tr>
<th>Variable</th>
<th>GMM SYS 1STEP</th>
<th>GMM SYS 2STEPS</th>
<th>GMM SYS ∆ DEV</th>
<th>GMM SYS 1STEP</th>
<th>GMM SYS 2STEPS</th>
<th>GMM SYS ∆ DEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROWTH&lt;sub&gt;t&lt;/sub&gt;</td>
<td>0.870 (0.026)</td>
<td>1.05 (0.036)</td>
<td>0.837 (0.019)</td>
<td>0.599 (0.097)</td>
<td>0.528 (0.088)</td>
<td>0.595 (0.081)</td>
</tr>
<tr>
<td>GROWTH&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.027 (0.057)</td>
<td>0.030 (0.137)</td>
<td>0.014 (0.520)</td>
<td>0.017 (0.201)</td>
<td>0.018 (0.134)</td>
<td>0.012 (0.369)</td>
</tr>
<tr>
<td>RULE of LAW</td>
<td>-0.001 (0.818)</td>
<td>-0.0065 (0.533)</td>
<td>-0.0004 (0.954)</td>
<td>0.013 (0.136)</td>
<td>0.011 (0.150)</td>
<td>0.012 (0.190)</td>
</tr>
<tr>
<td>N&lt;sub&gt;t&lt;/sub&gt; of REVOLUTIONS</td>
<td>-0.012 (0.633)</td>
<td>-0.0097 (0.798)</td>
<td>-0.011 (0.605)</td>
<td>-0.054 (0.104)</td>
<td>-0.048 (0.876)</td>
<td>-0.051 (0.131)</td>
</tr>
<tr>
<td>FREEDOM</td>
<td>-0.012 (0.429)</td>
<td>-0.013 (0.480)</td>
<td>-0.008 (0.678)</td>
<td>-0.023 (0.232)</td>
<td>-0.022 (0.179)</td>
<td>-0.024 (0.234)</td>
</tr>
<tr>
<td>PRIV.CRED(avg)&lt;sub&gt;t&lt;/sub&gt;</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>-0.014 (0.734)</td>
<td>-0.059 (0.876)</td>
<td>-0.002 (0.995)</td>
</tr>
<tr>
<td>CONCENTR&lt;sub&gt;t&lt;/sub&gt;</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>-0.012 (0.084)</td>
<td>-0.010 (0.150)</td>
<td>-0.011 (0.137)</td>
</tr>
<tr>
<td>GDP&lt;sub&gt;t&lt;/sub&gt;</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>0.044 (0.038)</td>
<td>0.039 (0.061)</td>
<td>0.040 (0.060)</td>
</tr>
<tr>
<td>(\Delta m1)</td>
<td>-2.369 (0.018)</td>
<td>1.667 (0.096)</td>
<td>-3.096 (0.002)</td>
<td>0.8451 (0.398)</td>
<td>1.000 1.000</td>
<td></td>
</tr>
<tr>
<td>Sargan</td>
<td>0.817</td>
<td>0.912</td>
<td>1.000</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Variable Definitions**

**NIM**: Net interest income minus interest over total assets (after subtracting defaulted loans).

**GROWTH**: Annual growth rate of real GDP.

**PRIV. CREDIT**: Private Credit by deposit money banks to GDP, calculated using the following deflation method: \(\{(0.5)[P_t^e + P_{t-1}^e]/[GDP_t]/a_t\}\)

**CONCENTRATION**: Assets of the three largest banks as a share of the assets of all the commercial banks in the system.

**OVERCOSTS**: Accounting value of a bank's overhead costs as a share of its total assets.

**INFLATION**: Annual inflation from the GDP deflator.

**REALRATE**: Real interest rate.

**Foreign Banks**: Number of foreign banks to total number of banks. A bank is defined to be a foreign bank if it has at least fifty percent foreign ownership.

**ΔForeign Banks**: Variation in the number of foreign banks.

**GDP**: Real GDP per capita.

**No. of Revolutions**: Average number of revolutions (1970-2000).

**FREEDOM**: Freedom House Ratings.

**Rule of Law**: ICRG Law and Order Rating.
## CHAPTER 2

### Table 1: Standard Deviation

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>RBC</th>
<th>ICFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>1.80</td>
<td>2.31</td>
</tr>
<tr>
<td>Consumption</td>
<td>0.52</td>
<td>0.70</td>
</tr>
<tr>
<td>Investment</td>
<td>5.74</td>
<td>12.08</td>
</tr>
<tr>
<td>Capital</td>
<td>0.49</td>
<td>0.94</td>
</tr>
<tr>
<td>Employment</td>
<td>1.37</td>
<td>2.19</td>
</tr>
</tbody>
</table>

Notes: Theoretical second moments (as percentage deviations from steady-state values) are reported. RBC refers to the standard RBC model and ICFM to the monopolistic financial market setup. The method used was the frequency domain technique described in Uhlig (1999). The series are H-P filtered with a smoothness parameter of 1600 so that only the cyclical components remain.

### Table 2: Relative Standard Deviation

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>RBC</th>
<th>ICFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Consumption</td>
<td>0.29</td>
<td>0.30</td>
</tr>
<tr>
<td>Investment</td>
<td>3.19</td>
<td>5.23</td>
</tr>
<tr>
<td>Capital</td>
<td>0.28</td>
<td>0.41</td>
</tr>
<tr>
<td>Employment</td>
<td>0.76</td>
<td>0.95</td>
</tr>
</tbody>
</table>

Notes: Standard deviations relative to output. For further information, see notes to Table 8.

### Table 3: Sensitivity Analysis

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>( r = 0.20 )</th>
<th>( r = 0.40 )</th>
<th>( r = 0.60 )</th>
<th>( r = 0.80 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>1.84</td>
<td>2.02</td>
<td>2.21</td>
<td>2.41</td>
</tr>
<tr>
<td>Consumption</td>
<td>0.60</td>
<td>0.62</td>
<td>0.66</td>
<td>0.74</td>
</tr>
<tr>
<td>Investment</td>
<td>8.24</td>
<td>9.67</td>
<td>11.26</td>
<td>12.89</td>
</tr>
<tr>
<td>Capital</td>
<td>0.68</td>
<td>0.78</td>
<td>0.89</td>
<td>0.98</td>
</tr>
<tr>
<td>Employment</td>
<td>1.43</td>
<td>1.71</td>
<td>2.03</td>
<td>2.35</td>
</tr>
</tbody>
</table>

Notes: Volatilities for different parameter values of \( r \). For further information, see notes to Table 8.
Figure 2

Percentage point response of the Monopolistic Financial Market (solid line), and RBC (dashed line) models' to an unanticipated one percent decrease in technology.
CHAPTER 3

Table 1: Net Interest Margins Statistics.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>MEAN</th>
<th>ST DEV(1)</th>
<th>STDEV(2)</th>
<th>COUNTRY</th>
<th>MEAN</th>
<th>ST DEV(1)</th>
<th>STDEV(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>0.020</td>
<td>0.003</td>
<td>15.8</td>
<td>Argentina</td>
<td>0.070</td>
<td>0.031</td>
<td>44.2</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>0.008</td>
<td>0.002</td>
<td>25.0</td>
<td>Israel</td>
<td>0.031</td>
<td>0.005</td>
<td>15.9</td>
</tr>
<tr>
<td>Ireland</td>
<td>0.013</td>
<td>0.003</td>
<td>18.8</td>
<td>South Korea</td>
<td>0.022</td>
<td>0.003</td>
<td>14.9</td>
</tr>
<tr>
<td>Japan</td>
<td>0.019</td>
<td>0.003</td>
<td>15.8</td>
<td>Malaysia</td>
<td>0.028</td>
<td>0.004</td>
<td>13.8</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0.017</td>
<td>0.003</td>
<td>15.8</td>
<td>Mexico</td>
<td>0.054</td>
<td>0.010</td>
<td>19.0</td>
</tr>
<tr>
<td>Germany</td>
<td>0.026</td>
<td>0.004</td>
<td>14.1</td>
<td>Philippines</td>
<td>0.040</td>
<td>0.008</td>
<td>20.3</td>
</tr>
<tr>
<td>USA</td>
<td>0.040</td>
<td>0.003</td>
<td>6.2</td>
<td>Slovak Rep</td>
<td>0.031</td>
<td>0.009</td>
<td>28.6</td>
</tr>
<tr>
<td>Thailand</td>
<td></td>
<td></td>
<td></td>
<td>Sample Average</td>
<td>0.020</td>
<td>15.9</td>
<td></td>
</tr>
</tbody>
</table>

Notes: The variable in consideration is Net Interest Margins (Bank Markups) for the period 1991-2000. Sample Mean, Standard Deviation (1), and Standard Deviation as a percentage deviation from individual mean values (2) are reported. Source: Database on Bank Structure, World Bank Research Department (1999 and 2003 editions).

Table 2: Standard Deviation

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>SOE</th>
<th>MBS</th>
<th>BS</th>
<th>BS+MBS</th>
<th>DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>1.50</td>
<td>1.89</td>
<td>1.83</td>
<td>2.28</td>
<td>2.79</td>
</tr>
<tr>
<td>Consumption</td>
<td>2.45</td>
<td>2.68</td>
<td>2.56</td>
<td>2.67</td>
<td>3.60</td>
</tr>
<tr>
<td>Investment</td>
<td>3.87</td>
<td>6.41</td>
<td>6.79</td>
<td>10.90</td>
<td>10.75</td>
</tr>
<tr>
<td>Bank Markup (Net</td>
<td>----</td>
<td>11.69</td>
<td>----</td>
<td>23.03</td>
<td>23.09</td>
</tr>
</tbody>
</table>

Notes: Observed and Theoretical second moments (as percent deviation from steady state values) are reported.

Theoretical Moments: SOE is the baseline small open economy model with nominal rigidities. BS adds the standard balance-sheet-effect to the previous specification; instead, MBS adds the Monopolistic Banking System setup. Finally, BS+MBS adds the “broad” financial accelerator (i.e. the combined effect of both). The method used was the frequency domain technique depicted in Uhlig (1999).

Empirical Moments: Observed Statistics for the selected sample of eight developing economies are based in seasonally adjusted quarterly data. Following Reinhart and Rogoff (2002), in the computations, I consider periods in which there is either a de facto peg or at least a de facto crawling band that never exceeds +/- 5% range. Variables, except interest rates are transformed in logarithms.

-For comparison purposes, both Empirical and Theoretical series are H-P filtered with a smoothness parameter of 1600 so that only the cyclical component remains.

Table 3: Welfare Analysis

<table>
<thead>
<tr>
<th>FLEXIBLE EXCHANGE RATES</th>
<th>BALANCE SHEETS ONLY</th>
<th>BALANCE SHEETS + MONOPOLISTIC BANKING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Exchange Rates</td>
<td>0.54%</td>
<td>7.20%</td>
</tr>
</tbody>
</table>

Notes: The welfare criteria considered here is based on a second-order Taylor expansion of the representative household's expected utility function (provided the parameterization specified in the paper). I report the percent increase in steady-state consumption that makes the household as well off than it would be in the baseline scenario.
FIGURE 2 - FLEXIBLE EXCHANGE RATE AND PERFECT COMPETITION IN THE BANKING SYSTEM

Percent point response of the standard "balance-sheet" (Solid Line), and the standard small open economy (SOE) with nominal rigidities (Dashed Line) models' to an unanticipated one hundred basis point increase in the foreign interest rate.

FIGURE 3 - FLEXIBLE EXCHANGE RATE AND MONOPOLISTIC BANKING SYSTEM

Percent point response of the complete (solid line), and the standard "balance-sheet" (dashed line) models' to an unanticipated one hundred basis point increase in the foreign interest rate.
Percent point response of the complete (solid line), and the standard “balance-sheet” (dashed line) models to an unanticipated one hundred basis point increase in the foreign interest rate. I assume that price adjustment in the foreign goods sector follows the specification described in Appendix B.

FIGURE 4 - LOCAL CURRENCY PRICING AND INCOMPLETE PASS-THROUGH

FIGURE 5 - FIXED EXCHANGE RATE AND MONOPOLISTIC BANKING SYSTEM

Percent point response of the complete (solid line), and the standard “balance-sheet” (dashed line) models to an unanticipated one hundred basis point increase in the foreign interest rate. I assume the presence of a fixed exchange rate regime.
FIGURE 6- THE "BALANCE-SHEET-EFFECT."

Percent point response of the standard "balance-sheet" (solid line), and the standard SOE with nominal rigidities (Dashed Line) models' to an unanticipated one hundred basis point increase in the foreign interest rate. I assume the presence of a fixed exchange rate regime and perfect competition in the banking system.

FIGURE 7- THE "BANK-SUPPLY CHANNEL."

Percent point response of the monopolistic banking system (solid line), and the standard SOE with nominal rigidities (Dashed Line) models' to an unanticipated one hundred basis point increase in the foreign interest rate. I assume the presence of a fixed exchange rate regime and no balance-sheet effects.

FIGURE 8- THE "BROAD" FINANCIAL ACCELERATOR.

Percent point response of the complete (solid line), and the standard SOE with nominal rigidities (Dashed Line) models' to an unanticipated one hundred basis point increase in the foreign interest rate. I assume the presence of a fixed exchange rate regime.