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Macroeconomic Implications of Credit Constraints

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An Abstract of
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ABSTRACT

Private credit plays a critical role in the real economy. The provision of credit to businesses reduces the need for internal finance and promotes investment, for households it reduces consumption volatility. While both businesses and households rely on bank credit, prior literature emphasizes production and investment and does not distinguish between household and business credit. The effects of credit conditions need not be confined to firms and capital spending but may arise through household spending decisions as well. Certainly, the distinction becomes important when the credit conditions for the two types of credit have distinct effects on the real economy. This dissertation differentiates between household and business credit and studies the implications of the two types of credit, from both theoretical and empirical points of views. The first chapter examines the impact of international and domestic credit market frictions on the relative consumption volatility differential between developed and emerging countries by modeling household and business credit effects explicitly. The second chapter uses a unique data set for household and business credit and studies the effects of household and business credit on the trade balance. The third chapter analyzes the link between financial crises and private credit decomposition.

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Preface

Private credit plays a critical role in the real economy. The provision of credit to businesses reduces the need for internal finance and promotes investment, for households it reduces consumption volatility. While both businesses and households rely on bank credit, prior literature emphasizes production and investment and does not distinguish between household and business credit. The effects of credit conditions need not be confined to firms and capital spending but may arise through household spending decisions as well. Certainly, the distinction becomes important when the credit conditions for the two types of credit have distinct effects on the real economy. My research differentiates between household and business credit and studies the implications of the two types of credit, from both theoretical and empirical points of views. On the theoretical side, I examine the impact of international and domestic credit market frictions on the relative consumption volatility differential between developed and emerging countries by modeling household and business credit effects explicitly. On the empirical side, I compile a unique data set for household and business credit for 47 developed and emerging countries that allows me to study the determinants and consequences of household and business credit. Below I briefly elaborate on the four papers that study various aspects of household and business credit.

First essay studies the relative consumption volatility differential between developed and emerging economies. The standard deviation of consumption relative to GDP in small open emerging economies is fifty percent higher than in small open developed economies. Frictionless real business cycle models of small open economies cannot explain the observed relative consumption volatility in emerging economies. To

explain the relative consumption volatility differential between developed and emerging economies, I build a model that incorporates three unique features of emerging economies: (i) domestic banks' credit constraints in international capital markets, (ii) a low level of collateral in the economy, and (iii) a highly skewed income distribution. I propose a Dynamic Stochastic General Equilibrium framework, which shows that these three macroeconomic features lead to higher consumption volatility in emerging economies. Relative consumption volatility is significantly higher in the model economy with international credit constraints, and time variation in the international credit constraints accounts for ten to thirty-five percent of the variation in total consumption. The model also suggests that lower levels of collateralizable assets increase relative consumption volatility. More importantly, lack of collateral, combined with time-varying credit constraints, which can be described as a "double jeopardy" effect, explains the relative consumption volatility differential between developed and emerging completely. Finally, I find that highly skewed income distributions strengthen the effects of international credit constraints on credit constrained households.

Second essay focuses on the trade balance in emerging economies using a framework that incorporates the credit constraints that households and businesses face. I relax the credit constraints on households and firms and study the distinction between household and business credit in terms of trade balance. The framework yields two empirical predictions: (i) a rise in household credit causes a decrease in the foreign trade surplus through its effect on consumption spending, and (ii) the effect of firm credit on the foreign trade balance varies according to the import-intensity of investment. I expect that eventually an expansion in firm credit should lead to a rise in net exports by boosting

capital accumulation, production and exports. Using the system generalized method of moments (GMM) estimation technique; I find that household loans have a significant negative effect on net exports while business loans contribute to an improvement in the trade balance. A key policy conclusion is that policy makers should decrease household credit but stimulate business credit when the trade balance deteriorates.

In the third essay, I study the roles of household and business credit in banking and currency crises. The literature has identified private credit expansion as an important predictor of banking crises. I extend the literature by providing a more detailed analysis of the use of credit by businesses and households. I compile a unique disaggregated data set and find evidence that household credit growth and firm credit growth have positive, distinct, and statistically significant effects on the likelihood of banking and currency crises. Furthermore, household credit growth is a particularly important predictor of banking crises in countries with a high propensity to consume.

Chapter 1

Consumption Volatility in Emerging Economies: Credit Constraints, Collateral, and Income Distribution

Abstract

Financial development policies in emerging economies have been shaped by a fundamental shift toward liberalized financial systems with the premise of consumption smoothing and risk sharing. However, consumption volatility relative to income volatility (RCV) is still higher in emerging economies than in small developed economies. Which characteristics of emerging economies prevent households from consumption smoothing? Why does consumption fluctuate more in emerging economies than in developed economies even after financial liberalization? To answer these questions, I explore three features of emerging economies: international credit constraints, lack of collateral, and income inequality. I develop a small-open economy DSGE model and show that these three features increase the RCV. More importantly, lack of collateral, combined with time-varying credit constraints, explains the RCV differential between emerging and developed economies. Finally, I show that time variation in the credit limits of domestic banks explains 24 percent of the variation in the total consumption.

JEL classification: E32, E44, F34, F41

Key Words: Consumption Volatility, Credit Constraints, Collateral, Income Distribution

1.1 Introduction

Financial liberalization has the potential to overcome credit constraints, smooth consumption, and hence improve welfare in emerging economies. Credit constraints caused by low-functioning financial systems affect poor households more deeply than wealthy households, who can rely on ample assets to smooth consumption in the face of negative income shocks. The gains from less constrained credit markets in emerging economies are substantial because average incomes for the poor are not only low, but also volatile. Households in emerging economies are more vulnerable to risks from sources like financial crises and recessions. Taken together, these factors establish the importance of improving risk sharing mechanisms. Therefore, policies that lead to financial development should benefit the poor and the middle income households directly by easing credit constraints and indirectly by reducing output volatility.

Given the potential welfare improvements following from consumption smoothing and risk sharing, financial development policies in emerging market economies have been shaped by a fundamental shift toward liberalized financial systems in recent decades. Despite these policy changes, consumption volatility relative to income volatility (henceforth referred to as the relative consumption volatility (RCV)) is still higher in emerging economies than in small developed economies. The RCV differential (δ_{RCV}) -- the ratio of the average RCV for emerging to developed countries -- is 1.543.[1] From a theoretical point of view, unlimited access to world capital markets should lead to higher levels of financial development, and hence similar patterns of risk sharing and consumption smoothing. A large δ_{RCV} is sharply at odds with fully developed financial

[1] Agiuar and Gopinath (2007). The emerging countries in their sample are Argentina, Brazil, Ecuador,

markets.

This paper explores the role of international credit constraints in explaining the δ_{RCV} between emerging and developed economies. International credit constraints arise because of limited contract enforceability: foreign lenders can not enforce repayment by domestic borrowers unless the debt is secured by collateral. These credit constraints capture in a simple way the difficulties of enforcing contacts between domestic and international credit markets that involve large transfers of resources. International credit constraints enter the model as the credit limits that domestic banks face in international credit markets. To model domestic banks explicitly allows me to emphasize the interaction of credit constraints of banks, households, and entrepreneurs in forming the transmission mechanism that links credit frictions to real economy. The addition of credit constrained households and financial intermediaries to the model plays a key role in driving the business cycle dynamics.

Several authors have used models of credit frictions to study the *output volatility* in emerging economies. This literature includes, but is not limited to, Aghion, Bacchetta, and Banerajee (2001, 2004); Caballero and Krishnamurthy (1999); Mendoza (2002); and Paasche (2001). While these studies document the importance of credit frictions for output volatility, they have not systematically evaluated the extent to which a general equilibrium model with financial frictions can explain δ_{RCV}.[2]

The analysis conducted here differs from existing studies in its focus on the household sector and the RCV. Most of the models studied so far in the literature feature credit constraints on the production sector. Hence, in this class of models the assumption

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Israel, Korea, Malaysia, Mexico, Peru, Philippines, Slovak Republic, South Africa, Thailand, and Turkey.

is that households can smooth their consumptions in case of shocks. Here, I relax this assumption and differentiate between constrained and unconstrained households to gain additional insights as to how the consumption dynamics change in response to productivity and credit shocks.[3]

In addition to international credit constraints, I explore the importance of two other features of emerging economies: lack of collateral and income inequality. Households in emerging economies find it more difficult to buy a house due to tight credit constraints. Moreover, in order to use a physical asset such as land or real estate as collateral, a person must legally own it. Evidence for emerging countries shows that it is extremely expensive and time-consuming to legalize the ownership of real estate.[4] To study whether the lack of collateralizable assets in economies can explain δ_{RCV}, I analyze two different regimes in which real estate and labor income are used as collateral.

A second feature of emerging economies is greater income inequality relative to that of developed economies. More specifically, I ask whether different income distribution schemes affect consumption dynamics. My hypothesis is that in economies with high income inequality, the RCV is greater due to the high population share of credit constrained households. To test this hypothesis, I change the population share of credit constrained households and compare the RCV statistics for two different income distribution schemes.

From a modeling point of view, my analysis follows in the tradition of studies like

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[2]One exception is Resende (2006). He studies consumption volatility in emerging economies with a DSGE model without investment or production.

[3]Campbell and Mankiw (1990, 1991), Zeldes (1989), Jappelli and Pagano (1989) and Bachetta and Gerlach (1997) provide empirical evidence for credit constrained households in the United States and for a set of developed economies.

[4]See World Bank's annual publication Doing Business in 2005 for more information. Mishkin (2007) and

Kiyotaki and Moore (1997) and Iacoviello (2005), in which lenders cannot force borrowers to repay their debts unless the debts are secured by collateral assets. More specifically, I begin with the set-up in Iacoviello (2005), which develops a monetary business cycle model for a closed economy without financial intermediaries. His model is extended in three dimensions. First, I use a real business cycle model in a small open economy context with *banks*, which are the only domestic agents borrowing and lending in international markets. Banks are an important element in emerging economies because they provide credit to domestic borrowers that do not have access to international credit markets. I further assume that banks face credit constraints while borrowing from international markets. The constraints take the form of collateral, whereby the domestic banks must commit a time-varying proportion of their assets before contracting any external credits. Second, I specify the credit constraints as *time-varying*. The time variation in the credit limit is motivated by the empirical evidence that foreign liabilities of banks, as a fraction of their total assets, show substantial variation around a constant mean and decline significantly in the face of a recession. Third, I compare consumption volatility under two types of collateral: real estate (as in Iacoviello (2005)) and labor income to see whether the lack of real estate assets has an impact on RCV's of households whose credit constraint is tied to their labor income. In emerging economies, labor income is a particulary important type of collateral. I will discuss the three characteristics of emerging economies in Section 2 in more detail.

The transmission mechanism in my model works as follows. In economies where banks face credit constraints in international markets, if the world interest rate is lower

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De Soto (2000) also provide comprehensive discussion on the costs of legal ownership in developing countries.

than the domestic interest rate, banks borrow up to their credit limits. Thus, when the economy face a positive productivity shock, there is an increase in capital inflow to the economy due to the increased level of banks' assets. Higher foreign borrowing leads to an increase in demand for labor and housing, thus raising wages and the real estate prices. In economies without credit constraints, a positive productivity shock decreases foreign capital borrowing since in good times, savings increase and banks choose to repay its debts. Savings is thus positively correlated with the business cycle. Hence, capital inflows would be countercyclical and would tend to stabilize the cycle. In economies with international credit constraints, on the other hand, procyclical capital inflow leads to pronounced cycles and increased instability.[5] Lack of assets and income inequality increase the scope of volatility.

There are four main findings of this paper: First, the RCV is significantly higher in the model economy with international credit constraints: the existence of international credit constraints results in δ_{RCV} equal to 1.19 in real estate collateral regime and to 1.25 in labor collateral regime when the credit constraints are constant. Second, lack of collateral increases the RCV by 38 percent. More importantly, lack of collateral, combined with time-varying credit constraints, explains the relative consumption volatility differential between developed and emerging economies. Third, the time variation in the international credit constraints accounts for 11 to 42 percent of δ_{RCV}. Finally, I show that highly skewed income distributions strengthen the effects of international credit constraints on consumption volatility. The relative consumption volatility increases by 15 percent when income inequality worsens. These results indicate

[5]See Kaminsky, Reinhart, and Vegh (2004) for a detailed discussion on procyclicality of foreign capital in

that financial liberalization does not lead to consumption smoothing when international credit constraints exist. Low levels of collateral, time variation in the credit constraints, and income inequality strengthens the effects of international credit constraints.

This paper proceeds as follows. Section 2 discusses the δ_{RCV} and the characteristics of emerging economies. Section 3 presents the model. Section 4 describes the quantitative analysis. Section 5 presents results and Section 6 concludes.

1.2 Consumption Volatility and Features of Emerging Economies

Table 1 reports consumption volatility, expressed as a percentage of output volatility, for emerging and developed markets. Each series is deseasonalized and Hodrick-Prescott filtered using a smoothing parameter of 1600. The average RCV in developed markets is 0.94. Conversely, the average RCV is emerging markets is 1.45. The associated δ_{RCV} (the ratio of the average RCV's for emerging to developed markets) equals 1.54. In the following sections I describe the three features of emerging economies to provide an explanation for the observed differences in RCV between emerging and developed markets.

The first characteristic of emerging economies concerns the foreign borrowing of the banking system. Figure 1.1 presents the foreign liabilities to total assets ratio of the banking system for three emerging markets (Mexico, South Korea, and Turkey). One important feature of Figure 1.1 is that the borrowing of banks, as a fraction of their assets, declines significantly in the face of a negative productivity shock. For example, Turkey was hit by two severe financial crises in 1994 and 2001, which coincided with significant

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emerging economies.

declines in foreign liabilities to total assets ratios. The Mexican economy experienced a similar trend in the foreign borrowing to total assets ratio in 1995, after the financial crisis in December 1994.[6] This strong procyclical behavior of capital inflows has also been documented in several studies in the international business cycle literature. (Agiuar and Gopinath, 2007; Aghion, Bacchetta and Banerjee, 2004; Mendoza, 2003) Conversely, developed economies exhibit weakly procyclical capital inflows. Agiuar and Gopinath (2007) shows that the average correlation of trade deficit and output in emerging economies is 0.51, whereas in developed economies it is equal to 0.17. From a theoretical point of view, this procyclical behavior of foreign borrowing suggests strong evidence of credit constraints since in the case of an unlimited foreign credit access, emerging markets should be able to cushion themselves against negative income shocks. Therefore, foreign credit should increase during a recession and decrease during an expansion.

The credit constraints used in this analysis are a way to ration out the amount of credit available to a particular economy through restriction in quantities. However, the price of foreign credit, namely the world interest rate, also has an important role in borrowing decisions of banks. When the world interest rate is lower than the domestic interest rate, banks will choose to borrow up to their limits and the credit constraint will be always binding. Table 3 compares London Interbank Offer Rate (LIBOR) for the US Dollar adjusted for inflation in the United States and the domestic real interbank interest rate for Canada, Mexico, Korea and Turkey. The world interest rate, with which banks in emerging economies can borrow to fund the domestic credit demand, is on average 5 percentage points higher than the world interest rate in annual terms. The fact that banks

alvo (1986) for a detailed discussion on "sudden stops".

in emerging markets can finance the domestic credit demand from international credit markets with a lower interest rate leads them to borrow up to their credit limits. This will have important implications in terms of the RCV.

The next characteristic concerns the collateral levels in emerging and developed economies. Households in emerging economies find it more difficult to buy a house due to tight credit constraints. On average, the housing stock per capita household is 20 percent lower in emerging economies than in small developed economies.[7] Moreover, in order to use a physical asset such as land or real estate as collateral, a person must legally own it. Evidence for emerging countries shows that it is extremely expensive and time-consuming to legalize the ownership of real estate. De Soto (2000) documents the problems that households face to legally own a physical asset. He argues that obtaining a legal title takes 13-25 years in Philippines, and 5-14 years in Egypt. These intuitional problems in emerging economies make it harder for households to offer real estate as collateral. Therefore, banks use labor income not only to reduce the asymmetry of information problem about the financial health of the borrowers, but also to secure credit by seizing the household's income in case of default.

The last feature of emerging economies is greater income inequality relative to that of developed economies. Changes in current or permanent income inequality might have different impacts on consumption volatility, depending on the structure of credit and insurance markets available to agents for smoothing income fluctuations. Income inequality, combined with a credit constrained banking system, might strengthen the adverse effects of income shocks, especially for the credit constrained households. The empirical evidence also provides some support for this hypothesis. Figure 2 presents the

positive correlation between the Gini coefficient and consumption volatility for a sample of emerging economies.[8] The correlation between those two variables is 0.45. This number is quite striking because total consumption volatility depends both on income shares and shares of these households in total population. In total, a more skewed income distribution leads to higher total consumption volatility only if the shares of these households in the total population is high.

1.3 The Model

This section presents two versions of a small-open economy model with international credit constraints. In the first version, households offer their real estate, and entrepreneurs offer their capital holdings as collateral. In the second version, I introduce labor income and output as collateral for households and entrepreneurs, respectively. The set up of the models are exactly the same otherwise. They feature discrete time and finite horizons. The economy is populated by entrepreneurs, patient and impatient households, infinitely lived and of measure one. In addition to households and entrepreneurs, there is a banking sector that intermediates funds between domestic agents and international capital markets, as well as between domestic savers and borrowers.

1.3.1 Model 1: Real Estate and Capital as Collateral

Patient Households

Households maximize a lifetime utility function given by

[7]Source: Global Market Information Database
[8]The countries are Bulgaria, Brazil, Costa Rica, Czech Republic, Estonia, Hungary, India, Lithuania, Latvia, Mexico, Malaysia, Thailand, and Turkey.

$$E_0 \sum_{t=0}^{\infty} (\beta^p)^t (\ln c_t^p + \gamma \ln h_t^p - (l_t^p)^\eta / \eta) \tag{1.1}$$

where E_0 is the expectation operator, $\beta^p \in (0,1)$ is the discount factor, c_t^p is consumption at t, h_t^p denotes the holdings of housing, and l_t^p are hours of work for patient households. γ and η represent the preference parameters for housing weight and elasticity of labor supply, respectively. The flow of funds for the patient households is as follows:

$$c_t^p + q_t \Delta h_t^p + R_{t-1} b_{t-1}^p = b_t^p + w_t^p l_t^p \tag{1.2}$$

where q_t denotes the real housing price, b_t^p denotes the borrowing of patient households, $R_t = (1 + r_t)$ and r_t is the real interest rate on deposits. Solving this problem yields first-order conditions for the consumption/housing margin (5) along with the consumption (3) and labor supply (4) conditions:

$$1/c_t^p = \beta^p E_t (R_t / c_{t+1}^p) \tag{1.3}$$

$$w_t^p / c_t^p = (l_t^p)^{\eta - 1} \tag{1.4}$$

$$q_t / c_t^p = \gamma / h_t^p + \beta^p E_t (q_{t+1} / c_{t+1}^p) \tag{1.5}$$

Impatient Households

Impatient households are characterized by $\beta^h < \beta^p$. They choose consumption c_t^h, labor l_t^h, and housing holdings h_t^h to maximize a life time utility function given by

$$E_0 \sum_{t=0}^{\infty} (\beta^h)^t (\ln c_t^h + \gamma \ln h_t^h - (l_t^h)^\eta / \eta) \tag{1.6}$$

where β^h is the discount factor for impatient households. As in patient households, γ and η represent the preference parameters for housing weight and

elasticity of labor supply. The flow of funds for the impatient household is

$$c_t^h + q_t \Delta h_t^h + R_{t-1}' b_{t-1}^h = b_t^h + w_t^h l_t^h \tag{1.7}$$

where q_t denotes the real housing price, b_t^h denotes the borrowing of impatient households, w^h is the impatient households wage rate, $R_t' = (1 + r_t')$, and r_t' is the real interest rate on loans.

In addition to the flow of funds constraint, impatient households face an additional credit constraint that limits the amount of borrowing. Their borrowing can not exceed a time-varying fraction, m_t^h, of the expected discounted value of their real estate holdings:

$$b_t^h \le m_t^h E_t (q_{t+1} h_t^h / R_t') \tag{1.8}$$

$$m_t^h = m^h \exp(\varepsilon_t^h) \tag{1.9}$$

$\beta^h < \beta^p$ implies that impatient households discount future more heavily than the patient households. This guarantees that impatient households are constrained in and around the steady state. Although the interest rates for loans and deposits will be different from each other because of intermediation costs, the impatience level of households will outweigh the interest rate for loans. Specifically, the fact that $(1/\beta^h) > R'$ leads the Lagrange Multiplier on the credit constraint to be greater than zero. Therefore, the borrowing constraint will hold with equality:

$$b_t^h = m_t^h E_t (q_{t+1} h_t^h / R_t') \tag{1.10}$$

Maximizing the objective function with respect to budget and credit constraints yields the following first order conditions:

$$1/c_t^h = \beta^h E_t(R_t'/c_{t+1}^h) + \lambda_t^h R_t' \tag{1.11}$$

$$(l_t^h)^{\eta-1} = w_t^h/c_t^h \tag{1.12}$$

$$q_t/c_t^h = \gamma/h_t^h + \beta^h E_t(q_{t+1}/c_{t+1}^h + \lambda_t^h m_t^h q_{t+1}) \tag{1.13}$$

Both the Euler (11) and the housing demand (13) equations differ from the patient household's first order conditions because of the presence of λ_t^h, the Lagrange multiplier on the borrowing constraint. λ_t^h equals the increase in lifetime utility that would arise from borrowing R_t' dollars, consuming or increasing the real estate holdings, and reducing consumption by an appropriate amount the following period.

Iacoviello (2005) argues that, with a concave objective function, the precautionary saving motive of households and entrepreneurs might outweigh impatience. In that case, agents might not hit the borrowing limit after a sufficiently long run of positive shocks. Here, I take as given that credit constraints on agents are so tight that it takes very high risk aversion coupled with very high volatility to have precautionary behavior. [9]

Entrepreneurs

Entrepreneurs produce a homogenous good, hiring households and combining it with capital. Output is given by a Cobb Douglas technology that uses capital and labor as inputs:

$$Y_t = A_t K_{t-1}^{\mu} L_{t-1}^{p\ \alpha(1-\mu)} L_{t-1}^{h\ (1-\alpha)(1-\mu)} \tag{1.14}$$

where A_t is the random technology parameter. L^p and L^h are the patient and impatient household labor (α measures the relative size of each group).[10] As in impatient

[9]See Iacoviello (2005) Appendix C for a detailed discussion on binding credit constraints.
[10]This functional form for production function is motivated by the fact that credit constrained households are low income group households. Hence, their share in labor income is lower than the patient households.

households, entrepreneurs are also restricted in their borrowing due to enforceability problems. The amount of borrowing can not exceed a time-varying fraction of the discounted value of their capital holdings:

$$b_t^e \leq m_t^e E_t(K_t/R_t') \tag{1.15}$$

$$m_t^e = m^e \exp(\varepsilon_t^e) \tag{1.16}$$

where m^e is assumed fixed and known and ε^e is a shock to the credit ceiling.

Assumption 1: $\beta^e < \beta^p$

In the presence of credit constraints, entrepreneurs can choose to postpone consumption and quickly accumulate enough capital so that the credit constraint becomes nonbinding. Essentially, one need to make sure that entrepreneurial consumption occurs to such an extent that self-financing does not arise. For that matter, I assume that entrepreneurs also discount the future more heavily than patient households, as stated in Assumption 1. As in impatient households, this guarantees that the credit constraint is binding in and around the steady state. Formally, the entrepreneurs maximize $E_0 \sum_{t=0}^{\infty} (\beta^e)^t (\ln c_t^e)$ subject to technology and borrowing constraint, as well as the following flow of funds constraint:

$$Y_t + b_t^e = c_t^e + w_t^p L_t^p + w_t^h L_t^h + R_{t-1}' b_{t-1}^e + I_t + \phi/2(K_t - K_{t-1})^2 \tag{1.17}$$

where b_t^e and c_t^e are entrepreneurs borrowing and consumption. $I_t = K_t - (1-\theta)K_{t-1}$. For capital, I consider the possibility of adjustment costs: capital installation entails a cost $\phi/2(K_t - K_{t-1})^2$.

The first-order conditions are the consumption Euler equation (18), the capital demand equation (19), and the labor demand equations for patient and impatient

households (20,21):

$$1/c_t^e = \beta^e E_t(R_t'/c_{t+1}^e) + \lambda_t^e R_t' \tag{1.18}$$

$$1/c_t^e(1+\phi(K_t - K_{t-1})) = E_t(\beta^e/c_{t+1}^e(\mu Y_{t+1}/K_t + \phi(K_{t+1} - K_t) + 1 - \theta)) + \lambda_t^e m_t^e \tag{1.19}$$

$$w_t^p/c_t^e = E_t((\beta^e/c_{t+1}^e)\alpha(1-\mu)(Y_{t+1}/L_t^p)) \tag{1.20}$$

$$w_t^h/c_t^e = E_t((\beta^e/c_{t+1}^e)(1-\alpha)(1-\mu)E_t(Y_{t+1}/L_t^h)) \tag{1.21}$$

Both the Euler and the capital demand equations differ from the usual formulations because of the presence of λ_t^e, the Lagrange multiplier on the credit constraint. The entrepreneur consumes and invests additional borrowing, and reduces consumption by an appropriate amount the following period.

Banking Sector and International Credit Constraints

The financial intermediaries link domestic agents to international capital markets, as well as domestic savers to borrowers. In period t, bank maximizes period t+1 profits:

$$(b_t^h + b_t^e)(1+r_t') - \kappa(b_t^h + b_t^e) - (-b_t^p)(1+r_t) - f_t(1+r_t^*) \tag{1.22}$$

subject to the following budget and borrowing constraints, respectively:

$$b_t^h + b_t^e \le (-b_t^p) + f_t \tag{1.23}$$

$$f_t \le m_t^b E_t(b_{t+1}^h + b_{t+1}^e)/(1+r_t^*) \tag{1.24}$$

$$m_t^b = m^b \exp(\varepsilon_t^b) \tag{1.25}$$

where m^b assumed to be fixed and known. Here f_t denotes the borrowing of the domestic bank from international markets and it can not exceed a time-varying fraction of the present value of bank's total assets. I assume that banks face a cost for intermediation when lending to domestic borrowers κ. Perfect competition and constant returns-to-scale imply that equilibrium bank profits are zero. Solving the maximization problem with

respect to deposits, foreign credit, and domestic loans, I get the following first order conditions:

$$\lambda_{1,t} = 1 + r_t \tag{1.26}$$

$$\lambda_{2,t} = r_t - r_t^* \tag{1.27}$$

where λ_1 and λ_2 are the Lagrange multipliers for the budget and credit constraints, respectively.

Assumption 2: $r_t > r_t^*$

Motivated by the empirical evidence on the world and real domestic interest rates, I assume that the world interest rate, r_t^*, is strictly lower than the domestic deposit interest rates, r_t. Hence, the bank will choose to borrow from international markets up to the credit limit. Therefore, $\lambda_2 > 0$ and the constraint becomes binding in all states:

$$f_t = m_t^b E_t(b_{t+1}^h + b_{t+1}^e)/(1 + r_t^*) \tag{1.28}$$

Finally, solving for the lending interest rate, I get the following equation:

$$r_t' = r_t - m_{t-1}^b(r_{t-1} - r_{t-1}^*)/(1 + r_{t-1}^*) + \kappa \tag{1.29}$$

Equation (29) shows that lending interest rate is positively correlated with the deposit and world interest rates. Also higher levels of credit from international markets lower the interest rate on loans. Finally, intermediation costs increase the lending interest rate.

Equilibrium

The competitive equilibrium is defined as a set of prices $(r_t, r_t', w_t^p, w_t^h, q_t)$ and quantities $(Y_t, L_t^p, L_t^h, K_t, I_t, l_t^p, l_t^h, c_t^p, c_t^h, c_t^e, b_t^p, b_t^h, b_t^e, h^h, h^p, f_t)$, given the sequence of

shocks to technology and credit constraints for impatient households and entrepreneurs, that solves the maximization problems for patient and impatient households and entrepreneurs and satisfy the following market clearing conditions for labor, goods, housing, and loans market:

$$\begin{aligned} L_t^p &= l_t^p \\ L_t^h &= l_t^h \end{aligned} \tag{1.30}$$

$$c_t^p + c_t^h + c_t^e + I + \phi/2(K_t - K_{t-1})^2 = Y_t + f_t - (1 + r_{t-1}^*) f_{t-1} \tag{1.31}$$

$$h_t^p + h_t^h = H \tag{1.32}$$

$$b_t^p + b_t^h + b_t^e = f_t \tag{1.33}$$

1.3.2 Model 2: Labor Income and Output as Collateral

Here I consider the case where credit constrained households do not own any real estate assets by setting the weight on housing equal to zero. So, the credit constraint is tied to the labor income.[11] I also assume that entrepreneur's credit constraint is bound to output, instead of capital because of two reasons. First, this way I gain analogy with the household sector, whose credit constraint is determined by labor income. Second, in emerging economies, banks can also choose to seize firms future earnings instead of liquidating their capital. Below I present the modified version of the impatient households and entrepreneurs problem, since other agents behavior are the same as before.

[11]Labor income can be used as collateral in case the lender has the right to seize the labor income of the borrower when the borrower defaults on the loan. In emerging economies, this is a common practice by banks when the borrower defaults.

Impatient Households

Impatient households maximize the following utility function:

$$E_0 \sum_{t=0}^{\infty} (\beta^h)^t (\ln c_t^h - (l_t^h)^\eta / \eta) \tag{1.34}$$

Note that compared by the previous model, housing holding of impatient households is absent because the impatient households do not own real estate. The credit limit of constrained households is now bound to the present value of future period's income[12]:

$$b_t^h \le m_t^h E_t (w_{t+1}^h l_{t+1}^h / R_t') \tag{1.35}$$

$$m_t^h = m^h \exp(\xi_t^h) \tag{1.36}$$

The flow of funds for the impatient household is

$$c_t^h + q_t \Delta h_t^h + R_{t-1}' b_{t-1}^h = b_t^h + w_t^h l_t^h \tag{1.37}$$

where $R_t' = (1 + r_t')$ and r_t' is the real interest rate on loans.

Maximizing the objective function with respect to budget and credit constraints yields the following first order conditions:

$$\begin{aligned} 1/c_t^h &= \beta^h E_t (R_t'/c_{t+1}^h) + \lambda_t' R_t' \\ \beta^h (l_t^h)^{\eta-1} &= \beta^h (w_t^h / c_t^h) + \lambda_{t-1}^h m_{t-1}^h w_t^h \end{aligned} \tag{1.38}$$

Entrepreneurs

To keep the analysis analogous, here I assume that the entrepreneurs' credit constraint is also bound to output instead of capital. So, the credit constraint for the entrepreneurs now becomes:

$$b_t^e \le m_t^e E_t (Y_{t+1} / R_t') \tag{1.39}$$

[12]In practice, many banks require income statements before they provide funds to the borrowers since

The first order conditions for the entrepreneur now becomes:

$$1/c_t^e = \beta^e E_t(R_t'/c_{t+1}^e) + \lambda_t^e R_t' \tag{1.40}$$

$$1/c_t^e(1+\phi(K_t - K_{t-1})) = \beta^e/c_{t+1}^e(\mu Y_{t+1}/K_t + \phi(K_{t+1} - K_t) + 1 - \theta) + \lambda_t^e m_t^e \mu Y_{t+1}/K_t \tag{1.41}$$

$$w_t^p/c_t^e = (\beta^e/c_{t+1}^e)\alpha(1-\mu)E_t(Y_{t+1}/L_t^p) + \lambda_t^e m_t^e(1-\mu)\alpha E_t(Y_{t+1}/L_t^p) \tag{1.42}$$

$$w_t^h/c_t^e = (\beta^e/c_{t+1}^e)(1-\alpha)(1-\mu)E_t(Y_{t+1}/L_t^h) + \lambda_t^e m_t^e(1-\mu)(1-\alpha)E_t(Y_{t+1}/L_t^h) \tag{1.43}$$

1.4 Quantitative Analysis

1.4.1 Calibration

For the conventional parameters, I follow previous research in quantitative equilibrium macroeconomics so that they are consistent with the small open economy business cycle literature. The time unit is one-quarter. Following Mendoza (1991), I set β^p, θ, μ, η and ϕ equal to 0.99, 0.03, 0.32, 1.45 and 0.025, respectively. Next, I set the β^h and β^e, the discount factors of constrained households and entrepreneurs. Here, I follow Iacoviello (2005) and choose the discount factors as 0.95 and 0.98, respectively. I set the banks overhead costs κ equal to 0.03, which is the average value for the overhead costs to total assets ratio in emerging economies.[13]

I then pick the value for the real estate parameter γ, the weight on housing services for households. This parameter determines the value of residential real estate in the model economy and also the level of borrowing since the borrowing is a fraction of households real estate assets. I set the weight on housing services for households to 0.08, which implies a 110 percent of the stock of residential housing over annual output. This

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income is associated with some observable measure of the borrower's financial health.

number is 20 percent lower than the stock of residential housing to annual output ratio for the US economy. Available data sets for emerging markets do not provide information on the value of housing stock. But the Global Market Information Database provides information on the per household housing stock for emerging markets, which is 20 percent lower than the per capita housing stock for the US economy. By setting γ equal to 0.08, I am able to match the ratio of housing stock between US and emerging markets.

Then I set α, the income share of patient households equal to 0.64. This parameter determines the severity of income distribution in the economy since the population shares of patient and impatient are the same. As α increases, the income distribution becomes more skewed. Iacoviello (2005) estimates the α by minimizing a measure of the distance between the empirical and theoretical impulse responses and finds it 0.64. On the other hand, the data on the GINI coefficient for the US economy is 40.6 for the 1980-2005 period. Using this mapping, I compare the model's results for two different income distribution schemes by assigning different population shares to impatient and patient households.

1.4.2 Driving Processes

1.4.2.1 Productivity Shock

The autocorrelation and volatility of the stochastic process of the production shock are obtained from an ordinary least squares (OLS) estimation of the Hodrick-Prescott(HP)-detrended output against its one-period lagged value using the data for South Korea, Mexico, and Turkey. Assuming that the output has a trend component and a business cycle component with zero average, the following regression is estimated using

[13]Source: Financial Structure Dataset by Beck, Demiguc-Kunt, and Levine (2000)

the data for Turkey, Korea, and Mexico as representatives of emerging countries:

$$Y_t^{det} = c + \rho^A Y_{t-1}^{det} + \varepsilon_t^A \tag{1.44}$$

After estimating the process of productivity shock for each country, I find an average value of ρ^A equal to 0.76. I also use the average value of the standard deviation of shocks for Korea, Mexico, and Turkey and set the standard deviation of the technology shock equal to 0.023.

1.4.2.2 World Interest Rate Shock

The correlation between the business cycles in emerging economies and the cost of borrowing that these countries face in international markets is the focus of a number studies (Uribe and Yue, 2006; Kose, 2002). To account for the effects of changes in the world interest rate, I allow the world interest rate to fluctuate. The world interest rate follows the AR(1) process shown as the following:

$$r_t^* = \rho_r r_{t-1}^* + \varepsilon_t^r \tag{1.45}$$

where ε_r is an i.i.d. innovation. Following Uribe and Yue (2006), I set the autocorrelation and the standard deviation of the world interest rate shocks equal to 0.83 and 0.007, respectively.

1.4.2.3 Credit Constraint Shocks

This group includes the stochastic processes of the credit constraint shocks. To calibrate the credit constraint parameters, I use foreign liabilities to total assets ratio for the banking system using the data for Korea, Mexico, and Turkey from International Financial Statistics. To obtain the autocorrelation parameter and standard deviation of

shocks for households, I use the household credit to disposable income data. For entrepreneurs, I utilize business credit to GDP data.[14]

For the bank's credit constraint, I assume that the credit availability is affected by its own lag, the shocks to the productivity and independent exogenous shocks. I define the process as the following:

$$\varepsilon_t^b = \rho^b \varepsilon_{t-1}^b + \rho^{ba} \varepsilon_t^A + \xi_t^b \tag{1.46}$$

where ξ^b is a white-noise random shock with mean zero and constant variance, and $-1 < \rho^b < 1$. The shocks to households and entrepreneurs are:

$$\varepsilon_t^h = \rho^h \varepsilon_{t-1}^h + \xi_t^h \tag{1.47}$$

$$\varepsilon_t^e = \rho^e \varepsilon_{t-1}^e + \xi_t^e \tag{1.48}$$

Table 2 summarizes the calibrated parameters.

1.5 Results

1.5.1 Accounting for the RCV Differential

1.5.1.1 International Credit Constraints

This section discusses the effects of international credit constraints for the two models presented in Section 3. The first model assumes that borrowing for households and entrepreneurs is constrained by real estate and output, respectively. The second model uses labor income and output as collateral for households and entrepreneurs. Since there are three possible scenarios (no international credit constraints, constant credit constraints, and time varying credit constraints) for each model, in what follows I discuss

[14]The steady state level of borrowing, as a fraction of output, is equal in both models. I use the household credit to disposable income and business credit to output data to get the autocorrelation and the standard

and compare my results for each scenario of the two models.

Case 1: No International Credit Constraints

Here I consider a small open economy model, in which domestic banks do not face credit constraints in the international markets. I follow the model of Schmitt-Grohé and Uribe (2003) for an open-economy with incomplete asset markets under the fixed discount factor. The Appendix describes the model's set up.

The calibration and parameterization are the same with the original model where there is an overlap. Table 4a summarizes the results for Case 1. The first column shows the consumption and income volatility statistics in the data for the emerging economies, second and third column show the consumption and income volatility statistics for the Model 1 (real estate and capital as collateral) and Model 2 (labor and output as collateral), respectively. Both versions of the model spit out RCV statistics that are significantly lower than its counterpart in the data. In the case without international credit constraints, Model 1 results in RCV that is equal to 0.52. This number is 1.45 in the data for emerging economies. When labor and output are used as collateral, the RCV increases to 0.59 but still significantly lower than 1.45. In both models patient households can smooth out their consumption more than the impatient households and entrepreneurs.

These results provide evidence that additional frictions are required to model the business cycles fluctuations in emerging economies, since standard open economy business cycle models fail to explain the higher consumption to output volatility ratios in those economies. Next, I discuss how much the existence of international credit constraints help to explain this puzzling empirical fact.

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deviations of credit constraints for households and entrepreneurs for both of the models.

Case 2: Constant International Credit Constraints

The second column in Table 4b shows the relative consumption volatility for Model 1. The existence of credit constraints increases the RCV by 20 percent compared to the case where there is no international credit constraints. Despite the fact that in both of the models the household and entrepreneurs are credit constrained, the addition of international credit constraints increases consumption volatility significantly. As shown in the third column of Table 4b, RCV increases to 0.65 when the borrowing is constraint by labor income and output.

Intuitively, the basic mechanism underlying this increase in volatility can be described as follows. In economies where the domestic interest rate is higher than the world interest rate, banks borrow from abroad up to their credit limits. Thus even when the economy faces a positive productivity shock, there is capital inflow to the economy, which raises wages and the real estate prices more than in the case where banks do not face credit constraints. This leads to pronounced cycles, increasing instability. In economies without credit constraints, on the other hand, a positive productivity shock decreases foreign capital borrowing since in good times the banks repay their debt. Savings of the patient households are thus positively correlated with the business cycle. Hence, in the model with no credit constraints, capital inflows would be countercyclical and would tend to stabilize the cycle.

To understand the model's transmission mechanism, it is essential to understand the patterns of foreign borrowing following the productivity shock. For this purpose, I plot the impulse response functions for the two cases in Fig. 3 and 4. The productivity shock in the case with unlimited accesses to the world capital markets leads to a decline

in the foreign borrowing where the impulse response of the foreign credit to the productivity shock in the credit constrained case shows an increase in the foreign credit. This raises the investment and the demand for primary factors and drives up factor prices and marginal costs. Higher wages and real estate prices relax the credit constraint on households, thus boosting spending. As a result, a positive productivity shock leads to more pronounced cycles, which can also be seen from the impulse responses of wages, real estate prices, and total consumption.

Case 3: Time-Varying International Credit Constraints

Here I allow the credit constraints of banks, entrepreneurs, and households to be time-varying. Table 4c second column shows that the RCV in Model 1 (0.69) is greater than their realizations in Case 1 and 2. The existence of time-varying credit constraints results in a higher consumption to output volatility ratio because a positive exogenous shock to the banks' credit constraint increases credit limits that banks face in international credit markets, thus increasing the capital inflows. Combined with a positive productivity shock, increased credit availability results in higher consumption volatility.

The increase in the RCV in Model 2 is even more striking than the case where real estate and capital are used as collateral. With time varying credit constraints the RCV increases to 0.95. Thus, changing the collateral regime improves the fit of the model significantly. Model 2 with time-varying credit constraints can explain the δ_{RCV}, which is shown in Table 5.

The entrepreneur's collateral also plays an important role in the increased volatility of consumption in Model 2. Since borrowing is bound to output, an increase in borrowing due to a positive credit shock leads to higher demand for labor. This increases

the real wage rates further, and also relaxes borrowing constraint since the constraint is bound to the labor income. Real wages respond to credit constraint shocks more than the real estate prices. As a result, consumption cycles are more pronounced. The impulse response functions of real wages and total consumption also provide evidence to this increased volatility, as presented in Fig. 6 and 7.

These results suggest that lack of real estate and capital, combined with time-varying credit constraints, leads to higher consumption volatility. However, it is also worth mentioning that Model 2 assumes the extreme case where constrained households do not own any real estate at all. One can include another type of households who can offer their real estate when borrowing. In that case, the RCV will be lower than 0.95. I choose to compare the two extreme cases since the model already has three types of agents and including another type would make the model more complicated.

At this point it is instructive to compare my results to those of Mendoza (2002) and Resende (2006). I find that international credit constraints are able to explain the higher consumption volatility in emerging economies. By contrast, Mendoza (2002) finds that the existence of financial constraints does not generate a significant difference in the relative volatility of consumption. Resende (2006) is able to increase the relative consumption volatility only by 16.3 per cent. Hence, my results suggest a much stronger role than previous studies for the international credit constraints in generating consumption volatility in emerging economies.

Because the model presented in this paper is considerably different from their models, there are a few other reasons why my results differ from theirs. First, I assume that international credit constraints are binding at all times because the banks will borrow

up to their limits as long as the domestic interest rate is higher than the world interest rate. Theory suggests a decline in domestic interest rates due to the increase in capital inflows and in the long run the world interest rate and domestic interest rate will equalize. In that case, the bank will be indifferent and any combination of domestic and foreign borrowing will cost the same. Here the equilibrium is maintained with different interest rates because of the existence of binding credit constraints. As discussed in Section 2, the empirical evidence on interest rates also provides support for this hypothesis. Domestic interest rates in most of the emerging economies stay above the world interest rate to attract foreign capital since part of the investment and consumption spending is financed by foreign capital, even in good times. In financial turmoil episodes, which are the times the economies need borrowing from abroad at most, due to the credit limits and the decline in the value of their collateral assets, the level of foreign borrowing declines and economies can not protect themselves against negative shocks. Another difference is that, I model the credit constrained households and banking sector explicitly, which plays a key role in driving the consumption volatility. The time variation in the credit limit has also important implications.

1.5.1.2 Income Distribution

In this section, I study the consumption dynamics of households and entrepreneurs under two different population share regimes. The baseline set-up assumes that the agents are equally distributed (33 percent each). To analyze the RCV for different income inequality levels, I increase the population share of impatient households to 50 percent, keeping their income shares constant. The distribution of income now becomes more skewed since half of the population gets the 34 percent of total labor income.

Table 6 presents the results. In the first row, I set population share of impatient households to 33 percent, which is the baseline value in the model's set-up. In this case, the consumption volatility for patient and impatient households are 2.10 and 2.95 percent, respectively. The consumption volatility of entrepreneurs is 0.77 percent, where the total consumption volatility is 2.03 percent. When I increase the population share of impatient households to 50 percent, the total consumption volatility increases to 2.35, leading to an increase in the RCV. In Model 2, the total consumption volatility increases to 3.03. More importantly, the RCV increases to 1.02, which is 18 percent higher than the case where income is more equally distributed.

The sample correlations between Gini index and relative consumption volatility presented in Section 2 shows some evidence to this link. In economies where the banks and households face credit constraints, income inequality leads to higher consumption volatility. Supported with the model statistics, this evidence indicates that greater income inequality in emerging economies is one of the factors that helps to explain the δ_{RCV} .

1.5.2 Variance Decomposition

Table 7a and 7b present the variance decompositions of output and consumption. The technology shocks tend to explain the lion's share of output and consumption variation. Examining the impact of credit constraint shocks, the results suggest that banks credit constraint shock explain 24 percent of total consumption volatility while it has its greatest impact on patient households consumption volatility by almost 32 percent. The channel for the patient households works through the impact on domestic interest rates since the variation in credit availability from abroad results in higher volatility in interest

rates. The exogenous shocks to the banks credit constraint explain almost 18 percent of variation in credit constrained households consumption via its effect on credit availability and 1 percent of entrepreneurs consumption. The results also suggest that the exogenous shocks to households and entrepreneurs credit constraints exert perceptible effect on consumption volatility of credit constrained households.

Finally, the world interest rate shock does not help to explain the output and consumption volatility which is consistent with earlier literature (see for example, Mendoza, 1991; Schmitt-Grohe, 1998) that finds world interest rate shocks have small effects on business cycle dynamics.

Table 7b presents the variance decompositions for the case where households borrowing is bound to labor income and entrepreneurs borrowing is bound to output. In this case, the shock to the banks credit constraints account for a 50 percent of variation in total consumption. Banks credit constraint shocks have their greatest impact on the patient households consumption volatility by 57.22 percent.

1.6 Concluding Remarks

This paper finds evidence that the higher relative consumption volatility in emerging economies can be linked to the existence of international credit constraints and its variation across time. The model economy that incorporates the constant international credit constraints experiences 20 percent higher consumption volatility compared to the economy where there is no international credit constraints. The credit shocks account for 12 to 24 percent variation of consumption and explains 4 to 20 percent of the δ_{RCV}. My results also suggest that collateral types matter and when interacted with time-varying credit constraints, it explains the δ_{RCV}. I further analyze whether different income distribution schemes affect the households consumption volatility. I show that total consumption volatility increases significantly when the population share of credit constrained households increase, keeping their income shares constant.

These results indicate that financial liberalization does not lead to consumption smoothing when international credit constraints exist. Low levels of collateral, time variation in the credit constraints, and income inequality strengthens the effects of international credit constraints. Focusing both on the supply and demand side of the economy and accounting for the three characteristics of emerging economies, the model successfully matches the δ_{RCV}. Welfare evaluations of credit constraints, collateral levels and income distribution skewness will be addressed in future research.

APPENDIX

This Appendix presents an open-economy real business cycle model used in Section 4.2.1. The set-up of the model differs from the model in the text only in the banking sector. Here, I assume that the model economy does not face borrowing constraints while borrowing from international markets. In this model, financial intermediaries have access to loans with exogenous interest rate without facing any borrowing constraints. As a consequence, the steady-state of the model depends upon the country's initial net foreign asset position. This leads transient shocks to have long-run effects on the state of the economy. That is, the equilibrium dynamics posses a random walk component. To resolve this problem, researchers resort a number of modifications to a standard open economy business cycle model. To induce stationarity, I study a model with a debt-elastic interest rate premium.[15] After solving the optimization problem of the banking system without the borrowing constraint, I get the following equations for the deposit and lending interest rates:

$$r_t = r_t^* + p(f_t) \tag{1.49}$$

$$r_t' = r_t + \kappa \tag{1.50}$$

where $p(.)$ is a country-specific interest rate premium. The function $p(.)$ is assumed to be strictly increasing. Following Uribe and Schmitt (2003), I use the following functional form for the risk premium:

$$p(f_t) = \omega(e^{f_t - \bar{f}} - 1) \tag{1.51}$$

[15]Uribe and Schmitt (2003) compares the business-cycle properties of five different variations of the small open economy. Their main result is that all models deliver virtually identical dynamics at business-cycle

The parameter $\bar{f}$ equals the steady-state level of foreign debt. I set the $\bar{f}$ so that the steady-state level of foreign debt equals to one implied by the baseline model, which 30 percent of GDP.[16] Finally, I set the parameter ω so as the ensure that this model and baseline model generate the same volatility in the current-account-to-GDP ratio. The remaining part of the model is unchanged.

frequencies.
[16]Mendoza (2002) sets the ratio of foreign borrowing to GDP equal to 0.35.

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Table 1.1: Relative Volatility of Consumption in Emerging and Developed Economies

Emerging Markets	σ_c/σ_y	Developed Markets	σ_c/σ_y
Argentina	1.38	Australia	0.69
Brazil	2.01	Austria	0.87
Ecuador	2.39	Belgium	0.81
Israel	1.60	Canada	0.77
Korea	1.23	Denmark	1.19
Malaysia	1.70	Finland	0.94
Mexico	1.24	Netherlands	1.07
Peru	0.92	New Zealand	0.90
Philippines	0.62	Norway	1.32
Slovak Republic	2.04	Portugal	1.02
South Africa	1.61	Spain	1.11
Thailand	1.09	Sweden	0.97
Turkey	1.09	Switzerland	0.51
MEAN	1.45	MEAN	0.94

Source: Agiuar and Gopinath (2007)

Table 1.2: Calibrated Parameters

	Parameter	*Value*
Patient households discount factor	β^p	0.99
Impatient households discount factor	β^h	0.95
Entrepreneurs discount factor	β^e	0.98
Labor elasticity	η	1.45
Weight on housing services	γ	0.08
Capital share	μ	0.32
Capital adjustment costs	ϕ	0.025
Income share of patient households	α	0.64
Depreciation	θ	0.03
Banks overhead costs	κ	0.03
Impatient households credit constraint	m^h	0.56
Entrepreneurs credit constraint	m^e	0.08
Banks credit constraint	m^b	0.32
Technology	ρ^A	0.70
Impatient households credit constraint	ρ^h	0.32
Entrepreneurs credit constraint	ρ^e	0.65
Banks credit constraint	ρ^b	0.70
World interest rate	ρ^r	0.83
Banks shock and technology	ρ^{ba}	0.60
Technology	σ^A	0.024
Impatient households credit constraint	σ^h	0.04
Entrepreneurs credit constraint	σ^e	0.02
Banks credit constraint	σ^b	0.09
World interest rate	σ^r	0.007

Table 1.3: Comparison of Domestic Real Interest Rates with World Interest Rates

	Interbank Real Interest Rate	Time Period
WORLD (LIBOR)	0.94	1990-2006
CANADA	2.63	1990-2006
KOREA	4.59	1990-2006
MEXICO	6.10	1990-2006
TURKEY	7.06	1990-2006

Source: International Financial Statistics

Table 1.4a: The RCV without International Credit Constraints

	Data	Model 1	Model 2
	(1)	(2)	(3)
$std(c_t^p)$	-	1.40	1.41
$std(c_t^h)$	-	2.35	4.15
$std(c_t^e)$	-	0.76	0.69
$std(c_t)$	3.97	1.52	1.77
$std(y_t)$	2.74	2.94	2.98
$std(c_t)/std(y_t) = RCV$	1.45	0.52	0.59

Notes: c^p, c^h, c^e are the log of consumption of patient households, impatient households, and entrepreneurs. c_t and y_t are log of total consumption and output, respectively. The entries are the standard deviations of each variable in percentages.

Table 1.4b: The RCV with Constant International Credit Constraints

	Data	Model 1	Model 2
	(1)	(2)	(3)
$std(c_t^p)$	-	1.69	2.01
$std(c_t^h)$	-	2.56	3.73
$std(c_t^e)$	-	0.76	0.68
$std(c_t)$	3.97	1.73	1.89
$std(y_t)$	2.74	2.81	2.90
$std(c_t)/std(y_t) = RCV$	1.45	0.62	0.65

Table 1.4c: The RCV with Time-Varying International Credit Constraints

	Data	Model 1	Model 2
	(1)	(2)	(3)
$std(c_t^p)$	-	2.10	2.97
$std(c_t^h)$	-	2.95	4.84
$std(c_t^e)$	-	0.77	0.68
$std(c_t)$	3.97	2.03	2.80
$std(y_t)$	2.74	2.92	2.94
$std(c_t)/std(y_t) = RCV$	1.45	0.69	0.95

Table 1.5: Accounting for the RCV Differential

	*Model*1	*Model*2
Constant Credit Constraints	1.19	1.25
Time-varying Credit Constraints	1.33	1.83

Note: The entries are the RCV differential (δ_{RCV}) -- ratio of the $RCV_{Emerging}$ to $RCV_{Developed}$ for the model economies. $RCV_{Developed}$ represents the case where economies do not face international credit constraints and have collateral (Table 4a Column 2). The four entries for $RCV_{Emerging}$ represent the four different scenarios. In the data, $RCV_{Emerging} / RCV_{Developed}$ (δ_{RCV}) is equal to 1.54.

Table 1.6: Income Distribution and the RCV

	Model 1		Model 2	
	Population share of impatient=0.33	Population share of impatient=0.50	Population share of impatient=0.33	Population share of impatient=0.50
$std(c_t^p)$	2.10	2.01	2.97	2.94
$std(c_t^h)$	2.95	3.02	4.84	4.42
$std(c_t^e)$	0.77	0.97	0.68	0.87
$std(c_t)$	2.03	2.35	2.80	3.08
$std(y_t)$	2.92	2.99	2.94	3.03
$std(c_t)/std(y_t)$	0.69	0.79	0.95	1.02

Notes: c_t and y_t are log of total consumption and output, respectively. The entries are the standard deviations of each variable in percentages.

Table 1.7a: Variance Decompositions under Real Estate Collateral Regime

	$Techn.(A)$	$Bank(m^b)$	$Entr.(m^e)$	$HH(m^h)$
$std(c_t^p)$	64.81	31.64	3.36	0.20
$std(c_t^h)$	78.19	17.45	2.86	1.50
$std(c_t^e)$	97.90	1.25	0.73	0.04
$std(c_t)$	73.78	23.74	2.18	0.30
$std(y_t)$	89.77	8.45	1.68	0.10

Table 1.7b: Variance Decompositions under Labor Income Collateral Regime

	$Techn.(A)$	$Bank(m^b)$	$Entr.(m^e)$	$HH(m^h)$
$std(c_t^p)$	31.34	57.22	7.08	4.86
$std(c_t^h)$	33.05	35.62	27.89	3.44
$std(c_t^e)$	96.34	0.30	1.06	2.30
$std(c_t)$	36.11	50.18	5.44	8.28
$std(y_t)$	81.56	4.21	0.85	13.39

Table 1.8: Glossary of Symbols

Symbol	*Definition*
b_t^p	Patient households borrowing
b_t^h	Impatient households borrowing
b_t^e	Entrepreneurs borrowing
f_t	Banks borrowing from international credit markets
c_t^p	Patient households consumption
c_t^h	Impatient households consumption
c_t^e	Entrepreneurs consumption
h_t^p	Patient households housing demand
h_t^h	Impatient households housing demand
H	Housing supply
l_t^p	Patient households labor supply
l_t^h	Impatient households labor supply
L_t^p	Patient households labor demand
L_t^h	Impatient households labor demand
r_t	Deposit interest rate
r_t'	Lending interest rate
$r*$	World interest rate
w_t^p	Patient households wage rate
w_t^h	Impatient households wage rate
q_t	Housing prices
Y_t	Output
K_t	Capital
I_t	Investment

Figure 1.1: Foreign Liabilities and Total Assets of the Banking System

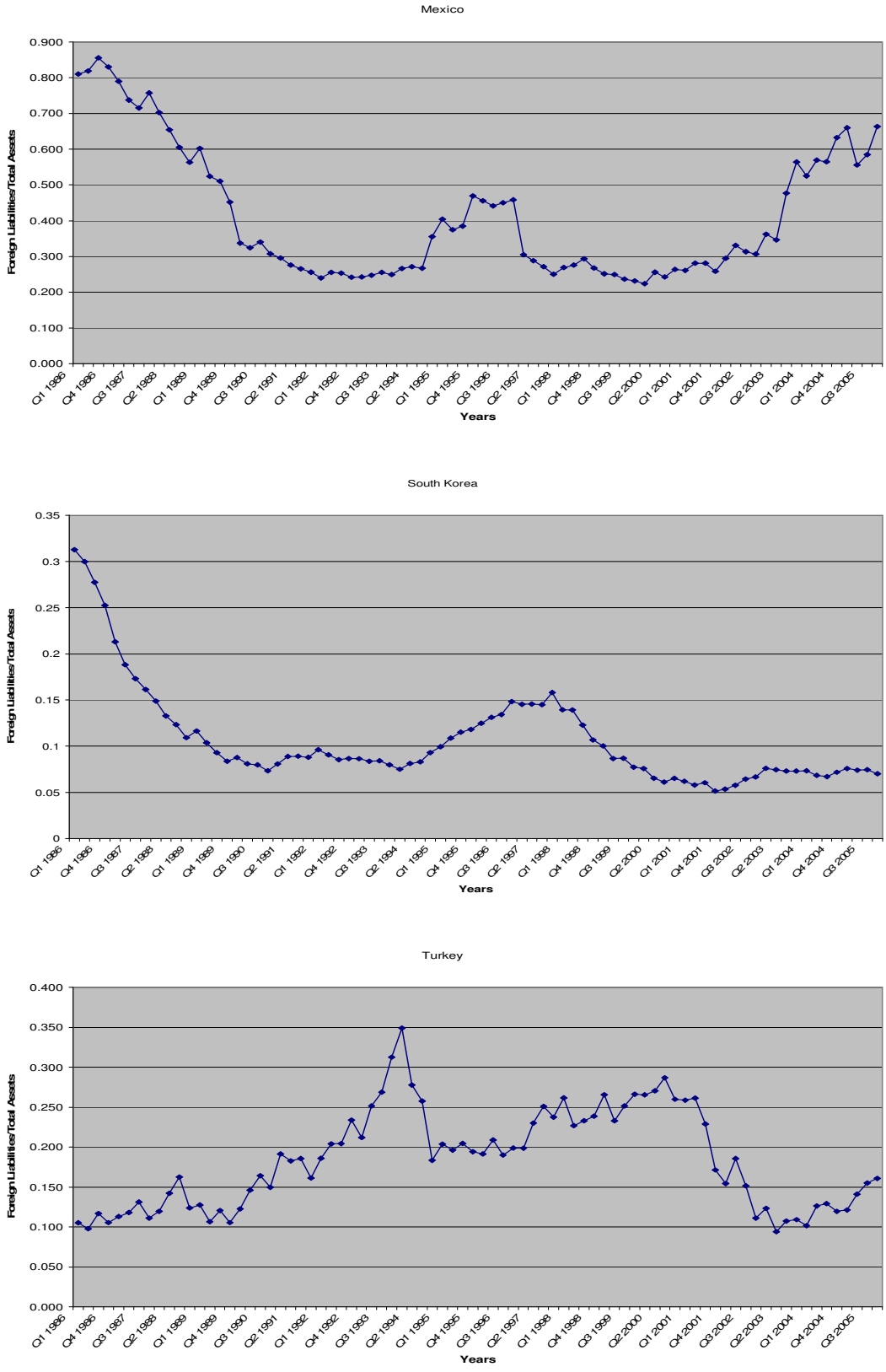


Figure 1.2: Impulse responses of selected variables to a positive productivity shock in a standard open-economy model

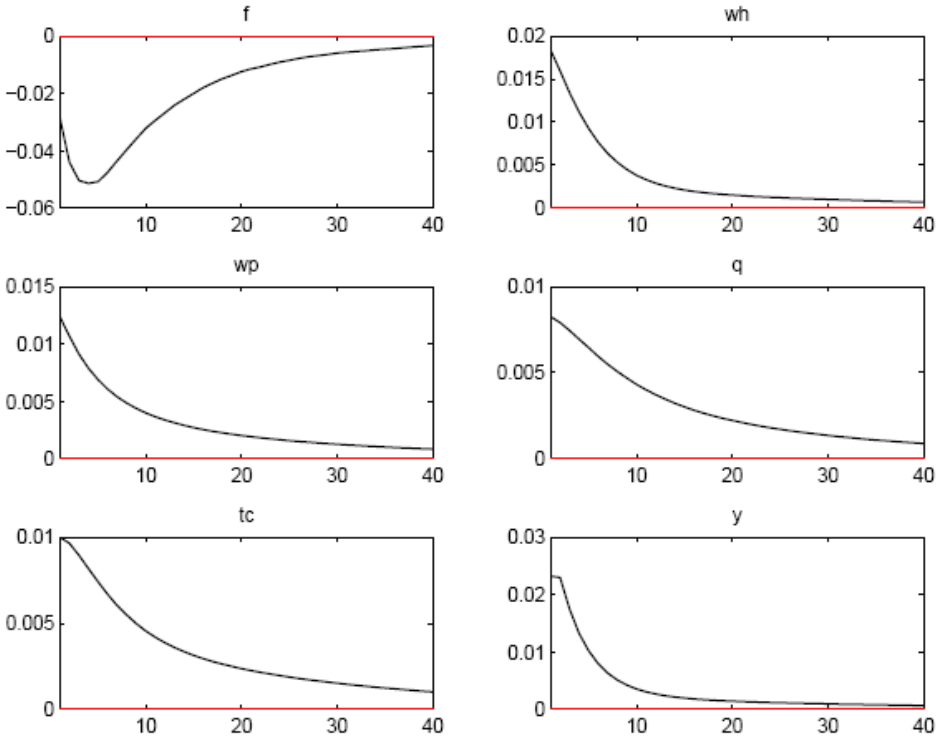


Figure 1.3: Impulse responses of selected variables to productivity shock in real estate collateral regime

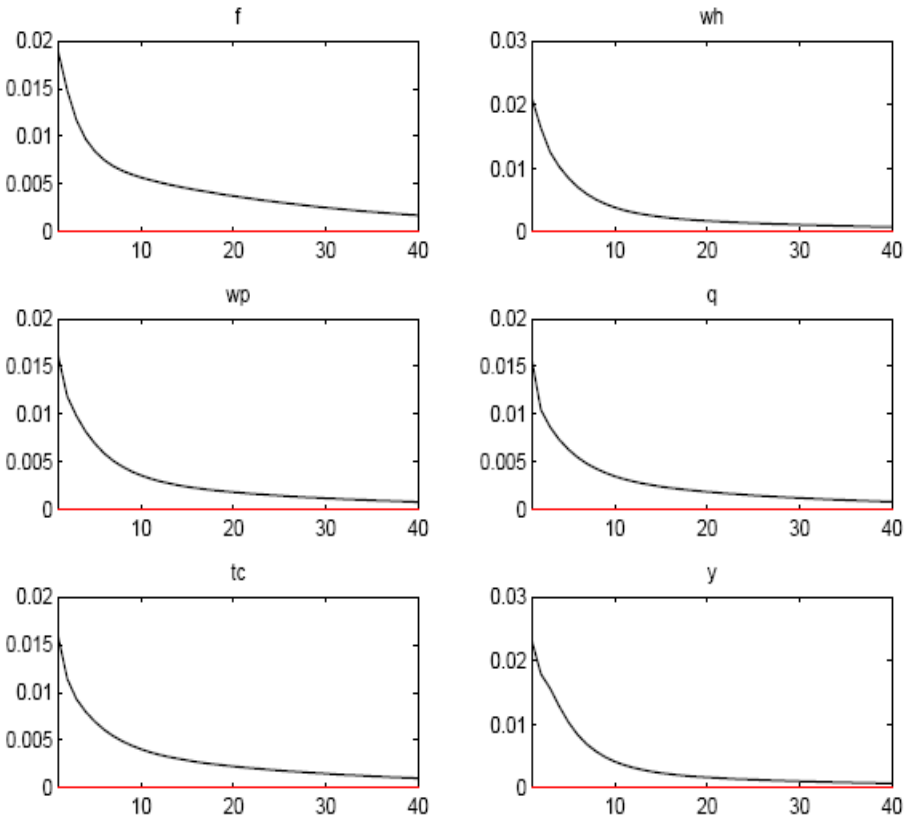


Figure 1.4: Impulse responses of selected variables to productivity shock in labor income collateral regime

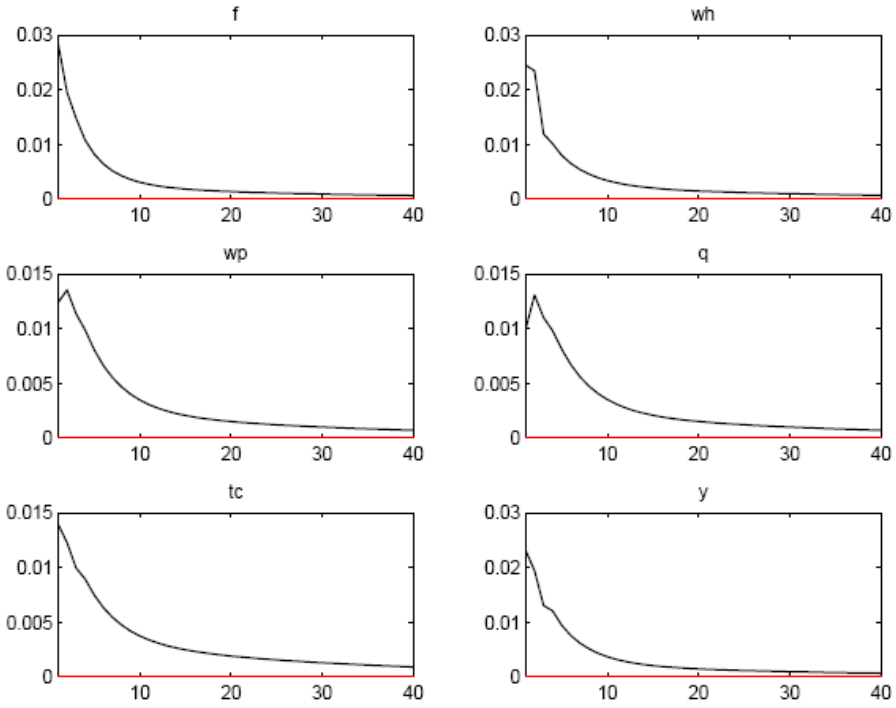
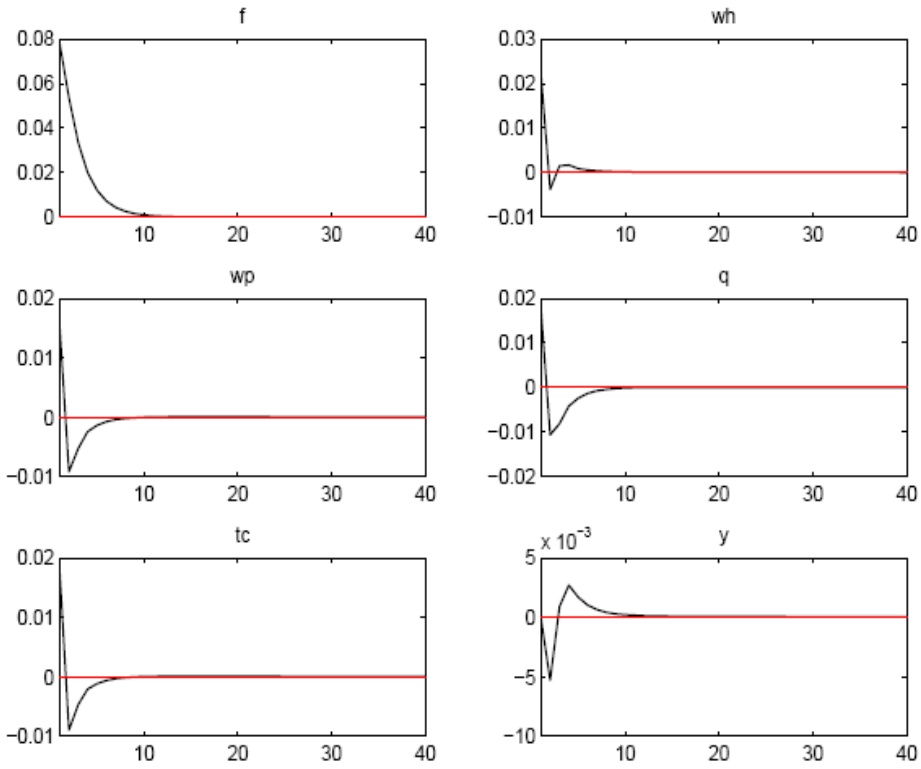


Figure 1.5: Impulse responses of selected variables to credit shock in labor income collateral regime



Chapter 2

Studying the Effects of Household and Firm Credit on the Trade Balance: The Composition of Funds Matters

Berrak Büyükkarabacak and Stefan Krause

Abstract

A higher level of private credit indicates better-developed financial markets and easier credit access for businesses and households. Yet, two types of borrowers vary in terms of the use of credit. In this paper, we study the link between the components of private credit and the trade balance. We focus on the distinction between household and corporate sector credit and investigate whether these two types of credit have adverse effects on the trade balance. Our results suggest that: 1) private credit to households is negatively and significantly correlated with net exports; 2) private credit to firms is positively and significantly correlated with net exports.

JEL classification: F32, F41, G21

Keywords: Firm and Household Credit, Financial Development, Trade Balance

2.1 Introduction

The implications of higher levels of financial development have been investigated by a large number of studies, both in the empirical growth and financial crisis literatures.[1] A widely used indicator of financial development is the relative importance of loans issued by commercial banks and other financial intermediaries to the entire private sector; i.e., the Private Credit to Gross Domestic Product (GDP) ratio, following the definition by King and Levine (1993a, b).

A higher level of private credit indicates better-developed financial markets and easier credit access for businesses and households. Yet, two types of borrowers vary in terms of the use of credit and might have different effects on macroeconomic variables. In this paper, we study the link between the components of private credit and the trade balance. We focus on the distinction between household and corporate sector credit and investigate whether these two types of credit have adverse effects on the trade balance of goods are services.

This paper builds on a theoretical framework by Backus, Kydland and Kehoe (1994) who studies the dynamics of the trade balance. We extend their work by assuming two types of households, one being credit constrained due to enforcement problems. We then ease the credit constraints on households and firms and study the hypothesized effects by comparative static analysis. More specifically, we argue that an increase in the household credit raises the demand for consumption goods whereas firm credit growth raises the demand for investment goods. While both can have a negative impact on the

[1] King and Levine (1993a, b), Levine (1997), Beck et al. (2000) and Levine et al. (2000) among others provide evidence for a statistically significant and economically important effect of financial system development on economic growth. See Demirguc-Kunt and Detragiache (1997), Kaminsky, Lizondo and Reinhart (1998), and Kaminsky and Reinhart (1999) on the adverse effects of credit expansions.

trade balance, the difference is important because borrowing to finance consumption does not add to the productive capacity of an economy and to greater export earnings (Frankel and Rose 1996). Firm credit, on the other hand, has the potential to increase investment by relaxing the credit constraints on firms, thus increasing exports and trade balance.

Exploring the decomposition of private credit in emerging countries is interesting for several reasons. First, the effects of the increased level of household credit in emerging economies are still ambiguous. On the one hand, the increased access to household credit helps credit constrained households to smooth out their consumptions; on the other hand, it boosts consumption and hence decreases savings. An influential paper by Japelli and Pagano (1994) shows that liquidity constraints on households raise the saving rates. They also find empirical evidence that an increase in the household credit decreases saving rates for a sample of OECD countries. Yet, the effects of household credit in emerging economies have not been explored.

Second, if we find that household and firm credit have different impacts on the trade balance of goods and services, this underlines the importance of the decomposition of private credit, which will also have important implications for the financial development-growth link. The level of private credit in emerging economies has been rising steadily after the financial liberalization process that has taken place in early 1990s. However, higher levels of private credit do not necessarily mean higher levels of firm credit. In fact, the data for emerging economies show that household credit, rather than firm credit, has been increasing in the last decade. The higher share of household credit in the total private credit can crowd out investment, especially in countries where the stock and bond markets are not well developed to fund the investment financing.

Finally, a possible negative link between household credit and trade balance has important policy implications for emerging economies. As argued by Wood (1997), "[...] the [International Monetary] Fund continues to place most emphasis within its programmes on the stabilisation objective and therefore the core of IMF programmes continues to be based upon the restriction of domestic credit creation [...]." The practice of limiting credit growth has been adopted by several developing countries; in particular Mexico during the 1994-1995 crisis (Gruben and McComb, 1997) and Brazil in 1999 (International Monetary Fund, 2003). Although the focus is mostly on total private credit, a recent IMF paper by Hilbers et. al (2005) points out that distinguishing between household and firm credit is a "key element" in evaluating the risks associated with credit expansions.

Kletzer and Bardhan (1987) and Beck (2001) have also investigated the relationship between trade balance and the level of financial development. Kletzer and Bardhan (1987) argue that countries with a relatively well-developed financial sector have a comparative advantage in industries and sectors that rely on external finance. Beck (2002) extends their work by allowing the manufacturing sector to be more credit extensive due to increasing returns to scale. He argues that in countries that have better-developed financial sectors, the ratio of the manufacturing products to total production will be higher due to lower external cost. This will lead to higher export shares of manufactured goods that facilitate large-scale and high-return projects.

While higher levels of private credit are associated with a higher trade balance in the theoretical literature, financial crises literature argues that rapid growth in bank credit to the private sector is a common factor associated with financial crises in developing

countries. There is abundant empirical evidence that credit expansions precede banking and currency crises (Demirguc-Kunt and Detragiache 1997; Kaminsky, Lizondo and Reinhart 1998; Kaminsky and Reinhart 1999). In their extensive and detailed review of the causes and consequences of the East Asian Crisis, Ito and Krueger (2001) found one common underlying explanation: the expansion of private domestic credit, combined with weak regulation, is the main catalyst of the currency crises and trade imbalances in East Asian countries during the latter 1990s.[2]

The empirical literature on financial development shows some mixed results regarding the link between private credit and external balances. This paper aims to extend the empirical literature by exploring the effects of the two components of private credit: household and firm credit. We test our hypotheses applying GMM dynamic panel estimators for a sample of eighteen emerging countries. Our empirical results show that household credit is negatively and firm credit is positively correlated with the trade balance of goods and services.

Since Beck (2002) also studies the link between financial development and trade balance, we find it worthwhile to compare our results with his results. Beck (2002) focuses on the trade balance of manufactured goods and finds that higher levels of financial development lead to a higher export share and trade balance in manufactured goods. While he focuses on the production sector in more depth and differentiate between constant returns to scale (food) and increasing returns to scale sectors (manufacturing), we believe that focusing on the credit decomposition enhances our empirical results in terms of the importance of private credit.

[2] See Corsetti, Pesenti, and Roubini (1999) for the derivation of a model of financial crisis that focuses on moral hazard as the common source of overinvestment, excessive borrowing, and current account deficits in an economy with a poorly supervised and regulated financial sector.

The remainder of the paper is organized as follows: In Section 2 we present a simple theoretical framework to analyze the effects of household and firm credit on the trade balance. We then describe our sample selection and data in Section 3. Section 4 describes the model specification and methodology. We model the trade surplus of goods and services as a function of private lending to consumers and producers, and the relative importance of each component, alongside some control variables. In Section 5 we present our results, some comparative statics exercises, and provide some policy prescriptions based on our main findings. Section 6 concludes and elaborates on possible extensions.

2.2 The Model

2.2.1 Households

In this section, we provide a simple theoretical framework to motivate our empirical analysis. Our model is in the spirit of Backus et al. (1994), in which they study the relationship between terms of trade and the trade balance. We enrich their model by relaxing the constraints on households and study the effects of household and firm credit on the trade balance. This is a two-country economy, in which each country produces a different good with its own technology. Preferences of the representative agent in each country n are characterized by utility functions of the form

$$E_t \sum_{i=0}^{\infty} \beta^i U(c_{n,t+i}) \tag{2.1}$$

where $U(c_t) = c_t^{1-\gamma}/(1-\gamma)$. Each household is endowed with an exogenous income of l_t. Following Campell and Mankiw (1991), we assume that there are two types of

households. Type 1 consumers can smooth out their consumptions because they are not credit constrained.

Type 1 consumer's problem is to choose consumption c_t to solve

$$\max \mathrm{U} = E_t \sum_{i=0}^{\infty} \beta^i U(c_{n,t+i}) \tag{2.2}$$

subject to

$$w_{t+1} = (1 + r_t) w_t + l_t - c_t \tag{2.3}$$

and

$$\lim_{i \to \infty} E_t [w_{t+i} / (1 + r_t)^i] = 0 \tag{2.4}$$

Equation (3) describes the evolution of wealth w_t over time; r_t is the real interest rate, and l_t is income. Equation (4) is the constraint that prevents the household from running a Ponzi scheme.

On the other hand, Type 2 consumers are credit constrained. They have an additional binding constraint.

$$w_{t+1} - (1 + r_t) w_t = -\mu_t l_t \tag{2.5}$$

where μ_t is a time-varying credit constraint. Equation 5 implies that the net indebtedness of a constrained consumer can not exceed a varying fraction of the income. The time-varying credit constraint μ_t is the fraction of the household credit to disposable income.

The division of the population into Type 1 and Type 2 consumers implies the following aggregate consumption function for each country

$$c_t = \lambda c_t^{Type1} + (1 - \lambda) c_t^{Type2} \tag{2.6}$$

This equation gives the fraction of consumption in total output of each Type 1 and Type 2 consumer. For the Type 1 consumers, the intertemporal Euler equation is standard.

$$U'(c_t) = \beta E_t[U'(c_{t+1})(1 + r_{t+1})] \tag{2.7}$$

Assuming that interest rates and consumption are jointly conditionally lognormal and homoskedastic, the Euler equation for Type 1 households simplifies to;

$$\Delta \ln c_t^{Type1} = \alpha^* + \sigma \ln(1 + r_t) \tag{2.8}$$

where α^* and σ are constants. With binding credit constraints for the Type 2 households;

$$c_t^{Type2} = l_t(1 + \mu_t) \tag{2.9}$$

where $l_t.\mu_t$ is equal to the amount of household credit, hc_t.

Combining Equations (8) and (9) and rearranging yields the aggregate consumption function:

$$\Delta c_t = \alpha + \beta_1 r_t + \beta_2 \Delta l_t + \beta_3 \Delta(l_t \mu_t) \tag{2.10}$$

2.2.2 Production

With respect to the technology, each country specializes in the production of a single good, labeled *a* for country 1 and *b* for country 2. The goods are produced using capital, *k,* with linear homogenous production functions of the same form. This gives rise to the resource constraints

$$a_{1t} + a_{2t} = y_{1t} = F(k_{1t}) \tag{2.11}$$

$$b_{1t} + b_{2t} = y_{2t} = F(k_{2t}) \tag{2.12}$$

We assume that in both countries $\partial F / \partial k > 0$. To incorporate the firm credit variable into the model, we assume that capital at time t is the sum of firm credit and wealth of the firms.

$$k_t = fc_t + w_t \tag{2.13}$$

where fc_t is the amount of credit that is allocated to firms. Consumption and investment, denoted *c* and *x*, respectively, are composite of foreign and domestic goods:

$$c_{1t} + x_{1t} = G(a_{1t}, b_{1t}) \tag{2.14}$$

$$c_{2t} + x_{2t} = G(a_{2t}, b_{2t}) \tag{2.15}$$

where $G(a,b) = [q_1 a^{-\rho} + q_2 b^{-\rho}]^{-1/\rho}$ is homogenous of degree one and $\rho \geq -1$. The elasticity of substitution between foreign and domestic goods is $\sigma = 1/(1+\rho)$. We measure the trade balance for country 1 as the ratio of net exports to output, with both measured in current prices:

$$nx_t = (a_{2t} - p_t b_{1t}) / y_{1t} \tag{2.16}$$

where p represents the nominal exchange rate. Using Equations (10), (14) and (16) the relation between trade balance and household credit for Country 1 can be shown as the following:

$$\frac{\partial nx_t}{\partial hc_t} = \underbrace{\frac{\partial nx_t}{\partial b_{1t}}}_{-} \times \underbrace{\frac{\partial b_{1t}}{\partial c_{1t}}}_{+} \times \underbrace{\frac{\partial c_{1t}}{\partial hc_t}}_{+} < 0 \tag{2.17}$$

Using Equations (13), (14) and (16), we can also show that the following derivative provides the relationship between firm credit and the trade balance

$$\frac{\partial nx_t}{\partial fc_t} = [\underbrace{\frac{\partial nx_t}{\partial a_{2t}}}_{+} \times \underbrace{\frac{\partial a_{2t}}{\partial x_{1t}}}_{+} \times \underbrace{\frac{\partial x_{1t}}{\partial k_{1t}}}_{+} \times \underbrace{\frac{\partial k_{1t}}{\partial fc_{1t}}}_{+}] + [\underbrace{\frac{\partial nx_t}{\partial b_{1t}}}_{-} \times \underbrace{\frac{\partial b_{1t}}{\partial x_{1t}}}_{+} \times \underbrace{\frac{\partial x_{1t}}{\partial k_{1t}}}_{+} \times \underbrace{\frac{\partial k_{1t}}{\partial fc_{1t}}}_{+}] \tag{2.18}$$

where $\frac{\partial nx_t}{\partial fc_t} = [\underbrace{\frac{\partial nx_t}{\partial a_{2t}}}_{+} \times \underbrace{\frac{\partial a_{2t}}{\partial x_t}}_{+} \times \underbrace{\frac{\partial x_t}{\partial k_t}}_{+} \times \underbrace{\frac{\partial k_t}{\partial fc_t}}_{+}] > 0$, $[\underbrace{\frac{\partial nx_t}{\partial b_{1t}}}_{-} \times \underbrace{\frac{\partial b_{1t}}{\partial x_{1t}}}_{+} \times \underbrace{\frac{\partial x_{1t}}{\partial k_{1t}}}_{+} \times \underbrace{\frac{\partial k_{1t}}{\partial fc_{1t}}}_{+}] < 0$

Our simple framework yields two empirical predictions: (i) household credit has a negative effect on the trade balance (ii) the effect of firm credit has two components: on the one hand, it helps firms to raise funds to increase investment, which in turn increase exports; on the other hand, an increase in investment has an increasing effect on imports because of the import-intensive structure of investment. Therefore, in theory, the sign of the effect of firm credit depends on which effect dominates. Still, it is our contention that for emerging markets the export-oriented production capacity generated through firm investment will more than offset the increase in imports of raw materials and capital, leading to an overall positive effect of firm credit on net exports.

The testable implications of our model can be thusly formalized into two main hypotheses:

- *Hypothesis 1: A rise in household credit causes a decrease in the foreign trade surplus through its effect on consumption spending*.
- *Hypothesis 2: The effect of firm credit is ambiguous depending on the import-intensity of investment. Eventually, an expansion in firm credit should lead to a rise in net exports by boosting capital accumulation, production and exports.*

Prior to performing the empirical tests of these hypotheses and discussing our main findings, we describe the data characteristics in the following section.

2.3 Sample Selection and Data Description

The available data sources used by the profession provide the aggregate value of credit to the private sector but do not distinguish between its household and firm credit components. Therefore, we use data from the national central bank reports and statistics of emerging market economies where historical disaggregated credit data are available. We study the question at hand using a panel of countries, for which at least ten years of data points is available and reliable. Eighteen emerging markets fit these criteria: Brazil, Costa Rica, the Czech Republic, Egypt, Hungary, India, Indonesia, Jamaica, Macedonia, Malaysia, Mexico, Poland, South Africa, Thailand, Turkey, Ukraine, and Uruguay.[3]

Although we use national sources, the definitions for the firm and household credit are consistent across countries. Specifically, the firm credit variable includes credit to non-financial corporations from the banking system. Household credit includes housing and consumer credit from banks to the households. Since not all of the central banks provide the decomposition of household credit, we cannot distinguish the separate effects.[4]

Our focus on emerging markets deserves some justification. The response of trade balance to changes in the economic conditions is likely to be different in emerging countries vis-à-vis developed economies. The countries in our sample are credit constrained, unlike industrial economies. Private credit is an important determinant

[3] We were also able to obtain data for South Korea and Slovenia. However, these two countries are outliers in terms of the economic development (over US$10,000 GDP per capita in 2000), so we do not include those countries. We also have data for Romania; however, due to an inconsistency in the data, we opted to exclude it.

[4] If the housing credit accounts for a high proportion of household credit, it is possible to argue that the causal link between imports and household credit is weak. Although there is no direct link between housing credit and import, an increase in housing credit can indirectly increase the consumption of imported goods through the increased demand for furniture and white durables goods. On the other hand, for the countries for which the household credit decomposition is available, the share of housing credit to household credit varies from 10 percent (Turkey) to 60 percent (Thailand).

source of funding because of small stock market size. All of the countries had relatively small stock markets during most of the period of study, as shown in the Table 1. With the exception of India, Malaysia, South Africa, and Thailand stock market capitalization does not exceed thirty percent of GDP during the last fifteen years. This implies that the private sector in most of these economies heavily relies on banks and financial intermediaries as a source of funds for investment.

Another reason to focus on emerging markets is that household credit is becoming increasingly important in the portfolios of commercial banks and is likely to increase in importance even further due to financial innovation. The countries we consider have undertaken measures to eliminate financial repression either slightly before or during the 1990s. Although two countries in our sample, Pakistan and India, has followed a more gradual financial liberalization process, credit composition has started to change in favor of household credit after liberalization of the domestic banking system and the international foreign capital. Table 1 shows the increase in the share of household credit in the total private credit. Except for Malaysia and South Africa, household credit has started to become an important portion of the total private credit.

We also provide further evidence on the evolution of both types of credit as a percentage of GDP in Table 2a and 2b. Most of the countries in our sample have been experiencing an expansion of household credit. During 1996-2005, household credit to GDP ratio increased by 13% per year on average for the countries in our sample. Although these high growth rates are striking, they are partially due to very low starting points. For example, in Turkey, household credit to GDP ratio is 0.69% in 1987, where in 2005 this number reaches to 9.35%. Firm credit to GDP ratio, on the other hand, follows

a more gradual process. The growth rate of firm credit to GDP ratio is around 1%, which shows that household credit has been a more dynamic component of private credit and requires further attention in analyzing the consequences of credit components on the trade balance.

Table 3 presents the sample correlation of trade balance and its components (exports and imports) with household and firm credit. Household credit and imports of goods and services are positively correlated, with a correlation coefficient 0.037. Firm credit also has a positive correlation with imports. However, when we look at the correlation between net exports and firm credit, the correlation coefficient is 0.142, where the correlation between net exports and household credit is negative, -0.008.

It is worth mentioning the two countries that the negative link between household credit and net exports of goods and services are pronounced: Turkey and South Africa. The experiences of these two countries suggest that an increase in the household credit to GDP ratio deteriorates the trade balance of goods and services. In Turkey, the negative correlation between household credit and net exports is -0.15. Two data points provide further evidence for the pronounced link: in 1993 household credit to GDP ratio increased from 0.21% to 2.4% coinciding with a trade deficit increase from 2.9% to 5.6%. Turkey experienced the same trend in household credit and trade deficit in 2000. Just before the severe financial crisis in 2001, the household credit to GDP ratio in 2000 was 5.5% with almost 100% growth rate.[5] The same year, Turkey experienced a trade deficit of 7.4%, which is almost 4% higher than the previous year's trade deficit.

The other country that experiences a strong negative relationship between household credit and net exports is South Africa. The data for South Africa show that in

[5] In 1999, the household credit to GGDP ratio was 2.8%.

2002 the household credit to GDP ratio is 28.5% with a trade balance of 3.6%. In 2005, the household credit ratio increased by almost 11% of GDP, where the trade balance deteriorated to -1.5%. These developments in the emerging markets raise the question whether household credit growth is sustainable or whether it deteriorates the trade balance; thus leading macroeconomic imbalances. It also casts some important policy questions in countries where the total private credit, hence firm credit, depends strictly on the access to international capital markets. Will the increase in the share of household credit put some restraints on the available funds for corporate sector? Yet, the literature has not paid much attention to the macroeconomic implications of household credit in emerging markets.[6]

2.4 Model Specification and Estimation Method

2.4.1 Model Specification

We now proceed to empirically analyze how the trade balance of goods and services, as a fraction of GDP, is associated with household and firm credit to GDP ratios. We also include additional control variables on the basis of their relevance in the literature. These are the domestic output growth rate, the real depreciation, real interest rate, the volatility of terms of trade, the black market premium, and the output growth rate of industrialized countries.

Our model is dynamic and includes some explanatory variables that are potentially endogenous. Clearly, the level of aggregate spending is directly related to

[6] A number of studies focus on the macroeconomic implications of household credit for developed economies. Muellbauer and Murphy (1990) and Miles (1992) discuss the effects of household credit on current account balance for United Kingdom. Bacchetta and Gerlach (1997) study the effects of household and consumer credit on consumption for developed economies. Ludvigson (1999) examines the role of consumer credit in United States.

bank lending and conversely. Also, by national accounting, both exports and imports depend on the level of aggregate demand and vice versa, which implies that net exports and domestic credit are determined simultaneously. We also allow the domestic output growth rate, the real depreciation, and real interest rate to be (weakly) endogenous since the behaviors of these variables are also affected by the movement in the trade balance. Because of the existence of the endogenous variables, along with the dynamic behavior of our analysis, we use dynamic panel generalized method of moments (GMM) techniques[7] Consistent with our testable implications from equations (17) and (18), and incorporating other control variables, we are interested in estimating the following equation:

$$\Delta n_{i,t} = \alpha_{11}\Delta n_{i,t-1} + \alpha_{21}\Delta n_{i,t-2} + \beta_{11} hc_{i,t} + \beta_{21} fc_{i,t} + \delta_1 cv_{i,t} + \upsilon_{2i} + \varepsilon_{2i,t} \qquad (2.19)$$

where: t represents the year; n represents the exports minus imports divided by GDP; υ_i and η_i are the country-specific effects; hc and fc are the household-credit-to-GDP ratio and firm-credit-to-GDP ratio; and cv is the set of control variables. It includes the real depreciation rate; the real domestic output growth, and the real interest rate. While an exogenous increase in the domestic output growth should decrease the trade balance, an increase in the real interest rate should have a positive effect on the trade balance.

We then consider the other additional variables that the literature uses as determinants of the trade balance of goods and services. More specifically, we control for the industrial output growth rate of industrialized countries, volatility of terms of trade,

[7] This method is fully described in Arrellano and Bond (1991), Arrellano and Bover (1995), and Blundell and Bond (1998).

and black market premium. Calderon, Chong and Loayza (2002) and Chinn and Ito (2005) have found these variables to be important in predicting the dynamic behavior of the current account balance.

The reason for using the difference rather than the level of the trade balance to the GDP ratio is the high persistence in the trade balance to GDP series. Unit root tests suggest that fifteen out of eighteen countries are not stationary. Along with testing the unit root for each individual country using the Dickey-Fuller and Phillips-Perron Tests, we also use Fisher panel data unit root test.[8] The auto-covariance of the trade balance for the pooled sample is 0.89 and with the specification we use, the coefficient of the lagged trade balance is estimated in the range of 0.9 and 1.[9]

As Frankel and Rose (1996) argued, it is possible that borrowing to finance investment might add to the *long-term* productive capacity of an economy and to greater export earnings. We investigate this hypothesis by taking the four-year moving averages and re-estimate equation (19).[10]

2.4.2 Estimation Method

To control for country-specific factors and joint endogeneity, we use *system* GMM estimator. This technique combines the GMM difference estimator with an estimator in levels. The GMM difference estimator uses the lagged levels of the explanatory variables as instruments under the condition that the error term is not serially correlated and the lagged levels of the explanatory variables are weakly exogenous. After

[8] Unit root tests for panel data test for the hypothesis that *all* series are stationary vs. *all* series are non-stationary. We reject the null that all series are non-stationary since three countries in our sample have stationary trade balance to GDP data.

[9] The results of the regression using levels are consistent with the results using first differences and are available from the authors upon request.

[10] We use overlapping averaged values because of our limited sample size. To use three and five year averages does not change our results.

first differencing Equation (19) to eliminate the country specific effect, the use of instruments is required to deal with the enodegenity between the credit and the trade balance; and between the new error term and the differenced lagged dependent variable. The following moment conditions are used to calculate the difference estimator:

$$E[y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \text{ for } s \geq 2 \text{ ; } t = 3,\ldots,T \tag{2.20}$$

$$E[X_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \text{ for } s \geq 2 \text{ ; } t = 3,\ldots,T \tag{2.21}$$

where $X_{i,t-s}$ is the matrix for the explanatory variables that includes the household credit to GDP, firm credit to GDP, real domestic output growth, and the real interest rate.

Blundell and Bond (1998) show that when the lagged dependent and the explanatory variables are persistent over time, lagged levels are weak instruments for the regression equation in differences. The weakness of instruments produces biased coefficients in small samples. So, combining the difference estimator with an estimator in levels reduces the potential biases and imprecision associated with the usual difference estimator. The additional moment conditions for the regression in levels are:

$$E[y_{i,t-s} - y_{i,t-s-1}(\eta_i + \varepsilon_{i,t})] = 0 \text{ for } s = 2 \tag{2.22}$$

$$E[X_{i,t-s} - X_{i,t-s-1}(\eta_i + \varepsilon_{i,t})] = 0 \text{ for } s = 2 \tag{2.23}$$

The consistency of the GMM estimator depends on whether the lagged values of the explanatory variables are valid instruments. To test the validity of the instruments we use Sargan statistics. The second test we use examines the hypothesis that the error term of the difference equation is not second order serially correlated. If the test fails to reject the null hypothesis of absence of second-order serial correlation, we conclude that the original error term is serially uncorrelated.

2.5 Results

2.5.1 Model Estimation

The first column of Table 2 presents the results of estimating the baseline specification from equation (19). The data corroborates both our hypotheses. The ratio of household credit to GDP is negatively and (at the 10% level) significantly correlated with a change in the trade balance. The coefficient on firm credit ratio is positive and significant at the 5% level, consistent with our second hypothesis: controlling for other variables, the rise in exports due to an increase in credit for business investment is larger than the increase in imports from acquiring foreign capital, raw materials, and intermediate inputs for production.

The first lag of the dependent variable is insignificant where the second lag is significant.[11] Real depreciation has the expected sign: an increase of the price of foreign goods relative to domestic goods is associated with a rise of the trade surplus. Finally, we note that the specification tests indicate no evidence of either over-identifying restrictions or second-order serial correlation of the residuals. Regarding the other control variables, the sign for domestic output growth is negative and significant at the 1% level. A rationale for this result is that a higher level of development in emerging markets, all other things equal, is associated with an increase in imports more than proportional than the rise in exports, leading to a deterioration of the trade balance. Finally, the effect of the real interest rate is negligible.

[11] The reason we do not use the more standard one lag specification is that the test for second order correlation does reject the null hypothesis that the error terms in the first-difference regression exhibit no second-order serial correlation. The results for the one lag specification are available from the authors upon request.

The second column of Table 2 incorporates the effect of output growth rate of industrialized countries. While the sign of the coefficient is consistent with the literature and indicates a positive effect, we failed to find a significant relationship between output growth rate of industrialized countries and the trade balance. The results for our variables of interest are unchanged: the coefficients remain significant and their signs are still as our hypotheses predict. Real depreciation maintains its positive and significant sign. Regarding the other control variables, we find that the volatility of terms of trade has no significant effect on the trade balance.[12] We also fail to find a significant effect of black market premium on the trade balance, which is consistent with Calderon et al. (2002). After controlling for these variables, both of the credit variables become significant at 5% confidence level.

As we mentioned in the previous section, it has been argued in the literature that borrowing to finance investment might result in greater export earnings in the medium term. We consider an alternative estimation employing four-year moving averages to verify if there is evidence of the validity of this claim in our sample of emerging markets.[13] The results of estimating equations (19) and (20) with four-year rolling averages are presented in Table 3.

Our findings suggest that, when looking at medium-term horizons, the relative importance of both household and firm credit on the trade balance becomes smaller: the coefficients, albeit in line with our hypotheses, are roughly half the size of the ones obtained employing year-by-year data. This outcome holds when GDP growth and the

[12] The level of the terms of trade would also be expected to affect the evolution of the trade balance (Calderon et al., 2002). However, since the data that we have is in index form, we were unable to use this variable in our analysis.

[13] We also performed estimations using three-year and five-year moving averages, with very little change in the main findings. These results are available from the authors upon request.

real interest rate are included as control variables. Therefore, we do not find any conclusive evidence that considering a longer time horizon increases the strength of the export effect of business investment.

One potential explanation is that "smoothing" the data through the use of moving averages results in a less precise relationship. One way to overcome this problem would be segmenting the data into separate subperiods of several years, and come closer to a "medium-term" effect. Unfortunately, we are unable to adopt this approach, due to our data limitations.

2.5.2 Comparative Statics and Implications

Exactly how big are the effects of changes in the allocation of funds to consumption and the composition of private credit on the trade balance? Given the high persistence of net exports, an increase of the household credit to GDP ratio of one percentage point per year over a period of 10 years, could result in a reduction in net exports ranging between 0.55% of GDP and 1.57% of GDP, all other things equal.

The relative importance of this outcome can be best explained by looking at a select group of countries, which have experienced an average trade deficit higher than 2% of GDP in the period 2001-2005.[14] Table 5 presents the results of a comparative statics analysis performed for Costa Rica, Hungary, Poland and Turkey. Our exercise sheds some light into the impact that the expansion of household credit has had on net exports. In the case of Costa Rica, if consumer lending as percentage of GDP had remained stable, the trade deficit could be as close as half of the actual average level between 2001 and

[14] There are six countries in our sample that meet this criterion: Costa Rica, Hungary, Jamaica, Macedonia, Poland, and Turkey. However, since we do not have complete data for Jamaica and Macedonia for 2005, we exclude them from this part of the analysis.

2005. For Poland and Turkey, a control of household credit growth could have led almost to a balanced account, compared to their actual average trade deficits of 2.39% and 2.95% respectively.

The most striking case would be that of Hungary: a control of consumer lending might have resulted, all other things equal in a favorable trade balance surplus of over 3% of GDP. Even simply halving their substantial increase of nearly 4 percentage points per year in consumer lending as a ratio to GDP to an average of 2 percentage points could have lead Hungary to a trade surplus.

Summarizing, there are several key implications that stem from our estimation results and the comparative statics analysis. First, the composition of credit does matter for the trade balance: lending to household has a significantly negative effect on net exports; while firm loans due contribute to an improvement in the trade balance. Second, the estimated effects are sizeable: a one percent rise in the foreign trade deficit may result from an increase in consumer credit as a fraction of GDP in the order of only **one** percentage point per year for a period of ten years.

2.6 Conclusions

We have argued and presented evidence that analyzing the effects of the particular distribution of funds between households and firms is more important for explaining foreign trade imbalances than the size of domestic credit per se. A key implication of our findings is that in the presence of a sizeable trade deficit or a high risk of a currency crisis, policy makers should focus on the composition of credit in assessing the riskiness of private credit. While the higher level of firm credit is also likely to deteriorate the trade

balance, it has also the potential to add to export earnings of a country. Household credit, on the other hand, fuels consumption, thus increases imports and trade deficit.

Our findings support the hypothesis that a higher relative share of credit to producers is associated with a boost to net exports. The discussion on the effects of firms' credit on foreign trade deficit can be extended by analyzing the imports of goods and raw materials. Contingent on data availability, we would be interested in studying the likely outcomes of the allocation of funds to the private sector by way of considering the value added from exports relative to the purchase of (imported) raw materials and capital.

The literature on private credit has not paid much attention to the macroeconomic implications of household credit. Our paper provides some preliminary evidence on the effect of household credit growth on the trade balance. However, distinguishing between household and firm credit in empirical and theoretical studies will become even more important as financial liberalization take hold and financial systems around the world continue to develop.

Appendix: Data Sources

The countries included in the sample are: Brazil, Bulgaria, Costa Rica, the Czech Republic, Egypt, Hungary, India, Indonesia, Jamaica, Macedonia, Malaysia, Mexico, Pakistan, Poland, South Africa, Thailand, Turkey, Ukraine, and Uruguay. Firm Credit and Household Credit data was obtained from the individual central banks' websites for each individual country, while information for the remaining variables was obtained from the International Monetary Fund's International Financial Statistics database and World Bank Development database. Gross Domestic Product is line 99b, Exports and Imports of goods and services was obtained from lines 90c and 98c, respectively. Inflation is given by the percentage change in the Consumer Price Index with respect to the corresponding quarter of the previous year, and it is taken from line 64. Devaluation is the percentage change in the exchange rate of national currency per U.S. dollar. The Interest Rates used differed from country to country depending on data availability: the money market rate for Brazil, the Czech Republic, Malaysia, Ukraine, South Africa, Poland, and Thailand; the discount rate for Hungary, Costa Rica, and Egypt; the call money rate for India, Indonesia, and Pakistan, the interbank rate is for Turkey; the time deposit rate for Uruguay; the bankers' acceptances rate for Mexico; lending rate for Macedonia, and Jamaica. We obtained the volatility of terms of trade, the black market premium, and the output growth rate of industrialized countries from World Bank Development database.

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Table 2.1: Stock Market Size and Share of Household Credit in Total Private Credit

Country	Avg. stock market total value traded to GDP (%) (1988-2004) [a]	Increase in Household Credit Share [b]
Brazil	12.07	5.86
Costa Rica	0.97	41.06
Czech Republic	9.35	39.69
Egypt	3.55	9.51
Hungary	10.96	10.90
India	30.79	4.75
Indonesia	7.41	11.85
Jamaica	2.77	21.77
Macedonia	1.12	24.53
Malaysia	72.84	-3.40
Mexico	8.83	17.24
Pakistan	20.73	3.60
Poland	4.11	33.09
South Africa	31.59	-0.65
Thailand	36.84	9.56
Turkey	28.11	34.98
Ukraine	0.42	20.80
Uruguay	0.02	16.78

[a] Source: Own computation based on data from the World Development Indicators (2004)
[b] The increase in the share of household credit in total credit is computed from the first data point to the last data point available for each country in our sample.

Table 2.2a: Household Credit (%GDP)

Sub-Period Averages for Household Credit (%GDP)				
Country	1986-1990	1991-1995	1996-2000	2001-2005
Brazil	-	9.85	9.86	9.03
Costa Rica	2.19	2.89	6.71	13.25
Czech Republic	-	3.17	3.25	8.57
Egypt	-	3.98	7.98	8.32
Hungary	-	7.16	4.49	15.57
India	0.90	1.53	1.97	2.50
Indonesia	15.12	11.77	8.73	9.22
Jamaica	-	4.14	4.13	5.01
Macedonia	-	0.51	1.04	3.10
Malaysia	-	-	10.12	5.18
Mexico	-	9.38	5.10	9.75
Pakistan	1.58	2.10	2.24	2.47
Poland	-	-	4.35	8.63
South Africa	-	32.69	33.65	32.78
Thailand	8.59	17.98	15.30	13.52
Turkey	0.27	0.98	3.13	4.85
Ukraine	-	0.25	0.52	3.70
Uruguay	1.34	1.72	4.19	6.39

Table 2.2b: Business Credit (%GDP)

Sub-Period Averages for Business Credit (%GDP)				
Country	1986-1990	1991-1995	1996-2000	2001-2005
Brazil	-	21.63	17.69	18.58
Costa Rica	16.25	12.13	10.52	13.04
Czech Republic	-	48.83	35.85	14.89
Egypt	-	22.39	36.87	46.29
Hungary	-	33.31	40.12	46.81
India	15.91	14.92	16.82	27.53
Indonesia	28.32	26.35	19.21	10.9
Jamaica	-	18.59	12.15	9.26
Macedonia	-	7.30	9.68	10.19
Malaysia	-	-	126.42	113.85
Mexico	-	9.34	9.34	5.65
Pakistan	12.88	13.63	13.57	14.07
Poland	-	-	13.98	13.41
South Africa	-	58.12	68.00	70.30
Thailand	59.64	91.83	106.97	70.63
Turkey	10.21	11.15	15.01	10.81
Ukraine	-	7.22	8.14	19.28
Uruguay	16.41	11.08	13.58	20.62

Table 2.3: Sample Correlations, Annual Data, 1986-2005

	Household Credit (% GDP)	Firm Credit (% GDP)	Imports (% GDP)	Exports (% GDP)	Trade Balance (% GDP)
Household Credit (% GDP)	1				
Business Credit (% GDP)	0.525	1			
Imports (% GDP) (Rate of change?)	0.037	0.099	1		
Exports (% GDP)	0.025	0.186	0.698	1	
Trade Balance (% GDP)	-0.008	0.142	-0.184	0.576	1

Table 2.4: Trade Balance and Household/Firm Credit Composition.
Dynamic panel regression; one-step system estimator (Annual data)

Regressors	(1)	(2)	(3)	(4)
Trade Balance/GDP (-1)	-0.008 (0.89)	-0.014 (0.84)	0.010 (0.86)	-0.198 (0.02)
Trade Balance/GDP (-2)	-0.184 (0.00)	-0.188 (0.00)	-0.232 (0.00)	-0.358 (0.00)
Household Credit/GDP	-0.043 (0.09)	-0.044 (0.08)	-0.053 (0.04)	-0.075 (0.03)
Firm Credit/GDP	0.014 (0.03)	0.015 (0.03)	0.014 (0.01)	0.022 (0.03)
Real Depreciation	0.046 (0.00)	0.045 (0.00)	0.038 (0.00)	0.048 (0.00)
Domestic GDP Growth	-0.193 (0.01)	-0.201 (0.01)	-0.274 (0.00)	-0.272 (0.00)
Real Interest Rate	-0.001 (0.93)	-0.002 (0.89)	-0.004 (0.74)	0.009 (0.46)
OECD Growth		0.117 (0.57)	0.143 (0.48)	-0.176 (0.47)
Terms of Trade Volatility			0.012 (0.76)	0.038 (0.47)
Black Market Premium (in log[1+BMP])				-0.06 (0.13)
Sargan test[a] (p-values)	0.33	0.31	0.28	0.14
Arellano-Bond test[b] (p-values)	0.31	0.28	0.94	0.30
No. Countries / No. Obs.	198/18	198/18	167/14	64/10

[a] Test for over-identifying restrictions. The null hypothesis is that the instruments used are not correlated with the residuals.
[b] Serial correlation test. The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

Table 2.5: Trade Balance and Household/Firm Credit Composition,
Dynamic panel regression; one-step system estimator (4-year moving averages)

Regressors	(1)	(2)	(3)	(4)
Trade Balance/GDP (-1)	0.602 (0.00)	0.592 (0.00)	0.523 (0.00)	0.032 (0.79)
Trade Balance/GDP (-2)	-0.273 (0.00)	-0.267 (0.00)	-0.316 (0.00)	-0.174 (0.00)
Household Credit/GDP	-0.015 (0.22)	-0.015 (0.20)	-0.020 (0.09)	-0.048 (0.00)
Firm Credit/GDP	0.007 (0.03)	0.007 (0.03)	0.008 (0.01)	0.017 (0.03)
Real Depreciation	0.034 (0.00)	0.033 (0.00)	0.029 (0.00)	0.044 (0.00)
GDP Growth	-0.048 (0.21)	-0.047 (0.23)	-0.142 (0.00)	-0.188 (0.00)
Real Interest Rate	0.007 (0.34)	0.006 (0.41)	0.004 (0.63)	0.030 (0.00)
OECD Growth		0.156 (0.43)	0.173 (0.36)	-0.119 (0.58)
Terms of Trade Volatility			0.019 (0.29)	0.079 (0.00)
Black Market Premium (BMP) (in log[1+BMP])				-0.04 (0.11)
Sargan test[a] (p-values)	0.30	0.28	0.24	0.10
Arellano-Bond test[b] (p-values)	0.38	0.40	0.46	0.10
No. Countries / No. Obs.	141/18	141/18	122/14	36/9

[a] Test for over-identifying restrictions. The null hypothesis is that the instruments used are not correlated with the residuals.
[b] Serial correlation test. The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

Table 2.6: Comparative Statics,
Effect of Change in Household Credit Ratio on the Trade Surplus (2001-2005)

Country	**Average Annual Household Credit Growth (pct. pts.)**	**Average Surplus (% of GDP)**	**Predicted Surplus (β_1=-0.015)**	**Predicted Surplus (β_1=-0.043)**
Costa Rica	0.97	-3.69	-3.16	-2.16
Hungary	3.93	-2.80	-0.65	+3.37
Poland	1.00	-2.39	-1.84	-0.82
Turkey	1.64	-2.95	-2.05	-0.37

Table A.2.1: Data Description

Country	Period	Variable used for Household Credit	Variable used for Firm Credit
Brazil	1995-2005	Housing & Individuals' Loans	Industry, Rural & Commerce Sector Loans
Costa Rica	1987-2005	Consumption Loans	Agricultural, Industry & Services Sector Loans
Czech Republic	1994-2005	Credit to Households-Individuals	Credit to Non-financial Corporations
Egypt	1991-2004	Loans to Household Sector	Loans to Private Business Sector
Hungary	1994-2005	Households' Balance Sheet	Firms' Consolidated Balance Sheet
India	1986-2003	Personal Loans	Agriculture, Industry, Transport and Trade Loans
Indonesia	1990-2005	Credit to Households	Credit to Enterprises
Jamaica	1993-2004	Personal Loans	Loans to Private Enterprises
Macedonia	1995-2004	Total Claims on Households	Total Claims on Private Enterprises
Malaysia	1996-2005	Credit to Individuals	Agriculture, Mining, Manufacturing, Trade and Services Credit
Mexico	1994-2005	Credit to Housing & Consumption	Credit to Primary, Industry & Services
Pakistan	1986-2005	Personal Loans	Agriculture, Industry, Transport and Trade Loans
Poland	1995-2005	Claims to Household Sector	Claims to Corporate Sector

Country	Period	Variable used for Household Credit	Variable used for Firm Credit
South Africa	1991-2005	Household Credit	Credit to Private Enterprises
Thailand	1986-2005	Personal Consumption Credit (Includes Housing)	Agriculture, Mining, Manufacturing, Trade and Services Credit
Turkey	1987-2005	Private Credit to Households	Private Credit to Firms
Ukraine	1995-2005	Credit Granted to Households	Credit Granted to Non-financial Sector
Uruguay	1987-2002	Credit to Consumption	Credit to Agriculture, Industry, Commerce & Service

Table A.2.2: Trade Balance and Household/Firm Credit Composition,
Dynamic panel regression; one-step system estimator (Annual data)

Regressors	(1)	(2)	(3)	(4)
Trade Balance/GDP (-1)	-0.030 (0.93)	-0.031 (0.60)	-0.023 (0.81)	-0.117 (0.13)
Household Credit/GDP	-0.047 (0.08)	-0.047 (0.08)	-0.059 (0.03)	-0.066 (0.03)
Firm Credit/GDP	0.024 (0.00)	0.024 (0.00)	0.024 (0.00)	0.027 (0.01)
Real Depreciation	0.047 (0.00)	0.047 (0.00)	0.039 (0.00)	0.063 (0.00)
GDP Growth	-0.245 (0.00)	-0.246 (0.00)	-0.330 (0.00)	-0.205 (0.00)
Real Interest Rate	-0.002 (0.90)	-0.002 (0.901)	-0.003 (0.81)	0.005 (0.73)
OECD Growth		0.015 (0.946)	0.048 (0.89)	-0.133 (0.54
Terms of Trade Volatility			0.014 (0.76)	0.030 (0.58)
Black Market Premium				-0.04 (0.36)
Sargan test[a] (p-values)	0.35	0.33	0.30	0.18
Arellano-Bond test[b] (p-values)	0.02	0.02	0.01	0.01
No. Countries / No. Obs.	216/18	198/18	167/14	75/11

[a] Test for over-identifying restrictions. The null hypothesis is that the instruments used are not correlated with the residuals.
[b] Serial correlation test. The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

Chapter 3

Credit Expansions and Financial Crises:

The Roles of Household and Firm Credit

Berrak Büyükkarabacak and Neven Valev

Abstract

The literature has identified credit expansions to the private sector as an important predictor of financial crises in emerging economies. We extend the literature by decomposing credit into credit extended to households and credit extended to businesses. We compile a unique disaggregated data set and find evidence that household credit growth and business credit growth have positive, distinct, and statistically significant effects on the likelihood of banking and currency crises. Furthermore, household credit growth is a particularly important predictor of banking crises in countries with a high propensity to consume.

JEL Classification: E44, F41, G21

Keywords: Financial Crisis, Household and Firm Credit Growth

3.1 Introduction

Rapid growth in bank credit to the private sector is a common factor associated with financial crises in developing countries. While an expansion of credit can be beneficial for economic development in the long-run,[1] it may lead to macroeconomic disbalances and poor credit allocation in the short and medium term. There is abundant empirical evidence that credit expansions are often followed by banking crises and currency crises (Demirguc-Kunt and Detragiache 1997; Kaminsky et al., 1998; Kaminsky and Reinhart, 1999).[2]

We build on these studies by investigating how the components of private credit affect the likelihood of financial crises. In particular, we differentiate between household and firm credit. The literature has used the growth of total credit to the private sector, household and firm credit combined, as a predictor of crises but not separately. Yet, expansions of the two types of credit present distinct concerns for policymakers. Hilbers et al. (2005) point out that distinguishing between household and firm credit is a "key element" in evaluating the risks associated with credit expansions. To break down total private credit into household and firm credit, we use data from the national central banks of thirteen emerging economies. We find evidence that firm credit growth and household credit growth each increases the probability of a currency and a banking crisis. Furthermore, household credit expansions combined with a low national propensity to save are an even stronger predictor of banking crises.

[1] King and Levine (1993a, b), Levine (1997), and Levine et al. (2000) among others provide evidence for a statistically significant and economically important effect of financial system development on economic growth.

[2] For example, the IMF (2004) estimates that about three-fourths of the periods of rapid credit growth in emerging markets are associated with a subsequent banking crisis and almost seven-eights are associated with a currency crisis.

The paper is organized as follows. Section 2 discusses the theoretical differences and similarities between household credit and firm credit as pertaining to financial crises. Section 3 describes the data and the crisis definitions. Sections 4 and 5 present the empirical model and the estimation results, respectively. Section 6 concludes.

3.2 Credit Expansions and Financial Crises: Theoretical Background and Review of the Empirical Evidence

Credit expansions can lead to financial crises through three channels: 1) by creating *external macroeconomic disbalances*; 2) by inflating *asset bubbles*; and 3) by leading to *inefficient use of resources*.[3] Starting with the first channel, rapid credit growth can lead to a current account deficit if the demand for goods fueled by it cannot be satisfied by domestic supply. Generally, household credit growth raises the demand for consumption goods whereas firm credit growth raises the demand for investment goods. The difference is important because borrowing to finance consumption does not add to the long-term productive capacity of an economy and to greater export earnings (Frankel and Rose, 1996). Therefore, a boom in the demand for consumption goods could be particularly problematic. There is ample evidence that an increase in household credit leads to an increase in consumption (Ludvigson, 1999; Bacchetta and Gerlach, 1997), reduced savings (Japelli and Pagano, 1994) and current account deficits (Muellbauer and Murphy, 1990; Miles, 1992). In the context of emerging economies, expectations of future instability can also lead to a consumption boom and current account deficits as

[3] See Kaminsky and Schmuckler (2003) for a comprehensive chronology of financial liberalizations. Credit expansions might be the result of financial liberalization policies that reduce reserve requirements, increase competition in the banking system, and liberalize international capital flows. They might also arise from an imperfectly credible exchange-rate based stabilization (Calvo, 1986) or from implicit and explicit bailout guarantees (Corsetti et al. 1999a; Schneider and Tornell, 2004).

consumption is shifted from the future to the present (Calvo, 1986). This process can be facilitated by the availability of credit.

The consumption boom that results from rapid credit growth can be particularly strong in countries with traditionally low savings rates. In these economies, the relaxation of credit constraints raises household indebtedness without boosting significantly future income, thus increasing default risks (see Antzoulatos, 1996 and Copelman, 1996 for analyses of this phenomenon in Latin America). Another consequence of a low national savings rate is that the credit booms are financed by international capital inflows, which also raises the potential for financial crises (McKinnon and Pill, 1997). Conversely, firm credit growth lowers the cost of external finance to firms in countries with low saving rates and scarce capital. Rajan and Zingales (1998) show that a higher level of financial development helps financially dependent firms grow faster thus leading to higher investment and growth. The empirical specifications discussed in the following sections include an interaction term of household credit growth and firm credit growth with savings rates to test whether savings rates influence the effect of credit growth on crises as these studies suggest.

Turning to the asset price bubbles channel for crises, Bernanke et al. (1999) focus on the role of credit market frictions in business fluctuations. In their "financial accelerator" framework, endogenous developments in credit markets work to amplify and propagate shocks to the economy. During a boom, credit expands and asset prices increase, which in turn increases borrowers' net worth and leads to new lending and even higher asset prices. During a bust, the borrowers are not able to repay their loans and defaults increase. Allen and Gale (2000) also explore the role of credit expansions in

creating asset bubbles using an asset pricing model. Their model explains the existence of bubbles by the inability of lenders to observe the riskiness of borrowers' investment projects. Borio and Lowe (2002) show that sustained rapid credit growth combined with growth in asset prices increases the probability of a financial crisis.

It is not clear whether household credit growth or firm credit growth fuel the financial accelerator process more strongly. However, the channels are likely to be different. A large portion of household credit is mortgage credit; therefore its rapid growth might result in inflated residential real estate prices, especially if households have limited access to alternative investment options such as a well developed domestic stock market (Bank for International Settlements 2005). McKinnon and Pill (1997, 1998), for example, discuss that the rapid growth in certain types of household lending, particularly real estate finance and consumer credit, have been more problematic than others. Conversely, growth in firm credit might be associated with growth in commercial real estate prices and/or equity prices, both of which have been associated with crises (Borio and Lowe, 2002).

The third channel for crises (the inefficient use of resources) refers to the difficulties faced by overburdened loan officers to price loans appropriately when the volume of new loans created is increasing rapidly. "Evergreening" might also be prevalent, i.e. new loans are used to service old loans. Furthermore, the temporary economic boom spurred by credit-driven consumption and investment growth might be misperceived as a long-term shift in the economic potential of the economy (Duenwald et al. 2005). Overoptimistic expectations of future income might lead to greater indebtedness and defaults.

These problems could arise from both household and firm credit growth. However, the literature has discussed the issue primarily in terms of firm credit. For example, Corsetti et al. (1999a, b), Krugman (1998), and Scheider and Tornell (2004) argue that implicit and explicit bailout guarantees contributed to overinvestment, excessive borrowing, and current account deficits in Southeast Asia by inducing private borrowers and lenders to develop and carry out risky projects. This system, characterized by moral hazard, lack of transparency, and inefficient monitoring of projects, unraveled into a financial crisis when the low profitability of past investments and the shaky foundations of investment strategies became apparent. It is possible that the literature has focused mostly on firm credit because much of the household credit involves collateral (real estate) and therefore requires less precise judgments on the part of loan officers. Poor judgment might be less costly unless there is a large drop in real estate prices, a sharp increase in unemployment or a sharp increase in interest rates (while long-term credit rates are already fixed). However, the increase in the unsecured household debt, e.g. through increased availability of credit cards should also be a concern since higher levels of debt to income increase the probability of defaults.

In summary, the literature has advanced a number of arguments that distinguish (with more or less clarity) between the effects of rapid growth in household credit and in corporate credit. Also, the literature has investigated empirically the combined effect of these two types of credit on both currency and banking crises. In the following sections we perform empirical tests of the effect of credit expansions on crises differentiating between household and firm credit.

3.3 Data Description

3.3.1 Household and firm credit

The available data sources used by the profession provide the aggregate value of credit to the private sector but do not distinguish between its household and firm credit components. Therefore, we use data from the national central bank reports of emerging market economies where historical disaggregated credit data are available. Our dataset includes the following 13 countries: Argentina, Brazil, India, Indonesia, Malaysia, Mexico, Pakistan, South Africa, South Korea, Russia, Thailand, Turkey and Uruguay.[4] Although we use national sources, the definitions for the household and firm credit are consistent across countries. Specifically, household credit includes housing and consumer credit from deposit banks to households.[5] The firm credit variable includes credit to non-financial corporations from deposit banks. Table 1 shows the labels and the time periods for household and firm credit and Table 2 shows the levels of household and firm credit as percent of GDP for each country in the sample.

We measure the growth in household and firm credit as the two years moving average of the rate of change in the household and firm credit to GDP ratios. For example, the reported 0.55 growth in household credit for Argentina in Table 3 means that household credit as percent of GDP has been expanding by 0.55 percentage points on average during the sample years. Taking an average of 2 or 3 years is customary in the literature (Demirguc-Kunt and Detragiache, 1997; Rodrik and Velasco, 1999). We obtained similar results using a one year growth rate.

[4] Not all countries report data on the two types of credit. Furthermore, we excluded Nigeria since the data had several intervals of missing observations.
[5] In most countries these two components of household credit are not given separately.

Table 3 shows that while the average growth in the household credit to GDP ratio was positive (0.25), the growth in the firm credit to GDP ratio was essentially zero. Hence, household credit is increasing in size relative to firm credit. Note also that while the correlation of the growth in household credit and the growth in firm credit is positive, it is not large (only 0.33). Hence, household credit expansions do not necessarily occur alongside firm credit expansions.

3.3.2 Defining Banking Crisis

In constructing our banking crisis variable, we used primarily two studies, Demirguc-Kunt and Detragiache (1997) and Caprio and Klingebiel (2003). Demirguc-Kunt and Detragiache (1997) identify an episode of distress as a full-fledged crisis if at least one of the following conditions apply: the ratio of nonperforming assets to total assets in the banking system exceeds 10%; the cost to rescue operations is at least 2% of GDP; banking sector problems resulted in a large scale nationalization of banks, or generalized deposit guarantees were enacted by the government in response to the crisis.

However, Demirguc-Kunt and Detragiache (1997) do not consider the countries and the periods in which we are particularly interested. By using their definitions, we constructed our banking crisis variable using the information available via Caprio and Klingebiel (2003). A banking crisis is deemed to have occurred for a given year if the situation in the banking system satisfies one of the criteria that are mentioned above. To avoid capturing the same banking crisis period, we treat any financial distress period in the following year as part of the same banking crisis. Using this methodology, we identify 11 banking crises.

3.3.3 Defining Currency Crisis

In general, a currency crisis is characterized by various events, such as a sharp depreciation of the exchange rate, a reduction in foreign exchange reserves or an increase in interest rates. In this paper, we define a currency crisis in two ways[6]: (1) a weighted average of the depreciation of the exchange rate and reserve losses and (2) the depreciation of the nominal exchange rate. To measure the exchange rate, we use the percentage change in the exchange rate of the national currency per US$. For the first definition, the weights are chosen so that the two components of the index have the same conditional variance[7]. The weighted average of the two components exceeding its sample mean by two standard deviations or more is classified as a currency crisis.

For the second definition, a currency crisis is defined as a nominal depreciation of at least 25%. This cut-off point is arbitrary; however it is consistent with the literature (Frankel and Rose 1996). To ensure that we do not consider each of the consecutive years that satisfies our criteria, we require that the change in the exchange rate not only exceeds 25%, but exceeds the previous year's change in the exchange rate by a margin of at least 10%. For each country-year in our sample, we define a currency crisis for a given year if the currency for any month of that year satisfies one of our currency crisis definitions. To reduce the chances of coding the continuation of the same currency crisis episode, we treat any similar threshold point reached in the following year as a part of the same currency crisis. With this methodology, we identify 12 crises using our first definition and 13 crises by the second definition. A list of the banking and currency crisis episodes is presented in Tables 4 and 5, respectively.

[6] We are using the same definitions as Hong and Tornell (2005), which are widely used in the currency crises literature.

[7] The weights are chosen in the same way as Kaminsky et al. (1998).

3.4 Empirical Model

We begin our analysis by estimating the effects of household and firm credit growth, along with several control variables commonly used in the literature (Demirguc-Kunt and Detragiache 1997), on the probability of banking crises. In particular, we estimate the following equation:

$$\begin{aligned}\text{Banking Crisis}_{it} = {} & \alpha + \beta_1 * \text{HH Credit Growth}_{it} + \beta_2 * \text{Firm Credit Growth}_{it} + \\ & + \beta_3 * \text{Bank Reserves/Bank Assets}_{it} + \beta_4 * \text{M2/International Reserves}_{it} + \\ & + \beta_5 * \text{GDP Growth}_{it} + u_i + \varepsilon_{it}\end{aligned} \tag{3.1}$$

where i denotes country i and t denotes the time periods. We expect the M2 to international reserves ratio to affect the probability of a banking crisis positively whereas the bank reserves to bank assets ratio to affect the probability of a crisis negatively. Similarly, we expect to find a negative effect of real GDP growth on banking crises as greater GDP growth reflects positive macroeconomic developments in a country. We expect that household and firm credit growth increase the likelihood of a banking crisis.

Our estimation equation for currency crises includes household and firm credit growth and control variables selected on the basis of economic theory as well as recent findings of the empirical literature (Kaminsky and Reinhart, 1999):

$$\begin{aligned}\text{Currency Crisis}_{it} = {} & \mu + \gamma_1 * \text{HH Credit Growth}_{it} + \gamma_2 * \text{Firm Credit Growth}_{it} + \\ & + \gamma_3 * \text{Debt/GDP}_{it} + \gamma_4 * \text{Current Account Balance}_{it} + \\ & + \gamma_5 * \text{GDP Growth}_{it} + \gamma_5 * \text{M2/International Reserves}_{it} + \nu_i + e_{it}\end{aligned} \tag{3.2}$$

We expect to find a negative effect of GDP growth and the current account balance to GDP ratios on the probability of currency crises. The debt to GDP ratio, the M2 to international reserves ratio, and credit growth are expected to have positive effects.[8]

We estimate equations (1) and (2) with two additional specifications of credit growth. First, we estimate the equations using the growth of household and firm credit growth combined. This provides a benchmark estimate similar to the estimations performed in the literature. Then we decompose credit into household credit and firm credit. Second, we interact the household and firm credit growth variables with a measure of savings rates to investigate whether the effect of credit growth is different in countries with a low/high savings rate. We create a dummy variable for countries with a high savings rate, which equals 1 if the average savings to GDP ratio during the 1976 to 2004 period is above the mean of our sample and zero otherwise.[9] Table 6 shows that in our sample, the countries that have traditionally low savings rates are mainly Latin American countries, India, Pakistan, Turkey, and South Africa.

Our dependent variables are binary (0 = no crisis and 1 = crisis) and therefore we use a binary choice model. We estimate equations (1) and (2) using a logit model with country-specific random effects as well as a logit model utilizing population-averages. One advantage of using the population-averaged method is that it allows us to use the

[8] Because of our limited sample size, we try to be as parsimonious as possible. In addition to the variables in equation (2), we also used the short-term debt to total debt ratio and a measure of real exchange rate appreciation as independent variables. These two variables were not statistically significant and their inclusion did not affect substantially the remaining coefficient estimates. In addition to the variables in equation (1), we also introduce the real interest rate and GDP per capita, which did not have a statistically significant effect on banking crises.

[9] We use the historical savings rates to group our data in order to avoid a potential endogeneity problem, i.e. causality running from credit availability to saving rates.

Huber/White/sandwich estimator of variance that produces valid standard errors. Robust standard errors are calculated by the generalized estimating equations (GEE) approach. [10]

3.5 Empirical Results

3.5.1 Credit Expansions and Banking Crises

Table 7 presents the results for banking crises. For our baseline specification estimated with the household and firm credit growth combined, the results show that total credit growth is statistically significant at the 1% level and has the expected positive sign. This result is in line with the literature that shows a positive effect of private credit growth on the likelihood of a banking crisis. Regarding our control variables, GDP growth is significant at the 1% level with the expected negative sign. Conversely, the M2 to international reserves ratio and the bank reserves to total assets ratios do not have a statistically significant effect on the likelihood of banking crises in our sample.[11]

Now, we turn our attention to the variables of primary interest: household and firm credit growth. Once we decompose the private credit growth into firm and household credit growth, we find a positive and statistically significant effect of both variables using both estimation methods. Thus, household and firm credit growth have a distinct influence on the likelihood of a banking crisis. Furthermore, the growth in

[10]The relationship between the population-averaged robust estimator and the random effects estimator can be shown as the following (see Zeger et al. 1988 and Wooldridge, J. 2002): $\beta_{PA} \equiv \beta_{RE} /(1+\sigma_c^2)^{1/2}$ where β_{PA} is the population averaged parameter, β_{RE} is the random effects parameter and σ_c^2 is the variance of the unobserved effect c_i conditional on x_i.

[11] For each of our specifications, we ran Hausman tests and could not reject the null hypothesis that random effects estimators are consistent and efficient. Nonetheless, we also estimate the models with country-specific fixed effects. However, our data includes countries that did not experience crises during the time period we are analyzing. Using fixed effects eliminates those countries and reduces our sample size significantly. Our results for fixed effects are in line with our random effects estimation but with higher standard errors. The tables for fixed effects are available upon request.

household credit has a particularly strong predictive effect on banking crises in countries with low savings rates, as indicated by the negative and statistically significant coefficient on the interaction term of household credit growth and the dummy variable for high savings rates. Firm credit growth, on the other hand, appears to be more of a problem in the high savings countries. In our sample these are mostly the Southeast Asian countries where the crises were largely driven by booming investments funded by domestic and international capital.

In terms of marginal effects, the results imply that an increase of household credit growth from 1% to 2% of GDP results in a 2% increase in the probability of having a banking crisis.[12] Once we account for the countries that have traditionally low savings rates (recall that these are mostly countries in Latin America as well as India, Pakistan, Turkey, and South Africa) the effect becomes stronger. An increase of household credit growth from 1% to 2% of GDP leads to a 20% increase in the probability of having a banking crisis in those countries. Note that such an increase in household credit growth is not uncommon. For example, in Turkey the household credit to GDP ratio increased from 0.21% to 2.36% just before the crisis in 1994. For firm credit growth, an increase of firm credit growth from 1% to 2% of GDP results in a 1% increase in the probability of having a banking crisis. For the countries that have high savings rates, namely Southeast Asian countries, we calculate the effect of an increase from 1% to 2% in firm credit growth to be associated with an increase in the probability of having a banking crisis by 20%.

[12] The tables with marginal effects are available upon request.

3.5.2 Credit Expansions and Currency Crises

Next we report our estimations of the currency crises models. Table 8 reports the estimates using the first definition of currency crises which incorporates information on currency depreciation as well as foreign exchange reserves. The dependent variable in Table 9 is based on currency depreciation only. Overall the results using the two definitions are similar. All of the control variables have the expected signs and are statistically significant. GDP growth and the current account balance have a negative and statistically significant effect on the probability of having a currency crisis. The debt to GDP ratio and the M2 to international reserves ratio have a positive effect on the probability of a currency crisis. Columns 1 and 4 in the two tables also show that the growth in the total private credit (household and firm credit combined) significantly increases the likelihood of having a currency crisis as the literature suggests.

Now, we turn our attention to the variables of interest: household and firm credit growth. We find a statistically significant positive effect of firm credit growth on currency crisis with both definitions of currency crisis. Similarly, household credit growth has a positive and statistically significant effect on currency crises using both crisis definitions and both the random effects and the population-averaged robust estimations. Unlike the results on banking crises, we find no evidence that the rate of savings influences these results. In terms of marginal effects, an increase of household credit growth from 1% to 2% of GDP leads to a 1.6 percentage points increase in the probability of having a currency crisis. The marginal effects of firm credit show a similar pattern with lower magnitudes. We find that an increase of firm credit growth from 1% to 2% of GDP leads to a 0.5% increase in the probability of having a currency crisis.

Overall, our estimation results show that household credit growth and firm credit growth have positive, distinct, and statistically significant effects on the likelihood of banking and currency crises.[13] In terms of economic importance, the effect of credit growth on the likelihood of a banking crisis is stronger than the effect on a currency crisis. Furthermore, the effect of credit growth on banking crises depends on an economy's propensity to save. Household credit growth is a particularly important predictor of banking crises in countries with a traditionally low savings rate.

3.6 Conclusion

The literature has identified credit expansions as an important predictor of banking and currency crises in emerging markets. We confirm this finding and extend the literature by decomposing the total credit growth into household credit growth and firm credit growth. Our results show that the two types of credit have distinct and positive effects on the likelihood of financial crises, especially on banking crises.

Distinguishing between household and firm credit growth is important because in theory the two types of credit can affect the likelihood of financial crises in different ways as we discuss in section 2. Even if the channels of the effects are the same, empirical tests can show whether the strength of the effects differs. Furthermore, household and firm credit expansions do not necessarily occur simultaneously. Looking at total credit growth does not reveal which component of credit is driving the growth.

[13] We also estimate the impact of household and firm credit growth on twin crises which are defined as the simultaneous occurrence of banking and currency crises. Our results suggest that household and firm credit growth have a positive and significant effect on twin crises, household credit growth being more dangerous in countries that have higher propensity to consume. In that regard, our results for twin crisis are in line with the results from the banking crisis estimation.

Household credit is becoming increasingly important in the portfolios of commercial banks and is likely to increase in importance even further due to financial innovations. Also, household credit is growing rapidly in countries where only firms had access to credit until recently. Yet, the literature has not paid much attention to the macroeconomic implications of household credit. Our paper provides some preliminary evidence on the effect of household credit growth on banking and currency crises. However, distinguishing between household and firm credit in empirical and theoretical studies will become even more important as financial liberalizations take hold and financial systems around the world continue to develop.

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Table 3.1: Household and Firm Credit Variable Description

Country	*Period*	*Variable used for Household Credit*	*Variable used for Firm Credit*
Argentina	1991-1999	Family & Individual Loans	Primary, Industry and Services Sector Loans
Brazil	1995-2004	Housing & Individual Loans	Industry, Rural and Commerce Sector Loans
India	1972-1996	Personal Loans	Agriculture, Industry, Transport and Trade
Indonesia	1990-2003	Credit to Household	Credit to Private Enterprises
Korea	1994-2004	Credit to Household	Credit to Private Enterprises
Malaysia	1996-2004	Credit to Individuals	Agriculture, Mining, Manufacturing, Trade and Services Credit
Mexico	1994-2004	Credit to Housing and Consumption	Credit to Primary, Industry & Services
Pakistan	1983-2002	Personal Loans	Agriculture, Industry, Transport and Trade
Russia	1996-2004	Household Credit	Corporate Credit
South Africa	1991-2004	Household Credit	Credit to Private Enterprises
Thailand	1965-2004	Personal Consumption Credit(Includes Housing)	Agriculture, Mining, Manufacturing, Trade and Services Credit
Turkey	1986-2004	Private Credit to Households	Private Credit to Firms
Uruguay	1983-2001	Credit to Households	Agriculture, Industry, Commerce and Service Credit

Table 3.2: Levels of Household and Firm Credit as percent of GDP

Country	*Household Credit/GDP Mean*	*Firm Credit/GDP Mean*	*Household Credit/GDP Growth Mean*	*Firm Credit/GDP Growth Mean*
Argentina	5.06	8.26	0.55	0.34
Brazil	9.01	14.4	-0.18	-0.30
India	0.83	14.21	0.05	0.22
Indonesia	10.13	20.34	-0.39	-1.36
Korea	47.55	59.08	1.44	-0.35
Malaysia	17.59	32.06	0.63	-0.47
Mexico	17.52	30.73	1.03	-0.23
Pakistan	1.91	12.96	0.006	-0.009
Russia	0.90	11.04	0.23	1.70
South Africa	32.81	65.23	0.16	1.08
Thailand	5.92	37.08	-0.30	0.44
Turkey	1.95	11.37	0.25	-0.26
Uruguay	2.48	20.37	0.21	-0.45

Table 3.3: Descriptive Statistics

Variable	*Household credit growth*	*Firm credit growth*	*GDP growth*	*Current account balance to GDP*	*M2 to reserves*	*Bank reserves to assets*	*Total Debt to GDP*
Mean	0.25	0.03	4.32	-0.60	6.35	9.13	7.31
Maximum	7.08	10.31	13.28	18.03	31.12	34.13	35.40
Minimum	-4.19	-13.01	-13.12	-8.53	1.31	1.56	0.78
Standard deviation	1.36	2.97	4.47	4.50	4.82	6.57	6.10
Correlations							
Household credit growth	1.00						
Firm credit growth	0.33	1.00					
GDP growth	0.10	-0.02	1.00				
Current account balance	-0.11	-0.32	-0.24	1.00			
M2 to reserves	-0.04	0.14	0.06	-0.25	1.00		
Bank reserves to assets	-0.01	-0.06	-0.10	0.02	-0.04	1.00	
Total Debt to GDP	0.07	-0.24	-0.17	0.25	-0.30	-0.16	1.00

Table 3.4: Dates of Banking Crises

Country	*Banking Crises*
Argentina	1995
Brazil	1997
Indonesia	1997
Korea	1997
Malaysia	1997
Mexico	1995
Russia	1998
Thailand	1983,1997
Turkey	1994, 2000
Total	11

Table 3.5: Dates of Currency Crises

Country	Currency Crises defined by depreciation and reserve losses	Currency crises defined by depreciation
Argentina	1991, 1995	1991
Brazil	1999	1999
Indonesia	1997	1997
Korea	1997	1997
Malaysia	1997	1997
Mexico	1995	1995
Russia	1998	1998
South Africa	1996	1996, 2001
Thailand	1997	1997
Turkey	1994, 2001	1991, 1994, 2001
Total	12	13

Table 3.6: Saving Rates

Saving/GDP	*1976-1990*	*1990-2004*	***1976-2004***
Argentina	20.94	16.42	18.76
Brazil	18.88	18.58	18.74
India	12.05	13.89	12.93
Indonesia	26.52	24.54	**25.44**
Korea	29.96	34.71	**32.16**
Malaysia	25.86	34.77	**30.00**
Mexico	20.85	19.20	19.96
Pakistan	16.06	14.03	15.09
Russia	-	27.84	**27.84**
South Africa	24.78	16.08	20.58
Thailand	24.94	32.48	**28.58**
Turkey	16.47	20.76	18.54
Uruguay	13.61	13.31	13.46

Table 3.7: Population-Averaged Robust and Random Effects Estimation
Credit growth and banking crisis: logit panel regression

	(1)	(2)	(3)	(4)	(5)	(6)
Independent Variables	*Pa Robust Estimation*	*Pa Robust Estimation*	*Pa Robust Estimation*	*Random Effects*	*Random Effects*	*Random Effects*
Total Credit Growth	0.333 (0.115)***			0.335 (0.111)***		
Household Credit Growth		0.451 (0.132)***	1.853 (0.410)***		0.445 (0.207)**	1.822 (0.594)***
Firm Credit Growth		0.276 (0.158)*	-1.106 (0.297)***		0.283 (0.136)**	-1.081 (0.419)***
Household Credit Growth*High Saving Countries			-1.292 (0.367)***			-1.277 (0.594)**
Firm Credit Growth*High Saving Countries			1.705 (0.471)***			1.688 (0.548)***
Bank Reserves over Total Assets	-0.020 (0.039)	-0.026 (0.039)	-0.043 (0.044)	-0.021 (0.055)	-0.027 (0.055)	-0.041 (0.060)
M2 over International Reserves	-0.020 (0.080)	-0.016 (0.074)	0.067 (0.073)	-0.017 (0.082)	-0.011 (0.081)	0.068 (0.084)
GDP Growth	-0.147 (0.049)***	-0.162 (0.050)***	-0.186 (0.057)***	-0.145 (0.065)**	-0.157 (0.070)**	-0.180 (0.077)**
Constant	-2.311 (0.859)***	-2.523 (0.916)***	-3.834 (1.248)***	-2.319 (0.870)***	-2.534 (0.825)***	-3.809 (1.111)***
Observations	177	177	177	177	177	177
Number of countries	13	13	13	13	13	13

Standard errors are in parentheses. *, **, and *** indicate rejection at the 10 percent, 5 percent and 1 percent significance level.

Table 3.8: Population-Averaged Robust and Random Effects Estimation
Credit growth and currency crisis defined using reserves and depreciation:
logit panel regression

	(1)	(2)	(3)	(4)	(5)	(6)
	Pa Robust Estimation	*Pa Robust Estimation*	*Pa Robust Estimation*	*Random Effects*	*Random Effects*	*Random Effects*
Total Credit Growth	0.402 (0.142)***			0.494 (0.183)***		
Household Credit Growth		0.611 (0.190)***	0.828 (0.742)		0.655 (0.317)**	0.813 (0.603)
Firm Credit Growth		0.317 (0.167)*	-0.080 (0.613)		0.399 (0.204)**	0.020 (0.368)
Household Credit Growth*High Saving Countries			-0.184 (0.768)			-0.150 (0.663)
Firm Credit Growth*High Saving Countries			0.518 (0.626)			0.547 (0.438)
Total Debt over GDP	0.105 (0.037)***	0.102 (0.036)***	0.100 (0.043)**	0.120 (0.073)*	0.116 (0.070)*	0.112 (0.075)
Current Account Balance	-0.314 (0.087)***	-0.334 (0.097)***	-0.335 (0.104)***	-0.374 (0.176)**	-0.374 (0.172)**	-0.368 (0.164)**
GDP Growth	-0.377 (0.121)***	-0.415 (0.121)***	-0.441 (0.122)***	-0.396 (0.120)***	-0.419 (0.129)***	-0.433 (0.134)***
M2 over International Reserves	0.126 (0.064)**	0.134 (0.066)**	0.160 (0.075)**	0.167 (0.183)*	0.163 (0.088)*	0.181 (0.088)**
Constant	-4.688 (1.293)***	-4.736 (1.308)***	-4.940 (1.222)***	-5.613 (1.463)***	-5.453 (1.460)***	-5.584 (1.478)***
Observations	168	168	168	168	168	168
Number of Countries	13	13	13	13	13	13

Standard errors are in parentheses. *, **, and *** indicate rejection at the 10 percent, 5 percent and 1 percent significance level.

Table 3.9: Population-Averaged Robust and Random Effects Estimation
Credit growth and currency crisis defined using depreciation:
logit panel regression

	(1)	(2)	(3)	(4)	(5)	(6)
	Pa Robust Estimation	*Pa Robust Estimation*	*Pa Robust Estimation*	*Random Effects*	*Random Effects*	*Random Effects*
Total Credit Growth	0.349 (0.125)***			0.458 (0.160)***		
Household Credit Growth		0.454 (0.129)***	0.549 (0.471)		0.531 (0.317)*	0.591 (0.521)
Firm Credit Growth		0.303 (0.160)*	0.025 (0.452)		0.428 (0.195)**	0.145 (0.309)
Household Credit Growth*High Saving Countries			-0.058 (0.528)			-0.021 (0.635)
Firm Credit Growth*High Saving Countries			0.378 (0.441)			0.491 (0.408)
Total Debt over GDP	0.091 (0.026)***	0.089 (0.026)***	0.083 (0.033)**	0.121 (0.076)	0.121 (0.077)	0.116 (0.084)
Current Account Balance	-0.233 (0.072)***	-0.238 (0.074)***	-0.235 (0.082)***	-0.304 (0.162)*	-0.306 (0.164)*	-0.311 (0.163)*
GDP Growth	-0.287 (0.083)***	-0.303 (0.081)***	-0.318 (0.080)***	-0.320 (0.107)***	-0.328 (0.112)***	-0.341 (0.118)***
M2 over International Reserves	0.107 (0.040)***	0.111 (0.039)***	0.132 (0.047)***	0.152 (0.087)*	0.153 (0.088)*	0.168 (0.091)*
Constant	-4.171 (1.053)***	-4.155 (1.041)***	-4.260 (0.993)***	-5.395 (1.508)***	-5.448 (1.519)***	-5.658 (1.570)***
Observations	168	168	168	168	168	168
Number of Countries	13	13	13	13	13	13

Standard errors are in parenthesis. *, **, and *** indicate rejection at the 10 percent, 5 percent and 1 percent significance level.