JCC
Journal of
CENTRUM
Cathedra ™

CENTRUM
CENTRO DE NEGOCIOS

Firms' Financing, Contract Enforcement, and Liability Dollarization

by

César Sosa Padilla Araujo[1]

Ph.D. (c) in Economics. University of Maryland, USA

Abstract

This paper analyzes how the presence of liability dollarization, different degrees of contract enforcement, and the possibility to default on debts affect firms' financing decisions. The framework is a dynamic model of heterogeneous firms. They finance their capital acquisitions using their own income and borrowing from foreign lenders. The set of contracts available incorporates the possibility of default. The incentives to repay or default are determined by the firms' value relative to the value of default, controlled by the degree of contract enforcement and the presence of liability dollarization. Quantitative evidence is found to support the common wisdom that firms in economies subject to liability dollarization are more likely to default. The presence of liability dollarization increases the likelihood of default by 13%. Weak contract enforcement increases the probability of default by almost 19%. Default regions are determined, with small, highly leveraged firms being more prone to default.

Keywords: Liability Dollarization, Contract Enforcement, Firm Default, Emerging Economies

Introduction

Is it the case that firms finance their capital acquisitions differently around the globe? Even inside a particular country, do larger firms finance differently than smaller firms? There is evidence that in countries like the UK, smaller firms use more debt financing than larger firms, whereas in countries like Ecuador, smaller firms use less debt financing than larger firms.[2] The model presented here tries to rationalize the empirical regularities where firms' debt financing is constrained by the lack of enforcement in financial contracts.

Another important characteristic of how firms (in small open economies) finance their capital acquisitions is the fact that they are subject to volatile exchange rates, liability dollarization, and the so-called balance sheet effects. During (for example) the Asian crisis of 1997, entrepreneurs in most developing countries were under a currency mismatch: debts were in foreign currency, while sales were usually priced in domestic currency. This gives a salient role to the balance sheet (or credit) channel: if the economy is unexpectedly forced into a real depreciation, the burden of debt instantaneously jumps, while revenues, at best, remain constant in domestic currency. Consequently, entrepreneurs' net worth decreases, many firms are unable to repay their debts and go bankrupt, and output decreases because of the decreased ability of firms to raise enough funds to finance the purchase of additional capital.[3]

This paper develops a dynamic model of firms' capital acquisitions and debt structure to study the patterns observed in the data. Debt is constrained by the likelihood of default, which varies across firms and economies with different degrees of contract enforcement and subject to random shocks of exchange rate variability. Firms use debt to finance capital and for precautionary motives because they want to avoid bankruptcy after a series of bad shocks. In economies with good contract enforcement, default is unlikely and loan availability is large for firms. This allows smaller firms to keep a relatively low buffer of precautionary savings. So, the ratio of debt to assets of small firms is higher than that of large firms. In economies with weaker institutions (i.e. where contract enforcement is harder and more costly), loans are limited because default probabilities are higher. Consequently, the opposite is true about debt to asset ratios: smaller firms keep lower debt to asset ratios than larger firms.

The framework is a dynamic model of heterogeneous firms similar to the specification in Arellano, Bai, and Zhang (2009). Other similar models in the literature are those of Albuquerque and Hopenhayn (2004) and Cooley and Quadrini (2001). Firms finance their capital acquisitions using their own income and borrowing from foreign lenders. Each firm is subject to two sources of randomness: an idiosyncratic productivity shock and an aggregate real-exchange-rate shock. It is assumed that loans cannot be contingent on the realization of the shocks, so they are just simple-debt contracts.[4] After observing the realizations of the shocks, each firm chooses whether to default on its debt (and get a one-time constant value) or not (and remain in activity). If they decide to remain in operation, firms choose capital acquisitions to be used in the next period and also make a decision on how to finance them.

The set of contracts available incorporates the possibility of default. The incentives to repay or default are determined by the firms' value relative to the value of default, which depends on the degree of contract enforcement. Weak contract enforcement acts like a tax on borrowing, which limits loans for all firms. Strong contract enforcement, on the other hand, acts like a subsidy on borrowing, which enables all firms to issue more debt.

Given the set of contracts available, firms' choices over borrowing depend on their current income (which comes in domestic currency), investment needs, and precautionary incentives to self-insure for the future. Given the incompleteness of markets, smaller firms find beneficial the large set of available loans that exists in countries with good contract enforcement, because access to credit allows them to avoid the costly accumulation of precautionary savings.

The main finding of the paper is the incidence of liability dollarization on the probability of default by firms operating in environments with different contract enforcement. We find that the probability of default increases by 13 percentage points under the presence of liability dollarization and up to 19% when weak enforcement is coupled with liability dollarization. The relevance of this result is clear when one considers the lending decisions of international creditors. Lending to individual firms in countries subject to currency mismatch and/or weak law enforcement is riskier, and higher spreads should be charged. This is consistent with empirical evidence on corporate interest rate spreads.[5]

The paper proceeds as follows: The next section provides some empirical facts about different degrees of contract enforcement, debt to assets ratios, and liability dollarization on selected countries. A discussion follows on the model economy and the definition of equilibrium. The next sections provide an explanation of the solution method and the parameterization as well as a presentation of the quantitative results and discussion of default regions. The paper ends with concluding remarks and avenues to be explored in future research.

Stylized Facts

Given that the central topic of this manuscript is the relation between firms' dynamics, liability dollarization, and contract enforcement, a brief overview of the empirical evidence about these three concepts is needed.

Arellano et al. (2009) documented empirical regularities regarding the financing patterns of firms in the UK and in Ecuador. For Ecuador, they have balance sheets for a panel of over 25,000 firms for the years 1996 to 1999, taken from the tax records of the local regulatory agency, Superintendencia de Companias del Ecuador. The dataset includes the universe of firms registered as legal entities in Ecuador from all sectors except agriculture and real estate. For the UK, they have balance sheet data for a panel of over two million firms for the years 2000 to 2005 from the Amadeus Database. The dataset covers all sectors in the economy. The majority of firms in both countries are private.

The most striking result they obtain is how the debt to assets ratio (also called leverage ratio) varies across firms' sizes and also across countries. In the UK (a country with good contract enforcement) smaller firms use more debt financing than larger firms (and consequently their leverage ratio is higher), whereas in countries like Ecuador (a country with not-so-good contract enforcement) smaller firms use less debt financing than larger firms (lower leverage ratio).

Regarding differences in contract enforcement across countries, La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998), as well as the literature expanded by them, examined legal rules covering protection of corporate shareholders and creditors, the origin of these rules, and the quality of their enforcement in 49 countries. The results show that common-law countries generally have the strongest legal protections of investors and French civil-law countries the weakest, with German- and Scandinavian-civil-law countries located in the middle.

Table 1 reports a contract enforcement index[6] in order to illustrate the differences across some selected countries. The contract enforcement index ranges from 0 to 10 with 0 being the lowest institutional quality and 10 the highest.

Table 1
Some Evidence on Contract Enforcement

Country	Contract enforcement index
UK	9.40
USA	9.52
Argentina	5.64
Ecuador	5.97
Chile	6.77
Mexico	5.99
Peru	4.83

The last facts to present are those related to the degree of (liability) dollarization that the economies exhibit around the globe. There are numerous studies about the dollarization phenomenon, and different criteria have been developed in order to assess how dollarized a country is. In this paper, we follow the work by Reinhart, Rogoff, and Savastano (2003) and use their types and composite index approach to illustrate the importance of dollarization in general and of liability dollarization in particular.

Table 2 below shows the varieties of dollarization for the time period 2002-2006.

Liability dollarization is captured by the first column of Table 2. Accounting for more than 40% of the countries under study, liability dollarization is a widespread phenomenon.

The Model

The model economy builds on Arellano et al. (2009). We take their environment and simplify it in some dimensions in order to stress the importance of the liability dollarization channel. More explicitly, we abstract from the dividends decision and costly equity issuance but at the same time incorporate an extra source of randomness through the time-varying exchange rate.

In the model, entrepreneurs own firms and decide on financing mechanisms for their capital needs. Debt contracts are not enforceable, so firms can default on the debt they owe. Debt contracts are also incomplete, so default occurs in equilibrium.

Firms

Each period the firm produces output y with a stochastic decreasing returns to scale technology that transforms capital goods into consumption goods. Given a certain level of capital K (decided in the previous period), the firm produces consumption goods by means of the following technology function:

$$y_i = z_i K_i^{\alpha} \tag{1}$$

where $\alpha \in (0, 1)$ and z is a productivity shock drawn from a distribution function $f(z)$. Full depreciation is assumed for capital.

The entrepreneur (i.e., the owner of the firm) has to decide how to finance capital K acquisitions. He has two options: using the firm's income or relying on external capital markets (here is how and where liability dollarization appears). In the first period, the entrepreneur has to finance initial capital with external loans.

A firm of productivity z starts the period with a loan to be paid of size B_R and produces zK^{α} after observing the realizations of the shocks. The firm's income is given by the difference between output and debt repayment (B_R):

$$x_i = z_i K^{\alpha} - EB_R \tag{2}$$

where E represents the real exchange rate (expressed in pesos per dollar) and is also an (aggregate) random

Table 2
Types of Dollarization 2002-2006

	Private sector debt accounts for **10% or more** of total external debt	Private sector debt accounts for **less than 10%** of total external debt	Total
At least 10% of broad money **or** of domestic public debt are denominated in or linked to a foreign currency	26 (32.1%)	34 (41.9%)	56 (74%)
Less than 10% of broad money **and** of domestic public debt are denominated in or linked to a foreign currency	9 (11.1%)	12 (14.9%)	21 (26%)
Total	35 (43.2%)	46 (56.8%)	81 (100%)

Note. Number of cases are given with shares in parentheses. Author's calculations and update from the database provided in *Addicted to Dollars* by C. Reinhart, K. Rogoff, & M. Savastano, 2003, NBER Working Paper 10015, available at http://ssrn.com/abstract=453809 variable with distribution *g(E)*. It is important to note that x is expressed in domestic currency (i.e. pesos).

The Possibility of Default

Every period the entrepreneur can choose to default if he finds it optimal. In case of choosing to default on its debt, the firm gets a default value V^D that summarizes all the costs and benefits of defaulting. The value V^D is used to parameterize the degree of contract enforcement of the economy. The benefits of default capture all the resources that the entrepreneur can divert for his own benefit from the firm before it ceases to exist. The costs of default are related to the reputation costs that the defaulting entrepreneur will face if he tries to engage in future business relations.

The timing of events is as follows: First, the firm observes the realizations of the shocks *z* and *E.* Then the firm decides whether to default or not. If the firm decides to repay its debt, it produces $zK\alpha$ and its income is equal to $zK^\alpha - EB_R$. The firm then decides on capital for the next period (K') and on how to finance it. If the firm decides to default, it gets V^D, the firm disappears, and a new firm (coming from a pool of potential entrants) takes it place, so that the total number of firms remains constant.

In the recursive formulation, the entrepreneur's default decision depends on the default value compared to the value of (not defaulting and) continuing in operation and is given by

$$V(x) = \max\{V^{ND}(x), V^D\} \tag{3}$$

where *V(x)* denotes the present value of the firm and $V^{ND}(x)$ the present value conditional on not defaulting. This decision can be formulated as a binary variable *d(x)* that equals 1 if default is chosen and 0 if repayment is chosen and can be expressed as[7]

$$d(x) = \begin{cases} 0, \text{ if } V^{ND}(x) \geq V^D \\ 1, \text{ otherwise} \end{cases} \tag{4}$$

All this means that if the firm decides to repay the debt, it chooses capital acquisitions for the next period and a debt contract with a creditor. The contract will specify how much the firm will receive (B') and how much it will repay the following period (BR') conditional on not defaulting. So the entrepreneur chooses { B', K', BR'} to maximize the value of continuing operating:

$$V^{ND}{}_i(x) = \max_{\{B',B'_R,K'\}} \left\{ z_i K_i^\alpha - EB_{R,i} + EB'_i - K'_i + \beta \iint V_i(x'_i(z'_i, E')) f(z') g(E') dz' dE' \right\} \tag{5}$$

where $x'_i(z',E') = z'_i K'^\alpha - E'B'_{R,i}$ stands for the internal net worth of the firm.

The firm's default policy can be characterized by its default set:

$$D(x) = \{x : V^{ND} \leq V^D\} \tag{6}$$

The default set is the set of pairs of capital level and debt repayment, given certain levels for the shocks, for which it is optimal to default. Using the definition of the default set, it is straightforward to get an expression for the default probability:

$$p^{def} = \int_{D(z,E)} df(z')dg(E$$

The optimal debt level is determined by trading off the cost and benefits of the variety of debt contracts offered to the firm by the creditors. Debt is beneficial especially when income is low and the desired investments are large. In a richer model, it could be argued that debt also helps firms to avoid costly equity issuance or finance dividend distribution. Debt can also be dangerous because it can generate scenarios of financial fragility and default.

It is also important to notice that the model displayed so far exhibits precautionary behavior by firms in the same way that Huggett (1993) and Aiyagari (1994) do for households in a savings model. Entrepreneurs have incentives to reduce their debt levels in order to avoid future financial instability.

Loans

The simple debt contract between an external creditor and the firm consists of a triplet *(B', K', B_R')* that is offered to the firm. If *B'* is positive, this means that the firm is borrowing from the creditors today and will repay B_R in the next period. The contract also specifies a certain level of capital acquisition *K'* because default probabilities are influenced by the level of capital. In general, the entrepreneur will face a menu of these triplets and will choose the one that maximizes the present discounted value of the firm.

Foreign creditors are assumed to be able to commit to the contracts. They are risk-neutral, behave competitively, and discount time at the world risk-free interest rate. Given their risk neutrality, they are willing to finance whichever project is presented to them as long as they are compensated for the expected losses in case of default.

The combination of competitive behavior (which guarantees zero profit in expectation) and risk neutrality (which provides linearity in the lenders' objective function) makes the following condition apply:

$$B'_R = B'(i+r)\frac{1}{[1 - \iint d(x'(z', E')) f(z') g(E') dz' dE']} \tag{7}$$

Equation (7) represents what is usually called zero-profit condition (or break-even condition), and it is the condition that typically governs the asset pricing in the sovereign debt literature. This condition states that (in case of repayment) the firm must give to the lenders the amount it borrowed in the previous period plus an interest payment which is not only the risk-free rate but also a premium reflecting the default risk.

In other words, if the firm is completely riskless, then lending to it should be equivalent to lending in the world funds market, and consequently lenders would charge only the risk-free rate (i.e., the term $\iint d(x'(z',E'))f(z')g(E')dz'dE'$ is equal to zero). When firms are able to strategically default, then default risk is anticipated by lenders (hence $0< \iint d(x'(z',E'))f(z')g(E')dz'dE'<1$) who will accordingly charge a "risk premium":

$$\frac{1}{[1-\iint d(x'(z',E'))f(z')g(E')dz'dE']}$$

Equilibrium

The *recursive equilibrium* for this economy is composed of (a) the policy functions of the firm *(K'(z,E), B'(z,E), BR'), d(x);* (b) the menu of contracts *(B', K', BR')* offered by the creditors; and (c) the mass of possible entrants such that

Taking as given the menu offered, the policy functions of the firm satisfy its optimization problem.

Contracts available reflect the probabilities of default such that creditors make zero profit in expected value.

The number of firms exiting is equal to the number of firms entering the market.

Parameterization and Solution Method

The model is solved numerically using value function iteration and discrete state space method. Whenever possible, this article considers the same parameter values as in Arellano et al. (2009). Table 3 presents the common parameter values.

Table 3
Parameter Values

		Value
Interest rate	r	0.02
Technology	α	0.9
Idiosyncratic productivity	z	0.11; 1.13
Discount factor	β	0.965
Enforcement	V^D	0; 0.03
Exchange rate shock	E	1; 3

Each period refers to a year with a constant world risk-free interest rate of 2%. The value for the technology parameter is chosen to be 0.9 (implying decreasing returns to scale), following empirical evidence by Basu and Fernald (1997).

The idiosyncratic productivity shock is assumed to follow a two-state Markov chain. The values for those two states are taken from Arellano et al. (2009). In a similar fashion, the exchange rate shock is modeled as a two-state Markov chain, and the values that it can take are 1 and 3.

The discount factor takes a typical value in the literature. Some comparative static exercises below assume more impatience to assess the influence of this parameter on the probability of default.

The value of default, V^D, is a key parameter in the solution to the model. A high V^D means that the economy has weak contract enforcement and one should expect to observe more default in equilibrium. On the contrary, a low V^D represents good enforcement mechanisms and therefore default is much less attractive. The values of 0 and 0.03 are taken from Arellano et al. (2009).

The algorithm used to solve the problem is very similar in spirit to those used in the sovereign default literature[8] and involves the following:

- Step 0: Rearrange terms to get:

$$q_t = (i+r)\frac{1}{[1-\iint d(x'(z',E'))f(z')g(E')dz'dE']}$$

- Step 1: Assume an initial guess for *q*. (The guess was the risk-free interest rate at each point in the state space.)
- Step 2: Iterate on the Bellman's Equation in order to solve for V^{ND}, and compute $V(x) = max\{V^{ND}(x), V^D\}$
- Step 3: For the initial guess for q, now estimate the default function *d(x)*. Next, update q using *d(x)* and with this repeat steps 2 and 3 until convergence.

Quantitative Results

Considering that the main objective of this paper is to assess the effect that liability dollarization has on firms' financing under different contract enforcement environments, it is natural to start the exposition of results by comparing the equilibrium outcomes under different specifications of the environment.

First we examine how the probability of default is affected by the mere presence of liability dollarization. This means that, for two otherwise identical economies, we make one of them subject to randomness of the exchange rate (and therefore prone to balance sheet effects) and the other not (i.e., we assume that both revenues and debts are denominated in national currency). Table 4 presents the results obtained.

Table 4
Probability of Default: Liability Dollarization vs. No Liability Dollarization Case

Probability of default	p^{def}
with liab. doll.	0.1894
w/o liab. doll.	0.0517

Table 4 presents one of the contributions of the paper: it provides a quantitative measure of how much liability dollarization increases the probability of default by a firm. This exercise was done for an economy with weak enforcement and shows that the presence of currency mismatch increases the likelihood of default by 13%.

The second exercise consists in assessing the effects of having good contract enforcement mechanisms on the probability of default. We ex-ante expect to find that in good enforcement economies defaulting on debt is less attractive to a firm, and therefore we should observe less default in equilibrium. Although this finding would not be a novel one, our interest in this particular dimension is more quantitative than qualitative.

Table 5
Probability of Default: Strong vs. Weak Contract Enforcement

Probability of default	p^{def}
with strong enforcement	0
with weak enforcement	0.1894

As shown in Table 5, increasing the rule of law and the efficiency of the judiciary system and/or reducing the risk of expropriation so that the general level of contract enforcement increases can reduce default. As shown above, low enforcement can account for an increase in the probability of default of roughly 19%. Notably, when the same exercise is done for an economy in which liability dollarization is not a concern, the probability of default increases only 5% when weak enforcement is compared to strong enforcement.

A third investigates the role of impatience. The sovereign default literature has argued that high levels of impatience are needed to generate a reasonable level of default along the equilibrium path.[9] The experiment here is to reduce the value of the subjective discount factor from 0.956 to 0.8. The results are shown in Table 6.

Table 6
Probability of Default: High vs. Low Impatience

Probability of default	p^{def}
with low impatience (β = .956)	0.1894
with high impatience (β = .80)	0.5064

The values shown in Table 6 are for the case in which the economy is subject to liability dollarization and weak contract enforcement. It is clear that assuming more impatient entrepreneurs induces more default in equilibrium. It should also be noted that observing roughly 50% of the firms defaulting along the equilibrium path is far from reality and represents a drawback of the as-of-now version of the model.

The figures presented in Table 6 correspond to a parameterization of the model assuming weak enforcement. If the same exercise is done for strong enforcement, no significant differences are found, and the probability of default is very close to zero. This implies that good contract enforcement outweighs the impatience effect.

Default Regions

The graphs in this subsection illustrate where default is taking place. The analysis is for the case of weak enforcement, low impatience, and liability dollarization. It is important to note that every default decision was made only for states in which the realization of the exchange rate shock was high (i.e., $E = 3$).

Some technical details about Figures 1 and 2 need to be explained: (a) the white, over-checked area represents the default area; (b) both axes are (automatically) labeled from 0 to 30, with 0 being the minimum value in each state discretization (−25 for B_R and 0 for K) and 30 the maximum (25 for B_R and 80 for K); and (c) on the x-axis, 15 represents the negative value of B_R that is closest to zero (that is, the state in which the firm is saving instead of borrowing but in the smallest possible amount).

Figure 1 presents the default region for the cases in which defaulting was the decision made after observing the shocks of $E = 3$ and $z = 0.11$. This group of firms defaulted every time they had B_R positive, meaning that every time they had to repay some amount in the next period, they decided to divert resources for themselves and

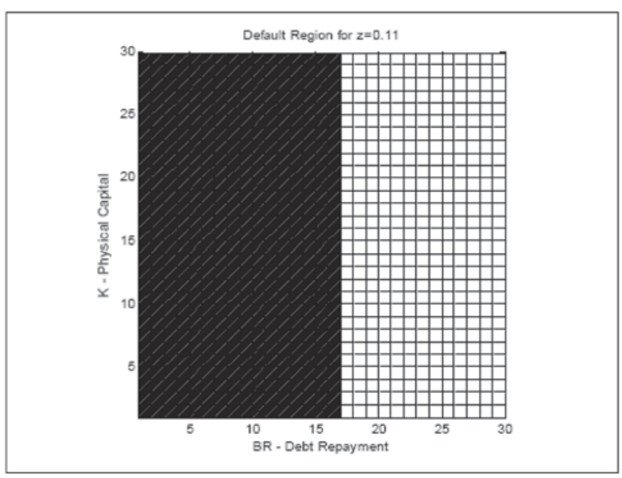

Figure 1. Default region for low technology shock.

exit. This behavior was observed independently of the capital level (hence the vertical line separating the default region from the non-default region).

The case of Figure 2 is the default decision by firms that observed a realization of shocks $E = 3$ and $z = 1.13$. In this situation, firms with positive repayment for the next period may choose not to default depending on their capital level. Clearly, firms with low levels of capital and positive debt repayment (i.e., highly-leveraged firms) default even when they receive a "good" productivity shock. For large enough levels of future repayment, default is always chosen, no matter the level of capital.

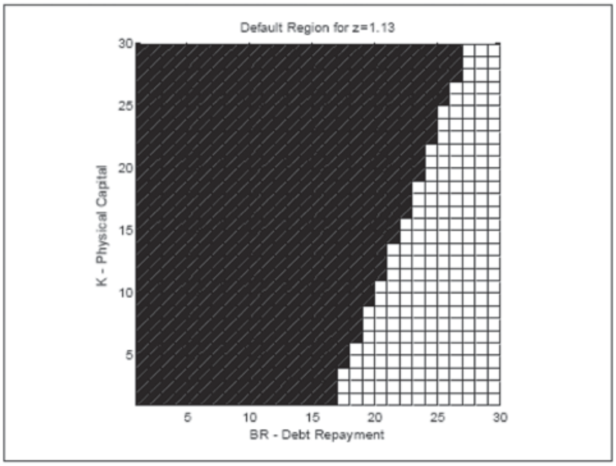

Figure 2. Default region for high technology shock.

Concluding Remarks

We presented a model of strategic default by firms that emphasizes the role of liability dollarization under different degrees of contract enforcement.

We started by referencing some empirical evidence on the differences on capital acquisitions by firms in different countries. Evidence on the different degrees of contract enforcement and liability dollarization was also provided.

The framework is a dynamic model of heterogeneous firms. They finance their capital acquisitions using their own income and borrowing from foreign lenders. Each firm is subject to two sources of randomness: an idiosyncratic productivity shock and an aggregate real-exchange-rate shock. It is assumed that loans cannot be contingent on the realization of the shocks, so they are just simple-debt contracts (i.e., the model casts incomplete markets). The set of contracts available incorporates the possibility of default. The incentives to repay or default are determined by the firms' value relative to the value of default, controlled by the degree of contract enforcement and the presence of liability dollarization.

Among the results obtained, the effect of the liability dollarization phenomenon on the probability of default is of special interest. The presence of currency mismatch increases the likelihood of default by 13%. This result was expected (in a qualitative sense) although not previously known (in a quantitative sense).

The role of contract enforcement was also assessed. Low enforcement can account for an increase in the probability of default of roughly 19%, and liability dollarization and contract enforcement seem to reinforce each other in increasing default probabilities.

The last set of results corresponds to determining the default regions. This implies recognizing which particular realizations of the nature would lead a firm to decide not to pay its debt and exit with as many resources as it can divert. For low realizations of the productivity shock, firms uniformly defaulted whenever they had some positive level of debt to repay in the next period, independent of the capital owned. For high realizations of the technology shock, firms with less capital and positive amounts to repay (i.e., higher leverage ratios) were the ones to default the most.

Among the many dimensions in which this paper can be improved and/or extended, the following are the most interesting:

- Introducing the possibility of costly equity issuance. Allowing the firm to finance its capital acquisitions not only with inside cash or foreign lending but also from equity issuance would push the model one step closer to real-world decisions made by entrepreneurs and would also generate the interesting question of who to default on.
- Introducing tradables and non-tradables sectors. The assumption that firms' revenues are in domestic currency and debt repayment in foreign currency is a simplification in order to obtain the balance sheet effect. The model environment should be extended to include tradables and non-tradables sectors. This would also permit one to say something about the distributive effects of the liability dollarization and contract enforcement phenomena.
- Allowing for possible bailouts. As is common in other branches of the macro-related literature, allowing for bailouts from some external organism (inside a particular country, it could be the central and/or state governments) affects the entire incentives scheme and could bring potentially interesting insights to the discussion on firms' dynamics, default, contract enforcement, and currency mismatch.

References

Aguiar, M., & Gopinath, G. (2006). Defaultable debt, interest rates and the current account. *Journal of International Economics, 69*(1), 64-83.

Aiyagari, S. R. (1994). Uninsured idiosyncratic risk and aggregate saving. *Quarterly Journal of Economics, 109,* 659-684.

Albuquerque, R., & Hopenhayn, H. A. (2004). Optimal lending contracts and firm dynamics. *Review of Economic Studies, 71,* 285-315.

Arellano, C. (2008). Default risk and income fluctuations in emerging economies. *American Economic Review, 98*(3), 690-712.

Arellano, C., Bai, Y., & Zhang, J. (2009). *Firm dynamics and financial development.* Unpublished manuscript, University of Minnesota.

Basu, S., & Fernald, J. G. (1997). Returns to scale in U.S. production: Estimates and implications. *Journal of Political Economy, 105,* 249-283.

Cespedes, L., Chang, R., & Velasco, A. (2001). Balance sheets and exchange rate policy. *American Economic Review, 94*(4), 1183-1193.

Cooley, T. F., & Quadrini, V. (2001). Financial markets and firm dynamics. *American Economics Review, 91,* 1286-1310.

Elton, E. J., Gruber, M., Agrawal, D., & Mann, C. (2001) Explaining the rate spread on corporate bonds. *The Journal of Finance, 56*(1), 247-277.

Hatchondo, J. C., Martinez, L., & Sapriza, H. (2007). Quantitative models of sovereign default and the threat of financial exclusion. *Economic Quarterly, 93*(3) 251–286.

Huggett, M. (1993). The risk-free rate in heterogeneous-agent incomplete-insurance economics. *Journal of Economic Dynamics and Control, 17*(5-6), 953-969.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. (1998). Law and finance. *Journal of Political Economy, 106,* 1113-1155.

Magud, N. (2007). *Currency mismatch, openness and exchange rate regime choice* (Working Paper). University of Oregon.

Oviedo, M. (2003). *Macroeconomic risk and banking crises in emerging market countries: Business fluctuations with financial crashes* (Working Paper). Iowa State University.

Reinhart, C., Rogoff, K, & Savastano, M. (2003). *Addicted to dollars* (NBER Working Paper 10015). Retrieved from http://ssrn.com/abstract=453809.

Footnotes

1 3105 Tydings Hall, University of Maryland, College Park, MD 20742, USA. Email: sosa@econ.umd.edu. I would like to thank Enrique Mendoza and John Shea for useful comments and advice. I also thank Carmen Reinhart for kindly sharing the dataset from Reinhart et al. (2003). All remaining errors are entirely mine.

2 See Arellano, Bai, and Zhang (2009).

3 For a model relating balance sheet effects with exchange rate regime choice, see Magud (2007) and Cespedes, Chang, and Velasco (2001) among others.

4 The focus of this paper is not on the financial intermediation between lenders and borrowers. For a model in which banks are present and use two-sided debt contracts to intermediate between international investors and domestic firms, see Oviedo (2003).

5 See, for example, Elton, Gruber, Agrawa, and Mann (2001).

6 This index was created as a simple average of the five most relevant measures related to the quality of the institutions affecting the enforcement of contracts: rule of law, efficiency of judiciary system, risk of expropriation, corruption, and risk of contract repudiation. In the original database (coming from La Porta et al., 1998), each of these measures ranged from 0 to 10 with 0 being the worst quality and 10 the best. Consequently this index also ranges from 0 to 10.

7 The fact that $V^{ND}(x)$ is increasing in x and V^D is a constant implies that there is an x^* such that $d(x) = 1$ for all $x \leq x^*$ and $d(x) = 0$ for all $x > x^*$. Clearly x^* is defined by $V^{ND}(x) = V^D$.

8 See Aguiar and Gopinath (2006). A MatLab code is available from Gita Gopinath's webpage. Another example is Hatchondo, Martinez, and Sapriza (2007).

9 See, for example, Aguiar and Gopinath (2006) and Arellano (2008).

* Correspondence concerning this article should be directed to César Sosa Padilla Araujo at: *sosa@econ.umd.edu*