Sovereign Defaults, Domestic Credit Market Institutions and Credit to the Private Sector

Guido Sandleris
Universidad Torcuato Di Tella
Sovereign Defaults, Domestic Credit Market Institutions and Credit to the Private Sector*

Guido Sandleris†
Universidad Torcuato Di Tella
January 2010

Abstract

During sovereign debt crises, even after controlling for the decline in relevant macroeconomic variables, both foreign and domestic credit to the private sector decline. This paper presents a mechanism through which sovereign defaults can lead to this decline, even if domestic agents do not hold government debt. The mechanism highlights the interaction between sovereign defaults, domestic credit market institutions and firms’ collateral constraints. In developing countries firms are usually collateral constrained. In a model with endogenous sovereign debt, a sovereign default, through its effect on expectations about fundamentals, affects the value of the firms’ international and domestic collateral, which limits the availability of foreign and domestic credit. The model also shows that, by attracting private capital flows to the private sector, stronger domestic financial institutions reduce governments’ incentives to default, which, in turn, facilitate public borrowing.

*For their useful comments and suggestions, I want to thank Don Davis, Paolo Siconolfi, Rick Mishkin, Alberto Martin, Filippo Taddei and seminar participants at Columbia University, UTDT, Johns Hopkins University, Universidad de San Andrés and the IADB. All remaining errors are my own.
†Universidad Torcuato Di Tella (UTDT), Saenz Valiente1010, Buenos Aires 1428, Argentina (email: gsandleris@utdt.edu)
1 INTRODUCTION

A stylized feature of the recent string of sovereign debt crises in Russia, Ukraine, Pakistan, Ecuador and Argentina was that in all of them, the defaults were associated with strong declines in credit to the private sector even after controlling for macroeconomic conditions. This association has been documented in the sovereign debt literature.\footnote{Arteta and Hale (2008) find systematic evidence of a decline in foreign credit to the private sector in the aftermath of sovereign debt crises. Even after controlling for macroeconomic conditions, they find that sovereign debt crises are associated with an additional decline in credit to the private sector of over 20\% below the country-specific average, which persists for more than two years after the restructuring agreement is reached. Trebesch (2009) also finds that debt restructurings affect foreign credit to the private sector. Sturzenegger and Zetelmeyer (2008) also find evidence of contractions in domestic credit.}

In this paper we analyze the interaction between sovereign defaults, foreign and domestic credit to the private sector and the quality of financial institutions in a country. In particular, we ask two questions: first, could sovereign defaults affect foreign and domestic credit to domestic agents even if they do not hold sovereign debt? Second, does the presence of stronger domestic financial institutions, such as better legal enforcement of private sector contracts or improved corporate governance, affect the incentives of a government to default?

Traditional models in the sovereign debt literature are not well-suited to study the effects of defaults on credit to the private sector. The reason is that they usually modeled the relation between a sovereign government and foreign creditors without including the domestic private sector in their models.\footnote{See for example Eaton and Gersovitz (1981) or Bullow and Rogoff (1989) or more recently Amador (2003) or Wright (2002). For a detailed review of the early literature on sovereign borrowing see Eaton and Fernandez (1995).}

More recently a number of papers have studied the costs of default related to their effect on the domestic private sector.\footnote{See for example Broner and Ventura (2008), Guembel and Sussman (2009), Alessandro (2009), Gennaioli et al. (2009).} A common feature of all these papers is that the government cannot discriminate between foreign and domestic creditors when it defaults. As a result, a default affects the balance sheet of domestic agents holding government bonds, which in turn can lead to a decline in domestic credit and output.

This paper shows that even if domestic agents do not hold government bonds, a sovereign default can create a credit crunch in domestic credit markets and a contraction in foreign lending to the private sector. These effects amplify the cost of sovereign defaults.

Another important result that emerges from this paper is that, in the presence of public default risk, private borrowing can enhance the ability of the government to engage in sovereign borrowing. In effect, by attracting private capital flows, stronger domestic financial institutions reduce governments’ incentives to default, which, in turn, facilitate public borrowing.
These results arise from the effects of sovereign defaults and the quality of domestic financial institutions on the borrowing constraints of the private sector. In a three periods set up, some domestic agents receive an investment opportunity and become entrepreneurs. In order to finance their investment, they can pledge as collateral a fraction of their endowment whose final value will depend on the fundamentals of the economy. Entrepreneurs will pledge their own international collateral first to borrow from abroad. However, they may not have enough international collateral and they may have to turn to the domestic credit market using their domestic collateral too. The supply of credit in the domestic credit market will come from those domestic agents that have international collateral but do not have an investment opportunity. These agents will become financial intermediaries, pledging their international collateral to borrow from abroad and then lend domestically to the entrepreneurs. Through this credit chain the economy may be able to aggregate its international collateral. However, it may fail to do so if the domestic collateral constraint of the entrepreneurs is very stringent.

The government borrows to produce a public good, and then has to decide whether to repay its debt or not. Prior to making this decision, as in Sandleris (2008), it receives some private information about the fundamentals of the economy. The government then faces a trade-off when it decides whether to repay or default on foreign creditors. On the one hand, repaying implies giving up resources that could be used for consumption. On the other, it allows to signal to the private sector the information that the government has about the fundamentals. A good signal could imply a higher expected value for the domestic agents’ collateral, and with it more credit to the private sector both domestic and from abroad. As when fundamentals are good, capital is more productive, the gain from repaying and conveying the signal will be larger. This generates a "single crossing" property in the model that can support positive amounts of sovereign borrowing.

In the model, a sovereign default affects the private sector through two channels: an investment channel and a credit channel. A sovereign default, perceived as a signal of bad fundamentals, decreases desired investment (investment channel) and also affects the value of entrepreneurs collateral and with it the availability of credit (credit channel). When domestic entrepreneurs are unconstrained, only the investment channel may be active. When all constraints bind, as one would expect in developing economies, both the investment and

---

4This information could be related to its willingness or ability to undertake structural reforms or deal with corruption or, alternatively about the state of the economy itself. Note that the information of the government about the fundamentals does not need to be better than that of the private sector, it just needs to be different and relevant.

5Note that the government may have incentives to “talk up” the value of the fundamentals to relax entrepreneurs’ collateral constraints. If this were the case, any information that the government reveals in a costless way would just be “cheap talk” and will not be believed.

6Note that the results of the paper could also arise from a sanction story in which it is the sanctions instead of the information content of defaults that affects the value of entrepreneurs collateral.
the credit channel could be active.\footnote{The fact that both channels are active in developing economies while may be just one in developed ones, does not imply that the costs of default are larger for developing economies, as the investment channel may be larger in developed economies.}

Within this framework, I also analyze how the quality of domestic financial institutions, understood as the quality of the legal enforcement of private sector contracts or corporate governance, affect the government’s incentives to default and, with it, its ability to borrow from abroad or the cost of such borrowing. A number of papers show theoretically and empirically that better financial institutions enhance the ability of domestic financial systems to attract foreign funds and use them efficiently (see for example Caballero and Krishnamurthy (2001) and Alfaro et al. (2008)). What has been overlooked is that they could also attract funds to finance the government. The model predicts that governments from countries that undertake financial reforms and improve the quality of their financial institutions should be able to borrow more from international credit markets, or alternatively, should be less likely to default for a given level of public debt.

This paper articulates two literatures that capture two types of financial constraints stories: the sovereign debt literature that emphasize the role of aggregate financial constraints limiting the amount a government can borrow from abroad, and the literature in which widespread individual financial constraints limit a country’s ability to reallocate resources.\footnote{The first group includes among others, the above mentioned sovereign borrowing models, while for the second type of models see Caballero and Krishnamurthy (2001), Bernanke and Gertler (1989), Kiyotaki and Moore (1997) or Holmstrom and Tirole (1997 and 1998).}

The paper is organized as follows. Section 2 presents the set up of the model, Section 3 presents and discusses the main results, and Section 4 concludes.

\section{THE MODEL}

\subsection{Environment}

The model has three periods, $t=0,1,2$ and three type of agents: the government, a continuum of foreign creditors and a continuum of domestic agents. Domestic agents are ex ante identical. Both domestic agents and foreign creditors have linear preferences on time 2 consumption. There is one consumption/capital good in the economy produced by the domestic agents and a public good produced by the government.

In order to motivate sovereign borrowing, I will assume that the only way in which the government can finance the production of a public good is by borrowing from abroad through one period non-contingent debt contracts. These contracts are not collateralized. These assumptions are consistent with real world sovereign debt contracts.\footnote{Alternatively, one could think that this model deals only with the uncollateralized part of sovereign borrowing.} Repaying is costly for the government as it
involves transferring resources to foreign creditors whose welfare does not enter into the government welfare function.

The government borrows from foreign creditors at time 0, and at time 1 gets to know the fundamentals, \( \theta \), while other agents in the economy only know the probability distribution of the fundamentals: good (\( \bar{\theta} \)) with probability \( p \) and bad (\( \underline{\theta} \)) with probability \( 1-p \).\(^{10}\) This assumption tries to capture the fact that governments, particularly in developing countries, might have some private information that affect private sector actions. This information could be related, for example, to their own ability or willingness to deal with corruption or implement structural reforms that may enhance some fundamental institutions of a country such as the respect of property rights or the rule of law.

After observing its private information about the fundamentals, the government chooses whether to repay its debt with foreign creditors (\( x = 1 \)) or to default (\( x = 0 \)). It is assumed that creditors cannot impose sanctions on the government following a sovereign default. However, the government makes the repayment/default decision being aware that economic agents might update their beliefs on fundamentals being good from \( p \) to \( p' \) based on the government action. Posterior beliefs, \( p' \), matter as they will affect domestic entrepreneurs’ credit constraints.

Domestic agents receive an endowment at time 0 consisting in an investment project that will generate output at time 2 and that can be used as collateral. In addition, a fraction \( \alpha \) of the agents, the entrepreneurs, receive at time 1 a new investment opportunity. The output generated by this new investment opportunity can not be seized, so it can not be used as collateral.\(^{11}\) So, we will have two types of domestic agents at time 1, those that receive a new investment opportunity (entrepreneurs) and those that do not. We will call the latter the intermediaries for reasons that will become clear below. Total output at time 2 will be given by:

\[
y_2^e = y(\theta) + A(\theta) f(k) \tag{1}
\]
\[
y_2 = y(\theta)
\]

where \( y(\theta) \) is the output generated by their endowed investment project and it is increasing in the fundamentals. \( A(\theta) f(k) \) is the output generated by the time 1 investment opportunity where \( f'(k) > 0 \) and \( f''(k) < 0 \). \( A(\theta) \), which is increasing in \( \theta \), captures the effects of the fundamentals on the productivity of investment. Finally, at time 2 output is produced and consumption takes place. The following table summarizes the timing of events in the model:\(^{12}\)

\(^{10}\)Note that, at the cost of some additional notation, both the government and the investors could have received noisy signals about the fundamentals. The relevant assumption for the results of the model to carry over would be that the government’s information is different and relevant for investors.

\(^{11}\)This assumption is made for simplicity.

\(^{12}\)The fact that private sector actions take place after the government repayment/default decision is not a strong assumption as there are a myriad of decisions that are influenced by fundamentals that are made almost all the time in the real world. So, for example there will always be some investment decisions made after the government repayment/default decision.
<table>
<thead>
<tr>
<th>$t = 0$</th>
<th>$t = 1$</th>
<th>$t = 2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Foreign creditors determine max lending to government and interest rate</td>
<td>• Govt. receives private information about fundamentals (good with probability $p$, bad with probability $1-p$)</td>
<td>• Payoffs take place (govt. payoff depends on domestic agents’ actions)</td>
</tr>
<tr>
<td>• Govt. borrows from foreign creditors and produces public good</td>
<td>• Govt. defaults or repays its debts using exogenous revenues</td>
<td></td>
</tr>
<tr>
<td>• Domestic agents receive endowment</td>
<td>• Foreign creditors and domestic agents update beliefs: $p' = p'(x)$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Domestic agents observe their idiosyncratic shock and borrow, lend and invest (all actions depend on $p'$)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1:

### 2.2 Credit chain and domestic credit markets

As entrepreneurs are not endowed with goods, but with investment projects that mature at time 2, they need to borrow to finance their time 1 investment. They can borrow from abroad or domestically. Foreign creditors require collateral to back their lending. Entrepreneurs can pledge as collateral a fraction, $\gamma_f$, of the output that their endowment will generate. Any excess production based on investment at date 1 is assumed to be neither observable nor verifiable. The securities that entrepreneurs issue to borrow from abroad promise to pay $\gamma_f y(\bar{\theta})$ if fundamentals end up being good. In case that fundamentals were bad, entrepreneurs would default and the collateral, $\gamma_f y(\bar{\theta})$, seized. In order to lend to domestic entrepreneurs, foreign creditors, which have large endowments relative to the size of the domestic economy and compete in international credit markets, require a return equal to the world interest rate, $R_w$. The collateral constraint faced by entrepreneurs is then given by:

$$b_f^t \leq \frac{\gamma_f E_1[y(\bar{\theta}) | x]}{R_w} \tag{2}$$

where $b_f^t$ is the amount of foreign borrowing that entrepreneurs undertake at time 1 and $E_1$ are the time 1 expectations.

One possible interpretation of $\gamma_f$ is that it captures the quality of institutions in a country. The better the institutions the larger the fraction of time 2 output that foreign creditors could recover if the debtor were to choose not to repay.\(^{13}\) Alternatively, one could interpret this parameter as the value of the time 2 output for foreign creditors (which would be less than for the original owner if there are costs of reselling it or if preferences differ).

The presence of the international borrowing constraint at time 1 may prevent entrepreneurs from borrowing enough as to achieve the optimal amount of investment. Despite the linearity of preferences, the presence of this financial constraint could create a demand for insurance. The domestic agents, turned

---

\(^{13}\) The assumption that only a fraction of future output is pledgeable as collateral is standard in the literature on credit constraints. It tries to capture capital market imperfections such as the existence of moral hazard, or the presence of limited liability.
into entrepreneurs at time 1 could be constrained and may not be able to invest as much as they would want to, while those agents that do not have an investment opportunity may have unused international collateral. As a result, an insurance contract that delivers collateral when they receive a new investment opportunity, and makes them pay when they do not will make agents better off. Although, agents could in principle sign such contracts at time 0, the presence of asymmetric information limits their existence in reality. The following assumption captures this and rules out these contracts:

A1: Entrepreneurs' private information
The idiosyncratic shock that determines whether an agent receives an investment opportunity and becomes an entrepreneur at date 1 is private information.

Although this assumption rules out the existence of insurance, it does not preclude the existence of a domestic credit market at time 1. At time 1 the agents that do not have a new investment opportunity, can still pledge a fraction of the output that their endowment will generate as international collateral to issue securities abroad. They may find convenient to issue securities abroad using this collateral, and then lend domestically to other entrepreneurs that have a new investment opportunity. These agents can become then financial intermediaries. Through this “credit chain” the economy may manage to aggregate its international collateral and raise resources for time 1 investment. In order to borrow from the intermediaries, the entrepreneurs can issue securities domestically, backed by their endowment. The following assumption presents the domestic credit markets collateralization requirements:

A2: Domestic Collateral
Entrepreneurs can pledge as domestic collateral a fraction, $\gamma_d$, of the output that their time 0 investment project will generate. The fraction that they can pledge as collateral for domestic borrowing is larger than the one they can pledge for foreign borrowing (i.e.: $\gamma_d > \gamma_f$). The collateral that they pledge for foreign borrowing reduces the available collateral for domestic borrowing.\footnote{This implies that foreign creditors have more seniority than domestic ones.} Again, any excess production based on reinvestment at date 1 is neither observable nor verifiable.

This implies that the time 1 domestic borrowing constraint is given by:

$$b_d^* \leq \frac{\gamma_d E_1[y(\theta) \mid x] - b_f^*}{R_d}$$

where $b_d^*$ denotes the amount borrowed domestically at time 1 and $R_d$ denotes the domestic interest rate.

As before, $\gamma_d$ can be interpreted as the quality of institutions that determine the fraction of the output that can be seized as collateral. While the assumption that only a fraction of the future output is pledgeable as collateral is standard in
the credit constraints literature, the asymmetry in the borrowing constraints for domestic and foreign borrowing is more unusual. Caballero and Krishnamurthy (2001) introduce a similar distinction and there is empirical evidence supporting this “home bias” in investments and bargaining advantages for domestic investors.\footnote{See Choe et al. 2001.}

The different valuation of collateral between domestic and foreigners can create a wedge between the domestic gross interest rate $R_d$ and the world interest rate $R_w$. In fact, intermediaries will only borrow from abroad to relend domestically if $R_d \geq R_f$. This implies that for the entrepreneurs borrowing domestically will be at least as expensive as borrowing from abroad. So, they will usually borrow as much as possible from abroad, and only after they exhaust their international collateral will they turn to domestic credit markets (for simplicity we will assume that this will be the case even if $R_d = R_w$).

We will assume that all agents have access to a risk free storage technology which pins down the world interest rate, $R_w = 1$.

2.3 Sovereign borrowing

The assumptions of the model determine the timing of government borrowing and the maturity structure of the sovereign debt in this model. As the world ends at time 2, there are no reputation considerations in terms of future market access to take into account at that time. Furthermore, as there are no agents making decisions at that time the government does not need to worry about affecting agents’ expectations through a default, and as there are no sanctions either, the government will never have an incentive to make a payment at time 2. As a result, foreign creditors will never offer the government debt contracts that mature at time 2. This implies that foreign creditors will never lend to the government at time 1, regardless of whether the government has defaulted or repaid its time 0 debts (if any) at time 1. So, the government will only be able to borrow at most once, at time 0 and the debt contracts will mature at time 1, exactly as described above.

As in Sandleris (2008) even in the absence of sanctions or reputation considerations (as the government can borrow only once), sovereign borrowing could arise as a result of the information structure of the model.

If foreign creditors were to lend to the government $b$ units of the good at time 0, they would obtain $xRb$ when the contract expires at time 1, where $R$ is the gross interest rate on sovereign debt promised in the contract ($R = 1$ if it were a zero coupon bond bond) and $x$ is an indicator variable that captures the government default decision (i.e.: $x \in \{0,1\}$, $x = 0$ if the government defaults and $x = 1$ if the government repays). That is, if the government defaults it will not repay anything.\footnote{This assumption is extreme as it excludes any possible renegotiation that could generate a positive repayment to foreign creditors upon default, which is what we usually observe in reality. The extension of the model to the case where the government could choose any...} Perfect competition between creditors will
make the expected return on sovereign lending equal to the world interest rate in equilibrium. In other words, the zero expected profit condition for foreign creditors is given by:

\[ b = E(x R b) \]  

(4)

If the government were always to default, trivially, the only amount of lending consistent with the zero expected profit condition will be zero lending. If the government were to default in some states of the world and repay in others, for the zero expected profit condition to hold, it has to be the case that the interest rate of the debt contract, \( R \), is larger than the world interest rate. So, the interest rate that the government will have to pay when borrowing from foreign creditors will be equal or larger than the world interest rate as a result of the default risk.

2.4 Optimization and equilibrium

The model can be solved by backward induction. Entrepreneurs have to choose the optimal amount of investment, external and domestic borrowing subject to the international and domestic collateral constraints. Their collateral constraints are a fraction of their verifiable expected net worth, namely the output generated by their endowment. As this output depends on the unobserved fundamentals of the economy, the expected value of the entrepreneurs collateral, and as a result their ability to borrow both domestically and from abroad will depend on creditors’ time 1 expectations of the time 2 output. Given the information structure of the model, creditors will update their expectations at time 1 after they observe the government default/repayment decision, which the government takes after observing the fundamentals. For the same reasons, entrepreneurs’ beliefs about the expected productivity of the time 1 investment will also be updated following the government repayment/default decision.

The time 1 optimization problem of the entrepreneurs is given by:

\[
W^e = \max_{b_{f}^{e}, b_{d}^{e}, x} E_1[\pi^e | x] = E_1[(y(\theta) + A(\theta) f(k)) | x] - b_{f}^{e} - R_d b_d^{e} + z(G) + \psi \\
\text{subject to} \\
b_{f}^{e} \leq \gamma_f E_1[y(\theta) | x] \\
b_{d}^{e} \leq \frac{\gamma_d E_1[y(\theta) | x] - b_{f}^{e}}{R_d} \\
k = b_{f}^{e} + b_{d}^{e}
\]

where \( \pi^e \) are the time 2 payoffs for the entrepreneurs, \( Tr \) are government transfers, \( z(G) \) is the effect of the public goods on welfare and all other variables are defined as before. The first constraint is the international collateral constraint that limits the amount of funds that entrepreneurs can raise abroad, \( x \in [0, 1] \) is straightforward.
the second one is the domestic collateral constraint that does the same for domestic borrowing. The last constraint states that all borrowing will be used for investment, and that borrowing is the only way in which entrepreneurs can obtain the capital good. In addition, we have the usual non-negativity constraints \( k, b_f^*, b_d^* \geq 0 \).

The financial intermediaries, those domestic agents that do not have an investment opportunity at time 1, have some international pledgeable collateral that they cannot used for investment. However, they can use it to borrow from abroad and relend domestically to entrepreneurs in need of capital. So, at time 1 the problem for these entrepreneurs is to choose the optimal amount of relending they are going to undertake:

\[
W^i = \max_{b_d^*} E_1[\pi^i \mid x] = E_1[y(\theta) \mid x] + (R_d - 1)b_d^* + z(G) + Tr \quad (6)
\]

subject to
\[
0 \leq b_d^* \leq \gamma_f E_1[y(\theta) \mid x]
\]

where \( \pi^i \) are the time 2 payoffs for the financial intermediaries, \( b_d^* \) is the amount that the financial intermediaries will borrow from abroad and relend domestically.

I assume that the government is benevolent and maximizes domestic agents’ welfare.\(^{17}\) The government faces two decisions in the model. At time 0 it has to decide how much to borrow and spend in the production of the public, and at time 1, once it has received its private information, it has to decide whether to repay or default on the debt "inherited" from time 0. The time 0 problem is given by:

\[
\max_{b, G} E[W] = E\left[\alpha W^e + (1 - \alpha)W^i\right] \quad (7)
\]

subject to
\[
\begin{align*}
    b &\leq \bar{b} \\
    G &= b \\
    Tr &= T - xRb \\
    G &\geq 0
\end{align*}
\]

where \( T \) are exogenous government resources, and \( \bar{b} \) is the maximum amount that foreign creditors are willing to lend and is the maximum amount of lending that satisfy their zero expected profit condition.

In the absence of any commitment problem the government would just equate the expected marginal return of investing in production of the public

\(^{17}\)With a little additional notation it is easy to analyze cases in which the government is not completely benevolent.
good with the marginal cost of borrowing, but its borrowing will be constrained by its inability to commit to repay.\footnote{The government resource constraint could also limit the ability of the government to borrow. However, in order to focus on the government incentives to repay, it is assumed that \( T \) is large enough.}

The time 1 repayment/default decision can be characterized as follows:

\[
\max_{x \in \{0,1\}} W = \alpha W^c + (1 - \alpha) W^d
\]  
subject to

\[
Tr = T - xRb
\]

\[
Tr \geq 0
\]

Note that at time 1 the government knows the true value of the fundamentals, but it has to take into account that entrepreneurs will maximize their welfare based on updated expectations about them.

Note that the government welfare function is such that it guarantees the existence of a "single crossing property" in the model. In effect, the increase in welfare generated by an increase in investment will be higher when fundamentals are good as capital becomes more productive,\footnote{In general, there would be two effects to take into account when analyzing how better fundamentals affect the effect of higher investment on welfare. The first effect can be thought of as a substitution effect - if more investment is more productive, the second effect, that appears with concavity, is a wealth effect - when fundamentals are good there is more output, so the welfare gain of having additional goods is smaller. Both effects work in opposite directions. The absence of concavity in the model guarantees that the first effect dominates.} while the cost of repaying when fundamentals are good will not be higher than when they are bad.\footnote{Under concavity of the welfare function, the welfare cost of repaying a given amount would be smaller when fundamentals are better as there are more goods available for consumption}

For simplicity, we impose a bit more structure in the model by assuming that:

A3: \( W(\theta, p'(1), G^c, Tr(1)) < W(\theta, p'(0), G^c, Tr(0)) \) \quad \forall \theta , \text{ where } G^c \text{ is the optimal level of public spending under full commitment.}

This assumption guarantees that the government credit constraint binds.

An equilibrium for this economy can be defined as follows:

\textbf{Definition 1} A Perfect Bayesian equilibrium of this economy is a set of time 0 and time 1 borrowing, lending and investment decisions, prices and beliefs:

\{(b^*, G^*), (x, k^*, b_i^*, b_d^*, b_d^*), (R^*, R_d^*, p'(x)) \} such that:

i. \( (b^*, G^*) \) are solutions to equation (7); \( x \) is a solution to (8); \( k^*, b_i^*, b_d^* \) are a solution to (5); \( b_d^* \) is a solution to (6) given prices

ii. Markets clear: \( \pi b_d^* = (1 - \pi) b_d^* \) and \( E(xR) = 1 \)

iii. Beliefs, \( p'(x) \) are consistent with Bayes’ rule

This model is a game that can be solved by backward induction. The strategy for each of the players (government, foreign creditors, entrepreneurs, domestic
financial intermediaries) is a mapping from their information sets that include all observed actions played by other players that move before them to each player action set. Note that as foreign creditors, entrepreneurs and domestic financial intermediaries make their time 1 decisions without observing the value of the fundamentals, they should update their beliefs about them and base their actions on the posterior beliefs, \( p^t \), that condition on the government choices after observing the fundamentals.

3 SOVEREIGN DEFAULTS, INSTITUTIONS AND CREDIT TO THE PRIVATE SECTOR

This section analyzes the interrelation between sovereign defaults, credit market institutions and credit to the private sector both domestic and from abroad. It highlights the effects that sovereign defaults may have on foreign and domestic credit markets through some novel transmission mechanisms. Sovereign defaults will affect the aggregate financial constraint of the private sector and also can constrain the ability of the economy to reallocate resources domestically. In other words, a sovereign default can create a credit crunch in domestic credit markets preventing resource reallocations. This happens even if domestic agents do not hold sovereign debt.

This section also shows that better domestic credit market institutions make sovereign defaults more costly and, as a result, allow for more sovereign lending.

3.1 Domestic credit market equilibrium with domestic and international borrowing constraints

In order to understand the relation between sovereign defaults, domestic credit market institutions and credit to the private sector I begin by analyzing the characteristics of the equilibrium in domestic credit markets.

These domestic agents that do not have a new investment opportunity at time 1 have some international collateral (a fraction of the output that their endowment will generate), and they can use it to borrow from abroad and relend domestically. Through this “credit chain” the economy may manage to aggregate its international collateral and raise resources to finance the time 1 investment projects. This credit chain will arise only if \( R_d \geq R_w \). In particular, if \( R_d > R_w \) all domestic agents without an investment opportunity will want to become financial intermediaries borrowing abroad and relending domestically as much as possible. They will do so up to the point when their international collateral becomes exhausted. On the other hand, if \( R_d = R_w \), they will be indifferent between borrowing and relending or not:

\[
b^*_d = [0, \gamma \tilde{E}_1 | y(\theta) | x]
\]  

(9)
This implies that borrowing from abroad will always be at least as cheap as borrowing domestically. Thus, entrepreneurs will turn to domestic credit markets only after exhausting their ability to borrow from abroad.\footnote{For simplicity I am assuming that if indifferent entrepreneurs will always borrow first from abroad.} In other words, if their international collateral constraint does not bind, then domestic credit markets will not arise.

Let’s focus on the more interesting cases, the ones where the international collateral constraint binds for the entrepreneurs. When this happens an entrepreneur can be in one of two possible situations at time 1:

- The international collateral constraint binds, but the domestic one is slack, so the expected marginal product of capital is equal to the domestic interest rate ($MPK = R_d$).

- Both the international and the domestic collateral constraints bind, so the expected marginal product of capital is larger than the domestic interest rate ($MPK > R_d$).

Financial intermediaries will also face two possible situations:

- The international collateral constraint binds, which would happen only if the domestic interest rate is larger than the world interest rate ($R_d > R_w$)

- The international collateral constraint is slack because financial intermediaries are indifferent between borrowing and relending or not doing it, which would happen only if the domestic interest rate is equal to the world interest rate ($R_d = R_w$)

I summarize in Proposition 1 the main results up to here:

**Proposition 1 (Proposition 1)** The economy can be in one of four regions at date 1, depending on which collateral constraints bind.

- Region I: the only binding constraint is the international collateral constraint of the entrepreneurs. As a result, the expected marginal product of capital will be equal to the domestic interest rate and to the world interest rate ($MPK = R_d = R_w$).

- Region II: the international collateral constraint binds for both the entrepreneurs and the financial intermediaries while the domestic collateral constraint of the entrepreneurs is slack. There is a positive spread between the domestic interest rate and the world interest rate ($R_d > R_w$); but the expected marginal product of capital is equal to the domestic interest rate ($MPK = R_d$)

- Region III: both the international and the domestic collateral constraints bind for the entrepreneurs, but the international collateral constraint of the financial intermediaries is slack. The domestic interest rate is equal to the world
interest rate \( R_d = R_w \), but the expected marginal product of capital is higher than the domestic interest rate \( MPK > R_d \).

- Region IV: both the international and domestic collateral constraints of the entrepreneurs, and the international collateral constraint of the financial intermediaries bind (i.e. all constraints bind). There is a positive spread between the domestic interest rate and the world interest rate \( R_d > R_w \), and the expected marginal product of capital is higher than the domestic interest rate \( MPK > R_d \).

The following Figures illustrates these regions. The supply curve in each figure is the supply of international collateral in the economy. It is horizontal at the level of the world interest rate, \( R_w = 1 \), up to the point where the economy exhaust its international collateral and the constraint binds. Initially entrepreneurs use their own international collateral, once exhausted, financial intermediaries begin borrowing from abroad and relending domestically. The unconstrained demand curve traces the marginal product of capital for entrepreneurs. The domestic borrowing constraint is downward sloping as higher domestic interest rates makes the constraint tighter.
While in Region I the economy achieves the unconstrained level of investment, in the other three regions the constraints distort the allocation of resources in the economy leading to less investment, output and welfare.

In Region II the economy manages to aggregate all of its international collateral, but this is insufficient to achieve the undistorted level of investment. The economy as a whole suffers from the lack of sufficient international collateral. As a result, there exists a positive spread between the domestic interest rate and the world interest. As the domestic collateral constraint does not bind the marginal product of capital equals the domestic interest rate.

In an economy situated in Region III the problem is not the lack of sufficient international collateral at the aggregate level, but the binding domestic collateral constraints at the individual level. Institutions in domestic credit markets, γ_d, are weak and allow for limited amounts of domestic borrowing. The lack of sufficient domestic collateral depresses the demand for funds and the economy
fails to aggregate all of its international collateral due to domestic credit markets imperfections. In this Region, domestic and world interest rates are equal, but smaller than the marginal product of capital. There are profitable investment opportunities that can not be pursued. However, providing more international collateral to such an economy would have no effect on the outcome, only more domestic collateral could change the outcome.

Finally, an economy situated in Region IV suffers from weak domestic credit institutions and insufficient international collateral. The economy is able to aggregate all of its international collateral, but this is insufficient to finance the demand for funds. Even if this demand is depress by the lack of sufficient domestic collateral. There exists a positive spread between the domestic and the world interest rate, and the marginal product of capital is higher than the domestic interest rate. Again there are profitable investment opportunities than cannot be pursued.

3.2 Sovereign defaults and credit to the private sector

In any of the four regions in which an economy could be, the information structure of the model is such that the repayment/default decision of the government reveals information to entrepreneurs, financial intermediaries and foreign creditors about the fundamentals of the economy.

In the model, a sovereign default will negatively affect the expected return of entrepreneurs’ investment projects and with it the desired level of investment and the demand for funds. At the same time, it will have a negative impact on entrepreneurs’ net worth. Their collateral, a fraction of their net worth, will also decline, reducing entrepreneurs’ ability to borrow both from abroad and domestically. In other words, a sovereign default will reduce the international collateral of the economy and also the ability of domestic credit markets to aggregate it. As a result, investment will decline and output will suffer.

The mechanism through which a sovereign default can create a credit crunch in domestic credit markets, reduce the ability of the private sector to borrow from abroad, and cause a decline in investment and output is not related to the domestic private sector holding government debt. It is the result of the information content of defaults.

A sovereign default may affect private sector expectations about the fundamentals of the economy. The intuition is straightforward. When the government makes its repayment/default decision, it has some private information about the fundamentals that is relevant for the private sector in choosing its investment, borrowing and lending levels. Assume that private sector agents’ were to believe that fundamentals are good if the government repays and that they are bad if it defaults. If fundamentals are indeed good the gain from repaying in terms of higher investment and output are higher than if fundamentals are bad, as capital is more productive when fundamentals are good. At the same time, the linearity of the preferences guarantees that the cost of repaying is the same if fundamentals are bad than if they are good. So, we will have
that for certain amounts of sovereign debt, the government will only repay if fundamentals are right and default if they are bad, so beliefs were consistent.

In the model, a default will endogenously become a signal of bad fundamentals and affect expectations. Thus, as in Sandleris (2008), the government may have incentives to repay at least for some realizations of the fundamentals even in the absence of sanction or reputational effects. The following proposition formalizes these observations.

**Proposition 2** *(Proposition 2)* There exists an equilibrium with positive sovereign borrowing where the government defaults when fundamentals are bad, and repays otherwise. In this equilibrium:

\[
p'(0) = 0 \text{ and } p'(1) = 1
\]

\[
R^* = \frac{1}{p}
\]

\[
b^* > 0 \text{ and, in particular it will be the one that makes: } W(\bar{\theta}, p'(1), b^*, T - \frac{1}{p} b^*) - W(\bar{\theta}, p'(0), b^*, T) = 0
\]

**Proof.** See Appendix ■

The previous proposition shows that there exists an equilibrium for this model with positive sovereign borrowing in which the government will default when fundamentals are bad, and repay when they are good. The government repays to communicate information about the fundamentals to other agents in the economy, and in this way influences their expectations. In other words, the government repays out of concern of the effect of a default on expectations.²²

It is interesting to analyze in more detail the potential effects of a default (through expectations) in this equilibrium. Assume that the government has privately observed that fundamentals are good and it has to decide whether to repay or default. In Region III the international collateral constraint binds for both the high and low output entrepreneurs and the domestic collateral constraint is slack. The binding aggregate constraint means that the economy has insufficient resources to finance all investment needs. A default would negatively affect the desired level of investment at time 1, and in addition it will decrease the value of the international collateral, making the constraints even more stringent. The economy as a whole would be able to borrow less from abroad and as a result the amount of time 1 investment will decrease. The domestic interest rate may go up or down depending on the demand and supply elasticities.

An alternative channel behind a real contraction following a default is a shortage of domestic collateral. This would happen in Region II where the economy is failing to aggregate all of its international collateral. Even when the private sector has sufficient resources in the aggregate, entrepreneurs in need of funds have insufficient domestic collateral, so they will not be able to access these resources. A default would make the collateral constraints more stringent.

---

²²This separating equilibrium is not the only possible equilibrium of this economy. Another trivial equilibrium is one in which there is no lending to the government. Another set of equilibria for this model is one in which there is a positive amount of sovereign debt and the government never defaults (pooling equilibria). We focus on the separating equilibrium, but the reasoning holds for the pooling too. See Sandleris (2008) for details on the pooling equilibrium in a different setting.
In these two regions, repaying following a good or a bad shock would relax the collateral constraints and allow an investment level closer to the unconstrained optimum. However, while the increase in welfare that this would generate outweighs the cost of repaying when the shock is good, it does not when the shock is bad. The reason is that investment is more productive when the shock is good than when it is bad, as a result relaxing the collateral constraints is more valuable when the economy has better investment opportunities.

Finally, in Region IV where all collateral constraints bind, a default would generate again a decrease in the desired level of time 1 investment and make all collateral constraints more stringent. The economy as a whole would be able to borrow less from abroad, and in addition domestic entrepreneurs will be able to borrow less domestically. It is the concern about these potential costs the reason why the government will repay foreign creditors in the model. The following graph shows the effects of a default for an economy in this region.

Repaying would relax the collateral constraints and allow an investment level closer to the unconstrained optimum. However, in this separating equilibrium, while the increase in welfare that this would generate outweighs the cost of repaying when fundamentals are good, it does not when fundamentals are bad. The reason is that investment is more productive when fundamentals are good than when it is bad, as a result relaxing the collateral constraints is more valuable when the economy has better investment opportunities.

Figure 2:
3.3 Domestic financial market institutions and sovereign borrowing

An interesting result of the model is that the degree of development of domestic financial institutions will affect the ability of a sovereign government to borrow from abroad. The mechanism is simple. More developed financial institutions, higher $\gamma$s, imply, for economies in Regions where the constraints bind, that a default would have a larger effect on credit to the private sector. So, the benefits of repaying become larger and as a result the amount of sovereign debt that can be supported in equilibrium are higher. The following proposition formalizes this.

**Proposition 3 (Proposition 3)** For all other things equal, countries in Region II, III and IV with more developed financial institutions, higher $\gamma$s, will be able to engage in more sovereign borrowing

**Proof.** See Appendix ■

This result allows us to understand the relation between domestic financial institutions that determine in the model the leverage that entrepreneurs can achieve and sovereign borrowing.

This result could be relevant for example to understand the issue of debt intolerance highlighted by Reinhart et al, that tries to understand why countries default at different ratios of debt to GDP. According to this model, part of the explanation would lie in different degrees of development in domestic financial institutions.

Note also that if we interpret $\gamma$ as the degree of leverage that the private sector can achieve we will have, for $\gamma > 1$ an amplifying effect of the financial systems on the cost of defaults.

4 CONCLUSIONS

This paper addresses two questions. First, it studies whether in an economy in which domestic agents do not hold sovereign bonds, a sovereign default can affect credit to the private sector. Second, it analyses whether the presence of stronger domestic financial institutions, such as better legal enforcement of private sector contracts or improved corporate governance, can affect the incentives of a government to default, and with it, the ability of a government to borrow or the cost of borrowing.

In a simple macroeconomic model the paper identifies two channels through which a sovereign default, through its effect on expectations about fundamentals, may have a widespread effect on the domestic economy, generating potentially massive costs in terms of output and welfare. A default can decrease domestic firms’ desired investment, and it can negatively affect firms’ net worth, which will make firms’ collateral constraints more stringent. These two effects,
in turn, could trigger a contraction in foreign lending to domestic firms (even without sanctions), a credit crunch in domestic credit markets, and a decrease in firms’ actual investment.

The paper also highlights an often overlooked benefit from reforming domestic financial institutions. Better financial institutions can reduce the incentives of a government to default and with it relax the government foreign borrowing constraint.
References


5 APPENDIX

5.1 Proofs

Proposition 2. The proof of this proposition involves 4 steps.

i. There exists a solution to agents individual problems

As all agents are maximizing continuous functions over compact sets, from
Weierstrass theorem there exists a maximum.

ii. There are updating rules of private sector beliefs for which the government
will repay a positive amount of debt

\[ W(\hat{\theta}, p'(1), G, T - Rb) - W(\hat{\theta}, p'(0), G, T) > W(\theta, p'(1), G, T - Rb) - W(\theta, p'(0), G, T) \]

if \( p'(1) > p'(0) \). Note that if \( bR = 0 \) then \( W(\hat{\theta}, p'(1), G, T - Rb) - W(\theta, p'(0), G, T) \)

is given the assumption that \( p'(1) > p'(0) \), so by continuity \( \exists bR > 0 \) for which

\[ W(\hat{\theta}, p'(1), G, T - Rb) - W(\theta, p'(0), G, T) > bR \] This implies that even under

bad fundamentals the government will be willing to make some repayments as

long as the amount of debt is low enough though still positive. Pick any positive

level of debt \( b \) and interest rate \( R \) such that

\[ W(\hat{\theta}, p'(1), G, T - Rb) - W(\hat{\theta}, p'(0), G, T) > bR > W(\hat{\theta}, p'(1), G, T - Rb) - W(\theta, p'(0), G, T) \]

It is clear that for any such level of debt and interest rate the government

will only find optimal to repay when fundamentals are good and that \( bR > 0 \).

iii. The updating of beliefs is consistent

In the previous step I have assumed that \( p'(1) > p'(0) \). In particular, let

\( p'(1) = 1 \) and \( p'(0) = 0 \). That is, after a default beliefs are that fundamentals

are bad, and after a repayment beliefs are that fundamentals are good. Given

this updating rule, from (ii) there exist strictly positive levels of debt for which

the government will repay only when fundamentals are good and default when

they are bad. As a result the updated beliefs will be correct on equilibrium.

iv. In this equilibrium: \( R^* = \frac{1}{p} \) and \( b^* \) will be such that \( W(\hat{\theta}, p'(1), b^*, T - \frac{1}{p} b^*) - W(\hat{\theta}, p'(0), b^*, T) = 0 \)

Perfect competition in international credit markets implies that foreign credi-
tors will lend to the government any amount that satisfies their zero expected
profit condition. The maximum amount that the government can commit to
repay (i.e.: the incentive compatibility constraint) when fundamentals are good
is the one that would make the government indifferent between repaying and
defaulting when fundamentals are good, which is given by: \( W(\hat{\theta}, p'(1), b^*, T - \frac{1}{p} b^*) - W(\hat{\theta}, p'(0), b^*, T) = 0 \)

From A5 the borrowing constraint will bind, so the government will borrow
as much as possible, which implies that \( b^* = \bar{b} \).

In addition, for the zero expected profit condition to hold:

\[ b^* = E[xR^*b^*] \]

As the government will only repay when fundamentals are good and this
happens with probability \( p \):

---

\(^{23}\)This proof follows that of Proposition 1 in Sandleris (2008).
\[E[xRb] = pR^*b^*\]
So, from the two previous expressions: \(R = \frac{1}{p}\) ■

**Proposition 3.** For a country in Regions II and IV total credit to the private sector, and therefore, investment is given by:

\[b_f^* = \gamma_f E_1[y(\theta) | x].\]
In the separating equilibrium we would then have:

\[b_f^*(x = 1) = \gamma_f y(\theta) \quad \text{and} \quad b_f^*(x = 0) = \gamma_f y(\theta)\]

Recall that \(W = \alpha W^e + (1 - \alpha)W^i\). and \(W^e = \max_{b_f^*} E_1[\pi^e | x] = E_1[(y(\theta) + A(\theta)f(k)) | x] - b_f^* - R_b^* + z(G) + Tr\)

So, \(W(\bar{\theta}, p'(1), b^*, T - \frac{1}{p}b^*) - W(\bar{\theta}, p'(0), b^*, T)\) is increasing in \(\gamma_f\). A similar argument can be made for a country in Region III. ■