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Optimal sovereign lending and default☆

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ABSTRACT

A model of dynamic contracting with private information is constructed to study sovereign lending and default. The model endogenizes debt exclusion and provides a theory of reentry and a theory of debt dynamics within the exclusion period. It explains why countries may end up more indebted after the exclusion period. It offers an interpretation for the mixed evidence on the correlation between default probability and indebtedness. It also explains the observed positive correlation between the duration of default and the size of haircut.

1. Introduction

We develop a model of dynamic contracting with private information to study sovereign lending and default. The model endogenizes debt exclusion, providing a theory of reentry and a theory of debt dynamics within the exclusion period. It explains why countries may end up more indebted after the exclusion period. The model also offers an interpretation for the mixed evidence on the correlation between default probability and indebtedness, and it explains the observed positive correlation between the duration of default and the size of haircut.

The hallmark of the market for sovereign debt is that defaults occur periodically with individual sovereign countries. Reinhart and Rogoff (2011) call this the "serial default", a widespread phenomenon especially across emerging markets. These defaults may occur five or fifty years apart. They may be wholesale default (or repudiation) or a partial default through rescheduling. During any default, the defaulting country is either completely excluded from the world credit market, or it must face extremely high interest rates for new loans. Moreover, the observed default spells are lengthy on average, with large variability in duration, and sometimes leaving the sovereign countries more deeply indebted coming out of default.[1]

The literature thus calls for an explanation for the widely observed serial default and the related dynamics and outcomes. Such a theory should let default emerge serially and endogenously, with variable and potentially long default durations. The theory should be able to endogenize the "exclusion" periods — when they start, how they end and what happens over them. As to be discussed shortly, standard incomplete market models of sovereign default view reentry into borrowing as an exogenous event. The theory must also explain why the default episodes are so lengthy and what puts the sovereign country more deeply in debt when they end.

We attempt to offer such a theory. Our approach is to view sovereign lending as being governed, in an environment with private information and limited commitment, by a dynamic contract that specifies, for each current and ex post state of the world, whether

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[1] e.g., Benjamin and Wright (2013) show that the average default takes more than 8 years to resolve, results in creditor losses of roughly 50%, and leaves the sovereign country as or more highly indebted than when they entered default. Their dataset also shows great variability in the length of the default spell across countries and over time.

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lending should occur in that state, and how much repayment must be made. Default is interpreted as a state of the dynamic contract where the borrower – the sovereign country – ceases, completely or partially, to repay the credit of the international lender; the lender suspends the borrower's access to international lending; and the parties enter a new continuation of the contract where the values of both the borrower and the lender are significantly marked down.

In the model, a risk averse borrower, the sovereign country, runs a project and privately observes its output. Each period, the project must be funded, either internally with the borrower's own capital, or externally with capital provided by a fixed risk neutral lender — a foreign financial institution or the international capital market. The source of finance affects the return of the project. Funded internally, it produces a low and constant autarkic output; externally, it produces a stochastic output with realizations strictly greater than the constant autarkic output.

In this environment, suspension in lending, or temporary cutoff in the supply of the external finance, is used as an incentive device for inducing the borrower to truthfully reveal the return of the project. The optimal contract generates long-run dynamics where episodes of lending and suspension alternate. All individual spells of lending end after a stochastic but finite number of periods, to be followed by a spell of suspension over which the values of the parties are reorganized to start a new cycle of lending and suspension. Over any individual episode of lending, the borrower's repayment of credit depends on the history of his output, and a sequence of low outputs would send him to a state of suspension. Over any episode of suspension, the borrower would continue to make non-negative debt repayments to the lender, until a new episode of lending begins.

In the model, lending is suspended because the low output has been reported too many times, and suspension allows incentives to be reorganized to support the next cycle of financial lending. Although permanent termination is feasible, it is not optimal in almost all times. The duration of suspension, which is chosen optimally, depends on the size of the repayment that would need to be installed before lending can be resumed. In a way then, what suspension does is to allow the borrower to repay old debt while not taking in new debt and so lending can restart, after a sufficiently large penalty on the borrower has been enforced.

We interpret a suspension spell as an episode of default where the "normal" debt repayment is revised to a minimum level (or simply zero depending on the size of the sovereign country's autarkic output), and the defaulting country is suspended from accessing international capital markets.[2] The suspension in lending, by reverting the sovereign country to the inferior autarkic technology, punishes not only the borrower, but also the lender, resulting in a lower value for both parties. When suspension ends, lending then reemerges with a "restructured" lending contract — the continuation of the optimal contract that follows the suspension in lending.

The model is constructed to capture an essential feature of the observed sovereign lending relationship: that the lender must depend on the borrower or the sovereign nation's willingness, not just its ability, to repay the debt. In the model, the lender cannot impose bankruptcy on the borrower — to seize the ownership or replace the management of his assets. What the lender can do is to terminate the lending, either temporarily or permanently, as such an action arises optimally from his perspective.

The optimal contract is fully characterized. It offers a vehicle for thinking about a set of key questions pertaining to the practice of sovereign lending. First, the model is in line with the observation that default events are usually associated with recessions in output. In the data, default is typically triggered by a negative productivity shock after which output drops and becomes less volatile over the spell of default.[3] In the model, only a negative (reported) output shock could trigger default, as the borrower has no incentives to report a high output when he produces a low. Once into a default, the exclusion from external credit would result in, for the sovereign country, both lower output and a lower ability to repay the lender.

Second, in the model, in all periods of suspension, the optimal contract specifies that the borrower transfer all its autarkic output to the lender. This is consistent with the many observed cases where an indebted country was denied new loans but has been asked to repay its outstanding debts after it has suffered an adverse output shock, as studied in Atkeson (1991). Our theory offers an interpretation for this, which, as the literature observes, seems at odds with efficient risk sharing.

Third, the model generates potentially long durations of defaults, depending on the characteristics of the sovereign country. The model also predicts the observed positive correlation between the length of the default and the size of the haircut.

Fourth, the model offers an interpretation for the mixed evidence on the correlation between default and indebtedness. In the model, higher probabilities of default are driven by lowered values of the sovereign country which, because of the following reasons, could be associated with either lower or higher values for the lender, and in the latter case increased borrower indebtedness. First, all else equal a lowered borrower value implies more repayments to the lender, which translate into larger borrower indebtedness. Second, lowered borrower value increases the probability of default (given limited liability, lower borrower value reduces the lender's ability in achieving incentive compatibility while keeping the lending ongoing, forcing the lender to rely more on the use of suspension for borrower incentives), reducing the total repayments that the lender is able to collect, lowering the sovereign country's indebtedness.

Fifth, the model is consistent with the observation that default resolutions are not necessarily associated with reduced country indebtedness.[4] In the model, whether the sovereign country would exit a default with increased or decreased indebtedness depends on the state it enters the default from, which in turn depends on the history and dynamics leading to that state. In most cases, the sovereign country would enter default from a sufficiently high level of pre-default indebtedness that the post-default level of indebtedness would be lower, as in the data.

The issue of sovereign lending and default has been extensively studied. Mainstream quantitative models of sovereign default, including Eaton and Gersovitz (1981), Arellano (2008), and Mendoza and Yue (2012), model international lending in incomplete markets. Lending is carried out in standard debt contracts that specify a constant repayment, and the sovereign country is not able to commit to its debt obligations. If the current state of the world is such that the net gains from defaulting dominates that of not defaulting, the country will choose to default. In these models, once default occurs, the sovereign country will either be excluded from the world credit market for an exogenously given number of periods, or face in each period after defaulting a constant probability to re-enter the world credit market.

Kovrijnykh and Szentes (2007) were the first to develop a theory of endogenous serial default. In their model, the sovereign country

[2] Most sovereign defaults are partial, in which the sovereign state refuses to pay the debt in full (Reinhart and Rogoff, 2011; Tomz and Wright, 2013). In this sense, our model predicts both full and partial default.

[3] For example, Mendoza and Yue (2012) summarize 23 default events in the 1977–2009 period. They show that default events are associated with deep recessions where on average GDP and consumption fall about 5% below trend.

[4] Benjamin and Wright (2013) show for their sample of 90 defaults that indebtedness, measured by the ratio of the face value of debt to GDP, does not fall, and may even rise, after a default. The median and average country exits default with a debt to GDP ratio −4 and +1 percentage points higher than before they entered default, respectively.