

Introduction to the Special Issue on Models of Debt and Debt Crises

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Abstract This special issue contains 10 articles that develop models of debt and debt crises. Some articles address fundamental questions about the theory of debt: What assumptions are needed to support positive levels of sovereign debt in models where governments can default? Is there evidence in the data to justify these assumptions? Are market outcomes in models of debt constrained optimal, or are interventions by an outside authority justified? Other articles address the question of why governments find it so difficult to reduce levels of sovereign debt. Yet other articles address the question

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of how the anticipation of actions taken after a crisis occurs—financial assistance by international agencies, bargaining over partial repayment of debt, and holdout investors who reject partial repayment bargains—can affect actions taken leading up to the crisis or can delay the resolution of a crisis.

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1 Introduction

The European debt crises that began in Greece in 2010 have unleashed a torrent of research on debt and debt crises. The editors of this special issue organized a symposium on debt and debt crises as part of the 13th Annual Conference of the Society for the Advancement of Economic Theory held in Paris in July 2013.

This special issue contains 10 articles based on papers presented at the 2013 symposium in Paris. There are many interrelationships across the research in the articles in the volume. This introduction provides one way of grouping the general themes covered by the articles. Some articles address fundamental questions about the theory of debt: What assumptions are needed to support positive levels of sovereign debt in models where governments can default? Is there evidence in the data to justify these assumptions? Are market outcomes in models of debt constrained optimal, or are interventions by an outside authority justified? Other articles address the question of why governments find it so difficult to reduce levels of sovereign debt. Yet other articles address the question of how the anticipation of actions taken after a crisis occurs—financial assistance by international agencies, bargaining over partial repayment of debt, and holdout investors who reject partial repayment bargains—can affect actions taken leading up to the crisis or can delay the resolution of a crisis.

2 Theories of debt

A crucial element of any theory of sovereign debt is the incentives to repay debt. If lenders know that a country does not have an incentive to repay its debts, they will not lend to the country. In a seminal contribution, [Bulow and Rogoff \(1989\)](#) argued that, contrary to arguments popular in the earlier literature, exclusion from borrowing upon default, a weaker punishment than reversion to autarky, is too weak to sustain debt repayment. The important insight is that the debt levels associated with a budget-feasible consumption contract are bounded by the natural debt limits defined as the present value of future net income. When interest rates are sufficiently high, natural debt limits are well defined and satisfy the following rollover property: the natural debt limit at some node on the uncertainty tree is higher than the present value of the natural debt limits at all immediate successor nodes. This property implies that, when the ratio of debt to natural debt limits attains its maximum, the sovereign can default and implement a replication strategy by saving to self-insure to achieve a consumption plan that improves on the consumption plan that is subject to debt

repayment. [Martins-da-Rocha and Vailakis \(2017\)](#) argue that, if interest rates are not high enough, this maximum ratio of debt relative to natural debt limits need not be achieved in finite time, in which case the argument of Bulow and Rogoff fails. Their main contribution is to show that the result in Bulow and Rogoff nevertheless holds in full generality, free of any assumption imposed on the net income process or on preferences, apart from strict monotonicity.

The lesson to be taken from the work of Bulow and Rogoff and of Martins-da-Rocha and Vailakis is that some sort of default penalty, other than exclusion from future borrowing, is needed to support positive levels of debt in equilibrium in models of sovereign debt. In a calibrated model of the 1994–1995 Mexican debt crisis, [Cole and Kehoe \(1996\)](#) assume that a country that defaults suffers a 5% drop in productivity forever, a common assumption in the literature since then. [Alonso-Ortiz et al. \(2017\)](#) develop a model in which a government's decision to default triggers a change in the regime of a stochastic productivity process. Using data on sovereign bond yields to infer probabilities of sovereign defaults and data on stock market returns to infer probabilities of drops in productivity, they estimate that investors anticipate that a default would result in a drop in productivity in the range of 3.7–5.9%. Their model and data analysis are important first steps in providing support for the assumptions used in models of sovereign debt.

Prompted by recent crises in the Eurozone, economists have reexamined arguments that a monetary union without a fiscal union is unworkable. The classic references are [Mundell \(1961, 1973\)](#) and [Kenen \(1969\)](#). More recent references are [Chari and Kehoe \(2004\)](#), [Galí and Monacelli \(2008\)](#), and [Farhi and Werning \(2012\)](#). A common argument is that within a monetary union, a unionwide authority orchestrating fiscal transfers between countries is necessary to provide insurance against country-specific economic fluctuations. [Kehoe and Pastorino \(2017\)](#) argue to the contrary, asking why governments do not use financial markets to hedge against these country-specific economic fluctuations on their own. They begin by showing that, in a benchmark economy with no international financial markets, an activist unionwide authority is necessary to achieve desirable outcomes. They then show that, with sufficient financial markets, however, such an authority is not necessary if its only goal is to provide cross-country insurance. Kehoe and Pastorino, in effect, challenge the incomplete markets foundations of models of debt and debt crises.

While Kehoe and Pastorino argue that rich enough financial markets can obviate the need for intervention by an outside authority, [Kokonas and Polemarchakis \(2017\)](#) show that such interventions can be welfare improving in environments where market outcomes are not constrained optimal. [Kokonas and Polemarchakis \(2017\)](#) extend the analysis of [Demange \(2002\)](#), who had studied an economy of overlapping generations with life spans of two periods, one commodity at each date, and uninsurable idiosyncratic uncertainty on endowments. Demange demonstrated that a long-lived asset, land, traded subject to a ban on short sales ensured the constrained optimality of competitive allocations. Kokonas and Polemarchakis, however, provide a series of counterexamples that demonstrate that constrained optimality depends crucially on the restrictions of life spans to two periods and of the commodity space to a single commodity. With multiple commodities in each period or more than two periods in the life spans of generations, constrained suboptimality results because young con-

sumers invest too much in land to insure themselves against unfavorable realizations of uncertainty later in life. This provides a justification for intervention by an outside authority: aggregate debt policy that provides an additional asset that consumers can save can implement Pareto improvements.

3 Preventing debt crises

Cole and Kehoe's (1996, 2000) analysis of the Mexican debt crisis demonstrated that the optimal policy of a government that finds itself vulnerable to a debt crisis is to run surpluses to reduce the debt over time. Three of the articles in this volume argue that this sort of austerity policy may be painful to implement and, in fact, may not be optimal in richer model environments. In discussing the first two articles, we draw a distinction between two different types of debt crises. This distinction is also relevant for the discussion of the articles in the next section. The first type of crisis is one touched off by a shock to fundamentals—usually a drop in productivity—that makes it difficult for the government to repay its debt. Arellano (2008) develops a dynamic, stochastic general equilibrium model of this sort of crisis; an important earlier reference is Eaton and Gersovitz (1981). The second type of crisis is a self-fulfilling crisis in which investors, anticipating a crisis, are unwilling to buy the bonds, thereby provoking the crisis. Here, the shock is a stochastic event, unrelated to fundamentals and often called a sunspot. Cole and Kehoe (1996, 2000) develop a dynamic, stochastic general equilibrium model of this sort of crisis; an important earlier reference is Calvo (1988).

The consequences of fiscal austerity measures generated a major debate during the European debt crises. Austerity proponents argued that cutting expenditures and increasing taxes would allow countries to reduce their debt and exit the crisis. Reinhart et al. (2012) point to the detrimental impact on the growth of public debt overhang in many advanced economies since 1980, suggesting that reducing public debt can generate growth. In contrast, the opponents of fiscal austerity see decreasing government expenditures as detrimental because it starves an economy of much-needed aggregate demand. House et al. (2017), for example, find that austerity in Europe during the debt crises was contractionary and in some cases led to an increase in debt. Arellano and Bai (2017) develop a model that supports the argument against austerity in the case of Greece. In their model—an extension of that of Arellano (2008)—an endogenous debt crisis can arise from either weak aggregate conditions or weak public sector revenues. They apply their framework to Greece and find that fiscal reforms would not have prevented the crisis; aggregate output in Greece was just too weak.

Conesa and Kehoe (2017) develop a model for analyzing the sovereign debt crises of 2010–2013 in the Eurozone. In their model, as in that of Cole and Kehoe (1996, 2000), the need to sell large quantities of bonds every period leaves the government vulnerable to self-fulfilling crises. As in the Cole-Kehoe analysis, the government has an incentive to reduce its debt to a level where crises are not possible. Conesa and Kehoe also model the economy as being in a recession where there is a positive probability of recovery, which gives the government an additional incentive to smooth consumption and increase debt. They identify the conditions on fundamentals—in particular, a severe recession with a significantly large probability of recovery—where

the incentive to smooth consumption dominates the incentive to reduce debt. In this sort of situation, a government optimally chooses to run fiscal deficits and increase its debt, thereby increasing its vulnerability to crises, a policy choice that Conesa and Kehoe call “gambling for redemption”.

Chen and İmrohorođlu (2017) do not model crises, but they assume that it is desirable to reduce the ratio of government debt to GDP in the USA or at least stem the growth of this ratio. To analyze the costs of different policies to curb the government deficit and the resulting debt, Chen and İmrohorođlu develop a calibrated dynamic general equilibrium model of the US economy with distortionary taxation. They argue that debt-to-GNP ratios above 100% are likely to continue into the future. Increasing labor taxes would cut the deficit but would also cut GDP. Their results indicate that labor income tax rates of 40% or more are required to reduce the deficit-to-GNP ratio to its historical level, but that these sorts of high tax rates would lead to a 10% drop in GNP per capita and large welfare losses.

4 During and after a crisis

International financial institutions play an important role in the management of international financial crises. During 2016, for example, the International Monetary Fund had a budget of over 600 billion US dollars for lending to countries in crisis. The purpose of IMF lending programs is to lower the costs of crises. This leaves open the important question of whether the existence of these programs affects the probability that a crisis arises in the first place. Kirsch and Rühmkorf (2017) develop a theory, based on that of Arellano (2008), to answer this question. They find that financial assistance programs reduce the likelihood of self-fulfilling runs but allow countries to accumulate more debt in total. Higher levels of debt can then increase the probability of fundamental sovereign debt crises despite the better insurance possibilities provided by financial assistance programs. In a quantitative application for the case of Argentina, they argue that financial assistance programs did in fact increase the probability of default.

Araujo et al. (2017) develop an extension of the Cole-Kehoe (1996, 2000) model in which the creditors and the debtor country engage in a Rubenstein (1982) bargaining game after a default has occurred to determine the share of debt repayment in a sovereign debt crisis. After a default has occurred, the possibility of partial repayment reduces the costs of default to both the creditors and the debtor country because it reduces the delay and costs of a settlement. Before a default, however, the possibility of partial repayment increases the upper limit for debt accumulation, as in the Kirsch-Rühmkorf model. It also reduces the incentives for the government to run down its debt when it is vulnerable to a crisis.

Holdout creditors impede and disrupt debt restructurings, leading to lengthy and costly processes. In 2013, for example, the holdout creditors from the 2005 Argentina default won a settlement that disrupted all financial markets transactions for Argentina. This sort of problem has become more prevalent over time as a larger number of creditors participate in secondary bond markets. The details of default events lead to delays for restructuring of varying length, and this connection is not well understood.

Pitchford and Wright (2017) provide a tractable and flexible theory that can be used to analyze a broad class of settlements after debt crises. Their framework contains a rich set of empirical predictions on the distribution of delays mapped to multiple factors, which enhance our understanding of the reasons for these costly delays.

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