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Sovereign debt and reserves with liquidity and productivity crises

Flavia Corneli [a,*], Emanuele Tarantino [b]

[a] Bank of Italy, via Nazionale 91, 00184 Rome, Italy
[b] Department of Economics, University of Mannheim, L7, 3-5, 68131 Mannheim, Germany

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During the recent financial crisis, emerging economies have kept accumulating both sovereign reserves and debt. To account for this empirical fact, we model the optimal portfolio choice of a sovereign that is subject to liquidity and productivity shocks. We determine the equilibrium level of debt and its cost by solving a contracting game between sovereign and international lenders. Although raising debt increases the sovereign exposure to liquidity and productivity crises, the simultaneous accumulation of reserves can mitigate the negative effects of such crises. This mechanism rationalizes the complementarity between debt and reserves.

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1. Introduction

During the recent financial crisis, several emerging economies have kept accumulating both sovereign debt and reserves. The descriptive evidence in Fig. 1 shows that, between 2008 and 2011, for most of the countries in the picture external sovereign debt increases together with reserves and the cost of this debt. The return on reserves is significantly lower than the cost of sovereign debt (Rodrik, 2006), and this piece of evidence has posed a puzzle (Alfaro and Kanczuk, 2009; Obstfeld et al., 2010): why don't countries repay debt instead of raising reserves? We develop a static model of optimal portfolio choice of a sovereign that is subject to liquidity and productivity shocks. We find that, although

* Corresponding author. Tel.: +39 06 4792 4150.
E-mail address: flavia.corneli@bancaditalia.it (F. Corneli).

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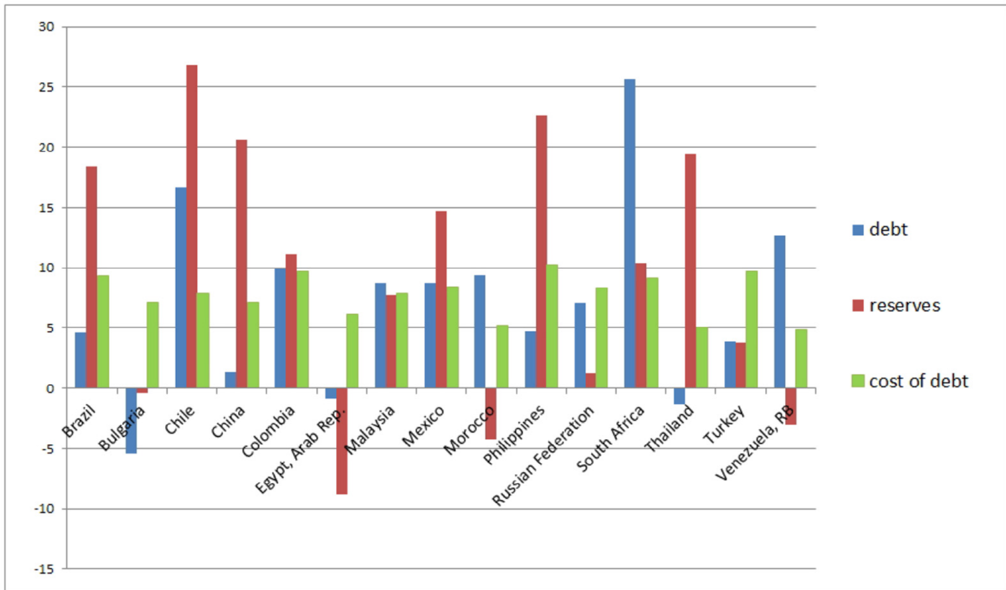

Fig. 1. External debt, sovereign reserves and the cost of debt – average % variation 2008–2011. Source: World Bank WDI, JP Morgan's EMBI.

raising debt increases the sovereign's exposure to liquidity and productivity crises, the contemporaneous accumulation of reserves mitigates the consequences of these crises on sovereign welfare. We therefore show that, in the sovereign's optimal strategy, reserves complement debt.

In principle, reserves and debt can be substitute means to address liquidity crises. By decreasing its level of debt, a sovereign reduces its exposure to liquidity shocks. By accumulating reserves, the sovereign holds resources that can be liquidated and injected if a liquidity shock occurs. Yet, Rodrik (2006) and Mohd Daud and Podivinsky (2011) show that the accumulation of reserves is not accompanied by a reduction of debt. Moreover, Dominguez et al. (2012), Bussière et al. (2014), and Broner et al. (2013a), among others, document that during the recent crisis countries depleted their sovereign reserves and then rapidly replenished them. This evidence suggests that reserves and debt can be in a relationship of complementarity.

We analyze the problem of sovereign reserves and debt accumulation in a model with liquidity and productivity shocks that draws on Bolton and Jeanne (2007). A risk-neutral sovereign borrows from international lenders and decides on the investment of these resources into a liquid (reserves) and an illiquid (production technology) asset. Debt and reserves are chosen by the sovereign, instead international lenders set the interest rate on debt. The value of sovereign output depends on the productivity of the sovereign's technology and the share of borrowed resources that the sovereign invests in public expenditure; that is, those resources that are not invested in reserves.

The interaction between the sovereign and international lenders is shaped by two frictions. First, due to limited liability, the sovereign cannot commit not to default on debt (Aguiar and Amador, 2015). Second, due to market incompleteness, the sovereign can issue only non-contingent assets and the risk-neutral competitive lenders incorporate the probability of default in the premium set on the debt contract (Arellano, 2008). Also, we assume that the sovereign does not have access to additional borrowing in the event of a liquidity shock. In an extension, we relax this constraint and show that our results do not change.

A simple trade-off determines the equilibrium value of reserves. On the one hand, they distract resources from the production technology. On the other hand, they can be injected in the event of a

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