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Quantitative implications of indexed bonds in small open economies ☆

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ABSTRACT

This paper analyzes the macroeconomic implications of real-indexed bonds using a general equilibrium model of a small open economy with financial frictions. Although indexed bonds provide a hedge to income fluctuations and can thereby mitigate the effects of financial frictions, they introduce interest rate fluctuations. Because of this tradeoff, there exists a nonmonotonic relation between the "degree of indexation" (i.e., the percentage of the shock reflected in the return) and the benefits that these bonds introduce. When the nonindexed bond market is shut down and only indexed bonds are available, indexation strengthens the precautionary savings motive, increases consumption volatility and deepens the impact of Sudden Stops for degrees of indexation higher than a certain threshold. When the nonindexed bond market is retained, nonmonotonic relationship between the degree of indexation and the benefits of indexed bonds still remain. Degrees of indexation higher than a certain threshold lead to more volatile consumption than lower degrees of indexation. The threshold degree of indexation depends on the volatility and persistence of income shocks as well as on the relative openness of the economy.

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1. Introduction

Liability dollarization[1] and frictions in world capital markets have played a key role in the emerging-market crises or Sudden Stops. Typically, these crises are triggered by sudden reversals of capital inflows that result in sharp real exchange rate (RER) depreciations and collapses in consumption. For example in 1994, Turkey experienced a Sudden Stop characterized by the following: a 10 percent current account-GDP reversal, 10 percent consumption and GDP drops relative to their trends, and a 31 percent RER depreciation (see Durdu, 2007).

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[1] Liability dollarization refers to the denomination of debt in units of tradables (i.e., hard currencies). Liability dollarization is common in emerging markets, where debt is denominated in units of tradables but partially leveraged on large nontradables sectors.

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Table 1
Previous attempts with indexed bonds.

Country	Date issued	Indexation clause	Note
Argentina	1972–1989, 2002–	CPI, GDP	GDP-indexed payments are granted to the investors as part of debt restructuring
Australia	1985–1988	CPI	
Bosnia and Herzegovina	1990s	GDP	Issued as part of Brady Plan, VRRs
Brazil	1964–	CPI	
Bulgaria	1990s	GDP	Issued as part of Brady Plan, VRRs
Colombia	1967–	CPI	
Costa Rica	1990s	GDP	Issued as part of Brady Plan, VRRs
Chile	1956–	CPI	
Israel	1955–	CPI	
France	1973	Gold	Debt servicing cost increased significantly from depreciation of French franc against gold
Mexico	1970s	Oil	Issued as petro-bonos
	1990s	Oil	Issued as part of Brady Plan, VRRs
	1989–	CPI	
Turkey	1994–	CPI	
United Kingdom	1975–	CPI	
Venezuela	1990s	Oil	Issued as part of Brady Plan, VRRs

Source: Borensztein and Mauro (2004); Campbell and Shiller (1996); Kopcke and Kimball (1999).

In an effort to remedy Sudden Stops and smooth macroeconomic fluctuations, Caballero (2002) and Borensztein and Mauro (2004) propose the issuance of state-contingent debt instruments by emerging-market economies. Caballero (2002) argues that crises in some emerging economies are driven by external shocks (e.g., terms of trade shocks) and that, contrary to their developed counterparts, these economies have difficulty absorbing the shocks as a result of imperfections in world capital markets. He argues that most emerging countries could potentially reduce aggregate volatility in their economies and cut precautionary savings[2] if they possessed debt instruments for which returns are contingent on the external shocks that trigger crises. He points out that these type of instruments are not widely used, and hence calls for the creation of an indexed bonds market in which bonds' returns are contingent on terms of trade or commodity prices (Table 1).[3] Borensztein and Mauro (2004) argue that GDP-indexed bonds could reduce aggregate volatility and the likelihood of unsustainable debt-to-GDP levels in emerging economies.

Despite the debates in the academic literature and policy circles regarding the merits of indexation, the existing literature lacks quantitative studies investigating the implications of indexed bonds and an understanding of their key features. This paper aims to fill this gap by introducing indexed bonds into quantitative models of small open economies to analyze the implications of those bonds for macroeconomic fluctuations and Sudden Stops. Can indexed bonds smooth macroeconomic fluctuations or help emerging countries mitigate the detrimental effects of Sudden Stops? Under what type of conditions are their benefits maximized? What type of frictions can those bonds introduce? Does the return structure affect their overall implications? I aim to provide answers to those questions in this paper.

The analysis consists of two steps. First, I start with a canonical quantitative one-sector economy in which infinitely lived agents receive persistent endowment shocks and credit markets are perfect but insurance markets are incomplete (henceforth, the *frictionless one-sector model*). Using this model, I analyze the implications of indexed bonds on the precautionary savings motive, consumption volatility and the co-movement of consumption with income. The reason for initially studying the frictionless one-sector model is that this model is relatively more tractable and deriving the intuitions are easier. In addition, in this set-up, the only borrowing constraint that agents face is the one that they self-impose (i.e., natural debt limit, see Section 2.1 for the definitions). Hence, investigating the direct link between precautionary savings and indexation is feasible.[4] This simpler model, however, is not rich enough to study the implications of indexed bonds on Sudden Stops. Hence, as a second step, I move to a two-sector model, which incorporates financial frictions proposed in the Sudden Stops literature (Calvo, 1998; Mendoza, 2002; Mendoza and Smith, 2005; Caballero and Krishnamurthy, 2001; among others). This model (henceforth, the *two-sector model with financial frictions*) can produce Sudden Stops endogenously through a debt-deflation mechanism similar to Mendoza (2002). Using this framework, I explore the implications of indexed bonds on Sudden Stops and RER fluctuations.

My analysis establishes that there exists a nonmonotonic relation between the "degree of indexation" of the bonds (i.e., the percentage of the shock that is passed on to the bonds' return) and the overall benefits of the bonds on macroeconomic

[2] Precautionary savings refers to extra savings caused by financial markets being incomplete. Precautionary savings in emerging countries might realize as excessive accumulation of foreign reserves as the New Mercantilism Theory suggests (see Durdu et al., 2008 for further details).

[3] Table 1 lists the previous experiences with indexed instruments. As the table illustrates the use of those bonds have been limited. Argentina is the most recent issuer of GDP-linked securities.

[4] In fact, in this set-up, deriving analytical solutions for the natural debt limit is feasible.