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Banking fragility in Colombia: An empirical analysis based on balance sheets☆

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A B S T R A C T

In this paper, we study the empirical relationship between credit funding sources and the financial vulnerability of the Colombian banking system. We propose a statistical model to measure and predict banking fragility episodes associated with credit funding sources classified into retail deposits and wholesale funds. We compute the probability of financial fragility for both the aggregated banking system and the individual banks. Our approach performs a Bayesian averaging of estimated logit regression models with monthly balance sheet data between 1996 and 2013. The results show the increasing use of wholesale funding to support credit expansion is a potential source of financial fragility. Therefore, monitoring credit funding sources could provide an additional tool to warn against banking disruptions.

Fragilidad bancaria en Colombia: Un análisis basado en las hojas de balance

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R E S U M E N

En este documento se estudia la relación empírica entre las fuentes de fondeo del crédito y la vulnerabilidad financiera del Sistema Bancario Colombiano. El trabajo propone la estimación Bayesiana de modelos de regresión logística para identificar y predecir episodios de fragilidad bancaria asociados con las fuentes tradicionales y no tradicionales de fondeo, que utilizan los bancos para proveer crédito. En particular, el ejercicio estima la probabilidad de que se presenten eventos de fragilidad tanto para el sistema bancario agregado como para los bancos individuales con datos mensuales de las hojas de balance para el periodo 1996-2013. Los resultados muestran que el creciente uso de los recursos no tradicionales para fondear el crédito, especialmente en sus fases de expansión, son fuente potencial de fragilidad financiera. Por consiguiente, el monitoreo a dichos recursos, a través de la técnica propuesta, proporciona una herramienta para detectar esos eventos.

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1. Introduction

Since the beginning of the global economic crisis in mid-2007, topics concerning financial stability have gained importance in both the theory and the practice of macroprudential policy. An understanding of issues such as the funding structure of bank lending, the role of leverage, the determinants of credit cycles and the identification of credit booms have become crucial subjects for authorities, given their aim of anticipating and avoiding financial crises. These themes are particularly relevant in emerging economies where periods of rapid expansion in credit could arise diverse fragilities in the financial system.

Literature on financial stability has studied extensively the dynamics of credit, the measurement of the financial cycle and its relationship to banking crises (e.g. Borio, 2012; Gourinchas, Valdes, & Landerretche, 2001; Cerra & Saxena, 2008; Jorda, Schularick, & Taylor, 2012; Schularick & Taylor, 2012). One particular branch of this literature examines the existing relationship between credit cycles and macroeconomic aggregates (e.g. Bruno & Shin, 2013; Mendoza & Terrones, 2008; Hume & Sentance, 2009; Bordo & Haubrich, 2010; Reinhart & Reinhart, 2010; Claessens, Kose, & Terrones, 2012).

Furthermore, recent literature on this topic has concentrated on the construction of early warning indicators of lending booms, financial fragility and banking crises (e.g. Drehmann, Borio, & Tsatsaronis, 2012, Guarín, González, Skandalis, & Sánchez, 2014 and Greenwood, Landier, & Thesmar, 2012; Frankel & Saravelos, 2010; Goldstein, Kaminsky, & Reinhart, 2000). In general, these indicators are built using financial data from the assets side of the balance sheet (i.e. the resources financial system intermediaries lend to firms and households) and information on macroeconomic variables.

Lately, there is a burgeoning literature that associates both credit cycle and financial stability to the dynamics of the funding sources the banking system uses for lending (e.g. Damar, Meh, & Terajima, 2010; Hahm, Mishkin, Shin, & Shin, 2012; Hahm, Shin, & Shin, 2012; Hamann, Hernández, Silva, & Tenjo, 2014; Huang & Ratnovski, 2010; Shin & Shin, 2011). According to this literature, in periods of rapid credit growth, the traditional funding sources (i.e. retail deposits from savers or core-liabilities) are not enough to cover the demand for bank lending. As a result, banks make use of funding sources other than traditional retail deposits (wholesale funds or non-core liabilities).

Shin and Shin (2011), Hahm, Mishkin, et al. (2012) and Hahm, Shin, et al. (2012) highlight that, in emerging economies with open capital markets (e.g. Korea), short-term foreign obligations and interbank loans are relevant sources of non-core liabilities. Moreover, their increasing use raises the vulnerability of financial institutions. In turn, Hamann et al. (2014) study the financial leverage pro-cyclicality in Colombia using data from banks' non-core liabilities. Except for Korea, empirical analysis on the relationship between banking fragility and funding sources of the financial system in emerging economies has been limited. Nevertheless, Korea is a particular case among emerging countries, because its financial system is large and highly globalized, and the main wholesale funds come from foreign creditors. However, for the case of less open economies, like Colombia, other types of wholesale funds such as bonds, institutional deposits made by other intermediaries and interbank operations could be predominant.

Hahm, Mishkin, et al. (2012) and Hahm, Shin, et al. (2012) note that the composition of bank liabilities provides valuable signals on lending booms, financial fragility and banking crises. In fact, large holdings of wholesale funds increase the willingness of the banking system to face greater risk exposure. Hence, the extent of wholesale liabilities could reflect the phase of the financial cycle and the degree of vulnerability to setbacks. Fig. 1 depicts the banking sector balance sheet before and after a credit boom. Clearly, this picture outlines the buildup of vulnerabilities associated with growth in wholesale funds.

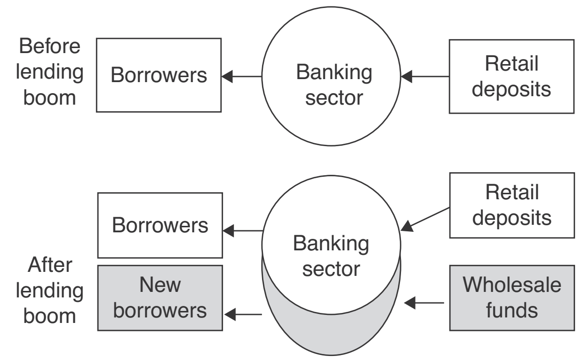

Fig. 1. Lending boom financed by wholesale funds.
Source: Adapted from Hahm, Shin, et al. (2012).

Bearing in mind the previous discussion, the main objective of this paper is to study the empirical relationship between credit funding sources and the vulnerability of the Colombian banking system. From this crucial link, we propose a monitoring tool based on predictions of the probability of financial fragility. In particular, the empirical exercise estimates the probability of being in a situation of banking fragility as a function of the credit funding sources. The econometric exercises carry out a Bayesian averaging of logistic regression models that express a financial risk index in terms of retail deposits and wholesale funds. Our index aggregates four distinct risks: credit, profitability, solvency and liquidity. The estimations are performed using monthly Colombian data from the balance sheet for the entire banking sector and 12 individual banks between 1996 and 2013.

The results show the increasing use of wholesale funds, particularly to support credit expansion, entails potential elements of risk and, hence, episodes of banking fragility. Within them, foreign credit, interbank operations and securities redemption are relevant factors to identify most of such episodes. Therefore, monitoring credit funding sources becomes an essential tool in a macroprudential scenario to prevent events of financial crisis.

The reminder of this paper is organized as follows. Section 2 presents the stylized facts of the dynamics of credit and its funding sources. Section 3 explains the construction of our measure of financial fragility, while Section 4 goes into the details of the econometric strategy. In Section 5, we perform the empirical exercises and present the results. Finally, Section 6 offers some conclusions.

2. Funding sources of banking loans

2.1. Accounting framework approach

We suggest financial fragility can be explained by credit funding sources. To illustrate this point, we adapt the Shin and Shin (2011) framework by starting with a simple accounting scheme traced from the balance sheet. Let us begin by defining the agents of the financial system as borrowers (domestic enterprises and households), creditors (households who offer retail deposits), banks (who channel resources from creditors to borrowers), and other creditors (additional local and external intermediaries), whose function is to provide funds (wholesale funds) to the local banking sector.

We adopt the assumptions that there exist n local banks (indexed by $1, 2, 3, \ldots, n$), and that the domestic-household creditor sector is represented by $n+1$. The other creditors sector (i.e. other domestic and external intermediaries) is indexed by $(n+2)$. Bank i has three types of assets: loans to final users (y_i), a portfolio