

The New Challenges of Greater Financial Complexity in Central America: A Network Analysis

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THE NEW CHALLENGES OF GREATER FINANCIAL COMPLEXITY IN CENTRAL AMERICA: A NETWORK ANALYSIS

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Abstract

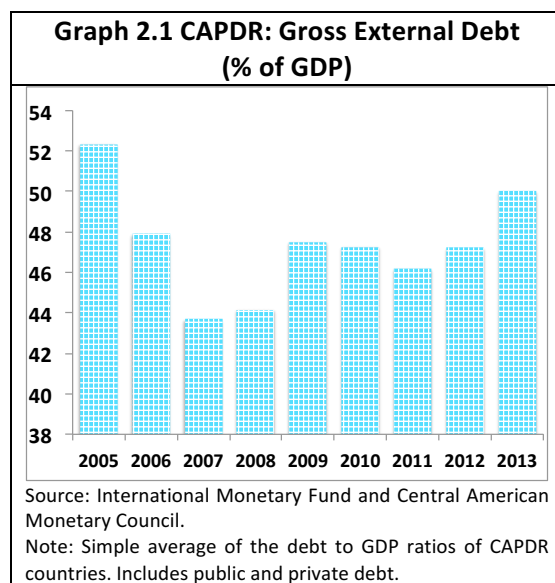
External financing flows to the region increased due to higher liquidity in international markets and low financing costs, and also thanks to the region's stability relative to developed economies. In this regard, the analysis presented here shows that the influx of funds from abroad has effectively modified credit and debit patterns in the entire region, leading to vulnerability in some cases. These vulnerabilities, associated with the intensification in financial operations and with the presence of sectors of high systemic importance, could eventually lead to imbalances that could ultimately spread negative effects through the rest of the economy. The lessons of this technical note are that the intensification of financial relationships between sectors must be accompanied by a multi-sectoral agenda for action.

JEL Classification: C02, C61, E58, E63, F15, F34, F37

Keywords: Financing Flows, Liquidity, Financial Stability, Interest Rates, Credit

INTRODUCTION

Between 2008 and 2013 external financing flows to the region increased due to higher liquidity in international markets and low financing costs, and also thanks to the region's stability relative to developed economies. These flows included foreign direct investment (FDI), bank loans, and in some cases, portfolio investment. This increase in international capital flows to CAPDR was associated with an accumulation of external debt (public and private), which rose from an average of 44% of GDP in 2008 to 50% of GDP in 2013 (see Graph 2.1).



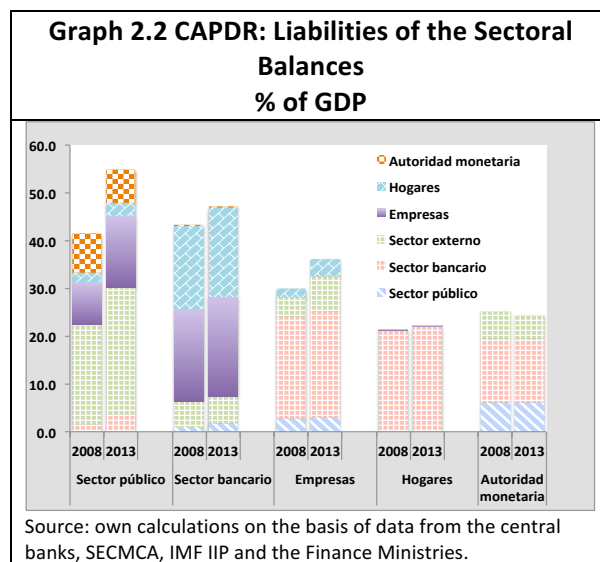
Although greater access to external resources can be beneficial (since it can complement internal savings and improve the viability of productive investment), it can also increase financial vulnerability if it leads to excessive risk-taking. For example, a depreciation of the exchange rate can trigger liquidity and solvency problems in the non-tradable sector whenever they build up liabilities in foreign currency. This in turn may put at risk the ability to meet their obligations to other sectors, thereby affecting the chain of payments. This example illustrates that, in order to evaluate the financial vulnerability of the economy, it is important to determine not only the sectors in which debt is accumulating, but also the financial linkages between them, as this makes it possible to see the importance of one sector in the economy for the financing of others.

Excessive dependence implies greater exposure to insolvency risks caused by shocks that affect the primary source of financing. In turn, the possibility of contagion increases as the integration between sectors rises. Thus, the liquidity management practices of mutually invested funds can create contagion effects if, for example, “leveraged” investors, facing demands for repayment, are forced to sell their assets- potentially at a lower market price than available under normal conditions.

This technical note offers a preliminary analysis of these vulnerabilities. The initial section analyzes the composition of sectorial balances in CAPDR before and after the crisis. The second part of this technical note then examines the vulnerabilities originating from credit and debit patterns between the main sectors of the economy and explores the options for mitigating them.

CAPDR in Balances: Before and After

Besides being reflected in the increase in external debt, inflows to CAPDR also changed the composition of balances within the economy. The direct effect of the influx of flows from outside was a higher level of external liabilities. However, within the economy it produced a great variety of operations between the different sectors, and this was reflected in their net positions. This technical note analyzes these by focusing on six broad sectors: the public sector, including its financial and non-financial component; the private sector, consisting of firms and households; the financial sector; the monetary authority; and, finally, the external sector, formed by non-residents.¹ Each of these sectors has a balance of assets and liabilities that, when consolidated (excluding the external sector), make up the aggregate balance of the economy.



Graph 2.2 presents the structure of liabilities of the five domestic sectors for the average country of the region.² For 2008 and 2013 period, two stylized facts can be identified. First, the imbalances in the public sector have led to an accumulation of public debt. Second, both banks and firms accumulated external liabilities. In this regard, for the average CAPDR country, public sector liabilities grew by 13% of GDP, from 42% to 55% of GDP.³ In addition, banks' and firms' liabilities rose by 9% and 20%, respectively. In the case of the banks, the external funds were mainly used to acquire public sector assets,⁴ which rose from 1.6% to 3.5% of GDP. Finally, firms increased their liabilities, with which they covered their operating costs and invested in both public sector and bank assets.⁵

¹ Financial institutions are consolidated with the monetary authority in accordance with the monetary survey manual of the International Monetary Fund.

² Belize is excluded from the analysis due to limitations regarding the historical figures in this technical note.

³ The debt of central government, public sector organisms and the financial public sector is considered. Belize is excluded from the analysis.

⁴ This pattern can be observed in Graph 2.2: liabilities of the public sector owned by the banking sector correspond to the assets that banks obtained from the public sector.

⁵ The corporate sector balance does not allow visualizing the position within the sector, given that its net balance is zero. However, what is shown here is the position of the corporate sector compared to other sectors and, therefore, its liabilities reflect firms' demand for assets of the public sector, banking sector, etc.

It is important to highlight the recent role that firms and the external sector have played in financing the rest of the economy. The private sector has increased its share of holdings of public liabilities (excluding external funds). Indeed, while external credit to the public sector rose from 20.8% to 26.7% of GDP, public securities held by firms increased from 9% to 15% of GDP, thereby continuing to be the second largest source of domestic financing for the public sector (see Graph 2.2). Similarly, the major component explaining the increase of banks' liabilities was the acquisition of financing supplied by firms, which rose from 19% to 21% of GDP. In contrast, external financing received by the banks increased from 5.3% to 5.6% of GDP. Finally, unlike other sectors, the liabilities of private corporations (see Graph 2.2) grew mainly through external financing credit lines, which increased from 4.0% to 7.5% of GDP between 2008-2013.

There are two reasons why the financial health of the private sector is important for banks. The first mainly originates from the fact that local firms may be financing through short-term portfolio investment (from abroad) and depositing these external resources in national banks (therefore denominated in local currency). In a scenario in which market conditions worsen suddenly, large-scale withdrawals may occur and liquidity problems could potentially arise. Second, variations in the exchange rate could also affect the balances of these firms in the case of a currency mismatch.

In summary, various trends emerged as a result of the influx of international capital to CAPDR. First, the increase in external indebtedness has been mainly attributable to the public and banking sectors, though perhaps the more striking trend has been the greater role of the corporate sector as a recipient of external flows. Second, the inter-relationships between the external inflows to the region and the new financing dynamics within the domestic economy highlight, in particular, the growing role of firms as providers of financing to the rest of the economy.

THE SECTORAL LINKS BEHIND THE SCENES

It is clear that financial balance sheets offer vital information on the financial position of the economy, but there are certain vulnerabilities associated with credit and debit operations that are not captured by these net balances. The intensified financing operations between sectors could be increasing exposure to risks inherent in the greater inter-relationship between agents. Thus, the distinction between net balances and the evolution of credits and debits among agents is crucial, in particular in the context of the greater influx of external financing. In general terms, the greater liquidity observed in the market could have stimulated the formation of new patterns of intermediation within the economy. This may have led to the creation of new financial agreements between market participants,⁶ increasing exposure to counterparty risks.

The entirety of debit and credit operations between economic agents can be conceived as a grid of flows. From this viewpoint, credits and debits represent inter-sectoral links, which create a network in the economy. The greater the number of credits and debits between sectors, the greater the integration between its members and, therefore, each agent finds himself exposed to the risks and issues of his counterparties. The usefulness of representing the flows as a network

⁶ With the aim of increasing the return on external flows through financial intermediation, the banks created and employed new instruments such as securitized assets, guarantees, credit notes, mutual funds or notes collateralized by other instruments. These securities have been acquired, in their turn, by the private sector and re-used as financial investments.

is that it makes it easier to examine the degree to which the sectors of the economy are tied together and to extract from that the vulnerabilities to which they are exposed.

Credit and debit flows can generate two kinds of vulnerabilities. The first arises from the allocation and frequency of financing and investment operations. Through these, information on the concentration of flows between sectors is revealed, making the insolvency or illiquidity problems that may arise should shocks affect the pattern of flows immediately apparent. The second kind of vulnerability is associated with the use of flows in multiple secondary operations and the risks of contagion inherent in a more complex structure of flows.⁷

Within the network of credit and debit operations, repeated transactions between some sectors imply a greater concentration of flows. This is indeed a vulnerability for the network, as in the case of an adverse event in a sector with a high level of concentration, a substantive reduction in flows would seriously affect financing for the rest of the economy.⁸ Moreover, the linkages between sectors make it possible to identify when one sector in the economy is key for the financing of another. Thus, higher concentration implies greater exposure to insolvency risks caused by shocks to the primary source of financing.

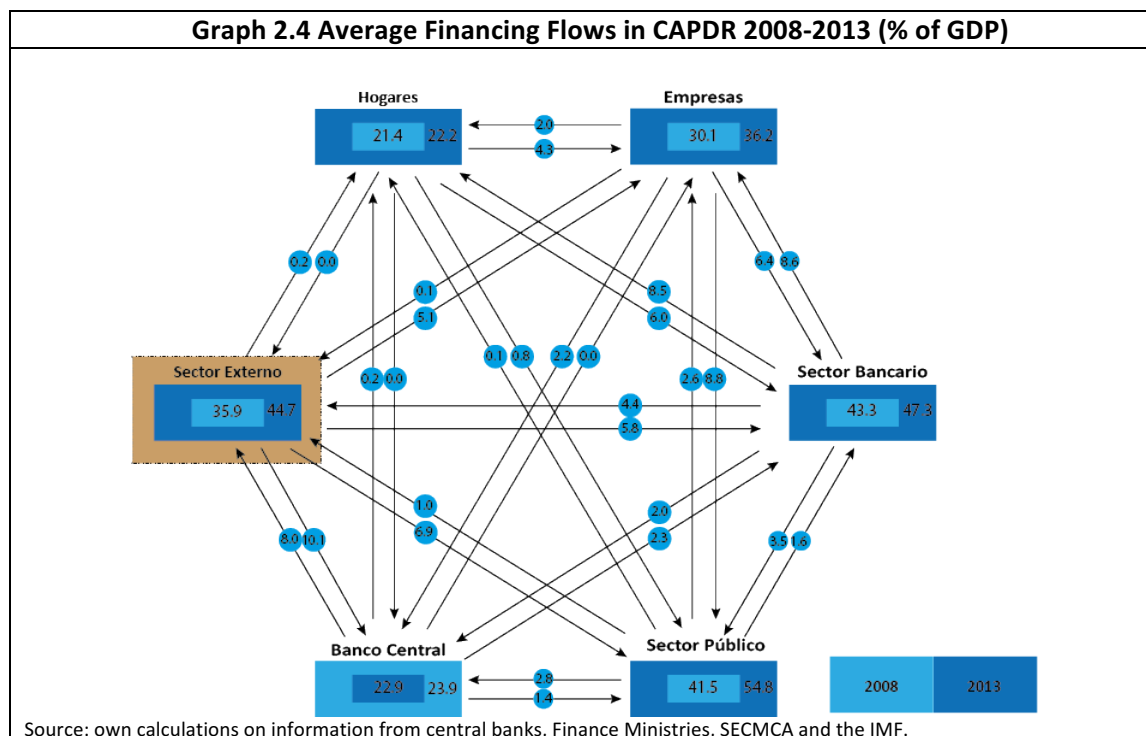
On the other hand, the increase in financing linkages can carry risks associated with bad management of assets and contagion. Inter-sectoral flows are similar to bank deposits, in which a sum of deposits is converted into multiple loan contracts. After entering a sector, flows splinter and become part of other intra- and inter-sectoral operations. These flows have the positive trait of generating multiplier effects by increasing the supply of funds in the economy. However, when they are not adequately backed or regulated, adverse events can generate multiplier effects in the opposite direction; that is, they can transmit the negative effects to all sectors of the economy.

The extent to which CAPDR countries are exposed to these risks depends on the dynamics of the credit and debit flows between sectors. The evolution of the network of credit and debit operations determines where the funds come from and where they have been directed. They also track the volume of the financing operations between sectors. The following section focuses on describing the main characteristics of the network of flows in CAPDR and quantifies the degree of exposure to these vulnerabilities.

⁷ An example of this is the use on the part of the private financial and non-financial sector of new instruments and financing and investment mechanisms not covered by prudential regulation and which might not be appropriately backed.

⁸ This concentration relationship is normally linked to measures of centrality. The effects that an adverse shock in sectors with high concentration would have on the rest of the economy have been explored, for instance, by Allen and Gale (2000), Babus (2013), Acemoglu (2011), Jackson *et al.* (2014).

THE FLOWS IN CAPDR: CHALLENGES AND POLICY OPTIONS



Graph 2.4 depicts the flows of funds between sectors of the economy between 2008 and 2013. As before, the figures summarize the values for the average economy in CAPDR. The boxes indicate the liabilities in these two years, while the arrows show the flows of credits and debits between sectors.

The following patterns in CAPDR can be extracted from the information shown in the diagram:

- a) **Firms were net recipients of financing.** Between 2008 and 2013, firms in the region received a (net) average inflow of 6.1% of GDP. Of this, 36% originated from banks, to give net credits totaling 2.2% of GDP; and gross external flows to finance firms doubled between 2008 and 2013, accounting for 5.1% of GDP. It is worth stressing that external financing came through contracts or commercial agreements, with portfolio investment only common in countries with a more integrated financial system, such as Panama.
- b) **The public sector of the average CAPDR economy increased its net debt.** Between 2008 and 2013, net flows to the public sector amounted to almost 13.3% of GDP⁹, increasing its liabilities from 41.5% to 54.8% of GDP. Until 2010, the public sectors of the region distributed their liabilities between bank credit lines, local market instruments and financing from international financial organizations. After 2010, although the local market continued to be the main provider of funds, the public sector absorbed, on average, about 6.9% of GDP¹⁰ from abroad, equivalent to 24.7% of external credit. The latter was either

⁹ It is worth highlighting that this pattern has not been uniform: for instance, Nicaragua has had negative net flows throughout this period; however, in the other countries this sector stands out as a net recipient of flows.

¹⁰ Gross flows from outside into the region are taken into consideration.

in the form of official development assistance, other credit agreements¹¹ or portfolio investment.¹²

- c) **The banking sector remained a net lender in the economy.** In order to finance their operations, on average, banks received flows from overseas of 5.8% of GDP, doubling the amount observed before the crisis. Nevertheless, the domestic market continues to be the main source of financing: firms deposited 6.4% of GDP, households about 6%, the monetary authority 2.3% and the public sector 1.6%. In this regard, the main mechanism for raising funds was the issuance of securities in domestic markets. In addition, interbank lending became a recurrent source to meet repayments on short-term liabilities.¹³ Meanwhile, credit granted by banks to the rest of the economy totaled 29% of GDP, mainly distributed to firms (8.5% of GDP) and households (8.6% of GDP).

In addition, the analysis shows that in the average CAPDR country there is a significant concentration of flows in the banking and public sectors.¹⁴ This is quite evident in the case of the banks, given that their role as financial intermediaries means they channel a large volume of flows to the entire economy. The importance of the public sector is associated with the government's role as a supplier of safe assets to banks and the rest of the private sector. Moreover, the public banks, contribute to higher concentration of the public sector, given the amount of credit and debit operations they have with the private sector.¹⁵ In fact the index of relative importance confirms their high dependency on both the banking and public sectors.¹⁶ The index is derived from information on credits and debits, the number of links and the volume of operations. It is constructed to assign a higher relative (or systemic) importance to a sector the more it intervenes in credit and debit transactions. Graph 2.5 shows the evolution of this indicator for the average CAPDR country between 2008 and 2013. The graph also includes the index for Colombia,¹⁷ a benchmark for the region. Colombia suits this task particularly well since its financial system has developed substantially over the past decade. In addition, it has carried out important fiscal consolidation policies and prudential reforms. As can be observed in the graph, the current flow structure of CAPDR shows an exceptional concentration in the public and banking sectors. In contrast, Colombia has a relatively more uniform systemic importance across sectors, apart from the household sector. However, it should be stressed that the systemic importance of the banking sector in CAPDR has tended to diminish and is closer to the level seen in Colombia for 2013. The same graph also reveals some other differences between the region and Colombia. One is the greater systemic importance of the public sector in CAPDR than in Colombia. As Graph 2.6 shows, this public sector dominance is most acute in countries with less developed financial and capital markets,¹⁸ such as Honduras and Nicaragua. Panama is the only country in the region with a private sector with systemic importance similar to that of other sectors. This fact is consistent

¹¹ They include loans, credit cards, purchase and sale agreements for goods and services documented in the financial account of the balance of payments as "other financing".

¹² Flows of a more volatile nature, such as portfolio investment, were captured by those countries with access to the markets. By contrast, financing schemes different to portfolio investment were commonly used in all countries of the region.

¹³ Interbank lending also showed higher activity. However, this is not observable in the aggregated banking balance. On average, from 2009 on, the region made 3.5 times more use of bank credit than in 2008 and 2009.

¹⁴ Calculations regarding the concentration of flows uses the methodology of networks; for more on it see the Annex.

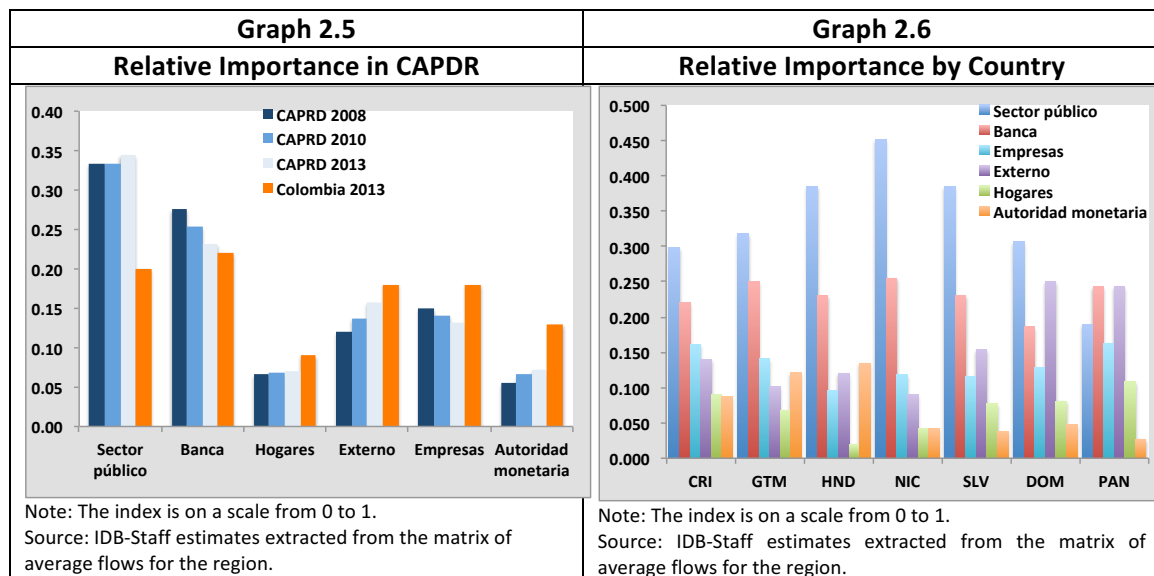
¹⁵ Public banks are relatively small in CAPDR, for example, the liabilities in the average CAPDR country are less than 3.5% of GDP; in flows, the figure for these credits is less than 1% of GDP.

¹⁶ A sector with great relative importance within the system of flows would have index values close to 1 while the least important would be closer to zero.

¹⁷ It takes into consideration information on flows between 2012 and 2013. Colombia is a natural case for a regional benchmark. On the one hand it is a country which has developed its financial system in the last decade and in addition it has strengthened its fiscal sector through prudential reforms.

¹⁸ This refers to the absence of mechanisms/instruments of non-bank intermediation (mainly the stock market).

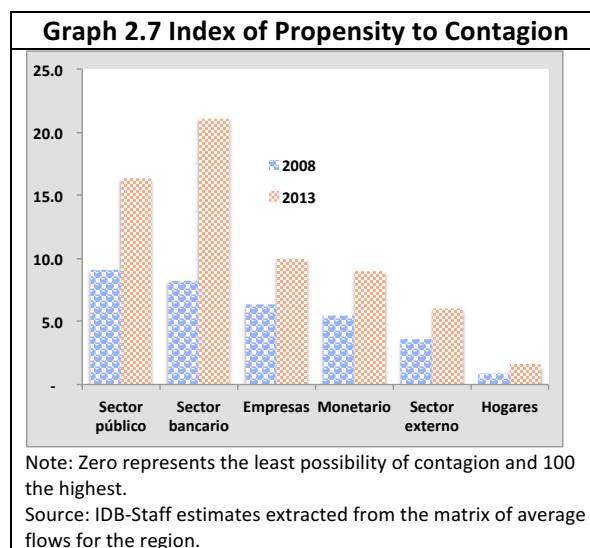
with the indicators of firms' and households' access to credit and investment opportunities in Panama.¹⁹



Finally, the flow chart provides us with another indicator of the ease with which a negative shock disseminates to the rest of the economy, and this reveals that the intensification of credit and debit operations has led to a higher propensity to contagion from negative shocks. As noted above, the flows initially received by one sector are subsequently used in operations with other economic agents, thus increasing the intra-sectoral and inter-sectoral ties. To measure the exposure to negative shocks, an indicator is used to quantify the number of times flows have been transferred between sectors. This index shows that in CAPDR all the sectors of the economy, on average, almost doubled their contagion propensity (see Graph 2.7). Between 2008 and 2013, what stands out is the remarkable increase in the exposure of the banking sector, which almost tripled its vulnerability to contagion. In the same way, the indicator confirms that the more inter-related sectors are the most exposed, followed by sectors with a greater number of links with sectors of systemic importance.²⁰

¹⁹ The index consists of a weighted average of three known centrality measures. For further information on these measures, see the Annex. The index goes from zero to one hundred, in which zero represents no probability of contagion and one hundred certain contagion.

²⁰ In other words, a sector's speed of contagion rises when it is more linked to the banking and the public sector.

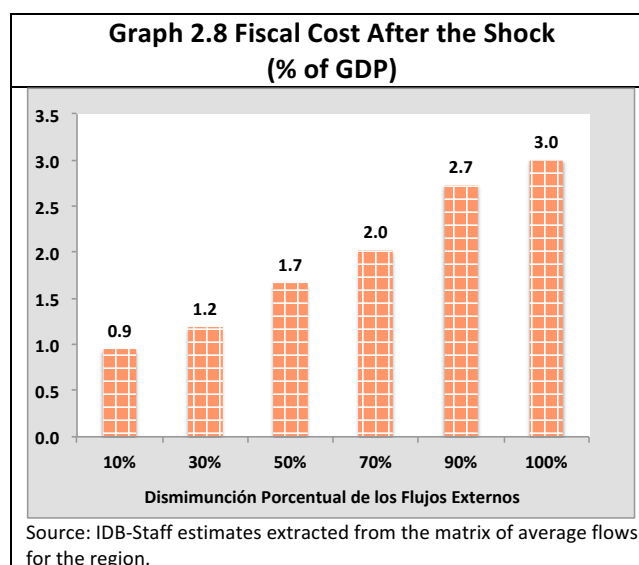


VULNERABILITIES... THE EFFECTS OF SHOCKS IN EXTERNAL FLOWS

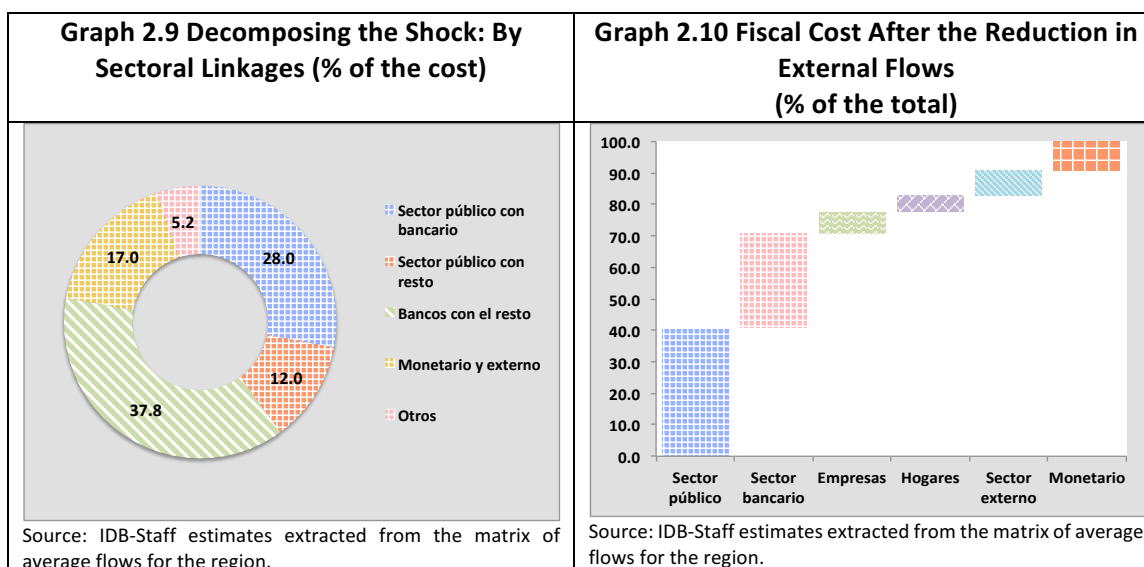
The impact on CAPDR of these levels of concentration of flows and propensity to contagion can be analyzed by using a stress test on the network of flows. In this test, the flows that the domestic economy receives from the external sector are reduced from their current level to their 2008 level (see Box 2.1 for more details).²¹ This sudden reduction in flows affects all the sectors that normally find financing from abroad. Assuming that economic agents cannot easily adjust their financing needs, the demand for domestic credit would increase. Since the banking sector is the main provider of domestic financing but cannot obtain resources from abroad, it seeks funds from the monetary authority, while reducing, to some degree, its credit lines to the private sector. Ultimately, it is the public sector that covers the liquidity problem by supplying resources to the economy (for example, to firms through the public banks). Graph 2.8 shows the fiscal cost incurred as a result of a reduction in external flows by different percentages,²² ranging from 10% to 100%. We find that the fiscal cost of keeping the network functioning would be between 0.9% and 3.0% of GDP, depending on the shock.

²¹ The exercise is replicated for the case in which the flows are reduced only by 90% from this first scenario. Later the replication is extended as far as 10%.

²² The reduction by 100% represents a shock, which takes external flows to levels prior to the recession, while 10% represents a contraction in the flows of only 10%.



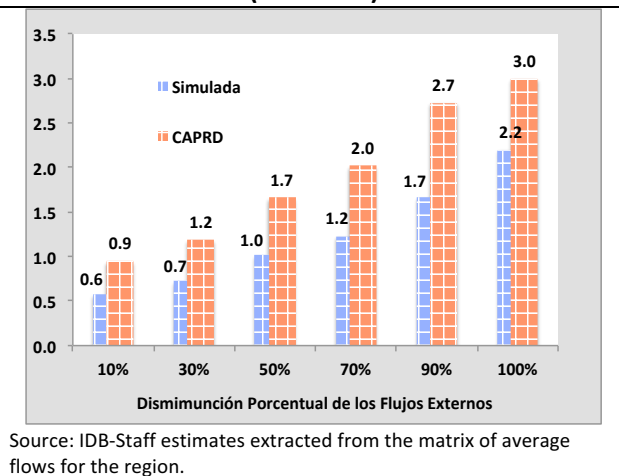
The results of the stress test also show that the main channels of transmission to the economy are those related to banking and public sectors. First, in terms of their contribution to the fiscal cost, these sectors seem to carry the largest share. In fact, the financial transactions between these two sectors account for almost 28% of the total cost (see Graph 2.9). Another 38% is caused by the banking sector's multiple links with the rest of the economy. About 12% originates from the dependence of other sectors on the government. A further 17% reflects the monetary effect of external flows and 5.7% accounts for the linkages between the remaining sectors. It is worth noting that without double-counting, and aggregating the costs separately for each sector, the role of the private sector stands out (as well as the public and banking sectors), accounting for around 12% of the total cost of the reduction of external flows (see Graph 2.10).²³



²³ Private sector here refers to firms (6.8%) and households (5.1%)

By contrast, it is evident that the costs of a reduction in external financing could be lower if the levels of concentration between sectors were reduced (Graph 2.11). This second test consists of a simulation aimed at lowering the fiscal costs in case of a reduction of external financing. The simulation rebalances the flow of credits and debits among sectors until a new network is obtained (for more details, see the Annex). This network is more resilient to cuts in external financing because the new pattern of linkages makes the respective sectors them more capable of satisfying a greater percentage of the financing needs. Improving the internal capacity to cope with a shock reduces the costs for the public sector. Three lessons emerge from this last stress test. First, moving to a less concentrated pattern of flows distributes shocks more uniformly between sectors and reduces the direct costs for the public sector; therefore, a uniform increase in debits and credits between all the sectors lessens the concentration and mitigates the effects of a negative external shock. Second, the systemic importance of the banking sector is confirmed and, consequently, the importance of effectively monitoring and regulating the sector in order to reduce its vulnerabilities. Third, if external flows increase, the monetary authority becomes more important as the agent that safeguards the system's stability. This reflects the important role of the monetary authority as a manager of net external assets of the economy.²⁴

Graph 2.11 Fiscal Cost after the Shock: CAPRD and Simulated (% of GDP)



Enhancing macroprudential regulation in the financial sector is an effective way of mitigating vulnerabilities associated with the concentration of flows. Regarding the multi-sectoral dimension, the tasks consist of identifying institutions of (relative) systemic importance within each sector and implementing measures that reflect the degree to which they could affect the stability of the system. Various criteria can be used to identify the institutions of highest importance, and the indicator of concentration of flows is one of them. The macroprudential approach suggests, on the one hand, that to reduce the concentration of flows it is necessary to allow other agents in the economy to have access to financing and investment mechanisms. On

²⁴ This would be achieved if the external sector increases its systemic importance by approximately the same amount as the monetary authority.

the other hand, to mitigate risks arising from the multiplication of financial transactions, policies to assure monitoring and capital adequacy are necessary.²⁵ Hence, there must be strict rules on capital reserves (including for the non-financial private sector) which, to a degree, fall within the most recent Basel guidelines. CAPDR could benefit from the experience of other countries, such as Colombia, Peru and Mexico, which offer possible paths for addressing these challenges (see Box 2.2 and the Annex).

A further factor for consideration is the growth of interbank credit, which also represents a shock amplifier. The interbank market is an important mechanism for the distribution of excess liquidity among financial entities, since it can provide coverage for institutions (banks) experiencing difficulties meeting their short-term liabilities.²⁶ Its correct functioning is important to guarantee financial intermediaries' access to sources of liquidity so that they can make financing available for households and firms. However, as was seen during the 2008-09 financial crisis, a shock to any of the participants in the interbank market can affect the pattern of flows, reduce the availability of funds, and interrupt the provision of liquidity, especially to the banks affected directly by the shock. Furthermore, while larger entities tend to obtain finance from a larger number of creditors, the small ones do not, thus making them the most vulnerable to shocks that affect the banking system.²⁷

Given the relative importance of the public sector in CAPDR, an all-encompassing management of the government's liabilities is crucial to reduce vulnerabilities in the economy. Under the multi-sectoral approach, the authorities should recognize that fiscal policy is the cornerstone of a general financial stability framework. Similarly, in CAPDR the public sector is the largest player in local financial markets and its domestic liabilities are the benchmark for risk-free interest rates in each of the financial systems. For these reasons, governments must take into account the impact of fiscal policy on the stability of the financial system. Concretely, fiscal policy should not only aim to be counter-cyclical, but also take into account the importance of strengthening fiscal buffers, as they will provide CAPDR with better capacities to cope with shocks affecting the financial sector.

CONCLUSIONS

During the years following the recent financial crisis, the convergence of diverse factors - both internal and external - in many ways predetermined the economic performance of CAPDR, a region that is more open than ever to international markets. In these years, the region experienced a boom in the attraction of financing flows from overseas. Like potential external shocks, these flows are key determinants of the behavior of the main macroeconomic variables. In this light, their effects represent a constant policy challenge for the economic authorities.

There is no doubt that the inflow of external funds has been beneficial, and so far the economy has not shown any notable deterioration in its balances, but inadequate management of the inter-sectoral flows could lead to instability. In addition, higher liquidity resulting from the external flows has facilitated greater activity in credit and debit operations between market participants,

²⁶ Bhattacharya and Gale (1987), Freixas *et al.* (2010), Acharya *et al.* (2012).

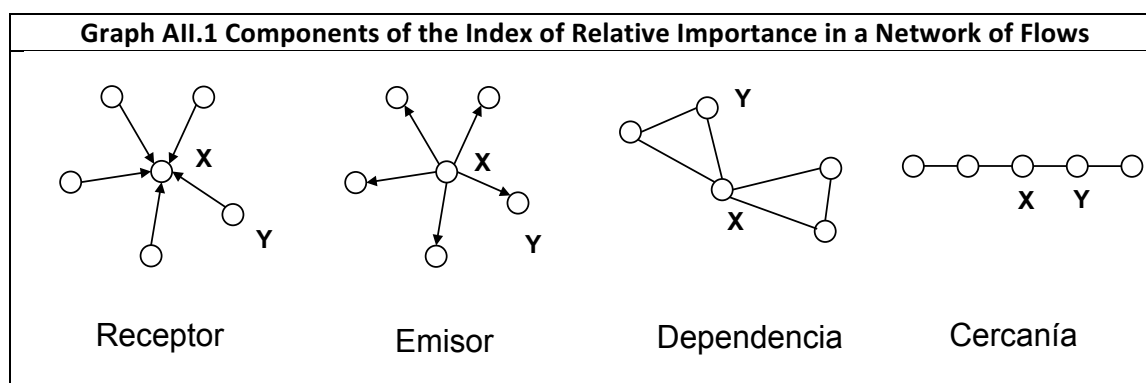
²⁷ Allen and Gale (1998)

and with this, the emergence of certain vulnerabilities, which are not immediately evident in the balances. In this regard, the analysis presented here shows that the influx of funds from abroad has effectively modified credit and debit patterns in the entire region, leading to vulnerability in some cases. These vulnerabilities, associated with the intensification in financial operations and with the presence of sectors of high systemic importance, could eventually lead to imbalances that could ultimately spread negative effects through the rest of the economy.

The lessons of this technical note are that the intensification of financial relationships between sectors must be accompanied by a multi-sectoral agenda for action. A multi-sectoral approach would make it possible to achieve coordinated results and confront vulnerabilities that might lead to scenarios of instability and risk aversion. In addition, with a policy framework of this kind, countries of the region could benefit by bolstering investor confidence and thereby enhancing creditworthiness. The policy agenda in CAPDR should broaden its scope, to take heed of the risk that imbalances in one particular sector might have damaging effects on the rest of the economy.

ANNEX

The index of relative or systemic importance. The index is generated from four broad components extracted from the network of flows: i) importance as a recipient of flows; ii) importance as a transmitter of flows; iii) dependence; and iv) proximity. The first two are based on the values of credits and debits received. Dependence is based on quantifying how indispensable each sector is for the flows of funds from one sector to another. Finally, proximity is based on the volume of flows between sectors. Each component is normalized between 0 and 1, where 1 is equivalent to a higher level in each case. The index weights each one uniformly and their sum shows the relative importance.

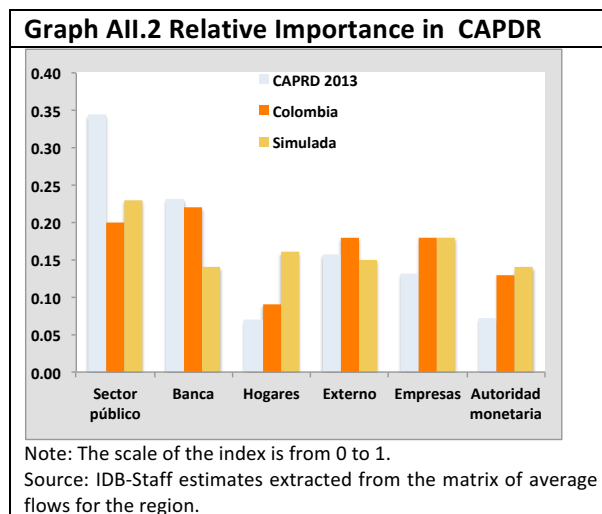


Systemic importance of CAPDR compared to Colombia. With the aim of having a comparative benchmark in Latin America, Graph AII.2 also includes the index for CAPDR in 2013 and Colombia.²⁸ Colombia is a natural choice as a regional benchmark: it is a country, which has developed its financial system in the last decade and, in addition, has strengthened its fiscal sector through prudential reforms. Thus, comparing the value of the systemic importance index, it can be seen that it has tended to diminish in the region's banking sector to stand very close to the

²⁸ Considers information on flows between 2012 and 2013.

value registered for Colombia in 2013. However, the same graph reveals some differences between the region and Colombia. One example is the high systemic importance of the public sector in CAPDR compared to Colombia. Another marked difference is that households and the monetary authority are much more important in Colombia than in CAPDR. This is consistent with the lower level of development of the financial and capital market in CAPDR.

The simulated network that minimizes fiscal costs. This network of flows is obtained beginning with the current structure of credits and debits. As was explained in Box 2.1, the shock takes external financing back to levels similar to those of 2008. However, in this simulation, the procedure shown in Box 2.1 and the findings of Graph 2.8 are used to find the distribution of debits and credits that would reduce the fiscal cost as much as possible. This means that the linkages between sectors change and therefore the patterns of debits and credits are modified. With the new patterns of flows, indicators of systemic importance are generated. Graph A2.2 compares the index of relative importance to what was observed in CAPDR in 2013, the comparable one for Colombia and the new simulated network. In their turn, the costs generated under this simulation are shown with blue bars in Graph 2.8.



Dimensions of the macroprudential policy approach (see Graph AII.3). The first aspect of the macroprudential approach is the multi-sectoral dimension. This seeks to avoid common features, such as similar capital structures and the inter-connection between entities. But in the time dimension the pro-cyclicality of bank activity stands out as well as its impact on systemic risk²⁹. The latter has been extensively explored, while the multi-sectoral dimension has drawn attention only since the recent financial crisis. The multi-sectoral dimension focuses on the system of flows as a whole, not just those that occur within a particular sector. It considers that the aggregated risk depends on the behavior of institutions; that is, decisions, which can be rational individually, can be prejudicial when combined with those of all other institutions. This approach, unlike others applied previously, uses prudential instruments such as regulation and supervision, but with systemic goals rather than focusing on a specific sector. Furthermore, it demands a view of the

²⁹ See, for example, Fernández de Lis (2010), Caruana (2010a) or Borio (2008)

effect of microprudential regulations beyond their immediate impact on the individual solvency of each sector or entity. In addition, it differs from the approaches to financial stability in general because it concentrates on macroeconomic aspects and the monetary stability of the country, and not only on forecasting the systemic stability of the financial sector. Graph A2.3 shows some of the measures included under the multi-sectoral dimension.

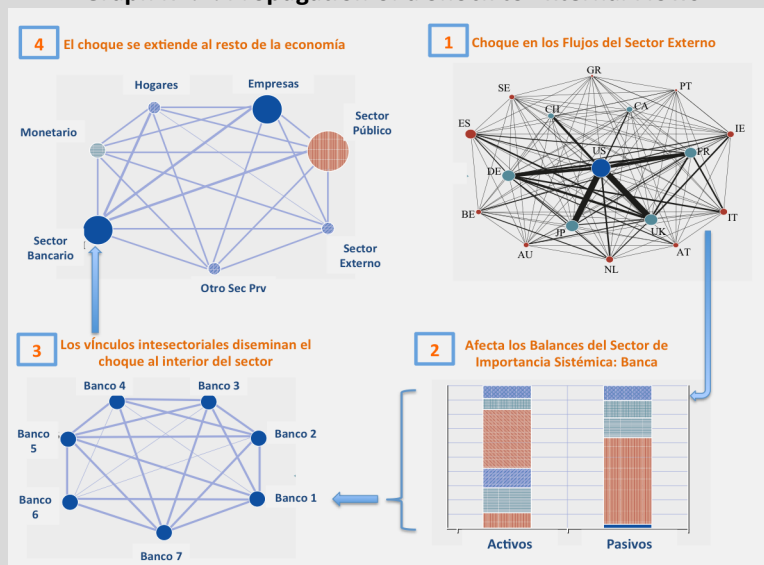
Box 2.1 Stress Test: Shock to Flows from Outside the Country

The structure of flows is submitted to a shock which reduces the availability of external financing to levels observed before the recession. Information on flows and balances from 2008 is used as a starting point as this was the point at which financial markets began to show signs of instability. Until the final quarter of 2008 financial conditions remained relatively normal and it was only with the fall of Lehman that conditions of stress applied.

The stress test assumes that after the shock each sector keeps its financing needs the same. Since each sector is tied to another through debits and credits, the shock propagates simultaneously to every member that has received external flows. The analysis suggests that the effects of the shock would be disseminated principally through the banking sector since it has links with each one of the other sectors. However, the shock would create an analogous dynamic beginning from the private or public sector when portfolio investment in the economy contracts.

The dynamic in which the contagion takes place could be the following: after the shock the banking sector is obliged to reduce credit to the economy as a result of the contraction in external financing. At the same time, the public sector sees its external sources of funds restricted and transfers its needs to the banking sector. Meanwhile the private sector turns to the banks, as it normally does, for lines of credit. This continues to occur until the latter is not able to meet the demand. To try to cover the demand, the banks first turn to interbank credit and then to the monetary authority to obtain funds, but only until its balance is adjusted. When this occurs, the private sector resorts to the public banks. To compensate for what is lacking, the public banks increase their lines of credit but not without first accessing financing from the monetary authority or transfers from the central government. These effects are greater when the flows have been transferred multiple times between sectors, whether in the form of loans or investments. In any case, owing to the high dependence on the public sector, what's lacking ultimately falls on it.

Graph R2.1: Propagation of a Shock to External Flows



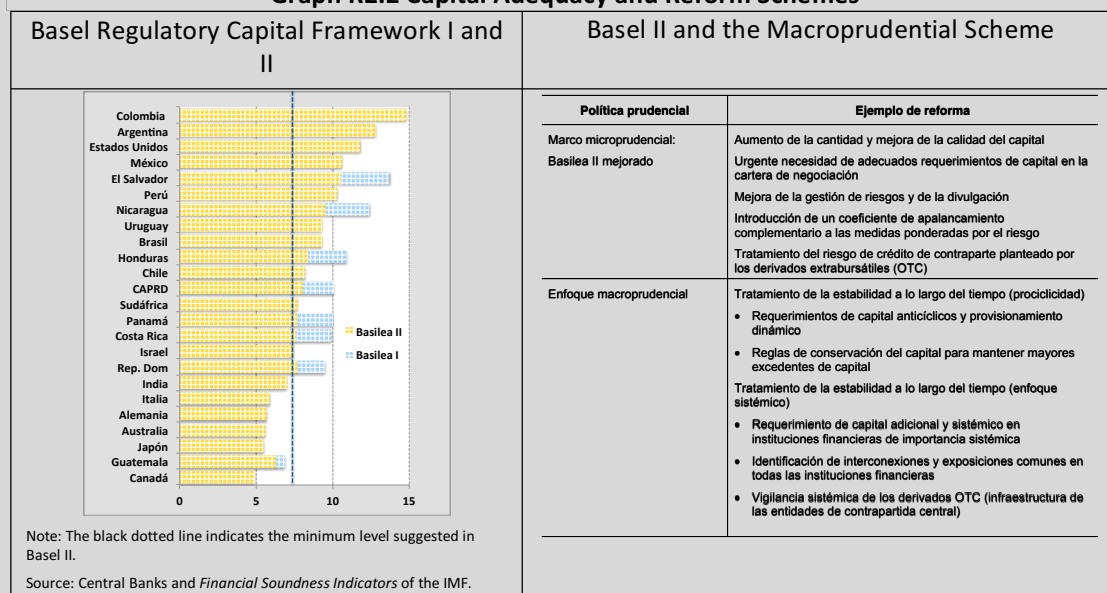
Box 2.2 Prudential Measures in Colombia, Mexico and Peru

In Latin America, Colombia, Mexico and Peru have benefited from the implementation of prudential regulations. Just as in other countries which are recipients of flows, the recent crisis generated important changes in the patterns of flows in these three countries and therefore in sectoral balances. However, they have been able to respond satisfactorily to them so far.

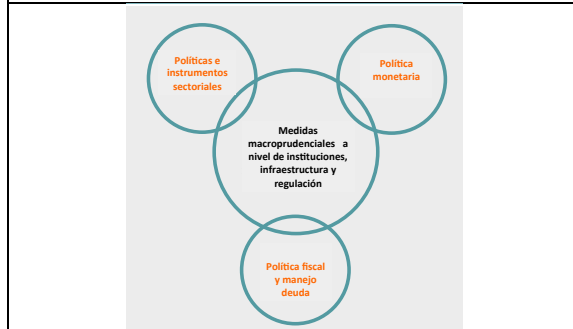
CAPDR could reduce its vulnerabilities by implementing similar measures to those carried out in these countries. To lessen concentration, the creation of non-bank societies with intermediation services of limited purpose (Sofol), and from which banks themselves have been restricted, has been encouraged. Their aim is to provide the financial system with institutions that increase the alternatives and the financing flows for economic agents. Among these societies are found mortgage lenders, educational loan institutions, household credit and credit to micro and small firms.

Meanwhile, to reduce the risks of contagion and its fiscal effects, it is important to have prudential regulation for international banks and repatriation of capital. In this regard, Mexico has required international banks to establish themselves as a subsidiary rather than a branch, thereby minimizing the exit of resources to the matrix. In addition, in Colombia, Peru and Mexico the gradual adoption of the Basel principles I and II has been rewarded by high levels of regulatory capital. It should be stressed that at present CAPDR is not very far from the capital adequacy levels suggested by Basel. However, it is important that the region assimilates the Basel Accords in order to reduce the vulnerabilities of the financial system in general. The risk mitigation agenda is not static and therefore permanent monitoring of market conditions is preferable. For this reason Colombia, Peru and Mexico are proceeding to improve their financial regulation criteria with the aim of extending them across the multi-sectoral, macroprudential field and making them more suitable for the post-crisis financial reality. Graph R2.2 points out some of these elements.

Graph R2.2 Capital Adequacy and Reform Schemes



Graph AII.3
Multi-Sectoral Policy Approach



Box AII.1 The Multi-Sectoral Dimension

Política prudencial		Política monetaria		Política fiscal	
Mitigar los problemas de los bancos individuales (microprudencial) Calidad/cantidad de capital Coeficiente de apalancamiento Niveles de liquidez Riesgo de crédito de contraparte Límites a las actividades bancarias (por ejemplo, negociación por cuenta propia) Fortalecimiento de la gestión de riesgos	Mitigar los problemas del conjunto del sistema (macroprudencial) Requerimiento de capital anticíclico Provisionamiento dinámico Requerimiento de capital sistémico Coeficiente de apalancamiento Límites máximos a la relación préstamo-valor Infraestructura robusta (entidades de contraparte central)	Mantener la estabilidad de precios Tasa de interés oficial Operaciones con pacto de recompra (<i>repos</i>) convencionales Políticas de garantías Pago de intereses sobre reservas Corredores de política	Amortiguar las expansiones Eleva la tasa de interés oficial Eleva los coeficientes de reservas obligatorias Drenar liquidez (certificados de tesorería del banco central, <i>repos</i> excepcionales) Ofrecer estímulos en las contracciones Reducir la tasa de interés oficial Reducir los coeficientes de reservas obligatorias Inyectar liquidez Relajación cuantitativa y crediticia Provisión de liquidez de emergencia Estrategias de salida Excedentes de reservas de divisas	Gestionar la demanda agregada Impuestos Estabilizadores automáticos Enfoque anticíclico (discrecional)	Generar excedentes fiscales en épocas de bonanza Reducir los niveles de deuda Introducir impuestos/gravámenes sobre el sector financiero Ofrecer apoyo al sector financiero en épocas de tensión Inyecciones de capital Garantías de depósitos y deuda Paquetes de rescate bancario Estímulos discrecionales