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CHILE

Selected Issues

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Approved by the Western Hemisphere Department

August 6, 2012

Contents Page

I. Output Fluctuations in Chile—The Role of External Factors 3
A. Introduction....3
B. Stylized Facts: Chile's Exposure to External Factors....3
C. External Factors and Output Fluctuations in Chile: A VAR Approach....5
D. Concluding Remarks....9
References....10

Figures
1. Latin America: Trade Openness 12
2. Commodity Dependence: Net Commodity Exports 12
3. Commodity Dependence and Export Concentration 13
4. Commodity Export Concentration: Gross Commodity Exports....14
5. Macro Performance of Commodity Exporters and Other Emerging Economies During Global Recessions, 1980–2010....15
6. Commodity Prices During Global Recessions, 1960–2010....15
7. Financial Integration, 1990–2010 16
8. Capital Account Openness, 2005–2010....16
9. Output Performance During Global Financial Shocks, 1990–2011 16
10. Output Response to External Shocks....17
11. Accumulated Response of Output to External Shocks 17
12. Historical Decomposition of Output....17
13. Response to a VIX Shock 18
14. Response of Output and Domestic Demand to a VIX Shock 18
15. Amplification Effect of Credit 18
16. Response to a Shock to Copper Prices....19
17. Response to a Shock to Copper Prices (alternative specification)....19
18. Accumulated Response to a Shock to Copper Prices 19
19. Response to a Global Demand Shock....19

Tables
1. Cumulative Impact on Output....20
2. Variance Decomposition of Output....20

II. Financial Spillovers to Chile....21
A. Introduction....21
B. Methodology and Data....21
C. Results....25
D. Concluding Remarks....27
References....28

Figures
1. Stylized Facts, 2008–12....29
2. Funding Markets, 2008–12....30

Tables
1. Bond Market Spread....31
2. Interbank Market Spread....32

III. Performance of Publicly Listed Chilean Firms during the 2008–09 Global Financial Crisis....33
A. Introduction....33
B. The Analytical Framework and Data....34
C. Empirical Results....37
D. Concluding Remarks....39
References....41

Figures
1. Density Distribution of Firm Performance During the 2007-09 Crisis....42

Tables
1a. Firm Summary Statistics Before and During the 2008-09 Crisis....43
1b. Summary Statistics for Dependent and Explanatory Variables....43
1c. Bilateral Correlations....43
2. The Impact of Crisis on Firm Performance: Baseline Results....44
3. The Impact of Crisis on Firm Performance: Robustness Checks (1)....44
4. The Impact of Crisis on Firm Performance: Robustness Checks (2)....45
5. The Impact of Crisis on Firm Performance: Robustness Checks (3)....46
6. The Impact of Crisis on Firm Performance: Using Sectoral Level Measures....47
Annex Table: Firms in the Sample by Industry....47

I. Output Fluctuations in Chile—The Role of External Factors[1]

A. Introduction

1. **As a small and open economy, Chile is exposed to external shocks.** Chile's trade openness and international financial integration are significant and copper accounts for a major share of exports, so the economy is potentially vulnerable to changes in global financial conditions, external demand, and commodity prices. A high quality policy framework, however, mitigates this vulnerability. The combination of a strong fiscal policy framework, a credible inflation targeting regime, and a flexible exchange rate regime increases Chile's resilience to changes in external conditions.

2. **This chapter attempts to quantify the potential impact of external shocks on Chile's economic activity.** This question is of particular interest today, in light of increased uncertainty about the global economic outlook. What impact would negative external shocks have on Chile's growth performance? More specifically, how renewed bouts of global risk aversion or a sharp decline in copper prices are likely to affect Chile? This chapter aims to address these questions, using a vector autoregressive (VAR) approach. The results suggest that external shocks—both financial and real—have a significant impact on Chile's output, and explain a sizable fraction of Chile's business cycle fluctuations. In particular, movements in copper prices and changes in international financial conditions play an important role.

3. **The chapter is organized as follows.** The next section documents Chile's trade and financial integration with international markets and the degree of commodity dependence and concentration of exports, from a historical and regional perspective. Section C describes the empirical approach and presents estimates of the effect of external shocks on Chile's output. The final section concludes with a brief discussion of policy implications.

B. Stylized Facts: Chile's Exposure to External Factors

4. **Chile's degree of trade openness is significant.** Chile witnessed a process of increased trade integration with the rest of the world in the past two decades, supported by unilateral import tariff reductions and the signing of several free trade agreements, including with the U.S. and the E.U. In fact, Chile's economy exhibits the largest degree of trade openness in the region (Figure 1).

5. **Chile continues to be highly dependent on commodities.** Chile is one of the most commodity dependent economies among emerging markets (Figures 2 and 3), and this feature has become more pronounced over time—with net commodity exports doubling from about 10 percent of GDP in 1970–80 to almost 20 percent in 2010. Moreover, commodities represent almost 70 percent of total exports, with a very high concentration in metals (mainly copper). Chile's share of commodities in total exports is almost 10 percentage points higher than the average for South America, and about three times larger than in Mexico and Central America, and emerging Asia, which experienced significant diversification in the past decades (Figures 3

[1] Prepared by Sebastián Sosa.

and 4). Commodity-related fiscal revenues are also significant, accounting for 17 percent of total revenues (3½ of GDP) in 2012.

6. **The high reliance on copper exports increases the economy's exposure to global economic developments, given the high sensitivity of metal prices to the global cycle.** Net commodity exporters are particularly affected during episodes of global recessions (Figure 5), displaying lower exports (values and volumes) and domestic output growth than non-commodity exporters. Moreover, the degree of vulnerability to a global slowdown varies within the group of commodity-exporting economies, with metals (and energy) exporters being especially vulnerable given the higher sensitivity of their export prices to the global cycle (Figure 6).

7. **Chile is also one of the most financially integrated economies among emerging markets.** Chile has been at the forefront of financial and capital account liberalization in the last decades. Today, it stands as one of the emerging market economies with the deepest international financial integration—measured as the sum of total foreign assets and liabilities, relative to GDP (Figure 7).[2] A similar picture is obtained by using a measure of capital account openness based on the index constructed by Chinn and Ito, 2008 (Figure 8).

8. **The degree of vulnerability to external shocks also depends on the flexibility and quality of the policy framework.**[3] Due to the strength of its policy framework, Chile's output decline during periods of global financial shocks has been broadly in line with that of other countries in the region, despite the country's deeper integration with international financial markets (Figure 9). Several recent studies have shown that Chile has become more resilient to changes in external conditions (in particular to copper price shocks) in the past two decades, arguing that this is mainly due to better policies and stronger fundamentals.[4] This chapter does not attempt to quantify the role of policies in mitigating shocks. Instead, it aims to assess empirically the magnitude of external spillovers to Chile (which also reflect the policy reactions to foreign shocks). In contrast to previous studies, the period of analysis focuses on the last two decades (a period of sound policies and strong fundamentals compared with the 1970–80s). The sample period includes the 2008–09 global financial crisis and the subsequent period of high volatility of external variables.

[2] An updated and extended version of the Lane and Milesi-Ferreti (2007) data set is used.

[3] Adler and Sosa (2011) and IMF (2011), for instance, show that limited exchange rate flexibility, a weak underlying external position, and loose fiscal policy tend to amplify the negative effects of terms-of-trade shocks on domestic output, whereas financial dollarization also appears to act as a shock "amplifier." IMF (2012), in turn, finds that external sustainability and especially exchange rate flexibility play a key role in mitigating the effect of global financial shocks.

[4] See, for example, Franken, Le Fort, and Parrado (2004); Betancour, De Gregorio, and Medina (2006); and De Gregorio and Labbé (2011).

C. External Factors and Output Fluctuations in Chile: A VAR Approach

Empirical strategy

9. **A standard VAR model is estimated to quantify the extent of spillovers from external shocks.** This empirical approach allows one to examine the role played by external factors as sources of business cycle fluctuations in Chile, and to identify the dynamic responses of Chile's output to external shocks.

10. **The structural model can be expressed as follows:**

$$A(L)y_t = \gamma_t$$

where y_t is an n vector of variables, $A(L)$ denotes a lag polynomial matrix, and γ_t is an n vector of structural disturbances or shocks. A_0, which represents the contemporaneous relationships between the variables of the model, is a non-singular matrix normalized to have ones on the diagonal.

11. **The reduced form corresponding to this structural model can be written as:**

$$B(L)y_t = u_t$$

where $B(L)$ is a lag polynomial matrix such that $B(L) = (A_0)^{-1}A(L)$ and $B_0 = I$, and u_t is an n vector of mean zero reduced form disturbances with covariance matrix Γ, such that

$$u_t = (A_0)^{-1}\gamma_t.$$

12. **The vector y_t includes a set of external factors (international financial conditions, global demand, and copper prices), and Chile's real output.** The external variables are measured as follows:

- International financial conditions are proxied by the S&P 500 Chicago Board Options Exchange Market Volatility Index (VIX);[5]
- Global demand is proxied by a weighted average of real GDP of the Group of Seven countries and China, with weights proportional to their purchasing-power-parity-adjusted GDPs; and
- International copper prices are measured in real terms and stripped of exchange rate effects (as in Adler and Sosa, 2011).

[5] The VIX is frequently used as a measure of global uncertainty or financial stress in the recent empirical literature. Bloom (2009), for instance, shows that this volatility index is highly correlated with measures of micro and macro-level uncertainty, including from financial variables. More recently, Carrière-Swallow and Céspedes (2011) also used the VIX to measure global uncertainty shocks.

13. **The model is estimated using quarterly data from 1990:Q1 through 2011:Q4.** All the variables are expressed in log levels, and the model is estimated in first differences (except the VIX, which is expressed in levels), using two lags.[6] Data sources include the IMF's International Financial Statistics (IFS) and World Economic Outlook (WEO), and Haver Analytics.

14. **To identify the structural parameters of the model, a set of restrictions must be specified.** Following Sims (1980), the reduced form errors are orthogonalized by standard Choleski decomposition. This identification strategy assumes that the correlation of errors across equations is assigned to the equation that appears first in the ordering. The selected ordering of the variables is as follows: the VIX, global output, copper prices, and Chile's domestic output.[7]

Econometric results

15. **External shocks have a significant impact on Chile's output** (Figure 10). A positive shock to the VIX has a negative impact on output.[8] The shock is transmitted fairly quickly—with most of the impact taking place within the same quarter—and the impact on growth is typically short-lived. A positive shock to global demand leads to an increase in Chile's output, with the impact on growth lasting for about one year. A positive shock to copper prices is also expansionary, with the effects on growth lasting for three quarters.[9]

16. **To gauge the economic significance of the impact of external shocks, the cumulative impact on the output level is computed** (Figure 11). A one standard deviation shock to the VIX (4.1 units) leads to an output loss of 0.7 percent after 8 quarters. A shock to global demand

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[6] Standard unit root tests (augmented Dickey-Fuller) show that all the variables are stationary in first differences (except the VIX, which is stationary in levels). In addition, most co-integration tests suggest that the variables in the model are not co-integrated. Hence, we estimate the model in first differences. The number of lags is based on the Akaike Information Criterion (AIC).

[7] Results are robust to different orderings within the group of external variables. The model was also estimated using block exogeneity restrictions for the set of external variables and the main findings hold.

[8] The impact of external shocks on domestic GDP is, of course, dependent on the policy response. The impulse responses here illustrate the impact on output given the average policy responses during the period of analysis. This could be problematic in case of sharp changes in policy regimes. However, Chile's macroeconomic policies were relatively stable and solid in the past two decades, especially comparing with the 1970–80s. In particular, fiscal policy has avoided a procyclical behavior, even before the establishment of a formal rule. While the monetary regime has changed with the implementation of an inflation targeting regime, data limitations preclude us from examining the existence of possible structural breaks.

[9] This last result may be somewhat surprising at first. As discussed in De Gregorio and Labbé (2011), there are in principle reasons to believe that Chile's business cycle should not be significantly affected by copper price movements. The mining sector accounts for only 3½ percent of total employment (or about 7 percent if people employed in activities linked directly or indirectly to mining are considered). Moreover, roughly two thirds of copper production is owned by foreign companies, with the rest corresponding to CODELCO, a state-owned company. As Chile's fiscal framework entails a rule that sets the path of public spending based on long-term copper prices, the impact of copper price fluctuations should in principle be mitigated. The next section discusses a few possible explanations.

growth (of 0.4 percentage points) increases Chile's output by 0.7 percent over the same horizon. Finally, a one standard deviation shock to copper prices (10 percentage points) increases output by 0.8 percent. Interestingly, despite being an economy highly integrated with the rest of the world, the impact of external shocks on Chile's economic activity is roughly similar to the regional average (Table 1).

17. **Variance decomposition analysis shows that foreign factors are a significant source of business cycle fluctuations in Chile.** External shocks account for almost 20 percent of the variance of Chile's real GDP growth at standard horizons (Table 2).[10] Copper prices are the most important external source of fluctuations, explaining about 10 percent of Chile's output variance.

18. **Finally, a historical decomposition analysis is used to assess how the importance of external shocks has evolved over time.** Figure 12 shows the decomposition of Chile's GDP growth in the past decade, with the contribution of each of the foreign factors.[11] Growth in the early-2000s was mainly explained by domestic factors. The contribution of external variables was actually negative in that period—characterized by low copper prices, and tight financing conditions for emerging markets (some countries in the region experienced deep financial crisis during this period, i.e., Argentina and Uruguay). External factors—particularly copper prices—explained a significant fraction of growth during the boom preceding the Lehman crisis, especially in 2006–07. The Lehman crisis strongly affected the Chilean economy, with external shocks—both financial and trade ones—explaining almost entirely the decline in growth. The recovery of copper prices contributed to Chile's economic recovery, with the output decline in the first quarter of 2010 being explained by the effect of the earthquake. More recently, the results suggest that while copper prices have continued to support economic activity in Chile, a substantial fraction of the observed growth has been explained by domestic factors.

Channels of transmission

19. **The results suggest that domestic demand is particularly sensitive to global financial shocks.** As shown earlier, an increase in the VIX typically leads to a decline in output in Chile. Domestic demand suffers a particularly strong decline after these shocks (Figure 13).[12] This is consistent with the results in Carrière-Swallow and Céspedes (2011), which show that a global uncertainty shock typically has a negative impact on investment and private consumption in emerging markets, including Chile.

20. **How are global financial shocks likely to be transmitted?** To shed some light on this question, we follow an approach similar to the one proposed by Bayoumi and Swiston (2008) to examine whether the credit channel plays a role as a transmission mechanism.[13] The exercise consists of augmenting the VAR by including credit growth in the model. The model is estimated

[10] The analysis focuses on a horizon of 8 quarters.

[11] Chile's observed GDP growth series is decomposed into a baseline projection and the accumulated effects of current and past innovations, based on a moving average representation.

[12] The impulse responses illustrate the impact of a VIX shock in a VAR that includes Chile's exports and domestic demand instead of domestic GDP.

[13] Adler and Sosa (2012) and Carrière-Swallow and Céspedes (2011) also use a similar approach.

using two alternative specifications: first, with credit growth as an endogenous variable and next, with credit growth as an exogenous variable. The estimated responses in the first specification capture the overall impact on Chile's output (or domestic demand) of a VIX shock, including the indirect (and possibly amplifying) effect through domestic credit. The second specification, in contrast, computes the responses to a VIX shock, "shutting off" any indirect effect through the credit channel. Thus, the role of bank credit as a channel can be gauged by the difference between the responses to the global financial shock in the two specifications, as follows:

$$B_t = r^1{}_t - r^2{}_t$$

where $r^1{}_t$ is the response of domestic output (or, alternatively, domestic demand) in period t from the model including credit as an endogenous variable, and $r^2{}_t$ is the response from the alternative specification where credit is included as an exogenous variable.

21. **The results suggest that credit indeed amplifies global financial shocks.** A significant fraction of the effect of an adverse external financial shock on output (or domestic demand) may be attributed to the credit channel (Figure 14). This amplification effect encompasses: (i) the sensitivity of credit growth to global financial shocks and ii) the effect of the credit response on domestic demand (Figure 15). The exercise, however, cannot rule out other potential explanatory channels proposed in the literature. For example, in models with adjustment costs and option-value of waiting mechanisms, economic agents reduce investment and consumption in durable goods voluntarily in periods of high uncertainty, given that the range of optimal inaction widens.[14] Moreover, the approach used in this study does not allow to disentangle the extent to which the decline in credit growth triggered by a global financial shock is mainly supply or demand driven, or a combination of both.

22. **Copper price shocks also appear to have a significant impact on Chile's domestic demand.** Figure 16 suggests that most of the impact of copper price shocks on Chile's growth could be attributed to the response of domestic demand. Real exports also increase on impact, but the effect is smaller and typically short-lived, probably reflecting the fact that the volume of copper production is relatively inelastic in the short run.[15] Figures 17 and 18 illustrate the reaction of the different components of domestic demand to a copper price shock, providing some insights on the possible channels. Investment appears to very sensitive to copper prices, while private consumption also tends to increase during copper price booms. The reaction of public consumption, on the other hand, appears to be more muted, consistent with the fiscal framework.

23. **What transmission channels can explain the impact of copper prices shocks on private domestic demand?** First, a higher copper price creates positive income and wealth effects. Whether copper-related revenue is private or public should in principle be irrelevant in

[14] The results are consistent with models where consumption in durable goods and investment fall during periods of high uncertainty, as the high degree of irreversibility would lead firms and consumers to postpone their consumption and investment decisions until uncertainty subsides. See Bernanke (1983).

[15] Though for a different period of analysis, Spilimbergo (1999) also finds that the impact of changes in copper prices on Chile's growth is not merely a reflection of the evolution of output in the copper sector.

this regard assuming the Ricardian equivalence holds.[16] Larger capital inflows (both FDI and portfolio flows) associated with higher export prices could also reinforce the boost to demand if foreign investors bid up domestic asset prices, further increasing Chilean wealth. Second, to the extent that the increase in copper price is (or is perceived as) permanent, the net present value of expected profits in mining companies is higher, thus increasing investment in that sector. The high sensitivity of investment to copper price fluctuations illustrated by the impulse responses presented in this section is consistent with this channel. Third, the increase in private consumption could also be explained by the existence of borrowing constraints, which tend to be eased during periods of high copper prices.[17] Finally, the real exchange rate may also be playing a role. A large fraction of durable goods in Chile are imported and are sensitive to the real exchange rate. Moreover, copper price changes are a key driver of real exchange rate fluctuations. This could (at least partly) explain why private consumption increases during copper price booms in Chile.

24. **Finally, both real exports and domestic demand are affected by shocks to global demand.** As shown earlier, a positive shock to global output is typically expansionary. Interestingly, this type of shocks affects not only exports (as expected) but also domestic demand (Figure 19).

D. Concluding Remarks

25. **The main findings of this chapter suggest that Chile remains vulnerable to changes in external conditions.** The chapter provides an empirical evaluation of Chile's sensitivity to external shocks. The main results suggest that external shocks—both real and financial—have a significant impact on Chile's output and are important drivers of business cycle fluctuations in Chile. In particular, movements in copper prices and changes in international financial conditions play an important role.

26. **The exposure of the economy to external shocks underscores the importance of a sound policy framework and the need to maintain substantial fiscal buffers**. Given the large potential impact of a sharp deterioration of the external environment, Chile should maintain strong fiscal buffers. Continued fiscal discipline would also help strengthen Chile's external position.

[16] It should be acknowledged, however, that the evidence on the Ricardian equivalence is limited, especially in economies where a significant fraction of the population lacks complete access to credit.

[17] Caballero (2002) argues that the impact of copper price shocks on Chile's economic activity reflects the fact that copper is used as collateral for external borrowing.

References

Adler, G. and S. Sosa, 2011, "Commodity Price Cycles: The Perils of Mismanaging the Boom," *IMF Working Paper* 11/283 (Washington: International Monetary Fund).

Adler, G. and S. Sosa, 2012, "Intra-Regional Spillovers in South America: Is Brazil Systemic after All?" *IMF Working Paper* 12/145 (Washington: International Monetary Fund).

Bayoumi, T. and A. Swiston, 2008, "Spillovers Across NAFTA," *IMF Working Paper* 08/3 (Washington: International Monetary Fund).

Bernanke, B., 1983, "Irreversibility and Cyclical Investment." *Quarterly Journal of Economics* 98(1): 85–106.

Betancour, C., J. De Gregorio, and J.P. Medina, 2006, "The 'Great Moderation' and the Monetary Transmission Mechanism in Chile," *Central Bank of Chile Working Papers* No. 393 (Santiago: Central Bank of Chile).

Bloom, N., 2009, "The Impact of Uncertainty Shocks." *Econometrica* 77(3): 623–85.

Caballero, R., 2002, "Enfrentando la Vulnerabilidad Externa: Un Problema Financero," *Economía Chilena*, Vol. 5, No. 1, pp. 11–36.

Carrière–Swallow, Y. and L. F. Céspedes, 2011, "The Impact of Uncertainty Shocks in Emerging Economies," *Central Bank of Chile Working Papers* No. 646 (Santiago: Central Bank of Chile).

Chinn, M. D. and H. Ito, 2008, "A New Measure of Financial Openness," *Journal of Comparative Policy Analysis: Research and Practice*, Vol. 10, No. 3, pp. 309–22.

De Gregorio, J. and F. Labbé, 2011, "Copper, the Real Exchange Rate, and Macroeconomic Fluctuations in Chile," *Central Bank of Chile Working Papers* No. 640 (Santiago: Central Bank of Chile).

Franken, H., G. Le Fort, and E. Parrado, 2005, "Business Cycle Responses and Resilience of the Chilean Economy During the Last Fifty Years," *Central Bank of Chile Working Paper* No. 331 (Santiago: Central Bank of Chile).

International Monetary Fund, 2011, *Regional Economic Outlook: Western Hemisphere* (Washington, October).

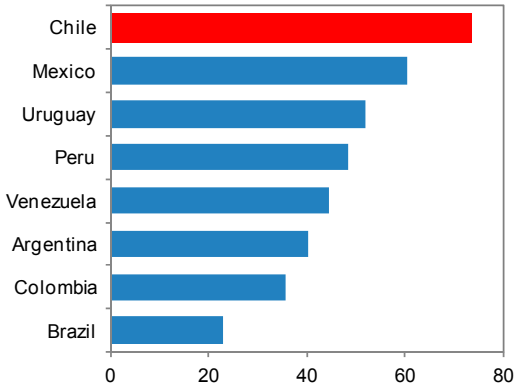
International Monetary Fund, 2012, *Regional Economic Outlook: Western Hemisphere* (Washington, April).

Lane, P. and G. M. Milesi-Ferretti (2007), "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004," *Journal of International Economics* 73 (November), pp. 223–50.

Sims, C., 1980, "Macroeconomics and Reality," *Econometrica*, Vol. 48, pp.1–48.

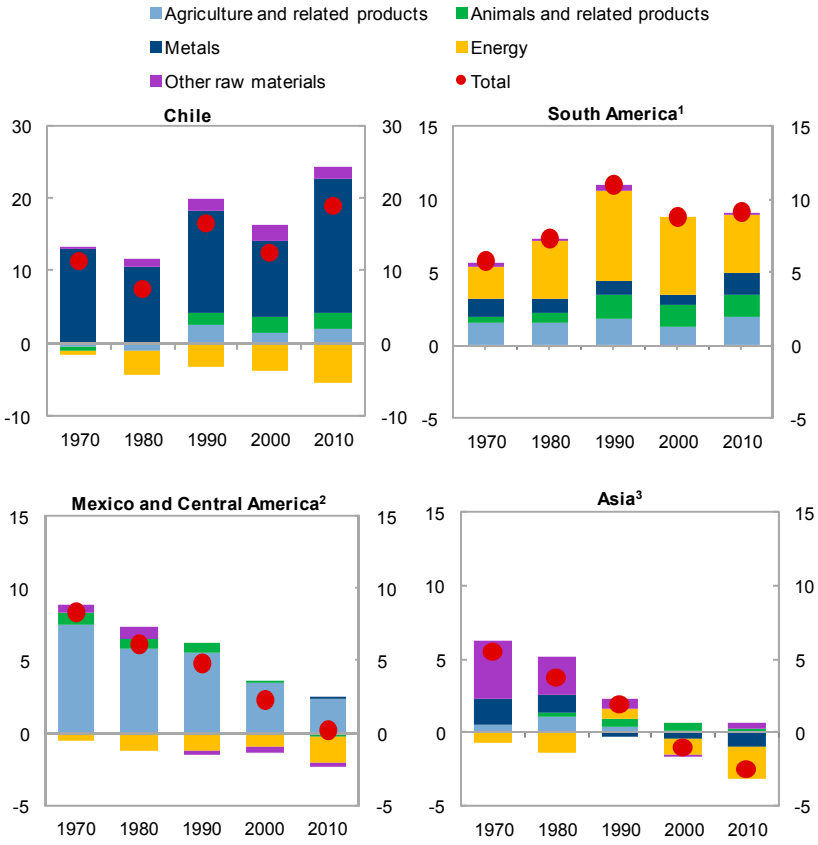
Spilimbergo, A., 1999, "Copper and the Chilean Economy, 1960–98," *IMF Working Paper* 99/57 (Washington: International Monetary Fund).

Figure 1. Latin America: Trade Openness[1]
(Percent of GDP)



Source: author's calculations.
[1] Ratio of the sum of exports and imports to GDP, in percent.

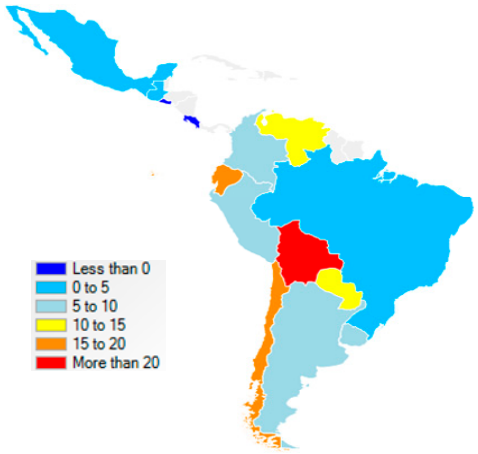
Figure 2. Commodity Dependence: Net Commodity Exports
(Percent of GDP)

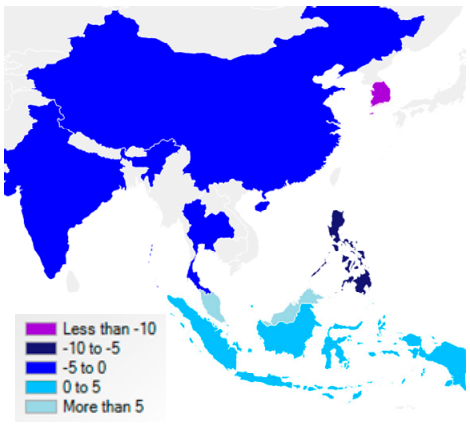


Sources: World Integrated Trade Solutions database; and author's calculations.
[1] Simple average for Argentina, Brazil, Colombia, Ecuador, Peru, Uruguay, and Venezuela.
[2] Simple average for Mexico, Costa Rica, El Salvador, and Guatemala.
[3] Simple average for China, India, Indonesia, Korea, Malaysia, Philippines, and Thailand.

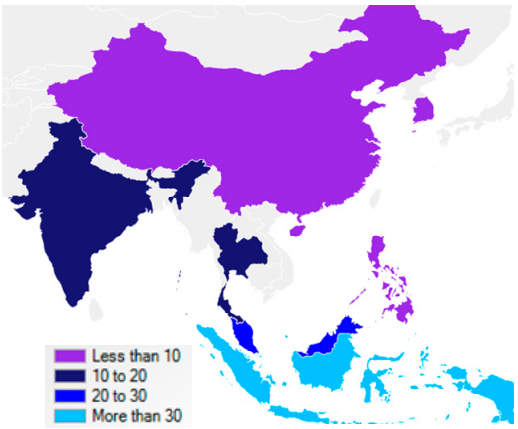
Figure 3. Commodity Dependence and Export Concentration

Dependence
(Net commodity exports in percent of GDP, 2010)



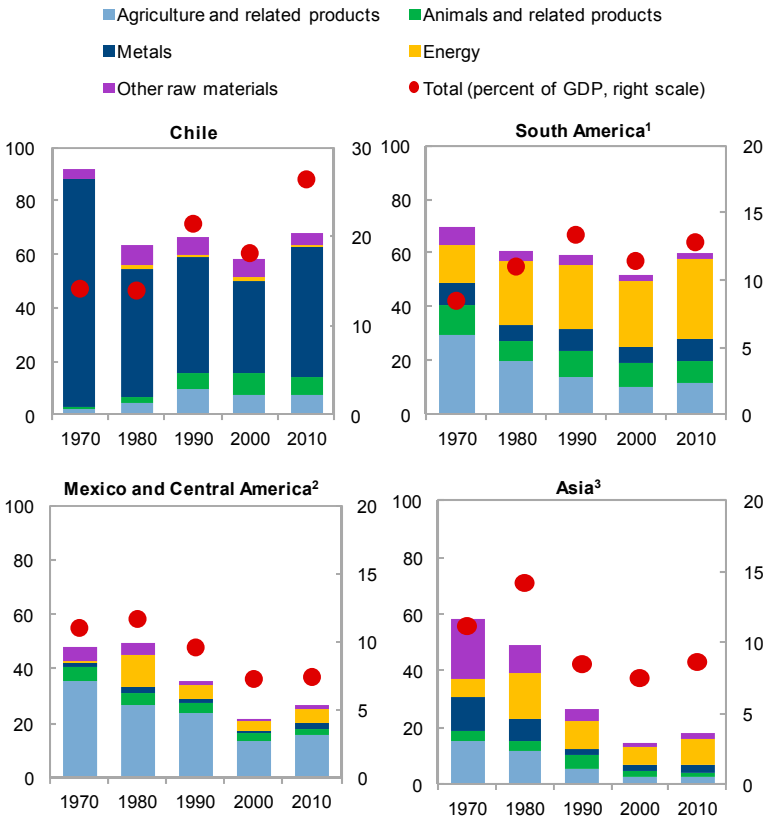


Export Concentration
(Gross commodity exports in percent of total exports, 2010)



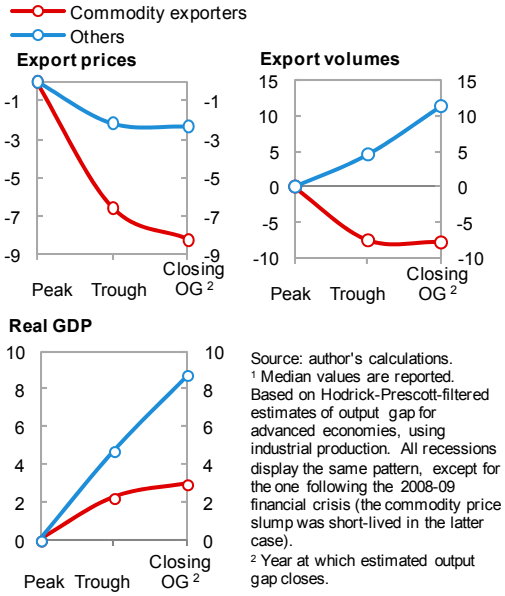
Sources: World Integrated Trade Solutions database and author's calculations.

Figure 4. Commodity Export Concentration: Gross Commodity Exports
(Percent of total exports of goods and services, unless otherwise indicated)



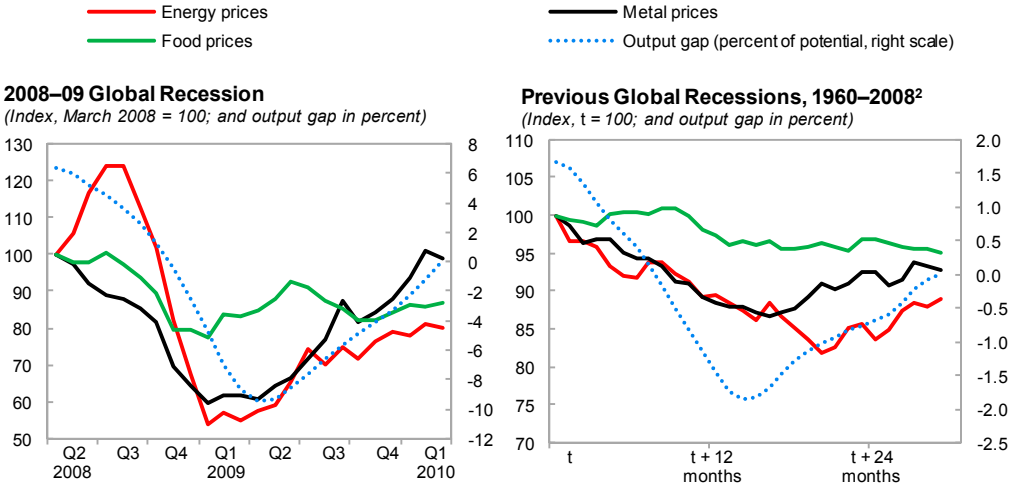
Sources: World Integrated Trade Solutions database; and author's calculations.
[1] Simple average for Argentina, Brazil, Colombia, Ecuador, Peru, Uruguay, and Venezuela.
[2] Simple average for Mexico, Costa Rica, El Salvador, and Guatemala.
[3] Simple average for China, India, Indonesia, Korea, Malaysia, Philippines, and Thailand.

Figure 5. Macro Performance of Commodity Exporters and Other Emerging Economies during Global Recessions, 1980–2010 [1]
(Median cumulative growth, peak year = 0)



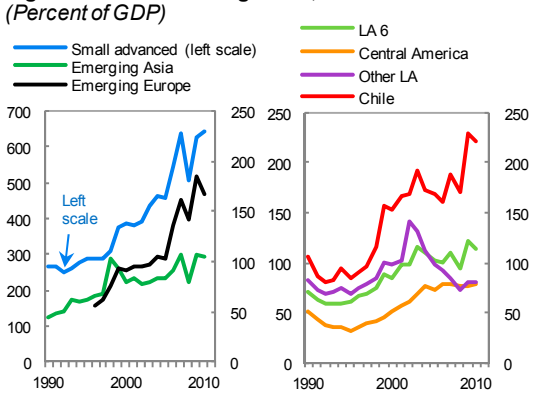
Source: author's calculations.
[1] Median values are reported. Based on Hodrick-Prescott-filtered estimates of output gap for advanced economies, using industrial production. All recessions display the same pattern, except for the one following the 2008-09 financial crisis (the commodity price slump was short-lived in the latter case).
[2] Year at which estimated output gap closes.

Figure 6. Commodity Prices During Global Recessions, 1960–2010[1]



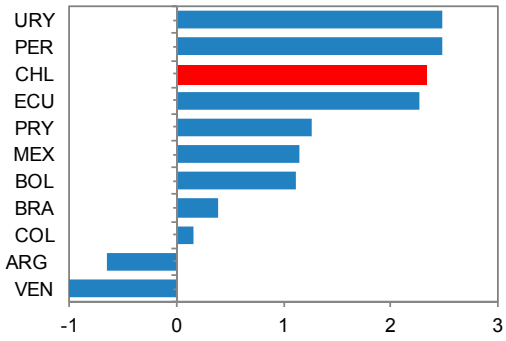
Source: author's calculations.
[1] Recessions defined on the basis of estimated output gap for advanced economies (using industrial production series). A slowdown is considered a recession if the output gap reaches at least –1. 5 percent of potential output for at least a quarter. Reported commodity prices are in real terms.
[2] *t* corresponds to the month of the peak value of the cyclical component of output, before ouput falls below potential. Only the first 30 months are reported as length of recessions varies across cases. Oil shocks of 1969 and 1973 are excluded.

Figure 7 . Financial Integration, 1990-2010[1]
(Percent of GDP)



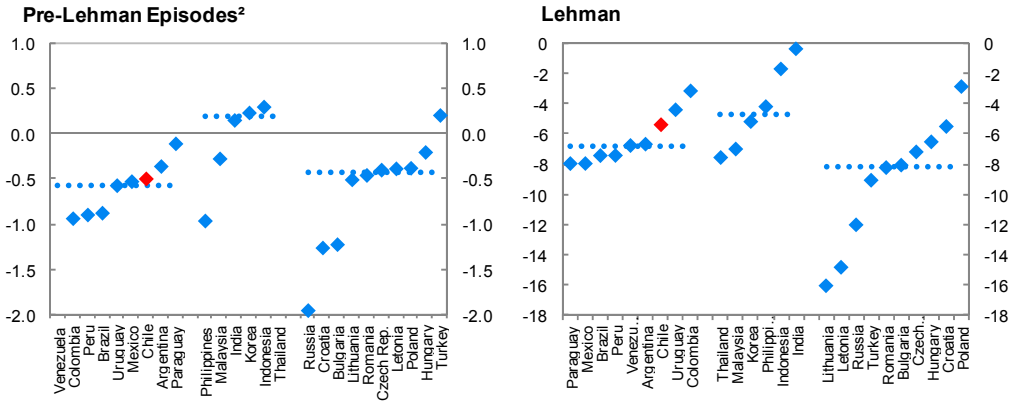
Source: Updated and extended version of the Lane and Milesi-Ferretti (2007) database; and IMF (2012).
[1] Foreign assets plus foreign liabilities net of international reserves and official external debt.

Figure 8 . Capital Account Openness, 2005-2010[1]
(Index)



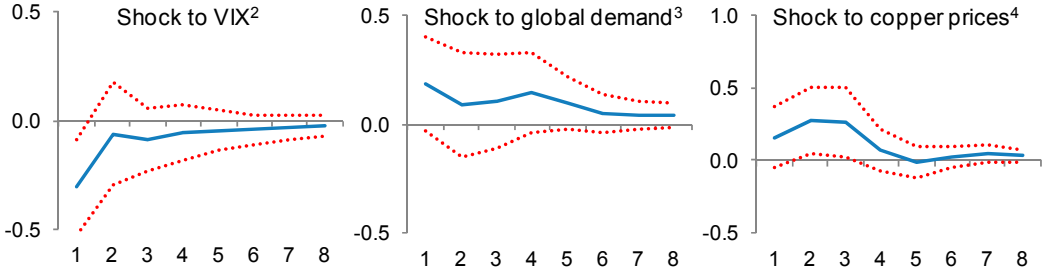
Source: author's calculations.
[1] Based on an updated version of the Chinn and Ito (2008) index. A higher value indicates higher capital account openness.

Figure 9. Output Performance during Global Financial Shocks, 1990–2011[1]
(Cumulative)



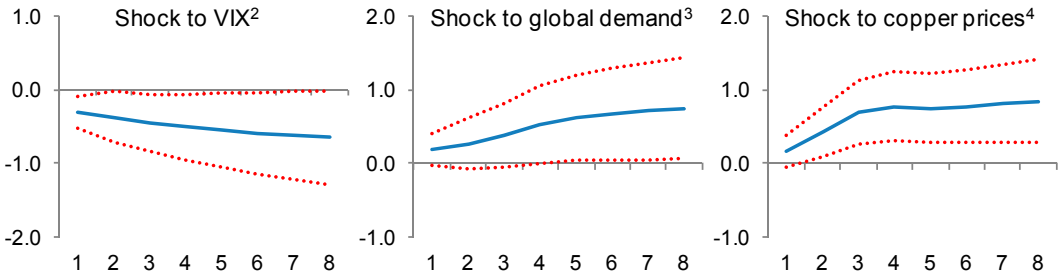
Source: IMF (2012).
[1] Cumulative change in the cyclical component of GDP, in percent of (potential) GDP. Dotted lines reflect regional medians.
[2] Average of different episodes, excluding cases of identified idiosyncratic events: Asian countries (1997), Russia (1998), Brazil (2002), and Uruguay (2001–02).

Figure 10. Chile: Output Response to External Shocks[1]



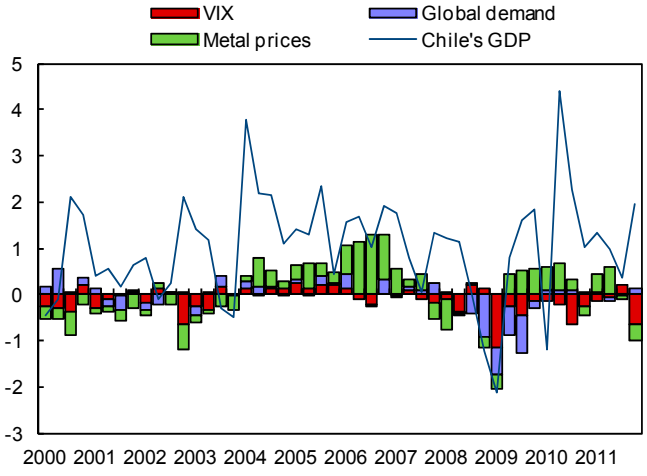
Source: author's calculations.
[1] Response of Chile's GDP growth rate to one standard deviation external shocks. Time horizon in quarters.
[2] Response to one s.d. shock to the VIX (4.1 units) ± 1.5 standard errors.
[3] Response to one s.d. shock to global GDP growth rate (0.4 percentage points) ± 1.5 s.e.
[4] Response to one s.d. shock to copper prices (10 percentage points) ± 1.5 s.e.

Figure 11. Chile: Accumulated Response of Output to External Shocks[1]



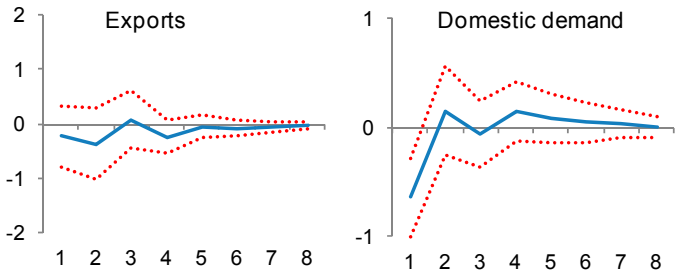
Source: author's calculations.
[1] Accumulated response of Chile's GDP to one standard deviation external shocks. Time horizon in quarters.
[2] Response to one s.d. shock to the VIX (4.1 units) ± 1.5 standard errors.
[3] Response to one s.d. shock to global GDP growth rate (0.4 percentage points) ± 1.5 s.e.
[4] Response to one s.d. shock to copper prices (10 percentage points) ± 1.5 s.e.

Figure 12. Chile: Historical Decomposition of Output
(Percent)



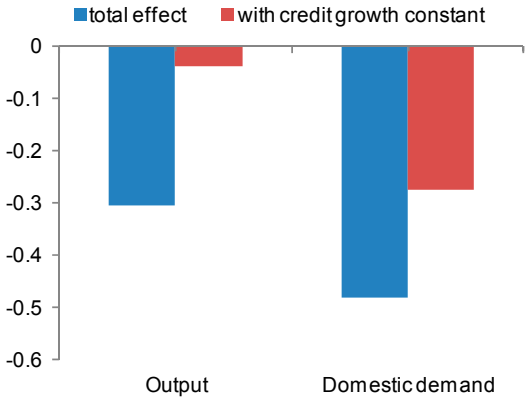
Source: author's calculations.

Figure 13. Chile: Response to a VIX Shock[1]



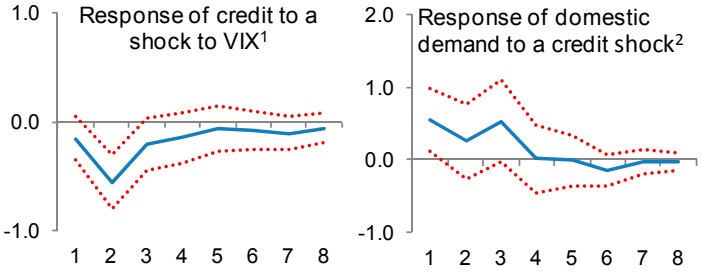
Source: author's calculations.
[1] Response to one s.d. shock to the VIX (4.3 units) ± 1.5 standard errors. Time horizon in quarters.

Figure 14. Chile: Response of Output and Domestic Demand to a VIX shock[1]



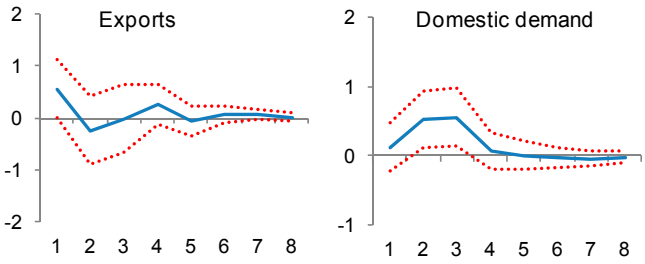
Source: author's calculations.
[1] Response of Chile's GDP and domestic demand growth to a one standard deviation shock to the VIX. Time horizon in quarters.

Figure 15. Chile: Amplification Effect of Credit



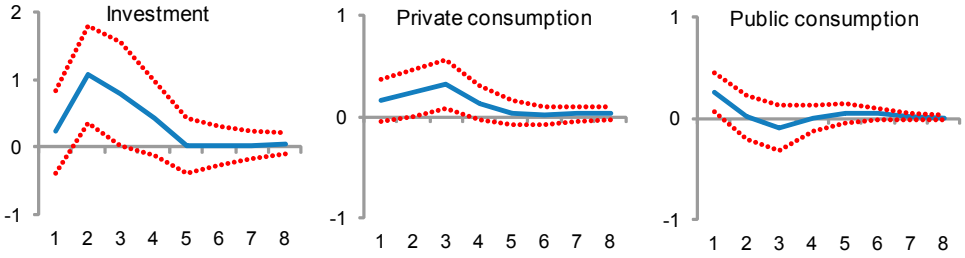
Source: author's calculations.
[1] Response to one s.d. shock to the VIX (4.3 units) ± 1.5 s.e.
[2] Response to one s.d. shock to credit growth (0.9 percentage points) ± 1.5 standard errors. Time horizon in quarters.

Figure 16. Chile: Response to a Shock to Copper Prices[1]



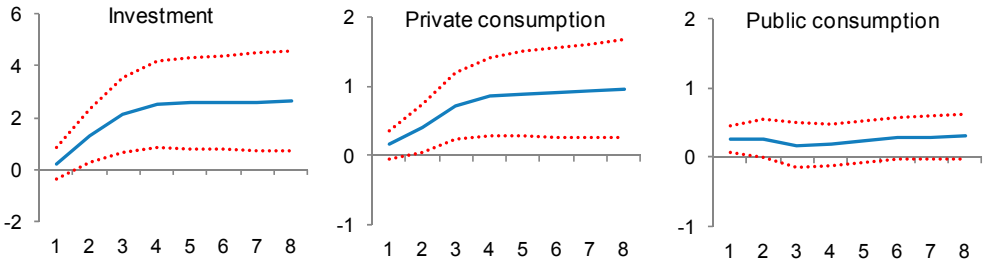
Source: author's calculations.
[1] Response to one s.d. shock to copper prices (10 percentage points) ± 1.5 standard errors. Time horizon in quarters.

Figure 17. Chile: Response to a Shock to Copper Prices[1] (alternative specification)



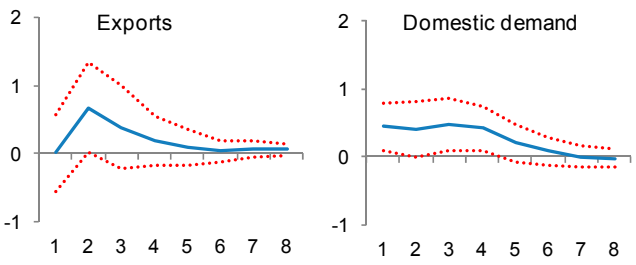
Source: author's calculations.
[1] Response to one s.d. shock to copper prices (10 percentage points) ± 1.5 standard errors. Time horizon in quarters.

Figure 18. Chile: Accumulated Response to a Shock to Copper Prices[1]



Source: author's calculations.
[1] Response to one s.d. shock to copper prices (10 percentage points) ± 1.5 standard errors. Time horizon in quarters.

Figure 19. Chile: Response to a Global Demand Shock[1]



Source: author's calculations.
[1] Response to one s.d. shock to global GDP growth rate (0.4 percentage points) ± 1.5 s.e. Time horizon in quarters.

Table 1. Cumulative Impact on Output
(After 8 quarters, in percent)

	One standard deviation shock to:[1]		
Country	VIX	Global demand	Copper prices[2]
Chile	-0.7	0.7	0.8
Argentina	-1.5	0.9	0.8
Brazil	-0.4	0.6	0.5
Bolivia	-0.4	0.2	0.1
Colombia	-1.0	0.5	0.1
Ecuador	-0.3	0.8	0.5
Paraguay	-0.5	1.1	-0.1
Peru	-1.1	1.1	0.3
Uruguay	-1.0	0.7	0.7
Venezuela	-2.3	1.3	-1.0
Average[3]	-0.9	0.8	0.2

Source: author's calculations.

[1] Equivalent to 4.6–4.8 units (VIX), 0.4 percentage points (global GDP), and 5.1–5.5 percentage points (commodity prices).

[2] Except for Chile, a broad commodity price index is used.

[3] Excluding Chile.

Table 2. Chile: Variance Decomposition of Output
(Percent)

Horizon (quarters)	S.E.	VIX	Global GDP	Copper prices	Chile's GDP
1	4.1	4.9	1.7	1.3	92.1
4	7.4	4.9	3.4	8.0	83.7
8	7.9	5.1	4.0	8.0	82.9

Source: author's calculations.

II. FINANCIAL SPILLOVERS TO CHILE[1]

A. Introduction

1. **Chile's economy is well integreated into the global financial system and is therefore exposed to changes in external financial conditions.** Changes in global risk aversion and liquidity directly affect costs and availability of banks' external borrowing (accounting for about 10 percent of liabilities). External pressures also transmit via arbitrage to domestic interest rates. In addition, changes in credit ratings of parent banks may affect foreign bank subsidiaries, which account for nearly forty percent of the banking sector (see Figure 1).

2. **This paper quantifies the spillover of global credit and liquidity risks to Chilean banks' funding costs.** For the bond market, a model of bank credit risk is used to study the effects of bank-specific factors and global credit risk factors on banks' bond credit spread. For the interbank market, the paper updates and extends the analysis of FSR (2010) by adding proxies for global risk as explanatory variables.

3. **The results suggest that global spillovers played an important role in the dynamics of funding spreads.** Spillovers on average accounted for 40 percent of the bond market spread and 60 percent of the interbank market spread. Until mid-2010, banks' bond credit spread was mostly driven by changes in banks' fundamentals and thereafter by global risk factors. Changes in the U.S. interbank market spread accounted for most of the movements in Chile's interbank market spread in 2008, while more recently spillovers from the euro area played a dominant role. Policy measures to increase liquidity implemented in Novemeber 2008 helped reduce the interbank market spread.

4. **Nevertheless, spillover effects after 2009 have been moderate and financial intermediation does not seem to be impaired.** The estimates suggest that spillovers elevated banks' bond credit and interbank market spreads in Chile by only about 50 basis points on average between mid-2010 and early-2012. Credit growth has been very strong over the last two years in all sectors.

5. **The rest of the paper is organized as follows.** Next section describes the data and methodology used to decompose the funding spreads. The section C reports the results of the analysis, and section D concludes.

B. Methodology and Data

6. **The effects of domestic and external variables on banks' bond credit spread and interbank market spread are examined using least squares estimation, with standard errors adjusted for heteroscedasticity and autocorrelation.** The interbank and bond markets are important bank funding sources. Interbank lending and wholesale deposits represent 20 percent of total banks' liabilities. Bonds account for about 15 percent of banks' funding. Changes in the wholesale funding rates should also affect retail deposit rates, possibly with some lag.

[1] Prepared by Jiri Podpiera.

The Bond Market

7. **Banks' bond credit spread is defined as the difference between the yield on these bonds and the risk-free yield (government bonds) of similar maturity.** Although this spread is affected by liquidity premia and tax issues, it mostly measures the premium for credit default risk that investors charge for lending long-term funds to banks (such as subordinated debt). The series is compiled by the Banco Central de Chile.

8. **The bond credit spread has been difficult to explain using standard structural models.** Modeling credit default risk is usually based on the value of a firm relative to its debt – the more the value of a company approaches the value of its debt, the more risky the company becomes, and vice versa (that is, measuring the distance to default). Since Merton (1974), the equity is viewed as a call option on a firm's assets with maturity T; the equity price is the spot price and the maturing debt at time T per share is the strike price. Using equities as proxy for a company's value, the credit default risk (corporate credit spread) is a function of the debt per share, volatility of equity price, and the risk-free interest rate. However, these variables explain only a fraction of credit spread variability. This is known in the literature as the credit spread puzzle – see Duffee (1998).

9. **This paper uses a semi-structural model to decompose banks' bond credit spread into a fundamental part and a global risk spillover part.** The methodology is based on Otker-Robe and Podpiera (2012), who derive pricing of bank credit risk from a leveraged portfolio model. Banks are viewed as leveraged portfolios, since they borrow funds and invest them into a portfolio of risky projects. Therefore, portfolio theory could be applied to banks. In particular, there exists a risk-return efficient frontier that is the yardstick for pricing the credit risk of banks. While fundamentals anchor the long-term level of the spread, short-term volatility tends to be connected with periods of high market uncertainty and risk aversion.

10. **The structural part of the model is based on the assumption that banks try to minimize risk and maximize profit.** The spread is modelled as a funcion of a set of fundamentals, including banks' net interest margin, operating expenses, return on assets, and the slope of the yield curve. Banks balance risk and return and thus optimize along a risk frontier. Following Otker-Robe and Podpiera (2012), the banks' bond credit spread (CS) is modeled as:

$$CS_t = \mathrm{c} + \alpha NIM_t + \beta \mathrm{EFF}_t - \gamma ROA_t - \delta SLOPE_t + \vartheta_t,$$

- NIM denotes the net interest margin, which is the difference between the interest received from lending and paid for cost of funds; expressed as a ratio of interest bearing assets. It could be viewed as a measure of risk-taking, since loans are priced according to their risk score. In a competitive market, banks with more risky portfolios would have a higher net interest margin and would have to pay a higher interest rates on their bonds.

- EFF is the efficiency ratio, calculated as the ratio of operating expenses to total revenues. It could be viewed as a measure of operational risk: a strong management would allocate resources well and maintain a low ratio of operating expenses to revenue. Thus, an

increasing efficiency ratio signalizes higher operational risk, which would lead to a higher bond spread.

- ROA is the return on assets, which measures profits the banking sector generates with given assets. Increasing profitability allows for strengthening capital and reserve buffers and thus increases resilience of the banking sector. As such, a higher return lowers default risks in the banking sector and the bond spread.

- Slope is the slope of the yield curve, which is the difference between the yields on four-year and one-year inflation-indexed bonds issued by the Chilean government. Changes in the slope indicate changes in expected growth prospects of the Chilean economy and have implications for the future profitability of the banking sector. An increase in the slope signalizes improving economic conditions and lower clients' default rates, hence better profitability of the banking sector and lower bond spread.

The data for all the above explanatory variables are from the SBIF, except for SLOPE, which is from Bloomberg.

11. **The remaining part of the model includes global risks measures and local liquidity factors.** In particular, the structural model is enriched by adding a global volatility index (*VIX*), *CDS* spread of European banks (both data from Bloomberg), and domestic liquidity factors (data from Banco Central de Chile):

$$CS_t = \mathrm{c} + \alpha NIM_t + \beta \mathrm{EFF}_t - \gamma ROA_t - \delta SLOPE_t + \theta VIX_{\mathrm{t}} + \varphi CDS_{\mathrm{t}} + \vartheta \Delta MF_t + \cdots \\ \ldots + \rho \Delta PF_t + \xi_t,$$

where $\xi_t \sim \mathrm{N}(0, \sigma)$.

- *VIX* is a volatility index based on S&P 500 and is often used as a proxy for global investors' risk aversion. However, since it is measured on the U.S. stock market, it does not necessarily capture the risk premia in other markets (such as Europe) and submarkets (banking industry, in particular). Increasing risk aversion increases credit risk premia on banks' long-term borrowings.

- *CDS of European banks* captures stress in the European banking system. European banks have substantial presence in Chile, so an increase in the European banks' CDS could have spillover effects.

- *MF* and *PF* stand for the stock of time deposits by mutual funds and pension funds, respectively. These funds are the major providers of wholesale deposits for Chilean banks, and the amount of these deposits varies over time as funds change their portfolios.

Financial market data is at daily frequency, while banking sector's fundamentals are interpolated to daily frequency from quarterly data. The regression analysis uses daily data from July 1, 2008 to January 6, 2012.

The Interbank Market

12. **Interbank market spread reflects risk premia on short-term funding.** In this paper the spread is proxied by the difference between the 90-day peso TAB rate and the overnight interest rate swap for the same maturity. The interbank market is a platform for unsecured lending among banks and thus quoted rates incorporate liquidity and credit risk premia. The interest rate swap contains expectations about the future path of the policy interest rate but practically no credit and liquidity premia, since the swap transaction does not involve transfer of funds. Therefore the spread reflects the two risk premia. While the liquidity premium is driven by the needs and availability of funds, credit risk is linked to the counterparty risk. Under normal market conditions, the spread is positive but close to zero as the credit and liquidity risk premia are small. An increase in the spread indicates rising market pressures. Both series are downloaded from Bloomberg.

13. **The liquidity premium is identified through a set of proxy variables.** In the literature, liquidity premia are only indirectly or partially identified. In its indicative decomposition of interbank rates, BoE (2007) identifies the liquidity premium as the residual (the so called non-credit risk premium) after accounting for credit risk. Michaud and Upper (2008) quantify market liquidity, while the liquidity of borrowing banks and technical factors of the market remain unobserved. This paper uses several proxies for market liquidity premia, including deposits of institutional investors, short-term central bank's instruments and the central bank's temporary extended liquidity facility (see also FSR, 2010). Market premia in the U.S. and Euro interbank markets are also inlcuded to control for spillover effects.

14. **Banks' counterparty risk can be approximated by credit spreads.** Counterparty risk is essentially the risk that the unsecured loan will not be repaid due to a default of the debtor. Such a risk is embedded in banks' bond credit spreads and credit default swaps, so they are often used as proxy variables for credit risk. For instance, BoE (2007) uses CDS spreads to identify the credit-risk component of the interbank market spread, while FSR (2010) uses banks' bond credit spreads for that purpose.

15. **The specification of the Chilean interbank market spread (*IMS*) includes domestic and global risk factors:**

$$IMS_t = \mathrm{c} + \alpha \Delta MF_t + \beta \Delta PF_t + \gamma \Delta CB_t + \delta IMS_{EU_t} + \theta IMS_{US_t} + \cdots$$
$$\ldots + \omega D_t + \rho CS_t + \varphi CDS_t + \varepsilon_t,$$

- *MF* and *PF* stand for the stock of time deposits by mutual funds and pension funds.

- *CB* denotes the stock of central bank's short-term instruments. It accounts for the regular liquidity operations by the central bank.

- *D* is a dummy for the period of expanded liquidity operations by the central bank. Since October 2008, the central bank accepted bank deposits as collateral for the 7-day repo operations. This measure, initially introduced for six months, was subsequently extended through the end of 2009, and the transaction tenor was prolonged up to 28 days. In

December 2008, the central bank introduced a collateralized line of credit for transactions exceeding 28 days, in which it accepted General Treasury bonds, among others, as collateral. And since mid-2009, a new facility was established (tenors of 90 and 180 days), through which banks accessed funding from the central bank at prevailing monetary policy rate. Further, the central bank introduced 28-day dollar swap auctions. The Ministry of Finance transferred government's dollar funds from abroad and deposited them as term deposits in local banks, and also auctioned dollar deposits. In the regressions, the effects of these policy measures are accounted for by a dummy variable, which equals one from November 2008 to mid-2010 and zero otherwise.

- IMS_{EU} denotes Euro interbank market spread, which is the difference between the three-month euro interbank market rate and the overnight euro interest rate swap for the same maturity. It measures liquidity and credit risk pressures in the euro interbank market.

- IMS_{US} denotes dollar interbank market spread, which is the difference between the three-month dollar federal funds rate and the overnight dollar interest rate swap at the same maturity. It measures both the liquidity and credit risk pressures in the dollar market.

- The credit risk premium is measured by banks' bond credit spread, denoted by *CS*, and CDS of European banks, labeled as *CDS*. And $\varepsilon_t \sim \mathrm{N}(0, \sigma)$.

Data for the domestic variables is from the Banco Central de Chile, while IMS_{EU} and IMS_{US} are from Bloomberg.

C. Results

16. **The results point to moderate spillovers from global financial stress.** Although spillovers were clearly one of the driving factors of domestic funding spreads, the magnitude of the effects is relatively small, especially after 2009. The estimates suggest that global spillovers pushed up funding cost in Chile by about 50 basis points on average from mid-2010 to January 2012. Pressures in the U.S. interbank market were the key driver of changes in Chile's interbank market spreads in 2008–09. More recently, financial tensions in the euro area have been the main source of spillovers. Both bank fundamentals and global factors have been important determinants of changes in the bond spread.

The Bond Market

17. **The bank bond spread has been driven by banks' fundamentals as well as global risk factors.** Table 1 shows the regression results for the bond spread. All coefficients are correctly signed and statistically significant. A decomposition of the spread shows that fundamental factors accounted for the largest portion of the spread until mid-2010 (see Figure 2). In the period since then, spillovers from global risk factors (proxied by VIX and CDS of European banks) have became more important.

18. **Domestic liquidity factors have also played a role.** Changes in the stock of time deposits of pension funds correlate negatively with bond market spreads, which suggests that when pension funds increase the share of domestic assets in their portfolio, they invest in both deposits and bank bonds. On the other hand, an increase in the time deposits of mutual funds increases bond market spreads, since mutual funds invest mostly in domestic assets and over time shift from deposits to bonds and vice versa.

19. **The evidence from partial regressions confirms the robustness of the results.** Isolating the effect of banks' fundamental factors and global risk factors individually (Table 1, last two columns) shows that both sets of variables are robust explanatory variables of the bond credit spread.

The Interbank Market

20. **The interbank market spread contains both domestic and external risk premia.** As shown in Table 2, the interbank market spread has been driven by domestic liquidity and credit risk factors as well as global spillovers. These factors together explain 70 percent of the variation in the spread.

21. **Among domestic factors are local liquidity shocks, policy measures, and counterparty risk.** Activities of institutional investors, such as shifts in time deposits of pension and mutual funds, affect banks' liquidity. Reduction of institutional time deposits reduces liquidity and increases the interbank spread. In addition, the interbank spread has been affected by the central bank's extended liquidity operations from November 2008 till mid-2010. The results suggest that these operations reduced the interbank market spread by about 24 basis points. The counterparty risk, which is proxied by the banks' bond credit spread, is also a significant factor. One percentage point increase in the bond spread leads to about 50 basis points increase in the interbank market spread.

22. **Spillovers from financial tensions abroad also afected risk premia in the interbank market.** The interbank spread has been affected by changes in global risk factors (see Figure 2). In particular, one percentage point increase in the interbank market spread in the U.S. or in the CDS of European banks triggers about 30 basis points rise in Chile's interbank market spread. Pressures in the U.S. interbank market were the key determinant of the Chile's interbank market spread until early-2009. In the reminder of 2009 and until mid-2010, the spread fell as external pressures dissipated and domestic credit risk premium delined. Since mid-2010, however, spillovers from hightened financial tensions in Europe have played a prominent role. The resutls remain similar if the CDS of Citibank (a proxy for CDS of credit risk in the U.S. banks, data from the Bloomberg) and the VIX are added to the regression (both variables turn out to be insignificant, see Table 2, last two columns).

D. Concluding Remarks

23. **This paper analyzed pressures in the bank funding markets in Chile from mid-2008 to early 2012 with particular focus on spillovers from global risk factors. The main findings are the following:**

- The interbank market in Chile had been severely affected by tensions in the U.S. interbank market after the Lehman crisis. As a result of aggressive policy responses in Chile and abroad, pressures dissipated by mid-2009.

- Between mid-2008 and mid-2009, banks' funding cost were also driven up by deteriorating fundamentals of the banking sector. Subsequent improvements in fundamentals significantly lowered spreads between mid-2009 and mid-2010.

- Since mid-2010, funding market spreads have been driven mainly by spillovers from financial tensions in Europe. However, spillovers so far have been moderate and have not affected credit intermediation.

References

BoE, 2007, "An Indicative Decomposition of Libor Spreads," *Markets and Operations, Quarterly Bulletin,* Q4, Bank of England.

Duffee , G. R., 1998, "The Relation Between Treasury Yields and Corporate Bond Yield Spreads," *Journal of Finance*, Issue 53, pp. 2225–41.

FSR, 2010, "Determinants of the Prime-swap Spread," *Financial Stability Report*, Second Half, Banco Central de Chile.

Merton, R. C., 1974, "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates," *Journal of Finance*, Issue 29, pp. 449–70.

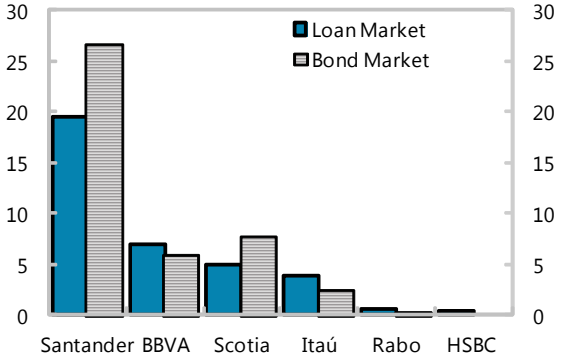
Michaud, F.-L., Ch. Upper, 2008, "What Drives Interbank Rates: Evidence from the Libor Panel," *BIS Quarterly Review*, March, Bank for International Settlements.

Otker-Robe, I., J. Podpiera, 2012, "Explaining Credit Default Swaps Pricing for Large Banks," *The Capco Institute Journal of Financial Transformation*, Series on Risk, Issue 34, pp. 63–75.

Figure 1. Chile: Stylized Facts, 2008-12

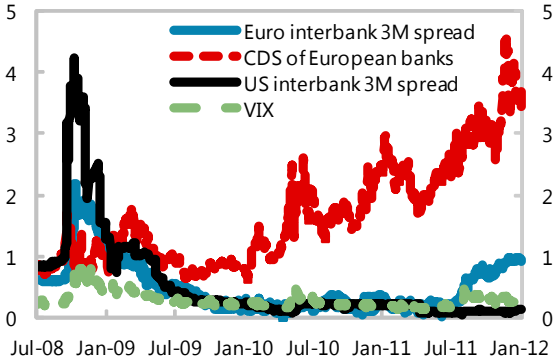
Chile's banking sector is well integrated, ...

Market shares of foreign banks
(In percent)



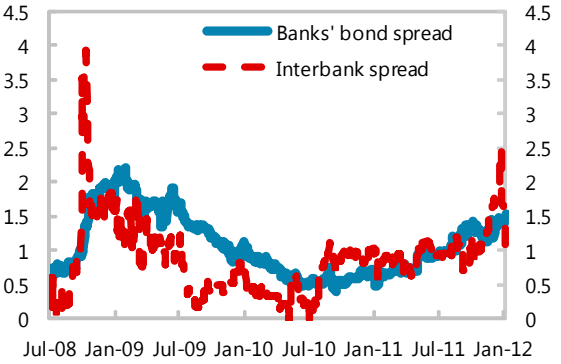
... and thus might be affected by global risk factors.

Global risk variables
(In percent)



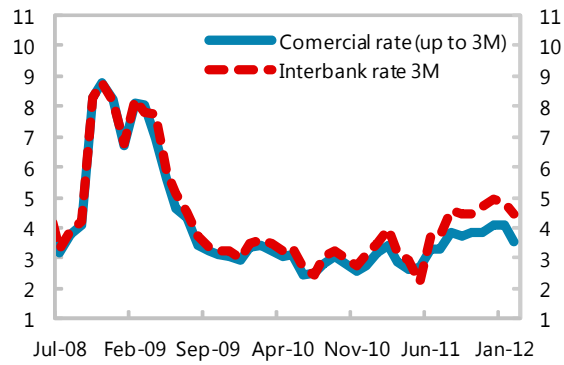
Market spreads have been elevated, ...

Interbank and bond spreads
(In percent)



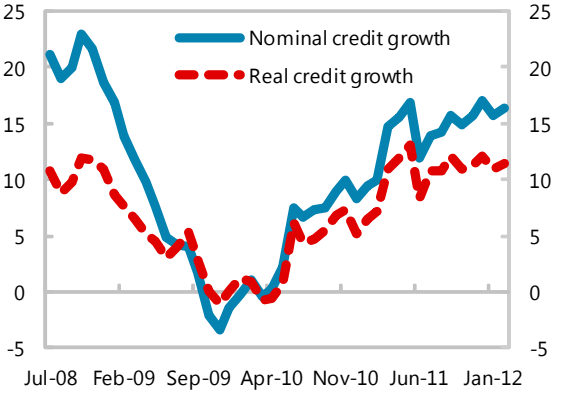
... which usually affects borrowing costs.

Lending spreads over policy rate
(In percent)



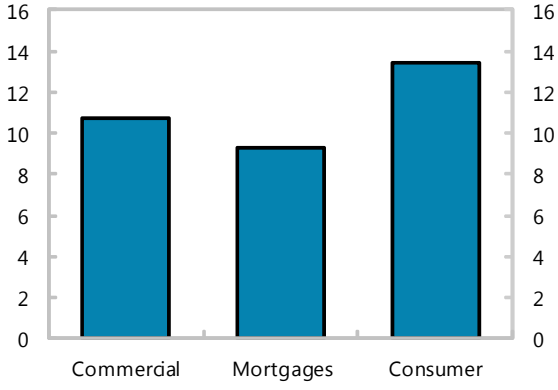
However, spillovers appear to be limited as credit grows strongly...

Credit growth
(In percent)



... in all sectors.

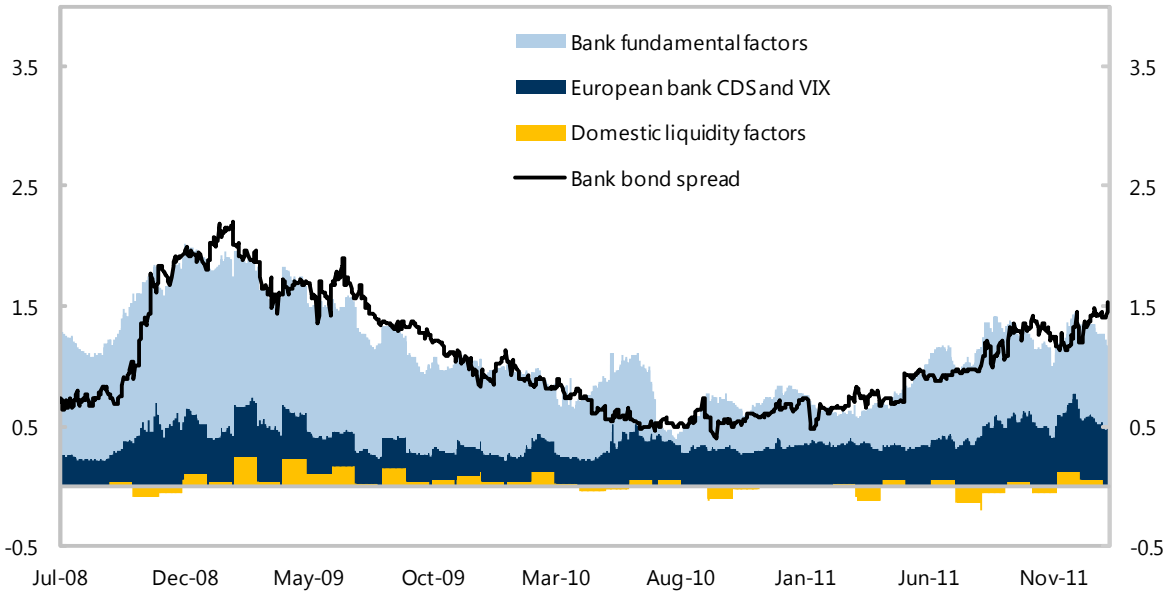
Sectoral credit growth
(Y/Y change 2011/10; percent)



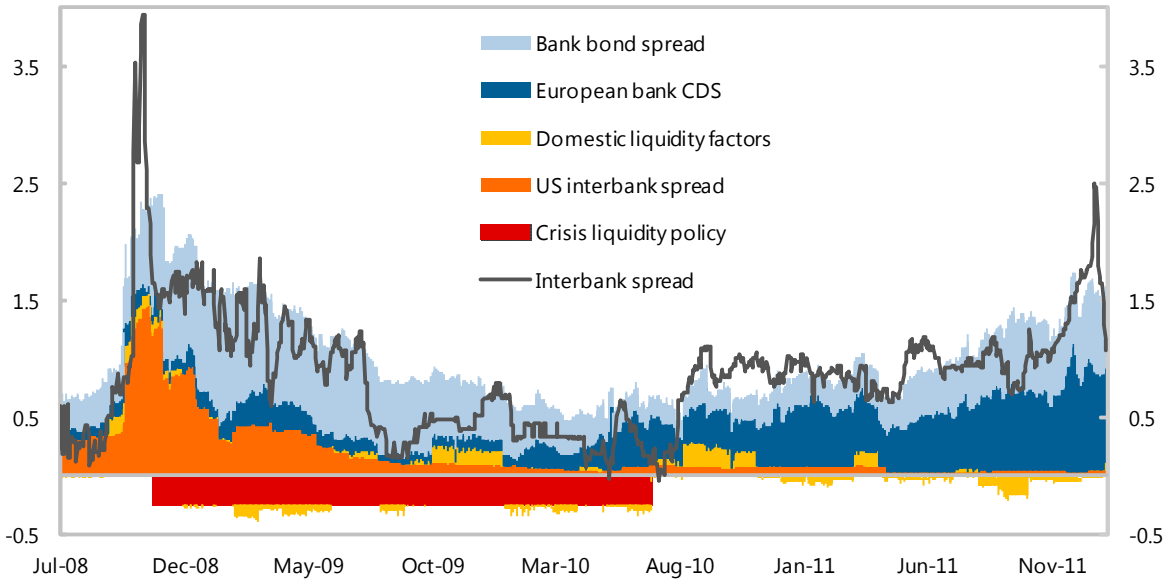
Source: Banco Central de Chile, SBIF, Bloomberg, and own calculations.

Figure 2. Chile: Funding Markets, 2008-12

Bank Bond Spread
(In percent)



Interbank Spread
(In percent)



Source: Banco Central de Chile, SBIF, Bloomberg, and own calculations.

Table 1: Bond Market Spread

	Baseline	Robustness 1	Robustness 2
Intercept	-0.73		
	(0.55)		
Fundamental factos			
Return on assets	-0.34**	-0.51***	
	(0.15)	(0.05)	
Net interest margin	0.1***	0.16***	
	(0.02)	(0.03)	
Efficiency ratio	0.034***	0.026***	
	(0.01)	(0.003)	
Slope of the yield curve (between one and four years)	-0.34***	-0.46**	
	(0.04)	(0.04)	
Global risk spillover			
VIX	0.71***		3.36***
	(0.2)		(0.19)
CDS of European banks	0.07*		0.05**
	(0.04)		(0.02)
Domestic liquidity factors			
Time deposits of pension funds (change in stock)	-0.13***		
	(0.05)		
Time deposits of mutual funds (change in stock)	0.15***		
	(0.04)		
R^2 - adj.	0.81	0.7	0.41

Note: Standard errors have been adjusted for autocorrelation and heteroscedasticity; Nobs = 1254.

Table 2: Interbank Market Spread

	Baseline	Robustness 1	Robustness 2
Intercept	-0.22	-0.22	-0.27
	(0.15)	(0.15)	(0.16)
Domestic liquidity factors			
Central bank's short-term instrument (change in stock)	-0.14*	-0.14*	-0.13*
	(0.07)	(0.08)	(0.07)
Time deposits of pension funds (change in stock)	-0.12**	-0.11	-0.12*
	(0.06)	(0.07)	(0.06)
Time deposits of mutual funds (change in stock)	-0.13***	-0.15***	-0.14***
	(0.04)	(0.05)	(0.05)
Central bank's crisis liquidity facility	-0.24***	-0.25***	-0.18**
	(0.07)	(0.07)	(0.08)
Domestic credit risk			
Banks' bond credit spread	0.51***	0.48***	0.52***
	(0.09)	(0.1)	(0.09)
Interbank risk spillover			
Euro interbank 3M spread	0.07	0.09	0.19
	(0.18)	(0.18)	(0.19)
US interbank 3M spread	0.35***	0.34***	0.39***
	(0.12)	(0.12)	(0.13)
Global risk spillover			
CDS of European banks	0.25***	0.24***	0.27***
	(0.06)	(0.06)	(0.06)
CDS of Citibank U.S.		0.03	
		(0.03)	
VIX			-0.7
			(0.43)
R^2 - adj.	0.7	0.7	0.7

Note: Standard errors have been adjusted for autocorrelation and heteroscedasticity; Nobs = 1255.

III. Performance of Publicly Listed Chilean Firms During the 2008–09 Global Financial Crisis[1]

A. Introduction

1. **After several years of strong growth, Chile–a small open economy well integrated into the global financial system–was hit hard by the 2008–2009 global financial crisis.** The price of copper, Chile's main exports, plummeted by two-thirds between July and December 2008, while peso deprecated twenty percent against the dollar, and the stock market lost one quarter of its value. Banks tightened credit standards markedly since 2007Q4, and liquidity pressures skyrocketed after the collapse of Lehman Brothers. Economic growth declined substantially in 2008Q4, and turned negative in the first three quarters of 2009. The authorities introduced substantial monetary and fiscal stimulus which, coupled with a recovery of copper prices, helped normalize the financial markets and revive growth.

2. **This chapter studies the performance of publicly listed Chilean nonfinancial firms during the crisis, and identifies the factors that affected their performance.** While it looks at a number of transmission channels, the study pays particular attention to how firms' dependence on financing affected their performance. The 2008–2009 crisis provides a good natural experiment as funding conditions deteriorated substantially during the crisis. The study relates to the literature that examines the linkage between financial markets and the real economy. King and Levine (1993) and Rajan and Zingales (1998) are early seminal papers showing that financial development is an important determinant of output growth. In a more recent paper, Jermann and Quanrini (2010) develop a model with debt and equity financing and show that a tightening of U.S. firms' financing conditions contributed to the 2008–2009 recession.

3. **A number of recent papers have studied firms' performance during the 2008–09 crisis and how various factors propagated the shocks**. Claessens, Tong, and Wei (2011) examine the performance of manufacturing firms in 42 countries and find that the crisis had a bigger negative impact on firms with greater sensitivity to aggregate demand and international trade. However, financial openness appears to have made limited difference. Also using cross-country data, Laevena and Valencia (2011) find that the growth of firms more dependent on external financing was more positively affected by bank recapitalization and stimulus fiscal policies. Aisen et al. (2011) find overall financing was a significant determinant of export contraction for Chilean exporting firms during the crisis. These results provide new evidence of a quantitatively important role of credit market frictions in influencing real economic activity.[2]

4. **The impact of the crisis varied across firms.** The study shows that in general the crisis had a bigger negative impact on investment and sales of Chilean firms with greater reliance on external financing for investment and higher working capital needs, and firms with higher

[1] Prepared by Yi Wu.

[2] Alfaro and Chen (2012) find that multinational subsidiaries with stronger financial linkages with parent companies showed greater resilience during the 2008–2009 crisis than local firms.

sensitivity to aggregate demand and exports. Firms with higher foreign currency debt also had larger declines in sales, although the mismatch of foreign currency liabilities and assets before the crisis did not seem to make a difference.

5. **The chapter is organized as follows:** Section B discusses the framework and data for the empirical test; Section C presents the statistical results; and Section D provides some concluding remarks.

B. The Analytical Framework and Data

6. **The study focuses on four channels that could affect firms' performance during the crisis: the financial channel, the aggregate demand channel, the export channel, and the foreign currency liability channel.** The strategy for the statistical tests follows Claessens et al. (2011). In particular, if funding conditions are important for firms' performance, the crisis should have a more negative impact on the performance of firms that rely more on external financing for investment and working capital compared to those firms that rely less on external financing. Likewise, if the aggregate demand or the trade channel is important, then firms that rely more heavily on domestic and foreign demand would be more negatively affected during the crisis.

7. **The main empirical challenge is the endogeneity problem.** For example, during the crisis a firm's sales could have declined along with a contraction of the aggregate demand. This would suggest that aggregate demand is important, but the reason for the decline in sales could be a lack of working capital. Our empirical strategy is therefore to check whether ex ante characteristics of firms–their dependence on external financing and domestic and foreign demand, and liabilities in foreign currency–help explain the cross-sectional variation in firms' performance during the crisis. To be specific, we estimate the following equation:

$$\Delta\text{Performance}_i = \beta*\text{Financial Dependence}_i + \gamma*\text{Demand Sensitivity}_i + \lambda*\text{Export Sensitivity}_i + \theta*\text{FX Liabilities}_i + \varepsilon \quad (1)$$

where *i* stands for firm. $\Delta\text{Performance}_i$ is the change in firm *i*'s performance as measured by the average value over 2008 and 2009 minus the value in 2007. The analysis uses three measures of performance: investment, sales, and profit, all scaled by firms' asset. The substantial devaluation of the peso during the crisis could have caused detrimental balance sheet effects for firms with high foreign currency liabilities, which could more than offset the expansionary competitiveness effect, changing their investment decision and/or sales and profit. The inclusion of firms' foreign currency liabilities in the regressions is made possible by a newly constructed dataset.

8. **The study uses annual data from two datasets for publicly listed nonfinancial Chilean firms.** The first dataset is *Worldscope*, from where data are available for firms' cash flow, investment, total assets, as well as sales and profit. The sample contains a total of 123 nonfinancial Chilean firms. Manufacturing firms account for the largest share (see the Annex table), followed by transportation, communications and utilities firms. The second dataset is a new dataset compiled by Kamil (2012) from different sources including individual companies' financial reports. This dataset (where data are only available up to 2007) contains firms' exports and their foreign-currency assets and liabilities, neither available in Worldscope. The sample size is reduced to 84 when the two datasets are merged. To reduce the impact of outliers, top and

bottom 1 percent observations for each variable are excluded. The films in the sample are publicly listed, thus tend to be larger firms. As a result, they may not be representative of all Chilean firms. Smaller firms probably would have encountered tighter financing conditions during the crisis than larger firms.

9. **Figure 1 plots the density distribution of firm-level investment, sales, and profit (all scaled by asset) from 2007 to 2009**. As one would expect, all three curves generally shift to the left from 2007 to 2009, suggesting lower investment, sales, and profit as a result of the global crisis. For investment, the distribution shifts to the left in both 2008 and 2009. The decline seems to have mostly happened in 2009 for sales and in 2008 for profit. These patterns are also confirmed by Table 1a, which reports summary statistics.

10. **All explanatory variables are pre-determined before the crisis to reduce endogeneity, and measured at firm level.**

- *Dependence on external financing for investment*

This measure is constructed following Rajan and Zingales (1998):

$$\text{Dependence on external financing for investment} = \frac{\text{capital expenditure} - \text{cash flow}^3}{\text{captial expenditure}} \quad (2)$$

Following the convention, the word "external financing" refers to financing from outside a firm's own cash flow. The variable is constructed using the median value over the period of 2000 to 2006 for each firm.

- *Working capital needs*

The second measure of firms' financing needs is the cash conversion cycle (see Raddatz, 2006). This is a measure of the time elapsed between the moment a firm pays for its inputs until it is paid for the goods it sells:

$$\text{Cash conversion cycle} = 365 * \left(\frac{\text{inventories} - \text{account payables}}{\text{cost of goods sold}} + \frac{\text{account receivables}}{\text{total sales}}\right) \quad (3)$$

This measure is commonly used in financial analysis to measure the liquidity position of a firm. Again the measure is constructed using the median value over the period of 2000 to 2006 for each firm.

- *Aggregate demand sensitivity*

[3] Cashflow consists of two components: (i) income before extraordinary items and preferred and common dividends, but after taking into account the operating and non-operating income and expense, reserves, income taxes, minority interest and equity in earnings; and (ii) depreciation, depletion and amortization.

The analysis also includes a firm-specific measure of aggregate demand elasticity. The impact a recession has on the demand for a firm's product is likely to depend on the types of products a firm produces. For example, the demand for necessities would be more inelastic compared with demand for luxury goods. To measure the demand elasticity, for each firm we regress its (log) real sales (nominal sales deflated by inflation) on Chile's (log) real GDP over the period of 1999 and 2007 using annual data, and use the coefficient as the (firm-specific) measure of the firm's sensitivity to aggregate demand. One would expect that firms with higher demand elasticity be more affected during the crisis.

- *Dependence on exports*

The ratio of a firm's exports to its total sales is used as the measure of its dependence on external demand. The median value over 2000 and 2005 is used, as exports data are only available up to 2005.

- *Foreign currency liabilities*

The ratio of a firm's foreign currency liability to total asset in 2006 is included in the regression. Using the 2007 ratio yields similar results.

11. **For the explanatory variables the analysis focuses on firm-specific measures.** Claessens et al. (2011) instead focus on sector-specific measures to address endogeneity. They use sector characteristics of U.S. firms before the crisis, and assign the same value to all the firms in the same sector across all countries. The concept is that these are intrinsic characteristics of the sectors. However, among firms in the same industry there could also be substantial differences. In particular, there is a life cycle in the pattern of financing for firms: firms are more dependent on external financing early in their life than later (Rajan and Zingales, 1998). As a result, a mature firm in an industry that is usually more dependent on external financing could be less dependent on financing than a new firm in an industry that is in general less dependent on external financing. In addition, the characteristics of U.S. firms may not apply to Chilean firms. This analysis therefore focuses on firm-specific measures, and using the pre-crisis values would help reduce the endogeneity problem. Nevertheless, as a robustness check the study also includes analysis using sector-specific measures of financing needs.

12. **Table 1b reports the summary statistics for all variables.** It is noteworthy that the standard deviations of the explanatory variables are quite large, suggesting diversified firm characteristics. In addition, most firms in the sample do not export. Table 1c reports bilateral correlations. The three dependant variables are positively correlated with each other. Their correlations with the explanatory variables are however mixed. These are only simple correlations and the next section reports multivariable regression results.

C. Empirical Results

Baseline Results

13. **Table 2 reports the baseline results.** Column (1) has the change in investment (capital expenditure), scaled by asset, as the independent variable and includes the three explanatory variables from Worldscope. Dependence on external financing for investment is negative as expected, and significant at the 15 percent level (p-value is 0.11). This suggests that firms that are more dependent on external finance for their investment experienced larger declines (or smaller increases) in investment during the crisis, as funding condition deteriorated. In addition, firms with higher working capital needs also on average experienced larger declines in capital expenditure during the crisis (significant at the 10 percent level). On the other hand, the aggregate demand sensitivity does not seem to affect investment.

14. **Column (2) adds the export dependence measure from the second dataset, which reduces the sample size from 110 to 84**. Dependence on external financing remains negative and is now significant at the 10 percent level, while the working capital needs remain negative and significant. However, both demand and trade sensitivity are insignificant. Column (3) further adds foreign exchange liabilities. Dependence on external financing remains negative, although now again only significant at the 15 percent level (p-value is 0.11), while working capital needs remain negative and significant. The other three independent variables are insignificant.

15. **The impact of external financing needs is quantitatively significant**. Using the coefficient values from Column (3), a one standard deviation increase in the dependence on external financing for investment will reduce the investment/asset ratio by 0.95 percentage point, or 13.6 percent of the average investment/asset ratio in 2007. A one standard deviation increase in the working capital needs would reduce investment by 0.83 percentage point, or 11.9 percent of the average 2007 level.

16. **Column (4) of Table 2 reports the results using sales (scaled by asset) as the dependent variable, with only the explanatory variables from Worldscope**. Dependence on external financing becomes positive, although barely significant at the 15 percent level (p-value is 0.15). Working capital needs remain negative and is significant at the 5 percent level. The economic impact however seems to be limited: a one standard deviation increase in the working capital needs would reduce the sales/asset ratio by 0.02 percentage point, or 2.4 percent of the average sales/asset ratio in 2007. The demand sensitivity is now also negative and significant, suggesting that firms with higher demand elasticity were hit harder during the crisis, as expected. In particular, a one standard deviation increase in the demand sensitivity would reduce the sales/asset ratio by 0.05 percentage point, or 6.4 percent of the average level in 2007.

17. **Column (5) of Table 2 adds the two additional explanatory variables.** Working capital needs now become insignificant, which is actually due to the smaller sample size. Demand sensitivity remains negative and highly significant. Dependence on exports is also negative and is significant at the 5 percent level. A one standard deviation increase in the export-to-asset ratio would reduce the sales/asset ratio by 0.05 percentage point, or 5.9 percent of the average ratio in 2007. Finally, debt in foreign currency is also negative and is significant at the 1

percent level. A one standard deviation increase in the foreign currency debt/asset ratio would reduce the sales/asset ratio by 0.06 percentage point, or 6.9 percent of the average 2007 level. The explanatory variables altogether could explain almost half of the variation in sales.

18. **Finally, Columns (6) and (7) of Table 2 report the results for return on assets.** Demand sensitivity is negative in both regressions, although only significant when only financing needs are included in the regression (its insignificance in Column (7) is due to the smaller sample size). The economic impact is significant: a one standard deviation increase in the demand sensitivity would reduce profits by 1.1 percentage points, or 15 percent of the average profits in 2007. Dependence on external financing for investment is positive but only significant in Column (7). Its turning into significance also results from the smaller sample in Column (7). Nevertheless, the positive coefficient on dependence on external financing may suggest that firms that borrowed more before the crisis are generally "stronger" firms, and thus were able to better sustain their profits during the crisis. This could imply that the negative coefficient for the dependence on external financing in the investment regressions is not driven by endogeneity. Overall, the results for the dependence on external financing for investment seem intuitive: while the investment of firms that relied more on external financing was more negatively affected during the crisis, lower investment does not necessarily lead to lower sales or profit in the short run.

19. **The results for foreign currency liability are worth noting.** Foreign currency debt does not seem to affect Chilean firms' investment or profit. Bleakley and Cowan (2008) also find that firms in five Latin American countries (including Chile) that hold more dollar debt do not invest less than their peso-indebted counterparts following a currency depreciation. They find that this is because the dollarization of liabilities is higher in firms whose income is likely to be more positively correlated with an exchange rate depreciation (firms with tradable products, for example). Another possible explanation of the muted impact is that Chilean firms are usually well hedged, with limited currency mismatch. For example, as of the third quarter of 2008, the corporate sector's total net currency mismatch was only 0.23% of total assets (The Central Bank of Chile, 2008). However, foreign currency liability does seem to negatively affect firms' sales as Column (5) shows. One possible explanation is that firms with high foreign currency debt are mostly exporters, and the negative impact may simply capture the decline in their exports amid weakening external demand. However, the correlation of the foreign currency debt and sensitivity to exports is only 0.3, suggesting this could only be a partial factor.

Robustness Checks

20. **As a robustness check, foreign currency liabilities are replaced with short-term foreign currency liabilities in Columns (1) to (3) of Table 3.** The results are pretty close to the baseline results. Columns (4) to (6) report the results using an alternative measure of aggregate demand elasticity, where the elasticity is estimated using the growth rate of firms' sales and Chile's GDP instead of levels. The correlation between the two elasticity measures is 0.41, and the results are again broadly similar with the baseline results. Using foreign currency asset and liability mismatch (instead of foreign currency liabilities) also yields broadly similar results, both for total and for short-term assets/liabilities. The results are not reported to save space. This is probably not too surprising–while the peso value of dollar liabilities increased during the crisis as

a result of peso's depreciation, the peso value of foreign assets could have either increased (due to peso's depreciation) or declined. For example, firms' foreign assets could include U.S. assets, whose value may have declined during the crisis.

21. **Columns (1) to (3) of Table 4 report the results using changes in firm performance from 2007 to 2008, and Columns (4) to (6) report corresponding regressions using changes from 2007 to 2009.** The investment of firms with higher reliance on external financing for investment and working capital needs was again more negatively affected during the crisis, although the coefficient is only significant for the 2007–2008 sample. The sign on foreign currency liabilities turns out to be positive in the 2007–2009 regression for investment and is significant at the 10 percent level, which is somewhat puzzling (although it becomes insignificant if short-term foreign currency liabilities are used). The results for the sales regression are similar to the baseline results across the two periods, except that the demand elasticity is only significant in the 2007–2009 regression, probably reflecting the smaller declines in sales from 2007 to 2008. Demand sensitivity and foreign currency liabilities are negative in the two profits regressions, although only significant in one of them.

22. **Table 5 reports the results with three more additional control variables:** firm size (as measured by total assets) and cash holdings to asset ratio, both using the 2006 value; and the change in the dependent variables from 2000 to 2006. Larger firms seem to manage weathering through the crisis better on all three measures of performance. Firms with more cash at hand at the onset of the crisis were also able to invest more during the crisis. Interestingly, firms with higher investment and sales growth before the crisis experienced larger declines. On the original explanatory variables, the baseline results still broadly hold although working capital needs now become insignificant.

23. **Finally, Table 6 reports the results using sectoral level measures for the dependence on external financing for investment and working capital needs.** The correlation between the sector-specific and firm-specific measures for the two variables is 0.11 and 0.56, respectively. Dependence on external financing is negative in all regressions, but insignificant. This probably reflects the fact that using sectoral measures for individual firms could introduce substantial measurement errors, which would bias the coefficients toward zero ("attenuation"). Working capital needs are negative and significant in the investment and sales regressions. Other results are broadly similar with the baseline results. Adding more control variables as in Table 5 also yield broadly similar results (not reported).

D. Concluding Remarks

24. **This chapter examines Chilean publicly listed nonfinancial firms' performance during the 2008–2009 crisis and the factors that affected their performance.** It finds that the investment and sales of firms with higher financial dependence were more negatively affected during the crisis. Sales of firms with higher sensitivity to aggregate demand and exports, and firms with higher foreign currency liabilities were also more negatively affected. In addition, the profits of firms with higher demand sensitivity declined more during the crisis.

25. **The analysis helps identify specific channels of spillover from financial conditions to the real economy.** The results suggest that measures to support bank lending during a financial distress would be important to help sustain firms' investment and sales. Such measures would be especially helpful for firms relying more on external financing for investment and firms with higher working capital needs.

REFERENCES

Aisen, Ari, Roberto Alvarez, Andres Sagner, Javier Turen, 2011, "Credit Contraction and International Trade: Evidence from Chilean Exporters," *Central Bank of Chile Working Papers* No. 639.

Alfaro Laura, and Maggie Xiaoyang Chen, 2012, "Surviving the Global Financial Crisis," *World Bank Policy Research Working Paper* 5946.

Bleakley, Hoyt and Kevin Cowan, 2008, "Corporate Dollar Debt and Devaluations: Much Ado About Nothing?" *Review of Economics and Statistics*, 90(4), pp. 599–611.

Claessens, Stijn, Hui Tong, and Shang-Jin Wei, 2011, "From the Financial Crisis to the Real Economy: Using Firm-level Data to Identify Transmission Channels," *Journal of International Economics*, forthcoming.

Jermann, Urban and Vincenzo Quadrini, 2010, "Macroeconomic Effects of Financial Shocks," *American Economic Review*, forthcoming.

Kamil, Herman, 2012, "A new database on currency and maturity composition of firms' balance sheets in Latin America: 1992–2007," International Monetary Fund, Washington DC, forthcoming.

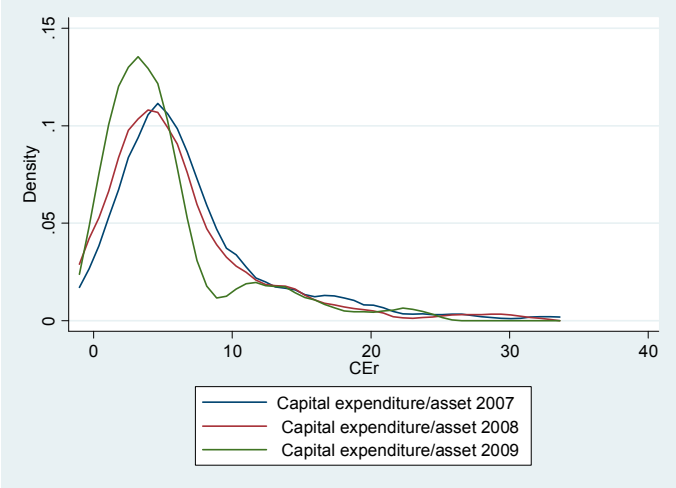
King, Robert G. and Levine, Ross, 1993, "Finance and Growth: Schumpeter Might Be Right," *Quarterly Journal of Economics*, 108(3), pp. 713–37.

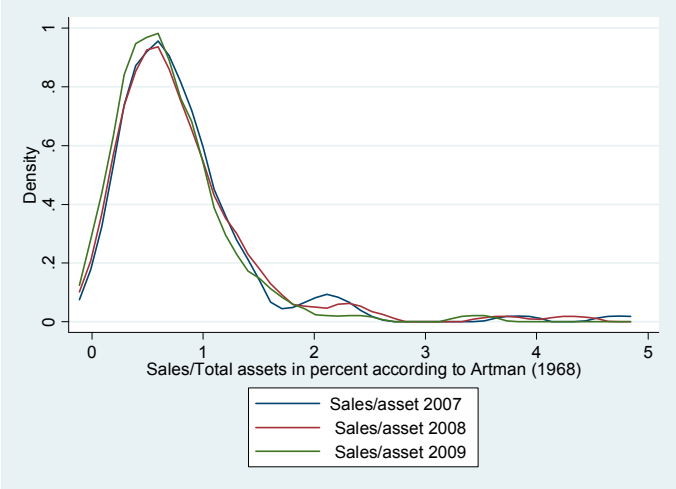
Rajan, Raghuram and Luigi Zingales, 1998, "Financial Dependence and Growth," *American Economic Review* 88(3), 559–86.

Raddatz, Claudio, 2006, "Liquidity Needs and Vulnerability to Financial Underdevelopment," *Journal of Financial Economics* 80, 677–722.

The Central Bank of Chile, 2008, "Financial Stability Report, Second Half 2008."

Figure 1. Density Distribution of Firm Performance During the 2007–09 Crisis





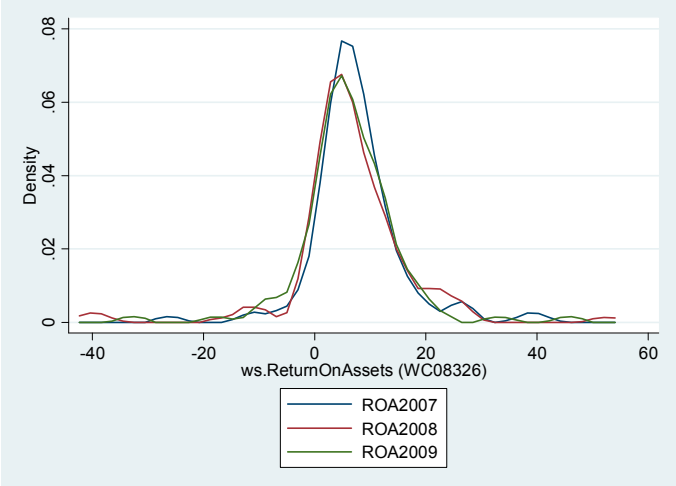


Table 1a. Firm Summary Statistics Before and During the 2008-09 Crisis

	Year	Obs	Mean	Std. Dev	Min	Max	p25	Median	p75
Capital exp./assets	2007	123	7.0	5.8	0	32.6	3.5	5.2	8.7
	2008	118	6.2	5.6	0	30.3	2.5	4.6	8.3
	2009	118	5.2	4.9	0	23.7	2.0	3.9	6.1
Sales/assets	2007	119	0.81	0.7	0.001	4.7	0.42	0.68	0.97
	2008	115	0.80	0.6	0.001	4.3	0.40	0.69	1.01
	2009	115	0.69	0.5	0.002	3.5	0.40	0.60	0.92
Return on assets	2007	120	7.5	8.1	-26.1	40.7	3.2	6.4	10.7
	2008	116	6.5	10.4	-40.8	52.6	2.3	5.7	11.4
	2009	116	6.2	8.7	-32.8	45.8	2.7	5.3	10.1

Table 1b. Summary Statistics for Dependent and Explanatory Variables

Variable	Obs	Mean	Std. Dev	Min	Max	Median
Change in investment/assets	123	-1.5	4.6	-27.5	12.6	-0.7
Change in sales/assets	119	0.0	0.2	-0.6	0.2	0.0
Change in return on assets	120	-1.4	6.0	-25.4	22.2	-0.8
Dependence on external finance for investment	113	-1.0	1.8	-8.4	5.6	-0.9
Working capital needs	121	104.0	88.1	-57.5	359.9	82.7
Demand sensitivity	119	1.6	2.5	-8.9	12.9	1.5
Dependence on exports	92	0.1	0.2	0	0.9	0.0
Foreign currency liabilities	89	0.1	0.1	0	0.6	0.0

Table 1c. Bilateral Correlations

	Δ inv.	Δ sales	Δ profit	Dep. on ext. fin.	Dep. on work. cap.	Demand elas.	Dep. on exports
Δ sales	0.12						
Δ profit	0.05	0.16					
Dep. on ext. fin. for inv.	-0.16	0.12	0.09				
Dep. on working cap.	-0.13	-0.10	0.15	-0.04			
Dom. demand elas.	-0.005	-0.24	0.0001	0.02	-0.12		
Dep. on exports	-0.003	-0.42	0.11	0.04	0.43	0.03	
FX liabilities	0.07	-0.52	-0.02	-0.11	-0.09	0.24	0.31

Table 2. The Impact of Crisis on Firm Performance: Baseline Results

Dependent variable	(1) Δ investment	(2) Δ investment	(3) Δ investment	(4) Δ sales	(5) Δ sales	(6) Δ profits	(7) Δ profits
Dependence on external finance for investment	-0.366#	-0.516*	-0.518#	0.011#	0.007	0.334	0.492**
	(0.225)	(0.300)	(0.319)	(0.008)	(0.006)	(0.247)	(0.210)
Working capital needs	-0.008**	-0.009*	-0.010*	-0.0002**	0.00005	0.008	0.005
	(0.004)	(0.005)	(0.005)	(0.0001)	(0.0002)	(0.006)	(0.007)
Demand sensitivity	-0.003	0.069	0.063	-0.021**	-0.018**	-0.452*	-0.457
	(0.103)	(0.143)	(0.152)	(0.008)	(0.006)	(0.245)	(0.361)
Exports/total sales		1.128	0.969		-0.207**		1.819
		(2.519)	(2.412)		(0.087)		(2.431)
FX liabilities/total assets			0.925		-0.432**		-0.015
			(2.858)		(0.108)		(5.843)
R-squared	0.06	0.08	0.09	0.11	0.45	0.07	0.09
No. of obs	110	84	79	107	78	108	78

Note: Dep. var. is calculated as average 2008/09 value minus 2007 value. Standard errors in parenthesis. #, *, and ** denotes significant at 15, 10, and 5% respectively.

Table 3. The Impact of Crisis on Firm Performance: Robustness Checks (1)

Dependent variable	(1) Δ investment	(2) Δ sales	(3) Δ profits	(4) Δ investment	(5) Δ sales	(6) Δ profits
Dependence on external finance for investment	-0.528#	0.007	0.436**	-0.514#	0.006	0.464**
	(0.320)	(0.006)	(0.217)	(0.317)	(0.006)	(0.205)
Working capital needs	-0.010*	0.0001	0.004	-0.010**	0.0001	0.007
	(0.005)	(0.0002)	(0.008)	(0.005)	(0.0002)	(0.007)
Demand sensitivity	0.081	-0.016**	-0.364			
	(0.142)	(0.006)	(0.368)			
Demand sensitivity (alt. measure)				-0.0005	-0.007**	-0.037
				(0.064)	(0.002)	(0.101)
Exports/total sales	1.201	-0.204**	3.045	0.952	-0.195**	1.918
	(2.576)	(0.095)	(2.666)	(2.459)	(0.086)	(2.388)
Short-term FX liabilities/total assets	-0.182	-0.601**	-8.106			
	(2.473)	(0.130)	(10.003)			
FX liabilities/total assets				1.220	-0.490**	-1.457
				(2.808)	(0.129)	(5.926)
R-squared	0.09	0.48	0.10	0.09	0.44	0.06
No. of obs	79	78	78	79	78	78

Note: Dep. var. is calculated as average 2008/09 value minus 2007 value. Standard errors in parenthesis. #, *, and ** denotes significant at 15, 10, and 5% respectively.

Table 4. The Impact of Crisis on Firm Performance: Robustness Checks (2)

	(1)	(2)	(3)	(4)	(5)	(6)
		2007-2008			2007-2009	
Dependent variable	Δ investment	Δ sales	Δ profit	Δ investment	Δ sales	Δ profit
Dependence on external finance	-0.829**	0.005	0.356	-0.379	0.006	0.497*
for investment	(0.411)	(0.007)	(0.260)	(0.292)	(0.008)	(0.272)
Working capital needs	-0.012**	0.000	0.009	-0.008	0.000	0.000
	(0.006)	(0.000)	(0.009)	(0.006)	(0.000)	(0.011)
Demand sensitivity	-0.018	-0.009	-0.716*	0.097	-0.028**	-0.570
	(0.166)	(0.007)	(0.399)	(0.196)	(0.011)	(0.520)
Exports/total sales	1.040	-0.152**	1.800	0.503	-0.306**	4.032
	(2.585)	(0.066)	(3.544)	(2.936)	(0.153)	(3.760)
FX liability/total asset	-4.234	-0.375**	-2.996	5.522*	-0.534**	-16.712#
	(3.243)	(0.120)	(10.127)	(3.276)	(0.188)	(11.002)
R-squared	0.14	0.38	0.13	0.08	0.35	0.13
No. of obs	74	75	75	77	77	77

Note: Dep. var. is calculated as average 2008/09 value minus 2007 value. Standard errors in parenthesis. #, *, and ** denotes significant at 15, 10, and 5% respectively.

Table 5. The Impact of Crisis on Firm Performance: Robustness Checks (3)

	(1)	(2)	(3)
Dependent variable	Δ investment	Δ sales	Δ profit
Dependence on external finance	-0.425#	0.0001	0.363
	(0.285)	(0.006)	(0.254)
Working capital needs	-0.007	0.000	0.003
	(0.005)	(0.0002)	(0.007)
Demand sensitivity	-0.076	-0.009#	-0.231
	(0.177)	(0.006)	(0.305)
Exports/total sales	0.812	-0.166**	2.645
	(2.238)	(0.081)	(2.586)
FX liability/total asset	0.607	-0.301**	-0.650
	(3.138)	(0.112)	(4.226)
Firm size	0.384#	0.016**	0.713**
	(0.248)	(0.006)	(0.273)
Cash holding/total asset	7.761*	-0.174	-16.523
	(4.177)	(0.128)	(13.530)
Change of dep. variable, 2000-06	-0.205**	-0.116**	-0.138
	(0.091)	(0.047)	(0.102)
R-squared	0.22	0.55	0.25
No. of obs	78	77	77

Note: Dep. var. is calculated as average 2008/09 value minus 2007 value. Standard errors in parenthesis. #, *, and ** denotes significant at 15, 10, and 5% respectively.

Table 6. The Impact of Crisis on Firm Performance: Using Sectoral Level Measures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable	Δ investment	Δ investment	Δ investment	Δ sales	Δ sales	Δ profits	Δ profits
Dependence on external finance	-0.371	-0.385	-0.353	-0.001	-0.005	-0.610	-0.602
for investment (sectoral measure)	(0.637)	(0.780)	(0.780)	(0.012)	(0.009)	(0.447)	(0.692)
Working capital needs	-0.014#	-0.017#	-0.015	-0.001**	-0.001*	-0.005	-0.022
(sectoral measure)	(0.009)	(0.012)	(0.012)	(0.0003)	(0.000)	(0.011)	(0.017)
Demand sensitivity	0.017	0.084	0.043	-0.014**	-0.010**	-0.127	0.041
	(0.078)	(0.090)	(0.103)	(0.006)	(0.005)	(0.426)	(0.575)
Exports/total sales		0.703	0.052		-0.153*		4.706*
		(2.303)	(2.213)		(0.078)		(2.464)
FX liabilities/total assets			3.996		-0.517**		-1.416
			(3.197)		(0.105)		(6.311)
R-squared	0.02	0.02	0.03	0.10	0.44	0.01	0.05
No. of obs	117	89	84	113	82	114	82

Note: Dep. var. is calculated as average 2008/09 value minus 2007 value. Standard errors in parenthesis. #, *, and ** denotes significant at 15, 10, and 5% respectively.

Annex Table: Firms in the Sample by Industry

Type	No. of firms
Agriculture, forestry, and fishing	9
Mining	4
Construction	2
Manufacturing	46
Transportation, communications, electric, gas, and sanitary services	37
Wholesale trade	6
Retail trade	7
Services	12