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SUPPLY AND DEMAND IDENTIFICATION IN THE CREDIT MARKET

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Abstract
This paper identifies supply and demand functions in the Chilean credit market. The analysis divides credit into three categories by debtor type, namely consumption, commercial and housing loans. We successfully exploit novel bank-level data on non-price covenants to address the simultaneous equation endogeneity problem in the estimation of interest rate elasticities. Our truly unique panel data set covers the 2003-2009 period and combines information on loan amount allocation, interest rates, balance sheet indicators with information from the "Survey on General Conditions and Standards in the Credit Market", conducted by the Central Bank of Chile since 2003. Additionally, we characterize the statistical determinants of the survey responses, and later we use our estimation results for understanding the credit contraction episode of the second half of 2008, during the global financial turmoil.

Resumen
En este trabajo se identifican funciones de oferta y demanda por crédito para Chile. Este análisis divide el crédito en tres categorías, por tipo de deudor: créditos de consumo, comerciales e hipotecarios. Explotamos información financiera a nivel de bancos combinada con información de prácticas contractuales para hacernos cargo de la endogeneidad propia de la estimación de elasticidades precio en un sistema de ecuaciones simultáneas. En efecto, nuestro panel consolida el universo de bancos chilenos en el periodo 2003-2009 con datos de colocaciones, tasas de interés efectivas, indicadores derivados del hojas de balance, e información de prácticas contractuales de la Encuesta de Condiciones Generales y Estándares de Otorgamiento de Crédito, recogida por el Banco Central de Chile desde 2003. Además de caracterizar estadísticamente esta información, utilizamos los resultados de nuestra estimación para analizar la desaceleración del crédito en la segunda mitad de 2008, periodo álgido de la crisis financiera global.

We have benefited from insightful comments by Rodrigo Alfaro, Roberto Álvarez, Rómulo Chumacero, Kevin Cowan, Borja Larraín and specially Luis Opazo. All remaining errors are our own. A preliminary version of this paper was presented at the Central Bank of Chile's workshop on Household Debt in Chile, Santiago October 21st, 2009. Email: mcalani@bcentral.cl, pgarcia@bcentral.cl, dodaze@bcentral.cl.

1. Introduction

To what extent can changes in credit be attributed to shifts of supply? and to shifts of demand?. The recent crisis, and in general, periods of financial stress usually lead to severe contractions of credit supply. Financial agents shy away from long term obligations to the security of liquidity; thereby contracting financing for risky businesses and people alike (Greenspan, 2004; Routledge y Zin, 2004)[4]. This, however, is only half the story. Rising unemployment and expected lower income may lead to postponing consumption, housing purchases and investment; reducing demand for credit. On the other hand, unavailability of alternative sources of funding or self insurance against potential future lack of liquidity by agents, may expand demand for banking loans in the short run. Policy makers are naturally interested in assessing the relative contributions of supply and demand shifts to guide their policy analysis and prescriptions. In this paper we take a first step in this direction.

Markets which operate under no distortions clear by adjusting prices. This is not quite the case in the market for loans. Its intertemporal nature leads to an informational problem; no creditor knows for sure whether a debt will or will not be honored (Stiglitz y Weiss, 1981). In this context, by simply rising interest rates to allocate scarce credit, a bank may be encouraging the well known adverse selection problem, in which it is precisely the riskiest agents who are the only capable of, and willing to, bear high credit costs. In this equilibrium not only do banks end up financing the riskiest businesses but also crowd out those which would more likely honor their debts at lower interest rates. Banks, then, choose to use alternative ways to allocate scarce credit. Every contract tries to eliminate to a great extent information asymmetries by including covenants and contractual clauses, which we call credit standards. Among these we have; the use of more severe credit scoring, lower credit ceilings, the favoring of shorter term allocations, higher collateral requirements and guarantees.

We exploit these features in the credit market to identify demand from supply. We assemble a unique panel data set with bank-level quarterly information on interest rates, type of debt, loan amounts and information from the "Survey on General Conditions and Standards in the Credit Market" (henceforth SCC). This survey provides micro data on commercial and contractual covenants for loan allocation for the three major credit categories. To the extent of our knowledge, panel data and similar survey information have not been used for such purposes in the related literature. The non-price practices in the SCC inform about non-price variations of loan supply which we exploit to achieve demand identification. Our results are encouraging; we are able to confidently estimate demand for loans and prove the usefulness of the informational content of the SCC survey. Our estimations are reasonable from a theoretical point of view; demand curves exhibit negative slopes and supply curves are positively sloped or inelastic to interest rate variations. Later we use our results to understand the credit contraction episode of the second half of 2008. We document that indeed, Chile experienced private credit contraction which was partly ameliorated by an mildly expanding demand in the short run (which eventually reversed).

[4]This self-insurance may imply real production costs and welfare losses as proposed in a wide variety of models from Diamond y Dybvig (1983) to Caballero y Krishnamurthy (2008)

The qualitative result is the same for the three credit categories.

Following this introduction, this paper is divided in three main sections. Section **??** provides a detailed description of the information we use, and an exhaustive literature review. Section **??** describes the two steps in our empirical exercise, namely the validation of the information from the SCC as a potential instrument, and the estimation of price-elasticities via instrumental variables. It also presents and discusses the main estimation results and a provocative application. Finally, section **??** concludes.

2. Data Description and Literature Review

2.1. The Survey on Credit Conditions: Background

As of 2003 the Central Bank of Chile conducts its "Survey on General Conditions and Standards in the Credit Market". This is a qualitative survey that collects information on commercial practices for loan allocation, and Senior Loan Officers' demand perception. As such the survey is similar to the Federal Reserve's Senior Loan Officer Opinion Survey[5]. The basic structure of the survey classifies credit aggregates by debtor type. Namely, commercial, housing and consumption related loans. The questions for each category are of closed form and collect information on issues such as the horizon of the contract, average spread, collateral requirements and ceilings on credit lines. Chile is not the first country implementing this kind of information recollection, as the FED has been doing it since 1967. The Chilean survey, nevertheless, is different in that it is more detailed and has maintained its basic structure since its very first implementation. Similarities, of course, also arise and noticeable. For example, the SCC would ask the following:

> "During the ending *period* [Quarter], how have credit approval standards in your institution changed for applications for general purpose loans, credit lines and housing credits?"

with five answer possibilities: 1) tightened considerable, 2) tightened somewhat, 3) remained basically unchanged, 4) eased somewhat, 5) eased considerable. Whereas the FED's survey would ask the following:

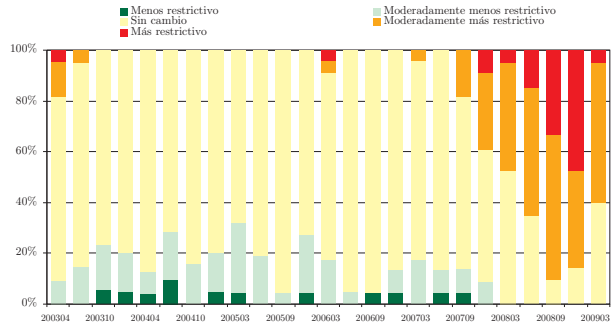
> "Over the past three months, how have your bank's credit standards for approving loan applications for Commercial and Industrial loans or credit lines – excluding those to finance mergers and acquisitions – changed?"

with the same five-choice closed form type of response.

Only aggregate results are reported to the public. Aggregation does not consider bank size. Instead, it shows the percentage of banks that answered on certain option. For instance, Figure **??** shows the results for commercial credit standards tightening (or easing) for large businesses. The red and orange bars at the end of our sample show that a large share of banks reported tighter credit standards, while no bank reported lower ones.

[5] See Lown et al (2000) for complete description of the Federal Reserve's Lending Standards Survey

Figure 1: Commercial Credit Standards Tightening/Easing for Large Businesses



Source: Central Bank of Chile

The SCC also collects information on specific credit covenants. For instance, for consumption loans it collets information on (i) maximum loan amount, (ii) loan term, (iii) spread, (iv) minimum credit scoring, (v) credit line ceiling (vi) minimum monthly payment and (vi) the possibility to lower scoring thresholds. The survey also collects information on loan officers' demand-perception in a separate section. It is worthy to notice that these answers are not actual practices, as in the case of lending standards, but instead opinions. The tone of the questions, however, are very similar to those which are more related to the supply side (the actual covenants), i.e.

> Provide your perception on the following:
> " How have new applications for loans evolved at your institution during the ending *period* [Quarter]? (Your answer should not consider possible seasonal variation)"

The five answer possibilities being: 1) Significantly stronger, 2) moderately stronger, 3) same as last period, 4) moderately weaker, 5) significantly weaker. Afterwards, the respondents are asked to provide their opinion on the importance of a wide set of potential causes driving to greater/lower demand. This set of answers includes possibilities such as; higher capital needs, larger investments, merger capital needs, refinancing outstanding debt, greater dynamism in the housing market or better economic perspectives and employment.

2.2. Bank-Level Information on Interest Rates and Loan Allocation

Information on interest rates is extracted from the D31 data set, collected by the Superintendence of Banks and Financial Institutions (SBIF). This database gathers, since 2001, information on active and passive daily interest rates, classified by debtor type, term and currency. More importantly, it contains data for all banking institutions[6]. As is standard practice, interest rate aggregation

[6]Non-banking credit sources exist but are limited on scope (See Section 4, Financial Stability Report, 2009)

involves obtaining weighted averages of effective interest rates, the weight being loan amounts. In this paper we use *real* annualized interest rates by substracting expected inflation[7]. Table **??** presents some basic statistics on interest rates.

Table 1: Descriptive Statistics Interest Rates

Variable	μ_r **(1)**	σ	**Min**	**Max**	ρ **(2)**	σ_ρ
r_{com}	5.40	1.70	2.75	10.15	0.84	0.026
r_{cons}	16.92	2.67	13.93	24.11	0.95	0.020
r_{hous}	4.40	0.67	2.91	5.65	0.74	0.037

(1): Simple average of amount-weighted in every point in time.
(2): AR 1 proces is considered. Pooled data

As expected, interest rates charged to consumption loans are the highest and the most volatile. Contrastingly, interest rates charged to housing-related loans are the lowest and least volatile. Further, column 6 in Table **??** shows the estimation of the persistence derived from an AR(1) process using pooled data. Interest rates for housing loans are the least persistent, whereas those rates for consumption loans are the most persistent.

2.3. Related Literature

As mentioned, the Federal Reserve collects similar information in its "Senior Loan Office Opinion Survey on Bank Lending Practices" since 1967 from a representative sample of U.S. banks that today gathers around 60 institutions accounting for about 70% of total private credit in the U.S. (Lown and Morgan, 2006). This lending standards survey has been periodically a subject of study. Harris (1974) proposes in a provocative and argumentative paper that the plain fact that banks deliberately modify their standards is clear proof that there is credit rationing. After all, why else would they change them?. Later, Schreft and Owens (1991) elaborate a link between lending standards and the business cycle. Their story is based on the historical positive correlation of the output slowdown following lending standards tightening. Their main interest is to provide elements on the role of credit availability in the U.S. economic slowdown of 1990-1991. Asea and Blomberg (1998), and later Cunningham (2006) focus on lending standards' predictive power to forecast economic activity and aggregate credit. The former authors argue that banks ease their lending standards during economic expansion. The latter author presents evidence on the survey's predictive ability on sectorial output. A more eclectic point of view is adopted by Lown and Morgan (2006) who use VAR analysis to document that lending standards dominate interest rate in explaining total credit and output variations. Even more, they find statistical precedence from lending standards to loans and output, but fail to find precedence from output to standards. Similarly, Lown et al (2000) document that tighter lending standards are associated to slower economic activity, as well as proposing that the natural transmission channel entails inventory adjustment.

[7] We have three alternatives as measures of expected inflation: 1) inflation compensation in the bond market, survey information from the Economic Expectations Survey – also conducted by the Central Bank of Chile – or 3) simply the Inflation Target. We choose the latter to avoid choosing a determined horizon for the inflation expectation from the two former alternatives.

The Bank of Japan and the European Central Bank have began conducting lending standards surveys only this decade; just like the Central Bank of Chile. Therefore there is little empirical evaluation of the informational content of such information[8]. Berg et al (2005) document that the experience of the ECB since 2003 has been in line with U.S. evidence. Their short sample horizon, however, prevent them from elaborating a formal analysis beyond stylized facts. The Bank of Japan conducts the "Credit Survey" from 2000, collecting (un-separately) information on lending standards for firms and households. Kanoh and Pumpaisanchai (2006) argue that it is possible to infer supply and demand curves by modelling the results of the survey with a discrete response model. However, their paper does not report important magnitudes such as price elasticities. Suzuki (2004), on his side, uses data from the "Credit Survey" in a dynamic system of simultaneous equations to evaluate the credit channel in Japan. His methodology is based on the impulse response functions from a VAR that incorporates the lending standards instead of the interest rate.

Previous literature attempting to disentangle demand and supply for credit is at least scarce. Most of the literature using credit time series focuses on the evaluation of the existence of a *credit channel* of monetary policy. One particular attempt to escape this trend and present estimations of demand and supply of credit can be found in Catao (1997). This paper focuses on the Argentinean experience following the Mexican peso devaluation in which lending capacity (deposits) steady growth through 1996 was not followed by credit expansion. The author estimates a three equation system and concludes that the slow growth of private sector borrowing in 1996 was explained mainly by demand factors.

3. Demand and Supply for Credit

This section provides the framework for the empirical exercise of modelling the demand and supply for loans by type of debtor. We begin by laying out the basic identification problem we address. Then we characterize the properties of non-price variables determining credit allocation. In this exercise we focus on assessing informational content of the survey on the supply and demand side, and validate our prior that the former is not determined by the latter. As will be evident later, this result enables us to impose exclusion restrictions to the system of simultaneous equations characterizing the credit market, and attempt to achieve identification using instrumental variables.

3.1. The Identification Problem

The credit market, such as any other, determines prices and quantities simultaneously. Assessing whether it is supply or demand shifts, which affect the

[8] Jiménez et al (2007) do not use information from a lending standards survey, but information from the Spanish credit record system. However their research provides illuminating conclusions to contrast the information on a potential lending standards survey. They relate monetary policy rate with loans and credit risk for a 22 year period. They find that low rates reduce credit portfolio risk which leads banks to engage in riskier lending, therefore deteriorating overall portfolio risk in the medium-rum. Lending standards surveys would not only provide information on the mechanisms used to engage in riskier lending, but also warn authorities on these dynamics on a timely fashion.

most equilibrium aggregates, is as hard as assessing which one scissor blade cuts paper. The econometric consequences are straightforward, OLS panel regressions are uninformative about the slopes of supply or demand. In effect, such estimator provides a weighted average of both slopes. Let us illustrate this point in a simple way. Assume a representative bank which faces a demand curve for loans (L_t^D) and decides the amount of actual credit allocation (L_t^S)according to a loan supply function that depends on the interest rate it charges r_t and other controls $\mathbf{z}$ which we will detail later.

$$\begin{aligned} L_t^S = &\quad \alpha_1 + \alpha_2 r_t + \alpha_3 \mathbf{z} + \epsilon_t^S \quad (1) \\ L_t^D = &\quad \beta_1 + \beta_2 r_t + \epsilon_t^D \quad (2) \end{aligned}$$

Let us also assume market clearing and that both, demand and supply can be disturbed by i.i.d. shocks ϵ_t^S and ϵ_t^D[9]. If the supply and demand curve have positive and negative slopes, respectively, then $\alpha_2 > 0$ and $\beta_2 < 0$. If there were some sort of credit rationing then $\alpha_3 < 0$. The reduced form equations would be

$$\begin{aligned} r_t = &\quad \tfrac{1}{1-\alpha_2/\beta_2}\left[\tfrac{\alpha_1-\beta_1}{\beta_2} + \tfrac{\alpha_3}{\beta_2}\mathbf{z} + \tfrac{1}{\beta_2}(\epsilon_t^S - \epsilon_t^D)\right] \\ L_t = &\quad \tfrac{1}{1-\alpha_2/\beta_2}\left[\alpha_1 - \tfrac{\alpha_2\beta_1}{\beta_2} + \alpha_3\mathbf{z} - \tfrac{\alpha_2}{\beta_2}\epsilon_t^D + \epsilon_t^S\right] \end{aligned}$$

As expected, both, interest rate and loan amount allocation depend on structural supply and demand shocks. Thus, regressing quantities on the interest rate in an equation such as $L_t = \gamma_0 + \gamma_1 r_t + \eta_t$ would result in γ_1 to be uninformative about supply or demand elasticities. In fact simple algebra allows us to show that γ_1 is a weighted average of both, as we had previously anticipated.

$$\begin{aligned} \mathbb{E}(\hat{\gamma_1}) = &\quad \beta_2(1-\omega) + \alpha_2\omega \\ \omega = &\quad \tfrac{\sigma^2_{\epsilon^D}}{\alpha_3^2\sigma^2_{\mathbf{z}} + \sigma^2_{\epsilon^S} + \sigma^2_{\epsilon^D}} \end{aligned}$$

The attempt to correctly identify the supply and demand slopes requires exclusion restrictions as identifying assumptions and the implementation of the instrumental variable approach. If both, supply and demand have other arguments besides the interest rate, then the exclusion restrictions provide potential instruments for identification. Thus let us assume a more realistic representation of the credit market as in

$$\begin{aligned} L_t = &\quad \alpha r_t + \mathbf{Z}^D\mathbf{\Gamma} + \epsilon_t^D \quad (3) \\ L_t = &\quad \beta r_t + \mathbf{Z}^S\mathbf{\Upsilon} + \epsilon_t^S \quad (4) \end{aligned}$$

[9]In this illustration we allow only the structural supply equation to contain an exogenous variable $\mathbf{z}$. The empirical analysis, however, allows the structural demand equation to have exogenous variables as well, and $\mathbf{z}$ to contain more than one variable

where $\mathbf{Z}^D$ and $\mathbf{Z}^S$ are exogenous to the system and contain the unitary column vector. Supply side variables include those general and particular non-price bank practices that aim to ration scarce credit. We also incorporate the initial share of non-performing loans to control for up-to-date portfolio quality. The lending standard variables are different for each of the three credit categories. On the demand side, we include the unemployment rate, the impulse provided by monetary policy and the expectation about the future evolvement of economic activity. In addition, both equations depend on the (real) interest rate. The dependent variable is the annual growth of each of the three credit categories, expressed in percentage points[10].

The estimation requires, in addition to our exclusion restriction (or identifying assumption) that

$$\mathbb{E}\left[\left(\mathbf{Z}^{S,D}\right)'\left(\epsilon^{S,D}\right)\right] = \mathbb{E}\left[\left(\epsilon^{S}\right)'\left(\epsilon^{D}\right)\right] = 0$$

The order condition which allows us to potentially identify the demand curve in this system requires that there is at least one variable in $\mathbf{Z}^S$ which is not in $\mathbf{Z}^D$. Symmetrically, the supply equation can be potentially identified only if there is at least one variable in $\mathbf{Z}^D$ which is not in $\mathbf{Z}^S$ as well. It can be easily shown that in this simple case, this also implies the rank condition. If the system had more equations and endogenous variables, this might not be the case (See Wooldridge, 2002).

In theory, identification of the system of equations can be done straightforwardly by imposing the exclusion restrictions. However, given that it is the same individual responding the survey on both, demand perception and lending standards, it might be possible for the former to influence the answers to the latter. Thus, if we excluded from one equation $\mathbf{Z}^D$, included $\mathbf{Z}^S$, and it were itself a function of $\mathbf{Z}^D$, then we would be imposing the exclusion restriction with one hand while reversing it with the other. The first part of our empirical assessment, then, deals with the relation between the demand and supply sections of the credit conditions survey, and whether one influences the other. Such verification is not standard in the literature using instrumental variables, mainly because it is an idiosyncratic economic test, derived by the nature of the SCC responses, rather than a standard statistical one.

3.2. Determinants of Credit Standards

Credit allocation entails two sources of costs for banks; funding cost and the expected cost associated to debtors who will not honor their debt. The second is a function of heterogeneous portfolio characteristics and macroeco-

[10] We choose to use one-period (%) changes, which circumvent the unit root problem we would otherwise confront. Alfaro et al (2008) illustrate that loan dynamics can be described as

$$L_t = L_{t-1} + N_t - Pt - W_t,$$

where L_t stands for loan stock, N_t for new loans granted in period t, P_t for period payments, and W_t for the write-off in t. Thus, the stock of loans is not stationary as it dependes on L_{t-1} and both, payments and write-offs are small compared to total loan stock. Even more, as the duration of loans increases (i.e. mortgage loans), the scale of the stock of loans hides movements of the other three key variables. Nonetheless, the other components are, indeed, $I(0)$.

nomic perspectives alike. Contractual practices such as those capture in SCC responses aim precisely to prevent excessively risky clients to be part of such portfolio. Additionally, the severity of this practices may, as well, be a function of idiosyncratic banks' portfolio characteristics.

Let SC_t^i be the severity of contractual practices by bank i. Also, allow it to be a linear function of $\mathbf{F}_t^i$, which is a vector or bank characteristics such as their market share, the concentration of their allocation portfolio (HHI index) and the interest rates they charge on loans. Further, $\mathbf{X}_t^i$ stands for standard macroeconomic variables including inflation, its expectations, exchange rate depreciation an national risk measures; and $\mathbf{D}_t^i$ for the demand perception respondes of the survey.

$$SC_t^i = \theta_0 + \mathbf{\Theta_1 F}_t^i + \mathbf{\Theta_2 X_t} + \mathbf{\Theta_3 D}_t^i + \upsilon_t^i \tag{5}$$

In this exercise we are interested in rejecting $\mathbf{H_0} : \mathbf{\Theta_1} = 0$ and not being able to reject $\mathbf{H_0} : \mathbf{\Theta_3} = 0$ at standard significance levels. We interpret such results as evidence that lending standards are not set independently of banks characteristics, and that the answers provided by credit officials are not influenced by their beholding of demand side developments at their respective banks.

The second null hypothesis is the more critical one. Its rejection would prevent us from blindly imposing exclusion restrictions, calling for caution when interpreting the results. Given that we cannot reject $\mathbf{H_0} : \mathbf{\Theta_3} = 0$ we can confidently use the information in the SCC to potentially disentangle loan demand from supply. In this section we aim to perform such exercise considering the discrete nature of the answers, i.e. using an ordered probit model for panel data.

Let SC_t^i stand for the lending standards, which can take 5 values. The higher its value the more restrictive is the contractual practice. Our econometric model is therefore,

$$P(SC_t^i = sc_{tj}^i) = P(\mu_{j-1} < SC_t^{i*} < \mu_j) \tag{6}$$

Let the latent response model be described as in equation **??**. SC_i is not observable directly but we do know which level of restrictiveness it belongs to. SC_i belongs to the j^{th} category if

$$\mu_{j-1} < \upsilon_t < \mu_j, \quad \text{for} \quad j = 1, 2, 3, 4, 5.$$

Where μ_{j-1} and μ_j are consecutive cut points defined over the support of the assumed density function governing the stochastic process υ_t.

3.2.1. Results: Commercial Loans

We cannot reject that the coefficients associated to demand perception are equal to zero. The incorporation of lagged lending standards does not change such outcome. The coefficients associated to the latter are significant and positive, indicating that these commercial policies are persistent in time. Regarding macro variables, inflation and its expectation seem to play a role. The same is true about economic activity, but whose effect seems to be less relevant with the inclusion of a country general risk index (EMBI Global [11]). The inclusion

[11] Emerging Market Bond Index, by JPMorgan Chase Co.

of the latter can be associated to more expensive external funding, and hence scarce loan amount capacity.

Table 2: Determinants of Credit Standards: Commercial Loans

Variable Dep. SC_t^i	(1)	(2)	(3)	(4)	(5)	(6)
Demand Side						
Mod. greater	-0.021	0.443	0.068	0.111	0.111	0.160
	(0.030)	(0.730)	(0.110)	(0.190)	(0.190)	(0.290)
Same level	0.343	0.611	0.102	0.141	0.141	0.182
	(0.460)	(1.090)	(0.180)	(0.250)	(0.250)	(0.350)
Mod. weaker	0.991	0.854	0.480	0.505	0.505	0.508
	(1.230)	(1.510)	(0.820)	(0.850)	(0.850)	(0.930)
Subs. Weaker	1.678	-0.021	-0.249	-0.248	-0.248	-0.409
	(1.720)	(0.020)	(0.310)	(0.290)	(0.290)	(0.430)
Supply Side						
Mod. less restrictive (-1)		0.939	0.868	0.865	0.865	0.882
		(4.86)**	(2.83)**	(3.00)**	(3.00)**	(3.10)**
Same level (-1)		1.699	1.683	1.669	1.669	1.689
		(7.65)**	(4.88)**	(4.94)**	(4.94)**	(5.14)**
Mod. more restrictive (-1)		3.500	2.420	2.275	2.275	2.282
		(11.85)**	(5.77)**	(5.15)**	(5.15)**	(5.21)**
Subs. more restrictive (-1)		3.783	2.818	2.599	2.599	2.613
		(9.79)**	(5.03)**	(4.46)**	(4.46)**	(4.48)**
Bank specific						
Market share			-0.022	-0.023	-0.023	-0.003
			(1.460)	(1.530)	(1.530)	(0.160)
Portfolio diversification			-0.004	-0.065	-0.065	-0.057
			(0.010)	(0.140)	(0.140)	(0.120)
Interest rate			0.008	0.071	0.071	0.069
			(0.210)	(1.260)	(1.260)	(1.280)
Macro Variables						
Annual CPI inflation			0.211	0.189	0.189	0.187
			(2.95)**	(2.00)*	(2.00)*	(1.98)*
12m CPI inf. expectation			0.307	0.393	0.393	0.396
			(1.660)	(2.00)*	(2.00)*	(2.01)*
Nom. depreciation QoQ(%)			0.018	0.012	0.012	0.011
			(1.920)	(1.060)	(1.060)	(1.020)
Annual Growth YoY (%)			-0.101	-0.046	-0.046	-0.018
			(2.99)**	(0.910)	(0.910)	(0.370)
EMBI Global				0.005	0.005	0.005
				(1.96)*	(1.96)*	(2.17)*
MPR				-0.108	-0.108	-0.104
				(1.120)	(1.120)	(1.100)
Mkt share ×						-0.004
Eco. Growth						(1.780)
Observations	523	473	438	438	438	438
Robust z stat in parenthesis						
p<.01***, .05**, .1*						

3.2.2. Results: Consumption Loans

There seems to be influence on credit standards by demand perception only if these are categorized in extreme values. Greater demand lowers restrictiveness, while weaker demand raises it. This extreme categories lead to a significant joint statistical test, thus results should be interpreted with this caveat in mind. Credit standards for consumption loans seem to be very persistent as well. Macroeconomic variables do not exert a strong influence on the determination of credit standards. Contrastingly idiosyncratic banks' characteristics do. Higher interest rates are positively associated with tighter credit standards. This may reflect the caution banks have to prevent the portfolio adverse selection problem. Also, larger banks also seem to be more cautious, as market share is positively associated to tighter credit standards.

Table 3: Determinants of Credit Standards: Consumption Loans

Variable Dep. SC_t^i	(1)	(2)	(3)	(4)	(5)	(6)
Demand Side						
Mod. greater	-0.552	-0.906	-0.756	-0.711	-0.711	-0.635
	(1.140)	(1.920)	(3.12)**	(2.85)**	(2.85)**	(2.50)*
Same level	0.036	-0.436	-0.303	-0.232	-0.232	-0.161
	(0.060)	(0.810)	(1.050)	(0.800)	(0.800)	(0.540)
Mod. weaker	1.320	0.608	0.523	0.624	0.624	0.666
	(2.11)*	(1.100)	(1.220)	(1.440)	(1.440)	(1.530)
Subs. weaker	1.881	0.887	0.742	0.833	0.833	0.812
	(3.26)**	(1.780)	(2.07)*	(2.15)*	(2.15)*	(2.03)*
Supply Side						
Mod. less restrictive (-1)		0.799	0.658	0.646	0.646	0.737
		(2.50)*	(1.610)	(1.660)	(1.660)	(1.710)
Same level (-.1)		2.242	2.170	2.161	2.161	2.195
		(7.27)**	(6.51)**	(6.67)**	(6.67)**	(6.50)**
Mod. more restrictive (-1)		3.292	3.218	3.201	3.201	3.249
		(8.75)**	(7.78)**	(8.19)**	(8.19)**	(8.26)**
Subs. More restrictive (-1)		2.630	2.378	2.352	2.352	2.372
		(5.09)**	(4.35)**	(4.28)**	(4.28)**	(4.18)**
Bank Specific						
Market Share			0.009	0.009	0.009	0.032
			(0.910)	(0.910)	(0.910)	(2.97)**
Portfolio diversification			0.013	-0.011	-0.011	0.017
			(0.030)	(0.020)	(0.020)	(0.030)
Interest rate			0.074	0.144	0.144	0.147
			(2.15)*	(2.00)*	(2.00)*	(1.99)*
Macroeconomic Variables						
Annual CPI Inflation			0.078	0.135	0.135	0.135
			(1.140)	(1.370)	(1.370)	(1.360)
CPI inflation expectation			-0.048	-0.072	-0.072	-0.058
			(0.320)	(0.410)	(0.410)	(0.340)
Nom. Depreciation QoQ(%)			-0.001	0.005	0.005	0.004
			(0.090)	(0.320)	(0.320)	(0.260)
Annual Eco. growth (%)			0.007	-0.052	-0.052	-0.005
			(0.150)	(0.520)	(0.520)	(0.050)
EMBI global				-0.001	-0.001	-0.001
				(0.320)	(0.320)	(0.160)
MPR				-0.165	-0.165	-0.174
				(1.420)	(1.420)	(1.480)
Market share ×						-0.006
Eco. growth Yoy (%)						(1.870)
Observaciones	419	362	328	328	328	328
Robust z stat in parenthesis						
p<.01***, .05**, .1*						

3.2.3. Results: Housing Loans

Demand perception would seem to play a role in lending standards determination in narrow specifications. Once we control for macroeconomic variables, however, such effect vanishes. Additionally, credit standards for housing loans are too, very persistent. Macroeconomic variables influence standards, unlike idiosyncratic banks' characteristics which appear to be not significant across specifications. Expected inflation is positively associated with tighter standards, as are the EMBI Global index and twelve-month economic activity growth.

From the three tables above we can see that the demand perceptions for each of the three credit categories do not influence lending standards in a systematic and predictable way.

3.2.4. Specification Test

A technical concern, in the sake of robustness, is related to the five-answer-choice specification. We test this assumption – which is given by the original

Table 4: Determinants of Credit Standards: Housing Loans

Dependent var. SC_t^i	(1)	(2)	(3)	(4)	(5)	(6)
Demand side						
Mod. greater	0.826	0.389	0.377	0.395	0.395	0.404
	(1.820)	(1.020)	(0.900)	(0.910)	(0.910)	(0.930)
Same level	1.408	0.725	0.487	0.467	0.467	0.479
	(2.67)**	(2.46)*	(1.470)	(1.260)	(1.260)	(1.260)
Mod. weaker	2.291	1.297	0.694	0.631	0.631	0.638
	(4.31)**	(4.42)**	(2.15)*	(1.800)	(1.800)	(1.800)
Subs. weaker	2.403	1.260	0.978	0.882	0.882	0.874
	(3.81)**	(2.89)**	(2.00)*	(1.810)	(1.810)	(1.820)
Supply side						
Mod. less restrictive (-1)		1.731	1.982	1.953	1.953	1.955
		(3.80)**	(3.91)**	(3.62)**	(3.62)**	(3.65)**
Same level (-1)		3.491	3.760	3.787	3.787	3.784
		(6.46)**	(6.86)**	(6.33)**	(6.33)**	(6.32)**
Mod. more restrictive (-1)		4.740	4.640	4.481	4.481	4.474
		(8.02)**	(7.72)**	(7.02)**	(7.02)**	(7.01)**
More restrictive (-1)		3.185	3.243	2.928	2.928	2.898
		(3.67)**	(3.82)**	(3.52)**	(3.52)**	(3.44)**
Bank specific						
Market share			0.007	0.008	0.008	0.011
			(0.570)	(0.650)	(0.650)	(0.800)
Portfolio diversification			-0.496	-0.655	-0.655	-0.656
			(0.780)	(0.970)	(0.970)	(0.970)
Interest rate			0.070	0.180	0.180	0.181
			(1.130)	(1.680)	(1.680)	(1.690)
Macroeconomic variables						
Annual CPI inflation			0.077	-0.094	-0.094	-0.095
			(1.030)	(1.270)	(1.270)	(1.300)
CPI inflation expectation			0.263	0.404	0.404	0.405
			(1.740)	(2.59)**	(2.59)**	(2.60)**
Nom. depreciation QoQ (%)			0.018	-0.004	-0.004	-0.004
			(1.740)	(0.310)	(0.310)	(0.310)
Annual Eco. growth (%)			-0.015	0.173	0.173	0.180
			(0.360)	(3.15)**	(3.15)**	(2.92)**
EMBI Global				0.010	0.010	0.010
				(3.14)**	(3.14)**	(3.12)**
MPR				0.048	0.048	0.045
				(0.310)	(0.310)	(0.280)
Mkt. share ×						-0.001
Eco. growth						(0.360)
Observations	401	346	315	315	315	315
Robust z stat in parenthesis						
p<.01***, .05**, .1*						

format of the survey – against the alternative hypothesis of only three choices; namely, less restrictive, equally restrictive, and more restrictive. The null hypothesis we test is given by

$$\mathbf{H_0}: \mu_1 - \mu_2 = 0 \tag{7}$$

$$\mathbf{H_0}: \mu_3 - \mu_4 = 0 \tag{8}$$

Hypothesis tests in (**??**) and (**??**) reject them at standard levels for all three loan categories. Hence, it is necessary to maintain the five categories in the estimation of credit standards determinants. To sum up, banks seem to react coherently to macroeconomic variables, external risk and monetary policy rate; credit standards are very persistent, and demand perception does not exert a prominent nor a systematic effect on credit standards determination, except in the face of extreme turnarounds in demand for consumption loans.

3.3. Supply and Demand Elasticities

Total private credit can be classified in four categories; loans driven by consumption, housing and commercial purposes, and those related to international trade. The nature of the former three is self-explanatory. In contrast, the latter credit category involves the operations of national and foreign debtors who use the domestic and off-shore financial system, without incurring in significant costs. The nature of their intricate international arbitrage makes equations **??** and **??** not to be a proper representation of this market's dynamics. Hence, we restrict ourselves to the first three credit categories.

Recall our basic specification of the credit market – equations **??** and **??** –, which we reproduce here for convenience,

$$\begin{aligned} L_t = &\quad \alpha r_t + \mathbf{Z}^D \mathbf{\Gamma} + \epsilon_t^D \\ L_t = &\quad \beta r_t + \mathbf{Z}^S \mathbf{\Upsilon} + \epsilon_t^S \end{aligned}$$

where $\mathbf{Z}^D$ contains at least one variable not included in $\mathbf{Z}^S$ and viceversa. Specifically, $\mathbf{Z}^D$ contains non-price variables that may potentially influence the position of the demand curve for loans. Among these, we consider the unemployment rate (and its variation) which would provide a measure of both, economic activity and the proportion of the people who a have verifiable collateral; the income stream. We also control for the expectation of economic activity for the year ahead[12], and the monetary policy rate (MPR). Finally, we also control for the demand-perception variable from the SCC survey. The latter is not included because of fundamental reason, but because it may help alleviate the bias caused by the omission of any other variable[13]. Similarly, $\mathbf{Z}^S$ includes at least one variable which is not in $\mathbf{Z}^D$. One pivotal advantage of the fresh information we use in this paper is that we have several supply-side variable which have potential impact on the position of the supply curve for loans, and that were neither available before, nor are they available for any country. $\mathbf{Z}^S$ includes macroeconomic variables such annual output growth; portfolio quality assessed through the the ratio of non-performing loans and our set of lending standards which include, a) the general assessment of credit restrictiveness and b) a set of particular practices which are specific to each credit category. Particular practices include restrictiveness on the total amount of credit, the payment horizon, the scoring threshold, credit card limits, collateral availability, etc.

For each credit category, those variables which are excluded from one equation in the system are included in the other as instrument for the interest rate; that is the endogenous variable to the system. Our identification assumption is simple; demand cannot be determined by internal – and not public – commercial practices in banks. We do need, however, that the instruments be *partially* correlated to the endogenous variable. Our estimations report the p-value of the

[12]The Economic Expectation for Output is the median 12-month-ahead forecast for output growth by a group of private consultants who report directly to the Central Bank.

[13]The results show that the demand-perception variable is not really important. Also, the omission variable bias is (partially) circumvented by using panel data techniques which control for fixed effects. Along our empirical work we test the possibility of using random effects with standard Hausman tests, whose results are mixed. Thus we privilege reporting the consistent estimator, the fixed effects specification.

test on this hypothesis in the first-stage regression. The results of each estimation, then, should be interpreted conditional on the power of the instruments. The left hand side variable we choose to model is que annual percentage growth of credit stocks. Another possibility in credit market modeling would be using stocks instead of growth rates. Stocks however are very likely to have a unit root, imposing several econometric difficulties[14]

3.3.1. Results for Commercial Loans

Table 5: Commercial Loans Supply

VARIABLES	Pooled OLS	FE	FEIV	FEIV	FEIV
Interest rate	-0.829*	0.356	2.081***	2.037***	1.818***
	[0.426]	[0.468]	[0.723]	[0.716]	[0.613]
GDP growth yoy (%)	0.244	0.153	0.581*	0.576*	0.592*
	[0.427]	[0.316]	[0.352]	[0.347]	[0.323]
Nonperforming Loans	-424.5***	-814.6***	-758.1***	-759.9***	-715.8***
	[123.7]	[112.6]	[117.6]	[115.4]	[109.0]
General Credit Standards	1.862	-0.399	-0.806	-0.737	
Large Bus. B11	[1.847]	[1.390]	[1.441]	[1.377]	
Part. practices Large Businesses					
Reduction in credit	-2.008	-0.0122	0.0328		
Lines B411	[1.760]	[1.274]	[1.315]		
Higher spreads	-3.122*	-0.757	-0.881	-1.024	
B412	[1.621]	[1.178]	[1.216]	[0.985]	
Larger requir.	-0.899	-0.951	-0.922	-0.861	
of collat B413	[1.865]	[1.502]	[1.551]	[1.495]	
Shorter loan	-2.549	-1.973	-1.959	-1.933	-3.032***
terms B414	[1.800]	[1.312]	[1.355]	[1.317]	[0.892]
Higher spread for	5.977***	1.892	1.209	1.399	
riskier loans B415	[2.197]	[1.655]	[1.722]	[1.448]	
General Credit Standards	0.0906	1.638	1.208	1.165	
M&S Bus. B12	[1.774]	[1.330]	[1.380]	[1.307]	
Part. practices M&S Businesses					
Reduction in credit	4.220**	3.305**	3.166**	3.178***	3.117***
Lines B421	[1.851]	[1.418]	[1.465]	[1.169]	[0.928]
Higher spreads	3.224	-0.502	-0.549		
B422	[2.388]	[1.725]	[1.781]		
Larger requir.	-1.142	0.409	0.399		
of collat B423	[2.385]	[1.700]	[1.755]		
Shorter loan	-0.660	-1.360	-1.170	-1.195	
terms B424	[2.025]	[1.433]	[1.480]	[1.428]	
Higher spread for	-0.771	-0.266	0.244		
riskier loans B425	[2.000]	[1.466]	[1.522]		
Constant	4.607	14.24**	4.040	4.345	4.951
	[7.241]	[5.732]	[6.718]	[6.567]	[5.893]
Observations	237	237	237	238	247
R2 — R2within	0.150	0.287	0.240	0.242	0.237
p-val first stage			0.00	0.00	0.00
Number of banco		15	15	15	15
Standard errors in brackets					
p<.01***,.05**,.1*					

[14]Unit roots would require dealing carefully with lags on the right hand side. Dealing with this characteristic requires using instrumental variables for dynamic panel data as proposed by Arellano y Bond (1991) or Arellano y Bover (1995). We choose not to deal with this complication since we are already using instrumental variable for the simultaneous equations problem. The instruments we chose would then have to fulfill the properties we require for both purposes. A second reason to use a specification that lacks dynamics is that the asymptotic properties of standard estimators are valid when $T/N \to 0$. In our case the ratio N/T is closer to one. Under such conditions Álvarez and Arellano (2003) show that the GMM estimator would be inconsistent.

This credit category gathers those loans whose purpose is to finance productive activities, and are further classified into those related to small and large businesses. On the supply side, the disposition to lend should depend on the profitability and the willingness to accept risks. The latter can be accounted for by including portfolio quality and economic activity as an indicator of how likely it is for a random debtor to honor her debt. Additionally we consider the various non-price variables used to allocate credit. On the demand side, the amount of credit should depend on the interest rate paid for it and perception of ones capacity to repay (Calza et al., 2003). Hence we consider the unemployment rate and its change, the monetary policy rate which captures the position in the business cycle and the monetary impulse and the credit cost. We also consider the demand perception by senior loan officers in order to capture possible omitted variables.

Table 6: Commercial Loans Demand

VARIABLES	Pooled OLS	FE	FE IV	FE IV	FE IV	FE IV
Interest rate	-1.370***	-1.167*	-2.593	-4.963*	-3.916*	-4.591*
	[0.411]	[0.618]	[2.305]	[3.010]	[2.320]	[2.575]
Unemployment rate	-1.853*	-1.629*	-1.003	-0.0482	1.950	2.394
	[1.095]	[0.843]	[1.250]	[1.481]	[2.030]	[2.183]
Exp. GDP growth 12m	0.732	0.466	0.801	1.282*	5.725**	6.269**
	[0.646]	[0.508]	[0.660]	[0.739]	[2.467]	[2.690]
MPR	2.731***	2.581***	4.094*	6.391**		
	[0.931]	[0.867]	[2.362]	[3.04]		
New Loans demand	-0.133	-0.663	-0.443			
perception M&S Bus. B52	[1.401]	[1.145]	[1.186]			
New Loans demand	-1.872	-0.183	-0.210			
perception Large Bus. B51	[1.384]	[1.099]	[1.120]			
Constant	22.31	17.90	12.19	3.945	-49.74	-56.10
	[14.74]	[11.21]	[13.06]	[13.94]	[32.70]	[35.24]
Observations	244	244	236	238	227	230
R2 — R2 within	0.162	0.198	0.183	0.0631	0.0979	0.0459
p-val first stage			0.00	0.00	0.00	0.00
Number of banco	15	15	15	15	14	14
Standard errors in brackets						
p<.01***, .05**, .1 *						

Note: Instruments in column three include all general and particular commercial practices sketched in table **??**. Instruments in column four exclude general credit conditions, B422, B423 and B425 which are not partially correlated with the interest rate. Instruments in column five include all except for the general credit condition variables. Finally, column five leaves aside non-performing loans, general standards and practices B415, B421 and B422 due to the same partial correlation reason

The estimations of the supply curve for commercial loans are reported in table **??**. The first two columns show the pooled OLS and the fixed effects estimators to illustrate that using instrumental variables does make a difference. Columns 3 to 5 show the results of the fixed effects instrumental variables estimation. Simple average of the growth of commercial loans is 8.25%, a 1% raise of interest rate is associated to higher 2% growth of commercial credit. Similarly, an additional 1% of economic growth implies a 0.5% of higher credit growth. The initial ratio of non-performing loans lies between 0 and 1, thus a 1% increase in this ratio implies a contraction of 7.15% of credit growth. Regarding particular practices which have statistically significant effect on credit allocation only two variables result highly significant and robust. Shorter horizons for credits to large businesses are associated to a supply contraction. Reduction of

credit lines for small and medium businesses result in an opposite effect; as if the uncertainty of potential borrowing is substituted by current debt application. All in all, the instruments, which are arguments in the demand equation, are partially correlated to the endogenous variable and seem to be useful in the identification of the slope of the loan supply. The p-values of a joint test of significance of such instruments in the equation relating interest rate, exogenous variables and the instruments, are reported at the bottom of table **??** and are close to zero. Instruments include those variables in the demand equation, namely unemployment rate, monetary impulse and the expectation of economic growth for the upcoming year.

In table **??**, that shows the results for the demand of commercial loans, we report five columns. The first two columns show the pooled OLS and the simple fixed effects estimators. The rest of the columns show the instrumental variable estimator using instruments from the SCC to account for the endogeneity of the interest rate. These instruments can identify the demand curve for commercial loans. We can confidently estimate a negative response of commercial loans growth of around 4% to 4.5 % given 1% raise of the relevant interest rate. Unemployment does not seem to play a major role, but then again one would expect it to exert a greater role for consumption, not commercial loans. The expectation of one year ahead economic activity has the opposite effect, namely it accelerates credit growth by 6% for every additional 1% increase of expected output growth. We also control for the position in the business cycle including the MPR, which could also be capturing a supply side effect such as an imperfect funding cost. Even though it is a significant variable, its exclusion does not change our prior conclusions. We also control for the loan officers' demand-perception, to account for possible omitted variables, but these result not significant.

3.3.2. Results for Consumption Loans

Next we focus our attention onto the market for consumption loans. Table **??** and **??** show the outcomes of our estimations. To have an idea of the economic significance of the estimated elasticities, we may bear in mind that consumption loans have grown at an annual average rate of 14.70% (simple average across banks), 15.27% as a system aggregate with a median of 15.55%. Our estimation for the consumption loan supply (Table **??**) shows that supply of consumption loans does not seem to automatically respond to a one percent raise of the interest rate, even though the instruments behave as expected. There are two ways to rationalize this result. First, interest rates for consumption loans are already the highest if compared to the other two credit categories. At an average of 16% in our sample, it more than doubles the 6.2% of commercial loans interest rate of the mild 4.8% charged for housing loans. Therefore, an additional percentage point may not be as important as it would be for the other two credit categories. Second, too high interest rates imply riskier portfolios for the very same reason that explains the existence of lending standards covenants; that is, information asymmetry and the consequent adverse selection problem (Stiglitz y Weiss, 1981). On the other hand, supply for consumption loans raises by 1.2% for every additional percentage point of income and shrinks by 8% to 10% for every additional percentage point of non-performing to total loans ratio. Particular non-price practices which influence supply the most, is the credit limit amount (D411). Also, restrictiveness on longer term loans results in higher

Table 7: Consumption Loans Supply

VARIABLES	Pooled OLS	FE	FEIV	FEIV	FEIV
Interest rate	0.0659	-0.317	-0.538	-0.415	-0.444
	[0.251]	[0.399]	[0.837]	[0.714]	[0.690]
GDP growth YoY (%)	1.596***	1.292***	1.203**	1.151**	1.244**
	[0.447]	[0.466]	[0.552]	[0.539]	[0.535]
General Standards	-2.400	-1.611	-1.484	-1.096	
for cons. loans	[2.417]	[2.427]	[2.466]	[2.231]	
Nonperforming loans (%)	-793.0***	-1,089***	-1,030**	-1,041**	-895.0**
	[259.6]	[401.9]	[448.6]	[422.5]	[415.5]
Particular practices					
Max loan amount D411	-6.238**	-6.734**	-6.805**	-6.777**	-6.844***
(more restrictive)	[2.901]	[2.915]	[2.927]	[2.721]	[2.260]
Max term D412	3.856*	5.010**	4.883**	5.381**	5.287**
(more restrictive)	[2.246]	[2.423]	[2.462]	[2.359]	[2.277]
Spread charged D413	-1.868	-0.568	-0.388		
(more restrictive)	[1.468]	[1.481]	[1.599]		
Credit limit D415	-1.104	-0.176	-0.262		
(more restrictive)	[2.553]	[2.653]	[2.671]		
Minimum payment D416	2.683	2.286	2.365	2.070	
(more restrictive)	[2.014]	[2.005]	[2.024]	[1.935]	
Threshold requirements D417	4.756***	1.772	1.905		
(more restrictive)	[1.677]	[1.841]	[1.895]		
Constant	14.87	25.33**	28.32**	28.81**	30.81**
	[9.299]	[10.10]	[14.20]	[13.12]	[13.20]
Observations	213	213	213	216	218
R2 — R2 within	0.228	0.258	0.257	0.250	0.233
P-val first stage		0.00	0.00	0.00	0.00
Number of banks		15	15	15	15
Standard errors in brackets					
p<.01***, 0.05**, .1 *					

Notes: Instruments are significantly partially correlated and include those excluded variables that are part of the specification of the demand equation, namely economic expectations for the 12 month ahead period, unemployment rate and monetary impulse. The results are unchanged by the inclusion or exclusion of the latter, even though its partial statistical significance cannot be rejected.

growth rates. Table **??** shows different specifications which are only a subset of a large process of consecutive elimination. Elasticity estimations in this process, are very robust to the inclusion or exclusion of those particular practices which result not significant in the fifth column.

Table **??** shows the results for our estimation for consumption loan demand. The first two columns, again, show the pooled OLS and the panel fixed effects estimations. Columns three to six show the fixed effects instrumental variable estimations, which differ in specification and in the subsets of instruments used. The results however are rather robust. A one percent raise of the relevant interest rate results in a decrease of around 2.6% to 3.6% of consumption annual growth levels. Given its annual mean growth is around 14%, we can conclude that consumption loan demand is highly responsive to its price. Additionally we find the expected sign for the influence of unemployment on loan demand. For every additional percentage point of unemployment the demand for loans shrinks in about 3%. Across specifications, we fail to find evidence of future economic activity shifting the demand curve. The same is true about the monetary impulse and both results are robust across specifications and the included sets of instruments.

Table 8: Consumption Loans Demand

VARIABLES	Pooled OLS	FE	FEIV	FEIV	FEIV	FEIV
Interest rate	-0.479	-0.631*	-3.029**	-3.497**	-2.681***	-3.601***
	[0.297]	[0.372]	[1.495]	[1.419]	[1.003]	[0.918]
Unemployment rate	-3.228*	-3.063**	-0.990	-0.960	-2.579**	-3.185**
	[1.779]	[1.560]	[1.974]	[1.986]	[1.176]	[1.272]
Δ unemployment	-2.101	-1.812	-1.580	-1.460	-1.045	
	[2.686]	[2.322]	[2.477]	[2.543]	[2.467]	
Expectation 12m	1.756*	1.594*	1.732*	1.753*	1.296	1.341
GDP growth	[1.027]	[0.900]	[0.979]	[1.009]	[0.952]	[1.037]
Demand perc. D51	-2.496	-2.833*	-1.952	-1.247	-1.529	
	[1.628]	[1.511]	[1.824]	[1.854]	[1.880]	
MPR	-1.488	-1.466	1.826	2.229		
	[1.397]	[1.275]	[2.350]	[2.268]		
Constant	60.25***	63.22***	68.74***	72.47***	85.67***	101.9***
	[22.36]	[19.71]	[21.44]	[21.94]	[23.59]	[26.80]
Observations	224	224	220	224	220	234
R2 — R2 within	0.159	0.209	0.127	0.0665	0.148	0.0252
p-value first stage			0.00	0.00	0.00	0.00
Number of banks		15	15	15	15	15
Std errors in brackets						
p<.01***, 0.05**, .1 *						

Notes: Columns 3 to 6 use the IV FE estimator. Column 3(5) and 4(6) differ in the set of instruments used. In column 3(5), all general credit standards and particular practices from table **??** are included. Column 4(6) includes those most relevant which are the ratio of nonperforming loans, general standards and the term restrictiveness D412.

3.3.3. Results for Housing Loans

Housing loans have grown, in our sample period at an annual average rate of around 14%. A second feature of this type of credit is that not all banks work in this business, reducing the number of observations available for estimation purposes. We should bare these two ideas in mind in order to interpret the results. We wish to estimate supply and demand curves using the same framework of equations **??** and **??**. Consider housing loans supply, which is to a great extent unresponsive to the interest rate levels. Table **??** shows a positive, however not significant, effect of interest rate on the annual growth rates. Every additional percentage point of output growth levels is associated with a 1.5% annual credit growth rate. We consider particular practices from the SCC but find no robust effect of any one practice besides the share of ground value to total output. Identification is a tricky business, and relies heavily on the quality of the instruments. This is the only case in our set of estimations in which we do not posses a set of instruments sufficiently (partially) correlated with the endogenous variable; namely p-values of the first stage are well above standard significance levels. Thus we could conclude any of the following notions; either our instruments from the demand side are poor, housing loan supply is inelastic to interest rates, or both.

Contrastingly, the SCC does provide information which can be used as instruments to identify housing loan demand, which is indeed the case. Unlike first stage p-values (of joint significance tests) for the loan supply, p-values for the loan demand are very close to zero. Housing loan demand shrinks around 5% to 6% percent for every 1% raise of the relevant interest rate. Unemployment does not exert a noticeable effect, but expectations about future economic activity do; credit demand expands by 1.3% for every extra 1% expected annual

Table 9: Housing credit supply

VARIABLES	Pooled OLS	FEIV	FEIV	FEIV	FEIV
Interest rate	-3.177***	-6.983	-7.057	2.303	2.315
	[1.193]	[4.822]	[4.820]	[7.787]	[7.907]
GDP growth YoY (%)	1.107**	0.922	0.921	1.429	1.491*
	[0.524]	[0.727]	[0.724]	[0.910]	[0.897]
General Stand	2.308	3.317	3.449		
D12 Housing L	[2.230]	[2.469]	[2.117]		
Particular Practices					
Income share	-3.665	-3.457	-3.417		
restrictiveness D421	[2.680]	[2.610]	[2.551]		
Max % of "letras hip"	0.451	0.191			
restrictiveness D422	[1.992]	[1.830]			
Credit scoring	-0.487	-1.357	-1.394	-0.0191	
restrictiveness D424	[2.770]	[2.918]	[2.871]	[2.804]	
Clients with no req	-3.159*	-5.054***	-5.037***	-0.853	
restrictiveness D425	[1.893]	[1.912]	[1.885]	[1.925]	
General Standards	-4.030*	0.0495			
real state bus C11	[2.079]	[2.056]			
General Standards	2.723	1.034	1.047		
constr bus C12	[1.851]	[1.699]	[1.613]		
Particular Practices					
Reeval conditions	-6.192**	-2.466	-2.474		
restrictiveness C41	[2.894]	[2.808]	[2.787]		
Reeval conditions	6.158**	2.930	2.979		
restrictiveness C42	[2.880]	[3.211]	[3.174]		
% of ground value	2.530	2.783	2.815	3.134*	3.084*
restrictiveness C43	[1.996]	[1.960]	[1.917]	[1.723]	[1.692]
Term of loan	-0.244	4.568	4.573*		
restrictiveness C44	[2.794]	[2.803]	[2.774]		
Higher spreads	3.392**	1.927	1.913		
restrictiveness C45	[1.449]	[1.406]	[1.357]		
Contractual covenants	-1.856	-3.194	-3.172		
restrictiveness C46	[2.327]	[2.505]	[2.408]		
Nonperforming loans (%)	-46.28	-446.8*	-446.7*		
	[219.4]	[268.6]	[259.7]		
Constant	36.20***	48.69	48.99	-4.863	-7.859
	[13.06]	[31.85]	[31.76]	[42.51]	[41.84]
Observations	160	158	158	165	166
R-squared	0.218	0.222	0.221	0.00882	0.00676
Number of banco		11	11	11	11
P - value first stage		0.16	0.16	0.24	0.36
Standard errors in brackets					
p<0.01 ***, 0.05**, 0.1*					

output growth rate. House prices also play a significant role, for they are the item which this type of loan is supposed to finance[15]. As in the previous cases, demand perception is considered in initial specifications, but results not to be significant, and hence does not appear in our final and preferred specification.

3.4. The Credit Shrinking after 2008S2

By having estimated interest rate elasticities of both, supply and demand, we can aim at analyzing certain specific events in which we observe only the initial and final equilibrium points. Put differently, given supply and demand slopes, and (observed) equilibrium points we can infer by how much demand and supply must have shifted to be consistent with data. The period following July 2008

[15]House prices are proxied with an index built by Cámara Nacional de Servicios Inmobiliarios

Table 10: Demand for Housing Credit

Variables	Pooled OLS	Panel FE	Panel IV FE	Panel (1) IV FE	Panel (2) IV FE	Panel (1) IV FE	Panel (2) IV FE
Interest rate	4.486	2.100	-4.867	-10.60***	-10.29***	-6.336*	-5.816*
	[3.814]	[4.003]	[5.966]	[2.958]	[2.908]	[3.269]	[3.306]
Unemployment (sa)	1.399	1.687	1.307	0.594	0.511	1.324	1.416
	[1.544]	[1.231]	[1.373]	[1.037]	[1.024]	[1.086]	[1.062]
Ec. Expectation	3.504**	3.351**				1.253*	1.317**
12m ahead	[1.636]	[1.372]				[0.645]	[0.638]
House prices	0.482**	0.540***	0.377***	0.353***	0.346**	0.471***	0.483***
	[0.201]	[0.165]	[0.138]	[0.136]	[0.136]	[0.145]	[0.145]
$(\text{Interest rate})^{-1}$	0.0935*	0.0882*	0.00517				
	[0.0539]	[0.0461]	[0.0800]				
Demand Perception	2.471**	1.849	-0.430				
from SCC D52	[1.219]	[1.161]	[1.118]				
Constant	-124.5**	-118.5**	-15.02	20.82	21.21	-25.96	-30.98
	[50.60]	[46.15]	[51.16]	[28.47]	[28.05]	[35.41]	[35.51]
Observations	171	171	150	166	157	162	157
R2 / R2 within	0.083	0.152	0.136	0.0559	0.0779	0.157	0.175
Num. banks	14	14	11	11	11	11	11
p-val 1st stage	–	–	0.00	0.00	0.00	0.00	0.00
St.Err in brackets							
p<.01***, .05**, .1*							

Notes: Instruments include
(1) General credit standards for housing debt (people and businessess) alone
(2) Particular lending practices for housing debt.

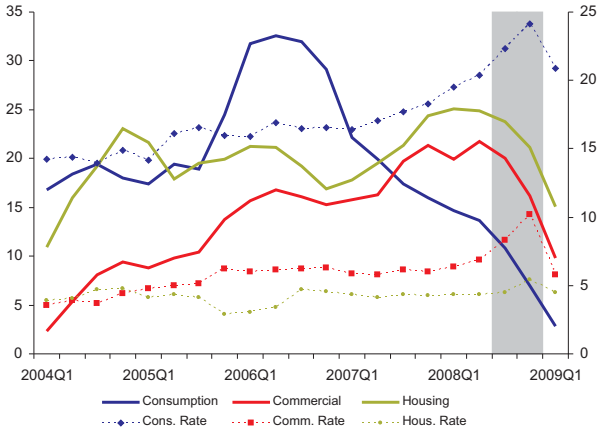
was characterized by a sharp decline of credit growth, mainly due to a flight to quality event in the face of uncertainty in international credit markets. By observing loan amounts and interest rates alone, however, we cannot confidently assess relative demand and supply contributions. Our stylized model allows us to quantify – although not fully explain – movements of supply and demand in such recent "credit shrinking" episode. This type of analysis is strikingly provocative, not only because it is simple but because it is useful to policy makers and academics alike. The former would use such assessment to guide economic policies and the latter to develop models and explanations which can reconcile such stylized facts with economic theory.

Table 11: Comparative Statics - The Data

	Date			
	2008Q2	2008Q3	2008Q4	2009Q1
Commercial Loans				
Growth rate YoY	21.8%	20.0%	16.2%	9.8%
Interest rate	6.8%	8.3%	10.2%	5.8%
Consumption Loans				
Growth rate YoY	13.7%	10.9%	7.0%	2.9%
Interest rate	20.4%	22.4%	24.1%	20.9%
Housing Loans				
Growth rate YoY	24.9%	23.7%	21.2%	15.1%
Interest rate	4.3%	4.5%	5.4%	4.5%

Our exercise is much simpler to understand using figure **??**. Let A and B be the initial and final equilibrium points. Given supply and demand slopes there is only one of each that is consistent with a given equilibrium point. Point A is consistent with only with DD and SS, while point B is consistent only with $D'D'$ and $S'S'$. We wish to illustrate the contribution of supply and demand

Figure 2: Loans Quarterly Growth



Source: D31 - Database System (SBIF)

curves to the movement from A to B. The magnitudes we report below are the horizontal distances between points F and B, for the supply curve shift; and between C and B for the demand curve shift. As this curves are actually linear, then these distances are the general horizontal shifts of demand and supply curves. Notice that different magnitudes would be reported if we assessed vertical, rather and horizontal, shifts.

Table 12: Comparative Statics - Results

Loan type	Curve	Shift (1)	% (2) (3)	% (4)
Consumption	Demand	Expansion	6.80	-13.26
Consumption	Supply	Contraction	-6.73	-8.00
Commercial	Demand	Expansion	9.68	-21.84
Commercial	Supply	Contraction	-9.45	-7.21
Housing	Demand	Expansion	1.72	-8.57
Housing	Supply	Contraction	-3.71	-8.64

Notes:
(1) Expansion (contraction) is defined as a shift to the right (left)
(2) This is the absolute (which is already in percentage points) horizontal distance between the two curves in t_0 and t_1
(3) t_0 = 2008Q2, t_1 = 2008Q4
(4) t_0 = 2008Q3, t_1 = 2009Q1.

Table **??** shows annual credit growth for each type of loan, from the second quarter of 2008 to the first quarter of 2009. This period is interesting to analyze not only because the economy was going through the most severe financial panic episode in the last decades, but because credit contraction was accompanied by a sharp raise of interest rates to the end of 2008, with a subsequent swift decline in the first quarter of 2009.

Lower credit growth vis a vis higher interest rates, of course, tell a supply side contraction story. But, to what extend is such effect intensified or ameliorated by the demand contraction or expansion? In which period? Then, the demand side is key to understanding the intensity of the credit contraction on the supply

side.

Figure 3: Comparative Statics: Diagram

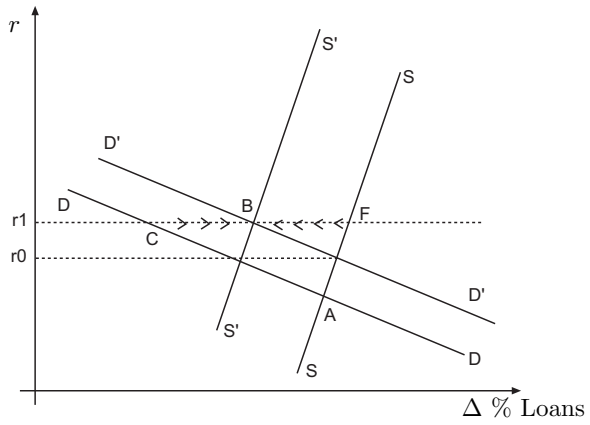
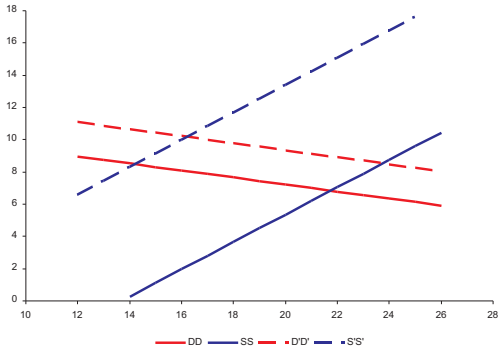


Table **??** shows the shifts – let them be contractions or expansions – of supply and demand curves which are consistent with the initial and final equilibriums. The three credit categories exhibit the same pattern. Interest rates raise initially, only to fall in the first quarter of 2009. Indeed – as we document below – demand for loans, must have initially and briefly expanded, and to some extend ameliorated the contraction of credit amount allocation. Later, as common wisdom suggests, it swiftly de-accelerated by the beginning of 2009. There are several ways to rationalize such brief demand expansion in the middle of the financial turmoil. First, counter-cyclical economic policies were undertaken. Second, when other sources of financing, at least for commercial loans, were interrupted (i.e. credit lines from suppliers, etc), demand for credit from banks becomes an attractive and feasible alternative. Also, credit card borrowing, which is a large component of consumption loans, are easily used at the beginning of a contraction cycle. Nevertheless, this story is only a short term perspective. By he first quarter of 2009, interest rates for each loan category were lowering and credit growth did not seem to boom, supporting a demand contraction story.

Now let us consider each credit category separately for the period that spans the last quarter of 2008 to the first quarter of 2009. We calculate that the supply of consumption loans shrank (horizontally) by 8% in tandem with the demand, which shank 13%. To understand these magnitudes consider that annual growth rates for consumption loans before 2008Q4, are close to 20%. If we wanted interest rates not to fluctuate, both demand and supply should exhibit the same growth rate. Our calculations say that supply grew at a lower pace (12%) and demand growth was even weaker (7%). For commercial commercial loans, our estimations suggest that commercial loan supply shrank by 7% and demand did so too by 21%. These are large movements if we consider that average annual growth rates are usually slightly higher than 15% for this credit category. Finally, both demand and supply for housing loans shrank by around 8%, which is a less severe contraction when compared with the historical 18 - 20 % annual

Figure 4: Comparative Statics in the Commercial Loans Market (2008Q2 - 2008Q4)



growth rates.

If we focus on the earlier period of 2008Q2-200Q4 a different pattern arises. While loan supply for all three credit categories shrinks, loan demand temporarily expands, raising further interest rates and ameliorating the amount allocation contraction. Figure **??** shows the actual commercial loan market drawn to scale for such period. Table **??** shows that supply for commercial, consumption and housing loans shrank by 9.5%, 6.7%, and 3.7% respectively; while demand expanded by 9.7%, 6.8% and 1.72% respectively.

To sum up, our very stylized exercise shows that credit supply contractions were behind the credit deceleration of the period spanning the second quarter of 2008 to the first quarter of 2009. Demand on the other hand, initially expanded to shrink later, in tandem with the supply side. This type of simple marshallian diagram exercises for comparative statics can be done (with all the caveats as one may wish to add) due to the estimation of demand and supply curve slopes which we could perform in the previous subsections.

4. Conclusions

Few markets are as important to macroeconomists as the credit market. Theoretical literature, since Bernanke, Gertler and Gilchrist (1999), has advanced steadily towards understanding the consequences of credit frictions, its allocation and macro implications. Even more, credit imperfections' consequences have been assessed in the context of understanding several other paradigms such as growth and its volatility (see Aghion et al. (2010) and the references therein). The importance of this market has been more evident than ever during the recent financial crisis of 2008-2009. However, in spite of such importance, the empirical literature has not kept pace with the theory. This paper contributes to the literature in such direction, by assessing the problem of characterizing the credit market using data from Chile. This exercise – perhaps because of the difficulty in collecting the necessary data – has not been done for other countries before. We exploit the information imperfections of the credit market, which translate in contractual practices, to identify demand and supply for credit. We assemble a panel for the period 2003-2009 which merges information

from the (D31) Chilean Superintendence of Banks and Financial Institutions database on loans and interest rates, with information from the "Survey on General Conditions and Standards of the Banking Credit Market". This survey gathers qualitative information on general restrictiveness and particular contractual practices for the same three credit categories of the D31 database. To the extent of our knowledge this has not been done before in the literature. The information from this practices are non-price sources of variation in credit allocation which provide the potentiality to disentangle demand from supply. We perform such exercise in a panel data framework, expanding the scarce previous attempts which used only time series data. Our results are reasonable from an economic standpoint; we identify demand curves with negative slopes and supply curves with positive (or vertical) slopes. We further use our estimations to understand the credit deceleration episode of the second half of 2008 and the first quarter of 2009. We document that in fact Chile experienced a credit contraction which was partly and temporarily ameliorated by an expanding demand which eventually also contracted. The qualitative result is the same for the three credit categories, although magnitudes can be rather different.

AppendixA. Supply and Demand Identification

Let the structural equations be

$$L_t^S = \alpha_1 + \alpha_2 r_t^i + \alpha_3 \mathbf{z} + \epsilon_t^D \quad (A.1)$$
$$L_t^D = \beta_1 + \beta_2 r_t^i + \epsilon_t^D \quad (A.2)$$

Then the reduced form equations are

$$r_t = \frac{1}{1-\alpha_2/\beta_2}\left[\frac{\alpha_1-\beta_1}{\beta_2} + \frac{\alpha_3}{\beta_2}\mathbf{z} + \frac{1}{\beta_2}\left(\epsilon_t^S - \epsilon_t^D\right)\right]$$
$$L_t = \frac{1}{1-\alpha_2/\beta_2}\left[\alpha_1 - \frac{\alpha_2\beta_1}{\beta_2} + \alpha_3\mathbf{z} - \frac{\alpha_2}{\beta_2}\epsilon_t^D + \epsilon_t^S\right]$$

In this particular example we can achieve identification only for the demand side equation which fulfills the *order condition* (one endogenous variable and at least one variable in $\mathbf{z}$ not included in it). Next let us analyze the theory of the estimation of estimating equation **??** through OLS and the sign of the bias we incorporate by not acknowledging the system endogeneity.

$$\hat{\beta}_2^{OLS} = \frac{\sum(r_i-\bar{r}_i)(L_i-\bar{L})}{\sum(r_i-\bar{r}_i)^2} = \frac{\sum(r_t-\bar{r}_i)(\beta_1+\beta_2 r_i+\epsilon_i^D-\beta_1+\beta_2\bar{r}_i+\bar{\epsilon}_i^D)}{\sum(r_i-\bar{r}_i)^2} = \beta_2 + \frac{\sum(r_i-\bar{r}_i)(\epsilon_i^D-\bar{\epsilon_i^D})}{\sum(r_i-\bar{r}_i)^2}$$

Thus the estimator is biased because the second right hand side term is a linear function of structural disturbances of both equations. This is evident if we assess the reduced form equation for the interest rate. Then, what is it exactly what we estimate through OLS in such a context?

$$\text{plim}\frac{\sum(r_i-\bar{r}_i)(\epsilon_i^D-\bar{\epsilon_i^D})}{\sum(r_i-\bar{r}_i)^2} = \frac{\text{plim}\frac{1}{N}\sum(r_i-\bar{r}_i)(\epsilon_i^D-\bar{\epsilon_i^D})}{\text{plim}\frac{1}{N}\sum(r_i-\bar{r}_i)^2}$$

Let us analyze this last term – numerator and denominator – separately.

$$\begin{aligned}
\text{plim}\frac{1}{N}\sum(r_i-\bar{r}_i)(\epsilon_i^D-\bar{\epsilon}_i^D) &= \text{cov}\left(\epsilon_i^D, \frac{1}{1-\alpha_2/\beta_2}\left[\frac{\alpha_1-\beta_1}{\beta_2} + \frac{\alpha_3}{\beta_2}\mathbf{z} + \frac{1}{\beta_2}(\epsilon_t^S-\epsilon_t^D)\right]\right) \\
&= \frac{1}{1-\frac{\alpha_2}{\beta_2}}[\text{cov}(\epsilon_t^D, \frac{\alpha_1-\beta_1}{\beta_2}) + \text{cov}(\epsilon_i^D, \frac{\alpha_3}{\beta_2}\mathbf{z}) + \text{cov}(\epsilon_i^D, \frac{1}{\beta_2}\epsilon_i^S) + \\
&\quad +\text{cov}(\epsilon_i^D, -\frac{1}{\beta_2}\epsilon_i^D)] \\
&= \frac{-1/\beta_2}{1-\frac{\alpha_2}{\beta_2}}\sigma^2_{\epsilon_D}
\end{aligned}$$

$$\begin{aligned}
\text{plim}\frac{1}{N}\sum(r_i-\bar{r}_i)^2 &= \frac{1}{(1-\frac{\alpha_2}{\beta_2})^2}\{\text{var}(\frac{\alpha_3}{\beta_2}\mathbf{z}) + \text{var}(\frac{1}{\beta_2}\epsilon_i^S) + \text{var}(-\frac{1}{\beta_2}\epsilon_i^D) \\
&\quad +2\text{cov}(\frac{\alpha_3}{\beta_2}\mathbf{z} + \frac{1}{\beta_2}\epsilon_i^S) + 2\text{cov}(\frac{\alpha_3}{\beta_2}\mathbf{z}, -\frac{1}{\beta_2}\epsilon_i^D) + 2\text{cov}(1\beta_2\epsilon_i^S, -\frac{1}{\beta_2}\epsilon_i^D)\} \\
&= \frac{1}{(1-\frac{\alpha_2}{\beta_2})^2}\left\{\left(\frac{\alpha_3}{\beta_2}\right)^2\sigma_z^2 + \frac{1}{\beta_2^2}\sigma^2_{\epsilon_S} + \frac{1}{\beta_2^2}\sigma^2_{\epsilon_D}\right\}
\end{aligned}$$

Then,

$$\begin{aligned}
\hat{\beta}_2^{OLS} &= \beta_2 + (\alpha_2 - \beta_2)\left[\frac{\sigma^2_{\epsilon_D}}{\alpha_3^2\sigma^2_{\mathbf{z}} + \sigma^2_{\epsilon_S} + \sigma^2_{\epsilon_D}}\right] \\
&= \alpha_2\left[\frac{\sigma^2_{\epsilon_D}}{\alpha_3^2\sigma^2_{\mathbf{z}} + \sigma^2_{\epsilon_S} + \sigma^2_{\epsilon_D}}\right] + \beta_2\left[1 - \frac{\sigma^2_{\epsilon_D}}{\alpha_3^2\sigma^2_{\mathbf{z}} + \sigma^2_{\epsilon_S} + \sigma^2_{\epsilon_D}}\right]
\end{aligned}$$

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