The Effects of the 1994 Mexican Financial Crisis on Firms' Investment Activity

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ABSTRACT: This paper finds evidence of the existence of rigidities in the Mexican credit market, thereby lending support to the important role of firm's internal funds in taking advantage of investment opportunities. Using balance-sheet data on firms listed in the Mexican Stock Market between 1988 and 2002, we find that the importance of internal funds varies according to firms' charactersitics and that the 1994 Mexican financial crisis modified firms' access to credit. The modification that a particular firm witnessed was determined by their leverage ratio and export activity. Exchange rate overshooting lead to increased income streams for export oriented firms, thus increasing their credit access. Meanwhile, the net-worth of highly leveraged firms dropped due to the increase in the value of their debt

I. Introduction

The behavior of the Mexican economy during the 1990's can be explained by two main features. The first is the consolidation of a series of structural reforms initiated in the 1980's, which aimed to reduce the distortions in the economy[1]. The second was the Mexican financial crisis.

The reforms launched in the 1980's have determined the characteristics of the current economic structure. As a result of these reforms, the public sector decreased its participation in economic activity. At the same time, the government tried to increase revenues through fiscal reform and began a deregulation process meant to increase the efficiency of production activities. Mexico also experienced an important commercial opening[2].

These reforms, accompanied by the financial liberalization carried out at the end of the 1980's, increased the attractiveness of Mexico in the eyes of international investors. At the same time, technological progress simplified commercial and financial transactions generating large flows of merchandises and capitals between countries. The result of this combination was a large flow of foreign resources into Mexico between 1990 and 1994[3].

This flow of foreign savings was followed by a domestic credit expansion that lacked adequate regulation. The government's commitment to the support of the exchange rate, in a semi-fix regime, created a large private debt in foreign currencies. This high leverage, in pesos and dollars, made the private sector vulnerable to changes in the interest and exchange rates.

The real exchange rate misalignment, which limited the competitiveness of the exporting sector and provoked an important current account deficit, placed the government in a predicament. If the government favored competitiveness through devaluation, the private sector with foreign denominated debt would be jeopardized. On the other hand, if

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[1] An exccelent review of the structural reforms in Mexico is given by Sales Sarrapy, Carlos, "La reforma económica", in *México a la hora del cambio*, Cal y Arena, Mexico.

[2] On this issue see Kessel, Georgina, "Liberalización Comercial y Crecimiento Económico", in *México a la hora del cambio*, Cal y Arena, Mexico.

[3] According to Guillermo Ortiz, Governor of the Bank of Mexico, from 1990 to 1994 Mexico received between 1/3 and ½ of the emerging markets portfolio flows. Capital account balance passed from 1.4% of GDP in 1989 to 7.8% of GDP in 1991 and 8.1% of GDP in 1993. Meanwhile, portfolio investment grew from 0.2% of GDP in 1989 to 4.1% of GDP in 1991 and 7.2% of GDP in 1993.

the exchange rate faced pressure and a defense of the parity was required those with debt in pesos would be affected by the higher interest rates.

In 1994 a succession of political events weakened the confidence of investors. At the same time, the Mexican government accumulated debt with short maturity that exceeded the diminished reserves of the Central Bank. Given the possibility of government liquidity problems, coupled with the desire to avoid potential looses in case of devaluation, investors flee the country validating a financial crisis.

The effects of the crisis were felt differently in the sectors of the economy. Using the structure generated by commercial openness, the exporting sector took advantage of the exchange rate over-shooting to increase its share in the international markets. All other sectors of the economy suffered as a consequence of a substantial drop of consumption and investment.

The crisis affected the mechanisms for financing transmissions, which is the main focus of this analysis. Specifically, we will investigate whether the crisis modified the credit conditions faced by firms listed in the Mexican Stock Exchange Market. We will analyze the direct effect of the financial crisis on firms' balance sheets and the consequence of this effect on their ability to access credit needed to finance investment opportunities.

There are some studies that analyze investment activity and credit market restrictions in Mexico. Conesa (1997) and Gelos and Werner (1998) focus on the effects of the financial liberalization, while Castañeda (2001) and Sánchez (2001) analyze the 1994 financial crisis episode. These analyses have been done using information of firms in the manufacturing sector (Gelos and Werner (1998) and Sánchez (2001)), and information of firms listed in the Mexican Stock Market (Conesa (1997) and Castañeda (2001)).

In general, the results obtained by these researches have found the existence of a financial accelerator mechanism. Financial liberalization relaxed the credit constraints, while the financial crisis tightened them. In addition, these studies reported that the effects varied according to different characteristics related to agency costs.

The contribution of this paper is to analyze the direct effect -through changes in net worth- that the crisis had over the firms' balance sheets and its consequences for access to credit. This will be useful because it can give us a framework in which to think of the consequences of those events that modify the firms' financial positions.

In the next section we will introduce and review the literature on the crisis propagation mechanism: the financial accelerator. Section III contains the empirical analysis and we will point out some problems with this methodology. Finally, we will present some conclusions.

II Financial Accelerator

II.1 Introduction

This section presents a partial equilibrium analysis of business fixed investment under asymmetric information problems. This framework will help us to understand the effect of information problems in credit markets and investment activity. We will see that these imperfections can generate sub-optimal credit allocations, as well as credit contractions and a differentiated access to credit between firms with different agency problems. This section ends with a review of the literature on this subject.

II.2 Financial Accelerator

Changes in credit market conditions amplify and propagate real and monetary shocks. Bernanke, Gertler and Gilchrist (1996) define the amplification of initial shocks produced by changes in credit market conditions as the ***financial accelerator*** mechanism[4]. This mechanism rests on the idea that asymmetric information problems between borrowers and lenders generates a gap between the costs of external and internal financing, *i.e*. financial resources in credit markets are more expensive than the opportunity cost funds internal to the firm. Also, given the financing requirements, the premium paid in credit markets is negatively correlated with borrower's net worth. An adverse shock that causes a reduction in this net worth increases the need for external funds, while at the same time it raises the premium. These factors create a contraction in output through the diminution in investments and consumption.

Asymmetric information problems become relevant because it is costly to monitor borrowers' activities. These informational problems are important because they alter

[4] Bernanke, Ben, Mark Gertler and Simon Gilchrist, "The Financial Accelerator and the Flight to Quality", The Review of Economics and Statistics, February 1996, 78 (1), pp. 1.

financial market's efficiency in the assignment of resources to profitable activities. One example of the consequences of these agency problems is credit rationing[5].

The cost gap between internal and external financing is justified by the probability that a portion of the borrowers does not pay back their loans. Given the impossibility of identifying those borrowers who will not pay, lenders charge a premium over the opportunity cost of funds[6]. This premium also covers monitor expenses.

Resources that can be used to finance investment opportunities and assets that can serve as collateral to guarantee some portion of the credit define the borrower's net worth. Higher own resources reduce the proportion of investment that is financed by external resources[7]. A higher value of assets that can serve as collateral reduces the proportion of uncovered credit. These elements justify the negative correlation between borrower's net worth and external financing premium.

When a borrower experiences a diminution in her cash flows, drops in the value of her assets and/or rises in the value of her debt, then she suffers a drop in her net worth. This will decrease the internal financing resources at the same time that it will raise the premium for external funds. Higher information asymmetries in the credit markets will be associated with larger borrowing constraints. Forgiven investment opportunities will amplify the initial adverse shock.

There are different factors that can provoke a diminution of firms' net worth. Drops in demand, a productivity drop or a deflationary process can cause these lower cash flows. Higher interest rates could reduce the value of the assets that can be used as collateral at the same time that they increase the value of debt. Another factor that can increase the debt value is a change in the price at which it was contracted[8].

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[5] Credit rationing idea was proposed by Stiglitz, Joseph E., and Andrew Weiss, "Credit Rationing in Markets with Imperfect Information", American Economic Review, 1981, 71, pp. 394 – 395.

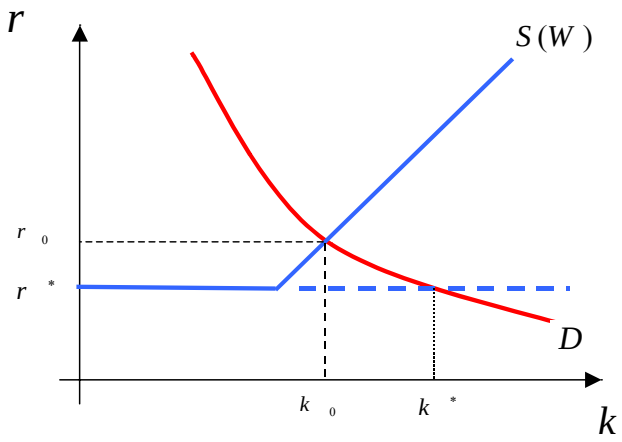
[6] In this case the opportunity cost is equal to the cost of self-financing.

[7] Jaffee and Stiglitz (1990) indicate that larger credits are usually associated to a higher default probability generating a higher interest rate.

[8] In our case, an increase in value of the debt denominated in a different currency as the one that the borrower has as main source of income.

Now, we present a graphic analysis developed by Hubbard[9] (1997) that illustrates the relation between internal resources and investment in an imperfect information framework. This analysis will help us to clarify the previous ideas.

Figure 1



This figure represents a firm's investment demand and the credit supply that it faces. Capital (k) is in the horizontal axis, while the cost of capital, r, is depicted on the vertical axis. The demand curve, D, has negative slope as an increase in the cost of capital decreases the quantity demanded of capital.

In a neoclassical model of investment the supply curve is depicted as a horizontal line in *r*, the market interest rate adjusted by risk. In contrast, the supply curve with asymmetric information, S, has two segments: one horizontal and another with positive slope. The horizontal segment corresponds to the capital that can be financed with own resources and with funds covered by collateral[10]. Meanwhile, the segment with positive slope is associated with the premium on external finance. A longer horizontal segment represents a higher net worth which can be used to finance investment opportunities. A higher asymmetric information problem is graphed with a steeper segment for the external resources.

Firm's equilibrium capital level is determined by the intersection of supply and demand. If this intersection occurs in the horizontal segment of the supply curve, that is the

[9] Hubbard, R. Glenn, "Capital-Market Imperfections and Investment", NBER Working Paper No. 5996, National Bureau of Economic Research, 1997.
[10] This point assumes the existence of a legal framework that assures the guaranty transfer in case of no payment.

firm has enough funds to finance its investment opportunities, the equilibrium capital level is the same as in the perfect market neoclassical model. However, if the firm requires more funds than those internally generated and the intersection occurs in the supply segment with positive slope, the equilibrium level of capital is lower than the one without information asymmetries. Therefore, given asymmetric information problems in the credit markets, we have a suboptimal level of investments.

In this graphical analysis we can see the points previously stated: i) the difference between the two segments in the supply curve reflects the gap between internal and external financing associated with agency problems; ii) there is a negative correlation between the premium paid for external financing and net worth, because higher own resources implies a lower use of external funds. A drop in firm's net worth shortens the supply's curve horizontal segment. This adverse shock increases the requirement of external funds and is associated with a higher cost of external financing, leading to a reduction in investment activity.

II.3 Empiric Literature

The empirical studies that analyze the effects of information problems in business fixed investment activity have developed in two ways. On one side, there are studies that use historic episodes to analyze the consequences of a drop in firm's net worth on investment. On the other, studies use firm level data to classify firms according to agency problems and try to detect if there is differentiated access to credit.

Fisher (1933) explained how a deflationary process could affect firms' net worth trough an increase in the real value of debt. Analyzing the 1929 US Great Depression, he found that over-indebtedness provoked a deflation and that this deflation increases the debt value. According to Fisher's own words: "when over-indebtedness is so great as to depress prices faster than liquidation, the mass effort to get out of debt sinks us more deeply into debt"[11].

Calomiris and Hubbard (1985) offered another example in which a drop in business net worth affected investment activity. These authors pointed out that large price flexibility

[11] Fisher, Irving, "The Debt-Deflation Theory of Great Depressions", Econometrica, October 1933, 1 (4), pp. 350.

could be a destabilizing factor as this could aggravate markets imperfections in the credit market. US prices showed low rigidity between the Civil War and the First World War[12]. As in Fisher (1933), those deflationary periods increased real interest rate and the real value of debt. These changes in debt value constrained borrowers' capacity to access credit.

Bernanke and James (1990) explained that the Gold Standard between the First and Second World Wars had a deflationary bias[13]. They analyzed the performance of 24 countries under the Gold Standard and found that financial factors, especially bank panics, had an important effect in explaining the relation between drops in prices and production. Bernanke and James concluded that, in every one of the 24 countries, the deflationary process had an effect in the economic cycle through its effects in the credit market.

Honkapohja and Koskela (1999) offered an example in which high levels of indebtedness lead to the reduction in net worth at the time of a crisis. In their study of the 1992 Finland's financial crisis they found that the financial factors acted as a propagation mechanism. The increase in interest rates, aimed at defending the fixed exchange rate, and the posterior exchange rate devaluation had negative effects over consumption and investment. This effect was magnified by the high levels of indebtedness registered by the firms and the households, and added to the fact that a significant proportion of that debt was denominated in foreign currency. During the economic depression the financial variables affected investment directly, and this effect was deeper for those firms who faced financial constraints previous to the crisis.

The studies at the firm level to test for differences in the access to credit have their origin in the work by Fazzari, Hubbard and Petersen (1988). In this study, these authors divided firms in different categories that *a priori* might have different access to credit[14]. They found that business fixed investment activity is more sensible to the evolution of financial variables (cash flows) in those firms that *a priori* might faced higher credit constraints.

Fazzari, Hubbard and Petersen's results have been replicated by several studies that use different data sets and other criteria to divide firms between constrained and

[12] Relatively to that observed in the period after the Second World War.
[13] This deflationary bias was provoked by several factors; among them was the asymmetry in the gold flows between countries with commercial surplus and deficit.

unconstrained. The studies at the firm level have been performed with samples of different countries, in different time periods, using firms from different economic sectors and including firms listed and not listed in the stock markets. The criteria to divide firms by their access to credit have been: dividend policy, size, age, belonging to an industrial conglomerate, exporting activity and property structure among others.

Some of the studies in the lines of Fazzari Hubbard y Petersen (1988) are: Schaller (1993) for Canada, Jaramillo, Schiantarelli and Weiss (1993) for Ecuador, Schiantarelli and Sembenelli (1995) study the Italian case, Hoshi, Kashyap and Scharfstein (1991) analyzes the Japanese experience, Devereux and Schiantarelli (1990) consider the United Kindom, Conesa (1997a), Gelos and Werner (1997) and Sánchez (2001) cover the Mexican case.

In their analysis of the financial accelerator and the flight to quality, Bernanke, Gertler and Gilchrist (1996) gave elements to test the hypothesis that in the bad circumstances credit turns more scare for those borrowers with higher agency costs. This is shown in direct form through the share of credit received by different borrowers and indirectly in terms of the combination of financial instruments in which credit is supplied.

Studies on Mexico

Gelos and Werner (1998) analyzed the effects of the financial factors and the financial liberalization on the investment activity of Mexican manufacture sector firms. In this study they found that the financial variables and the value of the assets that could serve as collateral are important to explain the investment activity, which gives evidence of frictions in the Mexican credit market. These authors claimed that the financial liberalization process created a higher liquidity that allowed many firms the access to credit[15].

Sánchez (2001) studied how changes in interest rates affects investment activities of firms in the manufacture sector in Mexico. As in Gelos and Werner (1998), this study found that the firms in this sector face credit restrictions. Also, it found that investment expenditure is sensible to changes in the real interest rate, but this effect is different

[14] In this study they divide the sample according to the firms' dividend policy, considering those that distribute few dividends as the ones that face higher credit constraints.

[15] These authors suggest that it was the increase in liquidity, rather than the reduction in the premium on external financing, what made possible to relax the restrictions in the credit market.

between firms of different size as smaller firms have a higher sensitivity. These results suggest that small firms have higher agency costs that limits further their access to credit.

Conesa (1997a) analyzed the effects of the financial liberalization in the capital structure and the investment decisions of the firms listed in the Mexican Stock Market. Especially, he analyzed if the financial liberalization relaxed the credit constraints associated with information asymmetries. According to this study, after the financial liberalization bigger firms, those more exported oriented, the ones that belong to a business group and those with a highly liquid stock faced less restrictions than the other firms, which allowed them to modify their capital structure[16].

Conesa (1997b) found that after the financial liberalization the Mexican firms listed in the stock market increased the share of foreign denominated debt in their portfolio. The gap between the cost of peso denominated and foreign currency denominated debt increased the incentive to increase the share in foreign debt, and this incentive only dropped with the possibility of an adjustment in the exchange rate.

Martínez and Werner (2001) analyzed the change in private sector's debt composition when moving from a fixed to a free float exchange rate regime in December 1994. These authors claim that the fixed exchange rate regime biased the use of foreign currency denominated debt because of an implicit government guarantee. In this study, they found that during the fixed exchange rate period the main factor that explains the share of foreign denominated debt is the size of the firm (bigger firms had a higher share of foreign denominated debt), while during the free float period the only explanatory variable is firms' exporting activity.

Confirming the results of Martínez and Werner, Castañeda (2001) found that the exporting firms had a higher access to credit after the 1994 crisis. Castañeda pointed out that the economic recovery was supported by a transfer of resources from the exporting to the non-export sector. Especially, he emphasized the importance of the business groups due to the intense capital market at the interior of the firm. After the crisis the sources of external financing, at least through the traditional sources: bank credits and capital and stock markets, were severally reduced, while the commercial credit gained importance.

[16] These firms got more credit, a higher access to the stock market (mercados de valores), they got more foreign denominated debt and increase the maturity of their credits.

III Empirical Analysis

III.1 Introduction

In this section we develop the empirical analysis to test for the existence of a financial accelerator in the firms listed in the Mexican Stock Market between 1993 and 2000. In the first subsection we explain the methodology used to perform the test. In the second subsection we talk about some problems with the type of methodology employed and some strategies used to correct them. Finally, we show the econometric analysis and the results obtained.

III.2 Empirical Strategy

In this study we analyze the effects of the 1994 currency and financial crisis on the access to credit experienced by the firms in Mexico. We present a study at the firm level to see the relation between asymmetric information problems, changes in net-worth and access to credit. If the information problems are significant we will see that, firms with different characteristics had a differentiated access to credit. Also, we will analyze the behavior of firms during the crisis as a result of changes in their balance sheets. We will study the effect of a drop in their net-worth and their dependence on external flows to invest.

In performing this test it is important to measure and control for firm's investment opportunities. According to the Hubbard's diagram presented in the previous section, investment opportunities are measured by movements in the demand curve. An increase in investment opportunities will move the demand curve to the right.

Also, it is important to measure and control for changes in net-worth and changes in the agency problems. According to the same diagram, changes in net-worth will be measure by variations in the horizontal segment of the supply curve, an increase in net-worth enlarges this part. Meanwhile, informational problems change the slope of the supply curve, higher information costs makes this segment steeper.

Also, it is necessary to distinguish between these changes, because there could be variations in net-worth uncorrelated with changes in investment opportunities. At the same

time, there could be variations in the information asymmetries uncorrelated to changes in investment opportunities[17].

One way to measure investment opportunities is by comparing the marginal return of each unit of investment with it marginal cost. Investment will be profitable if the marginal benefit is higher than the marginal cost, so the firms should invest up to the point in which these two measures are equal. Tobin (1969) developed one method to do this comparison, in which he proposed that firms base their investment policy according to the following ratio known as Tobin's "q":

$$q = \frac{\text{Market Value of Installed Capital}}{\text{Replacement Cost of Installed Capital}}$$

If q is bigger than one, there are investment opportunities as the market value of each investment unit is larger than its cost. When q is lower than one, firms should not replace capital as it depreciates.

Hayashi (1982) extended the Tobin's "q" theory by assuming certain properties in the capital adjustment cost function. Hayashi showed that if this cost function is quadratic then there is equivalence between the average Q and the marginal q[18]. The average Q can be constructed using financial data on the firms' market value (price of stocks) and the replacement cost of installed capital[19].

Therefore, we can express a relation between investment activity and average Q in the following way:

$$\frac{I_t}{K_{t-1}} = \alpha + \beta Q_t + \varepsilon_t$$

Where I_t is investment in time t, K_{t-1} is capital in time t-1, Q_t is the average Q at time t and α and β are parameters and ε is an error term.

[17] An example of this case would be the creation of a Credit Bureau that reduces information asymmetries, while investment opportunities remain unchanged.

[18] The assumptions behind this equality are: perfect competition in the factors market and firm's product market, homogeneous capital, linear homogeneous production technology and adjustment cost functions and independence between investment and financing decisions.

[19] Generally researchers use the book value re-expressed by inflation, however this value could be different to the replacement cost of installed capital at market prices.

In the case of our sample of firms from the Mexican Stock Market it is possible to construct average Q for the firms. However, many of the stocks are traded infrequently and it is not strange that the prices of some stocks remain unchanged for several quarters. Therefore, we are going to measure changes in investment opportunities by changes in sales divided by capital stock[20]. The inclusion of sales has the objective to control for changes in firm's product demand.

According to the neoclassical theory of investment in a correctly specified model, i.e. capturing all investment opportunities, the inclusion of financial variables should not be significant to explain firms' investment decisions. This logic is based on the work developed by Franco Modigliani and Merton Miller (1958), which showed that, under certain conditions, the finance structure and policy are irrelevant for business investment decisions. According to Modigliani-Miller, in a context of perfect capital markets, firm's finance structure does not modify its value, and therefore financing decisions should only be determined by the objective of maximizing the value of the firm.

In our setting, with credit market imperfections generated by asymmetric information problems, the financial variables become relevant to explain firm's investment activities. In this study, we are going to include firm's cash flow as a financial variable to explain firm's investment activity. A positive and significant cash flow will give evidence against a frictionless model and will reveal the presence of restrictions in the credit market[21].

Then, our specification for investment (I_t), including change in sales ($S_t - S_{t-1}$) to control for firm's investment opportunities and cash flow (CF_t) to see if financial variables are important, is:

$$\frac{I_t}{K_{t-1}} = \alpha + \beta \frac{(S_t - S_{t-1})}{K_{t-1}} + \delta \frac{CF_t}{K_{t-1}} + \varepsilon_t$$

Under the assumption of perfect information all the firms would face the same, adjusted for risk, credit supply curve (in last chapter's diagram it would be a common S

[20] This strategy has been followed by some authors, for the case of Mexico Conesa (1997) used it in a sample of firms from the Mexican Exhange Stock Market, Gelos and Werner (1997) and Sánchez (2001) applied the same strategy to study the manufacture sector.

[21] Here it is important to identify if the cash flow is correlated with future profits because a positive and significant relationship between cash flow and investment expenditure could be giving evidence of a relation

curve, horizontal at the level of the opportunity cost of the lend funds). However, in an asymmetric information context, borrowers with different characteristics will face different credit supply curves (different S according to firm's characteristics). Those firms with lower agency costs would face a lower premium for external funds (a smaller slope in the S curve). At the same time, those firms with higher net-worth would have more internal funds to finance investment (a larger horizontal segment of the S curve). Therefore, those borrowers with higher agency cost would depend more one their own resources to finance investment opportunities, while they will face a higher premium.

To test for the existence of different credit supply curves for firms with different characteristics, we are going to follow the methodology proposed by Fazzari, Hubbard and Petersen (1988) in which we are going to make an *a priori* classification of firms between those that supposedly should have different agency costs and therefore different credit supply curves. Also, we will analyze an episode in which a subset of firms faced a decrease in their net-worth to study if this event exacerbated their credit constraints. In general, we expect that those firms that have higher agency costs and those that suffered a sharper decrease in their net-worth after the 1994 Mexican financial crisis faced a higher credit rationing and increased their dependence on internal flows.

A priori classification to divide firms according to their asymmetric information problems is made in 2 categories: size and exporting activity[22]. Meanwhile, to analyze the effects of drop in the net-worth, we divide firms according to their debt level at the time of the crisis. Additionally, we divide firms by their economic activity to test if there is a differentiated behavior between sectors.

The division by size splits firms in two samples: big and small, according to the value of their assets at the end of 1993. Information theory suggests that bigger firms generally face lower credit restrictions because they have more assets that can serve as collateral. At the same time, the transaction costs for stocks and debt emission tends to decrease with size. Also, bigger firms are generally more diversified as they operate in a wider range of economic activities.

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between investment and future profits. This and other problems with the methodology will be analyzed in the last section of this chapter.

[22] The appendix shows which firms are in each group.

The division by exporting activity separates firms between high and low export oriented by their activity in 1993. Here, we assume that export oriented firms face lower credit constraints because exporting activity lowers agency costs as exports can be associated with efficiency. Also, exporting firms have a greater access to international finance sources because their incomes in foreign currency are more acceptable as colateral.

As we mentioned earlier, in order to examine the effect of a drop in net-worth we divide firms by their debt level at the time of the crisis. We are going to assume that those firms highly indebted suffered a sharper drop in their net-worth as a consequence of an increase in the value of their debt. Foreign denominated debt increased as a consequence of the peso devaluation at the end of 1994, while peso denominated debt rose by the increase in interest rates.

III.3 Problems with the Methodology

We are going to list the main problems of Panel Data analysis as the one performed here[23], as well as the strategy employed to try to correct them.

(1) *A priori* classification of firms.

One could ask if it is convenient to split firms and if this division leads to consistent results? It is more logic to think that at different moments, each firm faces different credit restrictions. In our case, the division by categories is needed because we want to compare the differentiated effect of the 1994 shock on firms with different, *a priori*, characteristics. We wanted to see if firms with different agency costs and a different debt positions faced a different access to credit and how this access changed after the crisis. The division by firms of different economic sectors has the objective to test for a differentiated response to crisis of firms from different economic activities.

(2) Q as a good approximation of investment opportunities.

A problem of the studies as the one performed here has to do with the correctly measurement of the investment opportunities. Generally the marginal "q" is different from the average Q as a consequence of the violation of the assumptions that justify their equality[24]. As we mentioned previously, in this study we do not use average Q because the

[23] Here we follow the revision made by Hubbard (1997).

[24] Especially if investment and financing decisions are not independent. Also, when firms have monopolistic power in their market.

Mexican Stock Market is thin and many of the actions are traded sporadically and it is no strange that the price of some actions remain unchanged for several quarters. Fazzari, Hubbard and Petersen (1988) pointed out that the omission of the marginal "q" does not alter significantly the results of an estimation of the accelerator type. To control for investment opportunities we use the change in sales, which is intended to control for the expected change in firm's products demand.

(3) Identification of changes in net-worth independent of changes in investment opportunities (isolate changes in W and S(W) from changes in D in last section's graph).

As a result of the investment opportunities measure, the significance of variables that try to measure worth (as cash flow) could be influenced by the error component in the investment opportunities. When we perform the Hausman test we got evidence that the error term is correlated with the explanatory variables. This problem was corrected by a fixed effects (within-groups) estimation.

It is important to mention that we are studying a period in which there was a sharp drop in net-worth through the huge increase in the real value of debt. But this period should have been associated with changes in investment opportunities associated to changes in firms product demand. Even more, these change in demand was differentiated between exporting and non-exporting firms with the former group having a positive effect and the latter a negative one.

(4) Risk-related differences in the cost of external finance.

We think that firms' classification does not correspond only to cost differences associated to risk differences. As an example, consider those firms that have larger debt, which could be associated with a greater access to credit at a lower cost. However, these firms were the ones that experienced tighter restrictions after the crisis.

(5) Links between cash flow and investment in non-value-maximizing firms.

The use of cash flows to finance investment activities could be dissociated from a firm's value maximizing process and could respond to a management use of internal funds[25]. In this case, larger investment could be associated with higher cash flows and not necessarily

[25] This point was proposed in Jensen, Michael, "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers", American Economic Review, May 1986, 76 (2), pp. 323- 329.

with higher investment opportunities. In the case of Mexico, firms have a very concentrated ownership structure that reduces the agency problems related to non-value-maximizing objectives. In the case of our sample, we found that those firms with a higher cash-flow as proportion of capital (CF/K) are not the ones that have the higher investment activity.

III.4 Econometric Analysis

The sample of our econometric analysis is composed of 93 firms that were listed in the Mexican Stock Market between 1993 and 2000. We used quarterly data of the financial statements reported by these firms to the financial institution. The definition of each variable, as well as the respective reference in the financial information catalogs can be consulted in the appendix.

The estimation that we will test is:

$$\frac{I_{it}}{K_{i,t-1}} = \alpha_i + \beta \frac{(S_{it} - S_{i,t-1})}{K_{i.t-1}} + \delta \frac{CF_{it}}{K_{i,t-1}} + \lambda D \frac{CF_{it}}{K_{i,t-1}} + Crisis + \eta_i + \varepsilon_{it}$$

where I is investment, K represents capital, S denotes sales, CF stands for cash flow, D is a time dummy variable that takes the value of 1 between Q1:1994 and Q4:1996 and the value of 0 elsewhere, Crisis is another time specific dummy variable that takes the value of 1 only in Q4:1994 and Q1:1995, η is a firm specific effect and ε is an error term.

As we mentioned before, change in sales is intended to control for changes in investment opportunities. Cash flow will give evidence about the importance of financial variables to explain investment expenditure, at the same time that it will reveal the existence of restrictions in the credit market. The time dummy variable for the 1994-1996 period has the objective to measure if the credit restrictions were magnified during the crisis period[26]. Meanwhile, the dummy variable Crisis is intended to control for the economic and financial shock experienced at the end of 1994.

[26] We include all 1994 because, although, Mexico registered economic growth (4.4%) and the financial crisis took place at the end of the year, as we will see in the next chapter, the country experienced a political crisis derived from a guerrilla uprising and political assassinations that provoked important changes in the financial system. Also, we include all 1996 because even when the economy registered economic growth every quarter (year over year) and registered an average 5.2% growth during the year, these figures are the result of a weak

As our specification includes firms' specific effects, η, we need to verify if this are correlated with other explanatory variables. In case that they are not correlated, we can consider the firms' specific effects as an additional source of random variation and the Ordinary Least Squares (OLS) estimators are consistent but inefficient, while the random effects estimators through a Generalized Least Squares (GLS) method are consistent and efficient. On the other case, if there is evidence of correlation between the firms' specific effects and the explanatory variables then both the estimation by OLS and GLS will be inconsistent and it is necessary to perform a within-groups (fixed effects) estimation[27]. In the case of our sample, the Hausman test gave evidence of correlation. Therefore, we performed our estimations using a within-groups (fixed effect estimation).

III.4.1 Analysis by Categories

Now, we present the results of the study when we divide the firms by category according with their size, their exporting activity and their debt level. The number in parenthesis below each category denotes the number of firms in each group (the firms that integrate each group can be seen in the appendix). Latter, we will present the results obtained when we divide the firms by sectors of economic activity.

The first point to highlight is that the cash flow is positive and significant at the 1% level in all the categories. This can be associated with the existence of rigidities in the credit market because firms depend on their revenue to carry out investments. This result is similar to those find by most studies with a similar specification that includes financial variables trying to explain investment.

The next point to analyze is the differentiated effect that the 1994 financial crisis had in the relation between cash flow and investment expenditure for the firms in the different categories. In the case of the whole sample we observe that there is a positive and significant effect, which reflects that the firms depended more on their internal resources to invest as a consequence of a drop in credit. However, the effect was differentiated as bigger

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comparison base because in 1995 Mexican economy registered a 6.2% drop. Also, it is not extreme to suppose that the effects of the crisis continued to have a significant impact in part of 1996.

Financial Accelerator Model Estimation

Generalized Least Squares with Fixed Effects

Category	All	Size	Exports	Debt
	(93)	Big (23)	High (19)	High (24)
CF/K	0.189***	0.365***	0.340***	0.109***
	(0.014)	(0.028)	(0.088)	(0.010)
(CF/K)*$D_{94\text{-}96}$	0.059***	0.170***	-0.097**	0.353***
	(0.018)	(0.017)	(0.039)	(0.011)
S	0.072***	0.022***	0.075***	0.033***
	(0.005)	(0.007)	(0.012)	(0.003)
D $_{(94:04\text{ - }95:01)}$	0.022***	0.025***	0.013***	0.036***
	(0.001)	(0.002)	(0.002)	(0.001)
Observations	2598	644	526	672
R^2	0.168	0.236	0.3	0.143
F	206.9	75.02	81.13	46.27

	Small (70)	Low (74)	Low (69)
CF/K	0.181***	0.158***	0.213***
	(0.013)	(0.014)	(0.035)
(CF/K)*$D_{94\text{-}96}$	0.017	0.085***	0.005
	(0.021)	(0.020)	(0.044)
S	0.077***	0.071***	0.082***
	(0.005)	(0.006)	(0.013)
D $_{(94:04\text{ - }95:01)}$	0.021***	0.026***	0.018***
	(0.001)	(0.001)	(0.002)
Observations	1954	2072	1926
R^2	0.14	0.136	0.165
F	130.34	133.93	150.76

Standard errors in parenthesis
***, ** and * indicate 99%, 95% and 90% significance respectively

[27] To decide the appropriate estimation method (random effects or fixed effects) we performed a Hausman test. This test is based on the idea that under the null hypothesis there is no autocorrelation, OLS and GLS estimators are consistent, but OLS are inefficient.

firms[28], those with lower exporting activity and those with a high leverage were more leverage were more affected by a reduction of credit. Small firms and those with a moderate debt level seem not to face tighter constraints with the crisis, while exporting firms were benefited. These results give evidence of a fly to quality, in which those firms with higher agency costs and/or those that experienced a greater diminution in their net-worth suffered a substantial worsening in their access to credit.

Change in sales, which is used as an approximation of investment opportunities, was positive and significant in all the cases as expected. The time dummy variable that is intended to control for the crisis is significant in all the cases.

Now, we analyze the results by category beginning by size. Bigger firms seem to depend more on their cash flows to finance investments (0.365) than smaller firms do (0.181). Also, only large firms where affected by the crisis to finance their investments (0.17). These results are different to what we expected under the assumption that bigger firms face lower information asymmetries than their counterparts.

Some studies as Hubbard (1990) and Whited (1992) have found that the relation between size and access to credit tend to disappear when it is controlled by financial variables (if the firm is highly liquid or if it belongs to a bond rating). For the case of Mexico, Conesa (1998) found higher sensitivity of the bigger firms listed in the Mexican Stock Market between 1987 and 1994, while Gelos and Werner (1998) and Sánchez (2001) found that the smaller depend more on internal flows to finance investment in the manufacture sector.

When we divide the firms by their exporting activity, we found that in those firms more exported oriented investment has a higher dependence on cash flows (0.340 versus 0.158 of the low-export firms). However, after the exchange rate devaluation at the end of 1994, were precisely the firms that exported more the ones that experienced a relaxation in their dependence of internal funds (-0.097) and had access to greater sources of external finance. On the contrary, those firms focused on the domestic market experienced a tightening on their credit constraints (0.085).

The results found by export category coincide with the ones found by Castañeda (2001) in the sense that exporting firms had a greater access to credit after the 1994 crisis.

[28] This is a contra intuitive result, however later we will give some arguments in order to explain it.

This is in line with the evidence reported by Martínez and Werner (2001) related to the importance of the exporting activity for access foreign denominated credit in the free float exchange rate regime.

In general, the firms that have a high level of debt depend less son their own resources to carry out investment. In the case of our sample, the coefficient that relates cash flows and investment in those firms highly leveraged (0.109) is lower than the one reported by less indebted firms (0.213). However, in the crisis period those firms that had a large debt experienced a greater contraction in their access to credit and depended more on internal generated flows (0.353), while the other firms, on average, did not registered an increase of their use of internal resources.

This differentiated behavior between firms with different debt levels is interesting because it gives evidence on how a drop in net-worth, as a result of an increase of the real value of the debt, affects investment activity. With the 1994 Mexican financial crisis the debt value of foreign and peso denominated debt rose as a consequence of the devaluation and the high interest rates. Highly indebted firms were more prone to suffer deterioration in their balance sheets and with this a drop in their access to credit. This result is similar, in the sense that a reduction in net-worth reduces the access to credit, to the debt-deflation episode reported for the 1929 Depression by Fisher (1993). This result gives evidence in line with the prediction of some general equilibrium models as Aghion, Bacchetta and Banerjee (2000) in which credit restrictions intensify when agents experience a drop in their net-worth[29].

III.4.2 Analysis by Sectors of Economic Activity

Now, we report the results obtained when we divided our sample of firms by their economic activity. It is important to mention that some sectors have very few firms listed in the Mexican Stock Market and as a result we have three groups with 5 or less firms. As in the previous table the number of firms is shown below the classification.

[29] Aghion, Baccheetta and Banerjee (2000) present a general equilibrium Third Generation financial crisis model in which the ability to get debt is a function of the agent net-worth. A drop in this net-worth, through an increase in the value of debt, further limits the capacity to get credit.

Financial Accelerator Model Estimation

Generalized Least Squares with Fixed Effects

Sectors	All (93)	Extraction (3)	Transformation (44)	Construction (13)
CF/K	0.189***	0.675	0.101**	0.136***
	(0.014)	(0.505)	(0.018)	(0.037)
(CF/K)*$D_{94\text{-}96}$	0.059***	-0.577	0.085***	0.294***
	(0.018)	(0.499)	(0.018)	(0.055)
S	0.072***	0.089	0.037***	0.054***
	(0.005)	(0.059)	(0.008)	(0.012)
D $_{(94:04 - 95:01)}$	0.022***	-0.013**	0.015***	0.047***
	(0.001)	(0.005)	(0.001)	(0.002)
Observations	2598	84	1226	364
R^2	0.168	0.031	0.17	0.114
F	206.9	2.88''	99.17	20.87

Sectors	Commerce (14)	Com. & Transp. (4)	Services (5)	Other (10)
CF/K	0.294***	0.083	0.628**	0.384***
	(0.099)	(0.317)	(0.299)	(0.057)
(CF/K)*$D_{94\text{-}96}$	-0.163	0.148	0.027	0.010
	(0.158)	(0.099)	(0.329)	(0.048)
S	0.086**	0.083**	0.127***	0.095***
	(0.039)	(0.038)	(0.030)	(0.015)
D $_{(94:04 - 95:01)}$	0.018***	0.029	0.063**	0.029***
	(0.006)	(0.028)	(0.028)	(0.007)
Observations	392	112	140	280
R^2	0.131	0.063	0.134	0.29
F	25.23	4.82	9.83	42.63

Standard errors in parenthesis
***, ** and * indicate 99%, 95% and 90% significance respectively

Differently from the result obtained when we divided by categories, here we see that not all sectors registered credit restrictions in the period outside the crisis. As in the division by categories, we have a differentiated behavior in the relation of cash flows and investment during the crisis period. Change in sales continues to be an important element to

control for investment opportunities and the time dummy for crisis continues operating although it is not significant for the Communications and Transportation sector.

Extraction sector only has 3 firms: Autlan, Grupo México and Peñoles. The firms in this sector do not register a dependence of cash flows for investment, which can be partially explained by the exporting activity of these firms. Also, this is the only sector in which change in sales is not significant even at the 10% level and the F-test for joint significance and it is only significant at the 5% level, while in the other cases this significance is at the 1% level.

Transformation sector contains the bigger number of firms in our sample (44). In this case we found that investment is partially financed with cash flows (0.101). Also, we found that during the crisis the use of own resources gained importance to finance investments (0.085).

Firms in the Construction sector were the ones that suffered more intensively the effects of the 1994 crisis. In this sector we have 13 firms that produce, mainly, non-tradable goods[30]. Here even when investment activity is linked to the availability of internal cash flows (0.136), during the crisis this dependency tripled when compared with the no-crisis period (0.294).

Commerce sector, dominated in our sample by super markets chains, drug stores and retail stores (tiendas departamentales), registered a high dependence on internal flows to finance investments (0.294). However, we observe that in the period of the crisis the firms of the commerce sector did not face higher credit restrictions than in other periods.

In the sector of Communications and Transport we have Grupo Radio Centro, Televisa, Teléfonos de México and Transportes Marítimos Mexicanos. As in the case of the Extraction sector, this group does not show evidence of credit restrictions during the crisis nor alter the crisis. In this case the joint significance F statistic is significant at 1% level.

Service sector has a similar behavior to Commerce in the sense that there is a very important relation between investment and cash flows (0.628). In this case, the sector is mainly integrated by firms associated with Tourism, which was partially stimulated by the 1994 peso devaluation, as Mexico became a cheaper place for international tourists. If the

[30] Cemex and Apasco that form part of this group represent notable exceptions, while some other firms in the construction sector have also extended their operations to other countries.

sector income is dominated by international tourism expenditure, then we would expect that this sector behaved as exporting firms in terms of expanding their access to credit. Unfortunately, the financial crisis caught many of these firms with high levels of foreign denominated debt which cancelled the potential effects of the peso devaluation.

Finally, the Mexican Stock Market presents a group of firms under the title of "others" ("varios"). The firms under this group have a positive and significant relation between cash flows and investment (0.384) and this relation did not increase with the crisis.

We can conclude that, in general, the firms in our sample exhibited a credit channel of the financial accelerator type. With the 1994 financial crisis there was a flight to quality in which those firms with higher agency problems suffered a further reduction in their access to credit. Also, we could observe that those firms with a higher level of debt at the time of the crisis experienced a drop in their net-worth through the increase in the real value of debt. This drop in their net-worth limited their capacity to get access to credit. Finally, we saw that the effect of the crisis was differentiated between firms of different economic sectors and those firms more export oriented were the ones that increased their access to credit.

IV. Conclusions

In this work we analyzed how information asymmetries have an important effect on the access to credit. Specifically we study how agency problems can provoke suboptimal finance assignations. Also, we analyzed how agents with different informational problems have different access to credit.

In one side, we gave evidence of the existence of rigidities in the Mexican credit market and the importance of firms' internal funds to take advantage of investment opportunities. However, the importance of these resources is differentiated according to the asymmetric information problems of each firm. Also, we saw that after the shock represented by the December 1994 Mexican financial crisis, the access to external sources of finance was different according to the effect that the firm had in the firms' balance sheets.

Export oriented firms were benefited in their access to credit by the higher income streams associated to the exchange rate over-shooting. Meanwhile, highly leveraged firms

suffered a drop in their net-worth through the increase in the value of their debt. When analyzing by the different sectors of economic activity we saw that the credit restriction problems were differentiated, as well as the effects of the crisis over the access to finance that each sector faced.

These results give evidence on how changes in the credit market conditions can propagate and magnify the effects of real and monetary shocks in the economy.

V Appendix

Data Set

The data set used consists of quarterly financial reports of firms listed in the Mexican Stock Market between 1993 and 2000. Since 1984, the accounting principles in Mexico require that financial statements are reexpresed to reflect inflation.

The definition of the variables used in this study is the following:

Sales (S): net sales (r01).

Domestic Sales (Sd): domestic sales (r21).

Exports (Sx): foreign sales (r22).

Investment (I): resources generated (used) in investment activities (c09).

Capital (K): net buildings, machines and equipment (s12).

Total debt (D): total liabilities (s20).

Short-term debt (Dst): short-term liabilities (s21)

Long-term debt (Dlt): long-term liabilities (s27)

Bank Debt (Db): short and long-tern bank loans (s23 + s26).

Dollar denominated debt (Dd): short and long-term dollar denominated debt (s52 + s59).

Short-term debt in USD (Ddst): short-term dollar denominated debt (s52).

Long-term debt in USD (DDlt): long-term dollar denominated debt (s59).

Counting Capital (E): consolidated counting capital (s33)

Cash Flow (C): resources generated (used) by the operation (c05).

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