"Internal Capital Markets and Financing Choices of Mexican Firms Before and During the Financial Crisis of 1995-2000"

First very rough draft

Presented by

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1.- Introduction

Since the seminal paper of Fazzari, Hubbard, and Petersen (1988), the empirical studies on investment and market imperfections have defined the liquidity constraint for firms in many different forms. The use of an a priori classification has been essential to test the validity of the theory that relates investment decisions with the capital structure of the firm. In the methodology where an expected profitability variable, such as Tobin's q, is used to control for growth opportunities, the theory is not rejected when the estimated parameter for the cash flow-investment sensitivity is larger for the sub-sample of liquid-constrained firms than for the remaining firms. The most common classifications in the literature are made attending to the following criteria: dividend pay-out behavior, size, age, tangibility of assets, credit ratings, variations over time in the tightness of financial constraints, ownership concentration, banking linkages and group membership.

With regard to the last classification, it is presumed that for divisions of a conglomerate, or firms belonging to a business network, the financing bottlenecks are loosened up for mainly two reasons. On the one hand, the existence of an internal capital market helps to provide retained earnings to cash-constrained member firms that exhibit a growth potential. On the other hand, member firms share risk, collateral and reputation that help them to avoid being rationed out from capital markets.

On the whole, the econometric evidence supports the view that internal and external sources are not perfect substitutes, being the

investment of independent firms more sensitive to variations in cash flow. Since membership to a particular group is generally a stable component of corporate governance, the possibility of an endogeneity problem is small when using this classification criterion. In other words, in the short and medium terms, it is not likely that firms will change this feature of corporate governance on the grounds of financial considerations, this fact reduces a potential bias in the estimation of the cash flow coefficient.

The paper presents several econometric tests of this theory for the Mexican case during the period 1990-2000. The late 90's in Mexico were characterized by a banking crisis and limited new issues of financial instruments through capital markets. Thus, the period under study provides an excellent laboratory to analyze firms' investment behavior under conditions of severe market failure. In this environment, group membership becomes an extremely important feature of corporate governance, which presumably helps firms to retain their access to external sources of financing. Moreover, it is considered that, under this macroeconomic scenario, firms belonging to a network might be forced to use more heavily their internal capital markets.

1.1.- The Macroeconomic context

In the second half of the nineties, the Mexican economy experienced a severe financial crisis. After a badly managed financial liberalization and a disruptive overshooting in the exchange rate, many banks became bankrupt between 1995 and 1998, and the entire banking community was overburdened by massive defaults on loans. In the first two years of the

banking crisis, the Mexican government implemented a wide variety of rescue programs, with the corresponding fiscal costs that will exert a heavy toll on the Mexican taxpayers in many years to come. Despite these programs, the high ratio of non-performing loans to outstanding debt created extreme liquidity problems and new lending came practically to a halt. In the first year of the crisis, the domestic market had a sharp fall that led the economy to a negative growth in real GDP, which reached an annual rate of –10% by mid 1995. The depressed demand in non-tradable activities and the financial stress in most non-financial firms contributed to the paralysis of the Mexican financial system. Over these years, external sources of financing were sharply reduced at least through the traditional channels of banking, money and capital markets. Real outstanding debt granted by commercial banks to the non-financial private sector diminished by 72% between 1995 and the first semester of 2000. Likewise, the net flow of financing channeled through the Mexican securities market, fell from an annual average of 6.23 billion dollars in 1991-1994 to 1.96 billion dollars in 1996-1999.

However, as the initial panic came to an end, the Mexican economy started to show promising signals of recovery. Not only the economy rebounded in one year period, but it has also kept growing at fairly good rates since 1996, averaging an annual rate of 5% in the period 1996-1999. Moreover, other macroeconomic achievements are present in the current situation of Mexico. Internal savings as a share of GDP increased from 14.7% in 1994 to 20.3% in 1999; the deficit in the current account as a percentage of GDP was reduced from 7% in 1994 to 2.9% in 1999; inflation was curtailed from 52% in 1995 to less than 10% in 2000. The main engine of this non-inflationary growth was undoubtedly the export sector, which has

increased yearly at impressive rates since the trade liberalization began. The share of exports to GDP raised from 15.2% in 1993 to 32.7% in 1999. Nowadays, Mexico is the eighth largest exporter in the world and the second trading partner of the United States of America. Moreover, the recovery was spread to non-tradable activities and, as soon as 1997, the economy was experiencing the highest growth in the last two decades. Although real purchasing power for the majority of people is still far behind of the increased average productivity, the macroeconomic upturn is a striking phenomenon that deserves further explanation.

A plain export-led-growth argument does not seem to be fully convincing in an economy where financial disarray prevails. It is not enough to argue that demand side multiplier effects were able to pull the rest of the economy. Such an outstanding performance in the real sector cannot be possible without financial flows moving from the booming export sector to the non-tradable sector. Exporting firms, beside being the best candidates to obtain domestic financing, have been able to issue bonds and equity in international markets, given their dollar-based sources of income. The surplus cash flow of booming firms has to be channeled through different means of financing. Therefore, an increased demand in non-tradable goods can be met only if financing is available for the supplier. Data shows that domestic sales of durable and non-durable goods during the period underwent also a swift recovery, creating not only a demand for working capital financing but for capital spending as well.

According to a survey of 500 firms, produced by the central bank for the years 1998 to 2000, Mexican firms' financial structure relies more on trade credit, either from clients or suppliers, than on bank credit or any other source of external financing combined. Adding up trade credit and

direct financing from affiliates in the business group or holding companies, 55-70% of total credit comes from non-banking network sources. These percentages are even larger when the firm is not very large or non-exporting. In general, 66% of the firms in the sample did not receive any form of bank credit during these three years, being this figure close to 74% for the case of small or non-exporting firms in 1999. Trade credit is also observed in other countries when there are important asymmetric information problems that hamper the functioning of external capital markets. However, trade credit is not the only missing link in the export-led-growth theory; in this paper, it is suggested that the existence of business groups made possible to have a strong internal capital market, contributing to the speedy recovery of the Mexican economy.

As in many developing economies, the industrial structure in Mexico is characterized by networks of firms tightly controlled by closed groups of owners, usually members of the same family. These business groups tend to be vertically integrated and widely diversified. Because of the lack of a well-functioning capital market, perhaps due to institutional immaturity, manager/owners prefer to set up large conglomerates where global profits are stabilized. Moreover, the large shareholders of these networks typically own a financial group and/or a bank, so that they are able to avoid being rationed out from the use of scarce savings, accumulated essentially by the high and middle-income segments of society.

In the empirical literature on unrelated business diversification of U.S. conglomerates, it is shown that the performance of affiliated firms (or divisions) is lower than the one observed in independent firm in the same industries. However, there are theoretical reasons to think otherwise in emerging markets. The absence of intermediaries, the limited protection

offered by property rights and the weak enforcement of law creates large transaction costs that handicap the functioning of a formal capital market; hence, firms are encouraged to build networks where an internal capital market arises. Through this market, groups diversified across unrelated business activities smooth out income flows, and thus overcome financial constraints for some of their affiliates.

The above suggests that, in the case of Mexico, the business groups structure contributed to the recovery of the economy, especially in the non-tradable sector with no direct access to international capital markets. The collapse of the banking system, and the interruption of financing flows through the domestic financial system, was overcome by a change in the firms' capital structure. Many firms started to depend more on trade credit, and the internal capital markets of business groups created a financial cushion that kept the economy working. Through this internal capital market, exporting firms were able to channel cash flow to network affiliates dedicated to non-tradable activities. Obviously, firms belonging to a business network, or those supplying to export firms, have better chances of surviving in a scenario of banking crisis.

In the theoretical argument presented in the paper, an internal capital market starts functioning once traditional financing is interrupted. Because of a severe moral hazard problem, investors decide to stop lending firms in a sector enduring a recession (perhaps a non-tradable sector). At the same time, investors increase their lending to booming firms (export oriented), which not only use financial resources for their productive activities but also for doing some financing themselves. Hence, export firms start offering trade credit to affiliate non-tradable firms; this allows them to obtain valuable inputs for their regular production and to make an additional profit out of

financial activity. Investors are aware of the existence of internal capital markets, yet they are willing to lend money because the structure of business group guarantees the expected return. That is, export firms reduce opportunistic behavior of non-tradable firms, and hence the initial moral hazard problem is attenuated. This theory is able to explain why, in the context of a financial disruption, certain sectors do not enter into a severe recession, and why the spill-over demand of a booming sector leads to higher output despite the presence of a banking crisis.

1.2.- Econometric methodology

For the different econometric models presented in this paper, a database of firms quoted on the Mexican stock market is used. This database contains financial information on approximately150 large firms, and it allows for building a balanced panel of 66 firms over the1990-2000 period. Tests will be performed for both balanced and unbalanced panels. These data refer to the main variables of the different models: investment, inventories, cash flow, cash stock, trade credit, export ratios, sales ratios, profitability and leverage. Moreover, from the list of boards of directors, group membership is established through the interlocking of directorates. The same can be done to identify banking linkages of non-financial firms. These variables are calculated for each year of the sample, and consequently it is possible to test cross-subsidies as well as risk sharing within each group.

Each model will be estimated by the Generalized Method of Moments (GMM), using specifications in levels, differences and systems, as suggested in the Bond and Arellano methodology for dynamic panel models. In the econometric literature, it is well known that there is an endogeneity bias in

the estimated coefficients when the explanatory variables are simultaneously determined with the dependent variable or there is a two-way causality relationship. This joint endogeneity calls for an instrumental variable procedure to obtain consistent estimates. However, it is also known that the weakness of the selected instruments might result in biased estimators as well. Therefore, it is preferred to use the GMM technique, where the panel nature of the data allows for the use of lagged values of the explanatory variables and their differences as instruments.

The remaining of the paper is structured as follows. In the second section, a brief theory of trade credit in business groups is sketched; the purpose is to present, by means of simple diagrams and intuitive explanations, the key features of the hypotheses to be tested. In the third section, a model of financial behavior is estimated. In particular, the hypothesis that trade credit is more prevalent within business networks is tested. Moreover, it estimated whether trade credit within groups was more important during the banking crisis period, since moral hazard problems not only paralyzed external capital markets, but also trade credit among many independent firms. The impact of the firms' financing choices on real activity is analyzed in the fourth section, where it is tested whether the availability of trade credit improved firms' observed growth. Likewise, it is studied whether trade credit had a differentiated impact, depending on the firm belonging or not to a business group, on the nature of the economic activity and on the sub-period: financial liberalization (1990-1994) and financial crisis (1995-2000). In the fifth section, an investment equation is derived from first order conditions. The equation has as explanatory variables: lagged investment -because of the corresponding adjustment costs- a growth opportunity variable and a cash flow variable. The latter is

the result of using a non-negative constraint for dividends. Therefore, it is possible to test whether firms' membership to a business group reduces the strength of the cash flow-investment link. According to the theory stated in this introduction, this sensitivity should be higher for independent firms, especially during the period of banking crisis. In the sixth section, an attempt is made to explain the absence of this link for non-exporting firms within business groups. Because of the export led-growth observed in the Mexican economy, cross-subsidies are considered in an extended version of the investment equation. In particular, the cash flow of export firms is considered a possible determinant of investment behavior for non-exporting firms that belong to the same group. In the seventh section, a full-insurance model is applied to investment behavior. Thus, a different regression equation is derived from an alternative Euler equation. In this case, majority stockholder of business groups, and not managers of individual firms, are the decision-makers. Thus, risk sharing becomes a relevant feature of the decision process. It is considered that under a collapsed financial sector, centralized decision making becomes important, hence investment by individual firms should be associated to aggregate investment in the business group. On the contrary, because of the functioning of internal capital markets that smooth income fluctuations, idiosyncratic shocks should not exert an impact on firm's investment, as long as they belong to a business group. The paper ends up with the conclusion, where the most important results are summarized, policy implications are considered, and some extensions for future research are suggested.

2.- A Moral Hazard Theory of Financing Alternatives

In order to have a better understanding of how the theory works, an intuitive explanation is presented in this section. Assume a business group (BG) formed by two productive units, the export firm (E) and the affiliate firm (A). Under normal circumstances each firm behaves as a profit center, that is, as an autonomous entity maximizing profits and looking for financing in the market by itself. The financial system is composed of a large number of independent banks (investors) which compete in the allocation of resources. However, it is assumed that the majority owners in the network exert their residual control rights when dealing with a situation of financial stress. In particular, without attempting to give a rationalization for this behavior, it is considered that manager/owners of the liquid (export) firm control decision-making and managers' effort in the affiliate when financial help is needed.

The export firm sells all production in a booming foreign market; formally, this is incorporated in the analysis by assuming that income revenue is independent from managers' effort. Besides the existence of cross-share-holdings, that keeps the BG together, there are important transactions that take place within the network. The affiliate firm produces an intermediate input for the export firm, which is sold at a transfer price set to market value given the profit center assumption stated above. Moreover, the affiliate is a diversified company since it not only produces inputs for the export sector but also goods for the non-tradable sector in the domestic

market. As opposed to the export sector, managers in the non-tradable sector need to exert an effort to succeed.

Banks are willing to lend as long as the expected return covers their cost of funds, yet their profits are zero because in this sector prevails a perfect competition structure. Firms, as well as lenders, face an uncertain environment when selling goods in the foreign or domestic markets. Figure 1 shows the chronology of decisions and events, making a difference between the strategic decisions facing managers in the affiliate firm, and the more straightforward decision of managers in the export firm. While the export firm has a yes-or-no decision to go ahead with production, the affiliate firm faces a trade-off between exerting more effort (increasing the probability of success) and enduring the cost of such effort. Likewise, the affiliate may behave opportunistically since it takes actions once credit has been assigned. The uncertainty in the final outcome precludes the possibility of the bank setting up a contract where the conflict of interest is eliminated.

Figure 1

Time line for decisions and events
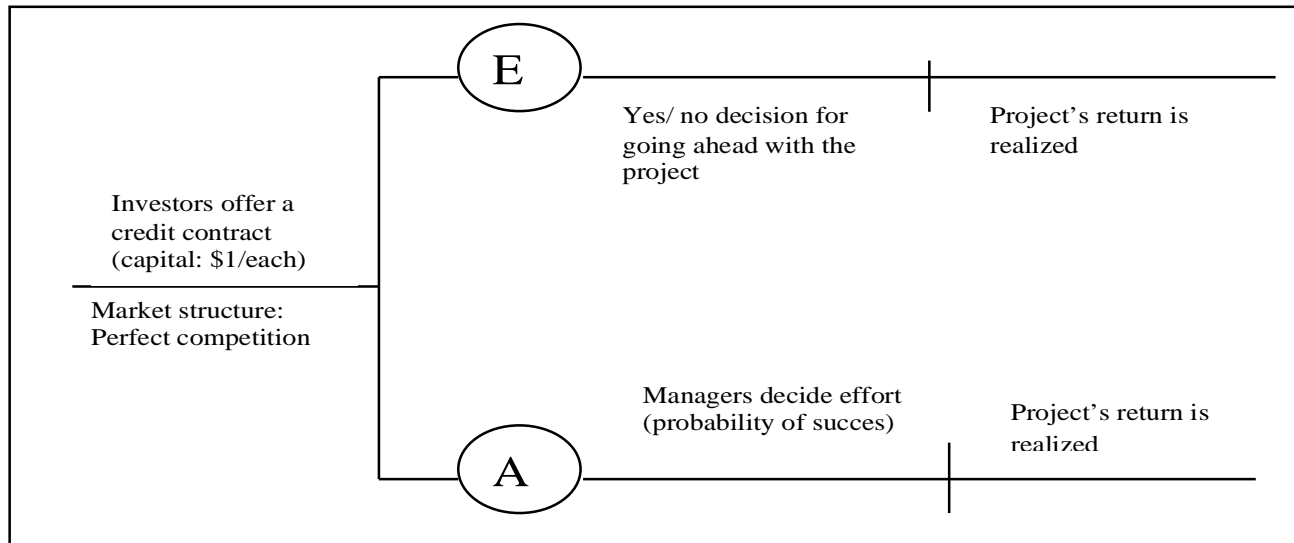
Banks I_1 and I_2, each holding one unit of capital, lend money to the BG's productive units. These firms demand one unit of capital each to make their production possible. Banks are aware of the moral hazard problem, thus rationality requires to take into consideration the profit-maximizing behavior of the affiliate before deciding to grant the unit of capital (see Figure 1). Under normal circumstances there is a combination of ex-ante interest rates (contract rates) and effort levels compatible with banks' cost of funding. At the same time that traditional flows in the financial market move from investors to production entities, there is a sale of inputs from the affiliate to the export firm (see Figure 2). Therefore, as long as there is not a disruption in financial markets these traditional flows allow production in the economy.

Figure 2

Financial Structure before the Banking Crisis
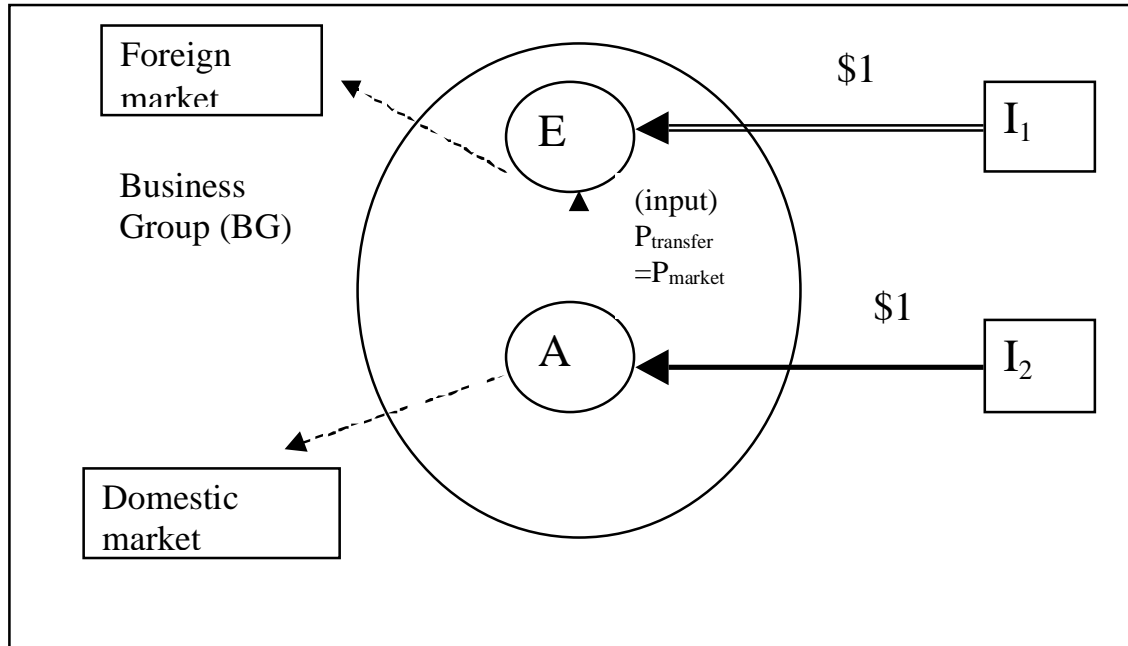
Assume now that economic actors become pessimistic about the strength of demand in the domestic market, and that banks decide to stop lending to the affiliate firm since there is not any longer an ex-ante rate that provides an expected return equal to their opportunity cost. Without financing, the affiliate firm would cease producing and a deep recession might take place. Trade credit financing per se is not capable of eliminating the moral hazard problem. However, trade credit –or internal market financing- in a close client-supplier relationship will allow the necessary resources for the affiliate to continue operations. The latter scenario is depicted in Figure 3, where both banks decide to offer all of their available credit to the export firm.

Figure 3

Financial Structure during the Banking Crisis
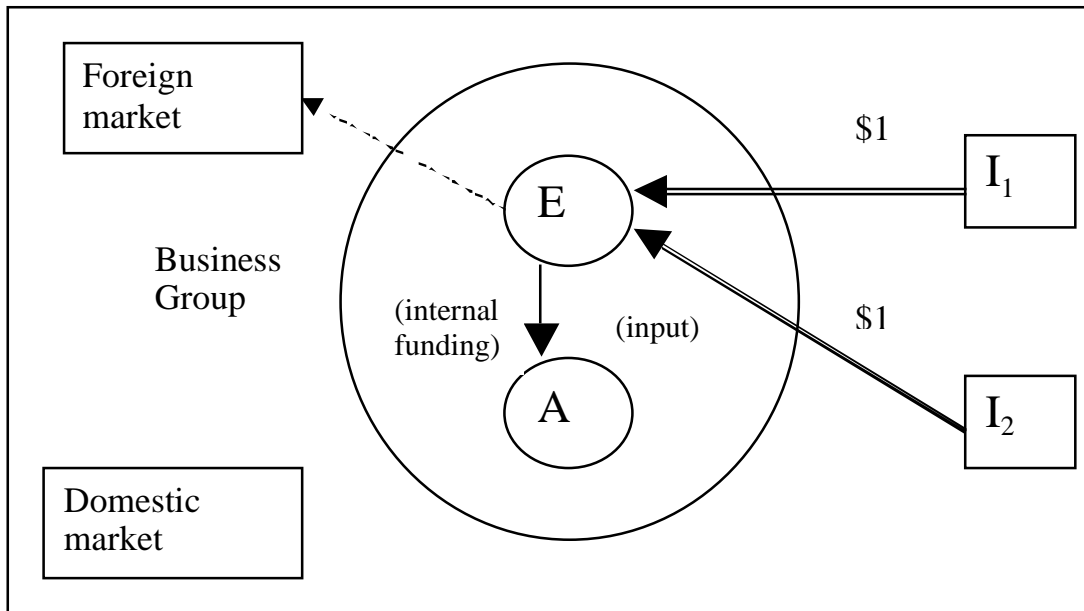
In this scenario, it is assumed that the export firm still faces a strong foreign market, hence one unit of borrowed funds is used for production of the export good. Yet, at the same time, this firm now has the possibility of making an additional earning by lending the other unit of capital through the BG's internal capital market. With the trade credit received, the affiliate firm can produce the intermediate input and the non-tradable good as well. The credit will be accepted by the affiliate as the only way to keep production going. On the other hand, banks will accept supplying all of their funds to the export firm, despite that one unit of the borrowed fund will be detoured through the internal capital market. The rationality for this is that

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manager/owners in the export firm can specify managers' effort in the affiliate when exerting control rights under financial stress. Consequently, the severe moral hazard problem that initially threatened with the collapse of financial markets was overcome by a change in affiliates' financial structure, which started to rely more on the internal capital market.

3.- Suppliers' Credit and Network Linkages

In this section an ad-hoc regression model is presented to test two hypotheses put forward in the previous section. Firstly, firms in a business network use more suppliers' credit than independent firms do, regardless of the macroeconomic context. As suggested above, this is so because the intertwined control rights in the network help to diminish the agency problems of a supplier-client relationship. Secondly, during the financial paralysis recently endured by the Mexican economy, associated firms had more opportunities for using this form of credit as an alternative source of financing, and thus, they were able to overcome financial constraints. In other words, independent firms without a close network of associates could not sustain their flow of credit from suppliers because the latter firms did not have control over debtors' decisions and collateral, and this element became more relevant in the context of financial fragility. Presumably, the same financial difficulties that handicapped the external credit and capital markets, obstructed the channels of financing in a client-supplier relationship when both firms were independently owned and controlled.

The regression model allows testing other implications from the analysis of previous sections. (a) Banking linkages: if suppliers' credit is a

substitute of external market credit when firms are rationed out by banks, then suppliers' credit should be negatively associated with a dummy variable that measures the existence of a tight firm-bank relationship. That is, credit from suppliers is not all that important to overcome financial constraints when there is enough availability of funding from a close banking partner. However, an alternative hypothesis is that, in the context of a solid banking system, bank ties work as a signaling device on the quality of the borrowing firm. In such a case, suppliers' credit will be positively associated with banking linkages.[1]

(b) Access to international markets: it is likely that highly exporting firms have better opportunities to issue financial claims in international markets, which in turn diminishes their need of credit from domestic suppliers. Moreover, if the foreign goods market is booming, as was the case during the period under consideration, these firms will have a larger cash flow and thus they can rely more on internal financing. However, it is also possible that the export capacity of these firms help them to maintain a good reputation in the domestic economy, which facilitates their access to suppliers' credit.

(c) Diversification: when firms are diversified their profits and cash flows are more stable, and this lower volatility diminishes the probability of a bad aggregate outcome for the conglomerate. Consequently, diversified firms might be less risky and less likely to be rationed out from external credit markets. Furthermore, if firms within a conglomerate are also vertically integrated, then certain volume of suppliers' credit might not show up in the

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[1] Theoretically, the reverse causality is also possible in the context of independent banks. That is, suppliers' credit works as a positive signal that might convince banks to grant some loans.

financial statements since payable and receivable accounts in the consolidated balance are canceled out.

(d) Financial booms and busts: in a period when stock market capitalization is high, firms will have a better opportunity to issue shares (or bonds) in the open market, diminishing their dependence on internal and network sources of financing, such as suppliers' credit. Symmetrically, when capitalization has gone down, and Tobin's q is low, firms will be reluctant to float more shares. Accordingly, it is expected to observe a negative relationship between the market capitalization ratio and suppliers' credit. Furthermore, if this ratio is an index of financial development, it is possible that this development might be related with a reduction in the size of internal capital markets –and hence in suppliers' credit as a form of network credit-. If the ratio of bank credit to GDP is used as an alternative index of financial development, then the same inverse relationship is expected. That is, when bank credit is more abundant, less firms will be rationed out, and thus, there will be lower need for internal credit. This argument implies that in times of financial liberalization, the level of suppliers' credit in independent firms should be closer to the level observed in network firms.

The remaining subsections are structured as follows. The subsection (3.1) presents some descriptive statistics where a differentiated pattern emerges for independent and network firms. Furthermore, the dynamics of the trade credit is analyzed by splitting the sample into two periods: financial liberalization (1990-94) and banking paralysis (1995-2000). The econometric model and formal hypotheses are presented in subsection (3.2), where some remarks are made with regard to the estimation technique. The subsection (3.3) presents the estimation results and the selection process of the different econometric models. Additional robustness tests are presented in subsection

(3.4). Finally, subsection (3.5) highlights the main conclusions, and establishes a connection with the following sections.

3.1 Some descriptive statistics.

In this subsection some descriptive statistics are presented to have a first approximation to the pattern of suppliers' credit in the sample period. The purpose is to highlight how the intensity of this form of financing changed according to specific features of the firm: associated, diversified, exporting and with banking ties. Furthermore, in terms of the hypotheses under consideration, it is also interesting to explore whether the financing behavior changed through time, taking 1995 as a turning point, the first year of the crisis.

Table 3.1

Descriptive statistics for the ratio of suppliers' credit

Period and characteristic	Mean	Std. Dev.	Median	Number of observations
90-94				
affiliated	0.23221	0.96896	0.078691	252
independent	0.20314	0.33760	0.097036	73
95-00				
affiliate	0.22929	0.57353	0.099294	281
independent	0.12925	0.12732	0.080940	109
90-94				
banking ties	0.26320	1.08628	0.080177	199
non-related	0.16642	0.27643	0.088527	126
95-00				
banking ties	0.22888	0.56807	0.10160	286
Non-related	0.12555	0.13410	0.076205	104
90-94				
Highly exporting	0.089510	0.068689	0.066356	22
Non-exporting	0.23557	0.89771	0.084083	303
95-00				

Highly exporting	0.096653	0.057917	0.081478	64
Non-exporting	0.22188	0.53662	0.10051	326
90-94				
diversified	0.24270	1.19642	0.088972	135
specialized	0.21359	0.52472	0.072496	190
95-00				
diversified	0.15432	0.13650	0.11294	162
specialized	0.23473	0.63324	0.079339	228

Table 3.1 summarizes the information of the ratio of suppliers' credit, defined as payable accounts divided by net fixed assets. From the standard deviations it is clear that during the financial boom period there was more variation in the firms' financing behavior than in the crisis years. According to the means, suppliers' credit seems to be more intensively used by firms associated to business groups in the entire sample period, although the gap with independent firms widened during the years of banking paralysis. This observation fits well with the hypothesis that asserts that network ties are important for the use of this form of financing, especially in times of financial crisis. With respect to banking ties, there is a similar pattern in the sense that linkages are important for having access to suppliers' credit. Despite that the crisis sharply reduced this form of financing for both types of firms, the suppliers' credit gap increased in relative term. Unfortunately, the high standard deviation precludes any assertive conclusion. Nevertheless, from these results, a tentative conclusion is that that suppliers' and bank credit were complimentary forms of financing during financial liberalization. Another conclusion is that the crisis in the external capital market, due to moral hazard complications, exerted a heavy toll on firms' creditworthiness, independently of their banking connections. Perhaps this fact is explained by the fragility of the banking system that reduced the strength of the signaling effect of a banking connection. The Table shows that only firms associated

with business networks were capable of sustaining this form of credit and, accordingly, suppliers' credit became a substitute source of bank financing for these firms during the period of financial paralysis.

It is also important to notice that the crisis did not change the disparities observed between highly exporting and non-exporting firms, the latter being always more active in the use of trade credit. Perhaps this is the result of a lack of external financing for those firms with a peso-dominated base of income. Finally, the financial crisis shifted up-side-down the pattern for diversified and specialized firms. Specialized firms in the last years of the sample started to use suppliers' credit more intensively. A tentative explanation is that in times of crisis and high risks, diversification became more relevant to keep open the access to very scarce banking loans, although this assertion is not proved in this study. Obviously all these conclusions are not definitive, since other factors influencing the firms' financial decision have to be controlled. This is precisely done in the following econometric analysis.

3.2. The regression equation and estimation methodology

The model presents both macroeconomic and firm-level variables as in Gallego and Loaiza (2000). The latter category includes: (i) Variables traditionally used in the finance literature to explain capital structure (size (S_{it}), tangibility (T_{it}), profitability (P_{it})). (ii) Variables that identify the firm-year with specific associations or structures: a dummy for group membership (G_{it}), a dummy for banking linkages (B_{it}), and a dummy for diversification (D_{it}). (iii) Variables that proxy for the degree of access to international

markets. This can be measured using an export capacity index, such as the export to sales ratio (E_{it}), or a dummy variable for firms issuing American Depositary Receipts –ADR's- (A_{it}). The macroeconomic variables considered in the model are the ratio of bank credit to GDP (C_{it}) and the ratio of market capitalization to GDP (M_{it}),. With these variables, it is attempted to measure the impact of financial booms and bust on the use of suppliers' credit. It is important to recall that during the sample period the Mexican economy experienced both.

Suppliers' Credit Model:

$$\frac{SC_{it}}{K_{it}} = \quad + \quad _1 T_{it} + \quad _2 S_{it} + \quad _3 P_{it} + \quad _1 G_{it} + \quad _2 D_{it} + \quad _3 B_{it}$$
$$_1 E_{it} + \quad _2 A_{it} + \quad _1 M_t + \quad _2 C_t + f_i \quad + d_t + \mu_{it}$$

....(1)

where: suppliers' credit for each firm-year observation (SC_{it}) is measured as a proportion of fixed assets or net capital stock (K_{it}); f_i is the firm's fixed effect term; d_t is the time effect term and μ_{it} is a random term. The dummy variables assign the value of one when the specific feature is present in the firm-year –membership, diversification, banking linkage, and international issuance of shares- and zero otherwise.

3.2.1. Hypotheses

The hypotheses to be tested are the following:

■ For the financial structure variables. H: $_1 < 0$, $_2 > 0$, $_3 > 0$

■ For the association and structure variables. Ho: $_1 > 0$, $_2 < 0$, $_3 > 0$

- For access to international markets. H: $_1 < 0$, $_2 < 0$
- For the macroeconomic variables. H: $_1 < 0$, $_2 < 0$

The reasoning for hyphotheses b)-d) was already discussed. With regard to the financial structure variables, the theoretical and empirical literature of corporate finance suggests the following relationships: (i) The ratio of fixed to total assets (proxy for tangibility) is positively associated with external debt, since banks and bondholders in case of default can have access to a larger collateral; hence, firms with relatively large tangible assets are less likely to be rationed out and will discard using credit from suppliers when expensive. Thus, this element supports the idea of substitutability between the two forms of financing. (ii) Size is related to notoriousness and lower costs of monitoring per unit of credit, thus, large firms are more likely to obtain credit from suppliers, as well from other sources. (iii) Profitable firms might be willing to use more credit in general, and suppliers' credit in particular if this strategy, despite the high cost of the latter form of credit, signals to outsiders the company's good financial conditions.

3.2.2. Application of GMM

In order to apply the Generalized Method of Moments technique to the suppliers' credit model is important to specify the nature of the explanatory variables. All financial structure variables and the export to sales ratio are considered endogenous since they might depend on the same firm-year decision making process. However, the macroeconomic variables are exogenous since their value is a given for individual firms. In this case, the

instruments to be used in GMM are the same variables, either in levels or in differences, depending on the estimated model. Finally, for the dummy variables two approaches were used. Firstly, for group membership, banking connections and diversification, the dummy variables are considered exogenous since these features are rather stable through the years. Moreover, the association variables do not depend on a unilateral decision but on a complex bargaining process between many actors. On the contrary, the ADR's dummy is considered endogenous since it is a financing decision variable similar to whether to use suppliers' credit.

It is important to highlight that the use of a time-invariant (or rather stable) variable such as the dummies (G, B, D) makes impossible (or rather imprecise) to estimate directly a group effect by means of GMM in differences. It is well known that in panel data, this type of within estimator is produced by taking differences in the equation in levels, which in turn removes the fixed effects term. Obviously, this will also be the case for any group effect considered in the model. Nonetheless, the hypotheses can be tested straightforwardly using GMM-levels and GMM-system. In the latter case, the use of instruments for the equation in differences helps to offset the efficiency loss in estimation due to the omission of the group dummy variables.

A second alternative is to estimate the dummy effects, and in particular the group membership effect, by an indirect procedure. In the first step, the model is estimated by GMM-differences excluding the dummy variables that are fixed over time. This makes it possible to obtain unbiased estimators by removing the fixed components of the random term. In the second step, the estimated coefficients are substituted in the level equation and residuals are calculated as the difference between the observed and the estimated

dependent variable. By construction, the residuals contain the random term, the firm-fixed effects and the group specific effects. In the third step, the residuals are regressed on the business group-dummy variable or any other dummy that might affect firms' financial choices. Thus, if the coefficients associated to these dummies are statistically significant, it implies that group effects exert an influence on the firms' trade credit practice. To run this final regression two approaches are followed: plain Panel OLS estimation and Panel Between estimation (OLS on means).

Between estimation is the adequate technique if the dummy variables are completely fixed over time (instead of stable). This is so, because by averaging the residuals and the dummy variables through time a cross section data set is created. The average for the residuals removes the idiosyncratic random variable that affects each of the firms in the sample in an inter-temporal dimension. Hence, by creating a cross-section sample, the residuals in the Between estimation contain only a random term and a group-specific effect. The latter assertion is tested regressing residuals on the dummy variables. However, if the dummy variables are not fixed but only stable, the average across time is different from zero or one for those firms whose structure was modified in some year of the panel. In such cases, a mode dummy variable was calculated. In particular, when a firm presents certain structure at least in 6 out of 11 years, a value of one is assigned; otherwise, the value attached is zero. This method was applied to the group membership and banking ties dummy variables. In the case of the ADRs variable, a value of one was assigned to the firm if at least in one year there was an issue of shares, and zero otherwise. Since it is rather implausible that firms issue shares frequently in foreign markets, one issuance was considered enough to signal that a firm had access to international capital markets. In

the empirical literature it has been observed that the issue of ADR opens up the possibilities for additional credit financing in international markets.

For firms that vary their structure, the residuals calculated in the second step have a differentiated group-effect through time; consequently, the average of the residuals will not necessarily reflect a specific group effect. Therefore, as a robustness check, an alternative regression is run with panel OLS and the original dummy variables. This method does not remove the firm idiosyncratic effects from the residuals, yet it allows the use of group-dummy variables that vary through time. In addition, the two indirect procedures are used to analyze a possible change in the suppliers' credit pattern between the two periods: financial liberalization (1990-1994) and banking paralysis (1995-2000). This test is applied running separate regressions for the two sample periods. There will be evidence of a structural change when the impact of group membership on the residuals is differentiated. In particular, a stronger impact on the second period means that network effects became more relevant during the Mexican economy financial crisis.

3.3. Estimation Results.

In this sub-section the panel equation (1) is estimated with different techniques: Panel within, GMM-levels without fixed effects, GMM-differences, and a GMM-system of levels and differences. For GMM estimations, Table 3.2 presents P-values of two specification tests: the Lagrange multiplier for serial correlation of different orders and the Sargan statistic for overidentifying restrictions. The models were estimated by

assuming that the error term in the level equation did not have any order of serial correlation. Accordingly, as suggested in Arellano and Bond ( ), the instrumental variables for the difference-equation are several lagged values of the explanatory variables in levels, starting with t-2, while the instrumental variables for the level equation in a system are the lagged values of the first differences. However, for the level equation by itself, the instruments are several lagged values of the regressors in levels, starting with t-1.[2] As can be seen from Table 3.2 there is persistent serial correlation for the GMM-level estimation in column (1), first and second order correlation for GMM-differences, and second order correlation for GMM-system. Consequently, all estimation models are rejected according to the serial correlation test.[3] Moreover, in GMM-levels the Sargan test has a small P-value. This result also implies that the model is not well specified, and that the instrumental variables were not properly selected. All the results presented in the Table 3.2 correspond to second step-estimators, although the conclusions are identical for the first-step estimators.

Table 3.2
Specification test for a model with no serial correlation
Second-step   covariance   estimators.

	(1)	(2)	(3)
Estimation technique	GMM-level	GMM-difference	GMM-system
P-values			
(a) Sargan	.00021	.60223	.28636
(b) Serial Correlation			
First -order	.00340	.00235	.79308
Scond-order	.00789	.07747	.05033

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[2] Instruments for the level equations were the explanatory variables lagged up to three periods.
[3] It is important to recall that first order correlation can be built in the model with differences.

Third-order	.01806	.28424	.51659

Because of the pattern of serial correlation observed in Table 3.2 and the rejection of the Sargan test for GMM-levels, a second iteration of the model was considered. In this case it was assumed that the error term in the difference equation followed a MA(2) process. Consequently, for GMM-difference and GMM-system, the lagged values for the instrumental variables in levels start with t-3, and two lags are taken for the instrumental variables in differences. Likewise, for the equation in levels with no fixed effect, the lags for the instruments in levels start with t-2.[4] The most important output is presented in Table 3.3. Notice from column (2) that the level equation with no firm-fixed effects is misspecified according to the persistent serial correlation observed. This result is consistent with the Sargan test of overidentifying restrictions. On the other hand, both Lagrange multiplier and Sargan tests do not reject the validity of GMM-differences, in column (3), and GMM-system, in column (4).[5] However, in the former model none of the coefficients is statistically significant, this is to certain extent the result of the time-stability of most of the dummy variables. In the GMM-system, the specification problem is eliminated and the standard errors are reduced, hence this procedure provides more precise estimates for the dummy variables. When comparing the Within estimates of column (1) with the GMM-system estimates of column (4), it is clear that the correction for weakly exogeneity is important to obtain consistent estimators. There are many flips in signs and the only common

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[4] Three lags were enough in the final estimation to meet the specification tests.
[5] The presence of second order serial correlation is not a problem since , in this case, the instrumental variables have three lags.

statistically significant coefficient in both methods is associated to the tangibility variable.

Table 3: Suppliers' Credit Model with a MA(2)

Dependent variable: ratio of suppliers' credit to net capita stock

	(1)	(2)	(3)	(4)	(5)
Estimation technique	Within Estimates	GMM-level	GMM-differences	GMM-system	GMM-system
Variables:					
Constant		0.84677 (3.07571)		.65597 (2.27114)	.54370 (2.00515)
tangibility	-1.76225 (-7.3854)	-1.16695 (-5.56887)	2.34633 (-.15131)	-.86676 (-2.03646)	-.91674 (-2.08786)
size	-.1349E-8 (-,28448)	-5.0623E-10 (-0.32588)	8.84320E-08 (.43229)	9.72692E-10 (.55822)	2.01834E-10 (.10590)
profitability	-.071137 (-.61361)	.20528 (.48916)	3.07841 (.39975)	-.087560 (-.37671)	.052861 (.21573)
Export to sales ratio	.037525 (.22223)	-.23346 (-2.47510)	-.75485 (-.25745)	-.14318 (-1.33764)	-.11734 (-1.02226)
market capitalization	-.056518 (-.19635)	-.17815 (-.63777)	1.14966 (.38173)	-.062191 (-.82960)	-.075694 (-.99229)
bank credit to GDP	.591801 (1.43434	.33954 (.49779)	-.27554 (-.089998)	0.13158 (.61248)	.28913 (1.20304)
ADR	.204337 (2.91818	.021115 (.045329)	-2.04598 (-.47566)	-.084583 (-.69236)	-.020758 (-.13796)
group membership	-.017677 (-.19707)	0.013313 (.20157)	.76022 (.47263)	0.097129 (2.15071)	
diversification		-.12805 (-3.37727)		-0.17896 (-3.28849)	
GS					.16823 (3.04819)
IS					.085268 (1.57123)
ID					-.045146 (-1.00572)
banking linkage	-.1863E-3 (-.34E-2)	.054830 (2.02104)	.16433 (.38685)	.068167 (2.88132)	.065923 (2.29730)
Adjusted R2	.431409				
Walt-test (P-value)					.08161
Specification Tests					

(P-values)				
(a) Sargan		.00055	.88523	.18591	.17751
(b) Serial Correlation				
First -order		.00155	.00019	.87630	.82476
Second-order		.00455	.11809	.01380	.01793
Third-order		.01213	.26054	.39440	.29902

Note: all GMM results are second-step covariance estimators

The signs of the coefficients in column (4) are in general as suggested by the theory. In particular, the coefficient for the group membership-dummy variable is positive and statistically significant. This result is consistent with the main hypothesis that the network connections improve the possibility of using this form of financing. Because the group effect is controlled by size, diversification, banking linkages, profitability, access to international markets, and other variables, it is reasonable to affirm that the extensive use of suppliers credit in specialized network firms is in part a consequence of the intertwined control rights.

Moreover, the coefficient for the banking linkage variable is positive and significant, which implies that in average bank and suppliers' credit were complementary in the sample period. This result favors the signaling explanation put forward in adverse selection models of trade credit. This should not be interpreted as a prove that in the entire period the two forms of credit were hand by hand, it only means that firms receiving bank credit were more likely to obtain suppliers' credit. Obviously when the former was absent, firms had to rely more on the latter, which according to the estimations was more likely for network firms. The other significant coefficients are: tangibility, the dummy for diversification and the constant

term. In the first two variables the signs are negative, as expected. Therefore, when the effects of the remaining variable are controlled, a network firm had more trade credit as long as it were specialized.

Finally in column (5), a small variant of the model is presented. There is in principle a possibility that some "independent" firms in the sample might be diversified with related activities. A low suppliers' credit statistic for these firms might be the outcome of payable and receivable accounts canceling out among the different divisions in each independent conglomerate, and not because of a absence of strong internal capital market. In order to differentiate this type of behavior, four interactive dummy variables were created with the group-dummy and the diversification dummy: group-diversified (GD), independent-diversified (ID), group-specialized (GS), and independent-specialized (IS). Hence, it is expected that once corrected for diversification, the suppliers' credit ratio might be larger for group firms than for independent firms. That is, the coefficient for GS should be larger than the coefficient for the interactive IS variable. However, irrespectively of this correction, it is still valid the assertion that network connections are important to establish suppliers credit, which does not need to be understood as a proof that only in group firms there are internal capital markets. From the results of column (5), it is evident that GS firms tend to have a larger ratio of suppliers' credit, in comparison with IS firms. This assertion is statistically validated by the Wald test, which rejects the hypothesis that the difference between these two coefficients is equal to zero.

3.3.1. Estimation for group-effect with the indirect procedure

In order to check the robustness of the group membership effect found above, an indirect approach is followed here. For the same lag structure considered in the models of Table 3.3, the GMM-difference model was applied including only time varying variables. According to conventional tests, there were not misspecification problems in the model. Once the residuals had been calculated for the level equation, as explained above, regressions were run on the dummy variables with the results observed in Table 3.4

Table 3.4

Group-effects estimated indirectly with residuals from GMM-differences

Models:	(1) Panel OLS	(2) Panel OLS	(3) Panel Between	(4) Panel Between
Dummy variables	.			
Group	.205056 (2.86808)	.294748 (4.21220)	.328352 (2.00794)	.328352 (1.99194)
ADR	.182484 (1.95678)			
Banking ties	.257042 (3.88232)			
Time		.109256 (1.78476)		.109896 (.423167)
Constant	-.047003 (-,689137)	.023103 (.327380)	.059943 (.426566)	
Adjusted R2	.045635	.024675	.045229	.060148

Note: The regression with the Panel Between method use a mode dummy variable for the group membership effect

In all regressions presented in Table 3.4, the group effect is positive and statistically significant. That is, the GMM-difference method underestimates the suppliers' credit ratio of those observations with a group effect. In other words, the membership to a network tends to increase

a firm's use of suppliers' credit. Notice that other dummy variables are also significant in the Panel-OLS models. Although, this was not the case for the diversification variable when included jointly. However, in the Panel-Between models there are collinearity problems among the dummy variables, given that these variables are not very different when averaging across time. This observation is particularly relevant for group membership and banking ties; although, significant by itself, the latter variable loses statistical significance when the model includes the group membership dummy as well. The Table also shows a time dummy effect in order to control for a non-specified structural change in 1995. This variable is significant only for the Panel-OLS model. Again the positive coefficient is interpreted as a likely underestimation of trade credit during the financial paralysis period.

An alternative method for testing the existence of a structural change consists in running the residual regression for the two sample periods. However, in this case, it is possible to specify the nature of the change, and in particular if the change is related to the role of network firms in credit practices. According to the results in Table 3.5, the group effect is smaller for the first financial liberalization period, and even not statistically significant for the Panel-OLS regression. The point estimate practically doubled during the financial paralysis period according to Panel-OLS, and increased slightly for the Panel-Between estimation. In other words, as suggested in the introductory hypothesis, network firms played a role in keeping, and perhaps in increasing, the use of suppliers' credit as an alternative form of financing during the financial paralysis period, which in turn might have helped in the recovery of the Mexican economy.

Table 3.5

Structural change analysis

Period:	Financial liberalization (1990-1995)	Financial paralysis (1996-2000)
Variables and Models		
Panel-OLS		
Group membership	.141789 (1.09378)	.274671 (3.52128)
ADR	.445665 (2.48624)	.0641351E-2 (.065744)
Banking ties	.241878 (2.16933)	.227169 (2.91134)
Constant	-.050279 (-.419979)	-.02067 (-.268264)
Adjusted R2	.03957	.060625
Panel-Between		
Group membership	.309616 (1.80567)	.343965 (1.90322)
constant	.023006 (.156135)	.090724 (.584162)
Adjusted R2	.049206	.039360

3.4. Robustness of results.

--Change definition of the group dummy variable

--Incorporate a growth variable (sales) in the RHS

--Omit extreme observations

4.- Trade Credit and Firm's Growth

The econometric model of this section analyzes the impact of trade credit on the growth of large firms quoted on the Mexican stock exchange. With that aim, a regression equation similar to those used in macroeconomic growth models is estimated, as done in Gallego and Loaiza (2000) for Chilean firms. In the literature on business groups, it is usually found that internal capital markets in emerging economies are very active. These markets substitute external capital markets, whose development is inhibited by the presence of institutional failures. However, there is a great deal of debate with respect to the actual benefits of these networks and capital markets. Many authors advocate the idea that these groups handicap growth, and worsen income distribution, through the process of rent extraction by controlling shareholders. It is argued that the potential opportunistic behavior precludes the long-term commitment of other stakeholder, which affects productivity negatively, even in those firms that belong to a network. Furthermore, the efficiency of resource allocation within a group is questioned because of the possibility of limited diversification and the pursuit of perks by unchecked manages/owners.

In this section, econometric evidence is presented in favor of a positive relationship between the activity of internal capital markets and production growth at the firm level. The recent Mexican experience is an excellent laboratory to test the workings of internal capital markets. In particular, it is expected that under conditions of banking crisis and extreme credit rationing, the activity of the internal capital market helped to avert an economic recession and even to spur growth. In the model, the proxy for internal capital market's activity is the ratio of trade credit to firm's net capital stock. Trade credit, in this econometric exercise, includes both suppliers' credit and payable accounts. Although this form of internal

financing is tied to a real transaction, it is the only data available to measure internal financing for Mexican firms. As shown in the descriptive statistics below, trade credit activity is more intense in business groups than in independent firms. In other words, trade credit is considered part of the internal capital market since network connections are important for this type of flow to take place. The trade credit ratio is incorporated into the model following the logic of the international trade variables in macroeconomic growth models. Presumably, a larger ratio implies that the firm has a stronger network of associated firms, suppliers and clients, which enhances firms' growth.

Although, the sample is limited to firms quoted in the Mexican stock exchange, these are the largest in the economy and their production contributes heavily to aggregate GDP, especially if non-listed members and close trading partners are taken into account. In particular, trade credit measures internal capital market activity with all kind of suppliers and clients, included or not in the sample. Hence, the results obtained from this microeconomic data set can be extrapolated, with some certainty, to argue that the observed macroeconomic growth is to some extent explained by the activity of these markets.

The remaining of the section is organized as follows. Subsection (4.1) presents some descriptive statistics to show the evolution of economic growth and internal market activity in the sample firms. The econometric model is presented in subsection (4.2) with some remarks on the use of the different explanatory variables. Subsection (4.3) contains the estimation results and interpretations. The robustness tests results are shown in subsection (4.4). Finally, the section ends with the main conclusions and some extensions for further research.

4.1 Some Descriptive Statistics

In this section, basic statistics are presented for two of the model's key variables: production growth and the ratio of trade credit to net capital stock at the firm level. Moreover, the sample is divided according to two criteria: time period and the membership (or lack of) into a business network. Only 23% of the firm-year observations in the panel data are classified as independent. That is, approximately 3/4 of the firms in the sample present intertwined board members with other firms listed on the stock market. In fact, only 9 firms in the sample were considered independent over the whole time period.

Table 4.1

Descriptive Statistics for Growth and Trade Credit

Variables	Entire sample Period 1990-2000	Financial liberalization 1990-1994	Banking and Exchange Crisis 1995-96	Banking Paralysis 1997-2000
Trade credit ratio				
--Means--				
All firms		0.69552 (2.81744)	0.57358 (1.06873)	0.60536 (0.98151)
Network firms	0.70366 (2.23860)	0.75287 (3.19622)	0.66555 (1.24104)	0.67013 (1.10965)
Independent firms	0.43786 (0.48060)	0.50435 (0.58406)	0.35092 (0.34969)	0.42793 (0.43944)
--Medians--				
All firms		0.31515	0.29305	0.34627
Network firms	0.34089	0.31911	0.30543	0.37619
Independent firms	0.28417	0.29086	0.24587	0.28640
Production growth				
--Means--				
All firms		0.080096 (0.29759)	0.055444 (0.29191)	0.086001 (0.53431)

Network firms	0.06717 (0.28307)	0.090743 (0.29305)	0.060295 (0.29982)	0.045583 (0.26284)
Independent firms	0.10725 (0.64342)	0.044607 (0.31217)	0.043698 (0.27533)	0.19671 (0.93327)
--Medians--				
All firm		0.059535	0.020599	0.034182
Network firms	0.045760	0.074180	0.015162	0.022896
Independent firms	0.045480	0.009813	0.033686	0.058597

Note: standard deviations are presented in the parenthesis.

Notice from Table 4.1 that, for the entire sample period, associated firms have a larger average trade credit ratio than independent firms, and the same can be said for the median. (Although there seems to be much more disparities in network firms since the coefficient of variation is 3.18 for member firms and 1.12 for independent firms.) These results are in line with the stylized fact presented in the literature, where the share of internal to external markets financing is larger in network oriented economies. With regard to production growth, the average mean is considerably higher in independent firms during the entire period; however, growth is practically identical in both types of firms according to the median statistics. Furthermore, annual growth is 1.39 more erratic in independent firms than in network firms when comparing their respective coefficient of variation. Presumably, if network associations are considered part of a corporate strategy, then the latter firms are willing to sacrifice growth in exchange for the benefits offered by a more stable growth.

The same statistics are also calculated for different time periods, so that it can be possible to track down the dynamics of the variables. The periods to be analyzed are the following: financial liberalization (1990-1994), exchange rate and banking crisis (1995-1996) and banking paralysis (1997-2000). For the trade credit ratio a U-pattern is observed for both, associated and

independent firms. That is, trade credit was reduced when the crisis hit the economy; however, it recovered once the economy started to grow. The evolution of production growth shows a fall in the years 1995-96 and a recovery during the years of banking paralysis for the aggregate set of firms, which was specially significant for independent firms. Perhaps, the cross-section stability observed for network firm has also a dynamic counterpart with a smoother business cycle. However, these statistics are very crude and a more assertive answer can be offered once the econometric model has been estimated. A caveat is in order with respect to the firms included in the data. Many of them, and even some of the so-called independent firms, are conglomerates with different divisions and legal affiliates. Because the data is presented in consolidated form, it is possible that some trade credit, from one affiliate to another, is not reflected at the conglomerate level statistics. Moreover, the more erratic component of independent firms might be the result of being a truly independent firm or of being a conglomerate with a vertical integration whose divisions are affected by the same idiosyncratic shocks.

■ The Econometric Model

In the model of section three, suppliers' credit was the only form of trade credit considered in the analysis, since the estimated equation represented firms' behavior on financial decisions. However, in this section the objective is to explain growth, hence, the ratio of suppliers' credit to net capital stock is included as a measure of firms' financial leverage. Thus, this variable serves to control for principal/agent effects of financing decisions on

firms' growth. A broader definition of trade credit –the sum of payable and receivable accounts- is included in the model to measure the activity of each firm in the associated internal capital market. The larger is this trade credit, the larger is the set of clients and the smaller are the chances of interrupting production lines due to a lack of inputs and raw material. In other words, the main objective in the model of section three was to test if suppliers' credit (receivable accounts) was relatively larger for affiliated firms of a business network than for independent firms. On the contrary, in this section, the model tests the relationship between trade credit and economic growth. Thus, suppliers' credit per se is not necessarily good for firms' growth, its presence might reflect a heavy financial burden and a strong control in decision making by debt investors. However, this credit will be helpful when removes financial constraint and makes it possible to re-allocate some of these funds to clients experiencing working capital difficulties. These two conflicting effects of suppliers' credit are captured in the model by incorporating in the model both trade and suppliers' credit. Moreover, because the estimation technique is the Generalized Method of Moments (GMM), it can be tested if, at least in a weakly exogenous sense, a larger activity in trade credit makes economic growth possible.

The specification for the growth regression considers some traditional macroeconomic variables such as investment, export ratio, stock market capitalization, bank credit and the initial level of production which are included as control variables. However, the model also incorporates corporate finance variables such as trade credit and debt-to-capital ratios. Most of these variables are measured at the level of the unit of analysis, and hence vary with each firm-year observation. This is not the case for the financial development variables, which are measured at the aggregate level of

the economy, and thus, they with time but are fixed over the cross-section of the panel. This characteristic also holds for the gross domestic product (GDP) growth of the Mexican economy. With the introduction of this variable it is possible to capture the relationship between the sample firms and the aggregate business cycle. Furthermore, when GDP growth is interacted with a dummy variable for business groups, it is also possible to measure a differentiated impact of the cycle depending whether the firm is independent or associated to a network.

Both, the dummy variable and macroeconomic growth are considered exogenous in the model. The former is practically fixed over time since group membership is a rather stable component of corporate governance, and the later is taken as given in the decision to grow for each firm. The other two exogenous variables are the aggregate indicators of financial development: market capitalization ratio and bank credit ratio. However, the remaining explanatory variables in the model need to be instrumented to apply GMM estimation.

Firm's growth model:

$$\frac{Y_{it}}{Y_{it-1}} = \ + \ _1 \frac{Y_{i,t-1}}{K_{i,t-1}} \ + \ _2 \frac{Q_{i,t}}{Q_{i,t-1}} \ + \ _3 \frac{Q_{i,t}}{AQ_{i,t-1}} * G_{it} \ + \ _4 \frac{TC_{i,t}}{K_{i,t}} \ +$$
$$ + \ _5 \frac{E_{i,t}}{S_{it}} \ + \ _6 \frac{I_{i,t}}{Y_{i,t}} \ + \ _7 \frac{SC_{i,t}}{K_{i,t}} \ \ _8 \frac{BC_t}{GDP_t} \ + \ _9 \frac{MK_t}{GDP_t} \ + f_i \ + \ d_t \ + \ \mu_{it}$$

where: Y is the change in firm's production, K is fixed assets, Q is the aggregate GDP growth rate, TC is the value of trade credit, G is a dummy variable that assigns one to business group membership, E is the value of export, S is the value of net sales, I is gross investment, SC is the value of

credit from suppliers, BC is the aggregate stock of bank credit debt, MK is the stock market capitalization, f is the firm-fixed effect, d is the time-fixed effect and μ is a random term .

From this model, it is straightforward to test the two main hypotheses stated in the introductory subsection. Firstly, the activity of the internal capital markets –trade credit- is positively associated to firms' growth (Ho: $_4$ > 0), and secondly, business cycles in network firms are smoother than in independent firms (Ho: $_3$ < 0 and $_2$ + $_3$ >0). If the latter hypothesis is not rejected, then it can be argued that income smoothing is one of the potential benefits for risk-averse stakeholders in a business group. If the former hypothesis is not rejected, then growth can be observed in an economy whose firms make a more intensive use of trade credit. According to the theory expressed in section two, this type of credit is possible when suppliers and clients have a long-term relationship and some reputation to protect. This relationship can be established even when debtor and lender are independent firms. However, as proved in the previous model for suppliers' credit and as shown here with means of payable and receivable accounts, the use of trade credit seems to be enhanced in firms that belong to the same business group. Consequently, firms with a strong internal capital market have a better opportunity to foster growth when the external market has been paralyzed, as experienced in the Mexican economy during the period 1995-2000.

The expected sign of the coefficients of the remaining explanatory variables is as traditionally mentioned in the literature. A negative sign for the initial level of production that captures a convergence effect to the steady-state production. A negative sign for suppliers' credit due to agency problems caused by the interference of external investors. That is, because

debtholders are more concerned with the left tail of the distribution function of revenues in limited liability firms, their monitoring activities might induce firms to undertake low-return but relatively safe projects. A positive sign for exporters if production is thought to be constrained by a limited domestic market. A positive sign for the investment ratio since future production tomorrow requires a larger capital stock today. Finally, the coefficients for the financial development variables should be positive if there is a financial bottleneck in the economy.

■ Estimation Results.

The model was estimated using different estimation techniques: panel OLS, panel within –fixed effect-, GMM-level, GMM-differences and GMM-system. For the GMM procedures, LM test for serial correlation and Sargan tests for over-identifying restrictions were applied to check the adequacy of the lag structure of the instruments, as suggested by Arellano and Bond( ). All estimations are presented in Table 4.2. The preferred model was GMM-system in column (5) since for the second-step covariance there is not serial correlation of any order, and the p-value of the Sargan test does not reject that the weighted sum of orthogonality conditions is equal to zero. Since there was no serial correlation of first order in the GMM-system, the instruments for the difference equation include even the first lagged values of the explanatory variables in levels.[6] Moreover, the fit is rather good in terms of the number statistically significant coefficients. On the contrary,

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[6] The instruments for GMM-levels were X_{t-1}, X_{t-2} and X_{t-3}; for GMM-differences were X_{t-1}, X_{t-2} and X_{t-3}, and for GMM system were $X_{t-1} - X_{t-2}$ for the equation in levels and X_{t-1}, X_{t-2} and X_{t-3} for the equation in differences. Furthermore, the dummy and the macroeconomic variables were used as their own instrument

GMM-differences is not appropriate since there is persistent serial correlation. For the case of GMM-levels, these two tests do not reject the validity of the instruments, but the fit of the model is rather poor since only one coefficient resulted statistically significant. In addition, Column (6) presents the results of GMM-system for a smaller set of explanatory variables, from where it can be observed that the variables concerned with the two main hypothesis keep the expected sign and remain statistically significant.

Table 4.2

Estimations   for   the   Growth   Model

Dependent variable: rate of growth in production (sales plus change in inventories)

Model	(1) Panel OLS	(2) Panel within	(3) GMM-level	(4) GMM-Differen.	(5) GMM-system	(6) GMM-system
Variables:						
constant	-.019752 (-.197944)		.14719 (1.54421)		-.040716 (-.34275)	-.099487 (-1.45069)
Lagged production	-0.1594E-9 (-.149143)	-.14256E-7 (-3.00586)	-1.1403E-9 (-1.59992)	-7.7271E-9 (-.42894)	-3.862E-10 (-.29296)	
GDP growth	46.6546 (3.09785)	52.1729 (2.78064)	13.46336 (0.57543)	57.77628 (1.45878)	45.71192 (2.51143)	47.13741 (2.36955)
G*GDP growth	-38.3792 (-3.08419)	-46.8720 (-2.47102)	-8.38474 (-.52969)	-45.34444 (-1.34576)	-43.67572 (-2.48614)	-44.32816 (-2.29930)
Trade credit ratio	.52305E-02 (.644907)	.010554 (1.11397)	.005857 (0.33748)	0.22561 (0.68857)	0.22128 (2.99091)	0.23882 (2.86496)
Export ratio	.130193 (1.89684)	.436621 (2.93915)	.050899 (.62623)	-.39494 (-.35297)	.072577 (.38731)	-.13613 (-.62427)
Investment ratio	.128615 (3.91477)	.102845 (3.0145)	.98238 (3.62624)	.41136 (1.69370)	.48549 (2.44896)	0.54465 (2.45598)
Debt ratio	.035003 (4.71905)	.03963 (4.4966)	-.006955 (-.23128)	-.010159 (-1.84616)	-.014207 (-2.53275)	-.013949 (-2.32410)
Aggregate credit	-.043028 (-.138725)	-.119925 (-.382498)	-.55149 (-1.64667)	-.12814 (-.28407)	-.22805 (-.69060)	
Market capital.	-.027599 (-.094118)	-.021778 (-.073606)	0.082626 (0.24819)	-.11127 (-.38246)	-.010729 (-.061814)	
Adj. R-squared	.070116	.061088				
No. of firms	65	65	65	65	65	65

Wald-test P-value Ho: $\beta_2 + \beta_3 = 0$					0.796	
Specification Tests (P-values)						
Sargan test			.14743	.13552	.21859	.12008
Serial correlation						
First-order			.97277	.00010	.31731	.31731
Second-order			.95048	.31148	.15696	.15693
Third-order			.18864	.09497	.16359	.1631

Notes: t-statistics are presented in parenthesis. All GMM estimations use the 2-step covariance matrix for the orthogonality conditions.

Notice from column (5) in Table 4.2 that neither the constant term, the initial production, the export ratio nor the financial development variables are statistically significant. However, the variables associated to the two main hypotheses are significant and have the expected sign. On the one hand, there is a positive relationship between internal market activity and growth. From this result, it can be argued that the recovery of the Mexican economy after the 1995-96 banking crisis is in part due to a larger activity of trade credit among Mexican firms. As observed in the descriptive statistic, for the period 1997-2000 the size of this market increased relatively to the exchange and banking crisis period. This result supports the validity of the hypothesis that the substitution of the external capital markets by the internal capital markets worked as a buffer in the Mexican economy to avoid a recession. Likewise, it is very likely that these markets made possible the steady economic growth observed in the last five years. Although the positive sign in an OLS equation might be also interpreted as a causality from firms' growth and more market transactions to trade credit financing, GMM estimations, by using weakly exogenous instruments, strengthens the validity of the first interpretation of the model.

On the other hand, the estimations show that independent firms are pro-cyclical, but that network firms are only marginally associated to aggregate output. In fact, the Wald test for the sum of coefficient of the aggregate growth variables does not reject the hypothesis of equality with zero. In other words, aggregate fluctuations have a much softer impact on firms associated to business groups than on independent firms, perhaps due to diversification, the workings of internal capital markets, and to the existence of a coordinated strategy between affiliated firms. Finally, the coefficient of the leverage ratio is negative as expected, and statistically significant. The estimation implies that suppliers' credit per se obstructs growth when firms are overburden by sizeable liabilities. In fact this result also holds when total liabilities or bank credit are included in the model instead of payable accounts. In a reverse causality, this result suggests that firms in a down turn accumulate payable accounts; however, the nature of GMM favors an interpretation from debt to growth. Finally, it is worthwhile to highlight the lack of statistically significance in the relationship between growth and the indicators of financial development. That is, the size of financial markets is not relevant to spur growth. In this case, the use of aggregate indicators in a regression where firms are the unit of analysis provides a truly exogenous measure of financial development, as opposed to the aggregate variables used in cross-country studies.