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# CREDIT, FINANCIAL LIBERALIZATION AND MANUFACTURING INVESTMENT IN COLOMBIA

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## **Abstract**

This paper evaluates the degree to which Colombian firms face credit restrictions that alter their investment decisions. It analyzes whether the evolution of the financial sector during the 1990s, characterized by an intense financial liberalization, an increase in size and a deepening of the activity, reduced the credit restrictions faced by firms and stimulated investment. The paper also explores whether, on the contrary, financial restrictions intensified during the recent 1998-2000 crisis. The paper provides empirical evidence suggesting that Colombian firms are indeed restricted by external resources and are compelled to resort to internal resources. The paper demonstrates that financial liberalization and the greater credit availability reduced such restrictions, and that the financial crisis had a strong and negative effect on investment and its financing. It compares the behavior of different groups of firms: (i) firms belonging to conglomerates vs. non-conglomerates, and (ii) firms with direct foreign investment vs. domestic firms. It shows that both groups face fewer financial restrictions and that they benefited less from financial liberalization. Finally, the paper evaluates the effects of indebtedness; the results suggest firms acquire debt before investing and/or that the acquired debt in the past serves as a sign of good credit history for the acquisition of new resources.



## 1. Introduction \*

Taking into account information asymmetries, costly monitoring, contract enforcement and incentive problems modifies Modigliani and Miller's view on the determinants of investment. In this alternative scenario the capital structure of the firm, *average* taxes, *current* profits and wealth matter; interest rates affect both the use of capital *and* the availability of funds, and the evolution and efficiency of the financial sector produces a "financial accelerator" that can affect cycles and growth (Hubbard, 1998).

Schumpeter (1934) recognized the potential effect of the financial sector in promoting economic growth, one of the robust conclusions in the analysis of King and Levine (1993, 2001). He also argued that credit affects productivity more than capital accumulation, a conclusion recently verified by Levine, Loayza and Beck (2000). A strong financial sector reduces global risk, allows progress in the mobilization of savings and in the allocation of capital funds, and increases the monitoring of managers. In addition, the financial sector seems to play a large role in the determination of cycles. Kindleberger (1978), for example, illustrated the importance of irrational financial markets in economic crises and Bernanke (1983) showed that debt crises and the collapse of the banking system were central factors in the explanation of the Great Depression of the 1930s. A strong financial sector is associated with macroeconomic stability and poverty reduction.<sup>1</sup>

The analysis of the relation between financial constraints, investment and firm growth was pioneered by Fazzari, Hubbard and Petersen (1988) and has been studied more recently by Gallego and Loayza (2000) for Chile, by Harris, Schiantarelli and Siregar (1994) for Indonesia, by Jaramillo, Schiantarelli and Weiss (1996) for Ecuador, by Gelos and Werner (1999) for Mexico and by Laeven (2001) for a group of 13 underdeveloped countries; by Love (2001) for 40 developed and underdeveloped countries, and by Demircuc-Kunt and Levine (1996 and 1999) for a large sample of developed and less developed countries. Common results in the literature show that financial constraints have decreased after most liberalization episodes, being indeed

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\* With the collaboration of Camila Aguilar, Maria L. Guerra and Mónica Parra. Juan José Echavarría is the director of Fedesarrollo and Maria A. Arbeláez is the editor of Coyuntura Económica, Fedesarrollo's quarterly publication. The paper benefited extensively from comments by Arturo Galindo and Fabio Schiantarelli. The authors also wish to acknowledge the comments of Mauricio Cárdenas and Fernando Tenjo, and the participants at Seminars at Fedesarrollo and the University of Los Andes.

large for those firms where information and monitoring are more costly: small and recently created companies, firms not belonging to conglomerates, and domestic as opposed to foreign firms.

The Colombian experience of the last two decades is used to further develop an understanding of this area. Colombian domestic investment grew much more than in any other Latin American country during the liberalization period of 1990-95, when capital flows and domestic credit expanded drastically, with a sharp reduction in 1998-99. Were the liberalization episodes of the 1990s important in explaining the investment boom? Did financial restrictions increase during the crisis of 1998-99?<sup>2</sup>

Section 2 of the paper reviews the evolution of the financial sector in Colombia and shows three relevant features: i) the process of financial liberalization undertaken during the 1990s was strong; ii) the financial sector and the capital market still remain very backward; iii) the crisis of 1998-2000 was deep, even when compared to the previous crisis of 1982-85. This section builds indexes of activity, size and liberalization that will be useful in the empirical analysis.

Section 3 presents some theoretical considerations, discusses the data and the estimation techniques, and explains the empirical results for Colombia. It shows that firms are financially constrained, that the financial liberalization of the 1990s and the large amounts of new credit reduced constraints, and that the recent crisis of 1998-2000 had a strong impact on investment and finance. Also compared is the behavior of different groups of firms: firms belonging to conglomerates vs. those with no conglomerate affiliation; and firms with foreign investment vs. domestic firms. It is found that conglomerate-affiliated firms and multinationals are less financially constrained; also, they benefited less from financial liberalization.

Those results should be expected in a financially constrained environment. The conglomerate is an organization partially designed to cope with information and contract enforcement problems, and firms belonging to a conglomerate are less likely to be financially constrained. They can rely on the financial resources of the group, the diversification of the group being an added bonus. Much less research has been done on the behavior of

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<sup>1</sup> According to Easterly, Islam and Stiglitz (2001), a doubling of private credit from 20 percent of GDP to 40 percent reduces the standard deviation of growth from 4 to 3 percent per annum. This improvement is not sustained with further financial deepening.

<sup>2</sup> See also Tybout (1983) and Echavarría and Tenjo (1993).

multinationals, but their connection with the parent company should facilitate access to credit and financial resources.

## **2. Financial Liberalization and the Relative Development of the Colombian Financial System**

### *The 1970s and 1980s*

During the 1970s the Colombian financial sector operated under very restrictive conditions. The regulatory framework was rigid, institutions were overregulated, and the Government tightly controlled the sector. Interest rates and credit allocation were subject to strict administrative controls. Directed credit to specific sectors at subsidized interest rates was an important proportion of total credit, and forced investment played a negative role in credit and credit institutions.

Most forced investment had a below-market return and intermediation margins were high (and tended to increase), negatively affecting financial institutions' ability to make profits. Reserve requirements were the main tool for monetary policy, with high levels and large volatility. Four commercial banks accounted for 43 percent of deposits and 45 percent of total assets.<sup>3</sup>

The Mexican debt crisis of 1982 and its aftermath hit Colombia much less than other Latin American countries,<sup>4</sup> but there were important effects nonetheless, particularly during the first part of the decade. The first casualties were observed in 1982, when deteriorating macroeconomic conditions negatively affected the performance of financial entities. A precarious regulatory framework, which combined repressive features with weak supervision, aggravated the distress of a very underdeveloped financial sector.

The financial crisis of 1982-85 was challenging. It was essentially a solvency crisis, with a portfolio deterioration aggravated by a simultaneous weakening of equity bases. Non-performing loans increased significantly in relation to total assets. The profitability of the institutions was strongly affected by the high provisions they had to undertake in 1985. Only 99 entities remained by 1986 out of the 111 functioning entities operating in 1980. Private

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<sup>3</sup> The dominant presence of government in the financial sector was evident, owning 57 percent of the capital of the commercial banks, 81 percent of Financial Corporations, 27 percent of the capital of Mortgage Corporations, CAVs, and 19 percent of the Commercial Financing Corporations.

<sup>4</sup> See Fischer (1988), Edwards (1995).

commercial banks, financial corporations and some CFCs were the most adversely affected, and the profitability of the financial sector fell abruptly in 1985. The measures adopted to overcome the crisis were oriented towards reducing solvency risk of the financial institutions, giving the government power to nationalize without compensation any financial entity undergoing severe crises; reserve requirements were lowered, and interest rates on forced investments were increased.

The Central Bank played a primary role by providing liquidity and solvency support, giving credit to the shareholders of financial institutions and to firms,<sup>5</sup> and relieving firms that had acquired foreign debt.<sup>6</sup> All those policies helped to overcome the crisis, but the state ended up as the main owner of the financial system, the undesired consequence of the whole package of measures. By the end of the decade the government owned approximately 66 percent of the assets of the banking sector and close to half the assets of the total financial system.

### ***Financial Liberalization***

A broad-based package of reforms was implemented in the early 1990s, aimed at enhancing competition, allowing the operation of foreign banks in the country, increasing reliance on market instruments,<sup>7</sup> and reducing government and monetary authorities' intervention in the financial system. The cornerstone in the area was the financial reform introduced by Law 45 of 1990, followed by Law 35 of 1993.

The financial reforms covered four main fronts: interest rate policy, credit policy, forced investment and monetary policy. Interest rates for savings deposits, for mortgage loans and for a large part of other loans were liberalized, and the Central Bank's capacity to intervene in interest rates was limited. Credit subsidies were phased out. Most interest rates were converted from fixed to variable terms at the beginning of 1987, and were gradually increased to market levels. Ceilings remained and are still in place today.

Concerning monetary policy, the Constitutional Reform of 1991 increased the autonomy of the Central Bank (Alesina, Carrasquilla and Steiner, 2000). Efforts were also made to

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<sup>5</sup> Financial capitalization (Resolution 42, 1983 and Resolution 60, 1984 of the Board). Board Resolutions 16 and 116 of 1983 (of the Board) created a capitalization fund for firms; subsidized credit was given to textiles, steel, and to the construction sector.

<sup>6</sup> Board Resolution 33 of 1984 of the Board.

<sup>7</sup> The package included Tax Reform (Law 75 of 1986), Foreign Investment Reform (Law 9 of 1991), Labor Reform (Law 50 of 1990) and Social Security Reform (Law 100 of 1993).



strengthen the role of open-market operations (OMAs) and to reduce considerably reserve requirements, which currently average approximately 5 percent, in comparison to 16.7 percent in January of 1994.

Finally, several measures of supervision and prudential regulation were taken to adjust the balance sheets of financial intermediaries to correctly reflect price changes and new investment in the sector, norms on provisions and non-performing loans were made stricter, and financial entities were required to maintain minimum solvency ratios. The overall result was a more liberalized and better-supervised financial sector.

Figure 1 presents the evolution of the liberalization process based on a compound index of domestic liberalization proposed by Lora and Barrera (1997, updated by Lora, 2001) based on the relation between reserves and deposits, the evolution of interest rate controls, and the imposition of Basel-type supervisory practices. The domestic liberalization index appears almost like a dummy variable, with a value of zero during the 1980s and 1 in the 1990s. The capital account liberalization index proposed by Morley, Machado and Pettinato (1999), on the other hand, shows a smoother trend, with the highest slope in 1990-95. The compound index is an arithmetic average of both.

**Figure 1. Domestic and Current Account Liberalization Indexes, 1978-99**

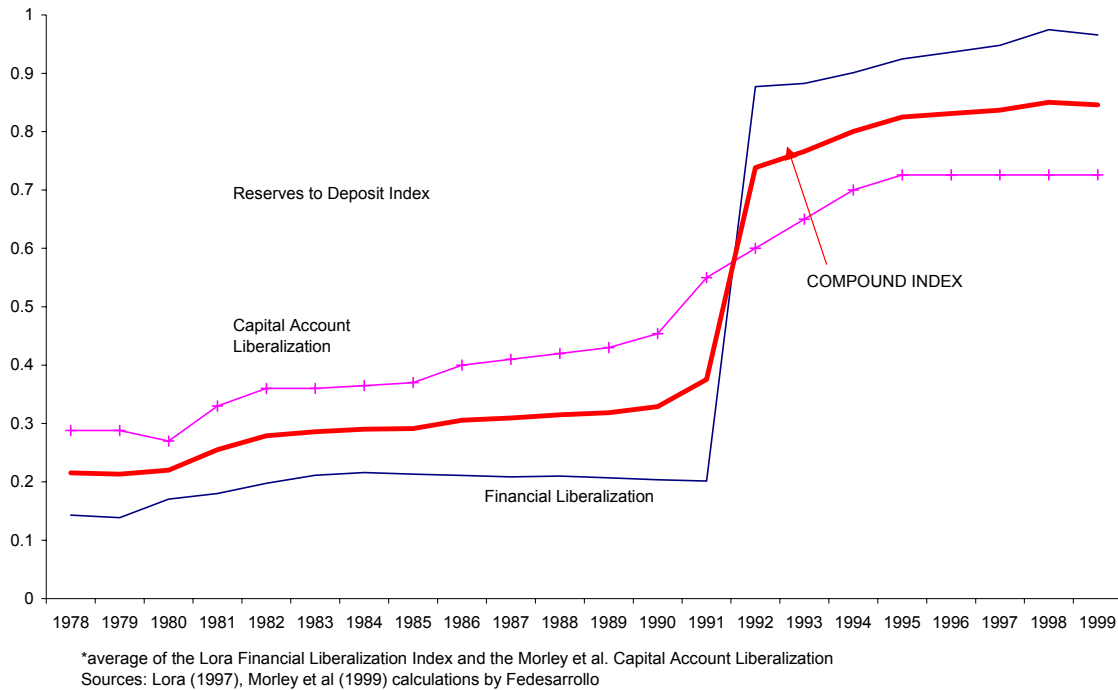
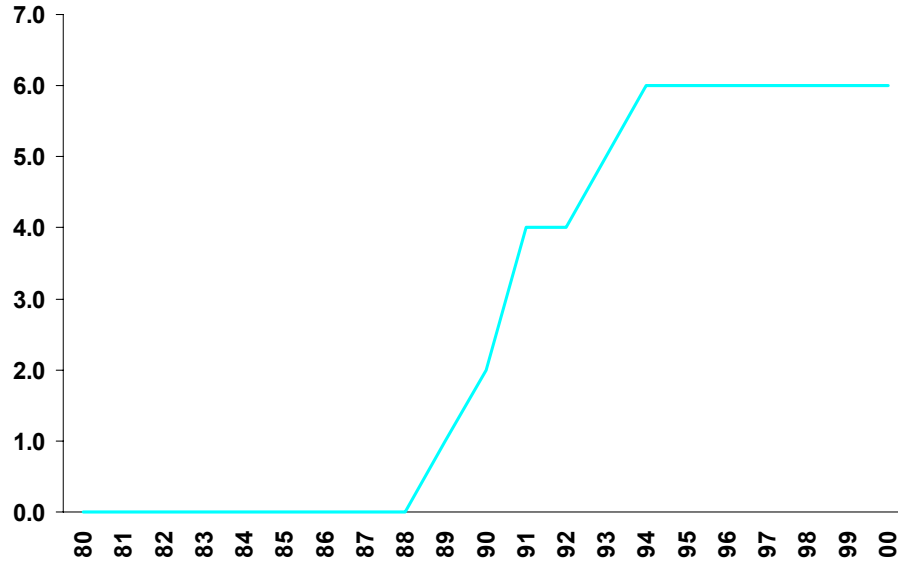


Figure 2 presents the Laeven (2001) index of liberalization. It assigns a value of 0 or 1 to each of six variables: interest rates, entry barriers, reserve requirements, credit controls, privatizations and prudential regulation. The index is the sum of the six variables; it takes a minimum value of 0 in one extreme case, and a maximum value of 6 when all six variables are “liberalized” and prudential regulations are adopted. The pattern obtained is relatively similar to that of Figure 1, though it suggests that the liberalization process started earlier (1988) and lasted longer.<sup>8</sup>

<sup>8</sup> The principal laws considered for this exercise were: interest rates (Decree 2994 of December 14, 1990); entry barriers (Law 45 of December 18, 1990); reserve requirements (Central Bank Resolution 7, 1993); credit controls (a series of decrees which partially eliminated forced investments and directed credit, FINAGRO’s investments were regulated in 1990); and privatization. The most important prudential regulation measures were adopted in 1989.

**Figure 2. Colombia: Laeven Index of Financial Liberalization**



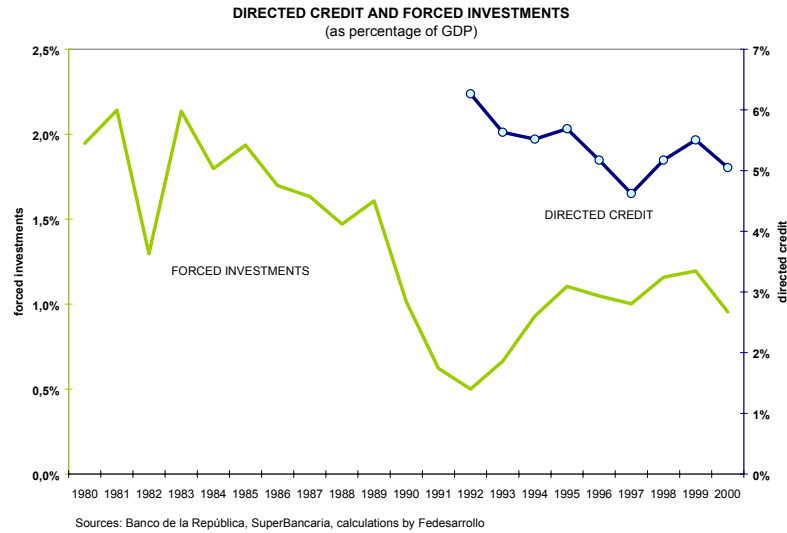
*Variables included: interest rates, entry barriers, reserve requirements, credit controls, privatizations and prudential regulation.*

Despite a great deal of liberalization on some fronts, a number of policies have gone in the opposite direction. As shown in Figure 3, for example, forced investments decreased until 1992 but increased in the following years.<sup>9</sup> The importance of directed credit decreased until 1997 but increased thereafter. FINAGRO (agriculture) and BANCOLDEX (exports) increased their directed credit in absolute terms. FOGAFIN (the financial sector guarantee fund) also exerted additional influence, particularly after 1997, when a large amount of resources were used to alleviate the pressure on the financial sector.

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<sup>9</sup> The only forced investments that still remain were the type A and B bonds for the agricultural sector (FINAGRO). In the year 2000, the Board of the Central Bank established that these forced investments would be realized as a function of the liabilities subject to reserve requirements, deducting from these the amount corresponding to required reserves. According to Hernández and Tolosa (2001), this captures the spirit of the Law 16 of 1990, whereby Finagro was created and investments were made compulsory inversely to the cost of the liabilities.

**Figure 3. Directed Credit and Forced Investment**



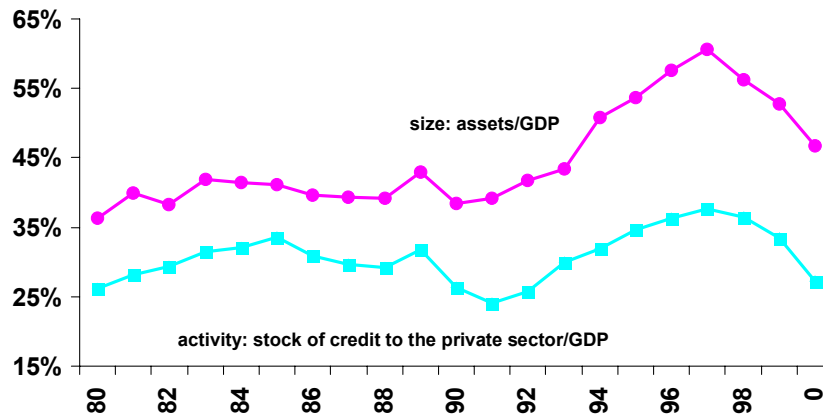
*Size and Activity*

Levine, Loayza and Beck (2000) consider “activity,” the stock of credit from the financial to the private sector, the “best” index of financial development. Gallego and Loayza (2000), on the other hand, use “activity” and “size” (the relation between assets of the financial sector and GDP) in their analysis of the impact of the financial sector in Chile.

The evolution of both variables is described in Figure 4 for Colombia. The financial system was relatively small during the 1980s, with *size* accounting for 35-40 percent of GDP. The same trend is observed in *activity*, with a weak expansion of credit during the 1980s, and a large expansion after the financial liberalization of the 1990s. The Colombian “credit boom” of 1991-97 was followed by a deep contraction during the following years, where a credit crunch could have taken place.<sup>10</sup>

<sup>10</sup> Fischer (1988) and Echeverry and Salazar (1999).

**Figure 4. Size and Activity of the Financial Sector**



Sources: Superbancaria, Banco de la República and Minhacienda.

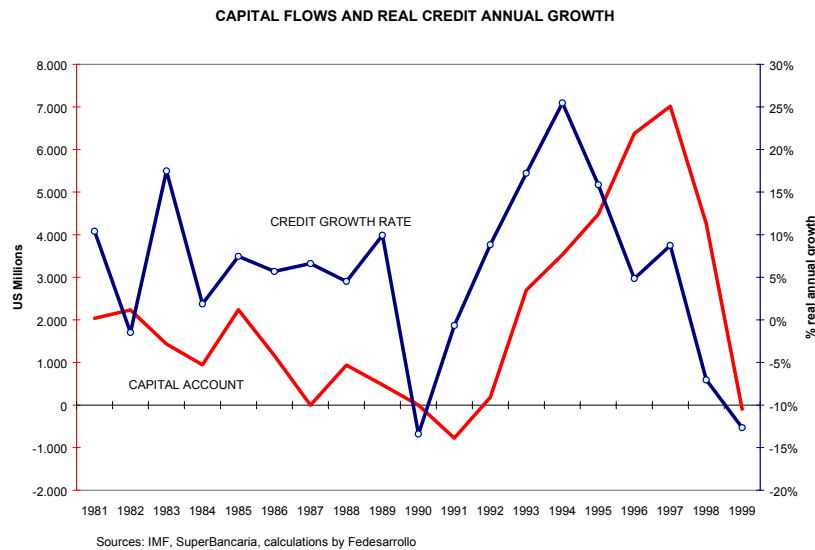
5

Financial reforms not only increased credit directly, but also indirectly through their impact on capital flows. The promotion of a larger role for foreign capital in the national financial system (in 1990 and Law 9 of 1991)<sup>11</sup> could be considered among the “pull” factors that increased capital flows and the presence of foreign banks in Colombia. Other important pull factors were the package of “structural” reforms undertaken during the first part of the 1990s and the very high interest rates of mid-1991 (39 percent for deposit rates). Calvo, Leiderman and Reinhart (1995) and Corbo and Hernández (2000) consider the relative importance of pull and push factors in Latin America during the 1990s.

Figure 5 shows the close association between capital flows and domestic credit in Colombia, a very relevant issue since capital flows to Colombia increased much faster than to other Latin American countries between 1990 and 1997, and also fell faster in 1997-2000. The close association between capital flows, credit and growth has been recently stressed by Calvo (2000).

<sup>11</sup> Before the liberalization of the 1990s, the entrance of foreign capital was restricted to 49 percent of the capital of the financial entity, a limit later eliminated. The external indebtedness norms for local agents were made more flexible, allowing for limit-free acquisition of debt with foreign banks.

**Figure 5. Capital Flows and Real Credit**



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***The Crisis of 1998-2000***

The financial crisis of 1998-2000 was much worse than any other crisis recorded in Colombia during the last decades, even much worse than the previous crisis of 1982-85 when the financial sector was also badly bruised. The deterioration of some indicators that began in 1996, especially in the mortgage sector,<sup>12</sup> was aggravated in 1998. The financial crisis was mainly induced by the economic recession of 1998 and 1999, the significant drop in national income, a spectacular increase in interest rates, and the crisis of the construction sector (Carrasquilla and Arbeláez, 2000).

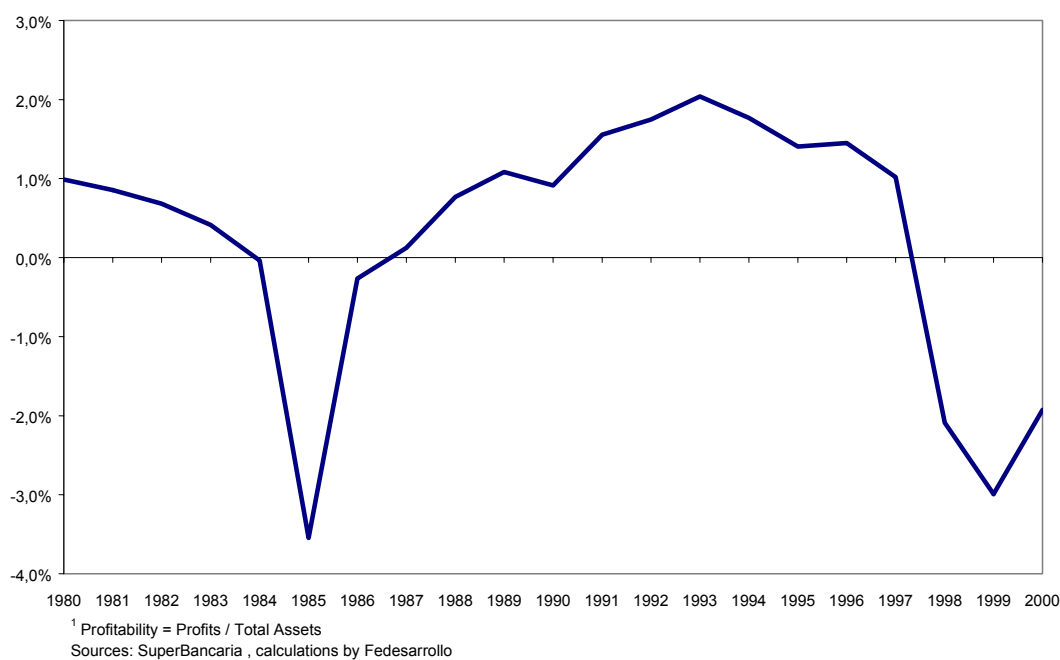
Bad loans and non-productive assets grew significantly (non-performing loans over total loans reached 12 percent in 1999). The increase in credit risk and liquidity risk caused by deposit reduction led to an important fall in credit which reached a negative real growth rate of -7.0 percent in December 1998 and averaged -12.5 percent in 1999. Solvency deteriorated and losses increased. The recent crisis has been deeper in public banks and Mortgage Corporations (CAVs) than in domestic and foreign private banks, with bailout measures mainly oriented to those sectors. In any case, it seems the government’s package has helped to ease financial distress.

<sup>12</sup> Mortgage Corporations were hardly affected by the financial reform, which included the elimination of the liquidity fund FAVI and the exclusive role of CAVs in having remunerated deposit accounts.

Solvency has recovered and credit stopped decreasing. Profitability in the financial sector (Figure 6) dropped abruptly after 1997, with negative figures in 1998, 1999 and 2000. It is not lower today than in 1985, the worse year of the 1980s, but it is less related to provision policies<sup>13</sup> and has lasted much longer.

**Figure 6.**

**PROFITABILITY<sup>1</sup> OF THE FINANCIAL SECTOR**

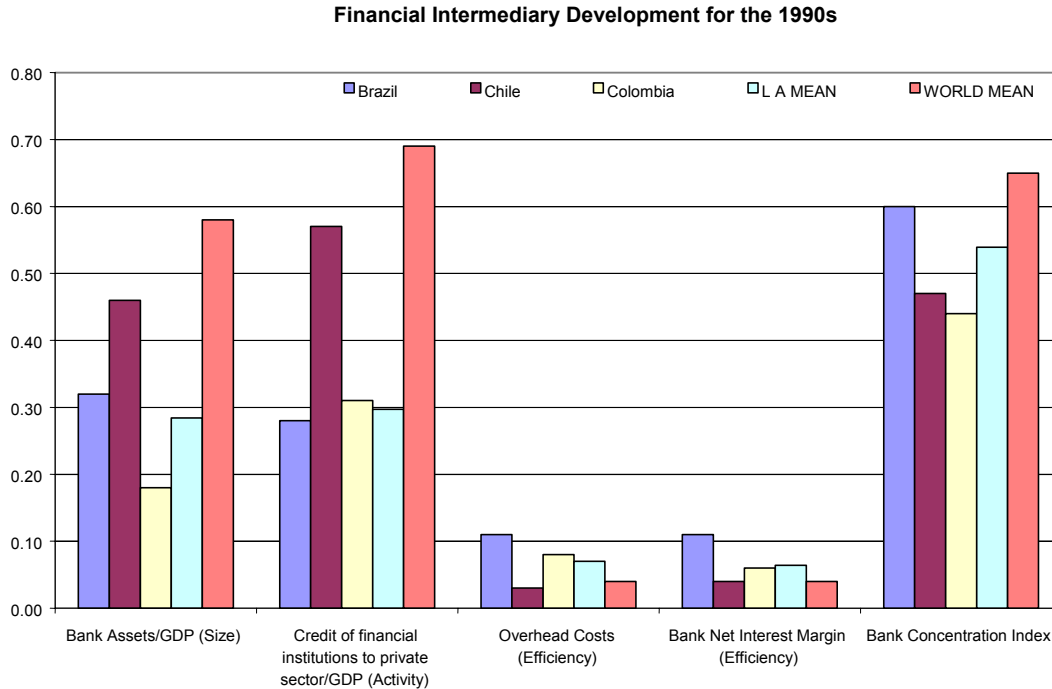


***The Colombian Financial Sector and the Stock Market Today: Still Far Behind***

Despite the important liberalization process described in the last section, the international comparisons available suggest that the Colombian financial sector remains small and inefficient. Thus, Colombia is behind the Latin American average in 7 out of the 8 variables considered in Demirguc-Kunt and Levine (1999), some of them illustrated in Figure 7, the only exception being “credit of financial institutions to private sector/GDP” in which the two practically coincide. Colombia is behind Chile and the world mean for all 8 variables, and behind Brazil for 5 of them.

<sup>13</sup> Provisions were increased only later in 1999, as a preventive and prudential measure.

**Figure 7.**



Source: Demiguc-Kunt and Levine (1999).

The previous quantitative results agree with those of a recent qualitative survey conducted by the Inter-American Development Bank and Fedesarrollo to 50-100 “representative” business people in 10 countries.<sup>14</sup> The results are reported in Arbeláez and Echavarría (2001). Colombia lags behind in most areas, from the influence of government controls, to the possibility of obtaining a loan with only a good business plan and no collateral (minimum value for Paraguay). The importance of retained earnings among the sources of funds is also greater. The available literature in the area suggests, finally, that the equity market is still more underdeveloped than the banking-financial sector (Demirguc-Kunt and Levine, 1999).

### **3. Evolution and Impact of Financial Constraints in Colombia**

This section evaluates the impact and importance of financial constraints in Colombia, using the investment equation framework developed by authors such as Hubbard (1998) and Schiantarelli (1996). Constraints should certainly matter, given the large importance of information

<sup>14</sup> Colombia, Dominican Republic, Guatemala, Honduras, Nicaragua, Panama, Paraguay, Uruguay, Jamaica, and Trinidad and Tobago.



asymmetries, costly monitoring, contract enforcement and incentive problems in a financially underdeveloped country.

This section goes further, however, and explores how much financial constraints decreased during the liberalization episodes of the first part of the 1990s and increased again during the recent and strong crisis of 1998-99. Did the Colombian experience show the positive consequences present in Chile, Mexico or Indonesia, or the fairly mild results reached in Ecuador? The section finally explores whether, as expected, those firms belonging to a conglomerate or with some direct foreign investment (FDI) face lower financial constraints.

### ***The Investment Function and Main Results***

Following Laeven (2000), an investment equation is estimated, derived from the first order conditions of a firm's value maximizing problem in a financially constrained environment. Based on Gilchrist and Himmelberg's (1998) basic setup, assuming quadratic and persistent adjustment costs as in Love (2000), and linearizing the underlying functions of the marginal productivity of capital and liquid assets, an investment equation is obtained of the following form:

$$\frac{I_{it}}{K_{it}} = \beta_1 \frac{I_{it-1}}{K_{it-1}} + \beta_2 MPK_{it} + \beta_3 \frac{FIN_{it-1}}{K_{it-1}} + \beta_4 \frac{LEV_{it}}{K_{it}} + f_i + d_i + \varepsilon_{it} \quad (1)$$

Where:

i: firm

t: year

I: investment (gross investment, absolute change in K)

K: capital stock (machinery, plant and equipment)

MPK: marginal productivity of capital

FIN: a proxy for liquidity

LEV: leverage

The specification above requires a measure of the marginal profitability of capital (MPK). As in Gilchrist and Himmelberg (1998), it is assumed that the underlying production function is a Cobb-Douglas. Under this setup the ratio of net sales to capital can be used as a

proxy for MPK. A distinctive feature of this model is that lagged investment appears as a determinant of current investment. In a framework with perfect capital markets current investment should not depend on lagged investment, but investment ratios can show high persistence when firms make arrangements that are costly to cancel (Laeven, 2001). The interest rate does not appear here, because it cancels out when solving the model.

This framework can test for departures from the basic Modigliani and Miller (1958) framework, where a firm's capital structure is independent of its value, where internal and external funds are perfect substitutes, and where investment decisions rely exclusively on expected profitability rather than financing choices. With imperfect capital markets, financing constraints may arise and internal and external funds are not usually substitutes. The nature of these could come from various sources such as information asymmetries, costly monitoring, contract enforcement and incentive problems, among others. These factors can lead to explanations of why investment decisions are in practice linked to firms' value and finance, especially in firms with higher information costs.

Hence, in a financially constraint environment, the signs of sales /k (proxying MPK) and liquidity in equation 1 should be positive. There is no a priori expected sign for leverage-debt. The positive relation obtained below can occur if firms obtain new loans (and become more indebted) before they invest, or if debt in the past act as a signal of creditworthiness to the financial intermediaries. This is the reasoning used by Harris, Schiantarelli and Siregar (1994) for the positive sign they find for large firms and conglomerates in Indonesia. Most authors find a negative sign for this relation, however, indicating that very indebted firms do not get credit easily.<sup>15</sup>

Two alternative proxies are used for FIN: the *stock* of "liquidity" defined as current assets – current liabilities and "cash flow" defined as operational profits. We obtain best results for the stock of liquidity suggesting that firms expecting high investment in the future will accumulate cash stock to use up when the opportunities arrive. Since holding cash is costly to the firm (it offers a low return) firms will accumulate cash stock only if they expect to be financially constrained in the future. This position agrees with the arguments given by Greenwald and

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<sup>15</sup> A negative relation between investment and debt is found by Gallego and Loayza (2000), Devereux and Schiantarelli (1989) and Jaramillo, Schiantarelli and Weiss (1996). Also, by Harris, Schiantarelli and Siregar (1994) for small firms. Laeven (2001) does not find evidence that small firms suffer from leverage costs.

Stiglitz (1988) and with the concept of “financial slack” in Myers and Majluf (1984). It is also the concept used by Love (2001).

There is no consensus in this area, however. Hsiao and Tahmiscioglu (1997), for example, argue that both variables are important: investment is determined by profitability considerations in the long run, and liquidity is an important determinant in the short run.<sup>16</sup> Hoshi, Kashyap and Scharfstein (1990) find a positive influence for both variables,<sup>17</sup> and the results in Devereux and Schiantarelli (1989) and Harris, Schiantarelli and Siregar (1994) are the opposite of those presented here.

Also of interest are the cross products of MPK, FIN and LEV with the macro indexes on liberalization, size and activity presented in Sections 2. This shows that the favorable development of the financial sector during the 1990s indeed decreased the financial constraints faced by the firms, or affected conglomerates or multinationals in different ways. The results are partially consistent with other studies in the area. In particular, the liberalization process reduced financial constraints in Chile for all firms, and in Mexico and Indonesia for small firms.<sup>18</sup> Laeven (2001) finds similar results for small firms in his sample of 12 countries. This did not happen in Ecuador, however, because subsidized credit for small firms disappeared after the liberalization process (Jaramillo, Schiantarelli and Weiss, 1996).

Results using the liberalization indexes are more significant than those using size or activity of the financial sector. This result in part confirms that a successful financial reform goes beyond increased credit availability but also has an impact on credit allocation. A successful financial reform removes controls on market allocation and leads to greater access to credit, reducing the premium paid on external finance. It reduces information asymmetries between borrowers and lenders and facilitates the reallocation of funds between firms. In more concrete terms, the reforms allow banks to set interest rates, abolish directed credits from official banks to preferential sectors, eliminate credit ceilings and forced lending, reduce reserve requirements, improve creditors’ rights, and stimulate securities markets. Domestic financial reforms were also accompanied by capital account liberalization in Latin America.

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<sup>16</sup> Their definition of cash flow (income after tax and interest + depreciation) and liquidity (cash flow less dividends) is, however, different from that presented here.

<sup>17</sup> Again, though, their definition of the variables differs from ours. They define cash flow as income after tax + depreciation – dividend payment and the stock of liquidity as short-term securities.

<sup>18</sup> Gallego and Loayza (2000), Gelos and Werner (1999) and Harris, Schiantarelli and Siregar (1994).

We are finally interested in the cross products between conglomerates and multinationals with the indexes of liberalization and financial development. We find that those groups are less financially constrained and benefited less with liberalization. Hoshi, Kashyap and Scharfstein (1991), Schiantarelli and Sembenelli (1995), and Cho (1995) also find important interactions between conglomerates and financial liberalization.

### ***The Data***

We use information provided by the *Superintendencia de Sociedades* and the *Superintendencia de Valores* (after 1995) in Colombia, with characteristics similar to the information used by Jaramillo, Schiantarelli and Weiss (1996) for Ecuador. The Superintendencia database contains balance sheets and income statements for eight to ten thousand firms reporting each year, with close to 25 percent of firms and 40 percent of sales in manufacturing. The Supervalores database contains balance sheets and income statements for close to 140 “very large” firms,<sup>19</sup> 42 percent of them in manufacturing (47 percent in sales, figures for 1999). In total, we worked with an unbalanced panel for 1,488 firms.<sup>20</sup>

The information on conglomerates comes from a special study undertaken by the Superintendencia de Sociedades (2000). The study presents the list of 887 “parents” and 1,983 “subsidiaries” existing in the country in the year 2000; we were able to identify balance sheets and income statements for most of the firms and work with those firms in manufacturing. We were also able to classify the different “groups” according to their ownership (or not) of “banks” (here defined as firms in the financial sector in general). The information on foreign investment comes from the census available at the Central Bank in 1998. We were not able to track the history of each firm through time, and a firm not belonging to a conglomerate or with FDI in the previous years will be erroneously considered in those two special groups.<sup>21</sup>

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<sup>19</sup> Average sales in 1999 were 22 times larger for the firms listed (Supervalores) than for the firms non-listed (Supersociedades).

<sup>20</sup> In at least some of the years in the period 1978-1999 1,972 firms reported information; 484 of them were removed because of lack of sufficient information in the regression analysis.

<sup>21</sup> Further research could shed light on the importance of different groups through time, but it is not easy to reconcile the information available in the few studies available. See Superintendencia de Sociedades (1978) and Fernández (1992). We know a little more in the area of foreign investment. Thus, the information derived from the Superintendencia de Sociedades reveals that 175 firms with (some) foreign investment in 1999, but not in 1995, represent 13.5 percent of sales. Of course, some firms disappeared: the 77 firms with foreign direct investment in 1995 but not in 1999 represent 6.7 percent of total sales.

Table 1 shows the relative weight of conglomerates and firms with FDI (in 1999, results do not change much when we consider other years). Those firms belonging to a conglomerate represent 10.6 percent of the number of firms, and 36.9 percent of sales. Firms with FDI represent 16.4 percent (number) and 45 percent (sales),<sup>22</sup> and the weight of firms belonging to conglomerates with and without banks is similar. Finally, firms created before 1970 represent more than half of sales, and those created during the 1990s represent only 9.2 percent. The comparison between number and sales indicate that firms belonging to conglomerates, firms with some FDI and “old” firms are relatively large.

**Table 1. Relative Weight in Sales, Different Groups of Firms in 1999**

	#	Sales
I. Conglomerates vs Non-Conglomerates		
Conglomerates with bank	2.3	18.6
Conglomerates without bank	8.3	18.2
Non-Conglomerates	89.4	63.1
Total (%)	100.0	100.0
II. Firms with Foreign Direct Investment (FDI)		
	16.4	45.0
III. Year of Creation		
Before 1970	30.2	60.5
70s	25.8	14.0
80s	31.0	16.3
90s	13.0	9.2
Total	100.0	100.0

Source: Superintendencia de Sociedades and Supervalores, firms with information in 1999.

### ***Evolution of the Key Variables***

Gross investment in Colombia reached in 1995 and 1999 its highest/lowest levels in decades (Figure 8), extreme levels even when compared to other Latin American countries. Contrary to the 1980s, the volatility of investment was also higher than in most Latin American countries.<sup>23</sup>

<sup>22</sup> The information derived from *Superintendencia de Sociedades* on the relative weight of firms with (some) foreign direct investment is relatively consistent with figures provided by the Central Bank, with a participation of 47.1 percent in manufacturing in 1999. Figures for other sectors would be, in descending order: energy, water and gas (62.6 percent), fishing (60.9 percent), transport (44.8 percent), banks and financial activities (33.2 percent), services (28 percent), commerce (26.3 percent), agriculture (15 percent), hotels and tourism (12.6 percent), health (11.9 percent), construction (7 percent).

<sup>23</sup> The standard deviation of investment /GDP in Colombia was 0.93 and 4.09 in the 1980s and 1990s. The value for the 1980s is less than half, and the value for the 1990s is more than double of Argentina, Brazil, Chile, Costa Rica, Ecuador or Mexico.

Finally, the second part of the figure shows that the participation of the private sector in total investment has been increasing for decades in the average Latin American country but not in Colombia.

**Figure 8. Gross Capital Formation in Colombia and Latin America, 1978-99**

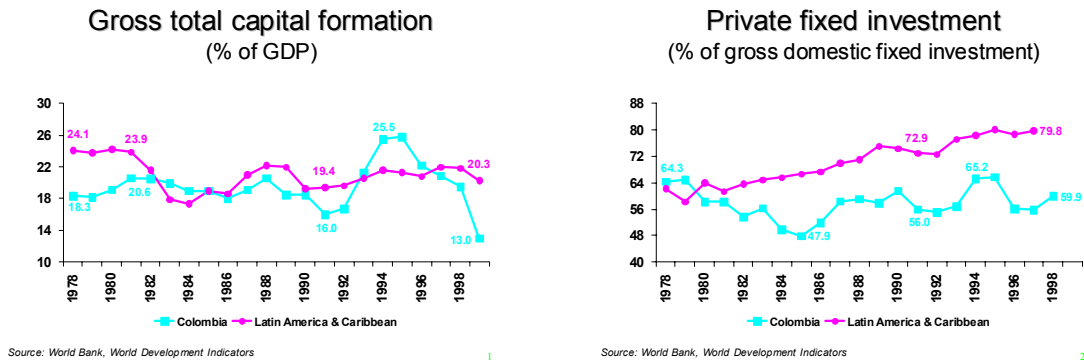
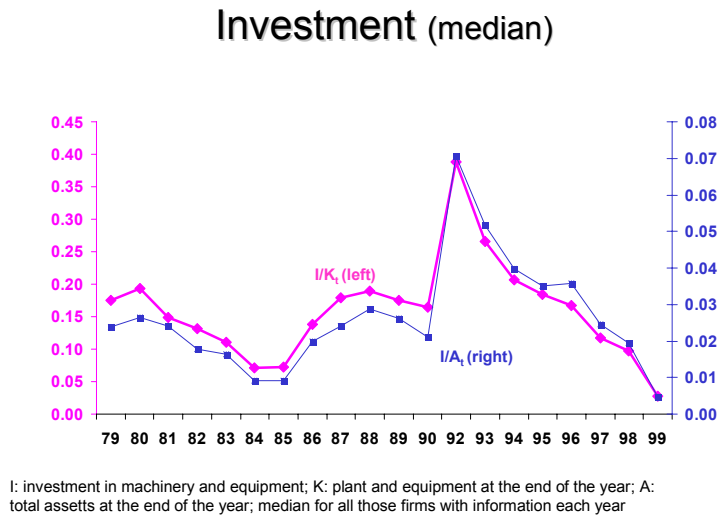


Figure 9 shows the evolution of the median value for I/K and I/A, where K corresponds to plant and equipment, and A to total assets (we will refer mostly to the variables divided by K, the ones we use in the paper). The pattern does not differ much from that of Figure 8, except that the peak occurs in 1992 instead of 1994. The value reached in 1999 is lower than in any other year in both Figures. Figure 10 shows the evolution of sales, debt, liquidity (stock of current assets – current liabilities) and cash flow (operational profits) in manufacturing, for those firms reporting each year.<sup>24</sup>

<sup>24</sup> The number of firms considered changes from 196 in 1979 to 474 in 1990. It increases very fast during the following years, reaching 1672 in 1999.

**Figure 9. Investment in Manufacturing, Median**

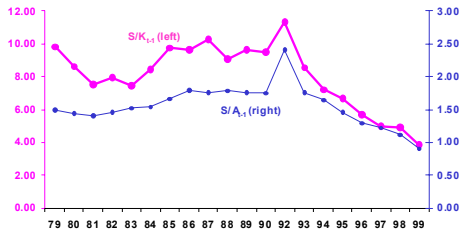


The variable  $\frac{S_t}{K_{t-1}}$  falls between 1979 and 1983, increases during the rest of the 1980s, jumps between 1990 and 1992 and falls year after year during the 1990s. The pattern for  $\frac{S_t}{A_{t-1}}$  is relatively similar, though more stable during the 1980s. Liquidity has been following in the long run, with some expansions in particular sub-periods like 1981-85 or 1990-92. There has also been a strong fall in cash flow – profits, at least during the 1990s, with bad years in 1983 and 1986. It seems finally, that firms’ level of debt is much lower today than in the past; the fall in  $\frac{D_t}{K_{t-1}}$  has been happening since 1985 and was especially marked in 1990-94. The fall in  $\frac{D_t}{A_{t-1}}$  has been much less marked.

There is the idea in Colombia that the real sector massively contracted debt during the 1990s, and that the recent recession of 1998-2000 was partially the result of the “bursting of the bubble.” The results do not confirm this idea and, on the contrary, show that levels of debt decreased during the 1990s. Table A.1 explores further the issue and shows that one of the multiple relations considered (debt *with the financial sector*/sales for manufacturing – not for all sectors) did debt increased, and only for large firms.

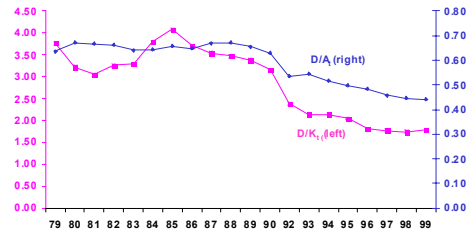
**Figure 10. Sales, Debt, Liquidity and Cash Flow-Profits in Manufacturing (Medians)**

**Sales (median)**



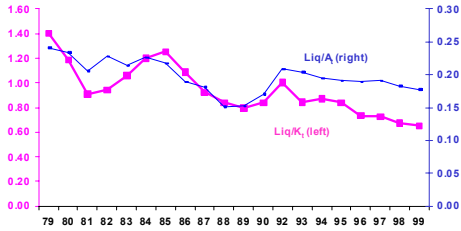
K: plant and equipment at the end of the year; A: total assets at the end of the year, median for all those firms with information each year

**Debt (total liabilities), (median)**



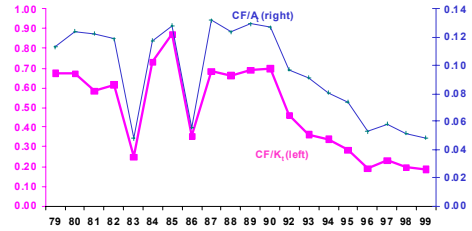
K: plant and equipment at the end of the year; A: total assets at the end of the year, median for all those firms with information each year

**Liquidity (Liq), (median)**



K: plant and equipment at the end of the year; A: total assets at the end of the year, median for all those firms with information each year

**Operational profits (CF), (median)**



K: plant and equipment at the end of the year; A: total assets at the end of the year, median for all those firms with information each year



### *Medians for Different Groups of Firms*

Table 2 presents the median values for the relevant variables (outliers removed, see Annex B) for close to 900 and 1,900 firms reporting in 1992 and 1999, respectively. It shows that sales (S/K) are larger for multinationals, firms belonging to conglomerates and “very old” firms (created before 1970). Multinationals are more liquid (Liq/k) than others, and firms created during the 1990s less liquid than others. Finally, those firms created during the 1980s have higher debt ratios (D/K) in 1999.

The other differences are not statistically significant, though all variables considered in the table are larger for multinationals in 1999, and most of them in 1992 (except debt; similar figures for sales). Firms belonging to conglomerates have higher liquidity (L/K) and lower debt (D/K). Finally, all variables except S/K are lower for the firms created during the 1990s.

All figures are lower in 1999 than in 1992, and especially for I/K, a result consistent with the information provided in Figures 13 and 14. Thus, I/K in 1999 is only 6 percent and 13 percent of the value in 1992 for conglomerates and non-conglomerates; it is 9 percent and 6 percent for firms with and without FDI; and only 5 percent for firms created during the 1990s. “Non-conglomerates” present the largest fall among all groups in CF/K and Liq/K. The fall in D/K was largest for the firms created before 1970 and during the 1970s.

**Table 2. Median Values for 1992 and 1999**

	1992					1999				
	I/K	S/K	CF/K	Liq/K	Dt/K	I/K	S/K	CF/K	Liq/K	Dt/K
I. Conglomerates										
Conglomerate	0.378	15.095**	0.493	0.882	2.764	0.052	3.772	0.099	0.501	2.076
Non-Conglomerate	0.389	16.157	0.388	1.072	2.665	0.026	4.424	0.208	0.759	1.911
II. Multinationals										
Without FDI	0.384	16.018	0.363	0.962	2.700	0.027	4.274*	0.186	0.705**	1.894
With FDI	0.392	15.998	0.578	1.280	2.585	0.035	4.867	0.220	0.849	2.029
III. Year of Creation										
Before 1970	0.417	17.714	0.543	1.266	2.913	0.030	4.914***	0.215	0.910	1.930
1970s	0.341	16.044	0.384	1.061	2.695	0.031	4.179	0.211	0.783	1.841
1980s	0.341	10.746	0.286	0.575	2.316	0.025	4.074	0.188	0.677	2.000**
1990s	0.327	33.693	0.218	0.526	2.295	0.018	3.853	0.136***	0.485***	1.904*

I: investment; K: stock of plant, machinery and equipment at the beginning of the year; S: sales; CF: cash-flow (operational profits); Liq: liquidity (current assets minus current liabilities); D: total liabilities

\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively

Methodology: significance levels were obtained with a regression between the variable and dummies for each category; outliers removed previously, following rules described in Annex 1

Source: Superintendencia de Sociedades, Superintendencia de Valores and author's calculations

### ***Correlation Matrix***

Table 3 shows the Spearman rank correlation between the variables we will consider in the regression analysis, for close to 17400 observations included in our unbalanced panel data. Correlations are relatively high (i.e., > 70%) for S/K and D/K. The correlation with sales (S/K) is similar for the stock of liquidity (Liq/K) and for cash flow – operational profits. Other criteria will be needed to choose among those two variables.

**Table 3. Spearman Rank Correlations**

Spearman Rank Correlations

	I/K	S <sub>t</sub> /K <sub>t-1</sub>	CF/K	Liq/K	D/K
I/K	1				
S/K	0.26	1			
CF/K	0.09	0.58	1		
Liq/K	-0.07	0.59	0.52	1	
D/K	-0.04	0.71	0.37	0.52	1

Source: Superintendencia Bancaria and Supervalores, close to 17400 observations

K: stock of capital at the end of the period

### ***Estimation Techniques***

The dynamic investment models considered above are likely to suffer from endogeneity since investment and cash flow or liquidity could be simultaneously determined and investment may feed back into sales. In fact, most variables pertaining to the firm, such as output and cash flow, are potentially endogenous since they depend on the technology stock (Hayashi and Inoue, 1982).

Arellano and Bond's (1988) Generalized Methods of Moments technique (GMM) allows the use of lagged dependent variables and controls for unobserved individual effects and endogeneity of explanatory variables. Their methodology considers the possibility of simultaneous determination and reverse causality. The GMM estimator *in differences*, the technique we will use in this section, uses  $(y_{i,t-2}, y_{i,t-3}, \dots, y_{i1})$  and  $(x_{i,t-2}, x_{i,t-3}, \dots, x_{i1})$  as instruments.<sup>25</sup>

<sup>25</sup> Only instruments lagged 2, 3 and 4 periods will be used. There is not much additional information in going back further, and the tests explained below will be more stringent when we include fewer instruments in the regression. Those instruments will be valid when the error term is serially uncorrelated (or at least follow a moving average process of finite order); and future innovations of the dependent variable do not affect current values of the explanatory variables. Although they can be affected by the current and past realizations of the dependent variable (jointly endogenous). See Gallego and Loayza (2000).

Arellano and Bond (1988) suggest a first and second-order correlation test to assess the validity of those instruments and the Sargan test for over-identifying restrictions. First-order serial correlation is expected by construction when we work with first differences of the variables and only second-order serial correlation will be a sign of misspecification. Our empirical evidence suggests that the GMM estimator in differences provides the most sensible results, but we also report in the Annex System (Arellano and Bover, 1995) and OLS estimators, given the potential shortcomings of each methodology (Mairesse, Hall and Mulkey, 2000).

### ***Empirical Results: Financial Constraints and Liberalization***

#### *The Basic Model*

Table 4 presents the results for the “basic model” (equation 1) using the unbalanced panel data for 1,488 of the 1,972 listed and non-listed firms that provided some information in 1981-1999.

GMM – in first differences is used, with  $\frac{I_t}{K_t}$  as the dependent variable with two lags, and sales,

liquidity (or cash flow) and debt as the independent variables. The table reports the Wald and Sargan tests (assuming homoskedastic errors) and the p values for the first and second-order serial correlation tests. Instruments lagged 2, 3 and 4 periods are used.

Results are compared for two alternative definitions of “liquidity”: current assets – current liabilities (Liq in columns 1 and 2) and operational profits (cash flow, CF, in column 3). Liquidity is sometimes preferred to CF under the argument that sales and cash flow are highly correlated, but Table 3 shows that there are no important differences between the two variables in this respect. As discussed above, there is no consensus in the theoretical literature in this area.

The relation between sales and the capital stock at the beginning of the year ( $\frac{S_t}{K_{t-1}}$ ) is used and, after considering different lag structures, one period lagged values (beginning of period) are used for liquidity, cash flow and debt  $\frac{Liq_{t-1}}{K_{t-1}}$ ,  $\frac{CF_{t-1}}{K_{t-1}}$ , and  $\frac{D_{t-1}}{K_{t-1}}$ . Second-order serial correlation does not seem to be a problem in our regressions, and the Sargan test suggests that

the restrictions are valid. Formally, the Sargan test does not reject the null hypothesis of valid over-identifying restrictions.<sup>26</sup>

The results indicate that investment depends on lagged investment (+, net for the coefficients of  $I_{t-1}$  and  $I_{t-2}$ ), sales (+), liquidity (+) and debt (+), the three variables being significant at the 1 percent level. Also, as shown in columns (1) and (2) the results for sales and liquidity are robust to the inclusion/exclusion of debt.

The stock of liquidity (current assets – current liabilities) gives “better” results than CF (operational profits). Each of the two variables in columns (2) and (3), and both variables in column (4) are used. Liquidity is highly significant and has the expected (+) sign but CF is not significant and has the “wrong” sign. The following sections will use the specification of Column (1) as the “best” model. Log-log regressions are run for this model of column (1) with elasticities of 1.3 for sales, 0.16 for the stock of liquidity and 0.36 for debt. The standardized beta coefficients are 9.3 for sales, 6.2 for liquidity and 2.6 for debt.

The system and OLS estimators of Table A. 2 and Table A.3 are very similar to those of Table 4, except for the negative (and significant) sign of D/K. However, the sign changes again to positive in the next sections when additional variables are included. OLS estimators also shift coefficients for D/K, but there is the additional difference that cash flow produces “better” results than liquidity.

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<sup>26</sup> Unfortunately, the values reported for the Sargan test using first differences are “too good,” equal to 1, in all the tables of the document, a problem which could be related to overfitting bias. The results did not change when using 2 and 3 alternative maximum lags for the instruments. The problem disappears, however, when we work with system estimators in the Appendix.

**Table 4. The Basic Model (Arellano and Bond in First Differences, 2 lags)**

Dependent variable: It/Kt				
	(1)	(2)	(3)	(4)
It <sub>1</sub> /Kt <sub>1</sub>	-6.010E-05 (-2.46)	-6.500E-05 (-2.69)***	-5.180E-05 (-2.23)***	-5.540E-05 (-2.20)***
It <sub>2</sub> /Kt <sub>2</sub>	1.127E-04 (5.69)***	1.169E-04 (6.44)***	1.131E-04 (5.99)***	1.192E-04 (6.07)***
St/K <sub>t-1</sub>	0.030 (9.34)***	0.033 (12.92)***	0.034 (11.24)***	0.030 (9.36)***
(Liq/K) <sub>t-1</sub>	0.051 (6.22)***	0.054 (6.38)***		0.055 (5.66)***
(CF/K) <sub>t-1</sub>			-0.005 (-0.23)	-0.025 (-1.17)
(D/K) <sub>t</sub>	0.022 (2.61)***		0.025 (3.00)***	0.021 (2.62)***
D_Year	X	X	X	X
Number of Observations	5377	5377	5377	5377
Number of Firms	1488	1488	1488	1488
Wald Test of joint significance	733.9	733.76	786.7	798.51
Specification Tests (p values)				
Sargan Test	1.0	1.0	1.0	1.0
First order serial correlation	0.000	0.0001	0.000	0.0001
Second order serial correlation	0.285	0.2409	0.345	0.336

S: sales; CF: cash flow (operating profits); Liq: liquidity (current assets- current liabilities); D: to debt; Kt corresponds to total assets for machinery and equipment the end of the year.

\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported

Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets; the constant not reported. The Sargan test was calculated assuming homoskedastic errors. The maximum number of lags allowed for the predetermined variables used as instruments was 4.

Sources: Superintendencia de Sociedades and Supervalores.

### *The Impact of Financial Development and Reforms*

Table 5 adds the cross products with the macroeconomic indexes of financial development mentioned in Section 2. The results for sales and liquidity are entirely consistent with those of the previous section, but the coefficient for D/K is no longer significant. The cross products indicate that the financial and the debt constraints decreased with financial “liberalization.”<sup>27</sup> The results are very similar for the four financial variables used, but liberalization indexes produce

<sup>27</sup> More rigorously we should talk of a liquidity constraint and a debt premium. Remember that the coefficient of debt is positive suggesting that indebted firms get easy credit because their good history in the bank.

better results when we include additional variables in the following sections. We also presented theoretical reasons for this choice in Section 3.A).

Regressions with “size” and “activity” for the stock market (not shown) with expected poor results given the precarious development of the stock market in Colombia. The Wald, Sargan and second-order serial correlation tests are satisfactory.<sup>28</sup> System and OLS estimators in Table A.4 and Table A.5 are consistent for most coefficients and D/K is (again, as in Table 4) significant. The cross products between debt and the macrofinancial variables are significant and have the correct signs for the system estimators and also for Lora and Laeven (but not for size or activity) when we use OLS.

The size of the coefficients in Table 5 indicate, on the other hand, that the financial liberalization had an important impact, larger for the liberalization indexes (Lora and Laeven) than for size or activity. Thus, the coefficients obtained would indicate that the financial restrictions decreased 70 percent (Lora, column 3) and 52 percent (Laeven, column 4) during the liberalization episode of 1990-1997.<sup>29</sup> The reduction is smaller but still very significant for size (30.9 percent) and activity (22.8 percent). The system estimators of Table A.4 indicate that financial restrictions decreased 56 percent (Lora), 41 percent (Laeven), 16.3 percent (size) and 26 percent (activity).

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<sup>28</sup> However, for the Sargan test see footnote 26.

<sup>29</sup> Thus, the results of column 4 (Laeven) indicate that the liquidity constraint changes from 0.0511 to 0.02432, a reduction of 52.44%;  $0.0511 + 4*(-0.0067) = 0.02432$ . The Laeven index changes 4 units between 1990 (2) and 1997 (6). For the other calculations we use the fact the size change 0.22 points (from 0.384 in 1990 to 0.606 in 1997), activity changed 0.112 points (0.264 in 1990, 0.376 in 1997) and Lora's index changed 0.744 (0.203 in 1990, 0.947 in 1997). See Figures 1 and 2.

**Table 5. Did Constraints Decrease with Liberalization and Credit?  
(Arellano and Bond in first differences, 2 lags)**

Dependent variable: $l_t/K_t$				
	(1)	(2)	(3)	(4)
$l_{t-1}/K_{t-1}$	-4.27E-06	-5.87E-06	2.96E-05	1.63E-05
	-(0.20)	-(0.27)	(1.28)	(0.70)
$l_{t-2}/K_{t-2}$	1.13E-04	1.19E-04	1.34E-04	1.27E-04
	(7.19)***	(7.48)***	(7.37)***	(7.98)***
$S_t/K_{t-1}$	0.043	0.043	0.041	0.039
	(12.70)***	(12.69)***	(12.12)***	(11.68)***
$(Liq/K)_{t-1}$	0.048	0.048	0.050	0.051
	(6.05)***	(6.07)***	(6.07)***	(6.29)***
$Liq_{t-1}/K_{t-1} * Fin\_Size$	-0.068			
	-(5.24)***			
$Liq_{t-1}/K_{t-1} * Fin\_Activity$		-0.098		
		-(4.96)***		
$Liq_{t-1}/K_{t-1} * Fin\_Liberalization (Lora)$			-0.046	
			-(5.47)***	
$Liq_{t-1}/K_{t-1} * Fin\_Liberalization (Laeven)$				-0.007
				-(5.25)***
$(D/K)_t$	0.005	0.005	0.009	0.012
	(0.65)	(0.62)	(1.07)	(1.49)
$D_t/K_t * Fin\_Size$	-0.204			
	-(9.85)***			
$D_t/K_t * Fin\_Activity$		-0.301		
		-(10.13)***		
$D_t/K_t * Fin\_Liberalization (Lora)$			-0.137	
			-(8.32)***	
$D_t/K_t * Fin\_Liberalization (Laeven)$				-0.020
				-(7.78)***
D_year	X	X	X	X
Number of Observations	5377	5377	5377	5377
Number of Firms	1488	1488	1488	1488
Wald Test of joint significance	1223.6	1221.1	662.22	699.41
Specification Tests (p values)				
Sargan Test	1.0	1.0	1.0	1.0
First order serial correlation	0.0000	0.0000	0.0001	0.0001
Second order serial correlation	0.7369	0.7261	0.5825	0.3254

S: sales; Liq: liquidity (current assets- current liabilities); D: total debt-liabilities; Kt corresponds to total assets for machinery and equipment at the end of the year; Fin\_Size: total assets of the financial sector/GDP; Fin\_activity: stock of credit from the financial sector to the private sector/GDP; Fin\_liberalization: Lora and Barrera (1997) or Laeven (2001);

\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported

Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets. The sargan test was calculated for homoscedastic errors. The maximum number of lags allowed for the predetermined variables used as instruments was 4.



### *The Crisis of 1998-99*

Liberalization and financial development reduced the constraints faced by firms, and we want to explore in this Section if those constraints increased again during the deep financial crisis of 1998-99. Table 6 adds to the basic model the cross products  $\frac{Liq_t}{K_t} \cdot D_{98-99}$  and  $\frac{D_t}{K_t} \cdot D_{98-99}$  where  $D_{98-99}$  takes the value of 1 during these last 2 years. As expected, their coefficients are significant and positive, suggesting that financial constraints did indeed increase during the financial crisis of the last two years.

The results of column (1) –liberalization – seem to be very similar to those of column (2) –activity. The results for lagged investment, sales and liquidity are consistent with those of the previous sections, and also the cross products between liquidity and debt with liberalization.  $\frac{D_t}{K_t}$  is not significant. The size of the coefficients indicates, on the other hand, that financial constraints increased 54 percent in 1998-99, with almost identical results for the Laeven Index and for activity in columns 1 and 2.<sup>30</sup>

The results of system estimators in Table A.6 are consistent for most coefficients and  $D/K$  is (again, as in Table 4) significant, but the OLS estimators in Table A.7 are less satisfactory for some variables and cross products related with liquidity.

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<sup>30</sup> In column 2 we calculate the new coefficient as  $0.0426 + 0.0232$ ; in column 1 as  $0.0454 + 0.0249$

**Table 6. The Crisis of 1998-99 (Arellano and Bond in First Differences, 2 lags)**

Dependent variable: It/Kt			
	(1)	(2)	
It-1/Kt-1	-1.56E-05	-3.16E-05	
	-(0.56)	-(1.12)	
I <sub>t-2</sub> /K <sub>t-2</sub>	1.34E-04	1.26E-04	
	(2.99)***	(2.42)***	
St/K <sub>t-1</sub>	0.042	0.045	
	(11.91)***	(12.77)***	
Liq <sub>t-1</sub> /K <sub>t-1</sub>	0.045	0.043	
	(5.77)***	(5.61)***	
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_activity		-0.083	
		-(4.41)***	
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_Liberalization (Laeven)	-0.006		
	-(4.90)***		
Liq <sub>t-1</sub> /K <sub>t-1</sub> *D_9899	0.025	0.023	
	(2.86)***	(2.67)***	
(D/K) <sub>t</sub>	0.006	0.001	
	(0.81)	(0.09)	
D <sub>t</sub> /K <sub>t</sub> *Fin_activity		-0.299	
		-(10.15)***	
D <sub>t</sub> /K <sub>t</sub> *Fin_Liberalization (Laeven)	-0.020		
	-(7.83)***		
D <sub>t</sub> /K <sub>t</sub> *D_9899	0.030	0.022	
	(3.43)***	(2.65)***	
D_year	X	X	
Number of Observations	5377	5377	
Number of Firms	1488	1488	
Wald Test of joint significance	827.85	903.51	
Specification Tests (p values)			
Sargan Test	1.0	1.0	
First order serial correlation	0.0001	0.0000	
Second order serial correlation	0.1838	0.5349	

S: sales; Liq: liquidity (current assets- current liabilities); D: total debt; Kt corresponds to total assets for machinery and equipment at the end of the year; Fin\_liberalization: Laeven (2001); Fin\_activity: stock of credit from the private sector to the financial sector/GDP; D\_9899: 1 for years 1998 and 1999  
 \*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported  
 Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets; The sargan test was calculated for homoscedastic errors. The maximum number of lags allowed for the predetermined variables used as instruments was 4.  
 Sources: information on most quantitative variables comes from Superintendencia Bancaria and from Super-valores

## ***Empirical Results: Conglomerates and Multinationals***

### *Conglomerates*

Table 7 adds the effect of conglomerates to the variables included in the “basic” model of Table 4). We use a dummy variable  $D\_conglom$  (1 when the firm belongs to a conglomerate in 2000 and 0 otherwise, Section 0) and cross products between the previous variables and the dummy. We consider Laeven liberalization index and *activity* in the regressions. We will confine our comments to column (1) of the table since liberalization seems to produce better results. Again, *liberalization* seems to capture better the impact of financial development than the amount of credit *activity*.

The coefficients and levels of significance of lagged investment, sales and liquidity are similar to those in the previous Sections, and also the cross products between liquidity and financial liberalization.  $\frac{D}{K}$  has the “correct” positive sign but is not significant. Our evidence indicates that conglomerates are less financially constrained and less debt constrained, since  $\frac{Liq_t}{K_t} \cdot D_{conglom}$  and  $\frac{D_t}{K_t} \cdot D_{conglom}$  are negative and significant. It also suggests that conglomerates benefited less from financial liberalization since the triple cross products are positive and significant. The size of the coefficients indicate that a conglomerate is 53 percent (column 1) or 19 percent (column 2) less financially constrained than the non-conglomerate firm.

The Wald and Sargan tests are satisfactory (high): the group of variables “explains” the behavior of investment, and the identifying restrictions are valid. Finally, we cannot reject the null hypothesis of no second-order serial correlation. Results for system estimators and OLS for the cross products between liquidity and debt with  $D\_conglom$  are not encouraging. The signs are as expected, but the coefficients are not significant.

**Table 7. Conglomerates (Arellano and Bond in first differences, 2 lags)**

Dependent variable: $It/Kt$	(1)	(2)
$I_{t-1}/K_{t-1}$	6.3200E-06 (0.28)	-7.21E-06 (-0.34)
$I_{t-2}/K_{t-2}$	1.2580E-04 (8.00)***	1.19E-04 (7.02)***
$S_t/K_{t-1}$	0.042 (12.02)***	0.043 (12.57)***
$(Liq/K)_{t-1}$	0.051 (6.40)***	0.047 (5.96)***
$Liq_{t-1}/K_{t-1} * Fin\_activity$		-0.069 (-1.36)
$Liq_{t-1}/K_{t-1} * Fin\_Liberalization (Laeven)$	-0.011 (-3.42)***	
$Liq_{t-1}/K_{t-1} * D\_Conglom$	-0.027 (-2.62)***	-0.009 (-0.21)
$Liq_{t-1}/K_{t-1} * Fin\_Liberalization * D\_Conglom$	0.009 (2.44)***	
$Liq_{t-1}/K_{t-1} * Fin\_acti * D\_Conglom$		-0.006 (-0.04)
$(D/K)_t$	0.009 (1.06)	0.005 (0.67)
$D_t/K_t * Fin\_Liberalization$	-0.033 (-3.58)***	
$D_t/K_t * Fin\_acti$		-0.363 (-3.90)***
$D_t/K_t * D\_Conglom$	-0.071 (-9.60)***	-0.006 (-0.15)
$D_t/K_t * Fin\_Liberalization * D\_Conglom$	0.026 (2.71)***	
$D_t/K_t * Fin\_acti * D\_Conglom$		0.088 (0.61)
D_Year	X	X
Number of Observations	5377	5377
Number of Firms	1488	1488
Wald Test of joint significance	810.67	1302.17
Specification Tests (p values)		
Sargan Test	1.0	1.0
First order serial correlation	0.0001	0.0000
Second order serial correlation	0.8564	0.6323

S: sales; Liq: liquidity (current assets- current liabilities); D: total debt; Kt corresponds to total assets for machinery and equipment at the end of the year; Fin\_liberalization: Laeven (2001); Fin\_activity: stock of credit from the private sector to the financial sector/GDP; D\_conglom: 1 when the firm belongs to a conglomerate in year 2000  
 \*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported

Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets; The sargan test was calculated for homoscedastic errors

The maximum number of lags allowed for the predetermined variables used as instruments was 4.

Sources: information on most quantitative variables comes from Superintendencia Bancaria and from Super-valores; Conglomerates from Superintendencia Bancaria (2000)

### *The Finances of the Conglomerate and Firm's Investment*

Do the finances of the conglomerate affect investment at the firm level? Do firms invest more when their conglomerate is more liquid or has a good history of debt? We calculated liquidity (current assets – current liabilities) and debt (total liabilities) for all the firms, in manufacturing and in other sectors, belonging to each of 14 conglomerates reported in *Dinero* in 1998 (Table 8).<sup>31</sup> Two of them, *Sindicato Antioqueño* and *Bavaria* account for almost half of the number of firms and close to 60 percent of sales (in 1998) of the 14 groups.

**Table 8. Conglomerates Considered and Number of Firms**

No.	Conglomerate	# firms	Sales, 1998 (%)
1	SINDICATO ANTIOQUEÑO	67	31.2
2	BAVARIA	36	27.3
3	ARDILA	26	13.1
4	SANFORD	19	5.8
5	CHAD NEME HERMANOS S.A.	11	0.7
6	MUNDIAL	9	3.8
7	CORONA	9	2.1
8	EL TIEMPO	8	1.5
9	HAIME	7	1.6
10	AVAL	7	0.9
11	OLIMPICA	5	5.3
12	COCA COLA	3	3.8
13	CAFETERO	3	1.7
14	LLOREDA	2	1.1
	<b>TOTAL</b>	<b>212</b>	<b>100.0</b>

Source: *Dinero*, Superintendencia de Sociedades, Superintendencia de Valores and author's calculations

Table 9 presents the basic model of Table 4, adding now

$\left(\frac{Liq_{t-1}}{K_{t-1}}\right)_{conglom}$  and  $\left(\frac{D_{t-1}}{K_{t-1}}\right)_{conglom}$ , liquidity and debt for the whole conglomerate. The

results do indicate, indeed, that the firm invests more when the liquidity of the whole conglomerate increases, but we did not obtain significant values for debt. Our results are entirely

<sup>31</sup> We eliminated those firms that did not have information on liquidity and debt for all years of the period 1978-99, so we ended up excluding 6 of the 20 groups considered by *Dinero*.

consistent with our previous findings related to the lower constraints faced by firms belonging to conglomerates.

**Table 9.**  
**Do Firms Invest when their Conglomerate Increases its Liquidity or Debt?**  
**(Arellano and Bond in First Differences, 2 lags)**

Dependent Variable: $I_t/K_t$		
$(I_{t-1}/K_{t-1})_i$	-0.003 -(0.07)	-0.010 -(0.20)
$(I_{t-2}/K_{t-2})_i$	-0.012 -(0.37)	-0.014 -(0.43)
$(S_t/K_{t-1})_i$	0.036 (5.05) <sup>***</sup>	0.035 (4.76) <sup>***</sup>
$(Liq_{t-1}/K_{t-1})_i$	0.054 (3.11) <sup>***</sup>	0.046 (2.90) <sup>***</sup>
$(Liq_{t-1}/K_{t-1})_{conglom}$		0.000 (2.10) <sup>***</sup>
$(D_t/K_t)_i$	0.054 (3.47) <sup>***</sup>	0.052 (3.45) <sup>***</sup>
$(D_t/K_t)_{conglom}$		-8.85E-07 -(0.02)
D_Year	X	X
Number of Observations	588	588
Number of Firms	94	94
Wald Test of joint significance	206.82	260.31
Specification Tests (p values)		
Sargan Test	0.91	0.92
First order serial correlation	-4.11	-4.11
Second order serial correlation	0.15	0.35

i: each firm; conglom: all the firms in that particular conglomerate

Source: Dinero, 20 largest conglomerates in Colombia

Methodology: we added information on liquidity (current assets - current liabilities) and debt (total liabilities) for all the firms in each conglomerate

\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported

Heteroskedasticity consistent t values in brackets; The sargan test was calculated for homoscedastic errors

### ***Direct Foreign Investment***

Not much has been done in this area to our knowledge, though it is traditionally assumed that the domestic affiliates of multinationals can partially use the resources of their parent company. The results of this section corroborate such a hypothesis, with coefficients relatively similar to those obtained for conglomerates before. We defined a dummy variable with 1 when the firm has some foreign investment in 1998 and 0 otherwise. Again, we will refer mainly to the results of column 1 using a Laeven index of liberalization (more solid than those of column 2, activity).

The coefficient of  $\frac{Liq_t}{K_t} \cdot D_{dfi}$  is negative and significant at the 5% level in Table 10, and the coefficients of the triple products  $\frac{Liq_t}{K_t} \cdot Fin\_liberalization \cdot D_{dfi}$  and  $\frac{D_t}{K_t} \cdot Fin\_liberalization \cdot D_{dfi}$  result positive and highly significant. This suggests that domestic affiliates face lower financial constraints than the average firm, but also benefited less from financial liberalization. The size of the coefficients indicates, on the other hand, that the firm with some foreign direct investment faces liquidity restrictions 46 percent lower than the other firms. System estimators (Table A.10) and OLS (Table A.11) are not as encouraging, however. The coefficients for  $Liq_{t-1}/K_{t-1} \cdot D\_DFI$  and  $Liq_{t-1}/K_{t-1} \cdot Fin\_Liberalization \cdot D\_DFI$  have the wrong signs, and are significant in some cases.

**Table 10. Direct Foreign Investment (Arellano and Bond in First Differences, 2 lags)**

Dependent variable: $\Delta I_t/K_t$	(1)	(2)
$\Delta I_{t-1}/K_{t-1}$	3.14E-05 (1.23)	4.24E-06 (0.19)
$\Delta I_{t-2}/K_{t-2}$	1.34E-04 (7.66)***	1.20E-04 (7.29)***
$\Delta S_t/K_{t-1}$	0.041 (12.52)***	0.043 (12.91)***
$(\Delta Liq/K)_{t-1}$	0.052 (6.30)***	0.047 (5.97)***
$\Delta Liq_{t-1}/K_{t-1} * \Delta Fin\_activity$		-0.109 (-4.71)***
$\Delta Liq_{t-1}/K_{t-1} * \Delta Fin\_Liberalization$	-0.008 (-5.52)***	
$\Delta Liq_{t-1}/K_{t-1} * \Delta D\_DFI$	-0.024 (-1.85)**	0.005 (0.11)
$\Delta Liq_{t-1}/K_{t-1} * \Delta Fin\_activity * \Delta D\_DFI$		0.032 (0.25)
$\Delta Liq_{t-1}/K_{t-1} * \Delta Fin\_Liberalization * \Delta D\_DFI$	0.009 (2.97)***	
$(\Delta D/K)_t$	0.012 (1.46)	0.006 (0.71)
$\Delta D/K_t * \Delta Fin\_activity$		-0.337 (-8.82)***
$\Delta D/K_t * \Delta Fin\_Liberalization$	-0.023 (-7.55)***	
$\Delta D/K_t * \Delta D\_DFI$	-0.07 (-7.14)***	-0.001 (-0.04)
$\Delta D/K_t * \Delta Fin\_activity * \Delta D\_DFI$		0.135 (1.15)
$\Delta D/K_t * \Delta Fin\_Liberalization * \Delta D\_DFI$	0.024 (5.36)***	
$\Delta D\_Year$	X	X
Number of Observations	5377	5377
Number of Firms	1488	1488
Wald Test of joint significance	748.38	1341.16
Specification Tests (p values)		
Sargan Test	1.0	1.0
First order serial correlation	0.0001	0.0000
Second order serial correlation	0.3504	0.6383

S: sales; Liq: liquidity (current assets- current liabilities); D: total debt; Kt corresponds to total assets for machinery and equipment at the end of the year; Fin\_liberalization: Laeven (2001); Fin\_activity: stock of credit from the private sector to the financial sector/GDP; D\_text: 1 if the firm has some foreign investment (registered in the Central Bank) in 1998  
 \*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported

Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent standard errors in brackets; The sargan test was calculated for homoscedastic errors. The maximum number of lags allowed for the predetermined variables used as instruments was 4.

Sources: information on most quantitative variables comes from Superintendencia Bancaria and from Super-valores; Foreign investment: Central Bank



## **Conclusions**

Financial constraints play an important role on investment in the developed economies where the financial sector is strong and diversified, and they certainly should play a larger role in some less developed countries, where the financial sector remains very behind. We show in this paper that firms are indeed financially constrained in Colombia, strongly limited by the availability of “external” funds despite the important reforms undertaken during the 1990s. The liberalization process of the 1990s decreased liquidity and debt requirements for investment, but constraints increased again during the recent crisis of 1998-99.

We do not find an important relation between operational profits – cash flow and investment, and we rather find that firms build a stock of liquidity before investment takes place. The amount of credit irrigating the economy is an important variable, but the relevant story is much more complex. In particular, the liberalization indexes seem to capture better the whole picture. A successful financial reform removes controls on market allocation and leads to greater access to credit, reducing the premium paid on external finance. They reduce information asymmetries between borrowers and lenders and facilitate the reallocation of funds between firms.

As expected, we find strong evidence that firms belonging to conglomerates and multinational firms are less financially constrained. The conglomerate is an organization partially designed to cope with information and contract enforcement problems, and firms belonging to a conglomerate are less likely to be financially constrained; they can rely on the financial resources of the group. Multinational firms, on the other hand, can use resources of the parent company and should be less constrained when they want to invest in new machinery and equipment. As expected, again, we show that those two groups of firms benefited less than the average from financial liberalization.

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## ANNEX: THE EVOLUTION OF DEBT

**Table A. 1. The Evolution of Debt, 1990-99**

I. TOTAL LIABILITIES					II. LIABILITIES WITH THE FINANCIAL SECTOR				
Total Liabilities/Plant and Equipment					Liabilities with the financial sector/Plant and equipment				
Weighted Average		Median			Weighted Average		Median		
All Sectors	Manufacturing	All Sectors	Manufacturing	All Sectors	Manufacturing	All Sectors	Manufacturing	All Sectors	Manufacturing
90	214.6	280.5	434.3	371.2	92	103.2	100.6	83.9	96.8
92	230.0	234.9	355.2	276.1	93	100.7	103.2	76.0	84.2
93	220.3	217.2	330.9	246.6	94	79.2	91.5	71.2	81.4
94	207.5	198.6	290.8	235.1	95	82.9	89.1	75.7	85.5
95	212.7	188.7	269.8	220.2	96	83.6	85.1	75.0	78.7
96	167.6	174.7	244.3	197.5	97	98.9	87.6	71.8	78.3
97	189.6	185.4	252.2	196.1	98	95.1	82.9	63.4	70.0
98	181.3	172.8	226.1	196.4	99	99.3	78.7	59.2	66.5
99	201.0	175.1	244.1	198.3					
Total Liabilities/Sales					Liabilities with the financial sector/Sales				
Weighted Average		Median			Weighted Average		Median		
All Sectors	Manufacturing	All Sectors	Manufacturing	All Sectors	Manufacturing	All Sectors	Manufacturing	All Sectors	Manufacturing
90	77.0	46.3	47.2	44.7	92	28.3	17.6	10.9	13.8
92	63.2	41.1	41.2	38.0	93	26.4	18.5	11.3	12.7
93	57.7	39.0	40.7	37.9	94	20.3	17.6	11.4	14.6
94	53.0	38.3	38.2	36.7	95	21.8	19.0	12.6	15.2
95	55.8	40.3	42.4	39.4	96	22.2	20.2	13.9	16.8
96	44.5	41.5	40.7	39.3	97	23.6	21.1	13.9	16.5
97	45.2	44.8	44.4	42.2	98	23.9	21.5	12.1	15.6
98	45.6	44.9	44.9	42.1	99	27.6	24.1	12.8	16.5
99	55.8	53.6	52.1	47.7					
Total Liabilities/Total Assets					Liabilities with the financial sector/Total Assets				
Weighted Average		Median			Weighted Average		Median		
All Sectors	Manufacturing	All Sectors	Manufacturing	All Sectors	Manufacturing	All Sectors	Manufacturing	All Sectors	Manufacturing
90	55.0	45.2	49.9	48.3	92	26.0	21.9	15.4	19.5
92	58.1	51.1	57.1	53.6	93	24.8	23.3	15.2	19.5
93	54.1	49.0	53.5	51.1	94	17.7	19.0	13.4	17.4
94	46.3	41.3	48.3	45.6	95	17.3	19.6	15.0	18.0
95	44.5	41.6	47.0	44.3	96	18.3	19.7	14.4	17.1
96	36.7	40.4	44.1	41.9	97	18.6	19.3	13.3	15.1
97	35.6	40.9	41.8	38.8	98	18.9	19.5	11.7	14.7
98	36.1	40.5	41.5	38.1	99	19.1	19.2	10.8	13.9
99	38.6	42.7	41.7	39.7					



## SYSTEM AND OLS ESTIMATORS

**Table A. 2. The Basic Model (Arellano and Bond, system estimators)**

Dependent variable: It/Kt			
	(1)	(2)	(3)
It <sub>1</sub> /Kt <sub>1</sub>	-8.003E-05 -(1.90)**	-7.294E-05 -(1.90)*	-7.622E-05 -(1.82)*
It <sub>2</sub> /Kt <sub>2</sub>	9.180E-05 (1.67)*	9.647E-05 (1.88)**	9.454E-05 (1.69)*
St/K <sub>t-1</sub>	0.010 (8.49)***	0.011 (1.88)**	0.009 (9.79)***
(Liq/K) <sub>t-1</sub>	0.013 (4.13)***		0.012 (3.64)***
(CF/K) <sub>t-1</sub>		0.015 (0.12)	
(D/K) <sub>t</sub>	-0.007 -(2.23)**	-0.004 (1.54)	
D_Year	X	X	X
Number of Observations	7239	7239	7239
Number of Firms	1762	1762	1762
Wald Test of joint significance	165	167.6	167
Specification Tests (p values)			
Sarga n Test	0.92	0.94	0.97
First order serial correlation (p value)	-4.783	-4.85	-4.776
Second order serial correlation (p value)	-0.7698	-0.8126	-0.7701

S: sales; CF: cash flow (operating profits); Liq: liquidity (current assets- current liabilities); D: total debt; Kt corresponds to total assets for machinery and equipment the end of the year.

\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported

Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets; the constant not reported. The sargan test was calculated assuming homoscedastic errors. The maximum number of lags allowed for the predetermined variables used as instruments was 4.

Sources: Superintendencia de Sociedades and Super-valores

**Table A.3. Basic Model (OLS)**

Dependent variable: $I_t/K_t$				
	(1)	(2)	(3)	(4)
$I_{t-1}/K_{t-1}$	7.510E-05 (0.56)	8.770E-05 (0.69)	9.910E-05 (0.72)	8.770E-05 (0.69)
$I_{t-2}/K_{t-2}$	6.350E-05 (0.39)	7.090E-05 (0.90)	7.260E-05 (0.36)	7.000E-05 (0.88)
$S_t/K_{t-1}$	0.006 (11.47)***	0.007 (9.13)***	0.005 (9.57)***	0.006 (9.44)***
$(Liq/K)_{t-1}$	0.006 (2.45)***		0.003 (1.25)	0.001 (0.56)
$(CF/K)_{t-1}$		0.032 (5.49)***		0.031 (5.09)***
$(D/K)_t$	-0.012 (-6.46)***	-0.010 (-5.36)***		-0.010 (-5.29)***
D_year	X	X	X	X
Number of Observations	7433	7433	7433	7433
Number of Firms	1762	1762	1762	1762

S: sales; CF: cash flow (operating profits); Liq: liquidity (current assets-current liabilities); D: total debt;  $K_t$  corresponds to total assets for machinery and equipment at the end of the year.

\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively

Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets; the constant not reported.

Sources: Superintendencia de Sociedades and Super-valores

**Table A. 4. Did Constraints Decrease with Liberalization and Credit?  
(Arellano and Bond, system estimators)**

Dependent variable: $I_t/K_t$				
	(1)	(2)	(3)	(4)
$I_{t-1}/K_{t-1}$	-1.67E-05 (-0.71)	-2.02E-05 (-0.79)	5.82E-07 (0.02)	-1.21E-05 (-0.50)
$I_{t-2}/K_{t-2}$	4.46E-05 (2.28)***	4.98E-05 (2.24)***	6.64E-05 (3.07)***	6.82E-05 (2.84)***
$St/K_{t-1}$	0.016 (9.90)***	0.017 (9.96)***	0.014 (9.18)***	0.012 (8.85)***
$(Liq/K)_{t-1}$	0.044 (6.61)***	0.043 (6.43)***	0.035 (6.30)***	0.030 (5.90)***
$Liq_{t-1}/K_{t-1} * Fin\_Size$	-0.065 (-6.66)***			
$Liq_{t-1}/K_{t-1} * Fin\_Activity$		-0.101 (-6.52)***		
$Liq_{t-1}/K_{t-1} * Fin\_Liberalization$ (Lora)			-0.027 (-5.39)***	
$Liq_{t-1}/K_{t-1} * Fin\_Liberalization$ (Laeven)				-0.003 (-4.29)***
$D_t/K_t$	0.059 (6.06)***	0.059 (6.19)***	0.044 (4.92)***	0.034 (4.20)***
$D_t/K_t * Fin\_Size$	-0.200 (-7.82)***			
$D_t/K_t * Fin\_Activity$		-0.302586 (-7.99)***		
$D_t/K_t * Fin\_Liberalization$ (Lora)			-0.107 (-6.74)***	
$D_t/K_t * Fin\_Liberalization$ (Laeven)				-0.015 (-6.25)***
$D\_year$	X	X	X	X
Number of Observations	7239	7239	7239	7239
Number of Firms	1762	1762	1762	1762
Wald Test of joint significance	274.4	248.2	227.3	210.4
Specification Tests				
Sargan test	0.998	0.886	1.000	1.000
First order serial correlation (p values)	-4.327	-4.508	-4.327	-4.353
Second order serial correlation (p values)	0.2316	0.1644	-0.6443	-0.9168

S: sales; Liq: liquidity (current assets- current liabilities); D: total debt-liabilities; Kt corresponds to total assets for machinery and equipment at the end of the year; Fin\_Size: total assets of the financial sector/GDP; Fin\_activity: stock of credit from the financial sector to the private sector/GDP; Fin\_liberalization: Lora and Barrera (1997) or Laeven (2001);

\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported

Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets. The sargan test was calculated for homoscedastic errors. The maximum number of lags allowed for the predetermined variables used as instruments was 4.

**Table A. 5. Did Constraints Decrease with Liberalization and Credit? (OLS)**

Dependent variable: It/Kt				
	(1)	(2)	(3)	(4)
$It_t/Kt_t$	4.86E-05 (0.66)	5.55E-05 (0.51)	4.90E-05 (0.42)	5.05E-05 (0.41)
$I_{t-2}/K_{t-2}$	0.0000035 (0.92)***	0.000 (0.22)	0.000 (0.38)	0.000 (0.86)**
$St/K_{t-1}$	0.010 (12.25)***	0.011 (12.34)***	0.008 (11.16)***	0.008 (10.86)***
$(Liq/K)_{t-1}$	0.037 (6.05)***	0.037 (6.00)***	0.015 (3.38)***	0.011 (2.60)***
$Liq_{t-1}/K_{t-1} * Fin\_Size$	-0.054 (-6.01)***			
$Liq_{t-1}/K_{t-1} * Fin\_Activity$		-0.088 (-6.08)***		
$Liq_{t-1}/K_{t-1} * Fin\_Liberalization (Lora)$			-0.007 (-1.44)	
$Liq_{t-1}/K_{t-1} * Fin\_Liberalization (Laeven)$				0.000 (-0.28)
$(D/K)_t$	0.081 (7.02)***	0.084 (7.22)***	0.044 (5.21)***	0.031 (4.40)***
$D_t/K_t * Fin\_Size$	-0.215 (1.27)			
$D_t/K_t * Fin\_Activity$		-0.333143 (0.48)***		
$D_t/K_t * Fin\_Liberalization (Lora)$			-0.092 (-6.90)***	
$D_t/K_t * Fin\_Liberalization (Laeven)$				-0.012 (-6.42)***
$D\_year$	X	X	X	X
Number of Observations	7433	7433	7433	7433
Number of Firms	1762	1762	1762	1762

S: sales; Liq: liquidity (current assets- current liabilities); D: total debt-liabilities; Kt corresponds to total assets for machinery and equipment at the end of the year; Fin\_Size: total assets of the financial sector/GDP; Fin\_activity: stock of credit from the financial sector to the private sector/GDP; Fin\_liberalization: Lora and Barrera (1997) or Laeven (2001);

\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported  
Methodology: outliers excluded following the rules described in Annex 1;  
heteroskedatsiticy consistent t values in brackets.

**Table A. 6. 1998 and 1999 (Arellano and Bond, system estimators)**

Dependent variable: It/Kt		
	(1)	(2)
$I_{t-1}/K_{t-1}$	-3.19E-05 -1.63	-2.93E-05 -(1.26)
$I_{t-2}/K_{t-2}$	7.17E-05 (4.27)***	5.31E-05 (3.19)***
$S_t/K_{t-1}$	0.013 (8.97)***	0.017 (9.96)***
$Liq_{t-1}/K_{t-1}$	0.025 (4.97)***	0.039 (5.67)***
$Liq_{t-1}/K_{t-1} * Fin\_activity$		-0.095 -(6.22)***
$Liq_{t-1}/K_{t-1} * Fin\_Liberalization (Laeven)$	-0.003 -(4.04)***	
$Liq_{t-1}/K_{t-1} * D\_9899$	0.020 (2.52)**	0.014 (1.78)*
$D_t/K_t$	0.031 (4.03)***	0.058 (6.11)***
$D_t/K_t * Fin\_activity$		-0.303 -(8.00)***
$D_t/K_t * Fin\_Liberalization (Laeven)$	-0.015 -(6.31)***	
$D_t/K_t * D\_9899$	0.027 (3.44)***	0.009 (1.44)*
D_Year	X	X
Number of Observations	7239	7239
Number of Firms	1762	1762
Wald Test of joint significance	336.1	296.1
Specification Tests (p values)		
Sargan Test	0.863	1.000
First order serial correlation:	-4.354	-4.528
Second order serial correlation:	-0.3096	-1.291

S: sales; Liq: liquidity (current assets- current liabilities); D: total debt; Kt corresponds to total assets for machinery and equipment at the end of the year; Fin\_liberalization: Laeven (2001); Fin\_activity: stock of credit from the private sector to the financial sector/GDP; D\_created in 1990s: 1 when the firm was created during the 1990s, 0 otherwise.

\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported

Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets; The sargan test was calculated for homoscedastic errors. The maximum number of lags allowed for the predetermined variables used as instruments was 4.

Sources: information on most quantitative variables comes from Superintendencia Bancaria and from Super-valores

**Table A. 7. 1998 and 1999 (OLS)**

Dependent variable: $I_t/K_t$		
	(1)	(2)
$I_{t-1}/K_{t-1}$	4.11E-05 (0.33)	5.39E-05 (0.50)
$I_{t-2}/K_{t-2}$	3.33E-05 (1.05)	9.43E-06 (0.27)
$S_t/K_{t-1}$	0.008 (11.12)***	0.011 (12.24)***
$Liq_{t-1}/K_{t-1}$	0.007 (1.76)**	0.034 (5.39)***
$Liq_{t-1}/K_{t-1} * Fin\_activity$		-0.083 (-5.86)***
$Liq_{t-1}/K_{t-1} * Fin\_Liberalization (Laeven)$	0.000 (-0.15)	
$Liq_{t-1}/K_{t-1} * D\_9899$	0.012 (1.80)**	0.008 (1.20)
$(D/K)_t$	0.029 (4.38)***	0.083 (7.26)***
$D_t/K_t * Fin\_activity$		-0.334 (-8.45)***
$D_t/K_t * Fin\_Liberalization (Laeven)$	-0.013 (-6.44)***	
$D_t/K_t * D\_9899$	0.033 (4.38)***	0.008 (1.61)
$D\_Year$	X	X
Number of Observations	7433	7433
Number of Firms	1762	1762

S: sales; Liq: liquidity (current assets- current liabilities); D: total debt;  $K_t$  corresponds to total assets for machinery and equipment at the end of the year; Fin\_liberalization: Laeven (2001); Fin\_activity: stock of credit from the private sector to the financial sector/GDP; D\_created in 1990s: 1 when the firm was created during the 1990s, 0 otherwise.

\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported

Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets.

Sources: information on most quantitative variables comes from Superintendencia Bancaria and from Super-valores

**Table A. 8. Conglomerates (Arellano and Bond, system estimators)**

Dependent variable: It/Kt		
	(1)	(2)
It-1/K <sub>t-1</sub>	-1.20E-05 (-0.47)	-1.97E-05 (-0.78)
It-2/K <sub>t-2</sub>	6.42E-05 (2.33)***	0.000 (1.810)**
St/K <sub>t-1</sub>	0.013 (8.19)***	0.017 (9.94)***
(Liq/K) <sub>t-1</sub>	0.040 (6.47)***	0.043 (6.31)***
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_activity		-0.073139 (-2.61)***
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_Liberalization (Laeven)	-0.004 (-2.73)***	
Liq <sub>t-1</sub> /K <sub>t-1</sub> *D_Conglom	-0.011 (-1.35)	-0.01366 (-0.29)
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_Liberalization*D_Conglom	0.002 (0.70)	
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_acti*D_Conglom		0.008 (0.05)
Dt/Kt	0.046 (5.02)***	0.059523 (6.43)***
Dt/Kt*Fin_Liberalization	-0.016 (3.65)***	
Dt/Kt*Fin_acti		-0.319 (-8.71)***
Dt/Kt*D_Conglom	-0.054 (-8.64)***	0.004839 (0.03)
Dt/Kt*Fin_Liberalization*D_Conglom	0.009 (3.65)***	
Dt/Kt*Fin_acti*D_Conglom		0.004349 (0.03)
D_Year	X	X
Number of Observations	7239	7239
Number of Firms	1762	1762
Wald Test of joint significance	235.4	322.3
Specification Tests		
Sargan Test	1.0000	0.8540
First order serial correlation (p values)	-4.055	-4.216
Second order serial correlation (p values)	-0.1864	-0.6895

S: sales; Liq: liquidity (current assets- current liabilities); D: total debt; Kt corresponds to total assets for machinery and equipment at the end of the year; Fin\_liberalization: Laeven (2001); Fin\_activity: stock of credit from the private sector to the financial sector/GDP; D\_conglom: 1 when the firm belongs to a conglomerate in year 2000

\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported  
Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets; The sargan test was calculated for homoscedastic errors

Sources: information on most quantitative variables and on Conglomerates come from Superintendencia Bancaria; Direct Foreign Investment: Central Bank of Colombia

**Table A. 9. Conglomerates (OLS)**

Dependent variable: It/Kt		
	(1)	(2)
It-1/K <sub>t-1</sub>	5.65E-05 (0.48)	5.91E-05 (0.55)
It-2/K <sub>t-2</sub>	2.98E-05 (0.70)	0.000 (0.26)***
St/K <sub>t-1</sub>	0.008 (10.50)***	0.011 (12.48)***
(Liq/K) <sub>t-1</sub>	0.022 (3.95)***	0.038 (5.95)***
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_activity		-0.063 (-2.53)***
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_Liberalization (Laeven)	-0.001 (-0.73)	
Liq <sub>t-1</sub> /K <sub>t-1</sub> *D_Conglom	-0.002 (-0.37)	-0.019 (-0.58)
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_Liberalization*D_Conglom	0.009 (4.24)***	
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_acti*D_Conglom		0.027 (0.26)
(D/K) <sub>t</sub>	0.050 (5.74)***	0.084 (7.37)***
Dt/Kt*Fin_Liberalization	-0.015 (-6.32)***	
Dt/Kt*Fin_acti		-0.352 (-9.25)***
Dt/Kt*D_Conglom	-0.048 (-10.10)***	-0.012863 (-0.41)
Dt/Kt*Fin_Liberalization*D_Conglom	0.009 (4.49)***	
Dt/Kt*Fin_acti*D_Conglom		0.059 (0.57)
D_Year	X	X
Number of Observations	7433	7433
Number of Firms	1762	1762

S: sales; Liq: liquidity (current assets- current liabilities); D: total debt; Kt corresponds to total assets for machinery and equipment at the end of the year; Fin\_liberalization: Laeven (2001); Fin\_activity: stock of credit from the private sector to the financial sector/GDP; D\_conglom: 1 when the firm belongs to a conglomerate in year 2000

\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported

Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets

Sources: information on most quantitative variables and on Conglomerates come from Superintendencia Bancaria; Direct Foreign Investment: Central Bank of Colombia



**Table A. 10. Direct Foreign Investment  
(Arellano and Bond, system estimators)**

Dependent variable: It/Kt		
	(1)	(2)
It <sub>t</sub> /Kt <sub>t-1</sub>	-7.09E-06 (-0.31)	-1.86E-05 (-0.78)
I <sub>t-2</sub> /K <sub>t-2</sub>	5.90E-05 (2.47)***	3.71E-05 (1.65)**
St/K <sub>t-1</sub>	0.012 (9.05)***	0.017 (9.86)***
(Liq/K) <sub>t-1</sub>	0.028 (5.26)***	0.044 (6.32)***
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_activity		-0.093 (-6.06)***
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_Liberalization	-0.002 (-2.90)***	
Liq <sub>t-1</sub> /K <sub>t-1</sub> *D_DFI	0.020 (2.33)***	0.050 (1.25)
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_activity*D_DFI		-0.185 (-1.57)
Liq <sub>t-1</sub> /K <sub>t-1</sub> *Fin_Liberalization*D_DFI	-0.006 (-3.36)***	
D <sub>t</sub> /K <sub>t</sub>	0.038 (4.50)***	0.060 (6.23)***
Dt/Kt*Fin_activity		-0.318 (-7.68)***
Dt/Kt*Fin_Liberalization	-0.016 (-6.16)***	
Dt/Kt*D_DFI	-0.033 (2.33)***	-0.082 (-2.66)***
Dt/Kt*Fin_activity*D_DFI		0.308 (3.08)***
Dt/Kt*Fin_Liberalization*D_DFI	0.010 (5.28)***	
D_Year	X	X
Number of Observations	7239	7239
Number of Firms	1762	1762
Wald Test of joint significance	257.3	349.9
Specification Tests		
Sargan Test	1.000	0.843
First order serial correlation (p values)	-4.402	-4.558
Second order serial correlation (p values)	-0.232	-0.8697

S: sales; Liq: liquidity (current assets- current liabilities); D: total debt; Kt corresponds to total assets for machinery and equipment at the end of the year; Fin\_liberalization: Laeven (2001); Fin\_activity: stock of credit from the private sector to the financial sector/GDP; D\_text: 1 if the firm has some foreign investment (registered in the Central Bank) in 1998  
\*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively; constant not reported

Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets; The sargan test was calculated for homoscedastic errors. The maximum number of lags allowed for the predetermined variables used as instruments was 4.

Sources: information on most quantitative variables comes from Superintendencia Bancaria and from Super-valores; Foreign investment: Central Bank

**Table A. 11. Direct Foreign Investment (OLS)**

Dependent variable: $It/Kt$		
	(1)	(2)
$It_{-1}/Kt_{-1}$	4.23E-05 (0.40)	4.62E-05 (0.38)
$It_{-2}/Kt_{-2}$	-5.07E-06 (-0.14)	2.31E-05 (0.60)
$St/K_{t-1}$	0.011 (12.33)***	0.007 (10.57)***
$(Liq/K)_{t-1}$	0.038 (6.05)***	0.005 (1.17)
$Liq_{t-1}/K_{t-1} * Fin\_activity$	-0.081 (-5.74)***	
$Liq_{t-1}/K_{t-1} * Fin\_Liberalization$		0.001 (1.04)
$Liq_{t-1}/K_{t-1} * D\_DFI$	0.063 (2.34)***	0.028 (5.03)***
$Liq_{t-1}/K_{t-1} * Fin\_activity * D\_DFI$	-0.222 (-2.71)***	
$Liq_{t-1}/K_{t-1} * Fin\_Liberalization * D\_DFI$		-0.008 (-5.19)***
$D_t/K_t$	0.084 (7.25)***	0.036 (4.73)***
$D_t/K_t * Fin\_activity$	-0.345 (-8.34)***	
$D_t/K_t * Fin\_Liberalization$		-0.013 (-6.36)***
$D_t/K_t * D\_DFI$	-0.064 (-2.91)***	-0.025 (-5.99)***
$D_t/K_t * Fin\_activity * D\_DFI$	0.244 (3.35)***	
$D_t/K_t * Fin\_Liberalization * D\_DFI$		0.008 (5.14)***
$D\_Year$	X	X
Number of Observations	7433	7433
Number of Firms	1762	1762

S: sales; Liq: liquidity (current assets- current liabilities); D: total debt; Kt corresponds to total assets for machinery and equipment at the end of the year; Fin\_liberalization: Laeven (2001); Fin\_activity: stock of credit from the private sector to the financial sector/GDP; D\_text: 1 if the firm has some foreign investment (registered in the Central Bank) in 1998  
 \*\*\*, \*\*, \*: significant at 1%, 5% or 10% respectively  
 Methodology: outliers excluded following the rules described in Annex 1; heteroskedasticity consistent t values in brackets.  
 test was calculated for homoscedastic errors.  
 Sources: information on most quantitative variables comes from Superintendencia Bancaria and from Super-valores; Foreign investment: Central Bank

## **DELETION CRITERIA**

We followed Laeven (2001) when choosing the deletion criteria. We eliminated those firms belonging to the top 5 percentile when working with the 1972 firms; and the top 1 percentile for the 167 stable firms. Thus, for the 1972 sample we eliminated:

Firms that operate in the financial sector

All firms with zero or negative value for the capital stock (property, plant and equipment)

All firms with  $I/K > 1.57$  (95% top percentile)

All firms with  $S/K > 51.8$  (95% top percentile)

All firms with  $CF/K > 4.48$  (95% top percentile), CF defined as operational profits

All firms with  $Liq/K > 12.8$  (95% top percentile), Liq defined as current assets – current liabilities

All firms with  $D/K > 21.8$  (95% top percentile), D being total debt