

Banco Central de Chile  
Documentos de Trabajo

Central Bank of Chile  
Working Papers

N° 412

Marzo 2007

**MULTINATIONALS AS STABILIZERS?: ECONOMIC  
CRISIS AND PLANT EMPLOYMENT GROWTH**

Roberto Álvarez

Holger Görg

---

La serie de Documentos de Trabajo en versión PDF puede obtenerse gratis en la dirección electrónica: <http://www.bcentral.cl/esp/estpub/estudios/dtbc>. Existe la posibilidad de solicitar una copia impresa con un costo de \$500 si es dentro de Chile y US\$12 si es para fuera de Chile. Las solicitudes se pueden hacer por fax: (56-2) 6702231 o a través de correo electrónico: [bcch@bcentral.cl](mailto:bcch@bcentral.cl).

Working Papers in PDF format can be downloaded free of charge from: <http://www.bcentral.cl/eng/stdpub/studies/workingpaper>. Printed versions can be ordered individually for US\$12 per copy (for orders inside Chile the charge is Ch\$500.) Orders can be placed by fax: (56-2) 6702231 or e-mail: [bcch@bcentral.cl](mailto:bcch@bcentral.cl).



**BANCO CENTRAL DE CHILE**

**CENTRAL BANK OF CHILE**

La serie Documentos de Trabajo es una publicación del Banco Central de Chile que divulga los trabajos de investigación económica realizados por profesionales de esta institución o encargados por ella a terceros. El objetivo de la serie es aportar al debate temas relevantes y presentar nuevos enfoques en el análisis de los mismos. La difusión de los Documentos de Trabajo sólo intenta facilitar el intercambio de ideas y dar a conocer investigaciones, con carácter preliminar, para su discusión y comentarios.

La publicación de los Documentos de Trabajo no está sujeta a la aprobación previa de los miembros del Consejo del Banco Central de Chile. Tanto el contenido de los Documentos de Trabajo como también los análisis y conclusiones que de ellos se deriven, son de exclusiva responsabilidad de su o sus autores y no reflejan necesariamente la opinión del Banco Central de Chile o de sus Consejeros.

The Working Papers series of the Central Bank of Chile disseminates economic research conducted by Central Bank staff or third parties under the sponsorship of the Bank. The purpose of the series is to contribute to the discussion of relevant issues and develop new analytical or empirical approaches in their analyses. The only aim of the Working Papers is to disseminate preliminary research for its discussion and comments.

Publication of Working Papers is not subject to previous approval by the members of the Board of the Central Bank. The views and conclusions presented in the papers are exclusively those of the author(s) and do not necessarily reflect the position of the Central Bank of Chile or of the Board members.

Documentos de Trabajo del Banco Central de Chile  
Working Papers of the Central Bank of Chile  
Agustinas 1180  
Teléfono: (56-2) 6702475; Fax: (56-2) 6702231

## MULTINATIONALS AS STABILIZERS?: ECONOMIC CRISIS AND PLANT EMPLOYMENT GROWTH

Roberto Álvarez  
Economista Senior  
Gerencia de Investigación Económica  
Banco Central de Chile

Holger Görg  
University of Nottingham  
y  
CEPR

### Resumen

Este artículo investiga si existen diferencias en la respuesta de firmas extranjeras y nacionales a la crisis económica que sufrió Chile a fines de los noventa. Se encuentra que el empleo manufacturero se redujo fuertemente durante esta crisis. Sin embargo, los resultados no revelan que la reducción sea distinta entre firmas extranjeras y locales. Estos resultados son robustos a cambios en la técnica de estimación y a la inclusión de otras variables de control, y no difieren de acuerdo con el grado de dependencia de financiamiento externo de las industrias. En general, este trabajo no respalda la idea de que las firmas extranjeras sean menos afectadas por una crisis económica y que esta manera puedan actuar como un estabilizador del empleo en países en desarrollo.

### Abstract

This paper examines the link between multinational enterprises and employment growth at the plant-level. We investigate in detail the comparative response of multinationals and domestic firms to an economic crisis, using the empirical setting of a well defined case of economic slowdown in Chile as a natural experiment. In our empirical analysis we find that employment growth in manufacturing plants has been drastically reduced during the economic crisis. More importantly, we do not find evidence that multinationals react to the economic crisis differently than do domestic firms. Our findings hold in a number of robustness tests, in which we also investigate the role of access to finance. The results are in contrast to the idea that multinationals are less affected by an economic crisis and that they may be able to act as stabilizers in developing countries.

---

Holger Görg gratefully acknowledges financial support from the Leverhulme Trust (Programme Grant F114/BF). We thank seminar participants at Central Bank of Chile, Department of Economics at University of Chile, and the 2006 Chilean Economic Society Conference for valuable comments and suggestions. We are also grateful to José Miguel Benavente and Kevin Cowan for detailed comments and Claudio Raddatz for providing us access to his data.

E-mails: [ralvarez@bcentral.cl](mailto:ralvarez@bcentral.cl); [holger.gorg@nottingham.ac.uk](mailto:holger.gorg@nottingham.ac.uk).

## 1. Introduction

Increasing levels of foreign direct investment (FDI) in the world economy have spurred considerable policy and academic interest into the determinants and consequences of this phenomenon. Governments in both developed and developing countries generally seem to view inward FDI as highly desirable. There is plenty of evidence that many countries actively promote inward FDI through relaxations of investment regulations, or investment incentives (UN 2003). What is the impact of FDI on host countries? How well justified is promoting FDI for developing countries? These are very important questions from a policy point of view. Most of the research on development effects of inward FDI in the host country has focused so far on micro-level productivity and wage spillovers, development of indigenous firms, and aggregate economic growth.<sup>1</sup>

In this paper we stress a different mechanism by which inward FDI, or more specifically the activities of foreign multinationals, may have an impact on host country development. In particular, we investigate whether multinationals react differently to economic crises than domestic firms, in terms of employment adjustment at the firm level. Little is known about the comparative reactions of these two types of firms to economic crisis<sup>2</sup>, especially in terms of employment. This may be crucial for understanding why some countries are more able to recover quickly from recessions.

In an early paper, McAleese and Counahan (1979) argue that multinationals may introduce instability into a host economy during an economic crisis, as it is easier for them to transfer production facilities internationally than it is for domestic firms. On the other hand, however, they point out that if one regards multinationals purely as profit maximizing multi-

---

<sup>1</sup> See Javorcik (2004), Barrios et al. (2005), Aitken et al. (1996), Alfaro et al. (2004) for recent examples.

<sup>2</sup> An exception is Blalock et. al. (2005). They analyze the impact of financial crisis on investment for domestic and foreign owned firms in Indonesia.

plant firms then there may be no strong case for arguing that they should be more unstable than domestic firms. Performing a simple empirical analysis by looking at differences in aggregate employment growth rates for Ireland they do not find any differences in employment adjustment between the two types of firms during a recession. In a more recent paper, Desai et. al. (2004) show that US multinationals located in emerging markets increase operations more than domestic firms in the presence of a currency crisis. Hence, rather than increasing instability they tend to impact positively on the host country during such a crisis. They argue that this is due to multinationals being less financially constrained than domestic firms (see also Harrison and McMillan, 2003) which allows them to expand economic activity during currency crisis.

Our paper relates to these earlier studies and investigates in detail the comparative response of multinationals and domestic firms to an economic crisis, using the empirical setting of a well defined case of economic slowdown in Chile. After growing for more than a decade at 7 percent per year, the Chilean economy was hit by the international financial crisis in the late 1990s. In 1998, the economy expanded at a lower rate of 3.2 percent, and 1999 experienced its first recession in two decades (-0.8 percent of GDP growth). Unemployment grew from 5.3 percent in 1997 to 8.3 percent in 2000, reaching a peak of 8.9 per cent in 1999 (Cowan et. al. 2005). We use this crisis as a natural experiment to examine the differences in employment growth between multinationals and domestic firms, and how this is affected by the economic crisis. We use firm level data for Chile and apply a difference-in-differences approach in which employment growth for multinationals is compared to domestic firms in

two different time periods: one of rapid growth and one of growth slowdown. To the best of our knowledge, this is the first in-depth empirical study of this issue using micro-level data.<sup>3</sup>

Why would we expect multinationals to react differently than domestic plants? One reason is that foreign firms may be less dependent on domestic finance in their operations (Desai et al., 2004; Harrison and McMillan, 2003). If this were true, we should observe that the impact of economic crisis differs according to the needs of financing<sup>4</sup>. To detect such a difference, we use measures of external dependence for 3-digit ISIC industries, developed by Rajan and Zingales (1998) and analyze whether multinationals are more prone to grow in industries where external financing is more important. Furthermore, we investigate whether a high dependence on interest payments for a firm is important in this regard.

Another potential reason is that multinationals are more volatile because they can move production facilities easily between different countries (Flamm, 1984). On the other hand, however, one may take a more benevolent view of multinationals and suggest that their response may not be different from domestic firms (McAleese and Counahan, 1979). After all, substantial sunk costs involved in FDI may imply that multinationals are unlikely to respond strongly to short term changes in host country conditions and behave more like domestic firms. Given these different theoretical priors, it appears worthwhile to turn to empirical evidence.

In our empirical analysis we find that employment growth in manufacturing plants has been drastically reduced during the economic crisis. Compared to the period 1990-1995, plant employment growth is between 13.5 and 23.6 percent lower in the late 1990s. More importantly, we do not find evidence that multinationals react to the economic crisis

---

<sup>3</sup> Levinsohn (1993) is an early paper examining the effect of trade liberalization in Chile on employment growth.

<sup>4</sup> At the aggregate level, Braun and Larrain (2005) show evidence that industries that are more dependent on external finance are hit harder during recessions. We focus here on the effects at the plant level.

differently than do domestic firms. Extending the baseline analysis, we use the measures developed by Rajan and Zingales (1998) and analyze whether multinationals are more prone to grow in industries where external financing is more important. Furthermore, we use a measure of a firm's dependence on interest payments to check whether this has any impact on employment growth. We do not find evidence in this regard. Our findings are, therefore, in contrast with the idea that multinational firms are less affected by economic crisis and may be able to act as stabilizers in developing countries.

The remainder of the paper is structured as follows. In section 2, we present our data and some preliminary evidence on employment growth for domestic and multinational plants. In section 3, we discuss our econometric strategy and present our main results. In section 4, we examine the role of external financing in explaining differences in plant performance. Finally, section 5 concludes.

## **2. Data and Preliminary Empirics**

The analysis is based on the Annual National Industrial Survey (ENIA) carried out by the National Institute of Statistics of Chile (INE). This plant level survey is representative of the universe of Chilean manufacturing plants with 10 or more workers. The dataset is available for the period 1979 to 2000, but we have information for exports and foreign ownership only since 1990. Given that we are interested in studying the relationship between plant growth and multinationals, and that we also explore some differences between multinational exporters and non-exporters, we use information for the period 1990 through 2000.

The INE updates the survey annually by incorporating plants that started operating during the year and excluding those plants that stopped operating for any reason. Each plant has a unique identification number which allow us to identify entry and exit. For each plant and

year, ENIA collects data on production, value added, sales, employment and wages (production and non-production), exports, investment, depreciation, energy usage, foreign licenses, and other plant characteristics. Plant ownership is identified by the percentage of capital owned by foreigners. We define a foreign plant as one with any foreign ownership. Most plants, however, have majority foreign ownership<sup>5</sup>. In addition, plants are classified according to the International Standard Industrial Classification (ISIC) rev 2. Using 4-digit industry level price deflators, all financial variables were converted to constant 1985 pesos. Plants do not report information on capital stock, thus it was necessary to construct this variable using the perpetual inventory method for each plant.

Table 1 presents the distribution of plants according to ownership and export orientation. We take export activity into account as the recent literature on firm level heterogeneity suggests that in a comparison of plants, domestic exporters may have characteristics that are somewhere between purely domestic firms and multinationals (e.g., Helpman et al., 2004). Furthermore, export oriented multinationals may behave differently to other multinationals in the presence of an economic crisis, as they are not reliant on the domestic output market.

Our data show that in 1990, foreign plants only represented 4.2 percent of total plants in the manufacturing industry. Their participation increased to 5.9 and 6.1 percent in 1995 and 2000, respectively. The majority of domestic plants are non-exporters, while more than 50 percent of multinationals export. Also, in general the importance of exporters has increased in domestic and multinational plants between 1990 and 2000. Although multinationals are relatively less important in terms of plant numbers they represent a large and growing share of employment, value-added, and exports as shown in Figure 1. Between 1990 and 2000, multinationals increased their importance in manufacturing employment from about 10

---

<sup>5</sup> The mean and median of foreign ownership are 77.7 and 100 percent, respectively.



percent to more than 15 percent. Over the same period, their participation in exports and value-added rose almost three times. In 2000, foreign firms accounted for more than 30 percent of manufacturing exports and value-added.

*[Table 1 and Figure 1 here]*

The main issue of this paper is the question as to whether employment growth is different between domestic and foreign plants. In order to get a first impression of this, Table 2 compares employment growth for foreign and domestic plants. We are particularly interested in analyzing whether there are statistically significant differences in the (unconditional) employment growth for different types of plants and time periods. Panel A of Table 2 compares domestic and foreign-owned plants. For both groups of plants, there is a reduction in employment growth between 1990-1995 and 1995-2000. Also, for both periods, we do not find that employment growth differs significantly for domestic and multinational plants. This may suggest that the negative effects of the slowdown of the economy hit both types of plants in a similar way.

Recall that the data in Table 1 showed that the majority of domestic plants are non-exporters, while for multinationals the distribution between exporters and non-exporters is almost even. As exporters are generally more efficient than non-exporters (see Alvarez and Lopez, 2005, for Chilean evidence) we also distinguish employment growth for plants by export orientation. As shown in panel B, there is also a reduction in employment growth for exporters in the crisis period, and we do not find evidence that multinational employment response differs significantly from domestic plants.

In sum, preliminary evidence in Table 2 suggests that there are no significant differences in employment growth between multinational and domestic plants in either the growth or slowdown period. However, these are unconditional averages, which may merely reflect the

effects of other plant or industry characteristics that are different for foreign and domestic plants. There are two main factors that could make a difference in employment response across plants. First, multinationals and exporters tend to be larger and more productive than domestic plants (Lipsey, 2004; Bernard and Jensen, 1999; Alvarez and Lopez, 2005). Second, we are comparing employment growth only for surviving firms. In fact, Alvarez and Görg (2005) find for Chilean plant level data that, once controlling for size and other covariates, foreign multinationals are more likely to exit than comparable domestic plants, especially in the crisis period.<sup>6</sup> In order to disentangle the effects of other covariates from the effect of ownership, we therefore turn to an econometric modeling of the determinants of employment growth. In this estimation we also correct for the potential sample selection problem introduced through exiting plants.

*[Table 2 here]*

### **3 Econometric Methodology and Results**

Our identification strategy is to consider the economic crisis in the late 1990s as a natural experiment and investigate its effect on plant level employment growth. We allow the crisis to impact differently on multinationals and domestic plants' growth trajectories. To do so, we use a difference-in-differences approach<sup>7</sup> by estimating the following employment growth equation:

$$\ln(L_{it}) - \ln(L_{it-s}) = \alpha + Z'_{t-s} \delta + \gamma_1 MNC_{it-s} + \gamma_2 D_{crisis} + \gamma_3 MNC_{it-s} * D_{crisis} + \varepsilon_{it} \quad (1)$$

---

<sup>6</sup> Bernard and Sjöholm (2003) find similar evidence for Indonesia.

<sup>7</sup> See Meyer (1995) for an overview of this methodology.

where the dependent variable is the log difference in employment in plant  $i$  between  $t$  and  $t-s$  ( $s \geq 1$ ).<sup>8</sup>  $Z$  is a vector of plant's characteristics,  $MNC$  is a dummy variable for plants that are affiliates of foreign multinationals, and  $D_{crisis}$  is a dummy for the period of economic crisis.

The potential differences in employment growth between multinationals and domestic plants are captured by  $\gamma_1$ . In the case that multinationals, independent of the period under study, tend to grow faster than domestic plants, we expect  $\gamma_1$  to be positive. The overall effect of the economic crisis on employment growth is given by  $\gamma_2$ , which is expected to be negative. If multinationals are more able to absorb negative shocks (e.g., because they are less likely to be financially constrained), employment growth in these plants should be higher than for domestic firms in the crisis period. In such a case, we expect  $\gamma_3$  to be positive. On the other hand,  $\gamma_3$  may turn out to be negative if multinationals are indeed more footloose than domestic firms and therefore more likely to contract employment in the crisis period. The third option is that  $\gamma_3$  is equal to zero, indicating that there are no differences in the response between multinationals and domestic firms to the crisis.

The control variables in vector  $Z$  are those that have been found in the literature to affect plant employment growth.<sup>9</sup> In particular, we include initial differences in total factor productivity, age, size (measured in terms of employment), and a dummy variable indicating whether or not the plant is an exporter. For example, Dunne and Hughes (1994), Dunne et al. (1989) and Evans (1987) show the importance of size and age of a plant for growth. TFP and the export dummy are included as it is generally found that more productive firms, and

---

<sup>8</sup> This definition of the dependent variable also wipes out any plant specific effects that determine employment levels.

<sup>9</sup> A table with variable definitions and a correlation table can be found in the Appendix.

exporters, are generally larger and perform “better” than others (e.g. Bernard and Jensen, 1999). These variables are also important for controlling for differences between domestic and multinationals firms. If foreign firms are larger or more productive, not controlling for these factors may bias the parameter associated to foreign ownership. In such a case, we may attribute an impact to foreign ownership that could be actually capturing their superior characteristics in terms of size or productivity.

In a first approach at estimating equation (1), we only consider two observations per plant – pre-crisis employment growth between 1990 and 1995 and the corresponding crisis employment performance between 1995 and 2000.<sup>10</sup> We define the economic crisis to have hit Chile at the end of the 1990’s, i.e., the variable  $D_{crisis}$  takes on the value 1 for the period 1995 to 2000.

In our estimation we face a sample selection problem due to the fact that employment growth is only observed for surviving firms between  $t-s$  and  $t$ . To deal with this problem, we use the common approach of estimating a Heckman selection model. We estimate jointly the outcome and selection equations using a maximum likelihood procedure. The selection equation includes the same covariates as the growth regression and a number of industry characteristics as additional regressors. These are the minimum efficient scale in the industry, the Herfindahl index as a measure of industry concentration, and a measure of the relative importance of multinationals in an industry.<sup>11</sup>

Table 3 presents these basic regression results, where all the explanatory variables are measured at the beginning of the two periods (i.e.  $t-5$ ). Column (3.1) shows the estimates of a simple OLS regression to provide a baseline against which to compare the estimates obtained

---

<sup>10</sup> In other words, subscript  $s$  in equation (1) is equal to 5. We use an alternative definition of  $s = 1$ , i.e., annual growth rates and lagged variables, as a robustness check in Section 4. Results appear robust to such changes.

<sup>11</sup> See, e.g., Görg and Strobl (2003) for a discussion of these variables in the context of modelling plant survival.

from the sample selection model in columns 3.2 and 3.3. Note from the last row that the null hypothesis of independence between both equations is rejected at 10 per cent and 5 percent respectively, which implies that sample selection is a relevant issue in our sample.

The difference between columns 3.2 and 3.3 is the inclusion of the industry growth rate to control for differences in growth across different sectors. The regressions produce similar results in the different specifications. Age and initial size are negatively related to employment growth, a finding in line with the literature (e.g., Evans, 1987, Dunne et al., 1989). Plants with higher TFP and exporters, on the other hand, grow faster than others, again in line with our expectations. The crisis dummy has a negative coefficient which indicates that employment growth slowed down during the period of recession compared to the early 1990s. The impact of the economic crisis is also economically significant. Compared to the period 1990-1995, plant employment growth is between 13.5 and 23.6 percent lower in the late 1990s. By contrast, we do not find any statistically significant coefficient on the multinationality dummy. In other words, the employment growth trajectory of plants belonging to foreign multinationals is not different from that of domestic plants. Importantly, we also find that the coefficient on the interaction term  $MNC * D_{crisis}$  is statistically insignificant, indicating that multinationals do not react any different in terms of employment growth to the economic crisis than do domestic plants.<sup>12</sup>

*[Table 3 here]*

Table 4 provides a robustness check of our results thus far by changing the specification in two respects. In the estimations reported we use a different definition of the dependent variable. Specifically, we follow the literature on job creation and destruction (e.g., Davis

---

<sup>12</sup> However, the selection equation suggests that multinationals are more likely to exit than domestic plants during the crisis.

and Haltiwanger, 1989) and define the growth rate as net job flows between t-5 and t.<sup>13</sup> Furthermore, we acknowledge that there is a potential problem of using initial size as a regressor in the growth regression, as this may lead to “regression towards the mean”. As an alternative we use average size over the period instead (e.g., Konings et. al., 1996).

Table 4 again reports simple OLS estimates in column (4.1) and the Heckman selection model in column (4.2). A comparison of Tables 3 and 4 brings up two main points. Firstly, using average size instead of initial size changes the coefficient on the size variable from negative to positive. This is in line with related studies and is to be expected (Konings et.al. 1996). Secondly, the use of the different dependent variable and the different regressor do not change the main result of our analysis thus far. The economic crisis has a negative and statistically significant effect on plant growth, but this effect is not different for foreign multinationals and domestic owned plants.<sup>14</sup> Hence, our results appear robust to the different variable definitions.

*[Table 4 here]*

#### **4 Role of external financing and robustness checks**

One rationale for expecting differences in the reaction to the economic crisis between multinationals and domestic firms is that access to external finance becomes more difficult for firms in a downturn and that multinationals are less dependent on domestic finance in their operations (Desai et al., 2004; Harrison and McMillan, 2003) and, hence, they should be less affected in a crisis. If this were indeed true, we would also expect to observe that the impact of an economic crisis differs across firms and industries according to their needs of financing.

---

<sup>13</sup> The exact definition is provided in the note to Table 4.

<sup>14</sup> Furthermore, all other coefficients, apart from the export dummy, are similar in Table 3 and Table 4.

While we do not have any detailed information on the external financing requirements at the level of the firm we try to take this point into account in two ways. Firstly, we make use of an identification strategy pioneered by Rajan and Zingales (1998) to measure external finance dependence of industries. Specifically, we use their measures of external dependence for U.S. plants at 3-digit industries, and analyze whether multinationals are more prone to grow in industries where external financing is more important.<sup>15</sup>

To test whether there are differences in employment growth trajectories across industries according to their degree of external financing dependence, we estimate a variant of equation (1) by including interactions of the crisis and multinational dummies with the variable for needs of external finance (*EXD*) computed by Rajan and Zingales (1998).

$$\ln(L_{it}) - \ln(L_{it-s}) = \alpha + Z'_{t-s} \delta + \gamma_1 MNC_{it-s} + \gamma_2 D_{crisis} + \gamma_3 MNC_{it-s} * D_{crisis} + \gamma_4 EXD_1 * D_{crisis} + \gamma_5 MNC_{it-s} * EXD_1 + \gamma_6 MNC_{it-s} * D_{crisis} * EXD_1 + \varepsilon_{it} \quad (2)$$

In the case that firms grow less (more) during the crisis in industries with high dependence on external financing,  $\gamma_4$  is expected to be negative (positive). If multinationals, independently of the period, grow faster than domestic plants in industries more dependent on external financing we expect  $\gamma_5$  to be positive. If multinationals were able to overcome the potential negative effects of the economic crisis by external financing from abroad, the impact of a crisis should be lower for multinationals in those industries that are more dependent on external financing. In such a case, we expect  $\gamma_6$  to be positive.

---

<sup>15</sup> This variable is defined as the fraction of capital expenditures not financed with cash flow operations, and it is computed for the median of US firms at 3-digit ISIC industries (some at 4-digit). To be consistent, we only use information at 3-digit level. Rajan and Zingales (1998) discuss at length the argument that this measure which is calculated using data for US firms can serve as a useful measure at the industry level for other countries as well. One critique with applying this approach in our context is that external dependence may also reflect different growth opportunities across industries. In fact, not all sectors are equally affected by an economic crisis. To take this into account we control for industry growth in our estimations.

Results of estimating equation (2) are shown in Table 5, columns 5.1 to 5.4. Columns (5.1) and (5.3) present results using the log difference of employment levels, as shown in the equation, as dependent variable, and initial size as a regressor. Columns (5.2) and (5.4) employ the alternative growth rate and average size as regressor. Overall, results again suggest that firms grow less during the crisis, as indicated by the negative coefficient on the crisis dummy. In terms of the importance of multinationals we find, again, no evidence that they are affected differently in terms of employment growth than domestic firms. Moreover, there are also no apparent differences between the two types of firms depending on industry financing needs. Multinationals are not growing any faster (or slower) than domestic firms in industries that are more dependent on external financing.

*[Table 5 here]*

While our data do not provide us with detailed information on firm's financing requirements we have one piece of information that may be considered as a (less than perfect) proxy. This is the value of interest payments as a proportion of total sales. We consider this variable as a crude measure of for access to capital markets and, hence, the role of external finance at the level of the firm to provide a comparison to the above results which measure financial dependence at the industry level.

Results of these regressions are presented in columns (5.5) and (5.6). In column (5.5) we find that the interaction term of MNC and interest payments is negative indicating the multinationals grow less the more dependent they are on interest payments. However, note that this result is not robust to the alternative definition of the dependent variable, and the size variable in column (5.6). Otherwise, all regressors including the interest payment variable are statistically insignificant. What remains robust, however, is the finding that firms grow less during the crisis, and that this effect is no different for foreign multinational firms.



Tables 6, 7 and 8 present the results of further robustness checks. In Table 6 we use an alternative measurement for differences in financing needs across industries. In a similar way to Rajan and Zingales (1998), Raddatz (2006) has calculated measures of short-run financing needs capturing the importance of working capital in the production process. It could be argued that this liquidity constraints could be potentially more important for firms facing a downturn and even more relevant for one developing economy like Chile. We use two of these variables for estimating equation (2). First, we use the relative importance of inventories for each industry, which is computed as the inventory to sales ratio (Columns 6.1. and 6.2). Second, we use a measure of cash conversion cycle, which is calculated as the length in days between the moment a firm pays for its raw materials and the moment it is paid for the sale of its final output during the normal course of operations (Columns 6.3 and 6.4). For both variables, we use the term liquidity needs.

Overall, the results show the negative effect of the crisis on employment growth. The parameter for the interaction between crisis and multinational dummy is positive, indicating that foreign plants would be less affected by a crisis. Note, however, that the parameter is only significant at 10 percent when we control for average size. Interestingly, the interaction between liquidity needs and MNC is positive, though barely significant in (6.2) and (6.4), suggesting that multinationals tend to grow faster in those industries where short-run financing needs are more important. If multinationals are indeed less financially constrained than domestic firms then this result is expected. More importantly, given our identification strategy, is that the triple interaction is negative and always significant. This result indicates that, even though multinationals tend to grow faster in high working capital demanding sectors, this is not specially true in time of crisis. In fact, our negative sign for this triple interaction would indicate that MNC's in these sectors tend to be more adversely affected

than domestic plants. In sum, we do not find evidence that superior access to financing is an advantage for foreign owned firms when facing an economic crisis.

*[Table 6 here]*

We explore the robustness of our result using employment growth as the change between  $t-1$  and  $t$ , i.e., we have annual growth rates instead of the five yearly rates used before ( $s = 1$ ). All regressors are defined for  $t-1$  also. In this case, our crisis dummy corresponds to years 1998, 1999, and 2000. The results, shown in Table 7, are largely comparable to the previous findings with one main exception<sup>16</sup>. We no longer find a statistically significant coefficient on the EXD\*Crisis interaction term, although the coefficient is still positive as before. In all other respects, results are similar to the ones obtained before. In particular, we still find that employment growth slows down during the crisis, and that this effect does not appear to be different for foreign multinationals and domestic firms.

*[Table 7 here]*

A further possible criticism with the above regressions is that employment size measured as a continuous variable is endogenous in the growth equation. This may be a particular concern with initial size, less so with average size. As a robustness check we therefore use another alternative measure of size. Similar to Levinsohn (1993) we define four size categories and generate four dummy variables for size classes, which are included in the regression. Table 8 shows the results of these estimations. Firms with less than 50 employees are the base categories. As can be seen, all size dummies are negative and statistically significant, in line with our previous results. More importantly, our previous

---

<sup>16</sup> For comparison with our evidence in previous sections, in Tables 7 and 8 we use the Rajan and Zingales (1998)'s measure of financing dependence.

results on the impact of a crisis on employment growth are robust to this alternative specification.<sup>17</sup>

*[Table 8 here]*

## **5 Conclusions**

This paper investigates in detail the comparative response in terms of employment growth of multinationals and domestic firms to an economic crisis. To do so we use the economic slowdown in Chile in the late 1990s as a natural experiment. We use firm level data for Chile and apply a difference-in-difference approach in which employment growth in our treated group, multinationals, is compared to a control group, domestic firms, in two different time periods: one of rapid growth and one of growth slowdown.

In our empirical analysis we find that employment growth in manufacturing plants has been drastically reduced during the economic crisis. Compared to the period 1990-1995, plant employment growth is between 13.5 and 23.6 percent lower in the late 1990s. More importantly, we do not find evidence that multinationals react to the economic crisis differently than do domestic firms. We also investigate whether access to finance matters. However, our analysis does not provide robust evidence to this extent.

Our findings are, therefore, in contrast with the idea that multinational firms are less affected by an economic crisis and may be able to act as stabilizers in developing countries. On the other hand, our results also imply that a fear, that multinationals are more footloose, and employment in foreign firms more precarious, is not borne out by the evidence. This has

---

<sup>17</sup> In a final robustness check, we distinguished domestic and foreign firms into four categories: domestic exporters, domestic non-exporters, multinational exporters, multinational non-exporters and interacted the crisis dummy with these four dummy variables separately. Results, which are shown in the appendix, show that we do not find any differences in the reaction of these four groups of firms to the crisis, in terms of employment growth.

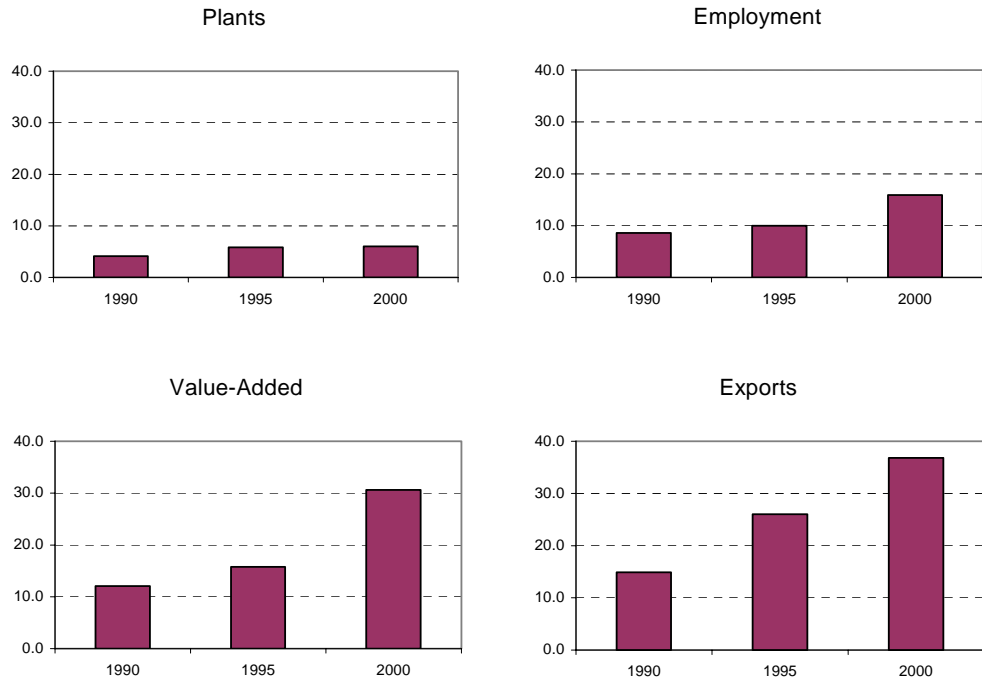
important consideration for an evaluation of the potential benefits of attracting multinationals. Multinationals, while potentially bringing new technology and other benefits to the economy are no different to domestic firms in terms of employment growth when it comes to their potential reactions to negative shocks to the economy. Hence our results show that there is no evidence to suggest that multinationals may pull out more quickly than domestic firms when the economy is hit by a negative shock.

## References

- Aitken, B.J., A.E. Harrison and R.E. Lipsey. 1996. "Wages and Foreign Ownership: A Comparative Study of Mexico, Venezuela, and the United States", *Journal of International Economics*, 40, 345–371
- Alfaro, L., A. Chanda, S. Kalemli-Ozcan and S. Sayek. 2004. "FDI and Economic Growth: The Role of Local Financial Markets", *Journal of International Economics*, 64, 89-112
- Alvarez, R., and R. A. López. 2005. "Exporting and Performance: Evidence from Chilean Plants," *Canadian Journal of Economics* 38(4): 1384-1400.
- Alvarez, R. and H. Görg. 2005. "Multinationals and Plant Exit: Evidence from Chile," IZA Discussion Paper 1611, Institute for the Study of Labor (IZA), Bonn.
- Barrios, S., H. Görg and E. Strobl. 2005. "Foreign Direct Investment, Competition and Industrial Development in the Host Country", *European Economic Review*, 49, 1761-1784.
- Bernard, A. B., and J. B. Jensen. 1999. "Exceptional Exporter Performance: Cause, Effect, or Both?" *Journal of International Economics* 47(1): 1-25.
- Bernard, A.B. and F. Sjöholm. 2003. "Foreign Owners and Plant Survival", NBER Working Paper 10039.
- Blalock, G., Gertler, P.J. and D.I. Levine. 2005. "Investment Following a Financial Crisis: Does Foreign Ownership Matter," mimeo, Cornell University and University of California Berkeley.
- Braun, M. and B. Larraín. 2005. "Finance and the Business Cycle: International, Inter-Industry Evidence", *Journal of Finance*, LX(3): 1097-1128.
- Cowan, K., Micco, A., Mizala, A., Pagés C. and P. Romaguera. 2005. *Un Diagnóstico del Desempleo en Chile*. University of Chile and Inter-American Development Bank.
- Desai, M. A., Fritz Foley, C. and K.J. Forbes. 2004. "Financial Constraints and Growth: Multinational and Local Firm Responses to Currency Crises," NBER Working Paper No. 10545.
- Dunne, P. and A. Hughes, 1994, "Age, Size, Growth and Survival: UK Companies in the 1980s", *Journal of Industrial Economics*, 42(2): 115-140.
- Dunne, T., Roberts, M. J. and L. Samuelson, 1989, "The Growth and Failure of US Manufacturing Plants", *Quarterly Journal of Economics*, 104(4): 671-698.
- Evans, D. S., 1987, "The Relationship between Firm Growth, Size, and Age: Estimates for 100 Manufacturing Industries", *Journal of Industrial Economics*, 35(4): 567-581.
- Flamm, K. 1984. "The Volatility of Offshore Investment", *Journal of Development Economics*, 16, 231-248.
- Görg, H. and E. Strobl. 2003. "Multinational Companies, Technology Spillovers, and Plant Survival", *Scandinavian Journal of Economics*, 105, 581-595.
- Harrison, A.E. and M.S. McMillan. 2003. "Does Direct Foreign Investment Affect Domestic Credit Constraints?", *Journal of International Economics*, 61, 73-100.

- Helpman E., M.J. Melitz and S.R. Yeaple. 2004. "Export versus FDI with Heterogeneous Firms", *American Economic Review*, 94(1): 300-316.
- Javorcik, B.S. 2004, "Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search Of Spillovers through Backward Linkages", *American Economic Review*, 94(3): 605-627.
- Konings, J., Lehmann, H. and M. E. Schaffer. 1996. "Job Creation and Job Destruction in a Transition Economy: Ownership, Firm Size, and Gross Job Flows in Polish Manufacturing," *Labour Economics* 3: 299-317.
- Levinsohn, J. 1993. "Employment Responses to International Liberalization in Chile", *Journal of International Economics*, 47, 321-344.
- Levinsohn, J. and A. Petrin. 2003. "Estimating Production Functions Using Inputs to Control for Observables", *Review of Economic Studies*, 70, 317-341.
- Lipsey, R.E. 2004. 'Home and Host Country Effects of FDI', in: Robert E. Baldwin and L. Alan Winters (eds.), *Challenges to Globalization*, Chicago, University of Chicago Press.
- McAleese, D. and M. Counahan. 1979. "Stickers or Snatchers? Employment in Multinational Corporations During the Recession", *Oxford Bulletin of Economics and Statistics*, 41, 345-358.
- Raddatz, C. 2006. "Liquidity Needs and Vulnerability to Financial Underdevelopment, *Journal of Financial Economics*, forthcoming.
- Rajan, R, and L. Zingales. 1998. "Financial Dependence and Growth," *American Economic Review*. 88(3): 559-586.
- UN (2003), *World Investment Report*. Paris: United Nations.

**Figure 1: Importance of Multinationals in Manufacturing Industry**  
(Multinationals as percentage of total)



**Table 1: Plant Distributions by Nationality Types**

	1990		1995		2000	
	Plants	%	Plants	%	Plants	%
Domestic	4,395	95.9	4,812	94.1	4,262	94.0
Non-exporter	3,744	81.7	3,839	75.1	3,524	77.7
Exporter	651	14.2	973	19.0	738	16.3
Multinational	190	4.2	300	5.9	273	6.1
Non-exporter	81	1.8	139	2.7	111	2.5
Exporter	109	2.4	161	3.2	162	3.6
Total	4,585	100.0	5,112	100.0	4,535	100.0

Source: Authors' own calculations based on ENIA.

**Table 2: Mean Tests for Employment Growth**

<i>A. Domestic versus Multinationals, all plants</i>				
	Domestic	Multinationals	Difference	t-test
1990-1995	-0.5	0.2	-0.7	-0.05
1995-2000	-21.4	-21.9	0.4	0.63
<i>A. Domestic versus Multinationals, only exporters</i>				
	Domestic	Multinationals	Difference	t-test
1990-1995	0.0	-2.7	2.7	0.42
1995-2000	-23.6	-16.2	-7.4	-1.09

**Notes:** Employment growth is defined as  $\ln L_t - \ln L_{t-5}$ . t-test is for the null hypotheses that difference in employment growth is equal to zero.



**Table 3: Plant Employment Growth Regressions**

	(3.1)	(3.2)	(3.3)
		<b><u>A: Employment growth</u></b>	
Size	-0.098 (11.40)**	-0.096 (11.25)**	-0.096 (11.22)**
Age	-0.050 (4.72)**	-0.047 (4.44)**	-0.048 (4.47)**
TFP	0.059 (7.23)**	0.060 (7.35)**	0.059 (7.15)**
Exporter	0.096 (4.22)**	0.096 (4.22)**	0.096 (4.25)**
Multinational (MNC)	0.038 (0.87)	0.039 (0.89)	0.041 (0.94)
1995-00 (Crisis)	-0.227 (15.53)**	-0.236 (15.20)**	-0.135 (4.28)**
MNC * Crisis	-0.027 (0.43)	-0.030 (0.48)	-0.040 (0.64)
Industry growth	-	-	0.263 (3.70)**
Constant	0.141 (2.54)*	0.112 (1.93)	0.077 (1.31)
		<b><u>B: Selection Equation</u></b>	
Size		0.153 (9.19)**	0.154 (9.21)**
Age		0.168 (9.25)**	0.166 (9.17)**
TFP		0.124 (8.22)**	0.120 (7.97)**
Exporter		-0.024 (0.56)	-0.024 (0.55)
Multinational (MNC)		0.131 (1.05)	0.136 (1.09)
1995-00 (Crisis)		-0.710 (21.89)**	-0.538 (7.58)**
MNC * Crisis		-0.342 (2.32)*	-0.355 (2.42)*
Industry growth		-	0.437 (2.74)**
MES		0.011 (0.05)	-0.013 (0.06)
Herfindahl		1.457 (1.00)	2.052 (1.38)
Multinational share		0.411 (0.53)	0.042 (0.05)
Observations	5738	8603	8603
R-squared	0.10	-	-
Wald Test Independent Equations P-Value	--	0.076	0.020

**Notes:** Robust absolute value of t-statistics and z-statistics in parentheses. \* significant at 5%; \*\* significant at 1%

**Table 4: Plant Employment Growth Regressions controlling for Average size**

	(4.1)	(4.2)
	<b><u>A: Employment growth</u></b>	
Average size	0.000 (1.97)*	0.000 (3.68)**
Age	-0.066 (7.08)**	-0.039 (3.99)**
TFP	0.049 (6.71)**	0.063 (8.44)**
Exporter	-0.028 (1.51)	-0.023 (1.26)
Multinational (MNC)	-0.004 (0.11)	0.009 (0.22)
1995-00 (Crisis)	-0.109 (3.91)**	-0.182 (6.42)**
Multinational * Crisis	-0.024 (0.44)	-0.063 (1.13)
Industry growth	0.218 (3.51)**	0.270 (4.29)**
Constant	-0.150 (3.29)**	-0.395 (7.70)**
	<b><u>B: Selection Equation</u></b>	
Initial Size		0.216 (21.14)**
Age		0.145 (11.44)**
TFP		0.119 (13.40)**
Exporter		-0.088 (3.33)**
Multinational (MNC)		0.106 (1.95)
1995-00 (Crisis)		-0.505 (12.60)**
Multinational * Crisis		-0.346 (4.57)**
Industry growth		0.459 (5.25)**
MES		-0.067 (0.54)
Herfindahl		1.669 (1.87)
Multinational share		-0.282 (0.63)
Constant		-0.704 (1.74)
Observations	5738	8603
R-squared	0.08	--

**Notes:** Robust absolute value of z-statistics in parentheses, \* significant at 5%; \*\* significant at 1%

Employment growth is defined as:  $[L_{it}-L_{it-5}]/[(L_{it}+L_{it-5})/2]$ , average size is  $[(L_{it}+L_{it-5})/2]$ , and initial size is  $L_{it-5}$ .

**Table 5: Plant Employment Growth Regressions and External Finance Dependence**

	(5.1)	5.(2)	(5.3)	(5.4)	(5.5)	(5.6)
	<b>A: Employment Growth</b>					
Initial size	-0.096 (11.15)**		-0.096 (11.15)**		-0.094 (10.95)**	
Average size		0.000 (3.45)**		0.000 (3.46)**		0.000 (3.82)**
Age	-0.046 (4.21)**	-0.037 (3.77)**	-0.045 (4.21)**	-0.037 (3.77)**	-0.049 (4.62)**	-0.041 (4.25)**
TFP	0.059 (7.18)**	0.065 (8.46)**	0.059 (7.18)**	0.065 (8.45)**	0.057 (6.99)**	0.061 (8.11)**
Exporter	0.099 (4.30)**	-0.022 (1.14)	0.100 (4.31)**	-0.021 (1.13)	0.100 (4.41)**	-0.012 (0.62)
Multinational (MNC)	-0.001 (0.02)	-0.036 (0.63)	0.019 (0.35)	-0.017 (0.36)	0.079 (1.66)	0.037 (0.87)
1995-00 (Crisis)	-0.163 (4.78)**	-0.202 (6.45)**	-0.161 (4.76)**	-0.199 (6.43)**	-0.127 (3.99)**	-0.170 (5.93)**
MNC*Crisis	0.027 (0.26)	-0.010 (0.11)	-0.013 (0.20)	-0.048 (0.80)	-0.051 (0.81)	-0.068 (1.21)
EXD*Crisis	0.130 (2.26)*	0.153 (2.89)**	0.122 (2.15)*	0.145 (2.80)**		
MNC*EXD	0.082 (0.44)	0.117 (0.71)	0.010 (0.09)	0.047 (0.46)		
MNC*EXD*Crisis	-0.140 (0.60)	-0.132 (0.64)				
Industry growth	0.277 (3.39)**	0.323 (4.35)**	0.279 (3.41)**	0.324 (4.37)**	0.267 (3.76)**	0.273 (4.35)**
Interest/Sales (INTS)					-0.143 (0.76)	-0.435 (1.78)
INTS*Crisis					-0.469 (0.84)	-0.877 (1.86)
MNC*INTS					-1.259 (1.98)*	-0.923 (1.46)
Constant	0.077 (1.32)	-0.402 (7.66)**	0.076 (1.30)	-0.402 (7.68)**	0.082 (1.40)	-0.372 (7.31)**

Table 5, cont.

	<b>B: Selection Equation</b>					
Initial size	0.152 (8.95)**		0.152 (8.95)**		0.165 (9.71)**	
Age	0.165 (8.97)**	0.144 (11.15)**	0.165 (8.97)**	0.144 (11.14)**	0.162 (8.87)**	0.141 (11.01)**
TFP	0.123 (8.05)**	0.121 (13.38)**	0.123 (8.05)**	0.121 (13.37)**	0.113 (7.46)**	0.112 (12.62)**
Exporter	-0.036 (0.82)	-0.098 (3.63)**	-0.036 (0.82)	-0.098 (3.63)**	0.011 (0.24)	-0.051 (1.85)
Multinational (MNC)	0.125 (0.71)	0.057 (0.68)	0.126 (0.72)	0.073 (0.83)	0.069 (0.51)	0.047 (0.65)
1995-00 (Crisis)	-0.505 (6.42)**	-0.484 (10.68)**	-0.505 (6.41)**	-0.481 (10.62)**	-0.516 (7.12)**	-0.488 (11.59)**
MNC*Crisis	-0.438 (2.08)*	-0.380 (3.24)**	-0.441 (2.10)*	-0.407 (3.34)**	-0.318 (2.15)*	-0.312 (3.85)**
EXD*Crisis	0.300 (1.86)	0.261 (2.84)**	0.299 (1.85)	0.255 (2.77)**		
MNC*EXD	0.114 (0.26)	0.239 (0.99)	0.108 (0.24)	0.181 (0.69)		
MNC*EXD*Crisis	0.189 (0.35)	0.018 (0.06)				
Industry growth	0.678 (3.38)**	0.665 (5.54)**	0.679 (3.38)**	0.667 (5.56)**	0.432 (2.70)**	0.455 (5.18)**
MES	0.143 (0.60)	0.015 (0.10)	0.142 (0.59)	0.015 (0.10)	-0.028 (0.14)	-0.081 (0.65)
Herfindahl	3.298 (2.06)*	2.398 (2.48)*	3.295 (2.06)*	2.398 (2.48)*	2.376 (1.60)	1.948 (2.17)*
Multinational share	-0.792 (0.89)	-0.825 (1.61)	-0.793 (0.89)	-0.828 (1.61)	0.105 (0.13)	-0.244 (0.55)
Interest/Sales (INTS)					-1.402 (2.79)**	-1.566 (3.16)**
INTS*Crisis					-2.318 (2.32)*	-2.143 (2.29)*
MNC*INTS					1.665 (0.97)	1.399 (1.17)
Constant	-1.196 (1.54)	-0.946 (1.96)*	-1.195 (1.54)	-0.946 (1.96)*	-0.662 (0.99)	-0.629 (1.56)
Observations	8338	8338	8338	8338	8338	8338

Notes: Robust absolute value of z-statistics in parentheses. \* significant at 5%; \*\* significant at 1%.

Employment growth is defined in (1), (3), (5) as  $\ln(L_{it}) - \ln(L_{it-5})$ , and in (2), (4), (6) as:  $[L_{it} - L_{it-5}] / [(L_{it} + L_{it-5}) / 2]$ , average size is  $[(L_{it} + L_{it-5}) / 2]$ , and initial size is  $L_{it-5}$ .

3-digit industry dummies are included, but not reported.

**Table 6: Plant Employment Growth Regressions with Alternative Financing Variables**

	(6.1)	6.(2)	(6.3)	(6.4)
	Inventories over sales		Cash conversion cycles <sup>+</sup>	
	<b><u>A. Employment Growth</u></b>			
Initial size	-0.097 (11.17)**		-0.097 (11.16)**	
Average size		0.000 (3.38)**		0.000 (3.40)**
Age	-0.047 (4.35)**	-0.039 (3.96)**	-0.047 (4.36)**	-0.039 (3.95)**
TFP	0.059 (7.15)**	0.064 (8.40)**	0.059 (7.14)**	0.065 (8.40)**
Exporter	0.104 (4.47)**	-0.018 (0.92)	0.104 (4.46)**	-0.018 (0.93)
Multinational (MNC)	-0.308 (1.54)	-0.360 (2.00)*	-0.220 (1.42)	-0.259 (1.92)
1995-00 (Crisis)	-0.064 (1.14)	-0.123 (2.48)*	-0.093 (2.01)*	-0.143 (3.48)**
MNC*Crisis	0.622 (2.21)*	0.470 (1.88)	0.405 (1.96)*	0.306 (1.67)
LIQ*Crisis	-0.841 (2.21)*	-0.631 (1.85)	-0.001 (2.26)*	-0.001 (1.98)*
MNC*LIQ	2.221 (1.84)	2.406 (2.19)*	0.003 (1.80)	0.003 (2.18)*
MNC*LIQ*Crisis	-4.325 (2.36)*	-3.481 (2.16)*	-0.005 (2.19)*	-0.004 (2.07)*
Industry growth	0.137 (1.70)	0.191 (2.54)*	0.121 (1.47)	0.177 (2.30)*
Constant	0.080 (1.39)	-0.394 (7.56)**	0.078 (1.35)	-0.397 (7.62)**

**Table 6, cont.**

	<b>B. Selection Equation</b>			
Initial size	0.151 (8.90)**	0.164 (8.90)**	0.151 (8.89)**	0.213 (18.44)**
Age	0.164 (8.90)**	0.142 (11.01)**	0.163 (8.89)**	0.142 (10.98)**
TFP	0.125 (8.17)**	0.124 (13.59)**	0.125 (8.14)**	0.123 (13.55)**
Exporter	-0.034 (0.76)	-0.097 (3.58)**	-0.034 (0.77)	-0.098 (3.60)**
Multinational (MNC)	-0.732 (1.31)	-0.628 (2.87)**	-0.304 (0.79)	-0.240 (1.45)
1995-00 (Crisis)	-0.617 (5.09)**	-0.593 (8.44)**	-0.564 (5.71)**	-0.541 (9.49)**
MNC*Crisis	-0.171 (0.26)	-0.281 (0.86)	-0.400 (0.88)	-0.485 (2.00)*
LIQ*Crisis	0.992 (1.15)	1.109 (2.22)*	0.001 (0.95)	0.001 (2.14)*
MNC*LIQ	6.322 (1.58)	5.281 (3.76)**	0.005 (1.22)	0.004 (2.46)*
MNC*LIQ*Crisis	-1.436 (0.31)	-0.486 (0.22)	0.000 (0.07)	0.002 (0.64)
Industry growth	0.589 (2.92)**	0.629 (5.69)**	0.602 (2.83)**	0.664 (5.73)**
MES	0.072 (0.31)	0.085 (0.59)	0.082 (0.34)	0.123 (0.83)
Herfindahl	2.164 (1.45)	1.838 (2.06)*	2.258 (1.51)	1.996 (2.23)*
Multinational share	-0.211 (0.25)	-0.607 (1.30)	-0.323 (0.38)	-0.804 (1.69)
Constant	-0.987 (1.30)	-1.168 (2.50)*	-1.007 (1.30)	-1.270 (2.66)**
Observations	8338	8338	8338	8338

**Notes:** Robust z statistics in parentheses. \* significant at 5%; \*\* significant at 1%

LIQ is a measure of liquidity needs, either inventory over sales or cash conversion cycles.

+ computed as the length in days between the moment a firm pays for its raw materials and the moment it is paid for the sale of its final output during the normal course of operations.

**Table 7: Plant Employment Growth Regressions and External Finance Dependence,  
Annual Data**

	(6.1)	(6.2)	(6.3)
	<b><u>A: Employment Growth</u></b>		
Initial size	-0.034 (16.66)**	-0.034 (16.65)**	-0.034 (16.86)**
Age	-0.013 (6.13)**	-0.013 (6.13)**	-0.013 (6.07)**
TFP	0.026 (14.33)**	0.026 (14.33)**	0.025 (14.35)**
Exporter	0.041 (7.91)**	0.041 (7.89)**	0.041 (8.18)**
Multinational (MNC)	-0.017 (1.12)	-0.010 (0.76)	0.006 (0.61)
Crisis	-0.074 (6.64)**	-0.072 (6.54)**	-0.039 (4.18)**
Crisis*MNC	0.047 (1.69)	0.027 (1.41)	0.023 (1.30)
MNC*EXD	0.042 (1.20)	0.020 (0.68)	
Crisis*EXD	0.020 (1.40)	0.015 (1.08)	
Crisis*MNC*EXD	-0.066 (1.06)		
Interest/Sales (INTS)			0.003 (0.05)
INTS*Crisis			-0.209 (1.62)
MNC*INTS			-0.255 (1.32)
Constant	0.011 (0.84)	0.010 (0.81)	-0.018 (1.45)

**Table 7, cont.**

	<b>B: Selection Equation</b>		
Initial size	0.161 (12.50)**	0.160 (12.49)**	0.164 (13.00)**
Age	0.111 (10.29)**	0.111 (10.29)**	0.114 (10.69)**
TFP	0.135 (13.72)**	0.135 (13.70)**	0.129 (13.34)**
Exporter	0.003 (0.09)	0.003 (0.10)	0.020 (0.69)
Multinational (MNC)	-0.101 (1.18)	-0.152 (2.00)*	-0.079 (1.25)
Crisis	-0.670 (9.36)**	-0.677 (9.48)**	-0.593 (9.15)**
MNC*Ints	-0.223 (1.62)	-0.088 (0.91)	-0.082 (0.89)
Crisis*EXD	0.185 (2.17)*	0.214 (2.57)*	
MNC*EXD	0.025 (0.13)	0.204 (1.23)	
Crisis*MNC*EXD	0.477 (1.37)		
MES	-0.123 (0.97)	-0.122 (0.97)	-0.111 (0.92)
Herfindahl	1.617 (2.22)*	1.625 (2.22)*	1.389 (1.99)*
Multinational share	0.361 (1.12)	0.360 (1.12)	0.224 (0.73)
Interest/Sales (INTS)			-0.941 (3.89)**
INTS*Crisis			-0.268 (0.61)
MNC*INTS			-0.504 (0.56)
Constant	0.509 (1.21)	0.508 (1.21)	0.490 (1.23)
Observations	36029	36029	37180

**Notes:** Robust z statistics in parentheses. \* significant at 5%; \*\* significant at 1%.  
Employment growth is defined as  $\ln(L_{it}) - \ln(L_{it-1})$  and initial size is  $L_{it-1}$ .  
3-digit industry dummies and full set of time dummies are included, but not reported.



**Table 8: Plant Employment Growth Regressions with alternative size variable**

	(7.1)	(7.2)
	<b><u>A: Employment Growth</u></b>	
50 <employment ≤150	-0.038 (8.35)**	-0.035 (8.11)**
150 <employment ≤250	-0.062 (7.68)**	-0.057 (7.27)**
Employment>250	-0.080 (10.34)**	-0.077 (10.28)**
Age	-0.020 (8.46)**	-0.016 (7.46)**
TFP	0.022 (10.57)**	0.024 (13.71)**
Exporter	0.026 (4.95)**	0.029 (5.74)**
Multinational (MNC)	-0.018 (1.21)	0.003 (0.34)
Crisis	-0.014 (1.38)	-0.025 (3.50)**
Crisis*MNC	0.045 (1.59)	0.020 (1.13)
MNC*EXD	0.044 (1.23)	
Crisis*EXD	0.015 (1.10)	
Crisis*MNC*EXD	-0.067 (1.07)	
Industry growth	0.000 (1.56)	0.000 (1.01)
Interest/Sales (INTS)		-0.008 (0.13)
MNC*INTS		-0.252 (1.29)
Crisis*INTS		-0.217 (1.66)
Constant	-0.087 (5.28)**	-0.109 (8.91)**

**Table 8, cont.**

	<b>B: Selection Equation</b>	
50 <employment ≤150	0.161 (6.10)**	0.164 (6.34)**
150 <employment ≤250	0.238 (4.89)**	0.231 (4.86)**
Employment>250	0.243 (4.97)**	0.255 (5.29)**
Age	0.114 (8.95)**	0.129 (12.20)**
TFP	0.143 (14.62)**	0.136 (14.11)**
Exporter	0.096 (3.16)**	0.103 (3.55)**
Multinational (MNC)	-0.071 (0.82)	-0.052 (0.84)
Crisis	-0.283 (6.14)**	-0.333 (6.49)**
Crisis*MNC	-0.202 (1.47)	-0.070 (0.76)
MNC*EXD	0.005 (0.03)	
Crisis*EXD	0.174 (2.05)*	
Crisis*MNC*EXD	0.471 (1.34)	
Industry growth	0.000 (0.26)	0.001 (0.56)
MES	-0.116 (0.94)	-0.073 (0.61)
Herfindahl	1.387 (1.93)	1.339 (1.93)
Multinational share	0.505 (1.58)	0.215 (0.70)
Interest/Sales (INTS)		-0.905 (3.83)**
MNC*INTS		-0.442 (0.51)
Crisis*INTS		-0.209 (0.50)
Constant	0.667 (1.63)	0.543 (1.38)
Observations	36029	36029

**Notes:** Robust z statistics in parentheses. \* significant at 5%; \*\* significant at 1%.

Employment growth is defined as  $\ln(L_{it}) - \ln(L_{it-1})$  3-digit industry dummies and full set of time dummies are included, but not reported.

## Appendix

### Appendix A: Variable Definitions

<i>Variable</i>	<i>Description</i>
Size	Total employment (in logs)
Age	1+year-first year a plant is observed (in logs)
TFP	Total factor productivity estimated using Levinsohn and Petrin (2003) methodology (in logs)
Exporter	Dummy for exporter plants
Multinational	Dummy for plants with positive foreign ownership participation
External dependence	Industry external financial needs computed by Rajan and Zingales (1998)
Interest/Sales	Interest payments over plant sales
Industry growth	Employment industry growth between t-s and t
Minimum efficient scale	Median plant size (in terms of employment) in the industry.
Herfindahl	The Herfindahl index defined in terms of plants' share on industry sales.
Multinational share	Multinationals employment over industry employment

## Appendix B: Correlation Table

(based on annual data)

	Initial size	Age	TFP	Exporter	MNC	Crisis (DC)	External Dependence EXD	DC*MNC	EXD*MNC	EXD*DC	EXD*MNC*DC	Industry Growth
Initial size	1											
Age	0.1835	1										
TFP	0.0694	0.0782	1									
Exporter	0.4922	0.0612	0.0749	1								
MNC	0.1839	0.0004	0.0312	0.2205	1							
Crisis (DC)	-0.026	0.0577	0.0247	0.0212	0.0148	1						
Exter. Dep.	-0.0077	-0.0445	-0.1093	0.0289	0.0391	0.0134	1					
DC*MNC	0.115	0.0187	0.0264	0.1364	0.553	0.196	0.0307	1				
EXD*MNC	0.1045	-0.0001	-0.0072	0.1472	0.7013	0.0173	0.2082	0.4134	1			
EXD*DC	-0.0182	0.0313	-0.0368	0.0345	0.0323	0.6472	0.42	0.1666	0.1167	1		
EXD*MNC*DC	0.0627	0.0137	-0.0014	0.0965	0.3941	0.1397	0.1266	0.7126	0.5891	0.2667	1	
Industry Growth	0.0277	-0.0791	0.0594	-0.0224	-0.0027	-0.5342	0.0287	-0.092	-0.0048	-0.3355	-0.0695	1

## Appendix C:

### Plant Employment Growth Regressions with four Firm Types

Heckman Two-Step Procedure

	<i>Employment Growth</i>	<i>Selection Equation</i>
Initial size	-0.097 (11.09)**	0.152 (8.95)**
Age	-0.045 (4.20)**	0.165 (8.98)**
TFP	0.059 (7.07)**	0.123 (8.05)**
Exporter		-0.036 (0.82)
Multinational (MNC)		0.125 (0.71)
1995-00 (Crisis)	-0.153 (4.46)**	-0.505 (6.42)**
MNC*Crisis		-0.439 (2.09)*
MNC*EXD	0.066 (0.36)	0.113 (0.25)
EXD*Crisis	0.133 (2.30)*	0.300 (1.86)
MNC*EXD*Crisis	-0.109 (0.47)	0.189 (0.35)
Industry growth	0.280 (3.44)**	0.679 (3.38)**
Domestic Exporter (DEXP)	0.123 (3.94)**	
MNC Non Exporter (MNEXP)	0.062 (0.97)	
MNC Exporter (MEXP)	0.072 (0.88)	
DEXP*Crisis	-0.047 (1.16)	
MNEXP*Crisis	-0.104 (0.80)	
MEXP*Crisis	0.086 (0.77)	
MES		0.143 (0.60)
Herfindahl		3.303 (2.07)*
Multinational share		-0.792 (0.89)
Constant	0.078 (1.33)	-1.199 (1.54)
Observations	8338	8338

**Documentos de Trabajo  
Banco Central de Chile**

**Working Papers  
Central Bank of Chile**

NÚMEROS ANTERIORES

PAST ISSUES

La serie de Documentos de Trabajo en versión PDF puede obtenerse gratis en la dirección electrónica: [www.bcentral.cl/esp/estpub/estudios/dtbc](http://www.bcentral.cl/esp/estpub/estudios/dtbc). Existe la posibilidad de solicitar una copia impresa con un costo de \$500 si es dentro de Chile y US\$12 si es para fuera de Chile. Las solicitudes se pueden hacer por fax: (56-2) 6702231 o a través de correo electrónico: [bcch@bcentral.cl](mailto:bcch@bcentral.cl).

Working Papers in PDF format can be downloaded free of charge from: [www.bcentral.cl/eng/stdpub/studies/workingpaper](http://www.bcentral.cl/eng/stdpub/studies/workingpaper). Printed versions can be ordered individually for US\$12 per copy (for orders inside Chile the charge is Ch\$500.) Orders can be placed by fax: (56-2) 6702231 or e-mail: [bcch@bcentral.cl](mailto:bcch@bcentral.cl).

- |  |                |
|--|----------------|
| DTBC-411<br><b>The China Phenomenon: Price, Quality or Variety?</b><br>Roberto Álvarez y Sebastián Claro   | Diciembre 2006 |
| DTBC-410<br><b>Optimal Inflation Stabilization in a Medium-Scale Macroeconomic Model</b><br>Stephanie Schmitt-Grohé y Martín Uribe                   | Diciembre 2006 |
| DTBC-409<br><b>The Relationship between Exchange Rates and Inflation Targeting Revisited</b><br>Sebastián Edwards                                    | Diciembre 2006 |
| DTBC-408<br><b>Credibility and Inflation Targeting in Chile</b><br>Luis F. Céspedes y Claudio Soto   | Diciembre 2006 |
| DTBC-407<br><b>Optimal Inflation Targeting under Alternative Fiscal Regimes</b><br>Pierpaolo Benigno y Michael Woodford                              | Diciembre 2006 |
| DTBC-406<br><b>Under What Conditions Can Inflation Targeting Be Adopted? The Experience of Emerging Markets</b><br>Nicoletta Batini y Douglas Laxton | Diciembre 2006 |

- DTBC-405  
**Financial Markets Incompleteness and Inequality over the Life-Cycle**  
Jaime Ruiz-Tagle  
Diciembre 2006
- DTBC-404  
**Does Inflation Targeting Make a Difference?**  
Frederic Mishkin y Klaus Schmidt-Hebbel  
Diciembre 2006
- DTBC-403  
**Optimal Inflation Targeting: Further Developments of Inflation Targeting**  
Lars E.O. Svensson  
Diciembre 2006
- DTBC-402  
**New Keynesian Models for Chile in the Inflation-Targeting Period: A Structural Investigation**  
Rodrigo Caputo, Felipe Liendo, y Juan Pablo Medina  
Diciembre 2006
- DTBC-401  
**Transparency, Flexibility, and Inflation Targeting**  
Carl E. Walsh  
Diciembre 2006
- DTBC-400  
**Inflation Targeting and the Anchoring of Inflation Expectations in the Western Hemisphere**  
Refet S. Gürkaynak, Andrew T. Levin, Andrew N. Marder y Eric T. Swanson  
Diciembre 2006
- DTBC-399  
**Inflation Targeting versus Price-Path Targeting: Looking for Improvements**  
Stephen G. Cecchetti y Stefan Krause  
Diciembre 2006
- DTBC-398  
**Inflation Targeting under Imperfect Knowledge**  
Athanasios Orphanides y John C. Williams  
Diciembre 2006