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Eugenia Andreasen   Sofía Bauducco   Evangelina Dardati

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economia@uahurtado.cl http://economia.uahurtado.cl/

Capital Controls and Firm Performance*

Eugenia Andreasen† Sofía Bauducco ‡ Evangelina Dardati §

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Abstract

This paper studies the effects of capital controls on firms' production, investment and exporting decisions. We empirically characterize the firm's responses to the introduction of a capital control, using the *Chilean encaje* implemented between 1991 and 1998 as a laboratory. Motivated by our findings, we build a general equilibrium model with heterogeneous firms, financial constraints and international trade and calibrate it to the Chilean economy. We find that capital controls reduce aggregate production and investment while increasing exports, the share of exporters and TFP. The effects of capital controls are exacerbated for firms in more capital-intensive sectors and for exporters.

Keywords: Capital controls, firm dynamics, financial frictions, international trade.

JEL codes: F12, F41, O47

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†Department of Economics, University of Santiago de Chile. O'Higgins 3363, 9170022. Santiago, Chile. Email: eugenia.andreasen@usach.cl.

‡Research Department, Central Bank of Chile. Agustinas 1180, 8340454. Santiago, Chile. Email: sbauducco@bcentral.cl.

§Department of Economics, Universidad Alberto Hurtado. Erasmo Escala 1835, Santiago, Chile. Email: edardati@uahurtado.cl.

1 Introduction

Capital controls (CCs) were the research topic of many studies in the 1990s. These papers aimed at understanding the aggregate consequences of the CCs that several emerging countries implemented to counteract the potential vulnerabilities of the large inflows of funds they were receiving. They found that aggregate level consequences were, at best, mild.[1] Since the 2007-08 financial crisis, CCs have regained widespread attention as they became part of the macro prudential toolbox used by policymakers seeking to reduce systemic financial risk and contagion. In this context, some recent contributions have provided a new theoretical justification for the use of CCs, based on the idea that they can reduce the pecuniary externalities that lead to sudden stops.[2]

Despite this relative abundance of papers on the topic, little is known about the effects of CCs at the firm level. The few empirical studies that do look into this issue find that CCs affect firms differently, depending on characteristics such as firm size and access to financial markets.[3] In this paper, we contribute to this literature by analyzing how the introduction of CCs on capital inflows shapes domestic firms' decisions on a number of unexplored margins of adjustment, such as exports, the export decision, investment and sales. To further deepen our understanding, we distinguish between firms in terms of the capital intensity of the sector in which they operate. The importance of studying these new dimensions at the firm level is twofold: first, it allows us to identify and understand the impact of CCs at the micro level for a rich characterization of firms, which, in itself is important from a policy perspective. Second, it opens the door to computing aggregate implications of CCs, such as factor reallocation and, ultimately, changes in TFP.

To this end, we analyze the firm- and industry-level consequences of the *Chilean encaje*, a widely studied market-based capital control.[4] We tackle the problem by first conducting an empirical investigation to extract some key lessons from the data. Using data from 1990 to 2007 from the *Encuesta Nacional Industrial Anual* (ENIA), we characterize the main firm and industry-level responses: the CC reduces aggregate investment while increasing aggregate

[1] See, among many, Edwards (1999) and De Gregorio et al. (2000).
[2] See, among others, Bianchi (2011) and Bianchi and Mendoza (2018).
[3] See Forbes (2007a), Forbes (2007b) and Alfaro et al. (2017).
[4] The *Chilean encaje* was an unremunerated reserve requirement imposed by Chile between 1991 and 1998.

exports and the probability of exporting. Additionally, we find that firms in more-capital-intensive sectors are more negatively (or less positively) affected by the policy. A more granular analysis of the data also shows that the higher aggregate exports are driven entirely by the behavior of previously exporting firms that increase both their extensive and intensive margins.

Motivated by these insights, we explore the aggregate implications of CCs, building a model that is rich enough to include the most important margins of firm adjustment. More specifically, we build a model with three main features: 1) heterogeneity in productivity and productive sector; 2) international trade; and 3) financial frictions. In this economy, a continuous number of heterogeneous entrepreneurs produce differentiated domestic varieties and sell them to final-good producers domestically and abroad. Entrepreneurs differ in their idiosyncratic productivity and operate in sectors with different capital-intensities. They can save and borrow, but they face a collateral constraint and a CC in the form of a tax on capital inflows. Unlike the collateral constraint, the friction introduced by the capital control affects all firms that rely on external borrowing by increasing the effective interest rate on loans. This deters capital accumulation and affects the firm's decisions on production. We calibrate the model with pre-policy Chilean data and then introduce a CC in the form of a tax on capital inflows, analogous to the *Chilean encaje*.

The capital control acts as a tax on debt that naturally brings down investment and consumption. More surprisingly, the CC also triggers an increase in both the extensive and intensive margin of exports. This effect is a combination of the depressed domestic demand, that lowers domestic prices and wages, together with the unaffected external demand. These two features together make domestic entrepreneurs more competitive internationally while increasing their incentives to export. As a result average exports increase by 6.5 percent while the share of exporters goes up by 0.7 percent. In spite of this, the large negative effects of the CC on investment and consumption shrink GDP by 2.0 percent. On the other hand, the substitution of domestic sales for exports shifts productive resources from less to more productive entrepreneurs, leading to an increase in aggregate TFP of 1.0 percent.[5] The

[5]The fact that a barrier to capital inflows increases TFP is in line with Gopinath et al. (2017), though our mechanism works through the boost on exports triggered by the CC, rather than on a size-dependent financial constraint. Given that exporting firms in the model (and also in the data) are also more productive, TFP increases after the real depreciation induced by the CC.

behavior of firms with different capital intensities and export statuses is consistent with the empirical analysis. The CC affects relatively more firms that operate with the high capital-intensity technology–i.e., the capital and domestic sales of the firms in this group fall more sharply. Additionally, conditional on being an exporting firm, those in the high capital-intensity sector are more negatively (or less positively) affected by the CC.

This study is related to three strands of the literature. First, our paper relates to the empirical literature on the microeconomic consequences of capital controls. In line with our results, a growing body of research shows that capital account restrictions are detrimental to firm financing and investment. Alfaro et al. (2017) find a decline in cumulative abnormal returns for Brazilian firms following the imposition of CCs in 2008-2009, they also found that this effect is stronger for smaller, non-exporting and more financially dependent firms. For the specific case of the *Chilean encaje*, Forbes (2007b) finds that smaller firms experienced significant financial constraints, which decreased with firm size. Our paper contributes to this literature by providing a theoretical framework in which to study these mechanisms and by extending the analysis to the trade dimension. Also, ours is the first study to show how industry's capital intensity shapes the effects of CCs. On the other hand, Bekaert et al. (2011) demonstrate that the easing of CCs positively affects capital stock growth and total factor productivity. Larraín and Stumpner (2017), focusing on Eastern European countries, find that capital account liberalization increases aggregate productivity through a more efficient allocation of capital across firms. Related to this, Varela (2018) studies the financial liberalization episode of Hungary in 2001 and shows that a reduction in CCs can lead firms to invest in technology adoption and, through this channel, aggregate TFP increases. Our results on TFP work in the opposite direction because we focus on a CC implementation that was significantly smaller in terms of capital flow deterrence with respect to the capital account liberalization episodes addressed in these papers.[6] For this reason, we do not explore possible changes in technology choices by firms or significant changes in the efficient scale at which firms operate.

Second, our study relates to the literature on the effects of financial friction on resource allocation and productivity. This literature typically uses a heterogeneous-firms model

[6]To see this, notice that the Chinn and Ito (2006) capital account index for Chile (almost) did not change between 1982 and 1999. In Hungary, on the contrary, it jumped from -0.13 in 2000 to 1.33 in 2001 and 2.10 in 2004. The countries analyzed in Larraín and Stumpner (2017) show patterns similar to Hungary's.

to study and quantify how policies or other factors can generate low TFP due to input misallocation across heterogeneous units (see Hopenhayn and Rogerson (1993) for an early example). In a model with sectors that differ in their degree of financial dependence, Buera et al. (2011) show that financial frictions can significantly distort the allocation of productive factors. Midrigan and Xu (2014) propose a model with one traditional and one modern productive sector in which debt constraints distort technology adoption decisions and create misallocation. Chen and Irarrázabal (2015) provide suggestive evidence that financial development might be an important factor explaining growth in output and productivity in Chile between 1983 and 1996. Our framework considers a different type of financial frictions—i.e., a tax on capital inflows—and explores how this type of friction generates heterogeneous effects across firms triggering a significant reallocation of resources and production.

Third, our analysis relates to a number of papers that study how financial frictions influence the extensive and intensive margins of exports. Under this approach, our paper fits within the trade literature following Melitz (2003). In this type of model, heterogeneous firms need to pay a sunk fixed cost to be able to export; then, the presence of financial frictions distorts the export decision and the efficient allocation of resources. Caggese, A. and V. Cuñat (2013) find that financial constraints reduce productivity gains from trade by 25 percent. Kohn et al. (2016) introduce a working capital requirement on top of borrowing constraints and show that financial frictions force firms with low internal funds to produce below their optimal scale, thus limiting their output and profits and affecting the overall allocation of resources. In Leibovici (2016), whose theoretical approach is closest to ours, industries differ in their dependence on external finance, and financial frictions generate a large effect on international trade across industries but a negligible impact at the aggregate level.[7] We contribute to this literature by studying how taxes on capital inflows trigger heterogeneous responses in terms of the exporting decision with more capital-intensive firms reducing their participation in the external markets and less capital-intensive firms becoming more internationally oriented. This mechanism has not yet been considered in the literature.

This paper is organized as follows. Section 2 describes the main features of the restrictions imposed by Chile between 1991 and 1998 and presents the data and the empirical

[7]Other related papers are Chaney (2016), Brooks and Dovis (2015), Manova (2013), and Gross and Verani (2013).

evidence. Section 3 describes the model while Section 4 presents the calibration and the numerical results. Finally, Section 5 concludes.

2 Empirical Analysis

2.1 The Chilean encaje

The resumption of capital flows to emerging market economies after the Latin American debt crisis of the 1980s led to a new wave of inflows to Chile starting in 1988. This surge in capital inflows exerted upward pressure on the real exchange rate; created symptoms of overheating; and made the trade-off between different macroeconomic objectives increasingly difficult and costly. As a response, in 1991, the Chilean authorities established a capital account restriction in the form of an unremunerated reserve requirement. Specifically, the capital control was an obligation to hold an unremunerated fixed-term reserve equivalent to a fraction of the capital inflow at the central bank. Hence, it was analogous to a tax per unit of time that declined with the permanence or maturity of the affected capital inflow (see Section 2.2 for a detailed derivation of the tax equivalence).[8]

We focus our analysis on the *Chilean encaje* because, for several reasons, it is a good laboratory in which to explore the firm-and industry-level consequences of capital controls. First, the *Chilean encaje* was one of the most well-known examples of market-based control, –i.e. taxes and reserve requirements, as opposed to administrative controls with which the authority limits some specific assets, and the market is not allowed to operate. Moreover, during the 2000s, many countries, such as Colombia, Thailand, Peru and Uruguay, imposed CCs similar to the ones imposed in Chile. Second, the *Chilean encaje* was economically relevant: the total equivalent reserve deposit represented 1.9 percent of GDP during the period 1991-1998, reaching 2.9 percent of GDP in 1997 and 30 percent of that year's net capital inflows. (Gallego et al. (2002)).[9] Finally, the CC period in Chile was long enough to

[8]The tax equivalence was made more explicit by its alternative form: foreign investors were allowed to pay the central bank an up-front fee instead of depositing the unremunerated reserve fraction with the central bank.

[9]In terms of the macroeconomic effects of the introduction of the Chilean capital control on inflows, the empirical evidence suggests that the more persistent and significant effect was on the time-structure of the capital inflows, which was tilted towards a longer maturity (see Gregorio et al. (2000), Soto (1997), Gallego and Hernández (2003))). The policy also increased the interest rate differential (although without a significant long-run effect) and had a small effect on the real exchange rate, while there is no evidence on a significant

generate sufficient variation in the data for the empirical analysis and to allow us to perform a numerical steady-state analysis. As Table 1 shows, various features of the *Chilean encaje* were altered during its existence. These modifications, together with changes in the foreign interest rate, generated significant variability on the effective cost of the CC over time (see Figure 1).[10]

2.2 Data

In this section, we empirically characterize the main firm- and industry-level consequences of the capital controls implemented in Chile between 1991 and 1998. This characterization requires three key ingredients: measures of firm performance; a proxy for the CC; and control variables at the firm and country levels.

For the measures of firm performance and firm control variables, we use the plant-level panel data from the *Chilean Encuesta Nacional Industrial Anual* (ENIA) for the period 1990 to 2007. The ENIA has data on all manufacturer establishments with more than ten employees. It includes approximately 5,000 observations per year and provides detailed information on establishments' characteristics, such as type of industry, employment, domestic sales, exports, investment, inputs, assets, etc.

We complement the database with some auxiliary calculations. We construct capital stock by adding cars, machinery, land and buildings. For the observations with missing values, we impute the capital stock using investment and the depreciation rate reported. Since we do not have data on the depreciation rate before 1995, we use a standard annual depreciation rate of 6 percent for the 1990-1994 period. To measure productivity at the establishment level, we follow the methodology of Levinsohn-Petrin. To deflate the variables used to calculate the productivity measure, we use the 3-digit NAICS code deflator and price of capital provided by the ENIA. Additionally, we use the wholesale price index and fuel price index reported by the *Instituto Nacional de Estadistica* (INE) to deflate the electricity and fuel use, respectively. Table 2 presents the summary statistics of the main variables at the firm level. Our total sample has 89,799 observations and 11,356 different IDs.

effect on the total amount of capital inflows to the country.

[10] Although the initial coverage of the restriction was actually partial in practice, over time, authorities made a great effort to close the loopholes that allowed for evasion of controls. For instance, in 1995, the control was extended to include ADRs, and, in 1996, the rules on FDI were tightened to exclude speculative capital.

Following the methodology in De Gregorio et al. (2000)[11], we derive a proxy for the *encaje* as an implied tax on the borrowing interest rate. The introduction of the CC varies the effective interest rate faced by domestic private agents, depending on whether they want to save or borrow. If they want to save, the interest rate remains equal to the risk- free interest rate r. However, if they want to borrow, the effective interest rate they face is higher and given by $r + \mu_g$, where μ_g is the tax equivalent of the CC. In order to compute μ_g, we first need to define r_g, the interest rate ignoring risk premia for a g-months investment in Chile at which an investor makes zero profits:

$$r_g = r + \mu_g.$$

Let u be the fraction of the loan that the investor has to leave as an unremunerated reserve and h the period of time that the reserve must be kept at the Central Bank. Then, if the investment period is shorter than the reserve fixed-time–, i.e., $g < h$–, borrowing US$1 abroad at an annual rate of r to invest at r_g in Chile for g months generates the following cash flows:

- At $t = 0$, the entrepreneur can invest $(1-u)$ at r_g.
- At $t = g$, repaying the loan implies the following cash flow: $-(1+r)^{g/12}$.
- At $t = h$, the reserve requirement is returned generating a cash flow u.

Therefore, the annual rate r_g at which the investor is indifferent between investing at home and abroad (computing all values as of time h, when u is returned) is:

$$(1-u)(1+r_g)^{g/12}(1+r)^{(h-g)/12} + u = (1+r)^{h/12}.$$

Solving for r_g, we find the tax-equivalent of the CC:

$$(1+r_g)^{g/12} = \frac{(1+r)^{g/12} - u(1+r)^{(g-h)/12}}{1-u} \equiv (1+r+\mu_g)^{g/12}.$$

If the investment horizon exceeds the term of the reserve requirement–, i.e., $h > g$–, the investor has to decide, at the end of the h-month period, whether to maintain the reserve

[11] See, also, Cárdenas and Barrera (1997) and Soto (1997)

requirement in Chile or to deposit the amount outside the country. In order to obtain closed-form solutions, we assume that the investor deposits outside the country at the risk-free interest rate. Under this assumption, the previous arbitrage condition remains the same for longer investment horizons.

Using the approximation that $(1 + j)^x \approx 1 + xj$, the approximate tax-equivalent is found by solving the following equation:

$$1 + gr - u(1 + (g - h)r) = (1 - u)(1 + g(r + \mu_g)),$$

which yields:

$$\mu_g = r \frac{u}{1 - u} \frac{h}{g}. \quad (1)$$

To derive the effective value of the tax equivalent, we use the information in Table 1 on the evolution of the required fractional reserve requirement and the length of the fixed term. Finally, we use the Libor interest rate from the FRED Economic Data as a proxy for the risk-free interest rate. Figure 1 in the Appendix presents the evolution of the tax equivalent of the *Chilean Encaje* during the 1990s. This variable presents a high degree of variability throughout the period, which is crucial to helping us identify the effect of the CC.

To the survey and CC database, we also link industrial measures of capital intensity. We measure capital intensity with investment intensity, which corresponds to the median of the ratio of gross fixed capital formation to value added in the United States for the 1986-1995 period in each industry listed in UNIDO's dataset. In particular, we use the measure constructed by Braun (2003) with data for all publicly listed US-based companies from Compustats annual industrial files at the 3-digit industry level. Finally, we also include a comprehensive set of controls at the country level to account for other changes that might be taking place in the economy. To this end, we use standard macroeconomic controls: growth, inflation, real exchange rate, GDP per capita, private credit to GDP, trade to GDP, world growth, the Libor interest rate and the local interest rate. Table (3) shows the summary statistics of the macroeconomic indicators during our analysis period.

2.3 Empirical Strategy

Capital controls make financing more expensive, potentially affecting firms' production, investment and export decisions. Additionally, heterogeneities at the industry and firm level, such as the industry's capital intensity and the firm's exporter status, might shape the individual effect of the CC on firms' decisions to invest, produce and participate in foreign markets.

Thus, our first task is to learn how these effects played out in the case of Chile. Our baseline econometric model is:

$$Outcome_{ijt} = \omega_0 + \omega_1 CC_{t-1} + \omega_2 CC_{t-1} * C\_Intensity_j + \omega_3 X_{it} + \omega_4 Y_{t-1} + A_i + \epsilon_{ijt} \quad (2)$$

where the subscript ijt refers to firm, i, industry, j, and time, t. $Outcome_{ijt}$ refers to the vector of outcome variables of the firm under analysis: exports, domestic sales, export decision and investment. All of our firm-level variables are expressed in logs, with the exception of the Export Decision variable. The variable *ExportDecision* takes the value 1 if the firm reports a positive value of exports and 0 otherwise.[12] CC_{t-1} is our main variable of interest, lagged one period, and $C\_Intensity_j$ is the industry-level calculation of capital intensity. The interaction term, $CC_{t-1} * C\_Intensity_j$, in Eq.(2) captures the heterogeneity in the impact of the capital control on firm performance across different levels of capital intensity. X_{it} is a set of time-varying firm characteristics–i.e., fixed capital, total workers, productivity, and expenditures on interest (to proxy for the level of indebtness). Y_{t-1} is the vector of macroeconomic variables lagged one period, and A_i is a vector of firm dummy variables that account for firm fixed effects. Firm fixed effects control for endogeneity arising from time-invariant firm characteristics. Errors are clustered for robustness at the industry level.

Table 4 presents the results of our baseline regression, while Figure 2 shows the magnitude of the impact of the *encaje* on firm performance across different industries by calculating the partial effect of CC_{t-1} at different levels of C_Intensity:

$$\frac{\partial Outcome_{ijt}}{\partial CC_{t-1}} = \omega_1 + \omega_2 C\_Intensity_j \quad (3)$$

[12] Approximately 20 percent of our sample exported during the time of analysis.

where the median value of capital intensity in the sample is 0.0613.

Table 5 and Figure 3 present the results when dividing the sample between exporters and non-exporters, with exporters defined as firms that exported at least once in the previous five years.[13]

The key empirical lessons we extract are:

1. **Capital controls increase exports and the probability of exporting.**

   On average, exports and the probability of exporting increase by 8.85 and 0.85 percent, respectively, while domestic sales and investment do not present any significant change.

2. **The effect of the CC is heterogeneous on several levels**.

   (a) **More capital-intensive firms are more negatively (or less positively) affected than less capital-intensive firms.**

   When analyzing the full sample, all of the outcome variables present a differential effect in terms of C_Intensity with the same pattern. While firms with low C_Intensity are positively affected by the introduction of the CC, this positive effect fades as C_Intensity increases. In the case of investment, the overall effect becomes negative for firms with levels of C_Intensity above the median. The effect on domestic sales presents the same pattern in terms of C_Intensity, but the effect is not significant throughout the interval.

   (b) **Exporters and Non-exporters react in almost opposite ways to the introduction of the CC**.

   The subsample of Exporters behaves similarly to the full sample in terms of the overall pattern of the direct effect and the interaction with C_Intensity. However, the effect of the interaction is now exacerbated. As a consequence, the positive effect on exports and the export decision increase to 17.8 percent and 1.54 percent, respectively, while investment goes down by 2.56 percent, and we now find a significant average reduction in domestic sales of 3.44 percent.

[13] Since we do not have exporting data before 1990, the pre-1995 non-exporter subsample might capture some firms that actually did export towards the last years of the 1980s. To make sure that this limitation is not biasing our results, we run the regression considering all the possible lags from one to seven and the results remain robust. The only exception is that the interaction coefficient in the non-exporters domestic sales regression loses its significance when three or fewer lags are considered. This suggests that, by reducing the number of lags considered, we are creating too much noise in the non-exporters group.

The subsample of Non-Exporters reacts very differently. The C_Intensity interaction has a significant effect only on investment, and this effect is now positive, implying that relatively more capital-intensive Non-exporting firms actually increase their investment with the introduction of the CC. The coefficient of the interaction for the other variables is also positive, although non-significant.

2.4 Robustness Checks

2.4.1 Time fixed effects

The macro variables in our baseline regression help us to control for aggregate factors other than the CC that might be influencing the response of firms to the measure. Despite this, there might be unobservables at the aggregate level that could be correlated with CC_{t-1}, which could potentially induce a bias in our estimation. To ensure that macro-level variables are not biasing the results, Tables 6 and 7 present our baseline regressions including time-fixed effects. The disadvantage of this approach is that, now, we can observe only the effect of the CC interacted with the capital intensity variable, while we miss the direct effect of the CC. However, the coefficients of the interaction maintain their sign and significance levels, which suggests that our baseline regression does a reasonable job of controlling for relevant aggregate confounding factors.

2.4.2 External financial dependence

An alternative industry-level characteristic that could shape the effect of the CC is external financial dependence (EFD), defined by Rajan and Zingales (1998) as the ratio of capital expenditures minus cash flow from operations to capital expenditures of firms in each industry. By affecting the cost of external finance, the imposition of capital controls could differentially affect firms that are more dependent on external finance to fund their investment efforts (Alfaro et al. (2017)).

To rule out the possibility that our interaction is actually capturing the EFD-channel, we report in Tables 8 and 9 the results of including the interaction between CC_{t-1} and EFD (for the full sample and for the subsamples of Exporters and Non-Exporters) in our baseline regressions. We borrow our measure of EFD from Braun (2003), which is based on data for all publicly listed US-based companies from Compustats annual industrial files covering 1986-1995.The coefficient estimates in Table 8 and 9 suggest that our results on the capital intensity channel are robust to the inclusion of the EFD interaction and that the latter is not significant when the capital intensity interaction is considered.[14]

3 Model

In order to disentangle the forces behind our empirical findings, we build a general equilibrium model with heterogeneous entrepreneurs and financial frictions in the spirit of Midrigan and Xu (2014) and Buera and Moll (2015). From the empirical analysis of the previous section, we learn that investment, domestic sales, exports and the decision to become an exporter are relevant margins that firms adjust when CCs are introduced. Moreover, we also observe that firms' response depends crucially on the capital intensity of the sector in which they operate. To this end, we augment the model in two directions: first, we allow entrepreneurs to become exporters by paying a fixed cost and to decide how much production to allocate domestically and internationally. Second, we consider entrepreneurs that belong to one of two productive sectors that differ in their capital intensity. Moreover, entrepreneurs differ in their level of constant idiosyncratic productivity.[15]

Entrepreneurs sell differentiated domestic varieties to both domestic and foreign final-good producers in monopolistically competitive markets. They can save and borrow in the international financial market at the international risk-free interest rate, but they face financial frictions in the form of a collateral constraint. In this framework, we introduce a CC on inflows in the form of a tax on foreign borrowing aimed at capturing the main features of the *Chilean Encaje*. Unlike the collateral constraint, the friction introduced by the tax on foreign inflows affects all firms that rely on external borrowing, effectively increasing the interest rate on loans. The rest of the world mirrors the domestic economy.

[14]In unreported regressions, we replicate the results for an alternative measure of EFD calculated using data on the firms in the ENIA for the period before the regression estimates that remains fixed at the industry level afterwards. In these regressions, we obtain results analogous to those reported in Table 8 and 9.

[15]See Leibovici (2016) for a similar framework.

3.1 The environment

3.1.1 Entrepreneurs

Risk-averse entrepreneurs maximize their lifetime utility by producing and selling intermediate goods to domestic and international markets. Preferences of an entrepreneur $i \in [0, 1]$ are:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\gamma}}{1-\gamma},$$

where c_t is consumption; γ is the coefficient of relative risk aversion; and β is the subjective discount factor. The expectation, $\mathbb{E}_0$, is taken over the realizations of a death shock, which happens with probability ν. At the end of the period, dead entrepreneurs are replaced by a measure ν of newborn entrepreneurs. In order to insure against the probability of death, entrepreneurs engage in an annuity contract by which, in the case of death, all savings and capital are transferred to existing entrepreneurs. Surviving entrepreneurs obtain $\frac{\nu}{1-\nu}$ additional units of capital and savings from deceased entrepreneurs at the beginning of each period.

In every period, entrepreneurs are endowed with a unit of labor that they supply inelastically to other entrepreneurs through the competitive labor market at the equilibrium wage w_t.

Selling goods in the international market is costly. If the entrepreneur wants to export in period $t + 1$, she has to pay a sunk export entry cost F in period t. F is denominated in units of labor. On top of the entry cost, entrepreneurs that export also have to pay an ad-valorem trade cost that requires them to ship τ units of intermediate goods for every unit that is sold in the foreign market, with $\tau > 1$.

At the beginning of their lifespan, entrepreneurs receive a fixed transfer of capital from the government $\underline{k}$, and they draw an idiosyncratic productivity parameter z that remains constant throughout their lifetime. z is distributed log-normally with mean μ_z and standard deviation ω_z. Additionally, entrepreneurs operate in sectors that differ in their capital intensity $\alpha_s \in (0, 1)$. In particular, we assume that the technology available to entrepreneurs of type z is also a function of the capital stock k_t, the amount of labor hired n_t, and the capital intensity α_s:

$$y_{h,t} + \tau y_{f,t} = z k_t^{\alpha_s} n_t^{1-\alpha_s}. \tag{4}$$

In every period, capital depreciates at a rate δ. In order to increase their stock of capital in the next period, entrepreneurs can invest in the current period x_t. Then, taking into account the probability of death, the law of motion of capital is given by:[16]

$$k_{t+1} = \frac{1}{1-\nu}[(1-\delta)k_t + x_t]. \tag{5}$$

3.1.2 Final-good producers

A unit measure of final-good producers purchase differentiated varieties from domestic and foreign entrepreneurs and aggregate them to produce a final good. Final-good producers maximize profits subject to a constant elasticity of substitution production function with $\sigma > 1$. Let the set $[0,1]$ index the measure of entrepreneurs in the domestic economy. Then, given prices $\{p_{h,t}(i)\}_{i\in[0,1]}$ and p_m charged by domestic and foreign entrepreneurs, respectively, final-good producers choose the optimum bundle of domestic, $\{y_{h,t}(i)\}_{i\in[0,1]}$, and imported, $y_{m,t}$, varieties so as to maximize final-good production, y_t:

$$\max_{y_{h,t}(i), y_{m,t}} p_t y_t - \int_0^1 p_{h,t}(i) y_{h,t}(i) di - p_m y_{m,t},$$

subject to

$$y_t = \left[\int_0^1 y_{h,t}(i)^{\frac{\sigma-1}{\sigma}} di + y_{m,t}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \tag{6}$$

where p_t is the aggregate price index of the economy and equation (6) is the production function of final goods.

Similarly, the rest of the world demands the domestic varieties produced by entrepreneurs and sells foreign intermediate goods to domestic final-good producers. Then, the demands faced by a domestic producer $i \in [0,1]$ are given by:

$$y_{h,t}(i) = \left(\frac{p_{h,t}(i)}{p_t} \right)^{-\sigma} y_t, \text{ and} \tag{7}$$

[16]Notice that k_{t+1} is multiplied by $1-\nu$ because of the extra $\frac{\nu}{1-\nu}$ units of capital k_{t+1} that entrepreneurs receive at the beginning of each period from the annuity contract.

$$y_{f,t}(i) = \left(\frac{p_{f,t}(i)}{\bar{p_t}^*}\right)^{-\sigma} \bar{y_t}^*, \tag{8}$$

where $\bar{p_t}^*$ is the exogenous foreign final-good price index; $\bar{y_t}^*$ is the exogenous foreign final-good production; $y_{f,t}(i)$ is the foreign demand faced by the domestic entrepreneur $i \in [0, 1]$; and $p_{f,t}(i)$ the price charged for that variety.

3.1.3 Financial markets

Entrepreneurs can save or borrow internationally through a one-period risk-free bond, but they face a collateral constraint: they can borrow up to a fraction $\theta \leq 1$ of the value of the capital stock at the time that the loan is due for repayment; i.e.:

$$d_{t+1} \leq \theta k_{t+1}. \tag{9}$$

The international risk-free interest rate is r. However, the effective interest rate $\hat{r}$ that entrepreneurs face depends both on r and on whether there are capital controls in place. In the model, the introduction of the CC varies the effective interest rate that entrepreneurs face, depending on whether they want to save or borrow. If they want to save, the interest rate remains equal to the risk-free interest rate r. However, if they want to borrow, the effective interest rate that they face is higher and given by $r + \mu$, where μ is the tax-equivalent on a capital inflow with m-month maturity.[17]

3.1.4 Entrepreneur's problem

The entrepreneur's problem consists of choosing consumption c, capital in the next period k', investment x, production, and debt due next period d' in order to maximize lifetime utility. Then, an entrepreneur with productivity level z that belongs to a productive sector of capital intensity α_s solves the following dynamic programming problem:

$$V(k, d, e; z, \alpha_s) = \max_{c,x,n,d',k',p_h,p_f,y_h,y_f,e\in\{0,1\}} \frac{c^{1-\gamma}}{1-\gamma} + \beta(1-\nu)V(k', d', e'; z, \alpha_s))$$

[17] We will consider capital inflows with a 12-month maturity in our benchmark exercise.

subject to (4), (5), (7), (8), (9), and

$$pc + px + pd + wn + wF\mathbb{I}_{e=0,e'=1} = w + p_h y_h + p_f y_f + pd' \frac{1-\nu}{1+\hat{r}} - T,$$

where $e = 1$ if the firm exports, and $e = 0$ otherwise; T is a lump-sum tax paid to the government, and

$$\hat{r} = \begin{cases} r + \mu & \text{if } d' > 0 \\ r & \text{if } d' \leq 0 \end{cases}$$

To reduce the number of state variables, we follow the methodology in Buera and Moll (2013) and assume that capital in the next period is chosen at the beginning of that period. We define a new variable $a = k - \frac{d}{1+r}$, which represents the entrepreneur's net worth. The previous problem can then be written as:[18]

$$G(a, e; z, \alpha_s)) = \max_{c,n,a',k,p_h,p_f,e' \in \{0,1\}} \frac{c^{1-\gamma}}{1-\gamma} + \beta(1-\nu)G(a', e'; z, \alpha_s))$$

subject to

$$pc + pa'(1-\nu) + pk(\hat{r} + \delta) + wn + wF\mathbb{I}_{e=0,e'=1} = w + \frac{p_h^{1-\sigma}}{p^{-\sigma}} y + \frac{p_f^{1-\sigma}}{\bar{p}^{*-\sigma}} \bar{y}^* + pa(1+\hat{r}) - T, \tag{10}$$

$$k(1 + \hat{r} - \theta) \leq (1 + \hat{r})a, \text{ and} \tag{11}$$

$$\left(\frac{p_h}{p}\right)^{-\sigma} y + \tau \left(\frac{p_f}{\bar{p}^*}\right)^{-\sigma} \bar{y}^* = zk^{\alpha_s} n^{1-\alpha_s}. \tag{12}$$

3.1.5 Capital controls

To clarify the impact of the capital control on entrepreneurs' decision problem, it is useful to analyze the Euler equation of this problem:

$$c^{-\gamma} = \beta(1 + \hat{r})(c'^{-\gamma} + \lambda'), \tag{13}$$

[18]Notice that this last problem is identical to the first one, but now there is only one continuous endogenous state variable, a, instead of two, k and d. This simplifies the numerical solution of the model. As the entrepreneur is not subject to shocks (except for the survival shock, which is irrelevant to the decision of how to assign net worth to capital and debt), this decision can be made at the end of period t or the beginning of period $t+1$, indistinctively.

where λ is the Lagrange multiplier associated with the collateral constraint (11). Notice that introducing a CC as a tax on capital inflows does not have a homogeneous effect on all entrepreneurs. Entrepreneurs that hold assets are not affected, as they continue to face the market interest rate r. Entrepreneurs that hold debt, however, face a higher interest rate that induces them to delay consumption. Finally, entrepreneurs facing a binding collateral constraint tomorrow (i.e., $\lambda' > 0$) are the most affected, as decreasing consumption today increases by $\beta\lambda'(1+\hat{r})$ the marginal value of assets that can be pledged as collateral tomorrow, reflecting the value of relaxing (11).

It is worth analyzing the implications of assuming that entrepreneurs have access only to international financing. This simplifying assumption prevents lenders from lending domestically, which, if allowed, could push up the domestic lending rate.[19] We do this so that a CC in the model affects entrepreneurs only in their transition to their optimal scales. To see this, notice that, as entrepreneurs become lenders when reaching their optimal scale[20], the scale remains unchanged (except for general equilibrium effects on aggregate prices). This is a desirable feature of the exercise since restrictions on capital inflows should not affect the long-run allocation of capital (see Gourinchas and Jeanne (2006) for a discussion).

3.2 Recursive equilibrium

For a given value of the interest rate $\hat{r}$, a recursive stationary competitive equilibrium of this economy consists of prices $\{w, p\}$, policy functions $\{c, n, k, p_h, p_f, y_h, y_f, a', e'\}$, lump-sum taxes T, value functions v and g and a measure $\phi : \mathcal{Q} \to [0, 1]$ over entrepreneurs' states such that:

1. Policy and value functions solve the entrepreneurs' problem;

2. Policy functions solve the final-good producers' problem;

[19]Depending on the size of the domestic supply and demand of funds, three possibilities can arise when we allow for a domestic financial market: first, when demand is large with respect to supply, the domestic interest rate is equalized to the borrowing rate from international lenders. Second, if supply is large with respect to demand, the domestic interest rate is equal to r. Third, demand and supply meet at a domestic interest rate lower than $\hat{r}$ but higher than r. The first and third cases are similar and have the undesirable effect of distorting the optimal scale of firms. In the second case, capital controls have no effect and, given that capital controls were economically significant, as discussed in Section 2.1, this scenario is not plausible.

[20]We assume in the calibration that $\beta(1 + r) > 1$ in order to eliminate possible multiplicity of equilibria when introducing the capital control. We discuss this in more detail in the next section.

3. The government budget constraint is satisfied: $p\nu\underline{k} = T$;

4. Labor market clears: $\int_{\mathcal{S}}[n(q) + F\mathbb{I}_{\{e=0,e'(q)=1\}}]\phi(q)dq = 1$;

5. Markets for domestic varieties clear: $y_h(i) = y_h(q)$ if $q_i = q$;

6. Final-good market clears: $\int_{\mathcal{S}}[c(q) + x(q)]\phi(q)dq + \nu\underline{k} = y$;

7. The measure ϕ is stationary.

4 Calibration and numerical analysis

4.1 Calibration

We calibrate the model to match key features of the Chilean economy during the period 1990-1991, before the introduction of the tax on capital inflows. This serves as our benchmark economy, in which firms are subject to collateral constraints but do not have to pay a tax on international debt. As a second step, we introduce the tax on capital inflows, compute the steady state of this economy, and perform a comparative statics analysis to assess in detail the interaction between firm performance (domestic sales, exports, investment and productivity) and the tax on capital inflows. To this end, we derive the tax-equivalent μ_g for the unremunerated reserve requirement following the methodology in De Gregorio et al. (2000), as described in Section 2.2. We consider the average tax equivalent for the period 1991-1998 corresponding to a loan maturity of 12 months, which results in $\mu_g = 1.98$ percent.

4.1.1 Predetermined parameters

We follow the standard values used in the literature to set several of the parameters of the model. We consider a CRRA utility function with a coefficient of relative risk aversion $\gamma = 2$, and we set the subjective discount factor $\beta = 0.96$. We set the elasticity of substitution across varieties $\sigma = 4$ and the rate of depreciation $\delta = 0.06$. The exogenous exit rate of firms is $\nu = 0.1$ to match the average exit rate of firms in the sample. We set the interest rate $r = 6$ percent to match the average real interest rate in Chile over the period. Table 10 summarizes the parameter values.

4.1.2 Calibrated parameters

We discipline the model by calibrating the rest of the parameters in the model to match key features of the Chilean economy prior to the introduction of the capital control. Specifically, we calibrate the iceberg trade cost τ, the productivity dispersion ω_z, the sunk export entry cost F, the stringency of the collateral constraint θ, and the fraction of steady-state capital allocated to new entrepreneurs as initial net worth $\underline{a}$[21]; the fraction of firms that belong to the high-capital intensity sector; and the α_s of each sector to match eight moments in the data: (1) the share of firms that export; (2) the average sales of exporters divided by average sales of non-exporters; (3) the ratio of average sales between five-year-old and one-year-old firms, among new firms that survive for at least five years; (4) aggregate exports as a fraction of total sales; (5) aggregate credit as a fraction of value added; (6) the aggregate capital stock divided by the wage bill; (7) the ratio of the average proportion of capital to labor between the high- and low-capital intensity sectors and (8) the ratio of the average number of workers between the high- and low-capital intensity sectors. All targeted moments are computed using the Chilean Encuesta Nacional Industrial Anual (ENIA) for the period 1990-1991, except for aggregate credit that is computed from the total value of outstanding credit in the manufacturing sector, as reported by the Superintendencia de Bancos e Instituciones Financieras de Chile. We choose the 1990-1991 time period for the calibration because capital controls were implemented only in mid-1991 and, arguably, did not affect the data reported for these years.

Table 11 shows the moments in the data and their counterparts generated in the calibrated model economy. As we can observe from Table 11, the calibration delivers moments that are reasonably close to the data.

4.1.3 Model validation

Column (1) of Table 12 shows the percentage change in the target moments in the period 1992-1998, when capital controls were in place, with respect to their analogues in 1990-1991, the period we use for calibration purposes. Column (2) shows the change in the same moments

[21] We assume that all new entrepreneurs receive a transfer from the government that equals a fraction $\underline{a}$ of their capital in steady state so that $a_0 = \underline{a}k_{SS}$. In Section 4.3.3, we explore the implications of assuming that all entrepreneurs receive an equal lump-sum transfer (irrespective of productivity or productive sector) $a_0 = \underline{A}$.

in the model when we set $\mu_g = 1.98$, with respect to the situation in which $\mu_g = 0$, keeping all other parameter values constant. Notice that the moments in 1990-1991 are a target for our calibration and, consequently, obtaining close counterparts in the model is part of our calibration exercise. However, the moments in 1992-1998 are outside this exercise, and any resemblance between the model and the data should be attributed to the model's ability to capture the main responses of the economy to the capital control. In this spirit, we regard the comparison of columns (1) and (2) of Table 12 as external validation of the proposed model.[22]

Table 12 shows that the model captures the main qualitative changes in the target moments in the period in which capital controls were in place in Chile. There are two exceptions to this: first, the ratio of average sales of exporters to non-exporters decreases in the data, while it increases in the model. The resource reallocation of resources from non-exporters to exporters that takes place in the model is the main explanation for this divergence. Although this reallocation seems also to be present in the data (see Section 2.3), the effect is probably mitigated by other factors affecting the economy during this period. Second, the ratio of aggregate capital stock over the wage bill strongly decreases in the data, while it increases in the model. This is due to the fact that, while CCs in the model deter capital accumulation (as seems to be the case in the data), general equilibrium effects push wages down, thus reversing the effect on the ratio.

4.2 Results

4.2.1 Policy functions

In order to clarify the intuition behind the following results, it is informative to explore the decisions on investment and debt holdings before and after the introduction of the CC. Figure 4 shows the policy functions for capital and debt that the model delivers in three cases:[23] (i) in the benchmark specification without CC (in blue); (ii) when CCs are introduced (in yellow); and (iii) in the case in which the interest rate increases for both lenders and borrowers (in

[22]The period 1992-1998 was one of many changes in macroeconomic conditions in Chile, apart from the introduction of the capital control. For this reason, we do not expect the change in the target moments to reflect only the effects of this measure. Similarly, we do not expect the model to quantitatively replicate the changes observed in the data, but rather to give an indication that, qualitatively, the variables of interest move in the right direction.

[23]These policy functions correspond to an entrepreneur born in a given sector with a given productivity level.

red).

In the benchmark case, an entrepreneur is born with a level of capital lower than her optimal level. Because there are financial frictions in the shape of collateral constraints, the entrepreneur gradually contracts debt and accumulates capital until the point at which the optimal scale is reached. From that point on, capital remains unchanged, and, given that $\beta(1+r) > 1$, the entrepreneur accumulates assets.

The introduction of the CC substantially alters the transition towards the optimal scale. When the level of capital is very low, its marginal productivity is high, and the entrepreneur finds it profitable to contract debt at an interest rate $\hat{r}$ to finance investment. There comes a point, however, at which the marginal productivity of capital becomes too low with respect to $\hat{r}$, so debt becomes too expensive. From this point on, the entrepreneur decides to repay her debt and finance investment with internal funds. Notice that investment is still profitable because the marginal productivity of capital is still high with respect to r, which is the relevant interest rate when $a \geq 0$. As before, when the entrepreneur reaches her optimal scale, she accumulates assets thereafter.

There are two aspects worth pointing out: first, once the optimal scale is reached, the CC no longer shapes the entrepreneur's decisions to invest, produce or consume. The optimal scale does change between the situations with and without CC, but this is due to general equilibrium effects only (through p, y and w).[24] Second, the transition towards the optimal scale takes longer when the CC is in place because the interest rate charged on debt holdings is higher. This will play an important role in the numerical results discussed in the following sections since some firms may die before reaching their optimal scale. This effect will be more important, the longer the transition.[25]

Finally, Figure 4 also shows how the policy functions change when one considers a symmetric increase in the interest rate, which would correspond to a tax on inflows and outflows of funds. As expected, in this case, the optimal scale is reduced and, because of this, the transition takes less time than in the benchmark case. Then, in the long run, all results

[24] The assumption that $\beta(1+r) > 1$ is necessary to prevent the possibility of multiple equilibria from arising when the CC is introduced. Notice that, if $\beta(1+r) = 1$, the optimal scale of the entrepreneur would depend on the initial condition for a.

[25] The fact that the transition towards the optimal scale is crucial to our results is in line with Gourinchas and Jeanne (2006). It also provides a justification for the assumption of collateral constraints on debt contracting: were these absent, the entrepreneur would reach her optimal scale immediately.

would stem from a lower level of capital.

4.2.2 Aggregate implications of the introduction of CC

Table 13 shows the main aggregate implications of introducing a CC. Column (1) shows steady-state moments (in levels) in the benchmark model economy with no capital controls. To this economy, we introduce capital controls on inflows so that the effective interest rate paid by entrepreneurs when they contract debt is now $\hat{r} = r + \mu_g$.

In order to better understand the effects triggered by the CC, we compute a *pseudo-partial equilibrium* in which entrepreneurs solve their optimization problem, considering aggregate prices and quantities p, w and y at their equilibrium levels of the economy with no CC. Column (2) shows the results of this exercise. Due to the higher cost of contracting debt, entrepreneurs slow down their investment process. As it now takes them longer to reach their optimal level of capital, and some firms die during the transition, the average firm size in the economy shrinks, which brings down aggregate capital by 1.3 percent.[26] The higher financing costs also affect the costly decision to become an exporter, triggering a 26.2 percent reduction in the extensive margin of exporters and a 11.3 percent reduction in total exports. In spite of the smaller average firm size, the massive reduction in exports explains the 1.1 percent increase in domestic sales. GDP[27] decreases by 0.6 percent, and, because exporting, high-productivity firms are hit the hardest, aggregate TFP falls by 1.7 percent.[28]

Once we allow entrepreneurs to update their information on aggregate prices and quantities, a series of new effects arises, as is clear from Column (3) of Table 13. First, the CC acts as a tax on debt that naturally brings down investment and entrepreneurs' consumption. The reduced levels of aggregate domestic demand amplify the fall in capital accumulation to 1.8 percent. This, in turn, translates into a reduced labor demand and, consequently, a decline in the equilibrium wage rate of 2.9 percent. Lower demand also translates into lower prices, thus bringing down the aggregate price level by 1.9 percent. Notice that $p^* = 1$ and it

[26] Absent any financial frictions, the entrepreneur immediately jumps to its long-run optimal level of capital by contracting debt with the rest of the world. If the collateral constraint binds, however, the entrepreneur has to gradually increase the level of capital until she reaches her optimal scale. Since entrepreneurs can exogenously die during this transition, longer transitions convey lower levels of aggregate capital, even if the optimal level of capital is invariant.

[27] GDP is computed as the sum of consumption, investment, government spending and net exports.

[28] Section 4.2.5 discusses in detail the assumptions and intuition behind this result.

remains constant throughout the exercise. Thus, the real exchange rate is defined as $1/p$ and the fall in the aggregate price level corresponds to a real exchange rate depreciation.

Since the external demand that entrepreneurs face remains unaffected by the CC, the lower wages and prices make domestic entrepreneurs more competitive in international markets, inducing some firms to pay the now lower entry cost to become an exporter and allowing existing exporters to increase their exports. All in all, both the extensive and intensive margins of exports expand, leading to a 6.5 percent boost in average exports and a 0.7 percent increase in the share of exporters, in line with Result 1 in Section 2.3.

Finally, driven by the large negative effects of the CC on investment and consumption, GDP decreases by 2.0 percent. The relative substitution of exports for domestic sales, on the other hand, shifts productive resources from less productive entrepreneurs to more productive ones, which leads to an increase in aggregate TFP of 1.0 percent.

Note that the lower level of wages and the aggregate price level are two general equilibrium outcomes that reinforce a redistribution of resources from domestic production to exports. Obviously, the response of prices and quantities in the economy depends on our choice of predetermined parameters, both quantitatively and, potentially, qualitatively. For this reason, in Section 2.4, we present a series of tests to corroborate the robustness of our qualitative results to changing the parameters in the calibration.

4.2.3 Capital intensity

Table 14 shows the same moments of Table 13 but for firms pertaining to the low-capital intensity (α_L) and high-capital intensity sectors (α_H), respectively. The results depicted in this table are in line with Result 2a in Section 2.3: the introduction of the CC affects those firms that operate in the α_H sector relatively more, as capital and domestic sales fall more sharply than for firms operating in the low capital intensity sector. Moreover, as discussed before, entrepreneurs take advantage of the fall in domestic prices to increase exports. Although this is a common feature across sectors, it is stronger in the α_L sector: the share of exporters increases in this sector but remains unchanged in the α_H sector; this leads to exports increasing more strongly in the former sector than in the latter. As a result, total production[29] falls in the α_H sector, whereas it increases in the α_L. Finally, TFP increases

[29]Total production is computed as $\int (y_h(i) + \tau y_f(i))di$.

in both sectors. As discussed before, this is a reflection of the fact that more productive, exporting firms are able to profit from their relatively higher competitive advantage in the foreign market to expand exports.

4.2.4 Export status

In this section, we explore firms' response to the introduction of the CC, depending on their export status.[30] Table 15 shows the results, dividing firms by export status and productive sector. The findings of Table 15 are broadly consistent with the empirical finding 2b in Section 2.3.

Conditional on being an exporting firm, those in the α_H sector are more negatively affected by the CC in their capital accumulation, domestic sales and total production. Exports and share of exporters increase by less in this sector. To understand these resuts, it is useful to distinguish between new exporters and pre-existing ones. Due to the real exchange rate depreciation (that is, a fall in p) and the decrease in the wage rate, exports increase for both capital intensities (*intensive margin*). However, only new low-capital intensity firms enter the foreign markets (*extensive margin*). When doing so, they achieve a new, larger scale. This is why α_L exporting firms increase their capital stock, domestic sales and total production. α_H firms, on the other hand, increase exports but due to the decrease in domestic demand and the higher cost of debt, capital, domestic sales and, ultimately, total production decrease more strongly.

Non-exporters, on the other hand, cannot compensate for the decrease in domestic demand with higher exports, so capital, domestic sales and total production decrease for this group, for both capital intensities. There are heterogeneities between sectors, however. This is, again, due to the extensive margin: the most productive firms from the α_L sector are becoming exporters, so the group of non-exporters is, on average, less productive, has smaller scale and produces less. This is a compositional effect that adds up to the direct effect of the CC.

[30] The analysis in this section compares the average change in the moment of interest for exporting firms before and after the introduction of the CC, allowing the group of exporting firms to vary with the CC. Another possibility is to take as exporters the group of firms that are already exporting in the economy with no CC and to keep this group invariant to compute the moments of Table 15. Qualitatively, all results hold through.

4.2.5 Total factor productivity

In this section, we explain how we compute the change in TFP reported in Tables 13 and 14 and analyze the mechanisms behind these changes. We follow the growth accounting literature and measure TFP as $TFP = \frac{Y}{\sum_j F_j^{\alpha_j}}$, where Y is production of the relevant good we are analyzing, and F_j are factors of production such as capital and labor for intermediate varieties, and imports, in the case of the final good.

In Table 14, intermediate varieties are produced using capital and labor only as production factors. Moreover, since firms in each sector produce according to a Cobb-Douglas production function, we use the α_h and α_l computed in the calibration exercise as the capital share and $1-\alpha_h$ and $1-\alpha_l$ as the labor share in the production function of each sector. Aggregate sectoral capital and labor are computed as the sum of all capital and labor used for production in each sector –i.e., $K_s = \int_s k(i)di$ and $N_s = \int_s n(i)di$ for $s = \{h, l\}$. Aggregate sectoral production is computed as the sum of the total production of each variety –i.e., $y^s = \int_s z(i)k(i)^{\alpha_s} n(i)^{1-\alpha_s}$ for $s = \{h, l\}$.

For the computation of TFP in Table 13 the weight of each production factor in the production function, α_j, is computed using the share of the factor income to total income, as is standard in the literature.[31] Aggregate capital and labor are computed as the sum of all capital and labor used for production in the economy: $K = \int k(i)di$ and $N = \int n(i)di = 1$. Aggregate total production, in this case, is computed as the sum of the production of the final good and the total production of exports –i.e., $Y = y + \tau \int y_f(i)di$.[32]

As already discussed in Section 4.2.2, aggregate TFP increases by 1 percent when the CC is introduced (see Table 13), and TFP in each sector increases as well. The reason for this increase is that the real exchange depreciation, along with the fall in wages, induces the more productive firms in each sector to increase exports. This generates a reallocation of resources from less productive to more productive firms that explains the increase in TFP, both at the sectoral level and at the aggregate level. This effect is reinforced by the fact that cheaper domestic varieties are partially substituted for imports. This, in turn, explains why

[31] Given that capital and labor markets are competitive, we compute $\alpha_K = \frac{(r+\delta)K}{Y}$, $\alpha_L = \frac{wL}{Y}$ and $\alpha_M = \frac{p_m y_m}{Y}$.

[32] Since this is an open-economy model in which firms export intermediate varieties, and, at the same time, imports are used as productive factors, we modify the standard growth accounting methodology to incorporate these elements.

the increase in aggregate TFP is larger than the increase observed in each productive sector.

The increase in aggregate TFP is consistent with the findings of Gopinath et al. (2017) on the detrimental effects of capital inflows in measured productivity in Southern Europe. In this paper, the authors conclude that the large increase in capital inflows that countries in Southern Europe, such as Spain and Portugal, experienced during the euro convergence process led to a decline in sectoral TFP. They argue that behind this decline is the fact that capital was allocated to firms that were not necessarily more productive but had a high net worth, to the detriment of smaller, more productive firms. In their model, this result arises as a consequence of assuming a size-dependent collateral constraint that is naturally more relaxed for larger firms.

Our mechanism works in a similar way as in Gopinath et al. (2017), although we do not need to assume a size-dependent collateral constraint. Still, since firms reach different optimal scales depending on whether or not they become exporters, a CC that conveys a decrease in domestic prices shifts the now scarcer capital inflows towards more productive firms that decide to become exporters or to increase exports because they are more internationally competitive.[33] Then, the positive effect on TFP follows. In this way, the trade dimension considered in our model substitutes for, at least qualitatively, the size-dependent collateral constraint of Gopinath et al. (2017).

4.3 Sensitivity analysis

In this section, we perform some robustness exercises to analyze how results change when we modify the values chosen for two of the predetermined parameters of the model: the elasticity of substitution between varieties, and the exogenous probability of death.

4.3.1 Elasticity of substitution σ

First, we explore how our main results change when we modify σ, the elasticity of substitution of varieties faced by the final-good producers. This parameter is important because it determines how sensitive are the domestic and foreign demands for varieties are to changes

[33] In other words, the CC limits capital inflows. These inflows are now directed towards more productive firms because of the exchange rate depreciation and its endogenous effect on the intensive and extensive margins of trade.

in their price.

In the benchmark model, we set $\sigma = 4$, a value commonly used in the literature. In our alternative specifications, we recalibrate the model with a lower and a higher sigma: $\sigma = 3$ and $\sigma = 5$, respectively. Table 16 shows the results. At first glance, it is not obvious how the elasticity of substitution is interacting with CC because the change in most variables is not monotonic when σ increases. The key, however, is to understand how the intensive and extensive margins of the export decision shape the results.

When $\sigma = 5$, substitutability between varieties is higher. As before, the lower demand for the final good stemming from the introduction of the CC leads to a lower demand for labor and a consequent reduction in prices and wages that makes domestic producers more competitive in external markets. Domestic varieties are better substitutes for foreign ones, so very productive exporters export more. Higher substitutability, however, implies that only very productive entrepreneurs get to participate in foreign markets. This explains the decrease in the number of exporters. This decrease reduces the optimal scale of those entrepreneurs that are no longer becoming exporters, explaining the sharp decline in capital. As a result, TFP increases, but less so than in the benchmark scenario, 0.7 percent vs. 1.0 percent.

When $\sigma = 3$, on the other hand, complementarity between varieties is higher, and the effect on exports is the opposite. Wages and prices respond less to the introduction of the CC, and domestic sales fall by less. These milder effects on prices discourage entrepreneurs from entering foreign markets, so the share of exporters declines. Again, TFP increases by less than in the benchmark scenario, 0.3 percent vs. 1.0 percent, because the general equilibrium effect of the CC on the export decision is milder.

4.3.2 Death probability ν

Since our results depend on the fact that the CC delays the transition towards the optimal scale of entrepreneurs, and some entrepreneurs die while in transition, the death probability, ν, is arguably a crucial parameter for our analysis. Table 17 shows our baseline results together with the results of changing the death probability to a higher and lower value —$\nu = 0.12$ and $\nu = 0.08$, respectively. As expected, a higher level of ν conveys a bigger decline in GDP as a result of the CC. In this economy, only very productive entrepreneurs find it profitable to become exporters. Thus, the decline in prices strongly motivates the entry of new exporters.

Notice, however, that although total exports also increase, the extensive margin is the one driving a large fraction of such an increase. As a consequence, TFP increases only slightly.

When ν is lower than in the benchmark case, however, the slower transition does not impact production so strongly because there are fewer firms below their optimal scale, and GDP falls by less than in the benchmark case —0.8 percent vs. -2.0 percent. Firms affected by the CC delay the decision to become exporters, while those that are already exporters take advantage of the fall in prices to increase export intensity. Overall, the share of exporters falls sharply, while exports decrease modestly. Once again, the concentration of production among entrepreneurs that have higher levels of productivity translates into a sizable increase in TFP.

4.3.3 Other sensitivity analysis

Table 18 shows some additional sensitivity analyses that we conducted to check the robustness of our results.

Column (2) shows the results of assuming that the international interest rate faced by the country is 4.5 percent, instead of six percent as in the benchmark case. Before, the higher interest rate provided incentives for entrepreneurs to accumulate capital faster. Thus, the effect of CC on slowing down convergence to optimal scale is more significant when r is higher: capital, domestic sales, wages and prices fall by more in the benchmark case than in the low r case. The share of exporters, however, increases by less. This has to do with the fact that, as the transition time is less affected when $r = 4.5$ percent, the decline in prices crucially provides incentives for entrepreneurs to become exporters. This translates into a sharp increase in the share of exporters. As it is mainly the extensive margin that is adjusting, though, TFP does not increase substantially.

In Column (3) we consider a CC that is more stringent. In particular, we consider $\mu = 2.57$ percent, which corresponds to the theoretical value of the tax equivalent when imputing a 12-month fixed-term reserve requirement of 30 percent, a 12-month maturity and a six-percent international interest rate.[34] As our benchmark calibration in this case remains invariant, the higher CC exacerbates the effects on capital, domestic sales and prices.

[34] In our benchmark case, μ is lower, as we consider the average over the whole period of the policy and both the reserve requirement and the fixed-term were smaller at the beginning and the end of the period of implementation.

The share of exporters, however, decreases sharply because the boost provided by the real exchange rate depreciation and the fall in wages do not compensate for the higher cost of acquiring capital. Existing exporters, however, increase exports, so TFP increases by more than the benchmark case.

Finally, Column (4) shows the results when we consider that all newborn entrepreneurs receive an equal transfer $\underline{a}$ when born, independent of their productivity or capital intensity. This implies that some entrepreneurs that operate in the low capital-intensity sector and have low productivity begin to operate with a level of net worth that is equal to higher than their optimal scale, so the transition for them is immediate. High capital-intensity, high productivity entrepreneurs, on the contrary, start very far from their optimal scale, and, thus, their transition takes longer. We see from Table 18 that the results of this exercise are quantitatively very similar to those in our benchmark case.

5 Conclusions

This paper studies the effects of the capital controls (CCs) on firms' production, investment and exporting decisions, focusing on the case of the *Chilean encaje* implemented between 1991-1998. Throughout the paper we have shown that the introduction of CCs on inflows shapes the decisions of domestic firms on a number of unexplored margins of adjustment. The CC acts as a tax on debt that brings down investment and domestic sales. However, the consequent decline in the equilibrium wage rate and prices in the domestic economy triggers an increase in exports and the number of exporters.

To further deepen our understanding, we distinguish between firms in terms of the capital intensity of the sector in which they operate. The importance of studying these new dimensions at the firm level is twofold: it allows us to depict and understand the impact of CC at the micro level for a rich characterization of firms, while allowing us to compute aggregate implications of CCs, such as factor reallocation and, ultimately, changes in TFP. From this perspective, we find that the introduction of the CC has a relatively greater effect on firms that operate in the high capital-intensity sector as capital and domestic sales fall more sharply than for firms operating in the low capital-intensity sector. Also, conditional on being an exporting firm, those in a high capital-intensity sector are more negatively affected by the CC in their capital accumulation, domestic sales and total production. The relative substitution of domestic sales by exports shifts productive resources from less productive entrepreneurs to more productive ones, which leads to an increase in aggregate TFP.

These results have implications for the ongoing debate on the desirability of capital controls. So far, this debate has focused on the macro-level cost-benefit analysis of the policy. However, our results show that CCs trigger significant responses at the firm level that eventually materialize in changes in the overall resource allocation in the economy and aggregate level consequences in terms of output and TFP. This presents a new research agenda for the ongoing debate.

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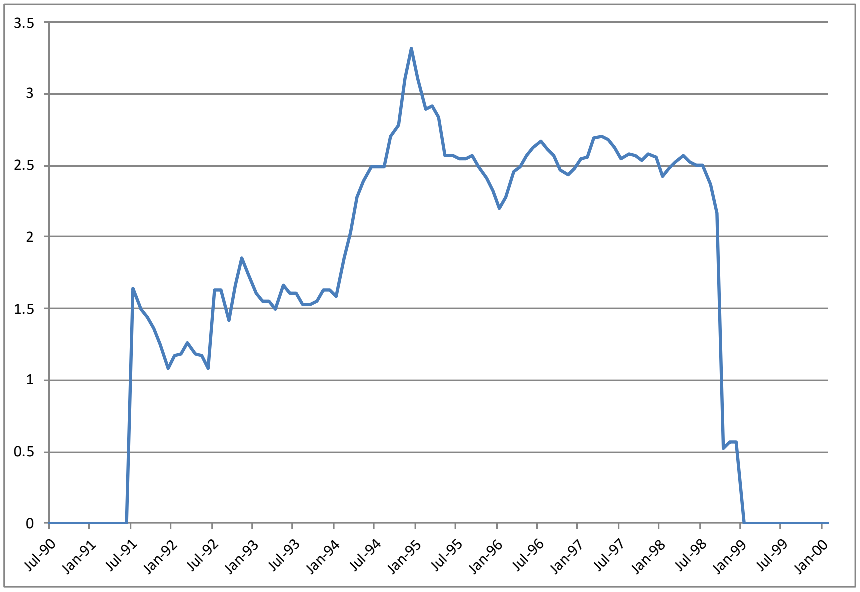
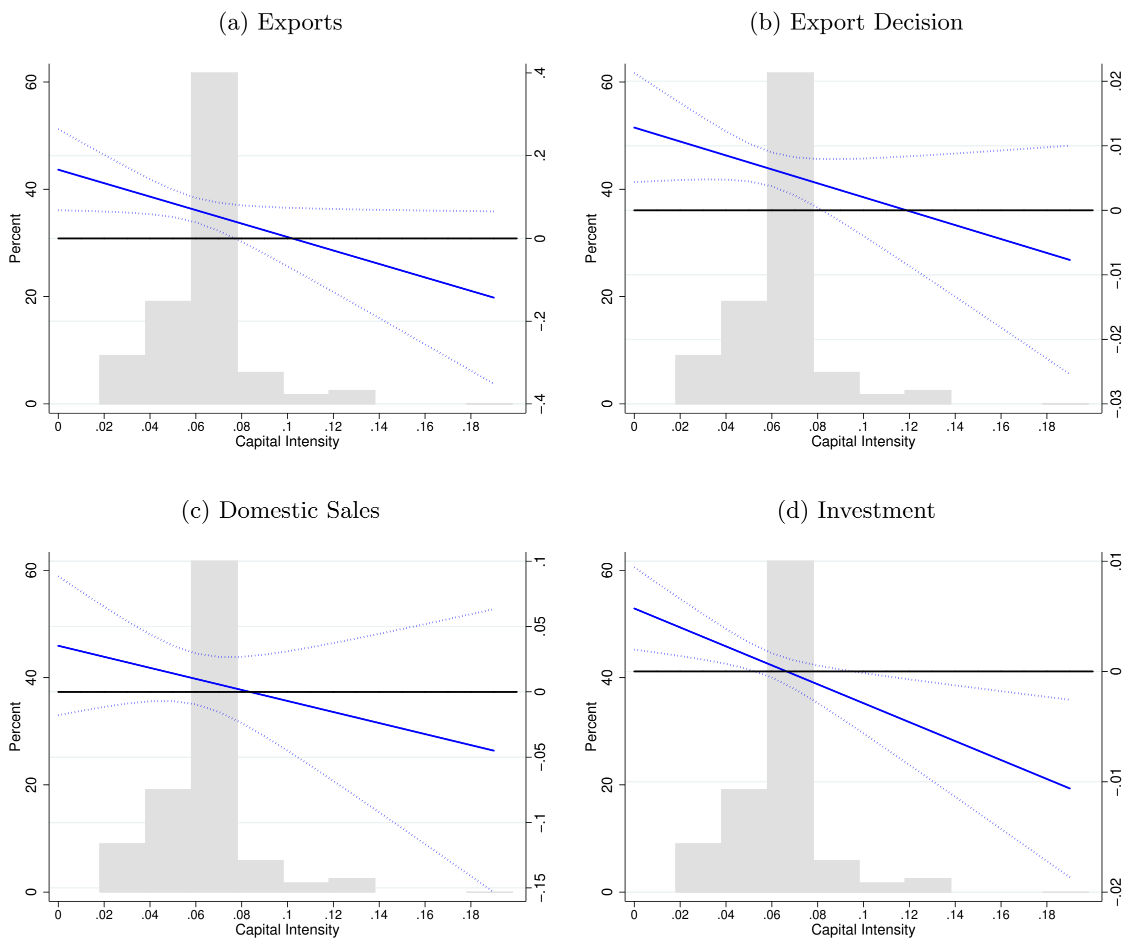
Appendix

Figure 1: The tax equivalent of the *Chilean encaje*



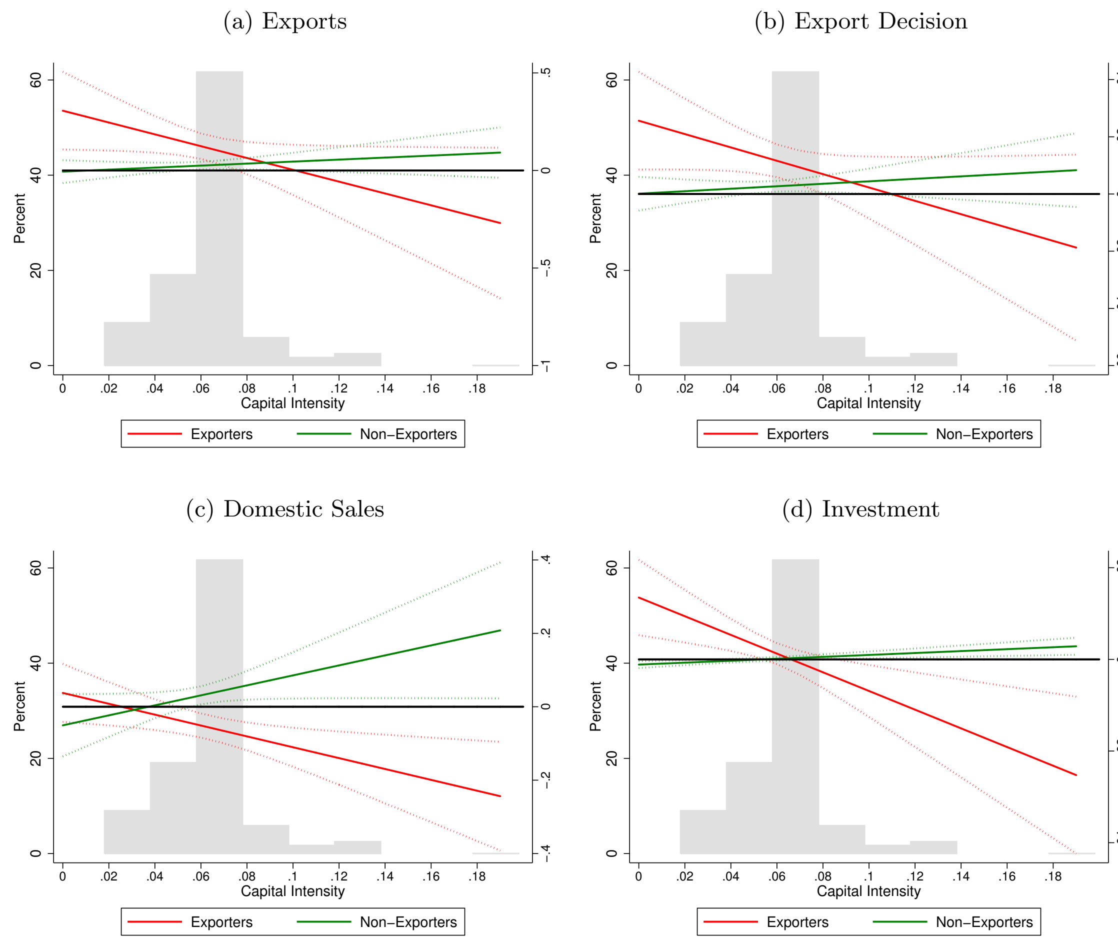
Note: We calculate the tax equivalent following the methodology in De Gregorio et al. (2000)
.

Figure 2: Percentage change in firm's outcomes by level of capital intensity. All Firms.



Note: Each panel graphically depicts the respective regression results from Table 4. In each panel, the vertical axis measures the percentage change in the corresponding dependent variable triggered by the CC for each level of C_Intensity, which is measured on the horizontal axis. The histogram, in light grey, depicts the distribution of firms in the sample in terms of C_Intensity, while the solid blue line shows the estimated effect of the CC for each level of C_Intensity for the whole universe of firms. The dotted blue lines correspond to the 95 percent confidence interval.

Figure 3: Percentage change in firm's outcomes by level of capital intensity. Exporters vs Non-Exporters.



Note: Each panel graphically depicts the respective regression results from Table 5. In each panel, the vertical axis measures the percentage change in the corresponding dependent variable triggered by the CC for each level of C_Intensity, which is measured on the horizontal axis. The histogram, in light grey, depicts the distribution of firms in the sample in terms of C_Intensity, while the solid red and green solid show the estimated effect of the CC for each level of C_Intensity for the subsample of Exporters and Non-Exporters, respectively. The dotted red and green lines are the corresponding 95 percent confidence intervals.

Figure 4: Policy functions for debt and capital

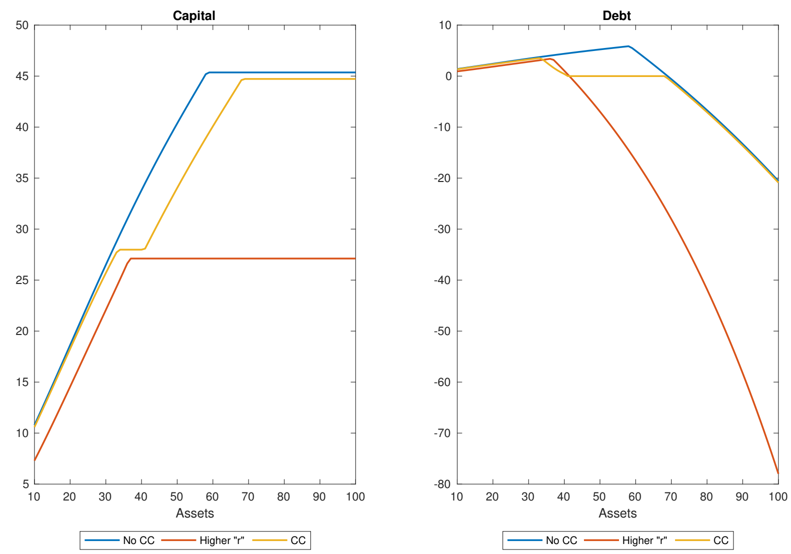


Table 1: Main changes in the administration of the *Chilean encaje*

Jun-1991	20% URR introduced for all new credit Holding period (months)=min(max(credit maturity, 3),12) Holding currency=same as creditor Investors can waive the URR by paying a fix fee (Through a repo agreement at discount in favor of the central bank) Repo discount= US$ libor
Jan-1992	20% URR extended to foreign currency deposits with proportional HP
May-1992	Holding period (months)=12 URR increased to 30% for bank credit lines
Aug-1992	URR increased to 30% Repo discount= US$ libor +2.5
Oct-1992	Repo discount= US$ libor +4.0
Jan-1995	Holding currency=US$ only
Sep-1995	Period to liquidate US$ from Secondary ADR tightened
Dec-1995	Foreign borrowing to be used externally is exempt of URR
Oct-1996	FDI committee considers for approval productive projects only
Dec-1996	Foreign borrowing <US$ 200,000 (500,000 in a year) exempt of URR
Mar-1997	Foreign borrowing <US$ 100,000 (100,000 in a year) exempt of URR
Jun-1998	URR set to 10%
Sep-1998	URR set to zero

Note: URR=Unremunerated Reserve Requirement
Source: De Gregorio et al. (2000).

Table 2: Summary Statistics: Firm Level Data

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Total Workers	89,799	78.02	163.9	0	5,745
Exp.Decision	89,799	0.200	0.400	0	1
TFP	89,799	9.689	1.332	1.053	19.23
Capital Intensity	89,799	0.0613	0.0201	0.0181	0.196
Int.Exp.	89,799	4.953	4.671	0	18.24
Exports (millions of CPL)	89,799	1.031	16.30	0	1,852
Dom. Sales (millions of CPL)	89,799	2.432	22.30	0	2,695
Investment (millions of CPL)	89,799	0.243	5.751	-9.933	788.9
Fixed Capital (millions of CPL)	89,799	2.188	30.10	6.00e-08	5,717
Number of id	11,356	11,356	11,356	11,356	11,356

Table 3: Summary Statistics: Macroeconomic Indicators 1990-2007

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
CC	18	0.881	1.109	0	2.649
Inflation	18	0.017	0.536	-0.626	1.887
RER	18	489.7	116.1	304.9	691.4
Trade/GDP	18	1.599	0.240	1.188	2.027
Growth	18	0.055	0.028	-0.021	0.120
World Growth	18	3.054	1.000	1.369	4.476
GDPpc	18	4,653	871.0	3,067	6,077
Private Credit/GDP	18	0.613	0.107	0.442	0.743
Interest Rate	18	11.63	7.995	2.400	34.72
Libor 12m	18	4.918	1.799	1.364	8.415

Table 4: All Firms

Note:

VARIABLES	(1) All Firms Exports	(2) All Firms Export Decision	(3) All Firms Dom. Sales	(4) All Firms Investment
CC	0.156***	0.013**	0.055	0.005
	(0.044)	(0.005)	(0.038)	(0.003)
CC*C_Intensity	-1.101*	-0.074	-0.350	-0.084*
	(0.567)	(0.070)	(0.597)	(0.048)
Total Workers	0.871***	0.058***	0.607***	0.011***
	(0.084)	(0.007)	(0.075)	(0.002)
Fixed Capital	0.060***	0.004***	0.065***	0.003***
	(0.016)	(0.001)	(0.019)	(0.000)
Int.Exp.	0.028***	0.002***	0.021***	0.000*
	(0.007)	(0.001)	(0.003)	(0.000)
TFP	0.142***	0.008***	0.421***	0.004***
	(0.031)	(0.002)	(0.030)	(0.001)
Inflation	0.046***	0.003**	-0.002	0.001
	(0.015)	(0.001)	(0.012)	(0.001)
RER	0.002***	0.000***	0.001	0.000**
	(0.001)	(0.000)	(0.001)	(0.000)
Trade/GDP	-0.707	-0.070*	-1.029***	0.003
	(0.486)	(0.041)	(0.200)	(0.007)
Growth	2.586***	0.221***	1.639***	0.055**
	(0.693)	(0.065)	(0.371)	(0.022)
World Growth	0.009	0.000	-0.006	0.001**
	(0.014)	(0.001)	(0.014)	(0.001)
GDPpc	0.001***	0.000***	0.000***	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Priv.Credit/GDP	-1.403*	-0.124*	-1.306*	-0.065**
	(0.817)	(0.061)	(0.759)	(0.029)
Interest Rate	0.011**	0.001*	0.004**	0.000**
	(0.005)	(0.000)	(0.002)	(0.000)
Libor	0.004	0.000	-0.002	-0.000
	(0.013)	(0.001)	(0.021)	(0.000)
Constant	-4.692***	-0.252***	5.092***	15.975***
	(0.778)	(0.069)	(0.710)	(0.027)
Observations	89,799	89,799	89,799	89,799
R-squared	0.311	0.263	0.194	0.0775
Number of id	11,356	11,356	11,356	11,356
Firm FE	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Exporters vs Non-Exporters

VARIABLES	(1) Exporters Exports	(2) Exporters Export Decision	(3) Exporters Dom. Sales	(4) Exporters Investment	(5) Non-Exporters Exports	(6) Non-Exporters Export Decision	(7) Non-Exporters Dom. Sales	(8) Non-Exporters Investment
CC	0.337***	0.028***	0.053	0.013**	-0.010	-0.000	-0.022	-0.001**
	(0.091)	(0.010)	(0.051)	(0.005)	(0.048)	(0.005)	(0.043)	(0.000)
CC*C_Intensity	-2.587**	-0.205*	-1.427**	-0.206**	0.700	0.058	1.324	0.021**
	(1.056)	(0.115)	(0.564)	(0.079)	(0.741)	(0.074)	(0.791)	(0.009)
Total Workers	1.406***	0.095***	0.558***	0.018***	0.235***	0.021***	0.746***	0.003***
	(0.136)	(0.012)	(0.088)	(0.003)	(0.051)	(0.005)	(0.082)	(0.001)
Fixed Capital	0.119***	0.008***	0.061**	0.006***	0.021***	0.002***	0.066***	0.001***
	(0.029)	(0.002)	(0.023)	(0.001)	(0.007)	(0.001)	(0.014)	(0.000)
Int.Exp.	0.044***	0.003***	0.024***	0.001*	0.008*	0.001*	0.013***	0.000
	(0.008)	(0.001)	(0.005)	(0.000)	(0.004)	(0.000)	(0.005)	(0.000)
TFP	0.276***	0.015***	0.410***	0.007***	0.050***	0.004***	0.359***	0.001***
	(0.058)	(0.004)	(0.041)	(0.002)	(0.015)	(0.001)	(0.033)	(0.000)
Inflation	0.084**	0.006*	-0.016	0.002	0.009	0.000	0.005	0.000
	(0.039)	(0.003)	(0.020)	(0.002)	(0.020)	(0.002)	(0.013)	(0.000)
RER	0.001	0.000	0.000	0.000*	0.001**	0.000**	0.001**	0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Trade/GDP	-1.569	-0.162**	-0.868**	-0.001	-0.328	-0.029	-1.197**	0.009
	(0.923)	(0.076)	(0.393)	(0.014)	(0.249)	(0.024)	(0.435)	(0.008)
Growth	6.933***	0.561***	1.814***	0.096**	0.879*	0.101*	1.963***	0.015
	(1.178)	(0.111)	(0.407)	(0.043)	(0.478)	(0.052)	(0.589)	(0.012)
World Growth	-0.090***	-0.009***	-0.030	0.002	0.029**	0.002*	0.007	0.000
	(0.028)	(0.002)	(0.025)	(0.001)	(0.012)	(0.001)	(0.013)	(0.000)
GDPpc	0.001***	0.000***	0.000***	0.000**	0.000**	0.000**	0.000***	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Priv.Credit/GDP	-1.897	-0.100	-2.181*	-0.096*	-1.684**	-0.190**	-1.204	-0.046**
	(1.955)	(0.144)	(1.171)	(0.049)	(0.816)	(0.086)	(0.844)	(0.021)
Interest Rate	0.016*	0.002*	0.008***	0.001**	0.008*	0.001	0.001	0.000
	(0.008)	(0.001)	(0.003)	(0.000)	(0.005)	(0.000)	(0.003)	(0.000)
Libor	-0.037	-0.004*	-0.025	-0.000	0.005	0.001	0.023	0.000*
	(0.029)	(0.002)	(0.038)	(0.001)	(0.010)	(0.001)	(0.019)	(0.000)
Constant	-7.281***	-0.293***	6.086***	15.867***	-1.995***	-0.175***	4.672***	16.059***
	(0.837)	(0.085)	(1.557)	(0.051)	(0.578)	(0.057)	(0.443)	(0.008)
Observations	45,728	45,728	45,728	45,728	44,071	44,071	44,071	44,071
R-squared	0.395	0.317	0.219	0.0813	0.0276	0.0235	0.138	0.0783
Number of id	9,512	9,512	9,512	9,512	6,297	6,297	6,297	6,297
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Time Fixed Effects, All Firms

VARIABLES	(1) All Firms Exports	(2) All Firms Export Decision	(3) All Firms Dom. Sales	(4) All Firms Investment
CC*C_Intensity	-1.086*	-0.073	-0.349	-0.084*
	(0.564)	(0.070)	(0.596)	(0.048)
Observations	89,799	89,799	89,799	89,799
R-squared	0.311	0.263	0.194	0.0776
Number of id	11,356	11,356	11,356	11,356
Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Time Fixed Effects, Exporters vs Non-Exporters

VARIABLES	(1) Exporters Exports	(2) Exporters Export Decision	(3) Exporters Dom. Sales	(4) Exporters Investment	(5) Non-Exporters Exports	(6) Non-Exporters Export Decision	(7) Non-Exporters Dom. Sales	(8) Non-Exporters Investment
CC*C_Intensity	-2.525**	-0.201*	-1.445**	-0.201**	0.718	0.059	1.313	0.021**
	(1.062)	(0.115)	(0.557)	(0.079)	(0.737)	(0.074)	(0.789)	(0.009)
Observations	45,728	45,728	45,728	45,728	44,071	44,071	44,071	44,071
R-squared	0.396	0.319	0.219	0.0817	0.0260	0.0219	0.138	0.0784
Number of id	9,512	9,512	9,512	9,512	6,297	6,297	6,297	6,297
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Capital Intensity vs External Financial Dependence, All Firms

VARIABLES	(1) All Firms Exports	(2) All Firms Export Decision	(3) All Firms Dom. Sales	(4) All Firms Investment
CC	0.159***	0.013**	0.055	0.005*
	(0.045)	(0.005)	(0.039)	(0.003)
CC*C_Intensity	-1.407**	-0.097	-0.412	-0.109**
	(0.676)	(0.077)	(0.754)	(0.050)
CC*EFD	0.057	0.004	0.012	0.005*
	(0.043)	(0.004)	(0.063)	(0.003)
Observations	89,799	89,799	89,799	89,799
R-squared	0.310	0.263	0.194	0.0760
Number of id	11,356	11,356	11,356	11,356
Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Capital Intensity vs External Financial Dependence, Exporters vs Non-Exporters

VARIABLES	(1) Exporters Exports	(2) Exporters Export Decision	(3) Exporters Dom. Sales	(4) Exporters Investment	(5) Non-Exporters Exports	(6) Non-Exporters Export Decision	(7) Non-Exporters Dom. Sales	(8) Non-Exporters Investment
CC	0.338***	0.028***	0.054	0.012**	-0.004	0.001	-0.017	-0.002**
	(0.093)	(0.010)	(0.050)	(0.005)	(0.050)	(0.005)	(0.042)	(0.001)
CC*C_Intensity	-2.879**	-0.224*	-1.549**	-0.255***	0.408	0.018	1.099	0.031**
	(1.177)	(0.119)	(0.697)	(0.074)	(0.876)	(0.084)	(0.811)	(0.013)
CC*EFD	0.062	0.004	0.026	0.010**	0.046	0.006*	0.035	-0.002
	(0.088)	(0.007)	(0.045)	(0.005)	(0.034)	(0.003)	(0.101)	(0.001)
Observations	45,728	45,728	45,728	45,728	44,071	44,071	44,071	44,071
R-squared	0.395	0.318	0.219	0.0793	0.0279	0.0239	0.138	0.0790
Number of id	9,512	9,512	9,512	9,512	6,297	6,297	6,297	6,297
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Parameter Values

Predetermined parameters			Calibrated parameters		
β	Discount factor	0.96	τ	Iceberg trade cost	4.964
γ	Risk aversion	2	η	Fraction of α_h firms	0.87
σ	Substitution elasticity	4	σ_z	Productivity dispersion	0.444
δ	Depreciation rate	0.06	F	Sunk export entry cost	1.35
r	Interest rate	0.06	θ	Collateral constraint	0.112
ν	Death probability	0.10	$\underline{a}$	Fraction of SS capital as initial net worth	0.092
			α_h	High capital intensity	0.451
			α_l	Low capital intensity	0.149

Table 11: Moments

Target Moment	Data (1990-1991) (1)	Model (No C.controls) (2)
Share of exporters	0.179	0.174
Average sales (exporters/non-exporters)	8.450	8.376
Average sales (age 5 / age 1)	1.513	1.640
Aggregate exports / sales	0.207	0.203
Aggregate credit / Value added	0.195	0.188
Aggregate capital stock / wage bill	7.826	7.633
Average (K_h/N_h) / Average (K_l/N_l)	3.981	3.909
Average N_h / Average N_l	1.552	1.546

Table 12: Model validation (Δ%)

Target Moment	Data (1992-1998) (1)	Model (w/ C.controls) (2)
Share of exporters	16.5	0.7
Average sales (exporters/non-exporters)	-9.5	2.3
Average sales (age 5 / age 1)	3.5	1.4
Aggregate exports / sales	4.6	9.7
Aggregate credit / Value added	-	-9.1
Aggregate capital stock / wage bill	-23.1	1.0
Average (K_h/N_h) / Average (K_l/N_l)	0.4	0.1
Average N_h / Average N_l	-8.5	-2.7

Table 13: Aggregate effects of the CC

	No CC (levels) (1)	CC: Pseudo-PE (Δ%) (2)	CC: GE (Δ%) (3)
Capital	3.69	−1.3%	−1.8%
Domestic Sales	0.89	1.1%	−5.1%
Exports	0.23	−11.3%	6.5%
Share of exporters	0.17	−26.2%	0.7%
Real GDP	1.12	−0.6%	−2.0%
TFP	1.33	−1.7%	1.0%
Wage	0.48	—	−2.9%
Price	0.55	—	−1.9%

Table 14: Effects of the CC by sector

	α_L (Δ%) (1)	α_H (Δ%) (2)	x_H/x_L (Δ%) (3)
Capital	−0.7%	−1.9%	−1.2%
Domestic Sales	−4.2%	−5.1%	−1.0%
Exports	13.1%	6.0%	−6.3%
Share of exporters	9.1%	0%	—
Total Production	1.7%	−0.5%	−2.1%
TFP	0.3%	0.4%	—

Table 15: Effects of the CC by export status

	Exporters		Non-exporters	
	α_L (Δ%) (1)	α_H (Δ%) (2)	α_L (Δ%) (3)	α_H (Δ%) (4)
Capital	4.0%	−1.5%	−5.7%	−2.5%
Domestic Sales	1.7%	−4.0%	−7.0%	−1.7%
Exports	14.6%	8.1%	—	—
Share of exporters	9.1%	0%	—	—
Total Production	1.7%	−0.5%	−7.0%	−1.7%

Table 16: Sensitivity analysis: σ

	$\sigma = 3$ (Δ%) (1)	$\sigma = 4$ (bench.) (Δ%) (2)	$\sigma = 5$ (Δ%) (3)
Capital	−2.7%	−1.8%	−2.2%
Domestic Sales	−3.3%	−5.1%	−4.7%
Exports	2.5%	6.5%	5.6%
Share of exporters	−0.1%	0.7%	−5.7%
Real GDP	−2.1%	−2.0%	−1.9%
TFP	0.3%	1.0%	0.7%
Wage	−2.0%	−2.9%	−2.5%
Price	−1.0%	−1.9%	−1.7%

Table 17: Sensitivity analysis: ν

	$\nu = 0.08$ (Δ%) (1)	$\nu = 0.10$ (bench.) (Δ%) (2)	$\nu = 0.12$ (Δ%) (3)
Capital	−1.7%	−1.8%	−1.7%
Domestic Sales	−4.1%	−5.1%	−4.7%
Exports	−0.8%	6.5%	7.7%
Share of exporters	−23.2%	0.7%	8.0%
Real GDP	−0.8%	−2.0%	−2.8%
TFP	1.4%	1.0%	0.2%
Wage	−3.8%	−2.9%	−2.0%
Price	−2.7%	−1.9%	−1.0%

Table 18: Sensitivity analysis: r, μ and $\underline{a}$

	Benchmark (Δ%) (1)	$r = 0.045$ (Δ%) (2)	$\mu = 0.0257$ (Δ%) (3)	Same $\underline{a}$ (Δ%) (4)
Capital	−1.8%	−1.5%	−2.0%	−1.4%
Domestic Sales	−5.1%	−3.6%	−5.4%	−3.8%
Exports	6.5%	5.5%	1.6%	4.9%
Share of exporters	0.7%	6.5%	−19.2%	1.6%
Real GDP	−2.0%	−2.1%	−1.5%	−1.6%
TFP	1.0%	0.1%	1.5%	0.6%
Wage	−2.9%	−1.5%	−4.3%	−1.6%
Price	−1.9%	−0.8%	−3.1%	−0.9%