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ORIGINAL PAPER

# Financial development, exporting and firm heterogeneity in Chile

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**Abstract** Using plant-level data from the manufacturing sector of Chile for the period 1990–2000, this paper examines the effect of financial development on the probability of exporting at the plant level, with a special focus on the heterogeneous responses of plants with different characteristics. The main results are that an improvement in financial development increases the probability of exporting of more productive plants and those with foreign ownership operating in manufacturing sectors that are more dependent on external finance. Our estimates also show that financial development does not appear to improve the probability of exporting for relatively smaller and younger plants. This result suggests that, at least for the case of exporting in Chile, smaller and younger plants are not necessarily more likely to benefit than larger and older plants from improvements in access to credit.

**Keywords** Exporting · Financial development · Credit constraints · Plant-level data · Chile

**JEL Classification** F14 · O16 · O54

## 1 Introduction

The recent financial crisis that affected many economies of the world during the latter part of the 2000s demonstrated the importance of financial systems for

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economic growth and international trade. While empirical studies at the macro level have shown that financial development is an important determinant of economic growth (King and Levine 1993; Levine 1997; Levine et al. 2000), and trade volumes and trade patterns (Beck 2002, 2003), still surprisingly little is known about the heterogeneous responses of firms at the micro level. A series of empirical studies has shown that international trade is characterized by a high degree of heterogeneity. Firms that are involved in exporting or importing activities are, on average, more productive, larger, more capital and skill intensive, and pay higher wages than firms that participate in domestic markets only (Bernard and Jensen 1999; Alvarez and López 2005; Kasahara and Rodrigue 2008; López and Yadav 2010).[1] The purpose of this paper is to link the macro and the micro literatures by examining the effect of financial development on firms' exporting decisions taking into account the potential different responses by heterogeneous firms.

Our conceptual framework is based on the recent theoretical analyses by Chaney (2005) and Manova (2010), who extend the Melitz (2003) model of international trade to study the relationship between firm export decisions and financial constraints. In these theories, given that exporting involves entry costs that need to be paid up front, limited access to financing can prevent the entry of firms into international markets. An implication of these analyses is that a higher degree of financial development should help reducing financial constraints at the firm level, thereby increasing the probability of exporting. Using plant-level data from the manufacturing sector of Chile for the period 1990–2000 we study the effect of financial development on the probability of exporting, and we extend the previous literature by considering explicitly the differential impact of financial development across plants and industries.

Most of the previous empirical papers at the micro level have examined the role of firm-specific credit constraints or financial health on the probability of exporting, but have overlooked the potential role of financial development. While some studies on this area find that firms with lower credit constraints are more likely to export (e.g., Berman and Héricourt 2009; Bellone et al. 2010; Minetti and Zhu 2011), others find that causality runs in the opposite direction, so that exporting improves firms' financial health (e.g., Greenaway et al. 2007). Since exporting and financial health are likely to be endogenous, establishing the direction of the causality is a challenge in all these studies.

The only paper we are aware of that considers the role of financial development explicitly in the export decision is the study by Berman and Héricourt (2009), who use a data set with information for 5,000 firms from nine developing countries. Similar to our approach, they include in some regressions a measure of financial development interacted with firm-level productivity. They find that financial development disproportionally increases the probability of exporting of more productive firms. Our paper extends the previous literature by analyzing whether productivity and other plant characteristics, such as size, age and foreign ownership, may play a role in determining the effect of financial development on the exporting probability.

[1] For a recent survey, see Wagner (2012).

In addition, we also look at how the heterogeneous effect of financial development differs across industries depending on their degree of financial dependence. To do this, we use a variant of the identification strategy developed by Rajan and Zingales (1998) to analyze whether financial development has a larger effect on more productive firms (or younger or foreign-owned firms) in those sectors where external financial needs are more relevant. This strategy has been used in a cross-country setting by Aghion et al. (2007) to study the effects of financial development on firm dynamics. Their results show that financial development matters most for entry of new firms and post-entry growth in sectors that are more dependent on external financing.[2]

Our econometric results consistently show that financial development benefits more productive and foreign-owned firms in industries that are more dependent on external finance. In contrast, smaller and younger firms do not appear to be particularly affected by financial development. Our results hold to several robustness checks such as the introduction of interactions between aggregate shocks and firm characteristics, and the use of alternative measures of financial dependence and estimation techniques.

One usual concern when analyzing the effect of financial development is the potential endogeneity of this variable. In our case, since a country's financial development is exogenous to the decision to export at the firm level, our analysis does not need to deal with the issue of causality going in the opposite direction. It can be argued, however, that capital markets development may depend on the industry characteristics of the country, which needs to be taken into account in the empirical analysis. In fact, Braun and Raddatz (2008) argue that changes in the relative strength of trade promoter and trade opponent industries result in changes in the political equilibrium level of financial development. They find evidence that strengthening of promoter relative to opponent industries resulting from trade liberalization is a good predictor of subsequent financial development. Similarly, Do and Levchenko (2007) show that a country's trade pattern can affect its financial development. They present evidence that countries with a higher specialization in financially dependent goods have a higher level of financial development than countries producing goods for which external finance is less important. Given that we use plant-level information we can rule out the effect of industry-specific shocks that can simultaneously affect both financial development and the probability of exporting, by including industry-year fixed effects in all our regressions.

This paper is structured as follows. Section 2 describes the data and presents some basic patterns. Section 3 introduces the empirical methodology. Section 4 presents and discusses the econometric results, and also several robustness checks. In Sect. 5 we conclude and discuss the implications of our findings.

[2] Recent papers using a similar identification strategy with microeconomic data are Jaud and Kukenova (2011) which shows that agri-food products that require more external finance survive longer in foreign markets if the exporting country is more financially developed, and Tsoukas (2011) which presents evidence that stock market development is particularly beneficial to large firms.

## 2 Data description

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 Chilean manufacturing plants with 10 or more workers.[3] The data set is available for the period 1979–2000, but we have information for exports and foreign ownership only since 1990. Given that we are interested in studying the relationship between exporting and financial development, we use information only for the period 1990–2000.

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 allows us to identify entry and exit. For each plant and year, the ENIA collects data on production, value added, sales, employment and wages (for production and non-production workers), exports, investment, depreciation, energy usage, payments in foreign technology licenses, and other plant characteristics. Plant ownership is identified by the percentage of capital owned by foreigners. We define as foreign-owned plants those plants with any amount of foreign ownership.[4] All plants in the data are classified according to the International Standard Industrial Classification (ISIC) revision 2. Using 3-digit ISIC industry-level price deflators, all monetary 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 a summary of the industrial structure in Chile. It shows the importance of each 3-digit industry in the total number of plants and employment. The most important sector, both in terms of employment and number of plants, is food manufacturing, with a share of about 30 % in terms of employment and number of plants in the year 2000. Other important industries include metallic products, and the wood industry, with employment shares of about 7 and 6 %, respectively in 2000. As it is evident from the table, the most important industries in Chile in terms of employment and number of plants are sectors that are intensive in the use of natural resources, which is not surprising given that Chile is a relatively natural-resources-abundant country. The importance of capital-intensive industries, such as machinery and transport equipment, is relatively low.

Measures of financial development come from the data set compiled by Beck et al. (2010). The variables that we use in our empirical approach are the ratio of private credit by deposit money banks over GDP (Bank Credit) and the ratio of private credit by deposit money banks and other financial institutions over GDP (Dom. Credit). These indicators of size of the financial markets have been commonly used in the economic growth and finance literature. The evolution of both variables is presented in Fig. 1. As we can see, both measures of financial

[3] Although a plant is not necessarily a firm, in the case of Chilean manufacturing, most firms have only one plant. Thus, the paper will refer to plants and firms interchangeable.

[4] Most of the plants with foreign ownership have actually majority foreign ownership (over 50 % foreign ownership).

**Table 1** Distribution of plants and employment by sector (%)

| ISIC code | Description | Plants share | | Employment share | |
|---|---|---|---|---|---|
| | | 1990 | 2000 | 1990 | 2000 |
| 311 | Food manufacturing | 30.7 | 28.7 | 26.5 | 31.5 |
| 313 | Beverages | 2.1 | 2.1 | 3.1 | 3.8 |
| 314 | Tobacco | 0.1 | 0.1 | 0.2 | 0.2 |
| 321 | Textiles | 7.9 | 6.3 | 8.7 | 5.4 |
| 322 | Apparel | 6.8 | 5.4 | 6.1 | 3.6 |
| 323 | Leather products | 1.1 | 0.7 | 0.8 | 0.4 |
| 324 | Footwear | 3.4 | 2.1 | 3.7 | 2.1 |
| 331 | Wood products | 7.2 | 6.5 | 7.1 | 6.3 |
| 332 | Furniture | 2.6 | 3.2 | 1.9 | 1.9 |
| 341 | Paper | 1.4 | 1.9 | 2.7 | 3.2 |
| 342 | Printing and publishing | 4.1 | 4.8 | 3.1 | 3.7 |
| 351 | Industrial chemicals | 1.6 | 1.4 | 1.3 | 1.9 |
| 352 | Other chemicals | 3.7 | 4.0 | 5.0 | 5.0 |
| 353 | Petroleum refineries | 0.0 | 0.1 | 0.3 | 0.4 |
| 354 | Petroleum and coal | 0.4 | 0.4 | 0.5 | 0.3 |
| 355 | Rubber products | 1.1 | 1.3 | 1.1 | 1.1 |
| 356 | Plastic | 4.3 | 5.0 | 3.7 | 4.4 |
| 361 | Ceramics | 0.4 | 0.1 | 0.7 | 0.4 |
| 362 | Glass | 0.4 | 0.5 | 0.6 | 0.6 |
| 369 | Non-metallic minerals | 2.6 | 3.3 | 2.1 | 2.7 |
| 371 | Iron and steel | 0.7 | 0.7 | 2.2 | 1.8 |
| 372 | Non-ferrous metals | 0.8 | 1.3 | 2.4 | 4.1 |
| 381 | Fabricated metal | 7.7 | 10.8 | 7.2 | 7.3 |
| 382 | Non-electrical machinery | 3.9 | 3.9 | 4.1 | 3.0 |
| 383 | Electrical machinery | 1.1 | 1.3 | 1.2 | 1.2 |
| 384 | Transport equipment | 2.4 | 2.2 | 2.8 | 3.0 |
| 385 | Professional and scientific equipment | 0.4 | 0.7 | 0.2 | 0.4 |
| 390 | Other manufacturing | 1.2 | 1.2 | 0.7 | 0.5 |

*Source*: Authors' elaboration based on ENIA, 1990–2000

development tend to move together. Although there was a decrease in these two variables between 1990 and 1991, they have grown continuously since then.

In order to examine preliminarily if the increase in these two measures of financial development has been associated with higher export participation rates among Chilean firms, Fig. 2 shows the evolution of export participation rates across quartiles of firm size, based on employment, over the period 1990–2000. As it has been shown for several economies, there is a positive relationship between the probability of exporting and firm size. We can see that smaller plants tend to be less likely to participate in export markets than larger firms. For example, while the

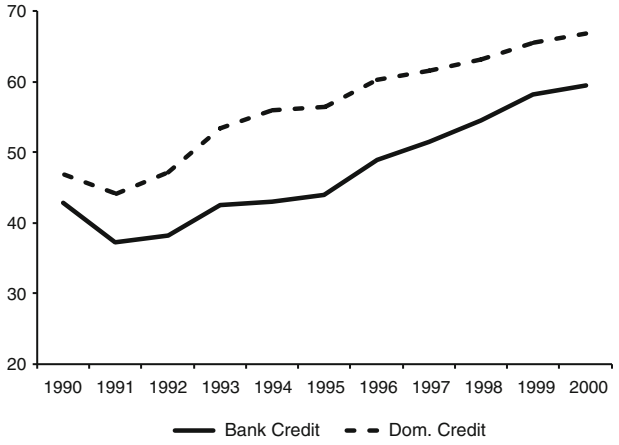


**Fig. 1** Measures of financial development for Chile

export participation rate of the group of plants in the first quartile of employment is less than 4 % in 2000, almost half of the plants in the fourth quartile are exporters. Looking at the evolution over time, in all four quartiles the export participation rates are higher in 2000 than in 1990, suggesting that financial development may have potentially helped to increase export participation during the period. It is not clear from the graph, however, if one particular quartile benefited more than others from better access to finance. The remainder of the paper examines these issues, and other potential heterogeneous effects of financial development.

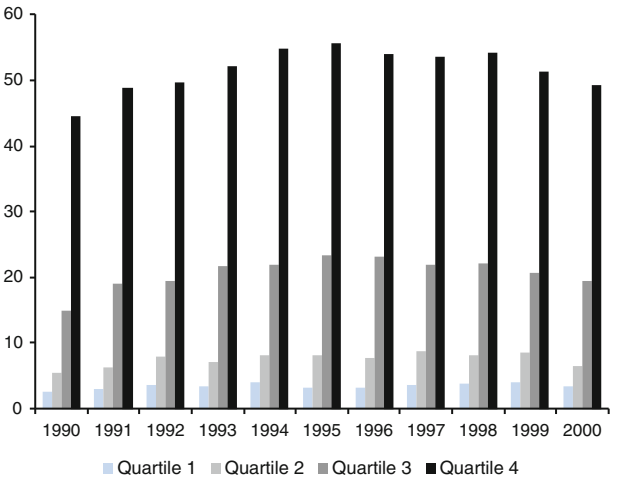


**Fig. 2** Export participation rates by plant size (employment) quartile

## 3 Methodology

The empirical analysis is based on the dynamic empirical model developed by Roberts and Tybout (1997) and later employed by Bernard and Jensen (2004). A firm $i$ chooses to export ($X_{ijt} = 1$) if current and expected revenues are greater than current period costs plus any sunk cost of exporting:

$$X_{ijt} = \begin{cases} 1 & \text{if } \hat{\pi}_{ijt} > c_{ijt} + F(1 - X_{ijt-1}) \\ 0 & \text{otherwise,} \end{cases} \quad (1)$$

where $\hat{\pi}_{ijt}$ are current and expected revenues for plant $i$ operating in industry $j$ in year $t$, $c_{ijt}$ are current costs, and $F$ represents the fixed sunk cost of exporting. In order to identify the factors that affect the probability of exporting, we use a binary-choice model of the form:

$$X_{ijt} = \begin{cases} 1 & \text{if } \beta \mathbf{Z_{ijt-1}} + \gamma FD_{t-1} - F(1 - X_{ijt-1}) + \varepsilon_{ijt} > 0 \\ 0 & \text{otherwise,} \end{cases} \quad (2)$$

where $\mathbf{Z_{ijt-1}}$ is a vector of lagged plant characteristics, which includes total factor productivity (TFP),[5] size (total employment), the capital-labor ratio, skill intensity (the fraction of skilled wages in the total wage bill), a dummy variable equal to one for importers of intermediate inputs, a dummy variable equal to one for plants with foreign ownership, and age. $FD_{t-1}$ is a variable that measures financial development at time $t-1$.

The binary-choice model is estimated using a linear probability model instead of a non-linear model such as probit or logit. We choose this methodology for several reasons. First, it allows us to control for different dimensions of unobserved heterogeneity. The basic specification includes plant fixed effects to control for all unobserved characteristics at the plant level that may be affecting the probability to export, and also 3-digit level industry-year fixed effects, which control for time-varying unobserved characteristics at the sector level. Second, we include several interaction terms between financial development and plant characteristics that are easier to interpret in a linear model. Finally, we can deal with endogeneity issues by using general method of moments (GMM) techniques that are not properly addressed for non-linear models. We recognize the limitations of our approach (e.g., that predicted probabilities may lie beyond the 0–1 interval), but since we are not interested in prediction, we opted for using a linear probability model. Thus, the estimated equation is:

$$P(X_{ijt} = 1) = \alpha_i + \alpha_{jt} + \delta X_{ijt-1} + \lambda \mathbf{Z_{ijt-1}} + \eta_1 FD_{t-1} \mathbf{z_{ijt-1}} + \eta_2 FD_{t-1} \mathbf{z_{ijt-1}} EFD_j + \varepsilon_{ijt}, \quad (3)$$

[5] Total factor productivity is measured as the residual of a regression that estimates a Cobb–Douglas production function for each 3-digit industry using the method proposed by Olley and Pakes (1996) and later modified by Levinsohn and Petrin (2003), which corrects the simultaneity bias associated with the fact that productivity is not observed by the econometrician but it may be observed by the firm. In some cases, the production functions were estimated at the 2-digit level due to the small number of observations of some industries at the 3-digit level of disaggregation.

where $\alpha_i$ represents the plant fixed effects, $\alpha_{jt}$ corresponds to the time-varying industry fixed effects, $EFD_j$ is a variable measuring industry-specific differences in financial needs (see below), and $\mathbf{z_{ijt-1}}$ is a sub-vector of plant characteristics that includes productivity, size, age and the foreign ownership dummy. These plant-level variables are included as interactions with financial development to examine if the effect of financial development has heterogeneous effects on the probability of exporting. In order to avoid potential endogeneity problems, all plant-level variables are included as one-year lags.

The inclusion of industry-year fixed effects allows to control for several shocks that can affect export profitability such as changes in Chilean tariffs and other measures of trade protection, and changes in trade protection in the rest of the world, among others. These fixed effects are useful also for dealing with concerns on the endogeneity of financial development driven by industry-induced changes in financial needs than can reduce or increase this variable. This can be the case, for example, if trade liberalization during the 90's induced financial development. If this is the case, it is trade openness rather than financial development the variable causing the increase in the probability of exporting of the some firms. In our specifications, the effect of changes in trade liberalization is already controlled for by the industry-year-specific effects.

The interactions with size, age, and foreign ownership intend to capture the differential effect of financial development on firms likely differing in their access to domestic financial markets. Following Aghion et al. (2007), given that smaller and younger firms are more likely to be financially constrained in a less developed capital market, it is possible that financial development has a positive, and larger, effect on these plants, and a smaller effect on larger and older plants. In the case of foreign-owned firms, we expect the interaction term to be negative. One reason is that foreign-owned firms are likely to be less dependent on domestic capital markets given that they can obtain credit from their multinational parents. In fact, there is evidence suggesting that foreign-owned firms tend to be less dependent of domestic capital markets (Desai et al. 2004, 2008). The inclusion of these firms' characteristics is also justified by the evidence provided by Beck et al. (2006) showing that younger, smaller, and domestically owned firms report more financing obstacles, in a survey of over 10,000 enterprises from 80 countries. Their econometric findings confirm that these variables are a good proxy for financial constraints at the firm level.

The variable measuring industry-specific differences in financial needs ($EFD_j$) is taken from Rajan and Zingales (1998). This variable is defined as the fraction of capital expenditures not financed with cash flow operations, and it is computed for the median of U.S. firms at the 3-digit ISIC industry level. Rajan and Zingales (1998) argue that this measure, calculated using data for U.S. firms, can serve as a useful measure at the industry level for other countries as well. They assume that this indicator reflects some technological factors for why some industries depend more on external finance than others, and they argue that these technological differences persist across countries. In our context, we are assuming that the ranking of the industries does not differ too much between the United States and Chile.

However, if this were not the case, these would be the differences that would prevail if Chile had financial markets with no significant restrictions, as in the case of the United States.

The triple interaction term among financial development, industry financial needs, and plant characteristics is included to examine the heterogeneous effect of financial development across industries depending on their degree of financial dependence. In such a case, we can test if financial development increases more the probability of exporting of smaller (or younger or domestic) plants in more financially dependent industries. Finally, the interaction term for productivity with financial development and industry financial dependence tries to examine if a more developed financial market allocates resources to more productive plants. This would be in line with findings by Berman and Héricourt (2009) who show that financial development disproportionally increases the probability of exporting of more productive firms. In our case, the inclusion of a triple interaction allows us also to test if this effect is larger in more financially dependent industries.

We attempt to deal with the endogeneity problem associated with including a lag of the dependent variable and the possible endogeneity of some of the plant-level explanatory variables, such as size and productivity. Following Bernard and Jensen (2004), we have estimated our regressions using the system GMM dynamic panel estimator. In this setting, past values of the explanatory variables, in levels and first-differences, are used as instruments. As we show in the next section, the results are similar to those not controlling for endogeneity, but there are several shortcomings related with the standard tests regarding the validity of the instruments and the absence of second-order correlation in the transformed error term.

In Table 2 we show the descriptive statistics for the dependent and explanatory variables. As it can be appreciated, the probability of exporting is about 24 %. As it has been documented in the microeconomic international trade literature, there is a lot of heterogeneity in plant characteristics such as size, productivity and capital (human and physical) intensity. In terms of property, only about of 5 % of the observations are from foreign-owned plants. Similarly to exporting, 27 % of the observations correspond to plants that use imported inputs. The indicators of financial development indicate that credit has fluctuated between 44 and 67 % of the GDP during this period. Finally, the measure of financial dependence from Rajan and Zingales (1998) varies from negative to positive financial needs across industries.

## 4 Results

### 4.1 Basic results

Tables 3 and 4 present the basic regression results. Table 3 uses domestic credit as the measure of financial development, while Table 4 proxies financial development with bank credit. Column (1) presents the main results including plant characteristics and the measure of financial development interacted with plant size. Columns (2)–(4) include additional interaction terms between plant characteristics, financial

**Table 2** Descriptive statistics

| | Obs | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| Exporter | 32,799 | 0.236 | 0.424 | 0.000 | 1.000 |
| Exported last year | 37,202 | 0.232 | 0.422 | 0.000 | 1.000 |
| Log (TFP) | 29,191 | 3.678 | 1.981 | −7.601 | 17.818 |
| Log (K/L) | 35,302 | 6.727 | 1.398 | 0.428 | 14.478 |
| Skill (skilled wages/total wages) | 37,201 | 0.388 | 0.264 | 0.000 | 1.000 |
| Log (size) | 37,203 | 3.744 | 1.071 | 0.000 | 8.251 |
| Log (age) | 37,206 | 2.434 | 0.586 | 0.693 | 3.091 |
| Imported inputs | 37,203 | 0.269 | 0.444 | 0.000 | 1.000 |
| Foreign | 37,005 | 0.054 | 0.225 | 0.000 | 1.000 |
| Domestic credit | 37,206 | 0.571 | 0.069 | 0.442 | 0.669 |
| Bank credit | 37,206 | 0.472 | 0.072 | 0.373 | 0.595 |
| Financial dependence | 36,012 | 0.256 | 0.259 | −0.450 | 1.140 |

*Source*: Authors' elaboration based on ENIA, 1990

development, and financial dependence. As seen in both tables, and consistent with previous studies,[6] size, capital intensity, and foreign ownership positively affect the probability of export. The estimate for the previous export participation dummy is positive and significant in all cases. Its magnitude suggests that being an exporter in the previous year increases the probability of exporting today by about 24 %, which is in line with previous findings (e.g., Bernard and Jensen 2004).

As seen in columns (3) and (4) of Tables 3 and 4, the only positive and statistically significant interactions are those for financial development, productivity (and foreign ownership) and financial dependence. This reveals that financial development significantly increases the probability of exporting for more productive plants and those with foreign ownership that operate in sectors that are more dependent on external finance. Most of the other estimates for the rest of the interaction terms are not significant with the exception of the estimate for the interaction between domestic credit and age which is negative in Table 3. This would suggest that younger plants benefit more from financial development. As seen in Table 4, however, this result is not robust to the use of bank credit as a measure of financial development.

Interestingly, financial development does not seem to affect differently plants with different size, since the estimates for the interaction terms between financial development, size, and financial dependence in Tables 3 and 4 are all statistically not significant. This result would go against the perception that small plants are more likely to benefit from a higher developed financial system (Aghion et al. 2007; Demirgüç-Kunt et al. 2008). At least, in terms of export participation, our results so far do not support this common view.

[6] See, for example, Roberts and Tybout (1997), Castellani (2002), Bernard and Jensen (2004), and Greenaway, et al. (2007).

**Table 3** Basic results using domestic credit

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Exported last year | 0.247*** | 0.244*** | 0.244*** | 0.244*** |
| | (0.011) | (0.011) | (0.011) | (0.011) |
| TFP | 0.003 | 0.004 | −0.004 | −0.005 |
| | (0.003) | (0.003) | (0.022) | (0.022) |
| K/L | 0.010*** | 0.011** | 0.011** | 0.011** |
| | (0.004) | (0.004) | (0.004) | (0.004) |
| Skill (skilled wages/total wages) | −0.009 | −0.011 | −0.011 | −0.010 |
| | (0.012) | (0.012) | (0.012) | (0.012) |
| Size | 0.052** | 0.050** | 0.050** | 0.046** |
| | (0.019) | (0.020) | (0.020) | (0.021) |
| Age | −0.002 | −0.003 | −0.003 | 0.036 |
| | (0.010) | (0.010) | (0.010) | (0.027) |
| Imported inputs dummy | 0.009 | 0.009 | 0.009 | 0.009* |
| | (0.005) | (0.005) | (0.005) | (0.005) |
| Foreign | 0.025** | 0.025** | 0.025** | 0.084 |
| | (0.010) | (0.011) | (0.011) | (0.082) |
| Dom. Cred. *Size | −0.027 | −0.030 | −0.033 | −0.025 |
| | (0.036) | (0.041) | (0.043) | (0.043) |
| Dom. Cred. *Size*Fin. Dep. | – | 0.029 | 0.047 | 0.041 |
| | | (0.049) | (0.052) | (0.050) |
| Dom. Cred. *TFP | – | – | 0.002 | 0.004 |
| | | | (0.039) | (0.039) |
| Dom. Cred. *TFP*Fin. Dep. | – | – | 0.053** | 0.053** |
| | | | (0.024) | (0.024) |
| Dom. Cred. *Age | – | – | – | −0.094** |
| | | | | (0.044) |
| Dom. Cred. *Age*Fin. Dep. | – | – | – | 0.006 |
| | | | | (0.053) |
| Dom. Cred. *Foreign | – | – | – | −0.161 |
| | | | | (0.162) |
| Dom. Cred. *Foreign*Fin. Dep. | – | – | – | 0.199*** |
| | | | | (0.060) |
| Constant | −0.056 | −0.057 | −0.056 | −0.034 |
| | (0.069) | (0.074) | (0.078) | (0.072) |
| Observations | 37,925 | 36,749 | 36,749 | 36,749 |
| R-squared (within) | 0.085 | 0.084 | 0.084 | 0.085 |
| Plants | 6,607 | 6,418 | 6,418 | 6,418 |

Robust 3-digit industry clustered standard errors in parentheses. ***, **, and * denote significance at the level of 1, 5, and 10 %, respectively. TFP, K/L (capital–labor ratio), size (employment), and age are in logs

**Table 4** Basic results using bank credit

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Exported last year | 0.247*** | 0.244*** | 0.244*** | 0.244*** |
| | (0.011) | (0.011) | (0.011) | (0.011) |
| TFP | 0.003 | 0.004 | −0.006 | −0.007 |
| | (0.003) | (0.003) | (0.018) | (0.018) |
| K/L | 0.011*** | 0.011*** | 0.011** | 0.011** |
| | (0.004) | (0.004) | (0.004) | (0.004) |
| Skill (skilled wages/total wages) | −0.010 | −0.011 | −0.011 | −0.011 |
| | (0.012) | (0.012) | (0.012) | (0.012) |
| Size | 0.057*** | 0.056*** | 0.056*** | 0.051*** |
| | (0.016) | (0.016) | (0.017) | (0.017) |
| Age | −0.002 | −0.004 | −0.004 | 0.037 |
| | (0.010) | (0.010) | (0.010) | (0.029) |
| Imported inputs dummy | 0.009 | 0.009 | 0.009 | 0.009 |
| | (0.005) | (0.005) | (0.005) | (0.005) |
| Foreign | 0.026** | 0.026** | 0.026** | 0.094 |
| | (0.010) | (0.011) | (0.011) | (0.071) |
| Bank. Cred. *Size | −0.042 | −0.047 | −0.051 | −0.040 |
| | (0.035) | (0.041) | (0.042) | (0.043) |
| Bank. Cred. *Size*Fin. Dep. | – | 0.029 | 0.050 | 0.043 |
| | | (0.061) | (0.065) | (0.064) |
| Bank. Cred. *TFP | – | – | 0.005 | 0.008 |
| | | | (0.037) | (0.038) |
| Bank. Cred. *TFP*Fin. Dep. | – | – | 0.061** | 0.062** |
| | | | (0.027) | (0.027) |
| Bank. Cred. *Age | – | – | – | −0.124* |
| | | | | (0.062) |
| Bank. Cred. *Age*Fin. Dep. | – | – | – | 0.003 |
| | | | | (0.073) |
| Bank. Cred. *Foreign | – | – | – | −0.211 |
| | | | | (0.172) |
| Bank. Cred. *Foreign*Fin. Dep. | – | – | – | 0.224*** |
| | | | | (0.073) |
| Constant | −0.054 | −0.059 | −0.057 | −0.008 |
| | (0.071) | (0.075) | (0.076) | (0.070) |
| Observations | 37,925 | 36,749 | 36,749 | 36,749 |
| R-squared (within) | 0.085 | 0.084 | 0.084 | 0.085 |
| Plants | 6,607 | 6,418 | 6,418 | 6,418 |

Robust 3-digit industry clustered SE in parentheses. ***, **, and * denote significance at the level of 1, 5, and 10 %, respectively. TFP, K/L (capital-labor ratio), size (employment), and age are in logs

**Table 5** System GMM results using domestic credit

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Exported last year | 0.462*** | 0.461*** | 0.461*** | 0.461*** |
| | (0.014) | (0.014) | (0.014) | (0.014) |
| TFP | 0.011*** | 0.011*** | 0.026 | 0.026 |
| | (0.003) | (0.003) | (0.017) | (0.017) |
| K/L | 0.021*** | 0.022*** | 0.022*** | 0.022*** |
| | (0.002) | (0.002) | (0.002) | (0.002) |
| Skill (skilled wages/total wages) | 0.019* | 0.017 | 0.018 | 0.017 |
| | (0.011) | (0.011) | (0.011) | (0.011) |
| Size | 0.116*** | 0.113*** | 0.112*** | 0.115*** |
| | (0.014) | (0.014) | (0.014) | (0.014) |
| Age | −0.018*** | −0.019*** | −0.018*** | −0.011 |
| | (0.004) | (0.004) | (0.004) | (0.027) |
| Imported inputs dummy | 0.053*** | 0.054*** | 0.054*** | 0.054*** |
| | (0.007) | (0.007) | (0.007) | (0.007) |
| Foreign | 0.074*** | 0.072*** | 0.072*** | −0.035 |
| | (0.011) | (0.012) | (0.012) | (0.077) |
| Dom. Cred. *Size | −0.048** | −0.048* | −0.047* | −0.049* |
| | (0.024) | (0.025) | (0.025) | (0.025) |
| Dom. Cred. *Size*Fin. Dep. | – | 0.022 | 0.028 | 0.016 |
| | | (0.019) | (0.019) | (0.020) |
| Dom. Cred. *TFP | – | – | −0.040 | −0.039 |
| | | | (0.031) | (0.031) |
| Dom. Cred. *TFP*Fin. Dep. | – | – | 0.056** | 0.053** |
| | | | (0.024) | (0.024) |
| Dom. Cred. *Age | – | – | – | −0.020 |
| | | | | (0.050) |
| Dom. Cred. *Age*Fin. Dep. | – | – | – | 0.023 |
| | | | | (0.030) |
| Dom. Cred. *Foreign | – | – | – | 0.134 |
| | | | | (0.140) |
| Dom. Cred. *Foreign*Fin. Dep. | – | – | – | 0.193** |
| | | | | (0.076) |
| Constant | −0.411*** | −0.409*** | −0.416*** | −0.418*** |
| | (0.030) | (0.031) | (0.035) | (0.037) |
| Observations | 27,954 | 27,050 | 27,050 | 27,050 |
| Plants | 4,188 | 4,059 | 4,059 | 4,059 |
| *p*-value Sargan | 0.000 | 0.000 | 0.000 | 0.000 |
| *p*-value Hansen | 1.000 | 1.000 | 1.000 | 1.000 |
| AR(1) *p*-value | 0.000 | 0.000 | 0.000 | 0.000 |
| AR(2) *p*-value | 0.000 | 0.001 | 0.001 | 0.001 |

Robust 3-digit industry clustered SE in parentheses. ***, **, and * denote significance at the level of 1, 5, and 10 %, respectively. TFP, K/L (capital-labor ratio), size (employment), and age are in logs

In Tables 5 and 6 we present the results using instrumental variables in the system GMM framework. As it can be appreciated, the main results regarding the sign and significance do not change substantially. First, as expected, we find that the coefficient for the lagged export status increases greatly from about 0.25 to 0.46. Second, in comparison with ordinary least squares (OLS) regressions, TFP and the proportion of imported inputs are now significant, while the sign of the parameters keeps being positive. In the case of productivity, this is more in line with the literature showing that an increase in productivity raises the probability of exporting. Regarding the interaction terms, we also find in the IV estimation evidence suggesting that domestic credit favors more the probability of exporting of more productive (and foreign firms) in those industries that are financially more dependent.

Although the general results tend to be similar, the GMM regressions have some shortcomings. First, the Hansen test for the validity of the instruments is too large. In fact, the *p*-value is always 1. This can be attributable, in part, to the fact that we have too many explanatory variables and the number of instruments increases exponentially. Roodman (2009) has shown that instruments proliferation weakens the power of the Sargan test of overidentifying restrictions. Second, the tests do not reject the absence of second-order errors correlation. We have tried several alternative specifications, reducing the number of lagged variables and introducing mores lags of the dependent variable, but most of times the results of the tests do not change. Given that most of our interest variables are associated with interaction terms and that the estimates do not change much between OLS and GMM estimations, we are confident that our results are not significantly biased by endogeneity problems.

To further investigate the relationship between size and exporting, and in order to consider the possibility of a non-monotonic relationship between size and export participation, we include in Tables 7 and 8 dummy variables for plants belonging to the first three size quartiles measured in terms of employment. In the tables, size 1 corresponds to the smallest plants (quartile 1), size 2 to the second smallest (quartile 2), and size 3 is the third smallest group (quartile 3). The omitted category is the group of largest plants (quartile 4). If financial development increases export probability of smaller plants, then the estimate for the interaction between financial development and the small plant categories should be positive and significant.

The results presented in Tables 7 and 8, with the two different measures of financial development show that none of the estimates for the interaction terms between financial development and size are statistically significant. We observe once again that financial development increases export probability of plants that are more productive and plants with foreign ownership in sectors more dependent on external finance. The estimate for the interaction term between the measure of financial development and age is negative and now significant regardless of the measure used to proxy financial development. This suggests that younger plants would be more likely to benefit from financial development. However, this result is not robust to alternative specifications and estimation techniques as we show in the next subsection.

**Table 6** System GMM results using bank credit

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Exported last year | 0.462*** | 0.461*** | 0.461*** | 0.461*** |
| | (0.014) | (0.014) | (0.014) | (0.014) |
| Size | 0.113*** | 0.111*** | 0.110*** | 0.111*** |
| | (0.012) | (0.012) | (0.012) | (0.012) |
| TFP | 0.011*** | 0.011*** | 0.024 | 0.024 |
| | (0.003) | (0.003) | (0.015) | (0.015) |
| K/L | 0.022*** | 0.022*** | 0.022*** | 0.022*** |
| | (0.002) | (0.002) | (0.002) | (0.002) |
| Skill (WC wages/total wages) | 0.019* | 0.017 | 0.018 | 0.017 |
| | (0.011) | (0.011) | (0.011) | (0.011) |
| Age | −0.018*** | −0.019*** | −0.018*** | 0.000 |
| | (0.004) | (0.004) | (0.004) | (0.023) |
| Imported inputs | 0.053*** | 0.054*** | 0.054*** | 0.054*** |
| | (0.007) | (0.007) | (0.007) | (0.007) |
| Foreign | 0.074*** | 0.072*** | 0.072*** | 0.006 |
| | (0.011) | (0.012) | (0.012) | (0.069) |
| Bank. Cred. *Size | −0.052** | −0.054** | −0.054** | −0.052* |
| | (0.025) | (0.026) | (0.026) | (0.027) |
| Bank. Cred. *Size*Fin. Dep. | – | 0.028 | 0.036 | 0.022 |
| | | (0.023) | (0.023) | (0.024) |
| Bank. Cred. *TFP | – | – | −0.043 | −0.042 |
| | | | (0.033) | (0.033) |
| Bank. Cred. *TFP*Fin. Dep. | – | – | 0.067** | 0.064** |
| | | | (0.029) | (0.029) |
| Bank. Cred. *Age | – | – | – | −0.050 |
| | | | | (0.053) |
| Bank. Cred. *Age*Fin. Dep. | – | – | – | 0.028 |
| | | | | (0.038) |
| Bank. Cred. *Foreign | – | – | – | 0.080 |
| | | | | (0.154) |
| Bank. Cred. *Foreign*Fin. Dep. | – | – | – | 0.222** |
| | | | | (0.091) |
| Constant | −0.406*** | −0.405*** | −0.408*** | −0.412*** |
| | (0.029) | (0.030) | (0.033) | (0.034) |
| Observations | 27,954 | 27,050 | 27,050 | 27,050 |
| Plants | 4,188 | 4,059 | 4,059 | 4,059 |
| *p*-value Sargan | 0.000 | 0.000 | 0.000 | 0.000 |
| *p*-value Hansen | 1.000 | 1.000 | 1.000 | 1.000 |
| AR(1) *p*-value | 0.000 | 0.000 | 0.000 | 0.000 |
| AR(2) *p*-value | 0.000 | 0.001 | 0.001 | 0.001 |

Robust 3-digit industry clustered SE in parentheses. ***, **, and * significance at the level of 1, 5, and 10 %, respectively. TFP, K/L (capital-labor ratio), size (employment), and age are in logs

**Table 7** Results by size (employment) quartile—domestic credit

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Exported last year | 0.249*** | 0.246*** | 0.246*** | 0.246*** |
| | (0.011) | (0.011) | (0.011) | (0.011) |
| TFP | 0.001 | 0.001 | −0.011 | −0.012 |
| | (0.003) | (0.003) | (0.020) | (0.020) |
| K/L | 0.004 | 0.004 | 0.004 | 0.004 |
| | (0.004) | (0.004) | (0.004) | (0.004) |
| Skill (skilled wages/total wages) | −0.013 | −0.014 | −0.014 | −0.014 |
| | (0.012) | (0.013) | (0.012) | (0.012) |
| Size 1 | −0.026 | −0.021 | −0.020 | −0.012 |
| | (0.051) | (0.053) | (0.056) | (0.056) |
| Size 2 | −0.052 | −0.041 | −0.039 | −0.032 |
| | (0.048) | (0.048) | (0.049) | (0.050) |
| Size 3 | −0.012 | −0.012 | −0.010 | −0.003 |
| | (0.046) | (0.047) | (0.047) | (0.048) |
| Age | 0.003 | 0.001 | 0.001 | 0.044 |
| | (0.010) | (0.010) | (0.010) | (0.027) |
| Imported inputs dummy | 0.010* | 0.010* | 0.010* | 0.010* |
| | (0.005) | (0.005) | (0.006) | (0.005) |
| Foreign | 0.026** | 0.026** | 0.026** | 0.087 |
| | (0.010) | (0.011) | (0.011) | (0.083) |
| Dom. Credit*Size 1 | −0.025 | −0.035 | −0.028 | −0.045 |
| | (0.097) | (0.117) | (0.124) | (0.123) |
| Dom. Credit*Size 2 | 0.034 | 0.028 | 0.031 | 0.017 |
| | (0.084) | (0.091) | (0.094) | (0.094) |
| Dom. Credit*Size 3 | −0.011 | −0.015 | −0.016 | −0.029 |
| | (0.079) | (0.083) | (0.083) | (0.085) |
| Dom. Credit*Size 1*Fin. Dep | – | 0.011 | −0.015 | −0.011 |
| | | (0.099) | (0.105) | (0.100) |
| Dom. Credit*Size 2*Fin. Dep | – | −0.037 | −0.058 | −0.053 |
| | | (0.063) | (0.067) | (0.066) |
| Dom. Credit*Size 3*Fin. Dep | – | 0.025 | 0.011 | 0.017 |
| | | (0.044) | (0.046) | (0.047) |
| Dom. Cred. *TFP | – | – | 0.012 | 0.014 |
| | | | (0.036) | (0.037) |
| Dom. Cred.*TFP*Fin. Dep. | – | – | 0.046* | 0.047* |
| | | | (0.024) | (0.024) |
| Dom. Cred. *Age | – | – | – | −0.106** |
| | | | | (0.044) |
| Dom. Cred.*Age*Fin. Dep. | – | – | – | 0.009 |
| | | | | (0.051) |
| Dom. Cred. *Foreign | – | – | – | −0.167 |
| | | | | (0.164) |

**Table 7** continued

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Dom. Cred. *Foreign*Fin. Dep. | – | – | – | 0.209*** |
| | | | | (0.060) |
| Constant | 0.152*** | 0.150*** | 0.153*** | 0.186*** |
| | (0.034) | (0.035) | (0.035) | (0.029) |
| Observations | 37,925 | 36,749 | 36,749 | 36,749 |
| R-squared (within) | 0.084 | 0.083 | 0.083 | 0.084 |
| Plants | 6,607 | 6,418 | 6,418 | 6,418 |

Robust 3-digit industry clustered SE in parentheses. ***, **, and * significance at the level of 1, 5, and 10 %, respectively. TFP, K/L (capital-labor ratio), and age are in logs

In order to analyze the quantitative importance of these interactions with productivity and foreign ownership we compute the effect of changes in financial development for different parts of the productivity distribution—and for domestic and foreign-owned plants—and for different values of industry-specific financial needs. In Fig. 3, we summarize these results considering low and high productivity firms as those in the 25 and 75 % percentile of the productivity distribution, and low and high financial dependence industries as those in 25 % and 75 % of the distribution of this variable. We present the effect of financial development on the probability of exporting for these firms when moving this variable from the minimum to the maximum of the period. As it can be appreciated, the differences are relevant, but not dramatic. The increase in financial development augments the probability of exporting for low productivity firms by 0.5 % in low financial dependent industries, and by 0.9 % in high financial dependent industries. For high productivity firms, the effect tends to be more important. The increases in the probability of exporting are 1.1 % in industries less dependent on finance and 2.3 % in industries with high financial dependence. In the last case this compares in order of magnitude with an unconditional probability of exporting of 22.5 % during this period.[7]

As the results presented above suggest that the effect of financial development is more important for foreign-owned firms in more financial dependent industries, we compute also the effects of changes in financial development on the probability of exporting for foreign-owned and domestic firms in industries with high and low financial dependence. The results are shown in Fig. 4. The raise in domestic credit to GDP during the period is associated with an increase of 0.8 % in the probability of exporting for domestic firms in low financial dependent industries and 1.6 % in industries with higher financial needs. In the case of foreign-owned firms, the increases in the probability of exporting are 1.0 and 1.9 %, respectively.[8]

[7] These marginal effects consider the results of column (4) in Table 3 and only the parameters that are statistically significant. In this case, the marginal effects are evaluated at the average of the variable foreign ownership. Given that the econometric results are very similar to those in Table 4 we do not present the effects corresponding to those results.

[8] The high and low financially dependent industries are classified as in the previous exercise. In this case, the marginal effects are evaluated at the average of TFP.

**Table 8** Results by size (employment) quartile—bank credit

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Exported last year | 0.249*** | 0.246*** | 0.246*** | 0.246*** |
| | (0.011) | (0.011) | (0.011) | (0.011) |
| TFP | 0.001 | 0.001 | −0.012 | −0.013 |
| | (0.003) | (0.003) | (0.016) | (0.016) |
| K/L | 0.004 | 0.004 | 0.004 | 0.004 |
| | (0.004) | (0.004) | (0.004) | (0.004) |
| Skill (skilled wages/total wages) | −0.013 | −0.015 | −0.015 | −0.014 |
| | (0.012) | (0.013) | (0.012) | (0.012) |
| Size 1 | −0.051 | −0.047 | −0.047 | −0.038 |
| | (0.042) | (0.044) | (0.046) | (0.046) |
| Size 2 | −0.071* | −0.065 | −0.063 | −0.054 |
| | (0.038) | (0.038) | (0.039) | (0.039) |
| Size 3 | −0.016 | −0.016 | −0.014 | −0.006 |
| | (0.045) | (0.046) | (0.046) | (0.047) |
| Age | 0.002 | 0.000 | 0.000 | 0.045 |
| | (0.010) | (0.010) | (0.010) | (0.030) |
| Imported inputs dummy | 0.010* | 0.010* | 0.010* | 0.010* |
| | (0.005) | (0.006) | (0.006) | (0.006) |
| Foreign | 0.026** | 0.026** | 0.026** | 0.095 |
| | (0.010) | (0.011) | (0.011) | (0.072) |
| Bank Credit*Size 1 | 0.023 | 0.014 | 0.022 | −0.000 |
| | (0.096) | (0.116) | (0.124) | (0.123) |
| Bank Credit*Size 2 | 0.083 | 0.085 | 0.088 | 0.067 |
| | (0.079) | (0.087) | (0.090) | (0.090) |
| Bank Credit*Size 3 | −0.006 | −0.010 | −0.011 | −0.029 |
| | (0.092) | (0.096) | (0.095) | (0.097) |
| Bank Credit*Size 1*Fin. Dep | – | 0.017 | −0.015 | −0.009 |
| | | (0.123) | (0.130) | (0.124) |
| Bank Credit*Size 2*Fin. Dep | – | −0.045 | −0.071 | −0.065 |
| | | (0.078) | (0.083) | (0.082) |
| Bank Credit*Size 3*Fin. Dep | – | 0.029 | 0.011 | 0.019 |
| | | (0.056) | (0.058) | (0.060) |
| Bank. Cred.*TFP | – | – | 0.016 | 0.019 |
| | | | (0.035) | (0.035) |
| Bank. Cred. *TFP*Fin. Dep. | – | – | 0.054* | 0.056* |
| | | | (0.027) | (0.027) |
| Bank. Cred. *Age | – | – | – | –0.137** |
| | | | | (0.063) |
| Bank. Cred. *Age*Fin. Dep. | – | – | – | 0.007 |
| | | | | (0.070) |
| Bank. Cred. *Foreign | – | – | – | –0.216 |
| | | | | (0.174) |

**Table 8** continued

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Bank. Cred. *Foreign*Fin. Dep. | – | – | – | 0.237*** |
| | | | | (0.073) |
| Constant | 0.151*** | 0.147*** | 0.148*** | 0.201*** |
| | (0.034) | (0.035) | (0.033) | (0.033) |
| Observations | 37,925 | 36,749 | 36,749 | 36,749 |
| R-squared (within) | 0.084 | 0.083 | 0.083 | 0.084 |
| Plants | 6,607 | 6,418 | 6,418 | 6,418 |

Robust 3-digit industry clustered SE in parentheses. ***, **, and * denote significance at the level of 1, 5, and 10 %, respectively. TFP, K/L (Capital-Labor Ratio), and Age are in logs

## 4.2 Extensions and robustness checks

One potential concern of using measures of financial development at the aggregate level is that they may be capturing the effect of other macroeconomic variables. In order to investigate this issue we add a set of interaction terms between plant characteristics and two additional macroeconomic variables: annual GDP growth and the log of the real exchange rate (RER). The first one tries to control for the heterogeneous effects of economic cycles and the second one for changes in export profitability associated with exchange rate movements. The results are presented in Table 9. Column (1) shows the results using domestic credit while column (2) uses bank credit. In both cases we find, once again, that financial development benefits more productive plants and those with foreign ownership in sectors more dependent on external finance. One difference with our previous results is the estimate for the interaction between financial development, size and dependence on external finance which is now positive and statistically significant, suggesting that larger plants in sectors more dependent on external finance are more likely to export if the development of the financial system increases.

Following Manova (2010) we check if the results are robust to the inclusion of an additional industry-specific measure of financial dependence used in the literature. This is a measure of assets tangibility developed by Braun (2003) and is defined as the share of net property, plant and equipment in book-value assets. Similar to the measure of Rajan and Zingales (1998), it is computed for the median sector in 3-digit ISIC industry. As seen in Table 10, the inclusion of interactions of this variable with financial development and plant characteristics does not affect the main result that more productive and foreign-owned plants, in sectors more dependent on external finance, are more likely to export in response to improvements in access to credit.

One additional concern with our results is the potential role of unobserved heterogeneity at the regional level. Plants may be more likely to export because they are located in regions that are more favorable for exporting or in regions in which a significant number of plants export, which may potentially create a spillover effect on other plants. In order to control for this possibility we re-estimated all the

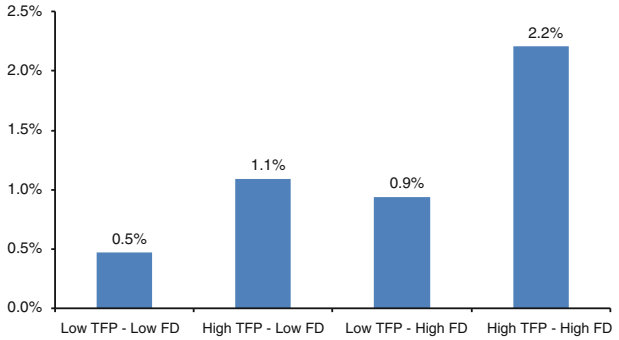


**Fig. 3** Comparative effects of changes in financial development by productivity

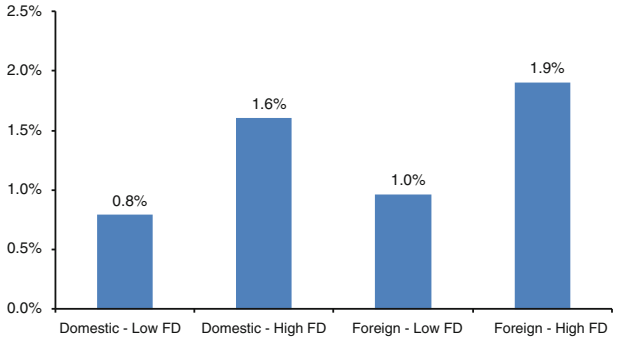


**Fig. 4** Comparative effects of changes in financial development by ownership

regressions including a full set of region-year fixed effects. The results, not shown here, are similar to our basic findings and indicate that financial development increases the probability of exporting of more productive plants and those with foreign ownership in sectors more dependent on external finance, which is consistent with our previous findings. We also find in some, but not in all, regressions that the interaction between financial development and plant age is negative and significant.

Another concern of our estimations is the possible selection bias due to the fact that we only observe surviving plants in the data. This sample selection may potentially bias our results. In order to deal with this issue we follow the standard Heckman (1976) correction technique, which consists on first estimating the inverse mills ratio from a probit model of survival, and then including the estimated inverse mills ratio in the regressions for export probability. The results of this estimation technique, not shown here, are very similar to our basic results, and confirm that more productive plants and plants with foreign ownership in sectors more dependent on external finance benefit more from financial development. Thus, or results are not driven by a sample selection bias.

**Table 9** Including other macroeconomic variables

| | Dom. credit | Bank credit | | Dom. credit | Bank credit |
|---|---|---|---|---|---|
| Exported last year | 0.243*** | 0.243*** | Growth*TFP | −0.000 | −0.001 |
| | (0.011) | (0.011) | | (0.001) | (0.001) |
| TFP | 0.139 | 0.037 | Growth*Size | 0.001 | −0.001 |
| | (0.141) | (0.247) | | (0.001) | (0.001) |
| K/L | 0.011** | 0.011** | Growth*Age | 0.001 | 0.002 |
| | (0.004) | (0.004) | | (0.001) | (0.001) |
| Skill (skilled wages/total wages) | −0.011 | −0.011 | Growth*Foreign | 0.000 | −0.005 |
| | (0.012) | (0.012) | | (0.006) | (0.004) |
| Size | −0.267 | 0.158 | Growth*TFP*Fin. Dep. | 0.000 | 0.002 |
| | (0.196) | (0.286) | | (0.003) | (0.003) |
| Age | −0.447 | −0.443* | Growth*Size*Fin. Dep. | 0.001 | 0.003* |
| | (0.361) | (0.225) | | (0.002) | (0.001) |
| Imported inputs dummy | 0.009 | 0.009 | Growth*Age*Fin. Dep. | 0.000 | −0.001 |
| | (0.005) | (0.005) | | (0.002) | (0.002) |
| Foreign | −2.062 | −0.264 | Growth*Foreign*Fin. Dep. | 0.013*** | 0.016*** |
| | (1.793) | (1.131) | | (0.004) | (0.004) |
| FD*Size | 0.020 | −0.168 | RER*TFP | −0.019 | −0.000 |
| | (0.073) | (0.118) | | (0.029) | (0.048) |
| FD*Size *Fin. Dep. | 0.355*** | 0.429*** | RER*Size | 0.066* | −0.007 |
| | (0.114) | (0.148) | | (0.037) | (0.051) |
| FD*TFP | −0.094 | −0.073 | RER*Age | 0.085 | 0.085** |
| | (0.064) | (0.098) | | (0.067) | (0.039) |
| FD*TFP *Fin. Dep. | 0.301* | 0.381** | RER*Foreign | 0.414 | 0.093 |
| | (0.153) | (0.180) | | (0.325) | (0.213) |
| FD*Age | 0.061 | 0.058 | RER*TFP*Fin. Dep. | −0.033 | −0.038* |
| | (0.104) | (0.144) | | (0.021) | (0.021) |
| FD*Age*Fin. Dep. | −0.240** | −0.234 | RER*Size*Fin. Dep. | −0.050*** | −0.054*** |
| | (0.092) | (0.169) | | (0.013) | (0.015) |
| FD*Foreign | 0.409 | −0.255 | RER*Age*Fin. Dep. | 0.028* | 0.025 |
| | (0.599) | (0.367) | | (0.016) | (0.017) |
| FD*Foreign*Fin. Dep. | 0.746** | 0.751** | RER*Foreign*Fin. Dep. | −0.094** | −0.083** |
| | (0.279) | (0.304) | | (0.037) | (0.036) |
| | | | Constant | 0.019 | −0.002 |
| | | | | (0.083) | (0.079) |
| Observations | | | | 36,749 | 36,749 |
| R-squared (within) | | | | 0.086 | 0.086 |
| Plants | | | | 6,418 | 6,418 |

FD means domestic and bank credit in each column. Robust 3-digit industry clustered SE in parentheses. ***, **, and * denote Significance at the level of 1, 5, and 10 %, respectively. TFP, K/L (capital-labor ratio), size (employment), age, and RER are in logs

**Table 10** Including industry financial exposure variable

| | Domestic credit | Bank credit |
|---|---|---|
| Exported last year | 0.242*** | 0.242*** |
| | (0.011) | (0.011) |
| TFP | −0.013 | −0.013 |
| | (0.022) | (0.018) |
| K/L | 0.011** | 0.012** |
| | (0.004) | (0.004) |
| Skill (skilled wages/total wages) | −0.010 | −0.010 |
| | (0.012) | (0.012) |
| Size | 0.040* | 0.047** |
| | (0.022) | (0.017) |
| Age | 0.040 | 0.032 |
| | (0.028) | (0.027) |
| Imported inputs dummy | 0.011* | 0.011* |
| | (0.005) | (0.005) |
| Foreign | 0.087 | 0.099 |
| | (0.083) | (0.071) |
| FD∗Size | 0.105 | 0.109 |
| | (0.078) | (0.086) |
| FD∗Size∗Fin. Dep. | 0.028 | 0.026 |
| | (0.042) | (0.053) |
| FD∗TFP | −0.003 | −0.005 |
| | (0.047) | (0.049) |
| FD∗TFP∗Fin. Dep. | 0.049* | 0.058* |
| | (0.025) | (0.028) |
| FD∗Age | −0.041 | −0.016 |
| | (0.068) | (0.111) |
| FD∗Age∗Fin. Dep. | −0.000 | −0.009 |
| | (0.047) | (0.063) |
| FD∗Foreign | −0.023 | −0.046 |
| | (0.159) | (0.167) |
| FD∗Foreign∗Fin. Dep. | 0.184*** | 0.206*** |
| | (0.060) | (0.070) |
| FD∗Size∗Assets Tang. | −0.362** | −0.413* |
| | (0.174) | (0.202) |
| FD∗TFP∗Assets Tang. | 0.071 | 0.088 |
| | (0.057) | (0.068) |
| FD∗Age∗Assets Tang. | −0.189 | −0.273 |
| | (0.199) | (0.257) |
| FD∗Foreign∗Assets Tang. | −0.444* | −0.546* |
| | (0.229) | (0.277) |
| Constant | −0.045 | −0.051 |
| | (0.057) | (0.056) |

**Table 10** continued

| | Domestic credit | Bank credit |
|---|---|---|
| Observations | 35,658 | 35,658 |
| R-squared (within) | 0.085 | 0.085 |
| Plants | 6,226 | 6,226 |

FD means domestic and bank credit in each column. Robust 3-digit industry clustered SE in parentheses. ***, **, and * denote significance at the level of 1, 5, and 10 %, respectively. TFP, K/L (capital-labor ratio), size (employment), and age are in logs

## 5 Conclusions

Motivated by recent models of international trade that emphasize the role of financial constraints on the decision to export, this paper investigated the effects of financial development on the probability of exporting among Chilean manufacturing plants for the period 1990–2000. Using a linear probability model that allowed us to control for unobserved plant and time-varying industry heterogeneity we found that financial development has a positive effect on the probability of exporting of more productive plants as well as those plants with foreign ownership that operate in sectors that are more dependent on external finance. This result remained robust to the inclusion of additional controls at the macroeconomic level and a measure of financial exposure at the sector level.

We did not consistently find a positive effect of financial development on smaller and younger plants, which suggests that, at least for the case of exporting in Chile, the conventional view that financial development is likely to benefit small and young firms, which are assumed to be more credit constrained, is not supported by the empirical evidence.

Our results imply that financial development cannot be expected to achieve significant changes in firm export performance for smaller and younger firms. As the evidence for other countries shows, exports are, in general, concentrated on a small number of large and highly productive firms. Our evidence for Chile suggests that capital market development is unlikely to be an effective mechanism to change that situation. Unfortunately, with our data we cannot identify the exact reason for this result. One may speculate that the development of financial markets in Chile has not yet translated into better access to credit for smaller and younger firms, or that the relaxation of financial constraints has not been enough to overcome the additional barriers that these firms face in international markets.

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