Market Reforms and Efficiency Gains in Chile*

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Abstract

Starting in the mid 1970s, Chile implemented a deep and comprehensive set of structural market reforms. In spite of the wide agreement there is with respect to the benefits these reforms should have on growth, little evidence has been provided to empirically establish and to quantify this connection. Using plant-level data on Chilean manufacturing firms for the 1980-2001 period, we provide suggestive evidence of the role of structural reforms on plant efficiency. The paper first analyzes the behavior of aggregate total factor productivity constructed from data at the plant-level. We find that, once major reforms had been fully implemented, aggregate efficiency gains were explained in equal proportions by within plant improvements and by the net entry of new and more productive economic units. The reallocation among incumbent plants did not contribute significantly to the enhancement of efficiency. The paper also finds that within-plant efficiency gains were the largest among firms producing traded goods, and among firms that were more likely to face binding liquidity constraints. Thus, in Chile, the adoption of better technologies and production processes, fostered by broader foreign exposure and a superior access to external finance, seem to have at least partially accounted for the observed improvement in manufacturing performance.

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1. Introduction

Since the mid 1970s, Chile implemented a deep and comprehensive set of structural market reforms. The main goal of these reforms was to increase the role of markets in the economy.

The results speak for themselves. Chile's outstanding macroeconomic performance during most of the last two decades has been portrayed as an example of successful market-oriented policies. And albeit these decades have not been free of turbulence, at the end, Chile has developed into a stable emerging economy that has clearly outperformed the rest of Latin America and the Caribbean. Although favorable external conditions contributed to achieve this rapid growth, its main source was a remarkable increase in total factor productivity (TFP). As a matter of fact, since 1980, almost 90% of total growth is explained by efficiency gains.[1]

The response of the economy to reforms at the macroeconomic level reflects substantial changes in the industrial organization of domestic markets, as well as the process of adaptation of individual firms to a new and more dynamic environment. Consistently, as this paper shows, plant dynamics -- through the net entry of new and more productive economic units and within plant productivity improvements – accounts for a substantial part of the observed aggregate efficiency gains in Chile. Thus, to better understand the link between market reforms and growth, we must first understand the link between these reforms, plant dynamics, and efficiency gains.

Surprisingly, in spite of the broad agreement on the importance of market reforms in explaining high and sustained growth in Chile over the past two decades, little empirical evidence has been provided to establish and quantify this connection. Using plant-level data on Chilean manufacturing firms for the 1980-2001 period, we provide suggestive evidence. To do so, we estimate and characterize plant-specific TFP and use these estimates to study the microeconomic sources of aggregate efficiency, and the relationship between plant-level efficiency and structural reforms.

The Chilean experience is particularly interesting for several reasons: First, the reforms were deep and affected all key markets. Among other reforms, public firms were privatized, most trade impediments were lifted, labor markets were flexibilized, the financial system was liberalized, and individual accounts for social security were created. Second, the available micro data encompass a long period of time, including part of the enactment and implementation of the reforms and over a decade of their aftermath. The long period that has passed since most reforms were implemented should allow us to capture their full effects.[2] Finally, although most reforms were implemented at once, the deep recession of 1982 and 1983 led authorities to reverse some of these policies. Other papers analyzing the

[1] See Bergoeing et al. (2002a). See also Kehoe and Prescott (2002) for similar findings in a sample of developed economies. In addition, Cole et al. (2004) show that most differences between the poor performance of Latin American countries and the success of Western economies takes root in differences in the behavior of TFP.

[2] Bergoeing et al. (2002b) provide empirical support for the evidence of a lag between government policy changes and the resulting change in productivity in Chile.

Chilean experience have used data between 1980 and 1986 (Pavcnik, 2002), and have incorrectly assumed that the Chilean economy was far more open in the mid 1980s than in the early 1980s. This is not the case as, for instance, the mean tariff reached 35% by mid 1985, whereas in 1980 it was only 10%.

Our findings show that aggregate efficiency grew steadily after the reforms, especially over the 1990s. The paper shows that the dispersion of TFP also grew steadily, in spite of the reduction in aggregate volatility.[3] In addition, we show that when reforms had been fully implemented, aggregate efficiency gains were explained in equal proportions by within plant improvements and by the net entry of new and more productive economic units. The reallocation among incumbent firms did not contribute significantly to the enhancement of efficiency.

We also analyze the behavior of within-plant efficiency gains. At the extensive margin, we find that although newly created firms display lower productivity than incumbents at the time of entry, entering survivors quickly improve their productivity. After one period only, the productivity of a new plant is statistically equal to that of an incumbent. Moreover, exiting plants experience a downward trajectory of productivity prior to exit. Thus, on average, inefficient plants are replaced by firms that are more efficient and that experience rapid improvements in productivity. That is, plant turnover leads to aggregate efficiency gains.

How do these idiosyncratic efficiency gains respond to specific market reforms in Chile? In this paper we look at the role of trade liberalization and financial market reforms on plant dynamics. To study the effects of trade, we analyze the behavior of plants according to the trade orientation of the sector they belong to. The results show that firms producing tradable goods are many times more productive than firms producing non-tradable goods. This productivity advantage of firms in traded sectors increased over time, indicating not only the existence of a lag between reforms and their effect on efficiency but also that the fall in trade costs from the bilateral agreements signed after 1990 is associated with additional productivity gains. We also analyze the reaction of plant-level TFP to changes in the effective tariff rate. Our results show that the productivity of plants producing in import-competing sectors grows faster when effective tariffs rise, whereas the productivity of plants in other tradable sectors is hurt.

Overall our results are consistent with the hypothesis that specialization and trade, both in input and final product markets, generate efficiency gains. These gains could potentially be attributed to a variety of reasons; for instance, to a reduction in the cost of production when tariffs fall and some inputs are imported, or to the fact that reduced protection induces domestic firms to trim their fat as foreign competition increases.

After the 1982-83 crisis, and the implementation of a tax and a social security reforms that strongly promoted savings, Chile experienced an investment boom, with financial market

[3] Comin and Mulani (2005) show that aggregate and firm level volatilities have also followed diverging paths over the past two decades in Canada and in the United States. In particular, while the former has decreased, the latter has increased.

deepening and foreign finance expansion. To explore the role of the development of financial markets on plant efficiency we identify plants that are more likely to be credit constrained. In particular, we use information on tax payments associated to the granting of credit as an indicator of the likelihood of credit restrictions. The results show that the productivity of credit constrained plants increased much faster over the sample period than that of plants not financially constrained. Similarly, using the identification strategy of Rajan and Zingales (1998), we find that financial market deepening relatively favored productivity growth within plants producing in sectors that are more dependent on external financing. These results are consistent with the hypothesis that firms that were credit constrained experienced the largest gains from financial market development.

In short, the exposure to foreign markets and the higher access to external finance have contributed to aggregate efficiency gains in Chile. These TFP increases may have resulted from the adoption of better technologies and production processes, both by new firms and incumbents. The policy implication derived from our results is clear: The exposure of firms to the best practices generates conditions that promote aggregate growth. On the opposite side, rigidities that block plant dynamics, particularly by altering the natural process of birth and death of plants, impede growth and limit development.

The paper is organized as follows. The next section describes the main structural reforms implemented in Chile since the mid 1970s and its macroeconomic performance afterwards. In Section 3 we present the manufacturing data used and we characterize aggregate and plant-level TFP. In Section 4 we study and quantify the role of market oriented policies in the process of efficiency enhancing plant-dynamics. The final section concludes.

2. Market reforms in Chile: An overview

Today few question the significance of the structural reforms initiated thirty years ago in shaping the economic transformation of Chile over the past few decades.[4] The scenario was very different in the late 1960s and early 1970s, however. Trade restrictions had practically isolated the Chilean economy from the rest of the world. The structure of relative prices was drastically distorted in favor of industrial goods at the expense of agricultural, mining and other tradable activities. Differential import duties exempted capital goods and levied high taxes on final goods, creating a largely inefficient capital-intensive industrial sector. In particular, import tariffs ranged from 0 percent for capital goods to 750 percent for luxury goods. There was also a requirement of a 90-day non-interest bearing deposit of 10,000 percent of the CIF value of imported goods and all import operations required administrative approval. In addition, a system of multiple exchange rates prevailed reaching, at the collapse of the economy in 1973, a 52 to 1 ratio.

[4]The Chilean economic transformation has been extensively documented by Cox-Edwards and Edwards (1991), De la Cuadra and Hachette (1991), and Bosworth, Dornbusch and Labán (1994), among others. The appendix provides a chronological enumeration of the key political and economic events over the years 1970-2001.

The few imports that resulted were concentrated on intermediate goods, followed by capital goods, and some "essential" consumer goods. Exports were mostly concentrated on copper, making the trade balance highly dependent on the evolution of copper prices. Moreover, several foreign mining companies, banks, and enterprises had been nationalized.

In short, the military government that took power in September 1973 inherited an economy closed to international trade, dominated by the public sector, and with severe macroeconomic imbalances in the form of an accelerating inflation and a deteriorating balance of payments. Relative prices were starkly distorted and the production and distribution of goods was mainly determined by bureaucratic rules. The labor market was dominated by a few unions, which were fighting for political rather than for workers' objectives. The country had practically no foreign exchange reserves and the fiscal budget reached a deficit of 25% of GDP.

Since the very beginning, the military government implemented far-ranging pro-market reforms. The initial set of trade reforms was intended to simplify the structure of the economy. Consistently, exchange markets were unified, all restrictions to trade other than tariffs were removed immediately, and tariffs were reduced from an average of 94% in 1973 to a uniform rate of 10% by 1979. Price ceilings and public purchasing mechanisms were also eliminated, and the state withdrew from most areas of the economy, including labor relations, international economic relations, and social services.

In short, the initial reforms contemplated nine main themes: (1) A stabilization program to reduce an increasing inflation; (2) the liberalization of markets in an effort to get the price system back in operation; (3) public sector reforms to reach macroeconomic stability and to improve the efficiency of the public sector and of the economy as a whole; (4) trade reforms to provide appropriate incentives to export oriented and import competing activities; (5) a social security reform to change from a pay-as-you go pension system into one based on individual capitalization; (6) a financial sector reform to improve the efficiency of financial intermediation; (7) a labor market reform to facilitate the industrial restructuring and the drastic reallocation of labor that had to take place from highly protected import competing sectors towards export oriented activities; (8) a comprehensive privatization program; and (9) social sector reforms to improve incentives in the production and provision of social services.[5]

Early on, the economy recovered at high speed: During the 1976-80 period GDP grew at an average rate of 7% and the availability of foreign goods expanded markedly. However, and although reforms continued advancing in several fronts, two major problems remained unsolved: Unemployment levels did not decline in a significant manner, and inflation remained stubbornly high. Among the instruments used to control inflation, the fixing of the nominal exchange rate in June 1979 proved to have a devastating effect. The highly indexed nature of the Chilean economy, in combination with the fixed exchange rate, induced an increasing real exchange rate overvaluation, fostering imports and discouraging exports, and leading to large current account deficits. In 1981, the external deficit reached 14.5% of GDP. Large amounts of foreign loans entered the country to finance the trade

[5] See Corbo (1993) for a detailed description of these reforms.

imbalance and, as a consequence, foreign debt skyrocketed from 1977 to 1981. Two additional elements also helped to generate the observed rise in the level of indebtedness: The resistance of the real interest rate to converge to world levels, and the deregulation of the financial market in 1981. The former induced a continuous flow of short-term lending; the lack of adequate supervision of the quality of the portfolio of banks due to the latter, led to a generalized miscalculation of risk levels and imprudent domestic lending (Barandiarán and Hernández, 1999).

With such a large trade imbalance, confidence on the Chilean economy faltered and foreign lending ceased. In June 1982 the authorities were forced to devalue the peso by 19%, but "it was too little, and too late" (Cox-Edwards and Edwards, 1991). The economy fell in a deep recession as GDP dropped by 13.6% in 1982 and a further 2.8% in 1983; unemployment, already high, swelled to 34% of the labor force (including emergency employment programs), and the government deficit increased to almost 9% of GDP when the Central Bank had to rescue the financial sector from bankruptcy. By 1983, foreign debt had reached 130% of GDP.

This recession led authorities to partially reverse the openness policies. In particular, the mean tariff was raised, which reached a level of 35% in 1985. Since then, however, the policy of tariff reductions continued.

Starting in 1985, the government went through a second round of privatizations that included public utility firms and several financial companies that had been taken over in the 1982 financial collapse. In 1986 a new banking law was implemented. As a result, the financial system was rebuilt and a greater supervisory role for the Central Bank was established. Chile also introduced innovative debt conversion schemes to reduce its foreign debt by approximately 50%.

In 1990, and after 17 years of a military regime, elections were held and Patricio Aylwin, the candidate of a center-left coalition, was elected. Immediately after the new president was in power, the commercial links with the rest of the world were strengthened. This time, however, a number of multilateral agreements were initiated. Today, Chile maintains trade agreements with most economies in the world, covering more than 95% of its exports. Similarly, capital inflows increased as foreign investment decisions were determined by market conditions. Evidently, the 1990s mark the consolidation of a market economy drastically transformed during the previous 15 years.

Since the beginning, the democratic governments maintained a strong fiscal stance and the Central Bank of Chile – independent since 1989 – gradually reduced inflation to its lowest level in half a century. Public spending on social programs increased sharply. Structural reforms proceeded at a much slower pace, however.

Summing up, only during the late 1980s and early 1990s the Chilean economy fully reaped the benefits from the changes in economic incentives and in the productive structure that came with market reforms. By the end of the 1990s, Chile had unquestionably been the Latin American country with the most consistent record in terms of the soundness and stability of most macroeconomic indicators. Furthermore, the sharp improvements in social indices catapult Chile as the most successful recent experience in the region. In fact, the 1990s were much more stable than the 1980s, in spite of the Tequila and the Asian crises. For instance, the volatility of detrended GDP was 5.8% during the 1970s, 5% during the 1980s, and only 2.1% during the 1990s.

3. Plant dynamics and aggregate TFP

Two sources of productivity gains drive aggregate efficiency over time: The exposure of economic units to better production methods (within-plant efficiency gains), and the Schumpeterian creative destruction process through which efficient firms thrive while inefficient ones disappear (reallocation driven efficiency gains). The former is the result of the adoption of better technologies and the implementation of more efficient production processes within incumbents; the latter, occurs from the reshuffling of resources from less to more productive firms, and the entry process of new and more efficient firms that replace old and less efficient ones. A number of papers report evidence for developed and developing economies on the importance of plant dynamics in accounting for aggregate efficiency gains.[6]

This virtuous process of reallocation, technology adoption and efficiency gains should be directly linked to market reforms. Two recently available regularities support this prior: First, the research based on plant-level data shows that productivity is highly heterogeneous across units, even within narrowly defined sectors at any given period of time. This heterogeneity is a necessary condition for the reallocation of inputs and output to be a relevant source of productivity gains and aggregate growth. Second, the data also show that vintage is an important factor in explaining productivity gaps. Hence, the entry of new firms with better technologies and more efficient production processes is also an important source of TFP gains. Therefore, market reforms that promote this entry-exit process, induce the adoption of more efficient production techniques, and facilitate an efficient allocation of resources, might be key in explaining why some economies prosper while others stagnate. In the following sections we provide evidence that suggests that, at least for Chile, this has indeed been the case.

3.1. The data and estimation of plant-level TFPs

The data in this study come from the Encuesta Nacional Industrial Anual (ENIA), an annual survey of manufacturing conducted by the Chilean statistics agency, the *Instituto Nacional de Estadísticas* (INE). The ENIA covers all manufacturing plants that employ at least ten individuals. Thus, it includes all newly created and continuing plants with ten or more employees, and it excludes plants that ceased activities or reduced their hiring below the survey's threshold.[7] The ENIA collects detailed information on plant characteristics,

[6] See Bartelsman and Doms (2000) for a review of the literature.

[7] The treatment of entry and exit is somewhat complicated by the fact that plants falling below the minimum employment boundary do not appear in the survey. Thus a plant interviewed in any given year, but that fails to enter the sample in the following year might not represent an exit. Similarly, a plant appearing for the first time in any given year does not necessarily correspond to an entry, as it might represent a growing plant that surpasses the ten employee boundary. See Micco (1995) for a discussion. In this paper, we classify a plant as exiting in year t if the plant produced in year t, but did not reappear in the sample in any period t+s, s>0.

such as manufacturing sub-sector at the 4-digit ISIC level, sales, employment, investment, intermediate inputs, and location. The available data cover the years from 1980 to 2001.

Unfortunately, the ENIA does not report plant-level output prices, so we constructed deflators at the 3-digit level from INE's wholesale price indices. The use of a common industry-level deflator might be problematic, as within-industry price differences are imputed as productivity shocks.[8] Nominal output was thus deflated using these 3-digit level price indices. Deflators for materials were also constructed at the 3-digit ISIC level, using the 1996 input-output table. All real variables are expressed in 1992 Chilean pesos. Capital series were constructed using information on investment and depreciation (Bergoeing, Hernando and Repetto, 2005).

We estimate production functions and plant-level TFP using the strategy developed by Olley and Pakes (1996) and further extended by Levinsohn and Petrin (2003). We excluded the tobacco industry (314) and petroleum refineries (353) from the analysis, because they are organized as monopolies, operating with very few plants. The estimation strategy of Olley and Pakes assumes that plant specific shocks are technology driven, and thus rules out markup shocks. Syverson (2004) shows that the failure of this assumption invalidates the strategy we use. That is, if a plant faces a markup shock, the procedure assumes that measured productivity changes are due to shifts in efficiency. After the exclusion of these two sectors, we are left with 26 3-digit ISIC sub-sectors that account for 92% of total real gross revenue in the ENIA.

We also excluded plants that report either no employment or no blue-collar workers, and plants that report zero wages, no production days, zero gross production value, negative value added, gross production value lower than value added, exports that are larger than total sales, or no ISIC code. At the end, our estimates are based on over 80 thousand observations on more than 10 thousand manufacturing plants.

Table 1 presents the main descriptive statistics of our sample. The table shows that both gross output and input usage (all measured in natural logs) increased between the two decades comprising the study. The table shows that plant-level inputs and output also experienced a rise in dispersion. Finally, the table reports average entry rates of 5.7%--the percentage of plants that are new in the sample--, and average exit rates of 6.3%--the fraction of plants that leave the sample. Both rates also rose significantly over the sample period.

To construct series of TFP we estimated revenue production functions at the three-digit level using skilled and unskilled (blue-collar) labor, capital, materials, and energy as inputs. As an already large body of literature has pointed out, the empirical estimation of production functions is problematic because productivity, a state variable in the firm's decision problem, is not observed by the econometrician. Moreover, instrumental variables are needed to disentangle the variation due to idiosyncratic technology shocks, input price

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Similarly, we classify a plant as an entrant in t if the plant produced in year t, but did not appear in the sample in any period t-s, s>0.

[8] See Eslava et al. (2004) for the relative relevance of plant-level technology shocks *vis a vis* demand shocks.

differences and plant specific demand shifts. Unfortunately, we do not observe plant-level output prices, so we cannot follow the strategy proposed by Shea (1993) and Syverson (2004). Instead we use the estimation procedure developed by Olley and Pakes (OP) and modified by Levinsohn and Petrin (LP).[9]

We use electricity demand as the proxy for productivity in the OP-LP estimation procedure.[10] Table 2 presents the estimated elasticities of unskilled and skilled labor, capital, materials and electricity. The reported elasticities exhibit wide variation across sectors. Most coefficients are precisely estimated. Only capital cannot be precisely estimated in a number of sectors, perhaps due to its little time variability, a result of investment's lumpy behavior. In about 75% of sectors, the null hypothesis of constant returns to scale cannot be rejected. The estimated degrees of returns to scale vary from 0.77 (chemical industry) to 1.77 (iron and steel basic industries). The largest elasticity of unskilled labor corresponds to the manufacturing of china, pottery and earthenware, with a point elasticity of 0.30. The most skilled-labor elastic sector is the manufacture of glass products, with an elasticity of 0.26. The statistically significant coefficients on capital vary between 0.09 (food products) and 0.98 (iron and steel basic industries).

3.2. Characterizing aggregate productivity

We estimate log TFP for each plant as the residual from the estimated production functions presented in Table 2.

Figure 1 plots the evolution of the simple average of plant-level TFP and its dispersion. The figure shows a large contrast in the behavior of average TFP in the first and second half of our sample. Specifically, in 1987, aggregate TFP was about 9% lower than in 1980. It then grew steadily until year 2000, experiencing a drop in 2001.

A similar evolution was followed by TFP dispersion, measured as the difference between the 90th and 10th percentiles. The figure shows that there is wide dispersion in TFP across plants at any given year. Calculations for sectors at the three-digit level show a consistent pattern. These large differences in productivity are a necessary condition for reallocation to be a quantitatively relevant source of efficiency gains. Additionally, the figure shows a substantial increase in the dispersion of TFP in spite of the reduction in aggregate volatility in the late 1980s relative to the earlier years of our sample period. In 1980, our heterogeneity measure was equal to 0.77. By 2001, it had reached a level of 0.90. This rising heterogeneity over the second half of the 1980s may reflect a higher degree of market flexibility due to the structural reforms that had been implemented a decade earlier.

Figure 2 plots the evolution of the simple and weighted average TFP, using the share of each plant's value-added out of total value-added in a given year as weights. This weighted measure has been extensively used in the literature in order to capture the aggregate productivity gains due to the allocation of activity (Foster, Haltiwanger, and Krizan, 1998).

[9] See Olley and Pakes (1996), and Levinsohn and Petrin (2003).

[10] Only a very small fraction of observations (about 1.5%) report no electricity consumption. Some plants generate and sell electricity. Our measure of electricity is purchases plus generation minus sales.

Olley and Pakes (1996) decompose this weighted average into the simple average and a covariance term between market shares and TFP. Whenever the most efficient firms have the largest market shares, the allocation of inputs and output is efficiency enhancing. If so, the weighted average reaches a higher level than the simple average.[11]

The figure shows that in Chile the weighted measure is always above the simple average, indicating that production is disproportionately located at the most efficient plants. It is interesting to note, in addition, that aggregate productivity is mostly accounted for by the simple average, and not by the allocation term. Foster, Haltiwanger, and Krizan (1998) find similar results for the US. In contrast, Eslava et al. (2004) find that the contribution of the covariance term accounts for almost all aggregate productivity in Colombia.

The figure also shows that the relative contribution of the covariance term varies over the period. It is larger over the 1980s when it reached an average relative importance of 9%. Our estimation results imply that average productivity drives the increase in productivity observed in the Chilean manufacturing sector, particularly starting in 1987. After a large number of distortionary policies that placed impediments on reallocation were removed, the allocation of resources among incumbents lost relative importance. The general adoption of better techniques seems to largely account for the improved industry performance.

3.3 The Sources of Aggregate TFP gains

We now disentangle aggregate productivity dynamics into the changes in efficiency within firms, and the reallocation arising from the expansion and contraction of continuing plants, as well as from the entry and exit of economic units. We follow Foster, Haltiwanger, and Krizan (1998) in decomposing productivity growth into four elements: (i) A within-plant effect, given by incumbents' productivity growth weighted by initial output shares; (ii) a reallocation effect, that captures the gains in aggregate productivity coming from the expanding market share of high productivity plants relative to the initial aggregate productivity level; (iii) an entry effect which is the sum of the differences between each entering plant's productivity and initial aggregate productivity, weighted by its market share; and (iv) an exit effect given by the sum of the differences between each exiting plant's productivity and initial aggregate productivity, weighted by its market share.[12] The decomposition is given by:

$$\Delta P_t = P_t - P_{t-k} = \sum_{i \in C} \theta_{it-k} \Delta p_{it} + \sum_{i \in C} \Delta\theta_{it} (p_{it} - P_{t-k}) + \sum_{i \in N} \theta_{it} (p_{it} - P_{t-k}) - \sum_{i \in X} \theta_{it-k} (p_{it-k} - P_{t-k})$$

where Δ refers to changes over the k-year interval; P_t is the log aggregate productivity level in year t; p_{it} is plant's i efficiency in year t; θ_{it} is its value added share in total value added

[11] The covariance term is the vertical distance between the weighted and simple averages plotted in Figure 2.

[12] There exist several alternative decomposition methods that follow this tradition. See Foster, Haltiwanger, and Krizan (1998) for a discussion.

at time t, and C, N, and X are sets of continuing, entering, and exiting plants, respectively. Thus, incumbents contribute to aggregate log productivity growth whenever they become more efficient, and whenever the more productive plants increase their market share. New plants contribute positively to productivity growth if they have higher productivity than the initial industry average. Exiting plants contribute if they have lower than average productivity. The last three terms of the decomposition capture the effects of heterogeneity. If all plants were identical, then the within effect would constitute the only source of aggregate gains.

The first column of Table 3 displays our decomposition results for the full sample period. Aggregate productivity gains are driven completely by the entry of new, more productive firms. The contribution of within-incumbents efficiency gains and of the reallocation of value added among continuing plants is small when such a long period of time is considered. Finally, the exit term, although relatively small, is positive. Our characterization of the relative productivity of shutdowns in the following subsection shows that on average, the efficiency of plants that exit is much lower. Thus, it must be the case that the exit term in the decomposition is positive due to the market share weights.

In the second column we repeat the exercise focusing on the aggregate productivity growth between 1988 and 2001[13]. As shown in Figure 2, the time-series pattern of aggregate TFP suggests a break in the evolution around 1988. The gains in aggregate efficiency in the later period are twice as large as the gains obtained over the complete period. Again, the net entry of new firms accounts for a large fraction of aggregate gains. However, this time within-plant efficiency improvements also contribute significantly to aggregate TFP growth.

Overall, the results suggest that when reforms had been fully implemented, the average plant exhibited important efficiency improvements. Reallocation played a key role due to the net entry of firms that had higher than average productivity and not to changes in the allocation of inputs and output across incumbent plants.

3.4. The behavior of plant entry and exit

The aggregate TFP growth accounting of Foster, Haltiwanger and Krizan (1988) grants a key role to the net entry of plants in long periods of time. In this section we further analyze the relative efficiency of newly created plants and shutdowns.

There exists a vast theoretical literature on firm heterogeneity pioneered by Jovanovic (1982) and further extended by Hopenhayn (1992), Ericson and Pakes (1995), and Bergoeing, Loayza and Repetto (2004). These models are characterized by heterogeneous

[13] Our estimates correct for the fact that plants may leave and re-enter the sample without having actually exited the market. For instance, a plant may leave the sample prior to 1988 and reenter in 1989 or later. This plant is an incumbent according to our definition of entry and exit, but would be incorrectly classified as an entry if only data for years 1988 and 2001 were to be considered. There are 93 plants in our data set that leave and reenter the sample around 1988. It is worth emphasizing, though, that the results in Table 3 are almost unchanged if these corrections are not made.

production units, vintage capital, common and idiosyncratic shocks, and an ongoing process of plant entry and exit. Plants exit if aggregate economic prospects loom negative. Plants may also exit if their current technology becomes obsolete. Thus plants with relatively low level of technology are scrapped. New units enter embodying inputs and production processes that reflect the leading edge technology. However, new firms are uncertain with respect to their own idiosyncratic efficiency, and thus may enter and quickly leave the market after this uncertainty is resolved.

Table 4 reports regressions of plant-level TFP accounting for entry and exit effects. The entry dummy is equal to one in period *t* if the plant produced in year *t* but not in any previous period. Similarly, the exit dummy is equal to one in period *t* if the plant produced in that year, but not in any period ahead. The first column shows that the typical entering plant is less productive than incumbents, contrary to the predictions of vintage capital models.[14] Still, newly created firms have a productivity advantage over shutdowns. Depending upon the model specification, incumbents have a 3.2% to 3.9% productivity advantage over entering plants. This difference rises to about 7% when continuing plants are compared to exiting plants.

The third and fourth columns of the table explore the dynamics of productivity post entry and prior to exit. Does the productivity of firms that enter increase over time? Are there learning effects? Similarly, does the efficiency of exiting plants deteriorate before they actually exit? That is, is there evidence of the "shadow of death" effect (Griliches and Mairesse, 1995). To explore the evolution of exiting firms' productivity we added one and two period leads of the exit dummy to our specification. Similarly, to account for learning effects we added one and two period lags of the entry dummy. The results reported on columns (3) and (4) suggest that exiting plants experience a downward trajectory of productivity prior to exit. Several studies have reported similar results for other countries.[15] The results also show that entering survivors quickly improve their productivity. After one period only, the productivity of a new plant is statistically equal to that of an incumbent. These patterns imply that more efficient and rapidly improving plants replace less efficient, exiting plants. Plant turnover thus leads to aggregate efficiency gains.

We next look further into the hypothesis that plants with relatively low level of technology are more likely to exit. Table 5 reports the average marginal effects of productivity and employment (as a proxy for size) on the likelihood of plant exit. We measure productivity as the distance between the plant's specific productivity and the annual average TFP at the sector level.[16] Both specifications show that larger and more efficient plants are indeed less likely to fail.

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[14] Bartelsman and Doms (2000) report similar evidence for the OECD.
[15] See Tybout (2000) for a review.
[16] The table reports the average marginal effects of a probit regression of the exit dummy on the measure of productivity and other variables. Marginal effects evaluated at the mean are practically identical to those reported in the table.

4. Market reforms and productivity gains: The Chilean evidence

In this section we analyze the effects of two key reforms on the dynamics of plant-level TFP: Trade liberalization and financial market deepening. The evidence we present here is suggestive of the important consequences these reforms may have had on plant performance. This evidence, though, should not be taken as fully conclusive, due to two limitations of our analysis. First of all, a large number of reforms were undertaken at the same time. Secondly, the reforms implemented in Chile were neutral in the sense that they gave the same incentives to all firms (e.g., one single tariff rate taxes the imports of all goods). Thus it is hard to identify the effects of any single reform on the economy.

With these caveats in mind, in this section we present evidence that suggests that the exposure to foreign markets and the higher access to external finance have fostered efficiency gains in Chile. These TFP increases may have resulted mostly from the adoption of better technologies and production processes, both by new firms and incumbents.

4.1 The effects of trade reforms on plant-level efficiency

Trade liberalization enhances plant and aggregate productivity through different channels. First of all, it exposes domestic firms to foreign competition, reducing their market power and forcing them to improve their efficiency in order to ensure survival. Secondly, if there are domestic and foreign market entry costs, trade liberalization induces the least efficient plants to shutdown, whereas only the most productive plants are able to successfully export.[17] Trade also facilitates the access to foreign technology and reduces the cost of foreign intermediate and capital goods. In this section we explore the effects of trade policy on plant-level productivity dynamics.

To identify these effects, we classify plants according to the trade orientation of the sector they belong to at the 3-digit ISIC level. Compared to firms in non-traded goods sectors, firms in export-oriented and import-competing sectors are exposed to the competition of foreign firms, and thus must be more efficient in order to survive. All plants, though, are benefited by the reduced cost of foreign inputs.

We use the sector classification of Hernando (2001), based on Campa and Goldberg (1995). According to this strategy, sectors can be classified depending upon the export intensity of sales and the volume of imported competing goods. A sector is non-traded if (1) the export share in total sales is lower than 10% and import penetration does not exceed 6%, or (2) import penetration is lower than 10% and the export share does not exceed 6%. A sector is export-oriented if the export intensity of sales is larger than 10%. A sector is import competing if import penetration exceeds 20%. Using data for 1986-1996, Hernando (2001) finds that export oriented sectors are those related to natural resources, such as the manufacturing of paper, chemicals, food processing, and beverages. The sectors classified as import-competing are those that are labor intensive, such as textiles and leather

[17] See Eaton and Kortum (2002), Melitz (2003), and Bernard et al. (2003) for recent models of trade with heterogeneous firms.

industries. The manufacture of machinery is also classified as import competing. Under this classification, some sectors are both import-competing and export-oriented, so we created another category called "other traded".

Ideally, to estimate the effects of trade liberalization on plants, one would use a measure of trade protection that varies across firms. However, Chile had reduced its tariffs to 10% for all goods in 1979 –prior to the start of our sample period--, and then changed the level of protection in a uniform manner. Thus, in the Chilean case is not possible to clearly identify the effects of trade reforms, and to disentangle them from the effects of other reforms enacted at the same time. Other countries, such as Brazil --studied by Schor (2004)-- maintained differential tariffs that depended upon sectors and upon the stage of production of goods (final or intermediate).

We have taken two approaches to deal with the identification issues discussed above. First, we estimated the differential evolution of plant-level TFP over our sample period for firms producing in export-oriented, import-competing and other tradable sectors. This is a rather flexible parameterization of the effects of trade on plant efficiency. However, it does not take into account the swings that trade protection has experienced in Chile since the mid-1970s. Although Chile today ranks high in an index of free trade policies, tariffs and other key variables did not evolve smoothly towards their current levels.[18] In our second exercise we take into account the dynamics of effective tariff rates as a determinant of the evolution of plant-level TFP.

To follow the evolution of plant TFP producing in traded relative to non traded sectors, we ran fixed effects regressions of plant efficiency. These regressions include time and sector effects, and dummies indicating the trade status of the industry. The regressions also include the interaction of the trade indicator variables with the time dummies. The estimated results show that firms producing tradable goods are many times more productive than plants producing non-traded goods.[19] Interestingly, the productivity advantage of tradables increased further over the sample period as depicted in Figures 3 and 4. Figure 3 shows the estimated coefficients on the interaction term, constraining the evolution of all traded sector to be the same. After a steep rise over the early 1980s, by 1986 the productivity advantage of traded sectors experienced a downturn. Although the estimated dynamics is not strictly monotonic, plant-level TFP in traded sectors experienced an upward trend in the 1990s relative to non traded sectors. Figure 4 shows that the evolution of TFP in export-oriented, import-competing and other traded sectors was quite similar over the sample period.

These findings suggest that plants did respond to an intensified foreign competition. Possibly the enhancement of within-plant productivity is a result of a reduced cost of foreign capital and intermediate materials, self-selection into international markets, and learning from international buyers, sellers and competitors. A better functioning of

[18] See the Index of Economic Freedom developed by the Heritage Foundation (http://www.heritage.org/research/features/index/).

[19] Similarly, Bergoeing, Micco and Repetto (2005) show that firms that export have a large productivity advantage over non-exporting firms.

financial markets might as well have helped to improve relative productivity if credit flows relatively favored traded sectors.

The results in Figures 3 and 4 do not take into account the fact that although trade was initially liberalized in 1976, the deep recession of 1982-83 led the authorities to reverse some of the free trade policies. Figure 5 depicts the effective tariff rate faced by domestic producers over the years 1980 to 2001. Between 1980 and 1982 the effective tariff reached an average of 5.47%. Between 1983 and 1986, this average almost doubled, reaching a level of 10.62%. Only in 1999 the effective tariff recovered the level of 1980. By 2001 and after a number of bilateral trade agreements were signed and were fully functioning, the rate had fallen to 3.69%.

These ups and downs in trade policy might explain the swings in the estimated evolution of the relative productivity of traded sectors shown in Figures 3 and 4. To explore this hypothesis we ran regressions directly controlling for the evolution of the effective tariff[20]. That is, we estimated the following model for the natural log of productivity of plant i in sector j, and year t,

$$p_{ijt} = \phi_i + \delta_j + \varphi_t + traded_j \cdot \beta + traded_j \cdot effective\_tariff_t \cdot \gamma + \varepsilon_{ijt}$$

where $traded_j$ is a dummy or a vector of dummies indicating the trade status of sector j, and $effective\_tariff_t$ is the level reached by the effective tariff in year t.

Table 6 displays our estimation results. The first column shows that a one percentage point rise in the effective tariff rate increases productivity in traded sectors by one-third of a percentage point. The sign of this effect indicates that on average, traded sectors benefit from trade protection. Nevertheless, the estimated effect is not statistically significant. The second column of Table 6 allows for a differential impact of tariffs on export-oriented, import-competing and other traded sectors. The regression results reveal that these sectors respond very differently to trade protection: the productivity of import-competing sectors is significantly enhanced as tariffs rise, whereas the productivity of plants in other traded sectors falls. In addition, plants in export-oriented activities show no statistically significant response to changes in effective tariffs.

These results suggest that effective tariffs help to improve the efficiency of plants that produce in import-competing sectors. This result is somewhat surprising, as the protection granted by tariffs reduces the toughness of competition. Perhaps, due to increasing returns to scale, efficiency and domestic production rise as a result of higher protection. Out of the six sectors that Hernando (2001) classifies as import-competing, four display constant returns to scale, according to the estimates reported in Table 3. The remaining two —Iron and steel (371) and Fabricated metal (381)—have increasing returns to scale. Possibly, the returns to scale in sector 371 may be strong enough to drive our results.

[20] Anderson and Neary (2005) discuss the drawbacks of the use of effective tariffs and other standard measures of trade protection whenever there are multiple trade barriers.

Other traded sectors are hurt when effective tariffs rise, possibly because foreign intermediate and capital goods become more costly, and because the reduction in external competition allows the less productive plants to survive. Export oriented sectors seem insensitive to tariffs. Yet, it is likely that our effective tariff measure is a poor proxy of the trade policy faced by exporters, as they respond to the tariffs imposed by other countries, and not to those relevant for local imports. Given that trade policy was undertaken unilaterally over most of the sample period, internal and external tariffs are most likely uncorrelated.

Overall our results show that on average all traded sectors have become more productive, relative to non-traded sectors over our sample period. The results are consistent with the hypothesis that specialization and trade, both in input and final product markets, generate efficiency gains. Our results also show that the response of plant TFP to domestic trade protection is strikingly different for plants producing in different sectors. They suggest that lowering effective tariffs reduces the efficiency of plants in import-competing sectors, but that firms in other traded sectors increase their productivity. These latter gains could potentially be attributed to a variety of reasons. The first may be that the cost of production is reduced whenever tariffs fall and some inputs are imported. Another possible explanation is that reduced protection induces domestic firms to trim their fat as foreign competition increases.

4.2 The role of financial markets development

Poorly functioning financial markets limit the creation of new firms as they lack the necessary funds for project finance. Similarly, credit constrained incumbents face limits to their ability to adopt new technology, to retool and to grow. Starting in the mid 1980s, Chile experienced an investment boom associated to the deepening of financial markets, the entry of foreign finance, the privatization of the public pension system, and a tax reform that promoted firms' saving.[21]

In this section we examine whether financial development facilitated within-plant productivity growth. In assessing the effects of a better access to financial markets on micro efficiency, we follow two strands of the literature on imperfect capital markets. In our first exercise, we identify firms that are more likely to be credit constrained.[22] We then examine whether the productivity of these plants grows faster than the productivity of plants that are less likely to be financially constrained. In the second exercise, we follow the strategy developed by Rajan and Zingales (1998), identifying plants producing in sectors that depend on external finance. We then examine whether these firms have larger increases in their productivity as the financial market deepens.

Both exercises are based upon the hypothesis that asymmetric information and incentive problems in financial markets imply that agency costs and the internal resources of a firm

[21] See Coronado (2002) for an analysis of the effects of the privatization of Social Security on savings, and Hsieh and Parker (2006) for an analysis of the role of the tax reforms on the Chilean investment boom using the ENIA.
[22] See Hubbard (1998) for a survey of this literature.

influence the cost of external funds. Capital market deepening reduces the extent of these agency problems, and thus the cost of funds. Therefore, when credit constraints are relaxed, the funds available for all firms increase, favoring relatively more those that lack the necessary funds to finance its activities. Thus, plants that are credit constrained are those that are more likely to gain when financial markets deepen.

The productivity dynamics of financially restricted plants

Identifying plants that face liquidity constraints is not an easy task. The literature has used a number of proxies to classify firms according to the significance of credit constraints. Firms' size, age, net worth, dividend policy, relationships with industrial and financial groups, the presence of bond ratings or commercial papers, and the sensitivity of investment to cash flows, have all been used as proxies of the spread between internal and external financing. All these variables have been subject to criticism as neither is a clean measure of the financial restrictions a given firm faces.[23]

With these limitations in mind, we divided plants that are more or less likely to face financing constraints and compared the relative performance of their TFP over the years 1980 to 2001. To proxy for liquidity constraints, we used plant-level information on loan tax payments. In Chile, all financial transactions involving credit are subject to a tax called *Actos Jurídicos* or *Timbres y Estampillas* (Judiciary Acts Tax or Stamp Tax). The tax paid depends upon the characteristics of the loan and the amount lent. Figure 6 shows the evolution over our sample period of the revenue associated to this tax as a fraction of GDP.[24]

Our measure of financial constraints is thus a dummy variable, $taxpay_{it}$, that indicates whether plant i reports the payment of *Timbres y Estampillas* in year t. Like other variables used in the literature, our measure has a number of drawbacks as a proxy for financial constraints. For instance, some firms may be credit rationed, receiving partial funding only. Similarly, some firms may not demand external funds, as their projects have already been fully financed. In all these cases, our identification strategy will incorrectly classify firms.

Recognizing that these caveats have the potential to limit the validity of our results, we proceed to estimate the differential time evolution of plant-level TFP of restricted and unrestricted firms. We estimate equations like

$$p_{ijt} = \phi_i + \delta_j + \varphi_t + \beta_t \cdot \varphi_t \cdot taxpay_{it} + \varepsilon_{ijt}$$

where p_{ijt} represents the natural log of plant's i TFP, producing in sector j at time t. The variables ϕ_i, δ_j, and φ_t are plant, sector and year dummies, respectively. The parameter of interest is the coefficient β_t that captures the differences in log productivity of firms paying

[23] For a discussion, see Kaplan and Zingales (1997 and 2000) and Fazzari, Hubbard and Petersen (2000).
[24] The tax rate and its maximum limit have changed over the sample period. Unfortunately, we observe only the amount of taxes paid in any given year, and not the characteristics of the loan granted.

and not paying the Stamp Tax in year t.[25] Figure 7 plots the estimated evolution of β_t and its confidence intervals ate the 95%. The coefficient experienced a negative trend over the sample years. This dynamics suggests that the productivity of plants classified as not being financially constrained grew relatively less as the market developed. This result is consistent with the hypothesis that capital market deepening reduces the extent of agency problems, favoring relatively more the firms that lack the necessary funds to finance their projects.

External finance dependence

As discussed above, the identification of financial constraints in micro level panel data is a difficult task. Particularly, many of the measures used in the literature are endogenous. To circumvent these problems, Rajan and Zingales (1998; henceforth RZ) proposed a measure of external financial dependence that is exogenous to any individual firm's growth prospects. Specifically, RZ identify an industry's need for external finance from data on U.S. firms. As the U.S. financial markets are relatively frictionless, an industry's external finance dependence in the American economy is a good proxy for the technological demand for external financing in other economies. RZ use this information to study whether industries that are more dependent on external financing grow relatively faster in countries that are more financially developed. A number of recent papers have used this identification strategy to perform tests of the effects of cross-country differences in financial development.[26]

We adapt RZ's strategy to the comparison of plant-level TFP over time within a country. That is, we study the differential impact of Chile's financial development over the 1980-2001 period on sectors with different external finance requirements. We estimate the following model

$$p_{ijt} = \phi_i + \delta_j + \varphi_t + \beta \cdot ext_j \cdot findev_t + \varepsilon_{ijt}$$

where p_{ijt} represents the natural log of plant's i TFP, producing in sector j at time t. As above, the variables ϕ_i, δ_j, and φ_t are plant, sector and year dummies, respectively. Finally, the variable ext_j is RZ's measure of the external financing dependence of sector j, whereas the variable $findev_t$ is a measure of Chile's financial development in year t. In this paper, we use two alternative measures of financial development --private credit by deposit money banks to GDP, and private bond market capitalization to GDP-- both taken from Beck, Demigurc-Kunt and Levine (2003).[27] Figure 8 shows the evolution of these measures over our sample period. The figure shows that market depth did not rise monotonically in Chile. There is a rise in the early 1980s and a fall after the massive failure of banks during the 1982-83 crisis. The measures started to recover in the early 1990s only after a number of regulatory changes took place.

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[25] Our qualitative results are robust to a number of different specifications, such as allowing or not for plant fixed effects, and interacting sector and year dummies.

[26] For instance, see Galindo, Micco and Ordoñez (2002), Fisman and Love (2004), Braun and Larraín (2005), and Hsieh and Parker (2006) for different applications of this identification strategy.

[27] The latter measure is available since 1990 only.

Table 7 presents our estimation results using alternative specifications. In all cases, the coefficient of the interaction variable between external financing dependence and financial development is positive, indicating that the TFP of plants in industries that require more external finance grows faster when capital markets are deeper. The lower panel of the table illustrates the economic importance of the estimated coefficients. The industry at the 75th percentile of the external dependence distribution is sector 321 (textiles), whereas the industry at the 25th percentile is sector 369 (the manufacture of other non-metallic mineral products). Additionally, between 1980 and 1990, the ratio of private credit by deposit banks to GDP grew from 0.31 to 0.43. The estimated coefficient implies thus a growth rate of plant-level TFP between 0.9 and 1.1 percentage points higher in sector 321 than in sector 369 as the market developed. The effect over the full sample period implies a difference in growth rates of about 2 to 2.5 percentage points.

Our results are again consistent with the hypothesis that firms that are credit constrained experienced the largest gains from financial market deepening. In an economy with poorly developed credit markets, actual firms and potential entrants with productive investment projects are unable to raise sufficient external funds to undertake these projects at the efficient levels. By allowing a better access to financial markets, these investment activities have a better likelihood of being implemented, and to result in an improvement in plant productivity.

5. Concluding remarks

In this paper we have examined how structural reforms contribute to productivity using information at the plant level. According to our results, the Chilean experience provides suggestive evidence on the contribution of market reforms on efficiency gains. In particular, we find that reforms to two key markets --the financial market and the traded goods market-- have helped significantly to improve plant efficiency. These efficiency gains may have resulted from the adoption of better technologies and production processes, both by incumbents and new firms. Much research remains to be done, though. For instance, future research should explore alternative identification strategies, possibly taking better advantage of the fact that not all reforms were undertaken at exactly the same time. Similarly, future research should broaden our identification approach based on the fact that the impact of market reforms is likely to depend on plant's characteristics. Moreover, other structural reforms could be studied. Overall, we believe that our results have a clear policy implication: Exposing firms to the best practices is crucial to promote aggregate growth.

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Appendix: Key political and economic events during the 1970-2001 period

1970-73: President´s Salvador Allende socialist government. Nationalization of many banks, foreign owned mines and other enterprises; workers self-management in other firms, price controls, high inflation, and large fiscal slippage.

1973: Military coup.

1974: Competition law, unique exchange rate, and value added tax.

1974-76: Non financial fiscal deficit is reduced from 31% of GDP in 1973 to a 4% surplus in 1976.

1974-80: Privatization of enterprises and banks previously nationalized. In 1973 public firms totaled more than 5000, by 1980 there were only 25, including one bank.

1975: Oil and copper crisis (GDP drop of 13%). Interest rates liberalized.

1976-80: Gradual capital movement liberalization.

1979: Reform of labor law decreased worker protection. This reform imposed a ceiling on the maximum severance payment a dismissed worker was entitled to. Tariffs uniformly reduced to 10% for all goods but cars and some luxury goods.

1980: New constitution is adopted extending President´s Pinochet term to 1988. Introduction of private pension funds, vouchers in schooling, and private insurance in health care.

1982-83: Debt and banking crisis (GDP drop by 16%). Authorities liquidated insolvent banks and *financieras*, quickly reprivatized solvent banks that had been taken over because of liquidity problems, and set up a new regulatory scheme to avoid mismanagement. Tariff rates are transitory raised, reaching 35% by mid 1985. Since then, tariff rates are consistently reduced.

1984: Tax exemptions and credits on various forms of personal financial savings and their returns. Tax incentives for corporate investment by establishing depreciation allowances. Corporate tax rates on retained profits drop to 0%.

1985-89: Privatization of public utilities.

1986: New banking legislation.

1988: A plebiscite rejected the prolongation of President Pinochet´s term, which remained in power in preparation for 1989 elections.

1989: Independence of Central Bank and amendments to Constitution.

1990: Democratically elected President Patricio Aylwin (*concertación*, a centre-left coalition) in power.

1990-94: New labor law adopted restoring several workers´s rights. Introduction of concessions for infrastructure investment (highways, ports, etc.). Education and judiciary reforms. Unilateral trade liberalization is reinforced with bilateral agreements.

1991-94: Reintroduced accrued total corporate earnings as the tax base at a 15% rate. Top marginal tax rates on personal income reduced from 50% to 45%.

1995: President Eduardo Frei (*concertación*) takes office.

2000: President Ricardo Lagos (*concertación*) takes office.

2001: Introduction of structural surplus rule for fiscal policy. Reform of labor law increased worker protection. Capital market reforms.

Table 1. Descriptive Statistics

	Average			Standard Deviation		
	Full period	1980-1989	1990-2001	Full period	1980-1989	1990-2001
Gross output	12.87	12.56	13.10	1.59	1.54	1.59
Skilled labor	1.68	1.53	1.79	1.30	1.26	1.31
Unskilled labor	3.65	3.58	3.70	1.11	1.01	1.18
Capital	11.13	10.89	11.32	2.02	1.93	2.07
Materials	12.03	11.84	12.18	1.65	1.58	1.70
Electricity	4.57	4.27	4.81	1.81	1.76	1.82
Entry	0.057	0.046	0.065	0.23	0.21	0.25
Exit	0.063	0.054	0.070	0.24	0.23	0.26

Production function variables in natural logs.
Entry is the number of new plants as a fraction of the total number of plants. Exit is the number of plants

Table 2. Production Function Estimates

	Food Products 311-312	Beverages 313	Textiles 321	Wearing Apparel 322	Leather Products 323	Footwear 324	Wood 331
Blue collar labor	0.0955	0.0788	0.0579	0.0730	0.0471	0.1035	0.1053
	(0.0107)	(0.0324)	(0.0184)	(0.0183)	(0.0494)	(0.0274)	(0.0172)
Skilled labor	0.1170	0.2338	0.1878	0.1795	0.2269	0.1451	0.1539
	(0.0066)	(0.0298)	(0.0173)	(0.0146)	(0.0487)	(0.0615)	(0.0163)
Capital	0.0941	0.1096	0.0101	0.0597	0.0954	0.2100	0.0018
	(0.0333)	(0.0577)	(0.0320)	(0.0565)	(0.0902)	(0.0522)	(0.0495)
Materials	0.5943	0.5748	0.5709	0.5791	0.5254	0.6066	0.5998
	(0.0165)	(0.0207)	(0.0191)	(0.0166)	(0.0451)	(0.0338)	(0.0175)
Electricity	0.0880	0.0743	0.2457	0.0812	0.0947	0.0636	0.2021
	(0.0176)	(0.0612)	(0.0412)	(0.0230)	(0.1287)	(0.0293)	(0.0707)
Sum of coefficients	0.9888	1.0712	1.0725	0.9725	0.9895	1.1287	1.0630
Chi^2 CRS (p-value)	0.786	0.3729	0.0160	0.6458	0.9436	0.0078	0.2562
N observations	24032	1978	6345	5431	918	2509	6064

	Furniture 332	Paper 341	Printing and Pub. 342	Chemicals 351	Other chemicals 352	Misc.Petr.and Coal 354	Rubber 355
Blue collar labor	0.0890	-0.0046	0.1861	-0.0408	0.0857	-0.0574	0.1195
	(0.0203)	(0.0306)	(0.0161)	(0.0363)	(0.0255)	(0.0503)	(0.0291)
Skilled labor	0.1116	0.1163	0.1725	0.1676	0.2076	0.1173	0.1767
	(0.0265)	(0.0314)	(0.0180)	(0.0367)	(0.0271)	(0.0611)	(0.0346)
Capital	0.0000	0.0100	0.2000	0.0489	0.2405	0.1781	0.1475
	(0.1025)	(0.0152)	(0.0348)	(0.0820)	(0.0897)	(0.1100)	(0.0888)
Materials	0.7117	0.6503	0.5186	0.5655	0.5717	0.8139	0.4863
	(0.0235)	(0.0264)	(0.0224)	(0.0287)	(0.0350)	(0.0767)	(0.0345)
Electricity	0.2254	0.1900	0.0100	0.0285	0.0000	0.0910	0.0493
	(0.0903)	(0.0797)	(0.0138)	(0.0331)	(0.0461)	(0.1044)	(0.0431)
Sum of coefficients	1.1377	0.9620	1.0871	0.7698	1.1056	1.1428	0.9793
Chi^2 CRS (p-value)	0.0073	0.6536	0.0316	0.0165	0.2131	0.375	0.8603
N observations	2322	1360	3346	1194	3396	330	1122

Table 2 Continued. Production Function Estimates

	Other Plastic 356	Pottery and China 361	Glass 362	Oth.Non Met.Minerals 369	Iron and Steel 371	Non-ferrous metal 372	Fabricated metal 381
Blue collar labor	0.0895	0.2963	0.0947	0.0639	-0.0167	0.0096	0.0820
	(0.0140)	(0.1092)	(0.1016)	(0.0247)	(0.0464)	(0.0484)	(0.0125)
Skilled labor	0.1483	0.1877	0.2600	0.1732	0.1983	0.1068	0.1812
	(0.0138)	(0.0541)	(0.0997)	(0.0375)	(0.0613)	(0.0472)	(0.0132)
Capital	0.0438	0.0000	0.1976	0.1015	0.9800	0.0422	0.0027
	(0.0639)	(0.1250)	(0.2243)	(0.0688)	(0.3804)	(0.1026)	(0.0562)
Materials	0.5905	0.4272	0.5745	0.5685	0.5611	0.6843	0.6153
	(0.0157)	(0.0673)	(0.0901)	(0.0226)	(0.1110)	(0.0351)	(0.0149)
Electricity	0.1855	0.4349	0.2780	0.1222	0.0500	0.0000	0.2176
	(0.0782)	(0.1731)	(0.2389)	(0.0414)	(0.0858)	(0.0711)	(0.0676)
Sum of coefficients	1.0577	1.3461	1.4048	1.0293	1.7727	0.8429	1.0987
Chi^2 CRS (p-value)	0.2486	0.1337	0.1588	0.7013	0.0298	0.2927	0.0487
N observations	4155	279	422	2441	650	651	7572

	Non elec. Machinery 382	Elect. Machinery 383	Transport Eq. 384	Prof. and Scient. Eq. 385	Other 390
Blue collar labor	0.0470	-0.0067	0.0611	0.1297	0.0016
	(0.0180)	(0.0427)	(0.0247)	(0.0792)	(0.0439)
Skilled labor	0.1745	0.2563	0.1746	0.1221	0.2507
	(0.0193)	(0.0463)	(0.0365)	(0.0612)	(0.0484)
Capital	0.0998	0.0000	0.2831	0.0700	0.1887
	(0.0827)	(0.1953)	(0.0135)	(0.2380)	(0.1098)
Materials	0.5862	0.6844	0.6053	0.5182	0.5226
	(0.0205)	(0.0307)	(0.0293)	(0.0611)	(0.0423)
Electricity	0.0408	0.2950	0.0815	0.0100	0.1329
	(0.0375)	(0.1121)	(0.0444)	(0.1054)	(0.0829)
Sum of coefficients	0.9483	1.2291	1.2057	0.8500	1.0965
Chi^2 CRS (p-value)	0.5343	0.1781	0.1393	0.5413	0.3912
N observations	3120	1180	1953	374	1051

Source: Author's estimates. Bootstrapped standard errors in parentheses using 250 replications.

Table 3. Decomposition of Aggregate TFP Gains

	Full period	1988-2001
TFP gain	0.428	0.801
Within	-0.014	0.464
Reallocation	-0.097	0.077
Entry	0.592	0.674
Exit	0.053	0.414
Net entry	0.539	0.260
Share of TFP gain (%)	100.00	100.00
Within	-3.22	57.95
Reallocation	103.22	42.05
Among incumbents	-22.66	9.58
Net entry	125.88	32.47
Entry	138.27	84.22
Exit	12.39	51.75

Table 4. Plant Level TFP, and Entry and Exit Effects

	(1)	(2)	(3)	(4)
Entry	-0.039	-0.032	-0.043	-0.037
	(0.008)	(0.008)	(0.008)	(0.008)
One period lag of entry			-0.011	-0.009
			(0.008)	(0.008)
Two period lag of entry			-0.005	-0.005
			(0.009)	(0.009)
Exit	-0.070	-0.073	-0.073	-0.076
	(0.008)	(0.008)	(0.008)	(0.008)
One period lead of exit			-0.051	-0.053
			(0.008)	(0.008)
Two period lead of exit			-0.029	-0.033
			(0.008)	(0.008)
Sector dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Sector*year dummies	No	Yes	No	Yes
N obs	84912	84912	84041	84041
R^2	0.89	0.89	0.89	0.89

Standard errors in parentheses.

Table 5. Productivity, Size and the Probability of Exit

	Marginal Effects	
	(1)	(2)
Productivity	-0.018	-0.020
	(0.002)	(0.002)
Employment	-0.026	-0.028
	(0.001)	(0.001)
Sector dummies	Yes	Yes
Year dummies	Yes	Yes
Sector*year dummies	No	Yes
N obs	81675	81675
Pseudo R^2	0.05	0.05

Marginal effects of probit estimates of the likelihood of plant exit.
Standard errors in parentheses.

Table 6. The Effect of Tariffs on Plant Level TFP

	(1)	(2)
Traded	1.958	
	(0.057)	
Traded * effective tariff	0.300	
	(0.219)	
Exported		1.955
		(0.057)
Exported * effective tariff		0.318
		(0.232)
Imported		2.355
		(0.072)
Imported * effective tariff		1.063
		(0.249)
Other traded		3.264
		(0.055)
Other traded * effective tariff		-0.519
		(0.250)
Number of observations	84912	84912
Overall R^2	0.880	0.880

Fixed effects regressions include time and sector dummies.

Table 7. The Effect of Financial Development on Plant-level Productivity

	Financial Development Measure			
	Private credit by banks over GDP		Private bond market capitalization over GDP	
External dependence x financial development	0.209 (0.094)	0.258 (0.065)	0.368 (0.277)	0.564 (0.190)
Firm fixed effects	No	Yes	No	Yes
Sector fixed effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Number of observations	84912	84912	48051	48051
Years included	1980-2001	1980-2001	1990-2001	1990-2001
Overall R^2	0.886	0.880	0.877	0.870
Differential in natural log of productivity				
Sector 321/ sector 369 in 1980 vs.1990	0.009	0.011		
Sector 321/ sector 369 in 1990 vs.2000	0.011	0.013	0.010	0.016
Sector 321/ sector 369 in 1980 vs.2001	0.020	0.025		

OLS and fixed effects (within) regressions of plant-level log TFP.

Figure 1. Mean TFP and TFP Dispersion

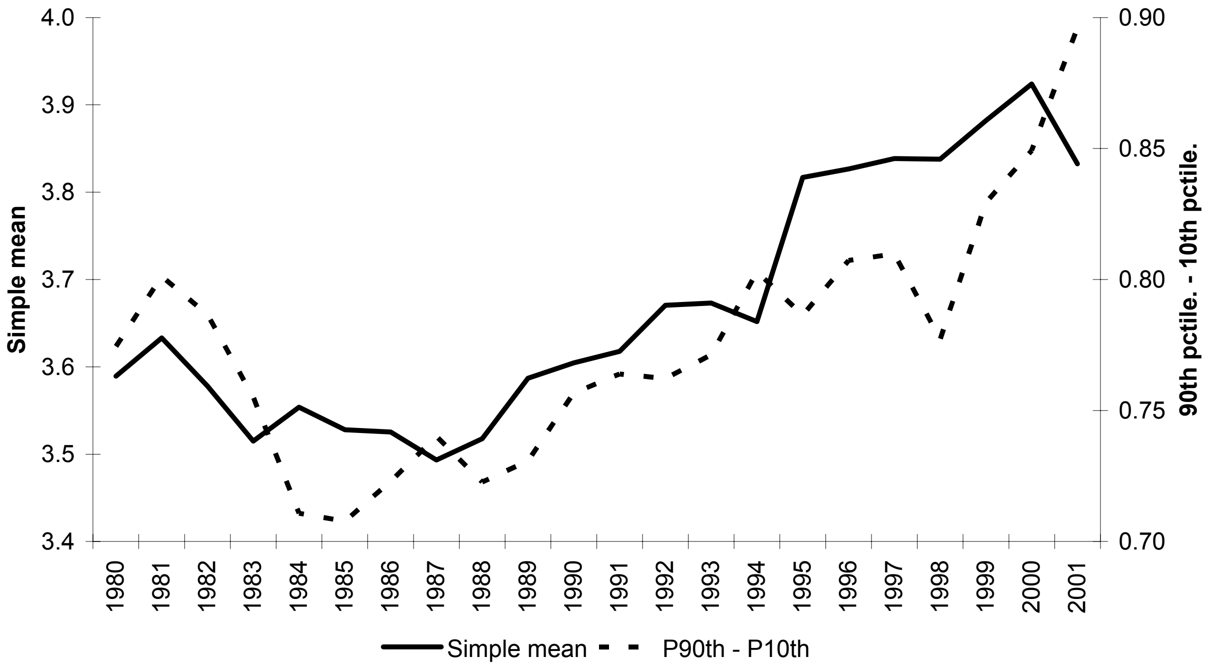

Figure 2. TFP Evolution: Simple and Weighted Averages

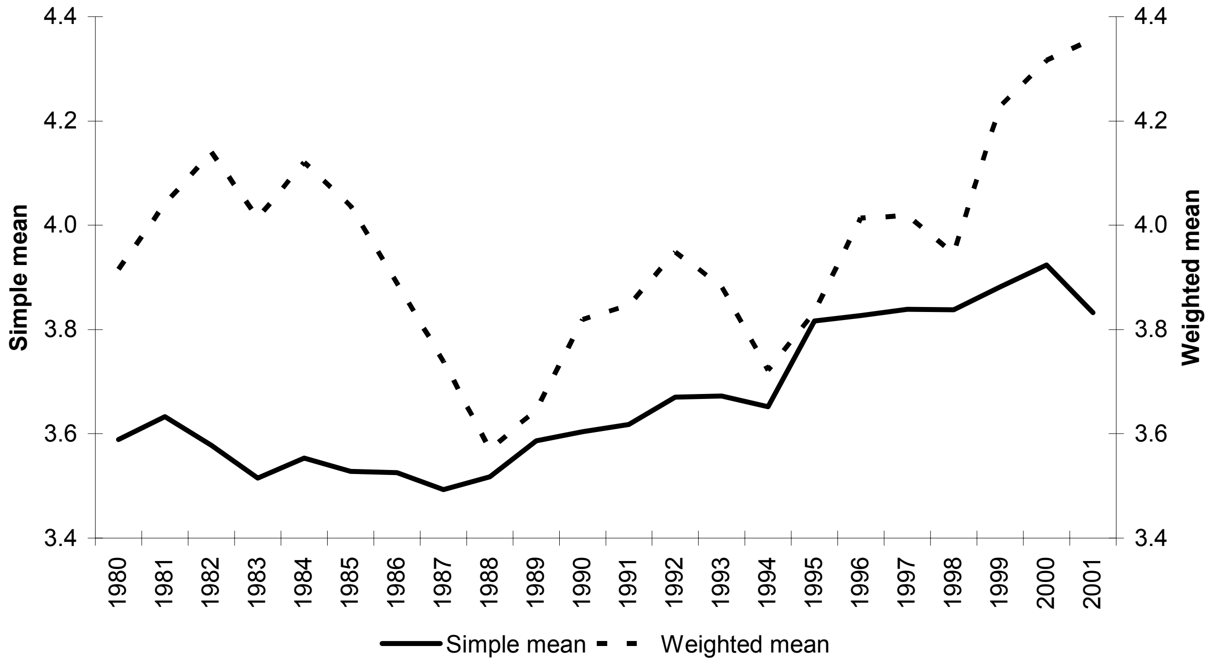

Figure 3. Productivity Evolution in Traded Sectors (relative to non-traded sectors)

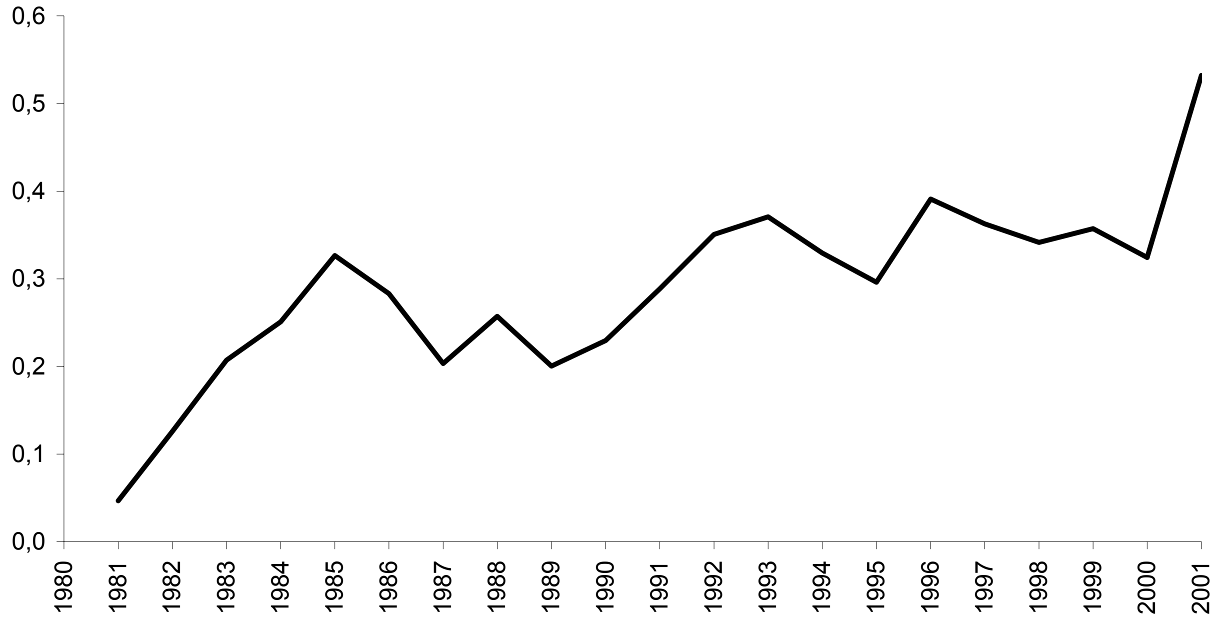

Figure 4. Productivity Evolution in Traded Sectors (relative to non-traded sectors)

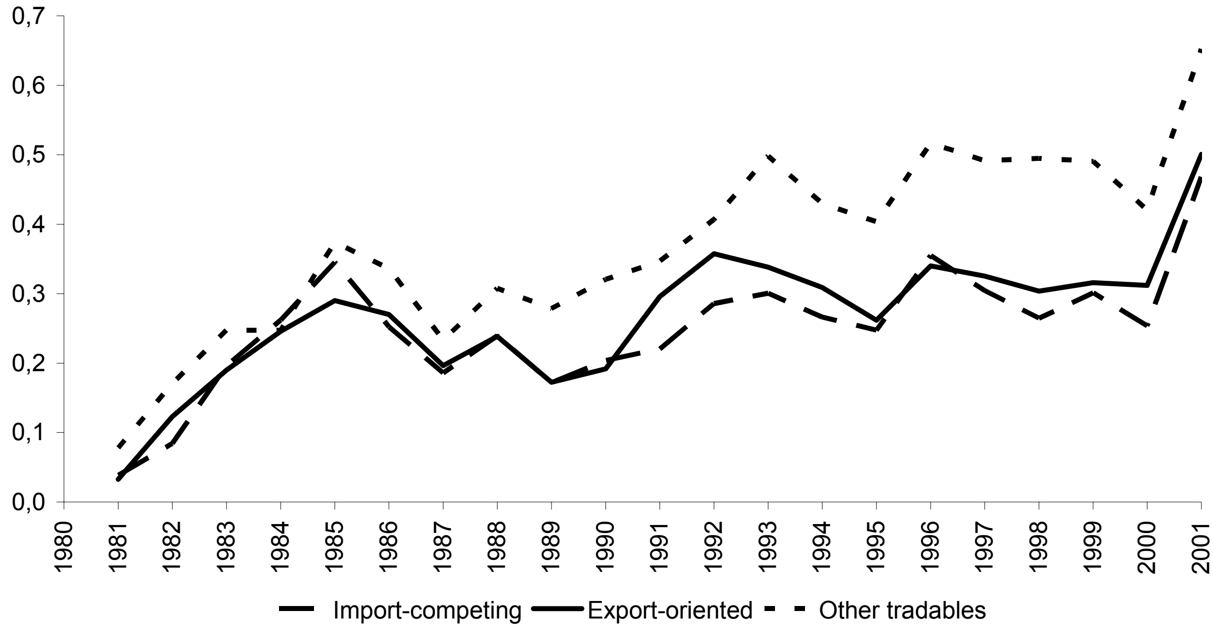

Figure 5. Effective Tariff in Chile

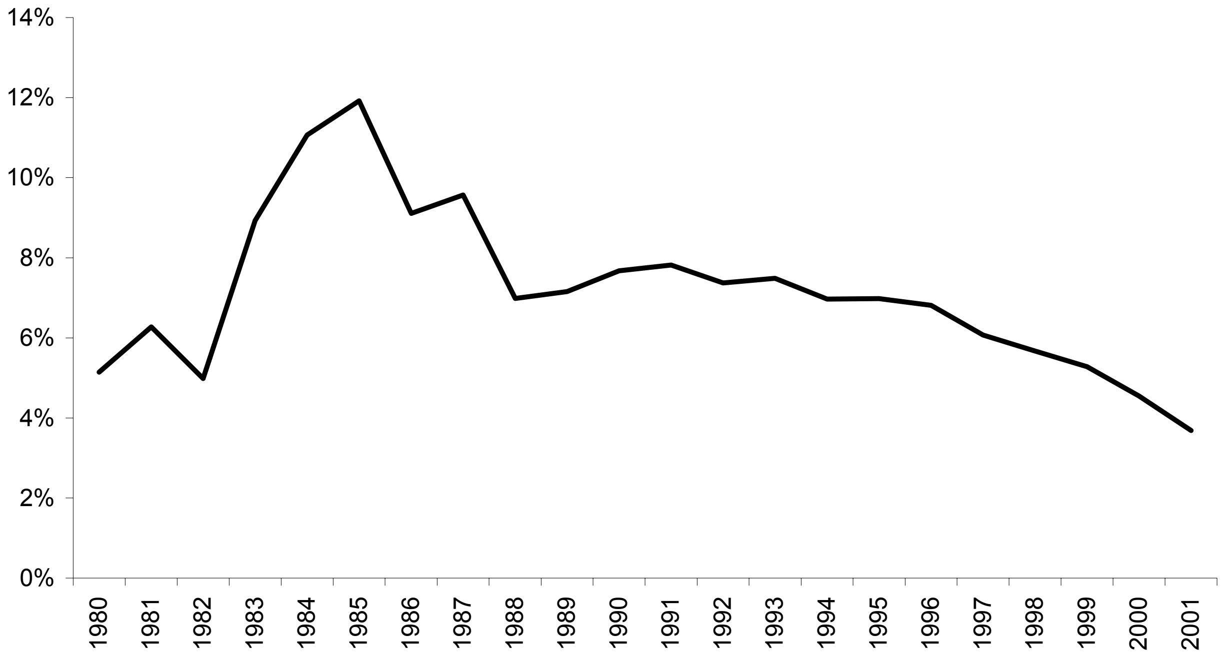

Figure 6. Revenues from Stamp Tax (% of GDP)

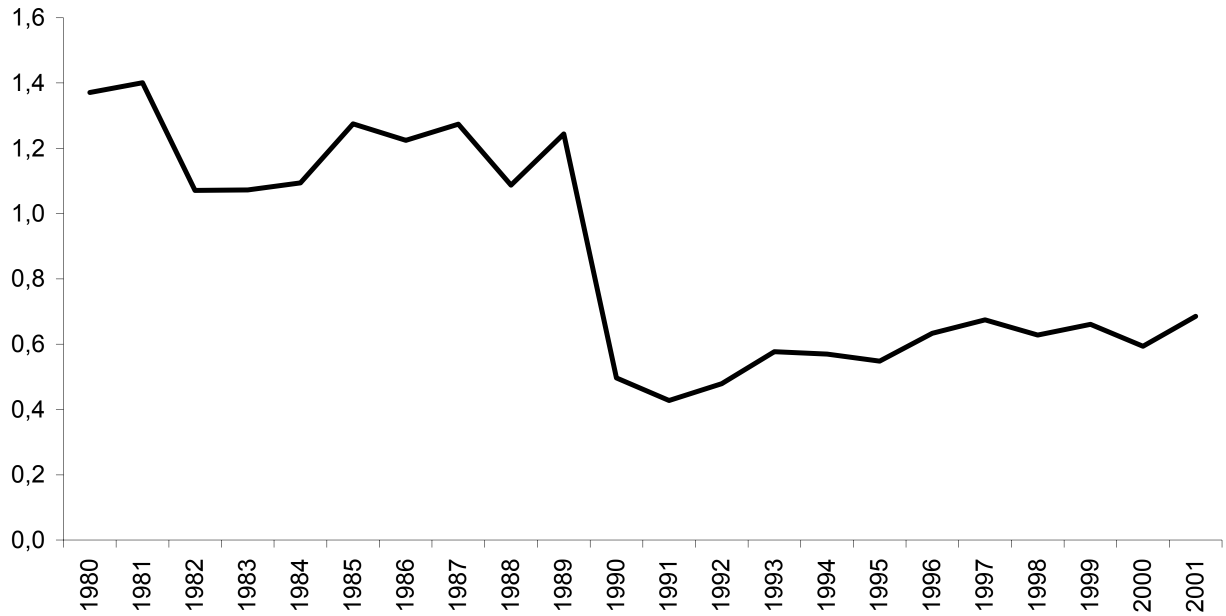

Figure 7. Productivity Evolution of Firms Paying Stamp Tax (relative to firms not paying the tax)

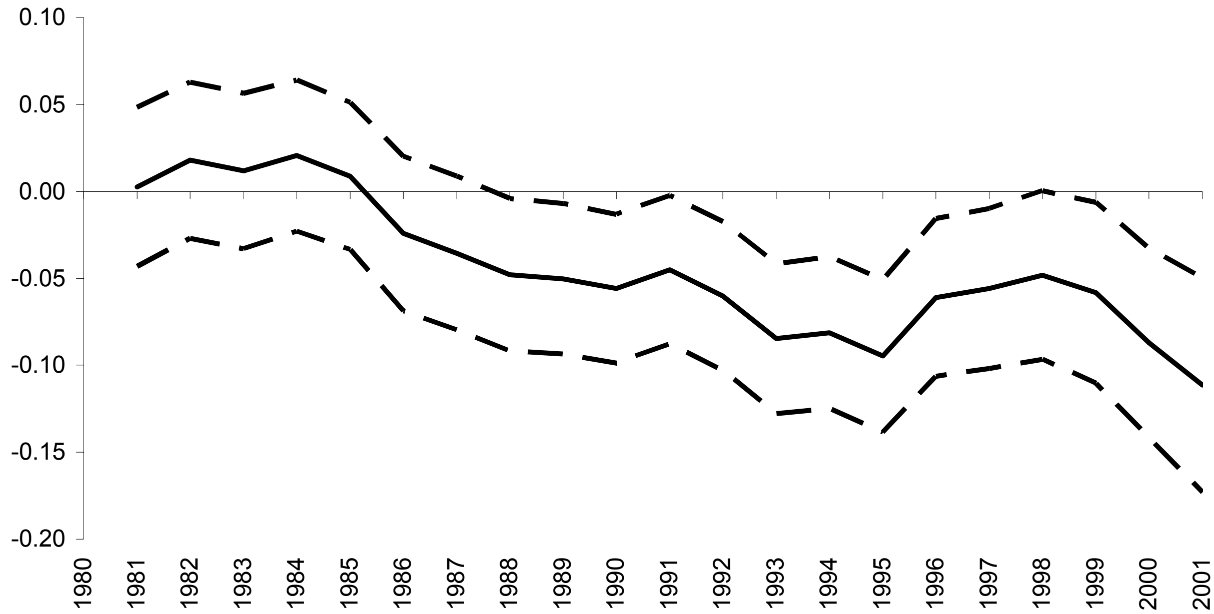

Figure 8. Financial Markets' Development