Local Impacts of Trade Liberalization: Evidence from the Chilean Agricultural Sector

José Ignacio Cuesta
University of Chicago

Francisco A. Gallego
Pontificia Universidad Católica de Chile and EH Clio Lab

Felipe A. González
University of California at Berkeley

Protectionist trade policies aim at shielding some sectors—typically, but not exclusively, manufacturing—from international competition. In doing so, they may produce unintended consequences. In particular, they tend to create some taxed sectors that use protected inputs, usually in the agricultural sector, which end up facing a negative effective rate of protection (ERP hereafter). In this way, protectionism distorts the allocation of resources and creates disincentives for the production of some goods. This was the case of the tariff structure in Chile before the massive process of economic and trade liberalization that began in the mid-1970s. Before the liberalization reform, average tariffs were as high as 220%, aggravated by high dispersion and several non-tariff barriers

This paper is prepared in honor of Professor Vittorio Corbo, a great economist, teacher, mentor and role model for several generations of economists at PUC-Chile and elsewhere. His teachings and research on the effects of economic policy on economic outcomes in Chile (e.g. Corbo 1985; Corbo and others 1991; Corbo and others 1995; Corbo 1997; Corbo and others 2005; just to mention a few) inspired the writing of this paper. We would like to thank José Miguel Sánchez (our discussant) and Ricardo Caballero and Klaus Schmidt-Hebbel (the editors) for comments, and Carlos Alvarado, Amanda Dawes, Daniela Marshall, Guillermo Marshall, and Antonia Paredes for superb research assistantship, and the CONICYT/Programa de Investigación Asociativa SOC 1102 for financial support. The usual disclaimer applies.

Economic Policies in Emerging-Market Economies, Festschrift in Honor of Vittorio Corbo, edited by Ricardo J. Caballero and Klaus Schmidt-Hebbel, Santiago, Chile.

(NTBs hereafter) that were quickly eliminated after 1975.[1] This tariff structure created a lot of heterogeneity in the ERPs between and within sectors. For instance, according to Hachette (2011), while agriculture had negative ERPs of about 27% in 1960-1969, sectors outside agriculture had high positive ERPs of about 73%.

In this paper, we take advantage of this heterogeneity in ERPs across goods, and the fact that different areas in the country produced different goods, to study how the decrease in the level and dispersion of tariffs affected agricultural production and other outcomes at the local level. This way we exploit the fact that counties with different conditions for the production of different goods were heterogeneously affected by the decrease in tariffs. In this sense, we take a "differential exposure approach" (Goldberg and Pavcnik, 2007), which relies on the fact that counties are heterogeneously affected by the trade liberalization process, given their different production structures, and this is closely related to a paper by Topalova (2010), which studies the local effects of trade liberalization in India after trade was opened in the early 1990s.[2] The cost of using this approach, however, is that we cannot identify the effects of liberalization on the overall growth of the country. In particular, we study what happened to the production of sectors that were initially either taxed or protected by the tariff structure, through effects on either the intensive margin or productivity. Thus, we only address partial equilibrium effects of trade liberalization.

To measure agricultural output, we use agricultural census information to construct a measure of agricultural production at the county level for the pre-liberalization (1955 and 1965) and post-liberalization (1997 and 2007) periods. To measure the effective rates of protection, we use information for three subsectors (fruits, livestock, and primary products) from Hurtado, Muchnik and Valdés (1990) (HMV hereafter); and a fourth (forestry) from De la Cuadra (1974) (DLC hereafter). Next, using production information for each county, we construct an index of production-weighted ERPs for each county.

In terms of the main results of the paper, we find that ERPs have an economically and statistically significant effect on agriculture

1. See Lederman (2005) for a detailed description of the liberalization process.

2. This approach assumes some degree of imperfect mobility of factors (in particular labor) across different sectors, which might be adequate in the case of developing countries (see Topalova, 2010, for a general discussion, and Bruhn and Gallego, 2012, for details on the case of the Americas).

output. Increasing the negative ERPs in the pre-liberalization period by one standard deviation increases post-liberalization output growth by about 12 log points when total output is considered. In contrast, a similar calculation for counties having positive ERPs before liberalization implies a slowdown in output growth of about 32 log points. This result confirms that some areas of the country were effectively protected before liberalization and that this protection implied producing more than efficient production levels. However, we find evidence that, in the case of the negative ERPs (i.e. initially taxed areas), the output expansion operates both through effects on the intensive margins and through total factor productivity (TFP) improvements. In the case of counties facing positive ERPs (i.e. initially protected areas), the output decrease is mostly due to effects on the intensive margin with no noticeable effects on TFP levels.

We also find that not only production increased in the counties benefiting from the elimination of negative ERPs, but also that there was an increase in output specialization. This presumably reflects the fact that these counties, when ruled by the right incentives in an open economy, moved towards higher specialization in the production of goods in which they had a comparative advantage. This is another positive effect of the trade liberalization process, as counties could benefit from this specialization. However, we cannot measure how much of this increase in output is due to increased efficiency.

This paper intends to complement three strands of the literature. First, it adds to incipient literature on the local effects of liberalization on economic activity and other broader development indicators. This strand includes papers by Topalova (2010), Edmonds, Pavcnik and Topalova(2010), and Khandelwal and Topalova (2011),[3] among others, all of which study the Indian case and exploit changes in tariff structure across time and industries in order to estimate the local impacts of trade reforms. The main difference between their approach and ours is that, in contrast to the case of India, in Chile the trade reform mostly took the negative pre-reform ERPsto zero, thus providing a cleaner experiment for testing the impact of tariff reductions in local contexts.

Second, we complement the empirical literature on the effects of liberalization on economic growth and other economic outcomes in Chile. This area is vast and takes different approaches from time-series

3. For instance, McCaig (2011) uses a similar approach for estimating the impact of tariff reduction in Vietnam over different poverty and demographic variables.

analyses (e.g., Rojas, López and Jiménez, 1997; Coeymans, 1999; Fuentes, Schmidt-Hebbel and Larraín, 2006; and Schmidt-Hebbel, 2006) to detailed studies using longitudinal information at the sectoral level (e.g. Corbo, Tybout and De Melo, 1991; Pavcnik, 2002; and Álvarez and Fuentes, 2003 for productivity effects in the manufacturing sector; and Beyer, Rojas and Vergara, 1999; and Gallego, 2012 for the effects of trade liberalization on the skill premium).[4]

This paper adds a new point of view to the empirical results by presenting empirical estimates of the effects of the trade reforms on agricultural output at the county level. We think this contribution is important as our analysis deals with endogeneity issues in a better way and also adds the regional dimension to an area with few studies examining the regional effects of the Chilean trade reform.[5] However, one limitation of our dataset is that we cannot clearly distinguish the effects of the trade reforms on productivity from the effects on total output.

Finally, we also contribute to the literature on the computation of ERPs for Chile in the agricultural-forestry sector (Balassa, 1971; Behrman, 1976; De la Cuadra, 1974; Varas, 1975; Hurtado and others, 1990; just to mention a few). In particular, we compute ERPs for different counties of the country. This contribution is important as we find significant variation across different sectors and present some empirical analyses to identify some empirical correlates to these measures.

The rest of the paper is organized as follows. Section 2 presents a brief description of the historical background of Chile's trade policies. Section 3 presents the data construction and section 4 presents some descriptive statistics of our measures of production and ERPs at the local level. Empirical results on the effect of the trade reform on agricultural output and other economic outcomes are given in section 5. Finally, a discussion of the results and concluding remarks can be found in section 6.

4. Some papers going back to Harberger (1959), Varas (1975), and Coeymans (1978) use different types of models to compute the potential effects of trade liberalization on different economic outcomes such as input and output levels of growth.

5. One exception is the paper by Pardo and Meller (2002), who find that the speed of GDP convergence increases in regions with bigger increases in trade openness.

1. Historical Background of Chilean Trade Policy[6]

Before the 1950s, trade policy was characterized by multiple instruments (e.g. quotas, tariffs and multiple exchange rates) that aimed to protect the economy (Ffrench-Davis, 1973). According to Lederman (2005), this process started in the early to late 1920s, which is where, using econometric techniques, he found the main structural break in trade-related variables.

This process was consolidated in the so-called import-substitution industrialization (ISI) period during the Radical period covering 1938 to 1952 (with the radical governments of Pedro Aguirre Cerda, 1938–1941; Juan Antonio Ríos, 1942–1946; and Gabriel González Videla, 1946–1952).[7] The policy objective was to start a vigorous growth path (see Prebisch, 1950 as an example). However, only ten years into the program, there was a general feeling that protectionism was not the adequate policy to reach economic development. Even Raúl Prebisch, an enthusiastic advocate of protectionist policies after the Great Depression, acknowledged this a couple of years later when he argued that protectionism (excessive tariffs, duties and restrictions) "has deprived the Latin American countries of the advantages of specialization and economies of scale." (Prebisch, 1963, cited by Hirschmann, 1968). The first attempt to move towards a relatively open economy involved the Klein-Saks mission in the 1950s during the rule of Carlos Ibáñez del Campo. However, their recommendations were not particularly effective in terms of results (Ffrench-Davis, 1973). After several attempts to move away from protectionist policies, a liberalization process was launched during the mid-1970s.

Lederman (2005) classifies the period 1927–1956 as the institutionalization of protectionism, the period from 1956 to 1973 as one of macroeconomic instability and delegitimization of protectionism, and the period after 1973 as one of unilateral trade liberalization. Figure 1 presents the average tax on imports and

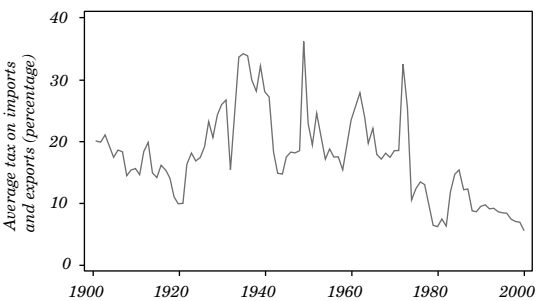
6. This is only a brief description of the historical background of the Chilean trade policy. Many papers present more detailed description (e.g., Corbo and others 1995, Corbo 1997). The more up-to-date source of information is Lederman (2005). The latter book presents a detailed description of the political economy of trade policies in Chile since the beginning of the nineteenth century up to the present.

7. See Hirschman (1968) for the main characteristics of the ISI process in Latin America, its evolution, and the principal difficulties it encountered during its implementation.

exports during the twentieth century (Díaz, Wagner and Lüders, 2010). We can see the policy volatility during the 1950s and 1960s, partly reflecting different policies that did not have the expected results,coupled with a situation of serious macroeconomic instability.[8] The sharp liberalization process that reduced the average tax before 1980 is also evident.

Another central characteristic of trade policy during the pre-liberalization period is the high dispersion of tariffs and, therefore, ERPs in different sectors. Lederman (2005) finds that while the mode of tariffs in 1973 was about 90%, the maximum tariff could be as high as 220% (and covering about 8% of all products). In addition, there were a number of NTBs in operation. The rationale for this variance in the treatment of different sectors comes from the idea to favor some sectors: (i) manufacturing over agriculture, agriculture over mining, and industries producing intermediate goods (until the 1960s); (ii) import substitution over export promotion; and (iii) goods imports over non-goods international transactions (Behrman, 1976). In particular, the most protected subsectors tended to be the traditional, "easy" import-substitution ones. In most cases, these industries started to receive specific protection since the 1897 Tariff Act, and had been consolidating their protection levels even before World War Two (Behrman, 1976).

Figure 1. Average Tax on Imports and Exports



Source: Díaz and others (2010).

8. Actually, Lederman (2005) shows quantitative and qualitative evidence suggesting that governments, during the 1950s and 1960s, were very active in implementing policies that both decreased and increased trade protection.

While the trade reform was introduced in the mid-1970s under the Pinochet dictatorship, the antecedents to that policy change started some years earlier. The main economic program was developed some time after the right-wing candidate Jorge Alessandri lost the 1970 presidential election to the socialist candidate, Salvador Allende, in the midst of economic and social turmoil. The designers of this program included two economists who would become finance ministers during the Pinochet regime: Sergio de Castro and Sergio de la Cuadra. Reforms proposed in the so-called "Program for Economic Development" were radical in form and scope.

The liberalization process unfolded between 1974 and 1990. Although the government did not have a clear picture of the depth and timing of the liberalization at the beginning of the process, during the first five years all quantitative restrictions and exchange controls were reduced from 100% to a flat 10% tariff across the board (except for automobiles) in 1979 by the Finance Minister, Sergio de Castro. However, there was a brief period in which the tariff was raised to 35% after the financial crisis of 1983-1984. Tariffs were finally reduced to 11% in 1991 (Edwards and Lederman, 1998).[9]

This process was not isolated; it was implemented together with a massive privatization program and several reforms to eliminate a persistent inflationary process and modernize the financial sector.[10] The program to implement the reforms was divided into two parts: diagnosis and implementation. The specific points of the trade reform included: (i) engineering a real exchange rate depreciation, (ii) implementing a crawling peg exchange rate regime, (iii) reducing import tariffs to a uniform level, (iv) eliminating all import licenses and prohibitions, and (v) implementing export promotion schemes. However, it was not explicit about the timing and speed of these reforms (Corbo, Lüders and Spiller, 1995; Edwards and Lederman, 1998).

It is important to stress that the liberalization process in Chile was always thought to reduce tariffs towards a uniform structure. For instance, Harberger (1991) argues that the existence of different distortions across industries is costly because it enables different economic-interest groups to lobby for specific trade policies for their, supposedly, "strategic" sector. Thus, trade barriers were not only reduced, but also simplified in terms of their structure, reducing their dispersion across products.

9. This path of liberalization is clearly reflected in figure 1.

10. See Harberger (1985), Edwards and Edwards (1991), Bosworth, Dornbusch and Labán (1994) and, especially, Corbo and others (1995) for a deeper analysis of these reforms.

This big trade policy change that reduced the average and dispersion of tariffs provides us with a significant shock that affects different counties in different ways. In particular, as we document below, before the reform there was a high variance in effective rates of protection across sectors and, therefore, across counties. Thus, the liberalization period that drastically reduced most tariffs to a uniform level implies that different counties were affected by changes in trade policy with different intensities. We exploit precisely that cross-county variation to identify differential effects of the trade liberalization period on economic outcomes at the local level.

2. Data Construction

2.1 Output and Specialization

We use output measures constructed using information available in the agricultural censuses of 1955, 1965, 1997 and 2007,[11] which were applied by the Chilean National Statistics Institute (INE); and information on prices taken from INE's wholesale prices series. The censuses provide information for a subset of products on quantity of production, and surface used in the production process, which we use to build county level measures of output for the sectors of forestry, fruits, livestock and primary products. We value each of the products at what we call long-term undistorted prices (i.e. the average price of each type of product over the 1993-2006 period) and use them to compute total and sectoral output changes and growth rates for all rural counties located between regions IV and X of Chile.[12] We focus on the rural counties in this part of the country because they hold almost all the agricultural activity of the country. We end up having information for about 214 counties.[13]

11. These are the only censuses presenting county-level information. The agricultural censuses between 1965 and 1997 do not include county-level information.

12. Chile is geopolitically organized into 15 regions, generally denoted as I through XV. The capital city, Santiago, is located in region XIII, the Metropolitan Region (MR). With regions I, II, III, XI, XII, XIV, and XV being in the extremes of the country and having a nearly nonexistent agricultural sector, we focus the analyses of this paper in regions IV through X and the MR, which is where agricultural production is concentrated.

13. Given the changes in county boundaries and the creation and consolidation of some counties in Chile, we created a set of counties that keep the same information over the time period included in the analysis. This implies that in some cases we have to merge modern counties to make the data consistent with the 1955-1965 county definitions and boundaries.

Using this output dataset, we construct indicators of specialization for each county, which we will use to discuss the potential effects of trade liberalization on specialization patterns across counties. In particular, we construct two specialization variables: firstly, we simply use a dummy indicator for each sector that equals 1 when a county is specialized in a determined sector at a determined period (i.e., the sector with the highest share of production); and secondly, we build Herfindahl-Hirschman indices (HHIs) for sectoral output concentration in each county for each period.

2.2 Quantifying Agricultural Trade Distortions

In this subsection, we present the construction of an effective rate of protection (ERP) index at the county level. We use ERPs because they capture effects of tariffs on both final and input prices. In addition, the local dimension of the index is very important as trade barriers will unevenly affect production in different geographical zones depending on whether the goods produced are relatively protected or unprotected by trade tariffs. Thus, we construct a local ERP index that tries to capture the unequal effects of the tariffs on production in different counties within the country.

Effective Rates of Protection

Several papers have constructed ERPs for goods and sectors in Chile (a non-comprehensive list includes Balassa, 1971; De la Cuadra, 1974; Varas,1975; Behrman, 1976 and Hurtado and others, 1990). We base our computations on DLC and HMV.

ERPs are defined by the authors in the following way:

$$ERP = \frac{V_A^i - V_A^{i*}}{V_A^{i*}},$$

where V_A^i is value added per unit of product, at the prevailing prices $V_A^i = P_i - \sum_i P_j a_{ij}$; where P_i is actual price of the final good i, P_j is actual price of input j, and a_{ij} is the amount of input j needed to produce one unit of good i. On the other hand, $V_A^{i*} = P_i^* - \sum_i P_j^* a_{ij}$, where P_i^* is the undistorted price of final good i, and P_i^* is the undistorted price

of input j. The calculations also include adjustments for exchange rate differences, as follows:

$$P_i^* = \frac{P^i}{(1+t^i)}\frac{E^*}{E_0},$$

$$P_j^* = \frac{P^j}{(1+t^j)}\frac{E^*}{E_0}.$$

With t^i and t^j being the import tariffs on good i and input j respectively. Given the way in which the ERPs are estimated, a negative value indicates a taxed industry and positive one a protected one. E^* and E_0 are introduced to account for the potential effects of liberalization on the exchange rate. HMV construct ERPs for 1969, which they argue is a "representative year in terms of output mix" and in their calculations they include 43% of the total agriculture production. Calculations by DLC for the forestry sector correspond to the second half of the 1960s, and are adjusted in order to make them comparable with HMV's calculations.

The Index

To obtain an index for each county we take the following steps:

1. Using the information from the agricultural censuses, we obtain the proportion of the total production that corresponds to each of the four subsectors we consider for each year.

2. We use the values calculated by HMV in order to obtain an ERP for Fruits, Livestock and Primary Products; and the values calculated by DLC to obtain an ERP for Forestry.

3. Finally, we calculated weighted averages of the ERPs across counties and time, where the weights are the shares of the total output represented by each subsector before the reform (i.e. including output information from the censuses of 1955 and 1965).

Therefore, the ERP index we use interacts differences in the output mix through counties and time with ERPs in each subsector:

$$\text{Index}_{ct} = \sum_s \omega_{sct} ERP_s,$$

where ω_{sct} is total production of sector s in county c during year t over total agricultural production in county c and year t, and S is the set

of four agricultural sectors. This index is an appropriate measure of agricultural trade distortions for each county in each period under the assumption that the products for which HMV and DLC built ERPs are representative of the output of the sectors covered by this study.

We do not construct specific indices for 1997 and 2007 because, as documented by Dornbusch and Edwards (1994) and Lederman (2005), trade tariffs in Chile had already been by then reduced to remarkably low levels and equalized through different products, which allows us to focus our empirical strategy on the initial levels of distortion (i.e. the indices from 1955 and 1965).

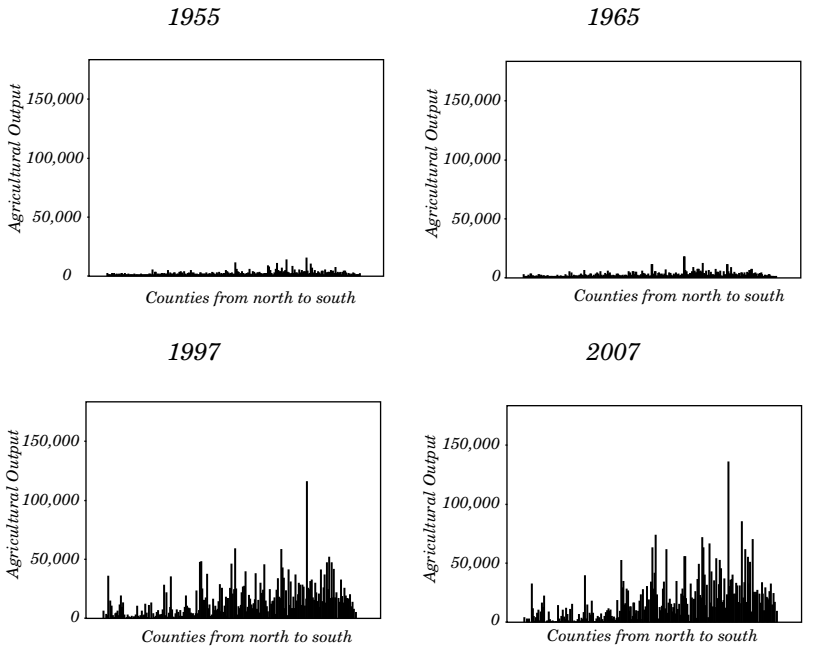
3. Descriptive Statistics

3.1 Output and Specialization

We start by presenting some stylized facts about output levels and specialization. Figure 2 presents total agricultural output per county, per year. It is noticeable that agricultural output grew strongly over the 1955-2007 period and that southern counties' participation—counties in regions VI through X—in national agricultural output is remarkably larger than participation of counties located in the northern area—regions IV through the MR. Table 1 presents annual output growth across sectors and time, showing that both Fruits and Forestry grew strongly during the period of study with annual growth rates of 4.2% and 4.9%, respectively, while Primary Products grew remarkably less, reaching a growth rate of only 1%. Interestingly, these growth rates show substantial heterogeneity across counties, which reveals huge differences in terms of sectoral composition of output.

Figure 3 presents how sectoral composition varies over time. It is easy to note that Primary Products lost relevance in the counties' output mix, decreasing their participation from 45% to 8.5% between 1955 and 2007; Fruits in the northern counties and Forestry in the South strongly increased participation; Forestry increased output participation in both geographic areas from 39% to 51%; Livestock also increased participation from 7% to 31%. Specialization patterns vary between regions and time, with the most radical changes occurring between 1965 and 1997 as was expected, since this period is the longest, but also the period in which most of the trade liberalization process took place.

Figure 2. Total Agricultural Output by County and Year



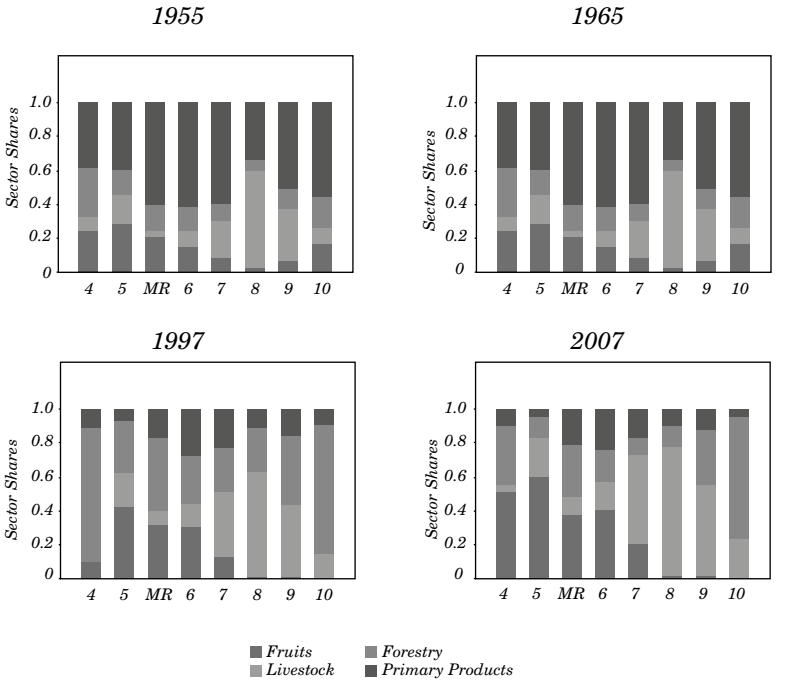
Source: Authors' elaboration.

Table 1. Annual Compounded Growth Rates by Sector

Sector	*Years*	*Mean*	*SD*	*National*
Forestry	1955-1965	-0.014	0.148	0.009
	1965-1997	0.052	0.107	0.062
	1997-2007	0.174	0.559	0.056
Fruits	1955-1965	0.02	0.148	0.010
	1965-1997	0.002	0.113	0.051
	1997-2007	0.124	0.444	0.049
Livestock	1955-1965	0.075	0.099	0.044
	1965-1997	0.096	0.051	0.115
	1997-2007	-0.118	0.198	-0.019
Primary products	1955-1965	0.011	0.054	0.017
	1965-1997	-0.005	0.038	0.017
	1997-2007	-0.040	0.098	-0.016

Source: Authors' elaboration.

Figure 3. Sectoral Composition of Agricultural Output by Region and Year



Source: Authors' elaboration.

This view of the Chilean agricultural sector development is reinforced by our calculations of the mean output shares represented by each of the four sectors considered in the study. This is shown in table 2, where additionally we can note that there is considerable variance in terms of agricultural output composition both across counties and over time.[14]

Moreover, when examining sectoral specialization at the county level (table 3), the above mentioned changes appear strongly: counties specialized in Primary Products decreased from 152 in 1955 to just16 in 1997; counties specializing in Forestry, Fruits and

14. This heterogeneity also appears when examining summary statistics for these output shares within regions, meaning that even between counties with somehow similar geographic characteristics, we observe non-trivial differences in terms of their agricultural output composition.

Livestock increased from 45, 8 and 9, respectively in 1955 to 86, 55 and 57 respectively in 2007, thus revealing production reallocation through the period of study.

Table 3 also presents summary statistics for the Herfindahl-Hirschman Indices (HHI) calculated at the county level for each year, which show a clear increase in the degree of specialization, moving up 17% from 0.54 in 1955 to 0.63 in 2007. This pattern suggests that the trade liberalization process may have induced switches in production decisions towards products for which different counties had a comparative advantage but were, formerly, strongly taxed or protected by trade tariffs that distorted production decisions. Besides, there is also heterogeneity in this dimension, implying there were both counties that were highly specialized, and others that held relatively more balanced compositions of their agricultural output.[15]

Table 2. Total Output by Sector

Sector	*Years*	*Mean*	*SD*
Forestry	1955	0.248	0.274
	1965	0.227	0.275
	1997	0.29	0.312
	2007	0.37	0.357
Fruits	1955	0.123	0.141
	1965	0.134	0.169
	1997	0.156	0.254
	2007	0.241	0.328
Livestock	1955	0.098	0.136
	1965	0.135	0.157
	1997	0.41	0.319
	2007	0.27	0.303
Primary products	1955	0.532	0.245
	1965	0.503	0.249
	1997	0.144	0.164
	2007	0.119	0.155

Source: Authors' elaboration.

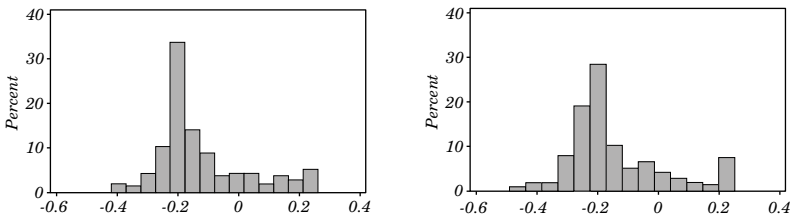
15. In fact, results for calculations of these indexes show that for each year, there are both counties with HHIs under 30%, which implies a highly balanced output composition, and counties with HHIs of more than 95%, which implies almost complete specialization. This heterogeneity is observed within counties specialized in the same sector too, which implies that even between somehow similar counties, specialization levels vary substantially. Obviously, some of this variance may be related to the size of the county, therefore in some empirical analyses we control for proxies for the size of the county and results are robust in these controls.

Table 3. Number of Counties Specialized in Each Sector

Sector	*1955*	*1965*	*1997*	*2007*
Forestry	45	48	68	86
Fruits	8	15	35	55
Livestock	9	16	95	57
Primary products	152	135	16	16
Hirschman-Herfindahl	0.541	0.531	0.586	0.632
	(0.151)	(0.159)	(0.202)	(0.218)

Source: Authors' elaboration.

Figure 4. ERP Index Histograms per Year



Source: Authors' elaboration.

3.2 Agricultural Trade Distortions

As explained in subsection 2.2, we built on ERPs constructed by previous research in order to generate measures of trade distortions in agriculture. The ERPs that we use for our calculations are 0.27 for Forestry, –0.51 for Livestock, –0.22 for Primary Products, and –0.20 for Fruits. Therefore, Forestry is the only sector that was relatively protected in the 1960s. On the other hand, the other three sectors are relatively taxed, with Livestock and Primary Products being more strongly taxed than Fruits. As mentioned before, we combine these differences in initial levels of sectoral trade distortions with the already described heterogeneity in the agricultural output composition in order to build a county level index of agricultural trade distortions.

Figure 4 shows the distribution of ERPs across counties for 1955 and 1965. According to our calculations, 15% and 12% of the counties in the sample were protected in 1955 and 1965, respectively—mainly those that were highly specialized in forestry—while the remaining ones were taxed.

Table 4. Descriptive Statistics of ERP Indices by Region and Sector of Specialization

	1955		*1965*	
	Mean	*SD*	*Mean*	*SD*
Panel A: Index by region and year				
4	-0.208	0.089	-0.262	0.087
5	-0.146	0.109	-0.177	0.095
MR	-0.225	0.083	-0.242	0.070
6	-0.185	0.089	-0.209	0.085
7	-0.121	0.157	-0.139	0.130
8	0.040	0.159	0.049	0.170
9	-0.073	0.146	-0.106	0.136
10	-0.200	0.075	-0.224	0.101
All	-0.125	0.150	-0.146	0.156
Panel B: Index by sector of specialization and year				
Forestry	0.122	0.094	0.098	0.109
Fruits	-0.179	0.026	-0.189	0.057
Livestock	-0.345	0.071	-0.352	0.072
Primary Products	-0.183	0.064	-0.203	0.059

Source: Authors' elaboration.

Table 4 complements the previous figures by presenting summary statistics at the county level for the ERP indices (in rows labeled "All"). As can be noted, the situation in 1955 and 1965 is almost the same in terms of trade distortions, reaching a mean ERP of –0.125 and –0.146 for the two years, respectively, meaning that counties in the sample were, on average, taxed by trade tariffs. Additionally, from the same table it is easy to observe that there is a high variation in the values of the index.

Regarding this heterogeneity, a relevant concern would be the amount of such variance that could be explained just by geographic or

climatic patterns. If this was the case, we would be partly capturing the huge dispersion in climate and geographic characteristics observed in Chile with our ERP index. In order to somehow rule out this possibility, we analyze the variation of the index, both by region and sector in which the counties are specialized. Panels A and B in table 4 show that, effectively, there are certain regularities in the values of the index that are related to geographic or productive characteristics, primarily that regions and counties more specialized in forestry are more protected than the other regions, as expected, but at the same time within each region, and within each sector of specialization, the index still vary substantially.

4. The Local Impacts of Trade Liberalization on Economic Outcomes

4.1 Empirical Strategy

Using the theoretical and historical motivation described above, we develop in this section an empirical investigation of the local effects of trade liberalization on economic outcomes, in particular agriculture output, demand for inputs, productivity, patterns of specialization.

We first describe the empirical methodology we use to study these relationships. Our main estimating equations are as follows:

$$\hat{y}_i = D_i\alpha + D_i * PP_i\beta + \boldsymbol{X}_i'\gamma + e_i, \quad (1)$$

where i refers to county, $\hat{y}$ is the change of the log of an economic outcome along the period of trade liberalization with respect to the previous period (i.e., agricultural output growth, proxies for input use, and proxies for production specialization, among other variables), D is the *absolute value* of the ERP in the pre-reform period, PP is a dummy taking the value of 1 if the ERP of the county is positive before liberalization and 0 if negative, $\boldsymbol{X}$ is a vector of control variables (including initial y, the intensity of the Chilean agrarian reform in the county, and region fixed-effects, among others),[16] and e is an error term.

16. Notice that regions in Chile are composed of group of counties.

We use Huber-White robust standard errors to deal with potential heteroskedasticity.

The effect of initial negative ERPs is therefore captured by, which we expect to be positive as higher initial levels of protection implied that the reform decreased by more than the negative protection of the area. In turn, the effect of positive ERPs is captured by $\alpha + \beta$. The sign of this effect depends upon two sources with opposing potential effects: the size of the decrease in output because of the decreased protection, and the size of the productivity and re-allocation effects that trade liberalization may have produced.

Notice that we control for initial output levels and, therefore, our results are not driven by mean-reversion or conditional convergence effects after the liberalization period. In addition, by controlling for the Agrarian Reform Index (which measures the share of land that changed hands as a consequence of the agrarian reform at the county level), we aim to capture the extent of one of the main political reforms affecting agriculture in the same period. Similarly, we include other controls that may capture omitted variables correlated with the effects of the reform. Among these, we include a vector of climate and geographic controls at the county level (i.e., dummies for whether the county is outside the Chilean central valley or it is landlocked, annual rainfall, number of dry months, average temperature, and distance to the nearest port) and a vector of variables that may be correlated with initial levels of trade protection through political economy arguments such as the share of right wing votes, total votes, ratio of unskilled workers to total workers and total workers.

There are two data limitations we should mention: First, we do not have measures of NTBs at the county level. This is a limitation for our approach if changes in this variable are important and correlated with changes in our ERP index. Edwards and Lederman (1998) argue that the most important part of the trade reform was the decrease and homogenization of ERPs across sectors, and changes in NTBs were of secondary relevance. Thus, we consider this limitation as fairly unimportant, but still worth to be mentioned, and we leave a more detailed analysis for future research. Second, other than the agrarian reform, we do not have measures of other reforms at the county level. Again, the interpretation of our results would be affected if changes in other policies were correlated with changes in ERPs at the county level. We do not have evidence of this, but we think that by controlling for a vector of variables that includes political economy dimensions, we would probably capture the determinants

of changes in other policies. As we discuss below, our results remain mostly unchanged after doing this.[17]

4.2 Effects on Local Output

Table 5 presents the results of estimating equation (1) with agricultural output growth as the dependent variable. Results imply that counties that were initially more taxed, experienced higher levels of agricultural output growth throughout the liberalization period. The size of the impact is not only statistically significant, but also economically: a one standard deviation increase in the absolute value of the initial level of the negative ERP (equivalent to an increase of about 0.08 in the ERP) increases agricultural output by 13.6 log points (equivalent to 0.11 standard deviations of the variable). Inversely, the effect of liberalization for counties that were initially protected by the tariff structure is negative. In fact, we find that a one standard-deviation increase in positive ERPs decreased agricultural output growth by about 19.2 log points (equivalent to 0.16 standard deviations of that variable).

In column (2), we add a vector of additional geographic and climate controls and find that the main effects do not change. Finally, in column (3) we add control variables for relevant county level variables that may play a role in terms of determining agricultural output at the local level. We find that the main effects remain statistically significant, while the point estimate barely changes in size. This suggests that the effects we find are not driven by omitted variables that, through political economy channels, may affect our estimates. In our preferred specification in column (3), the effect of a one-standard-deviation change in the county ERP are 11.7 log points for initially taxed counties, and–32.2 log points for initially protected counties.

17. Still, we have implemented a couple of robustness exercises in order to assess the importance of these data limitations. First, we have controlled for a proxy for price distortions in agriculture final goods and found that our results have not changed significantly. As price distortions in final goods should capture the impact of NTBs, we think that the absence of NTBs is not important for our results. Second, we have run regressions controlling for the share of votes supporting Pinochet in the 1988 plebiscite as a proxy for political economy factors affecting (or having been caused by) the implementation of other policies. Again, results do not change significantly.

Table 5. Effects on Local Agricultural Output

Dependent variable: Change in log Agricultural Output			
	(1)	*(2)*	*(3)*
Initial negative ERP (α)	1.794**	1.923**	1.548**
	(0.874)	(0.870)	(0.774)
Positive value of ERP (β)	-4.099***	-5.228***	-5.420***
	(0.733)	(0.866)	(1.031)
Initial positive ERP (α + β)	-2.305***	-3.305***	-3.872***
F-test α + β (p-value)	0.010	0.000	0.000
Initial log output	-0.950***	-0.920***	-0.774***
	(0.227)	(0.236)	(0.252)
Agrarian reform index	-0.791**	-0.751**	-0.748**
	(0.329)	(0.341)	(0.332)
Land gini	-7.605***	-5.748**	-4.864*
	(2.208)	(2.528)	(2.672)
Right wing % votes			0.311
			(0.603)
Log total votes			-0.121
			(0.088)
Log (unskilled / total workers)			-0.098
			(0.084)
Log total workers			-0.212
			(0.171)
Region fixed effects	Yes	Yes	Yes
Geographic controls	No	Yes	Yes
Counties	188	182	182
R^2	0.382	0.410	0.432

Source: Authors' estimations.
Notes: Robust standard errors in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. All regressions include a constant term.

In all, results so far imply that, as expected, the distortions in operation under the pre-1975 tariffs structure had a significant impact on the cross-sectional growth rates of agricultural output: after the trade liberalization reforms, counties with initial negative ERPs grew faster than counties with an ERP of 0 and counties

with positive ERPs grew slower than counties with an ERP of 0, thus suggesting that reducing distortions imposed by the complex pre-reform tariffs structure might have led to a better allocation of resources in agricultural production.

4.3 Effects on Inputs Use, Productivity, and Specialization

Now we study the impact of trade liberalization on several other margins. In table 6, we analyze the impacts on input usage (in particular, labor, land use and tractors, as a proxy for capital use) and then on TFP—as computed using a trans-log production function with constant returns to scale on land, labor, and capital.[18] In columns (1) to (3), we find that the growth rate of labor use does not change significantly for counties with different levels of ERP in the pre-reform period. In the case of land, we find a decrease in land use for counties that were taxed relatively more in the pre-reform period. Valdés and Jara (2007) also document this pattern. In column (3), we find that capital use—tractors—move similarly to the patterns we found for output in table 5. These results suggest that the previous estimates reflect a significant effect on the intensive margin, with shifts in the use of both land and capital. Then, in column (4) we present regressions for the log change of TFP and, interestingly, we find that in the case of initially taxed counties, there was a significant TFP increase after the trade reforms and, therefore, an important part of the change in output documented before is related to increases in TFP; while in the case of initially protected counties, the effect is not statistically different from 0, thus suggesting that most of the effects we identify in table 5 for those counties were associated with impacts in the intensive margin and not with productivity effects.

Next, we study how the trade reform affected specialization at the county level. We implement this exercise because, as we discussed above, one of the margins of interest (probably affected by the elimination of trade distortions) is product specialization at the county level. Thus, in table 7 we study two proxies for specialization: (i) the

18. Estimates without imposing CRS yield similar results. See Corbo and Meller (1979) for an application of trans-log production functions for the case of Chilean establishments. A more general description of this function appears in Christensen, Jorgenson and Lau (1973) and Jorgenson (1988), and an application to the agriculture sector in Udry and others (1995).

Hirschman-Herfindahl Index (HHI) of product concentration, and (ii) the maximum share in the subsectors included in the sample at the county level. Columns (1) and (2) present results for both variables. The pattern in this case is not as clear. However, it is interesting to note that the reduced output growth in initially more protected sectors that we documented in table 5 seems to be associated with a higher specialization of productive structure in these counties posterior to the liberalization process. This is an expected consequence of the incentives created by a more open economy.

Table 6. Effects on Input Use and Productivity

	Dependent variable: Δ log y			
	Workers	*Land*	*Capital*	*TFP*
	(1)	*(2)*	*(3)*	*(4)*
Initial negative ERP (α)	0.449	-0.933*	1.430**	1.839***
	(0.679)	(0.546)	(0.629)	(0.527)
Positive value of ERP (β)	-0.671	1.900***	-3.315***	-3.209***
	(0.926)	(0.620)	(1.102)	(0.863)
Initial positive ERP (α + β)	-0.222	0.967*	-1.885*	-1.370
F-test α + β *(p-value)*	0.811	0.068	0.093	0.149
Agrarian reform index	0.511**	0.134	0.453**	-0.349
	(0.204)	(0.234)	(0.217)	(0.289)
Initial land gini	4.484	-2.595	-5.062	-2.085
	(2.809)	(1.598)	(3.214)	(1.985)
Initial log *y*	-0.089	-0.115*	-0.010	-0.008
	(0.108)	(0.067)	(0.092)	(0.095)
Region fixed effects	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes
Counties	182	182	180	182
R^2	0.540	0.430	0.483	0.178

Source: Authors' estimations.
Notes: Robust standard errors in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. TFP stands for Total Factor Productivity.

Table 7. Effect on Input Use and Specialization

	Dependent variable: Δ log y				
	HHI	*Specialization*	*Plot size*	*Land Gini*	*Number of exploitations*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Initial negative ERP (α)	0.472	0.965	-1.041*	-0.056**	0.587*
	(0.301)	(0.600)	(0.612)	(0.026)	(0.353)
Positive value of ERP (β)	2.814***	1.069	0.141	-0.040	-1.105*
	(0.422)	(0.964)	(0.807)	(0.051)	(0.620)
Initial positive ERP (α + β)	3.286***	2.034*	-0.900	-0.096*	-0.518
F-test α + β *(p-value)*	0.000	0.066	0.338	0.092	0.473
Agrarian reform index	-0.283**	-0.319*	-1.388***	-0.006	0.486***
	(0.113)	(0.171)	(0.347)	(0.007)	(0.165)
Initial land gini	-2.708***	4.342	-2.759	-0.046	1.439
	(1.000)	(2.811)	(2.206)	(0.168)	(1.589)
Initial log *y*	-2.124***	-0.599*	-0.000***		-0.013
	(0.240)	(0.316)	(0.000)		(0.067)
Region fixed effects	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes
Counties	188	188	188	188	188
R^2	0.641	0.353	0.332	0.328	0.191

Source: Authors' estimations.
Notes: Robust standard errors in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. All regressions include a constant term. HHI: Herfindahl-Hirschman Index, a measure of output concentration by sector.

Finally, the trade reform could affect another margin: the size and concentration of landholdings and the number of different agricultural firms (exploitations). This is expected as the decrease in distortions may change the marginal return to consolidate plots for agricultural production. We study this hypothesis in columns (3) through (5) in table 7. In both cases we find that, in counties that were initially more taxed, both the average size of plots and the Gini index for land concentration decreased significantly. Consistently, the number of agricultural exploitations follows the opposite pattern

through the post-reform period: counties that were initially more taxed, present post-reform increases in the number of agricultural firms, a development that is not observed for counties that were initially protected more.

These results probably reflect the changes in incentives that trade openness creates: while in the pre-liberalization period—with negative ERPs—the land value for agriculture use was very low; landowners tended to use land for other purposes that needed big shares of the land to be profitable (see, for instance, Robinson and Baland, 2008). Through the liberalization period, the decrease in negative ERPs produced changes in the extensive and intensive margins that, on average, decreased the size of the agricultural production and land concentration.[19]

5. Conclusions

The economic liberalization abruptly implemented in Chile during the 1970s offers a unique opportunity to study the impact of this process on several economic outcomes at the local level. We take advantage of the initial differences in agricultural production and specialization patterns across counties, and the different levels of effective rates of protection across sectors in order to construct a measure of tariff-related price distortions before trade liberalization took place. Then, we use the fact that effective rates of protection were dropped across different sectors to a low and uniform tariff structure to estimate how this process affected several economic outcomes across counties.

Besides contributing with the construction of a panel dataset of counties over a period of 50 years—primarily by merging different datasets related to one of Chile's most important economic sectors—we find, in line with the previous literature, that trade liberalization affected counties differently in several economic outcomes. Agricultural output grew faster in counties that were relatively more taxed in the pre-reform period, probably by allowing expansions on the extensive margin, but also more product specialization and a more efficient allocation of resources, which is reflected in increases in TFP in these counties. Conversely, we find that counties that

19. Notice that we are already controlling for the intensity of the agrarian reform at the county level in these regressions in order to rule out its effect on these outcomes.

were relatively more protected in the pre-reform period grew slower through the post-reform period, which seems to be related mostly to changes in the intensive margin and not to productivity effects. These results not only contribute to different parts of the existing literature of the economic effects of liberalization, but also shed light on Chile's growth path during the last fifty years, mainly by analyzing trends across counties exposed differently to one of Chile's most emblematic economic policies of the past decades.

These results are relevant in terms of understanding the effects of economic policies such as trade liberalization on economic development, even though a number of questions remain open in two lines: First, we still need a better understanding of the economic mechanisms through which the effects we estimated were caused. Second, and related to Topalova (2010) and other papers, we also need more evidence on the impact of trade liberalization on broader development measures such as poverty and inequality, among others. While Topalova (2010) finds that labor immobility played a relevant role in explaining the increase that the Indian tariff reform caused on poverty in certain regions, it might be the case that the Chilean reform had different impacts on poverty in counties that were harmed by the reform (i.e. initially protected counties), mostly due to the fact that the Chilean economy operates under a more flexible structure. Both of these are relevant topics for future research.

References

Álvarez, R. and J.R. Fuentes. 2003. "Trade Reforms and Manufacturing Industry in Chile." Working Paper 210, Central Bank of Chile.

Balassa, B. 1971. *The Structure of Protection in Developing Countries.* Baltimore, MD: Johns Hopkins Press.

Behrman, J. 1976. *Foreign Trade Regimes and Economic Development: Chile*. Washington, DC: National Bureau of Economic Research.

Beyer, H., P. Rojas, and R. Vergara. 1999. "Trade Liberalization and Wage Inequality." *Journal of Development Economics* 59(1): 103–23.

Bosworth, B., R. Dornbusch, and R. Labán (eds.) 1994. *The Chilean Economy: Policy Lessons and Challenges*. Washington, DC: Brookings Institution Press.

Bruhn, M. and F. Gallego. 2012. "Good, Bad, and Ugly Colonial Activities: Do They Matter for Economic Development?" *Review of Economics and Statistics* 94(2): 433–61.

Christensen, L., D. Jorgenson, and L. Lau. 1973. "Transcendental Logarithmic Production Frontiers." *Review of Economics and Statistics* 55(1): 28–45.

Coeymans, J. 1978. "Foreign Trade Liberalization and its Effects on Employment." Working Paper 59, Instituto de Economía, Pontificia Universidad Católica de Chile.

————. 1999. "Determinantes de la Productividad en Chile." *Latin American Journal of Economics* 36(107): 597–637.

Corbo, V. 1985. "Reforms and Macroeconomic Adjustments in Chile during 1974–1984." *World Development* 13(8): 893–916.

————. 1997. "Trade Reform and Uniform Import Tariffs: The Chilean Experience." *American Economic Review* 87(2): 73–7.

Corbo, V., L. Hernández, and F. Parro. 2005. "Institutions, Economic Policies, and Growth: Lessons from the Chilean Experience." Working Paper 317, Central Bank of Chile.

Corbo, V., R. Lüders, and P. Spiller. 1995: "The Institutional Foundations of Economic Reforms: The Case of Chile." Unpublished manuscript, Instituto de Economía, Pontificia Universidad Católica de Chile.

Corbo, V. and P. Meller. 1979. "The Translog Production Function: Some Evidence from Establishment Data." *Journal of Econometrics* 10(2): 193–9.

Corbo, V., J. Tybout, and J. De Melo. 1991. "The Effects of Trade Reforms on Scale and Technical Efficiency: New Evidence from Chile." *Journal of International Economics* 31(3): 231–50.

De la Cuadra, S. 1974. "La Protección Efectiva en Chile." Working Paper 22, Instituto de Economía, Pontificia Universidad Católica de Chile.

Díaz, J., G. Wagner, and R. Lüders. 2010. "La República en Cifras 1810-2000." Unpublished manuscript, Pontificia Universidad Católica de Chile.

Dornbusch, R. and S. Edwards. 1994. "Exchange Rate Policy and Trade Strategy." In *Chilean Economy: Policy Lessons and Challenges*, edited by B.P. Bosworth, R. Dornbusch, and R. Labán. Washington, DC: Brookings Institution Press.

Edmonds, E., N. Pavcnik, and P. Topalova. 2010. "Trade Adjustment and Human Capital Investments: Evidence from Indian Tariff Reform." *American Economic Journal: Applied Economics* 2(4): 42–75.

Edwards, S. and A. Edwards. 1991. *Monetarism and Liberalization: The Chilean Experiment.* Chicago, IL: University of Chicago Press.

Edwards, S. and Daniel Lederman. 1998. "The Political Economy of Unilateral Trade Liberalization: The Case of Chile." NBER Working Paper 6510.

Ffrench-Davis, R. 1973: *Políticas Económicas en Chile 1952-1970*. Santiago: Ediciones Nueva Universidad.

Fuentes, J.R., K. Schmidt-Hebbel, and M. Larraín. 2006. "Sources of Growth and Behavior of TFP in Chile." *Latin American Journal of Economics* 43(127): 113–42.

Gallego, F. 2012. "Skill Premium in Chile: Studying Skill Upgrading in the South." *World Development* 40(3): 594–609.

Goldberg, P. and N. Pavcnik. 2007. "Distributional Effects of Globalization in Developing Countries." *Journal of Economic Literature* 45(1): 39–82.

Hachette, D. 2011. *Latinoamérica en el Siglo XX.* Santiago: Ediciones UC.

Harberger, A. 1959. "Using the Resources at Hand More Effectively." *American Economic Review* 49(2): 134–46.

————. 1985. "Observations on the Chilean Economy 1973-1983." *Economic Development and Cultural Change* 33(3): 451–62.

————. 1991. "Towards a Uniform Tariff Structure." Unpublished manuscript, University of Chicago.

Hirschman, A. 1968. "The Political Economy of Import-Substituting Industrialization in Latin America." *Quarterly Journal of Economics* 82(1): 1–32.

Hurtado, H., E. Muchnik, and A. Valdés. 1990. "Trade, Exchange Rate, and Agricultural Pricing Policies in Chile." The Political Economy of Agricultural Policies, World Bank Comparative Studies, World Bank, I and II.

Jara, E. and A. Valdés. 2007. "Distortions to Agricultural Incentives in Chile." Working Paper 48391, Agricultural Distortions, World Bank.

Jorgenson, D. 1988. "Productivity and Postwar US Economic Growth." *Journal of Economic Perspectives* 2(4): 23–41.

Khandelwal, A. and P. Topalova. 2011. "Trade Liberalization and Firm Productivity: The Case of India." *Review of Economics and Statistics* 93(3): 995–1009.

Lederman, D. 2005. "*The Political Economy of Protection: Theory and the Chilean Experience.*" Stanford University Press.

McCaig, B. 2011. "Exporting out of Poverty: Provincial Poverty in Vietnam and U.S. Market Access." *Journal of International Economics* 85(1): 102–13.

Pardo, A. and P. Meller. 2002. "El Rol de las Exportaciones en el Crecimiento Económico Regional." Unpublished manuscript, Universidad de Chile.

Pavcnik, N. 2002. "Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants." *Review of Economic Studies* 69(1): 245–76.

Prebisch, R. 1950. *The Economic Development of Latin America and its Principal Problems.* ECLAC, United Nations.

————. 1963. *Towards a Dynamic Development Policy for Latin America*. ECLAC, United Nations.

Robinson, J. and J. Baland. 2008. "Land and Power: Theory and Evidence from Chile." *American Economic Review* 98(5): 1737–65.

Rojas, P., E. López, and S. Jiménez. 1997. "Determinantes del Crecimiento y Estimación del Producto Potencial en Chile: El Rol del Comercio." Working Paper 24, Central Bank of Chile.

Schmidt-Hebbel, K. 2006. "Chile's Economic Growth." *Cuadernos de Economía* 43 (May): 5–48.

Topalova, P. 2010. "Factor Immobility and Regional Impacts of Trade Liberalization: Evidence on Poverty from India." *American Economic Journal: Applied Economics* 2(4): 1–41.

Udry, C., J. Hoddinott, H. Alderman, and L. Haddad. 1995. "Gender Differentials in Farm Productivity: Implications for Household Efficiency and Agricultural Policy." *Food Policy* 20(5): 407–23.

Varas, J. 1975. "El Impacto de una Liberalización del Comercio en el Sector Agrícola Chileno." *Latin American Journal of Economics* 12: 121–34.