



PARIS SCHOOL OF ECONOMICS
ÉCOLE D'ÉCONOMIE DE PARIS

WORKING PAPER N° 2007 - 50

**Trade integration in manufacturing:
the Chilean experience**

Maria Bas

Ivan Ledezma

JEL Codes: F10, F12, F41

Keywords: market access, gravity equations, trade reforms in Chile



PARIS-JOURDAN SCIENCES ÉCONOMIQUES
LABORATOIRE D'ÉCONOMIE APPLIQUÉE - INRA



48, Bd JOURDAN – E.N.S. – 75014 PARIS
TÉL. : 33(0) 1 43 13 63 00 – FAX : 33 (0) 1 43 13 63 10
www.pse.ens.fr

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE – ÉCOLE DES HAUTES ÉTUDES EN SCIENCES SOCIALES
ÉCOLE NATIONALE DES PONTS ET CHAUSSÉES – ÉCOLE NORMALE SUPÉRIEURE

Trade integration in manufacturing: the Chilean experience

Maria BAS and Ivan LEDEZMA ^{*†}

October 17, 2007

Abstract

Using bilateral trade flow data from 1979 to 1999, we estimate trade integration between Chile and its principal trading partners during the period (European Union, United States and Latin America). Our estimates are based on a gravity specification, theoretically grounded on a monopolistic competition framework with increasing returns. Trade barriers are measured following the border effect methodology by comparing inter-national imports to intra-national ones. Our results are consistent with the agenda of trade integration followed by Chile. Moreover, trade integration turns out to be heterogeneous across industries and over the time. We also find asymmetries between export and import oriented policies. All these features are usually missing when one uses direct measures of trade policies.

Keywords: Market Access, Gravity Equation, Trade Reform in Chile.

JEL Classification: F10, F12 and F41

*We are grateful to Jose Miguel Benavente and Thierry Mayer for helpful comments. Usual caveats apply.

[†]PSE joint research unit Cnrs-Ehess-Enpc-Ens, Paris. Email: bas@pse.ens.fr ; ledezma@pse.ens.fr. Postal Address: Pse-Ens, 48 bd Jourdan, 75014 Paris, France. Phone: +33(0)14313 6254.

1 Introduction

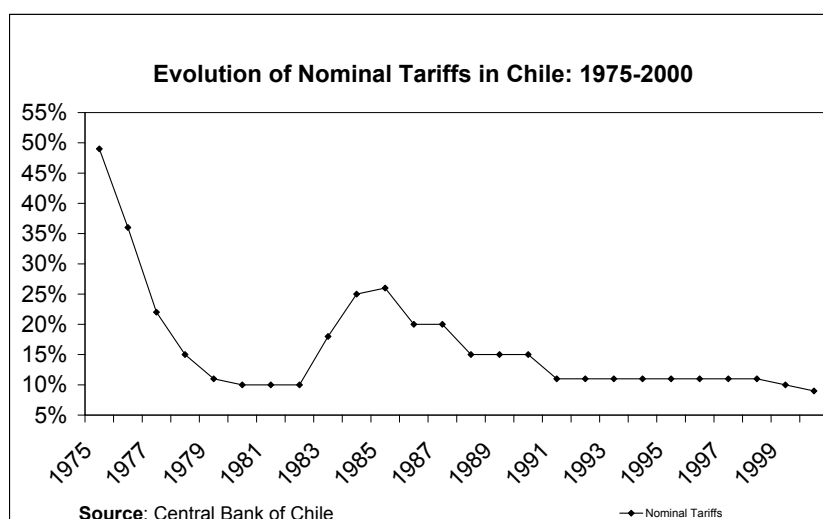
Despite common views of world globalization, the assessments about the level of trade integration of an "open" country reveal contrasted results (Anderson and van Wincoop, 2004). The reason is that trade costs involve not only direct policies such as tariffs, non-tariff barriers and exchange rates, but also more indirect integration policies like insurance, infrastructure, informational networks, enforcement laws and property rights. The picture becomes still more complex if language, preferences and tastes are taken into account to encompass a potential home bias in consumption. In this context, the standard use of tariff data or aggregate trade ratios turns out to under exploit well known international examples of trade integration.

The Chilean experience is one of these examples. Chilean dictatorship in power from 1973 to 1990, implemented a deep package of market reforms concerning every economic field. Among them, trade liberalization took place in the second half of seventies. Since the beginning of the military government, all trade barriers and restrictions to trade were removed. Average nominal tariff decreased gradually from 98% in 1973 to 10% in 1979 (Figure 1). Specially during '90s, Chilean government further achieved its commitment to promote trade by pursuing several trade agreements with different countries and regions (Table 1) including almost all Latin American countries, the United States (US), the European Union (EU) and also Asian countries in recent years. However, if one looks at nominal tariffs, after the middle of '80 the picture depicts a flat evolution, which in addition is almost homogeneous across industries. This picture documents the quite radical unilateral trade liberalization in late '70s, but it hides important policy efforts to boost exports and the international political integration obtained after the transition to democracy. On the other hand, aggregated trade flows will not be a plausible measure because of its lack of detail and the bias induced by "exogenous" shocks on productivity and demand sides.

This paper aims at getting deeper insights of the Chile's integration strategy by disentangling two elemental dimension of trade: export and import oriented policies. By the means of bilateral industry-level trade data of Chile and its main trading partners in manufacturing (European Union, the United States and Latin America), we measure the evolution of market access across industries in both direction of trade. Since the strategy of Chilean government was to set a combination of trade policies, we should be able to capture the effect of the full set of barriers faced by Chilean exporters to access foreign markets and also the one faced by Chilean partners to reach the domestic market. This also means the identification of potential asymmetries in policy protection and their evolution. The methodology stemming from the empirical literature of border effect fits these requirements.

This methodology makes use of gravity equations and provides a measure of international trade integration by considering, as a very intuitive benchmark, the market access of domestic producers reaching domestic (intra-border) destinations. Consider for instance

Figure 1: Nominal Tariffs



two countries. If, after crossing the national border, producers face no additional barriers to trade than those already present in the national market, both countries will be considered as completely integrated. The pioneer work of McCallum (1995) uses this strategy along with detailed intra-national trade data to study the market access between Canada and the US. Despite of their high expected trade integration, trade between US and Canada is found to be around 22 times more difficult than Canadian intra-national trade.

Such assessment, of course, should be done keeping everything else equal. Anderson and van Wincoop (2003) have demonstrated that the lack of theoretical foundation might lead to a bias on the estimated border effects. Namely, omitted variables concerning multilateral price indexes would have induced an upward bias in McCallum (1995) estimates, though the "corrected" border effect still remains important in regard of direct trade cost measures between both countries. In order to identify a set of determinants of trade that we should control for, we follow Fontagné, Mayer and Zignago (2005) and Head and Mayer (2001) specification based on a Dixit and Stiglitz (1977) monopolistic framework with increasing returns as in Krugman (1980). Their theoretically grounded gravity equation relies on Wei (1996) strategy to solve the problem of the lack of information on internal national flows by simply considering production minus exports. By using this specification we stay as close as possible to theory and keep a nice feature of border effect literature: the measure of eventual asymmetries in protection. Since in this paper we focus on disentangling export and import barriers, the rigorous exercise of general equilibrium comparative statics of Anderson and van Wincoop (2003) is less convenient for our purpose as it assumes symmetry in trade costs across countries.

Previous studies concerning Chilean integration have mainly focused on macro-economic and welfare effects of trade agreements using general equilibrium models (Harrison, Rutherford and Tarr (2003); Chumacero, Fuentes and Schmidt-Hebbel (2004); Cabezas (2003)). Among the exceptions using a gravity approach, Nowak-Lehman, Herzer and Vollmer (2007) analyze the impact of trade agreements between Chile and the EU on the structure of exports and predict important export expansion on foods industries (mainly fish, fruits and beverages). Our contribution to this literature consists of providing an assessment of the evolution of trade integration at the industry level considering *all* barriers to trade. By doing so, we obtain measures of Chilean trade integration presenting heterogeneity across sectors and over the time.

The rest of the paper is organized as follows. In Section 2 the estimation strategy is presented. Section 3 presents the database used in the estimations. Section 4 discusses the main results of border effects estimations at national and also at industry level. Section 5 concludes.

2 Methodology and Data

2.1 Estimation strategy

Several empirical applications of gravity equations have been proposed in the literature. We are particularly interested in those comparing intranational trade flows (within a country) to international trade flow (between countries). We follow the methodology of Fontagné, Mayer and Zignago (2005) based on Head and Mayer (2001) gravity model derivation. This methodology seems suitable to measure Chilean trade integration as it corrects for the lack of theoretical foundations of earlier works, keeping the intuitive strategy of using intra-national trade as a benchmark of trade integration. Let us consider a CES utility function in which the (representative) consumer of country i has specific preferences for each variety h depending on the country of origin j (the exporter).

$$U_i = \left[\sum_{j=1}^N \sum_{h=1}^{M_j} (a_{ij} c_{ijh})^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

Where $\sigma > 1$ is the constant elasticity of substitution among domestic and foreign differentiated varieties. This standard CES formulation, implies an expenditure in imports from country j with the form:

$$m_{ij} = c_{ij} p_{ij} = \left(\frac{p_{ij}}{a_{ij} P} \right)^{1-\sigma} M_j Y_i \quad (1)$$

Since varieties belonging to the same country share the same weight in the utility function we just drop the h subscript and consider the whole set of $K = \sum_{j=1}^N M_j$ international varieties. Imports are valued at the point of consumption (in c.i.f) $p_{ij} = p_j \tau_{ij}$ and include the producer price (in f.o.b.) p_j augmented of all transaction costs related to trade, modeled as iceberg costs τ_{ij} . Total expenditure of country i equals its income $Y_i = \sum_{k=1}^K m_{ik}$ and considers all imports, including intra-national ones. This gravity-like equation in (1) summarizes in $P = \left[\sum_{k=1}^K \left(\frac{p_{ik}}{a_{ik}} \right)^{1-\sigma} M_k \right]^{\frac{1}{1-\sigma}}$ the consumer prices of all varieties.

This index allows us to introduce Anderson and van Wincoop (2003) critics about the absence of theoretical foundations and the assumption of identical prices across countries. P is a multilateral variable that takes into account asymmetries across countries in price setting, namely size, as well as trade barriers and preferences. If omitted, not only a multilateral control is missing but also a bias is generated between the error term and the border effect dummies. Anderson and van Wincoop (2003) argue that the omission of multilateral price effects (what they call "multilateral resistances") explains the upward bias in border effects of Canada vis-à-vis the US estimated by McCallum(1995).

One might mention four possible strategies to consistently estimate this equation capturing price effects in a theoretical index. The first strategy is to use price index data. Bergstrand (1989) and Baier and Bergstrand (2001) follow this strategy measuring prices with GDP deflators. However, as highlighted by Anderson and van Wincoop (2004), empirical counterparts of P such as CPIs measures neglect changes in the true set of varieties and do not accurately reflect non tariff barriers and indirect trade policies.

The second strategy is the one followed by Anderson and van Wincoop (2003). They develop a method using estimated border effects to measure price effects. This estimation strategy is based on two steps. The first one consists in the estimation of the gravity equation using a non-linear least squares estimator to obtain the parameters. In the second step, they remove border barriers and calculate the change in bilateral trade flows to determine the impact of national borders on trade flows. Besides practical difficulties of implementation¹, one crucial limitation for our purposes, as we previously explained, is the assumption of symmetry in bilateral trade costs.

The third approach is to use fixed effects specification to measure unobservable prices. Price indexes are considered as unobservable variables and they are measured as the coefficients of individual fixed effects related to source and destination (Harrigan, 1996; Hummels 1999). Feenstra (2003) shows that the coefficients of fixed effects estimation

¹One should implement a routine in which at each iteration the sum of square residuals of the gravity equation are minimized, solving simultaneously the estimation of trade cost at each stage and computing the multilateral prices index

are consistent and present values very similar to the non-linear least squares estimation. Nevertheless, this method requires data of trade flows between all provinces of Chile and the full list of countries, information which is now unavailable.

An additional strategy is to eliminate the price index in equation (1) by expressing inter-national imports m_{ij} , relative to intra-national ones m_{ii} . This is what Head and Mayer (2001) do. Under monopolistic competition and symmetric technology, quantities are symmetric at the equilibrium and the number of firms of each country is obtained by simply dividing output value v_j by firm output value: $M_j = \frac{v_j}{qp_j}$. Considering $p_{ij} = p_j \tau_{ij}$, equation (1) can be written as:

$$\frac{m_{ij}}{m_{ii}} = \left(\frac{a_{ij}}{a_{ii}} \right)^{\sigma-1} \left(\frac{p_j}{p_i} \right)^{-\sigma} \left(\frac{\tau_{ij}}{\tau_{ii}} \right)^{1-\sigma} \left(\frac{v_j}{v_i} \right) \quad (2)$$

To obtain an empirical counterpart of this gravity equation, Fontagné, Mayer and Zignago (2005) state, as usually, that trade costs (τ_{ij}) are composed by distance (d_{ij}) (related to transport costs), advalorem tariffs (t_{ij}) and "tariff equivalent" of non tariff barriers (NTB_{ij}).

$$\tau_{ij} p_j \equiv d_{ij}^{\delta} (1 + t_{ij}) (1 + NTB_{ij}) p_j.$$

The structure of protection varies across all partner pairs and depends on the direction of the flow for a given pair. To capture this protection framework, taking the example of the US as trade partner, the following dummy structure is defined:

$$(1 + t_{ij}) (1 + NTB_{ij}) \equiv \exp [\eta US_CHL_{ij} + \gamma CHL_US_{ij}]$$

Where US_CHL_{ij} is a dummy variable set equal to 1 when j is Chile and i is the US (related to imports of the US from Chile). Similarly, CHL_US_{ij} is a dummy variable set equal to 1 when j is the US and i is Chile (imports of Chile from the US).

Preferences a_{ij} are composed by a random component e_{ij} and a coefficient β_i , representing a systematic preference for goods produced in the home country. This "home market bias" is reduced to $(\beta_i - \lambda)$ when the countries share the same language ($L_{ij} = 1$):

$$a_{ij} \equiv \exp [e_{ij} - (\beta_i - \lambda L_{ij}) (US_CHL_{ij} + CHL_US_{ij})]$$

Combining the previous equations and adding the subscript s for variables that will be used at the industry level, the following estimable equation is obtained:

$$\begin{aligned} \ln \left(\frac{m_{ijs}}{m_{iis}} \right) &= \ln \left(\frac{v_{js}}{v_{is}} \right) - (\sigma - 1) \delta \ln \left(\frac{d_{ij}}{d_{ii}} \right) + (\sigma - 1) \lambda L_{ij} - \sigma \ln \left(\frac{p_j}{p_i} \right) \\ &\quad - (\sigma - 1) [\beta_i + \eta] US_CHL_{ij} - (\sigma - 1) [\beta_i + \gamma] CHL_US_{ij} \\ &\quad + \epsilon_{ij} \end{aligned} \quad (3)$$

Where $\epsilon_{ij} = (\sigma - 1)(e_{ij} - e_{ii})$. Hence, the ratio of bilateral trade flows over intranational trade flows in the industry s $\left(\frac{m_{ijs}}{m_{iis}}\right)$ is explained by a list of observable variables: the relative value added of partners in the industry $\left(\frac{v_{js}}{v_{is}}\right)$, their relative distance $\left(\frac{d_{ij}}{d_{ii}}\right)$, the relative prices at national level $\left(\frac{p_j}{p_i}\right)$ and a dummy to indicate if the pair (i, j) share the same language (L_{ij}) . The part of missing trade not explained by these determinants is attributed to the fact that the exchanges take place between two particular and different nations. In that sense, the border effects coefficients reveal all market access difficulties for each specific trade flow. Other than "standard" trade policies, these difficulties might reflect consumers' preferences for domestic goods relative to foreign ones ("home market bias"). As long as the latter might be interpreted, at least in part, as the outcome of history and political efforts, we consider them as a part of the measure of trade integration.

In the regressions, we drop the constant and incorporate both dummy variables, each for one direction of trade flows. Thus, their coefficients can be directly interpreted as the border effect of each combination. For example, the exponential of the coefficient of US_CHL_{ij} multiplied by -1, $\exp((\sigma - 1)[\beta_i + \eta])$ indicates the difficulty for Chilean exporters in accessing US markets.

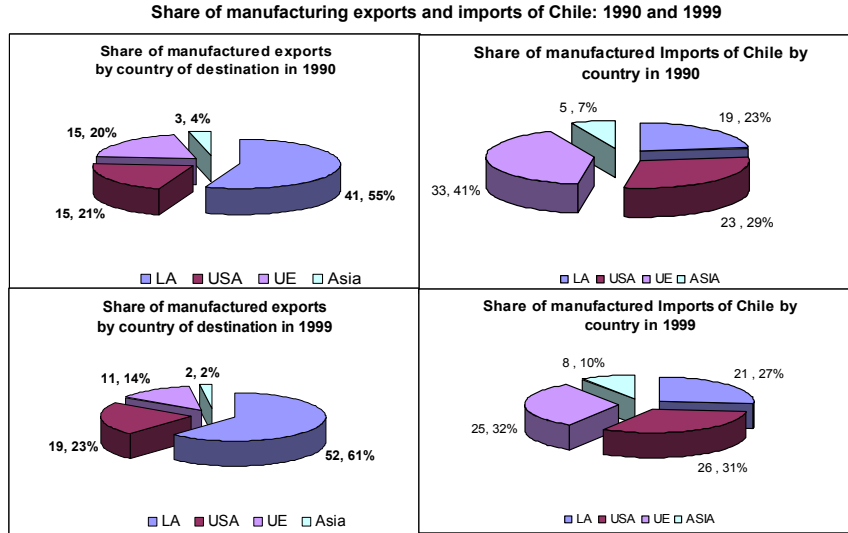
As Fontagné, Mayer and Zignago (2005) we use aggregate prices to address the possible endogeneity problem that might arise in the estimation of equation (3). This endogeneity issue is associated to the simultaneity in the determination of prices and output in a monopolistic competition framework. Prices at national level should be less likely correlated with profit maximization at the industry level. We also consider relative wages at the industry level. This alternative measure of relative prices is used to control for potential asymmetries in technology. More productive industries are expected to have lower border effects. We also run regressions using lagged values of relative value added and relative prices to reduce the risk of correlation between both sides of equation(3) in the nominal valuation of flows.

In the estimation of equation (3) we should consider a representative set of countries trading with Chile. Looking at the aggregated trade flow data of the Economic Commission for Latin America and the Caribbean (ECLAC) between 1990 and 1999, the main destination of Chilean manufacturing exports are Latin America (AL), the United States (USA) and the European Union (UE) (Figure 2). The graph also shows that, during the same period, most manufacturing imports of Chile came from these countries.

2.2 Data

Use is made of the Trade and Production Database constructed by CEPII. The main source is the Trade and Production Database constructed by Nicita and Olarreaga (2001) at the World Bank. Since this database presents many missing values for production

Figure 2: Chilean manufacturing trading partners



variables in recent years, the CEPII has extended it using production variables of UNIDO and OECD STAN for OECD members. They have also completed trade data with their international trade database BACI. The final dataset provides information on value added, export and import trade flows, origin and destination countries, wages and labour at the 3-digit industry level (ISIC Rev-2) over the period 1976-1999 for 67 developing and developed countries. Price indexes stem from Penn World Table as price level of GDP expressed relative to United States.

Detailed intranational trade flows for our sample of countries is not available. Following Wei(1996), intra-national trade is computed as output minus exports. This requires an appropriate measure of internal distance that should take into account economic activity to weight internal regions. For distance variables, contiguity and common language, we use the CEPII database of internal and external distances. The CEPII use specific city level data in order to compute a matrix of distance including the geographic population density for each country. Similarly, distance between two countries are measured based on bilateral distance between cities weighted by the share of the city in the overall country's population.

At the end the data is available for nine members of the European Union throughout the whole period 1979-1999 (Germany, France, Great Britain, Italy, Belgium, Luxembourg, Ireland, Netherlands and Denmark) and for six Latin American partners (Bolivia,

Argentina, Brazil, Mexico, Uruguay and Venezuela)

3 Estimation results

Equation 3 is estimated at the country level (all manufacturing) and also splitting the sample by industries. Firstly, we analyze the aggregated evolution of Chilean trade integration. We run pooled regressions and estimate border effects over all industries and years and also within different periods. Secondly, we go to the detail of the 2 digit industry level to explain differences in the degree of trade openness across sectors. From this estimation we obtain the global border effect measure for each industry as a weighted average of all trading partners.

3.1 Border effects at the national level

Table 1 presents the results across all industries and years. All regressions are run using OLS and Hubert and White standard errors to control for the correlation in the error term in (3). Column [1] reports regressions using current values of independent variables and aggregated prices. As predicted by the theory, the coefficient on relative value added is significant, positive and relatively closed to one. The coefficient on relative prices is significant and negative. However as usually in this kind of exercise, its value is smaller than the expected elasticity of substitution. The effect of contiguity is also significant and positive indicating that having a common border facilitates trade. Surprisingly, the coefficient of the dummy variable indicating whether the partners share a common language is negative. This can be explained by the countries present in the sample. Relative to Latin American countries, those sharing the Spanish language, the EU and the US represent important international flows that might offset the effect of language.

In column [2] we use relative wages at the industry level instead of relative price at national level. In the monopolistic competition framework relative prices equals relative wages. More importantly wages take into account labour productivity differentials among partners. Their effect turns out to be similar to relative prices but with a lower coefficient that might reflect labour market asymmetries. Column [3] in Table 1 introduces the lag of relative value added and relative prices to address potential correlation between both sides of the equation steaming from the valuation of nominal trade flows and output. Results remain almost unchanged. A Similar conclusion can be obtained from column [4], which considers lagged relative wages.

Table 1: Border Effects at the country level (all manufacturing industries)

	[1]	[2]	[3]	[4]
Rel. VA	0.822*** (0.007)	0.829*** (0.007)		
Rel Price	-1.012*** (0.066)			
Rel Wage		-0.742*** (0.013)		
Rel.VA (t-1)			0.815*** (0.008)	0.819*** (0.007)
Rel Price (t-1)			-1.122*** (0.068)	
Rel Wage (t-1)				-0.743*** (0.012)
Rel Distance	-0.827*** (0.025)	-0.776*** (0.025)	-0.819*** (0.026)	-0.754*** (0.026)
contiguity	0.876*** (0.035)	0.990*** (0.036)	0.890*** (0.037)	1.035*** (0.038)
Language	-0.350*** (0.033)	-0.360*** (0.029)	-0.355*** (0.035)	-0.355*** (0.030)
UE_CHL	-5.386*** (0.138)	-5.783*** (0.131)	-5.190*** (0.146)	-5.582*** (0.138)
CHL_UE	-4.239*** (0.124)	-4.269*** (0.112)	-4.079*** (0.128)	-4.224*** (0.115)
USA_CHL	-4.061*** (0.114)	-4.399*** (0.105)	-4.071*** (0.116)	-4.381*** (0.106)
CHL_USA	-3.897*** (0.113)	-3.822*** (0.105)	-3.828*** (0.118)	-3.860*** (0.110)
UE_UE	-2.723*** (0.054)	-2.836*** (0.054)	-2.744*** (0.057)	-2.893*** (0.057)
AL_CHL	-5.120*** (0.092)	-4.946*** (0.093)	-4.944*** (0.096)	-4.828*** (0.097)
CHL_AL	-4.765*** (0.103)	-5.200*** (0.099)	-4.622*** (0.107)	-5.099*** (0.102)
AL_AL	-5.347*** (0.079)	-5.663*** (0.077)	-5.276*** (0.083)	-5.674*** (0.081)
UE_AL	-5.020*** (0.120)	-5.609*** (0.110)	-5.141*** (0.126)	-5.726*** (0.115)
AL_UE	-4.774*** (0.098)	-4.913*** (0.088)	-4.679*** (0.103)	-4.945*** (0.092)
AL_USA	-4.508*** (0.091)	-4.403*** (0.081)	-4.359*** (0.095)	-4.406*** (0.084)
USA_AL	-3.752*** (0.095)	-4.738*** (0.085)	-3.856*** (0.099)	-4.811*** (0.087)
UE_USA	-2.878*** (0.092)	-2.744*** (0.093)	-2.873*** (0.096)	-2.775*** (0.097)
USA_UE	-2.685*** (0.070)	-2.883*** (0.068)	-2.703*** (0.072)	-2.938*** (0.071)
Number of Obs	53278	63073	47843	57861
Adjusted R-Sq.	0.912	0.911	0.912	0.911

Note: Huber White Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The coefficients of border effects estimates indicate that, on average, during the period 1979-1999 Chilean exporters faced higher barriers to enter the European Union than the barriers faced by European's exporters to sell in Chilean markets (5.386 versus 4.30). A similar asymmetry is founded in flows regarding the US (4.061 against 3.897). These first

results indicate that, on average, Chilean exporters experienced more difficulties to access foreign markets in the period than their partners. The larger border effect found in the case of Latin American countries illustrate that distance, language and contiguity are not the only source of barriers. Although higher, these estimates are in line with those found by Fontagné, Mayer and Zignago (2005) for the US and the EU. Inside the EU trade is reduced by a factor of 14.87 ($\exp(2.73)$, column [1]) when crossing the border of European nations.

Table 2: The evolution of Border Effects at the country level

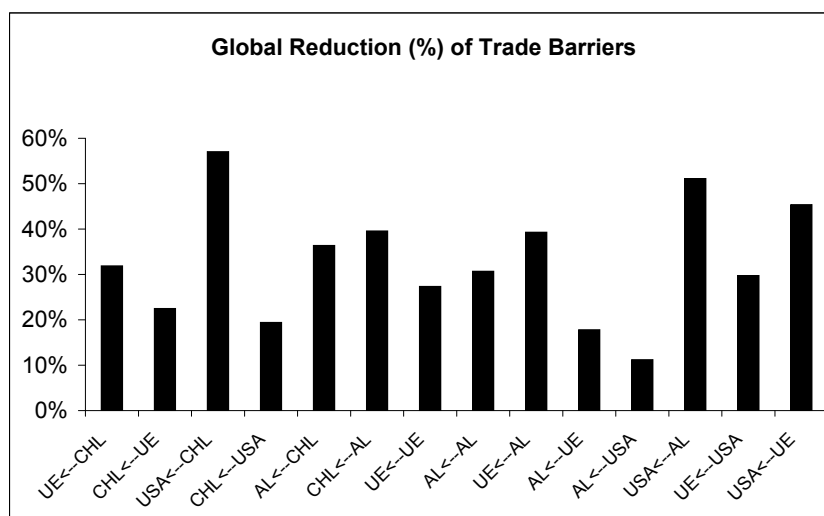
	[79-82]	[83-86]	[87-90]	[91-94]	[95-99]
Rel. VA	0.793*** (0.018)	0.835*** (0.016)	0.822*** (0.015)	0.834*** (0.017)	0.832*** (0.015)
Rel Wage	-0.905*** (0.073)	-0.855*** (0.017)	-0.471*** (0.071)	-0.435*** (0.059)	-0.301*** (0.044)
Rel. Distance	-0.651*** (0.070)	-0.691*** (0.054)	-0.701*** (0.050)	-0.868*** (0.052)	-0.921*** (0.048)
Contiguity	1.014*** (0.084)	0.995*** (0.081)	1.068*** (0.078)	0.983*** (0.074)	0.779*** (0.070)
Language	0.028 (0.064)	-0.061 (0.066)	-0.144** (0.065)	-0.234*** (0.067)	-0.315*** (0.051)
UE_CHL	-6.617*** (0.366)	-6.663*** (0.297)	-5.871*** (0.281)	-4.497*** (0.280)	-4.507*** (0.264)
CHL_UE	-4.844*** (0.323)	-5.021*** (0.246)	-5.048*** (0.254)	-4.113*** (0.251)	-3.754*** (0.208)
USA_CHL	-6.491*** (0.379)	-5.604*** (0.237)	-4.009*** (0.203)	-3.248*** (0.209)	-2.787*** (0.180)
CHL_USA	-4.185*** (0.296)	-4.433*** (0.220)	-4.815*** (0.259)	-3.627*** (0.233)	-3.372*** (0.187)
UE_UE	-3.273*** (0.140)	-3.057*** (0.116)	-2.996*** (0.111)	-2.483*** (0.117)	-2.378*** (0.114)
AL_CHL	-6.096*** (0.359)	-6.599*** (0.239)	-6.141*** (0.192)	-4.583*** (0.176)	-3.879*** (0.152)
CHL_AL	-6.391*** (0.278)	-6.517*** (0.214)	-5.904*** (0.204)	-4.913*** (0.210)	-3.862*** (0.172)
AL_AL	-7.035*** (0.280)	-6.813*** (0.169)	-6.338*** (0.159)	-5.486*** (0.158)	-4.876*** (0.139)
UE_AL	-6.561*** (0.310)	-6.515*** (0.242)	-5.569*** (0.241)	-4.637*** (0.242)	-3.982*** (0.229)
AL_UE	-5.529*** (0.279)	-5.649*** (0.189)	-5.800*** (0.213)	-4.764*** (0.194)	-4.545*** (0.169)
AL_USA	-4.635*** (0.250)	-5.212*** (0.177)	-5.441*** (0.202)	-4.120*** (0.178)	-4.115*** (0.158)
USA_AL	-6.292*** (0.218)	-5.440*** (0.182)	-4.354*** (0.195)	-3.827*** (0.185)	-3.076*** (0.184)
UE_USA	-3.207*** (0.260)	-3.175*** (0.201)	-3.189*** (0.188)	-2.339*** (0.201)	-2.253*** (0.186)
USA_UE	-3.886*** (0.170)	-3.307*** (0.147)	-3.002*** (0.140)	-2.550*** (0.145)	-2.123*** (0.136)
Number of Obs	9110	12769	13950	11642	15602
Adjusted R-Sq.	0.915	0.915	0.916	0.915	0.912

Note: Huber White Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

One possible explanation of these high average estimates relates with the high protec-

Figure 3: Trade barriers reduction (%), last period versus first



tion of Chilean economy in early '70. To analyze this, Table 2 splits the full sample in five periods. This time, regressions consider wage differentials, the specification in column [2] of Table 1. Clearly trade integration in recent years is higher than their initial level and the average of the period. On the other hand, our first results are confirmed: even though trade has become easier over time, Chile appears as more open to imports from Europe (CHL_UE) than Europe to Chilean exporters (UE_CHL).

A similar asymmetry is found for trade flows with the US until the first half of '80. However, in the last two periods (1987-1999) the US has become more open to Chile than Chile vis-a-vis the US. Regarding Latin American countries trade barriers have evolved almost symmetrically, though the border effects still remain important. In the last period, trade between Chile and a Latin American country of the sample was reduced in average by a factor of 49% ($=\exp(3.9)$) in comparison with intra national trade. Figure 3 summarizes the reduction of border effect during time by comparing the last period to the first one. The most important change in trade integration is found in the US market access for Chilean exporters (USA←←CHL). Trade barriers faced by Chilean producers when reaching American markets have been reduced by around 57%. In addition, considering differences instead of levels highlights asymmetries: Chilean border effects vis-à-vis the US have been reduced only by 19%.

3.2 Border Effects at Industry level

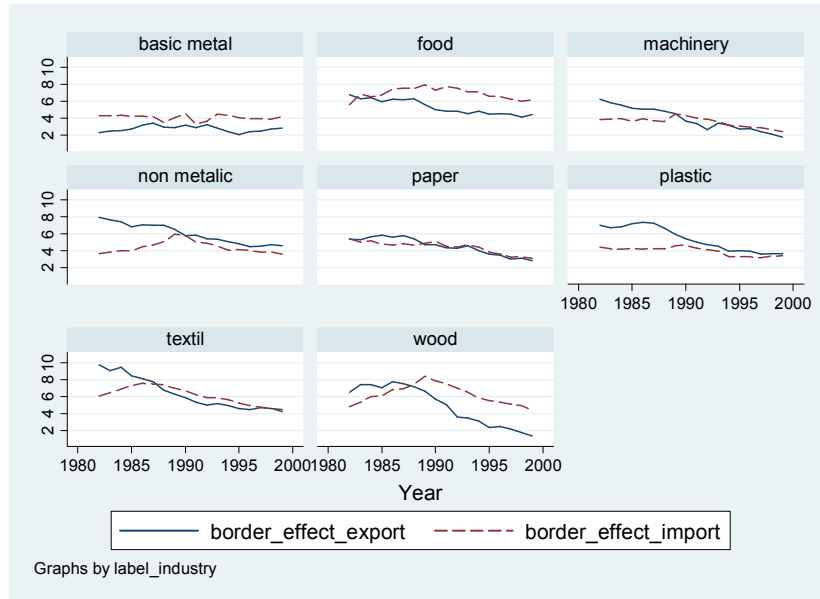
Finally, we estimate border effect at the two digit industry level to observe differences across industry patterns. To take into account the evolution over the full time period we run the regressions using a rolling window of four years. For instance, the border effect of the year 1982 is the estimate of the regression between 1979 and 1982. Figure 4 shows these estimates. All of them are significant, at least at 5%. The dashed line depicts import border effects and the solid one those corresponding to exports. The figure summarizes the weighted average of border effect across partners using their share over total export or imports.

Difficulties of Chilean exporters accessing foreign markets were relatively constant at the beginning of eighties. Reflecting the beginning of the active trade agreements agenda and political integration, most industries switch to a downward trend which is specially pronounced during nineties. This is namely the case of wood, textile, plastic and machinery. Two important exporting industries, basic metals and food, experiment an evolution of export border effects almost flat. The former, however, is the most traditional exporting industry and its trade barriers are already low at the beginning of the period. On the other hand, the rather flat evolution of food exports relative to its consumption within the national border might reflect namely quality controls imposed by EU and the US. Home biases are also likely associated with this type of industry. Once again one observes the extent to which direct measures of trade such as tariffs do not reflect the whole picture of trade policies : export difficulties have considerably diminished in all industries during nineties even if tariffs were already very low.

Figure 4 also shows the evolution of the weighted measure of industry level barriers faced by UE, LA and USA to access Chilean markets (dashed line). In this case, in many industries market access difficulties increased during the first half of eighties (food, textile, wood, non metallic goods and machinery). This seems very consistent with the rise in import tariffs during this period and other discretionary measures to control the current account deficit during the crises. As we consider a moving average this tendency is observed even in late eighties, reflecting a lagged effect of protection.

During nineties, import border effects have been reduced in almost all industries with the exception of basic metals. Tariffs attain a very low level at the beginning of '90s (11%). This is also the decade in which the new strategy of trade integration based on several bilateral and multilateral trade agreements begins. The reduction and convergence of import border effect observed for some industries (machinery, non metallic products, plastic and textiles) seems quite consistent with the agenda of Chilean trade policies.

Figure 4: Border effects at the industry level



4 Conclusion

Using bilateral trade flow data of Chile and its principal trading partners for the period 1979-1999, we have estimated the barriers to trade arising when a producer locates in a foreign nation. Our econometric specification, theoretically grounded in a monopolistic competition framework with increasing returns to scale, search to explain each inter-national import flow relative to intra-national one. The estimates of international trade difficulties are thus relative to those faced by domestic producers reaching domestic consumers.

Results are consistent with the agenda of trade integration followed by Chile. Namely, during nineties the reduction of export barriers estimates have been considerably reduced. This pro-active strategy implies asymmetries between the rapid evolution of export barriers and the tendency depicted by import's unilateral liberalization, specially regarding the US. At the industry level a certain convergence is observed for the last periods, reflecting the effects of free trades agreements. Overall, these results highlight an heterogeneity in trade barriers measures across industries, among export and import policies and over the time that is not captured using direct measure of trade policies. This heterogeneity could help to understand the effects of trade on manufacturing performances as it brings more variance concerning the outcome of trade policies. Further research should be oriented to implement this type of exercise.

References

- [1] Anderson, James. and Eric Van Wincoop (2004). *Trade Costs*. Journal of Economic Literature. Vol. 42, No. 1, pp. 691-751.
- [2] Anderson, James. and Eric Van Wincoop (2003). *Gravity with Gravitas: a Solution to the Border Puzzle*. The American Economic Review. Vol. 93, No. 3, pp. 170-192.
- [3] Baier, Scott and Jeffrey Bergstrand (2001). *The growth of World Trade: Tariffs, Transport Costs and Income Similarity*. Journal of International Economics. Vol. 53, No. 1, 1-27.
- [4] Bergstrand, Jeffrey (1989). *The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade*. The Review of Economics and Statistics. Vol. 71, No.1, 143-153.
- [5] Berthelon, Matias (2004). *Growth effect of regional integration agreements*. Central Bank of Chile Working Papers No 278.
- [6] Cabezas, Mabel (2003). *Tratado de libre comercio entre Chile y Estado unidos: revision de estudios que cuantifican su impacto*. Central Bank of Chile Working Papers No 239.
- [7] Chumacero, Romulo; Fuentes, Rodrigo and Schmidt -Hebbel (2004). *Chile's free trade arrangements: How big is the deal?*. Central Bank of Chile Working Papers No 264.
- [8] Dixit, Avinash and Joseph Stiglitz (1977). *Monopolistic Competition and Optimum Product Diversity*. The American Economic Review. Vol. 67, No. 3, pp. 297-308.
- [9] Evans, Carolyn (2003). *"The Economic Significance of National Border Effects"*. The American Economic Review. Vol. 93, No. 4, 1291-1312.
- [10] Evenett, Simon and Wolfgang Keller (2003). *"On Theories Explaining the Success of the Gravity Equation"*. Journal of Political Economy. Vol. 110, No. 2, pp. 281-316.
- [11] Feenstra, Robert (2003). *Advanced International Trade: Theory and Evidence*. Princeton University Press.
- [12] Fontagné, Lionel ; Mayer, Thierry and Soledad Zignago (2005). *Trade in the triad: how easy is the access to large markets?*. Canadian Journal of Economics. Vol. 38, No. 4, pp. 1402-1430.
- [13] Harrigan, James, 1996. *Openness to trade in manufactures in the OECD*. Journal of International Economics. Vol. 40 No. 1-2, pp. 23-39.
- [14] Harrison, Glenn; Rutherford, Thomas and David Tarr (2003). *Chile's regional arrangements: the importance of market access and lowering the tariff to six percent*. Central Bank of Chile Working Papers No 238

- [15] Haveman, Jon; Nair-Reichert, Usha and Jerry Thursby (2003). *How effective are trade barriers? An empirical analysis of trade reduction, diversion and compression*. The Review of Economics and Statistics. Vol. 85. No. 2. pp. 480-485.
- [16] Head, Keith and John Ries (1999). *Rationalization Effects of Tariff Reductions*. Journal of International Economics. vol. 47, No.1, pp. 295-320.
- [17] Head, Keith and Thierry Mayer (2001). *Effet frontière, intégration économique et "Forteresse Europe"*. Document de travail CEPII No 2001-06.
- [18] Head, Keith and John Ries (2002a). *Increasing Returns versus National Product Differentiation as an Explanation for the Pattern of Us-Canada Trade*. The American Economic Review. Vol. 91, No. 4, 858-76.
- [19] Hummels, David (2001). *Towards a Geography of Trade Costs*. Purdue University, manuscript.
- [20] Hummels, David and James Levinsohn (1995). *Monopolistic Competition and International Trade: Reinterpreting the Evidence*. Quarterly Journal of Economics Vol. 110, No. 3, pp. 799-836.
- [21] Krugman, Paul (1980). *Scale Economies, Product Differentiation, and the Pattern of Trade*. The American Economic Review, Vol. 70, No 5, pp. 950-59.
- [22] McCallum, John (1995). *National Borders Matter*. The American Economic Review, Vol. 85, No.3, pp. 615-23.
- [23] Nicita, Alessandro and Marcelo Olarreaga (2001). *Trade and production, 1976-99*. Policy Research Working Paper Series 2701, The World Bank.
- [24] Nowak-Lehmann, Felicitas; Herzer Dierk and Sebastian Wollmer (2007). *The Free Trade Agreement Between Chile and the EU: Its Potential Impact on Chile's Export Industry*. Applied Econometrics and International Development, Vol. 7, No 1.
- [25] Redding, Stephen and Anthony Venables (2004). *Economic Geography and International Inequality*. Journal of International Economics. Vol. 62, No. 1, pp. 53-82.
- [26] Wei (1996). *Intra-National Versus International Trade: How stubborn are nations in Global Integration?*. NBER Working Papers No 5531.