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Chile's Market Share in the EU Market: The Role of Price Competition in a Panel Analysis Setting

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Chile's Market Share in the EU Market:
The Role of Price Competition in a Panel Analysis Setting

By

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Abstract

It is the objective of this paper to analyze Chile's development of market shares in the EU market in the period of 1988 to 2002, testing for the impact of price competitiveness on market shares with panel data. Price competitiveness is considered a decisive determinant of Chile's market shares since Chile's successful export products are rather homogeneous products (fish, fruit, beverages, ores, copper, and wood and products thereof). Six EU countries, namely France, Germany, Italy, the Netherlands, Spain and the UK, with perceptible imports from Chile in the above-mentioned sectors, serve as cross-sections in this study. It is found that Chile's market shares in all seven sectors under investigation were unstable in economic terms in the 1988-2002 period. From a statistical point of view market shares were non-stationary variables, integrated of order one (I(1)) and so were Chile's relatives prices and its competitors' relative prices, which turned out to be I(1), too. All variables being I(1), a panel cointegration test was conducted. Pedroni's residual based cointegration test revealed cointegration between market shares and relative prices in all seven sectors allowing regression coefficients to be estimated by means of Dynamic Ordinary Least Squares (DOLS). The DOLS results were then compared with the ones obtained by the Three Stage Feasible Generalized Least Squares (3SFGLS) and the Generalized Method of Moments (GMM) technique.

Keywords:

market shares, panel unit root tests, panel cointegration tests, panel DOLS modeling, 3SLS - Feasible Generalized Least Squares estimation, panel GMM estimation

JEL: F14, F17, C23

Chile's Market Share in the EU Market:
The Role of Price Competitiveness in a Panel Analysis Setting

1. Introduction

Chile signed a far-reaching FTA with the EU on 3 October 2002 in order to improve its market access to the EU. The FTA between Chile and the EU, once fully implemented, is in the interest of the EU and Chile since it will be beneficial for both parties.[1] With respect to trade, the EU expects a major expansion of its manufactured exports to the Chilean market, whereas Chile hopes to expand its agricultural and light manufactured exports to the EU.

From Chile's point of view, the agreement can be clearly considered as a means to maintain and/or strengthen its competitive position in the EU market. In the short run, a reduction or elimination of trade barriers through a FTA and its impact on relative prices will improve Chile's competitive position not only with respect to the EU countries but also with respect to third countries which do not have a FTA with the EU. In the medium to long run however, the effect of the FTA will be eroded if the EU decides to conclude also FTAs with e.g. the MERCOSUR's full members and perhaps some Asian countries.

Given that Chile's main export commodities comprise copper, fish, fruits, paper and pulp, and wine and are thus heavily natural resource, Chile's actual competitors are already numerous[2]: Norway, Russia, Indonesia, Malaysia, the Philippines and Thailand are much like Chile exporters of timber and rubber. Besides, the South East Asian countries were able to strongly increase their light manufactured exports to industrial countries in the last decade. South Africa, Australia and New Zealand, belonging to the Southern Hemisphere, threaten Chile's position as a successful fruit and wine exporter. As far as agricultural products are concerned, Chile faces stiff competition from the EU countries. UK, Ireland and Norway are Chile's main competitors as far as fish exports are concerned. Besides, China, enjoying low labor costs, has become a strong exporter of machinery and equipment, textiles and clothing, footwear, toys and sporting goods and mineral fuels, thus reversing in general terms Latin America's competitiveness in textile, clothing and shoe exports.

Based on 2003 data, the EU is Chile's first world-wide trading partner. 25% of Chile's exports go to the EU and 19% of its imports come from the EU. During the first semester of

[1] Next to trade facilitation through reduction and elimination of tariffs and modern customs techniques, it comprises economic co-operation and technological innovation, protection of environmental and natural resources and support to the reform of the state (EU Commission, 2005).

[2] Even though Chile can still be considered the most competitive and the least corrupted economy in Latin America.

2003, mining (predominantly copper) still represented 46% of total Chilean exports, while agriculture, farming, forestry and fishing products represented 13.02%. Trade with Chile represents 0.45 of total EU trade, placing Chile as 41st in the ranking of EU main trading partners. Between 1980 and 2002, EU imports from Chile increased from EUR 1.5 billion to EUR 4.8 billion, whilst EU exports to Chile increased from EUR 0.7 billion to EUR 3.1 billion (EU Commission, 2005).

It is the purpose of this paper to analyze Chile's market share in the EU-market on a sectoral level and to evaluate its relative competitiveness on the EU market in the period of 1988 to 2002 by applying panel time-series techniques. According to economic reasoning, market shares are seen to be determined by Chile's and its main competitors' relative prices in the EU countries and an unobserved variable, such as strategic behavior. Price competitiveness is considered a decisive determinant of Chile's market shares since Chile's successful export products are rather homogeneous products (fish, fruit, beverages, ores, copper, and wood and products thereof).

The empirical analysis on Chile's market shares is performed in two very distinctive ways: The first approach applies panel unit root tests and panel cointegration tests. If cointegration of the series results, then a Panel Dynamic OLS Model (DOLS) is set up to deal with the problem of non-stationarity of the series and the endogenity problem. This part builds on path-breaking studies on panel unit root and panel cointegration techniques (Breitung and Pesaran, 2005; Dreger and Reimers, 2005; Westerlund, 2004 and 2005; Pedroni, 2004; Pedroni (1999); Banerjee, 1999 a, 1999 b). In order to deal with cross-section correlation of the disturbances the Seemingly Unrelated Regression (SUR) technique is also applied. The second method of analyzing market shares utilizes a dynamic model, partial adjustment model, that is estimated both by Three Stage Least Squares (3SLS) and the Generalized Method of Momemts (GMM) in combination with a Feasible Generalized Least Squares (FGLS) to get around of both the problem of endogenity and of autocorrelation of the residuals across cross-sections and over time.

The study is set up as follows. Section 2 gives an overview of Chilean market shares in the EU market and develops a very simple model to explain sectoral market shares. Section 3 contains some general remarks on the panel unit root tests, panel cointegration tests, DOLS modeling and FGLS in a 3SLS and a GMM framework. In section 4 we present and discuss the results. Finally section 5 concludes with a more general comparison of results and approaches.

2. Chile's Market Shares in the EU Market

2.1 The Development of Chile's Market Shares over Time

In Table 1 we list Chile's largest export sectors, its export shares and its market shares in the EU market. In this table the EU market is considered as one market. However, in the empirical analysis we investigate Chile's sectoral market shares in specific EU countries.

Table 1: Chile's seven most important export sectors and their competitive position

HS code	Sector	Annual percentage change of exports (1988-2002)	Export share in 2002[3]	Potential extra-EU competitor[4]	Average Market Share in the EU[5] (1988-2002)
03	Fish and crustaceans, molluscs	7.2 %	5.2 %	Norway	1.22 %
08	Edible fruit and nuts	7.5 %	10.0 %	Australia, South Africa, New Zealand	2.62 %
22	Beverages, spirits and vinegar	44.6 %	7.8 %	South Africa, Australia	0.77 %
26	Ores, slag and ash	11.9 %	9.1 %	Brazil, Australia, China	3.75 %
44	Wood and articles of wood	12.4 %	1.5 %	Norway, Russia, Canada,	0.26 %

[3] Share of Chile's sectoral exports in total Chilean exports.
[4] According to TradeCAN (World Bank, 2002)
[5] Share of EU imports from Chile in total EU imports (both from other EU-countries and non-EU countries).

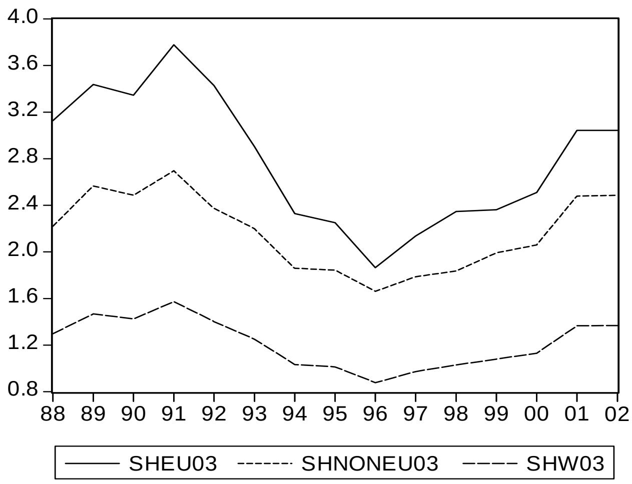
				Malaysia, Indonesia	
47	Pulp of wood	13.9 %	6.6 %	Norway, Canada, Russia	2.89 %
74	Copper and articles thereof	5.4 %	37.0 %	South Africa, Canada	10.34%

Source: EUROSTAT (2003); COMEXT CD ROM, 'Intra- and Extra-EU Trade, Annual data, Combined Nomenclature', European Commission ; own calculations.

All seven sectors experienced remarkable export growth, beverages being the most dynamic sector. It should be clarified, however, that 'beverages' started from a lower level in 1988 than the more traditional sectors such as fruit, wood, pulp of wood, and copper. Copper had the biggest market share in EU imports with 10.34 %, followed by ores (3.75 %), pulp of wood (2.89 %) and fruit (2.62 %) in the period of 1988 to 2002.

Graphs of market shares depict Chile's position with respect to EU-countries (sheu), with respect to non-EU countries (shnoneu) or with respect to the world (shw), which comprises all EU- and all non-EU countries (see Figures 1-7).

Figure 1: Chile's market share in EU's fish imports with respect to EU and non-EU competitors in the period of 1988 to 2002



According to figure 1, Chile lost market shares not only with respect to EU countries but also with respect to non-EU countries during 1991 and 1996. It could catch up after 1996, reaching its share of 1988 again in the year 2002. Overall, competition during the 1988-2002 period was very stiff. Competition came mainly from within the EU (UK, Ireland, Portugal, Spain, Italy) as far as all fishery products are concerned or from Norway as far as salmon is concerned.

Figure 2: Chile's market share in EU's fruit imports with respect to EU and non-EU competitors in the period of 1988 to 2002

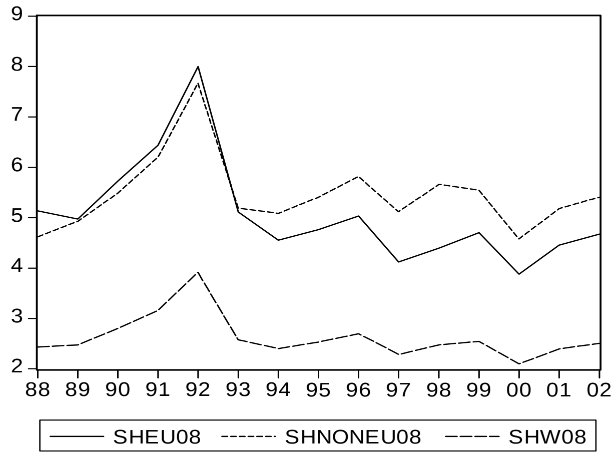
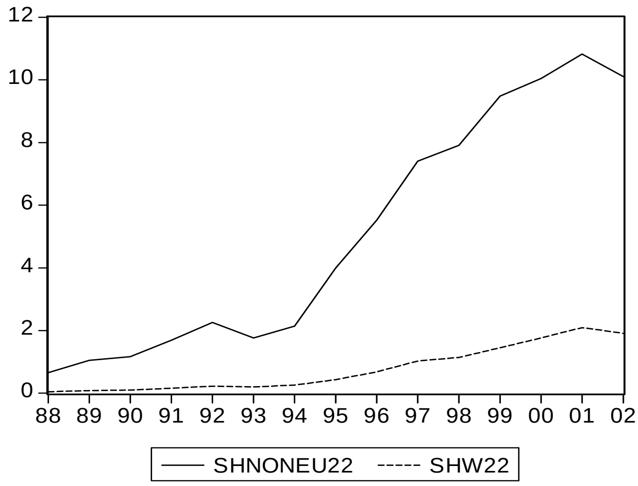


Figure 2 shows that competition for market shares was also very fierce in the fruit sector due to competition from the EU countries themselves and from outside the EU (Australia, New Zealand, South Africa). Chile could increase its market shares in the late 1980s and early 1990s. Thereafter, however, the defence of market shares became very hard for the Chilean fruit exporters. Chile clearly lost competitive strength with respect to EU countries since 1993. Pre-tests on whether this was due to an appreciation of the real effective exchange rate pointed to a rather strong reaction of exports to a loss in price competitiveness.

Figure 3: Chile's market share in EU's imports of beverages with respect to EU and non-EU competitors in the period of 1988 to 2002



In figure 3 we can observe a steady increase in Chile's market shares in the beverages segment with respect non-EU and EU-countries. The most important export item in the beverages sector is wine. When checking for the relevance of non-EU competition in a pre-test, Australia did not turn out to be a threat for Chile, but South Africa did. Chile clearly has been gaining competitiveness with respect to non-EU since 1994.

Figure 4: Chile's market share in EU's imports of ores, slag and ash with respect to EU and non-EU competitors in the period of 1988 to 2002

Figure 4 reveals the ups and downs in the ores sector. Chile succeeded in improving its market share in the ore segment as compared with 1988 when looking at endpoints. Especially competition with the EU countries was very rough in the 1988-91 period. Brazil and Australia being the main exporters of ores, the role of these non-EU competitors competition was pre-tested. However, their price competitiveness turned out to be irrelevant for Chilean export success. This could be due to the fact that Chile and Australia/Brazil produce different qualities or in a different sub-segment of ores.

Figure 5: Chile's market share in EU's imports of wood thereof (44) with respect to EU and non-EU competitors in the period of 1988 to 2002

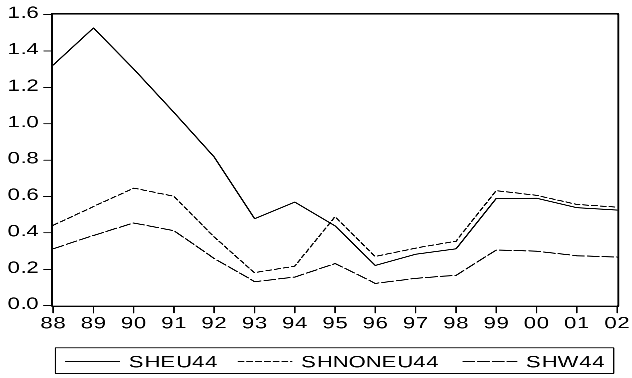
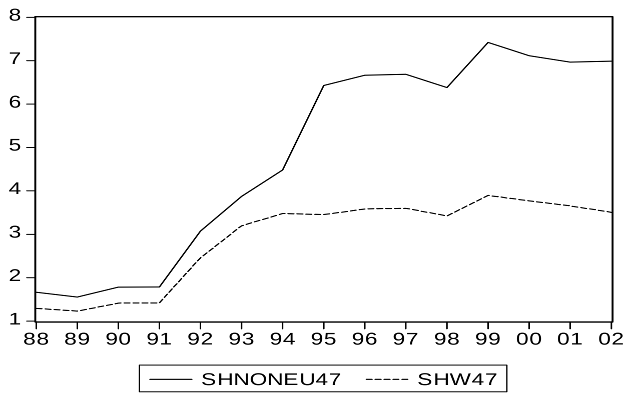
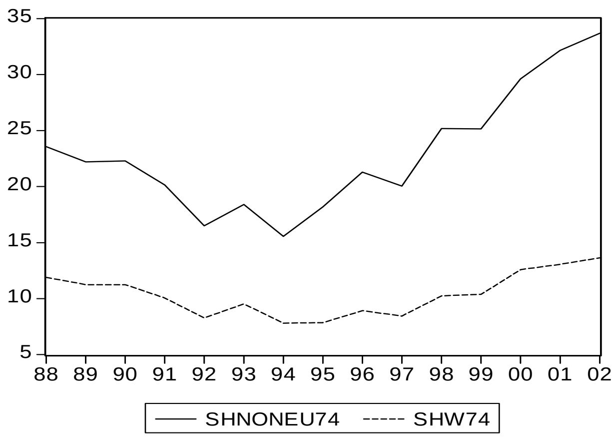


Figure 6: Chile's market share in EU's imports of pulp of wood (47) with respect to non-EU and world-wide competitors in the period of 1988 to 2002



According to figures 5 Chile had to face strong competition in the wood-sector (44) from the EU (Sweden, Finland) and even lost market share in the 1988-1996 period. Competition with non-EU countries such as Norway, Russia, and Canada was subject to up- and down-swings. Regarding its competitive position in the pulp of wood-sector (47), Chile could increase its overall market share, especially that with respect to non-EU countries (compare figure 6).

Figure 7: Chile's market share in EU's imports of copper (74) with respect to non-EU and world-wide competitors in the period of 1988 to 2002



According to Figure 7 Chile succeeded quite well in defending its competitive position in the EU market in the period of 1988 to 2002. Chile is the world's largest producing country followed by the United States which are a producer and a net importer of copper at the same time. Success in the copper industry depends on keeping production costs low compared to market prices. Major production costs include labor costs, energy costs and environmental regulations which play a bigger role in industrialized countries.

To sum up, the development of Chile's market shares was subject to up and downs in most of the export sectors. Defending its market shares was no easy business for Chile, except for the sectors 'beverages', 'pulp of wood' and 'copper'.

2.2 Development and Determinants of Market Shares

Following Sutton (2004), there are two contradicting views on the development of market shares over time: The first goes back to Alfred Chandler inter alia and asserts that market shares are robust over time and that leadership tends to persist for a 'long' time. The second view, propagated by Schumpeter, emphasizes the transience of leadership positions. Schumpeter labels those positions temporary monopolies created by invention and innovation. However, there is no benchmark for long or short leadership positions (2002 Japan Conference, 2005). We will test the relevance of these hypotheses by means of panel unit root tests. If market shares turn out to be stationary (I(0)), we will conclude that they are robust and persistent during the period of 1988 to 2002. If they result to be non-stationary, we will conclude that the Schumpeter hypothesis cannot be rejected by the 1988-2002 data.

There are also two approaches of modeling market shares: According to one approach, market shares are basically stochastic, according to the other approach market shares are influenced by hard economic factors such as prices, marketing expenditure, number and strength of competitors etc. When modeling market shares Sutton (2004) chooses an eclectic approach. Favoring the idea of building a stochastic model[6], he enriches the model by industry-specific features (e.g. a strategic representation of firms' competitive responses to market share changes). However, he has to concede that strategic behavior is very often intrinsically unobservable. In contrast to Sutton, we put less emphasis on the stochastic nature of market shares but stress the role played by sectoral real effective exchange rates that can be treated as a industry-specific feature. We believe that exchange rates, cost differentials, tariffs and subsidies are important 'hard' factors explaining market shares over time. Thus we consider price competitiveness as decisive for the competitive position. Strategic behavior being difficult to model, we restrict our model by allowing strategic behavior and sector-specific characteristics to be incorporated in the residuals of equations (1) and (2) below.

Market shares in a specific sector (s) are computed as ratio of Chile's sectoral exports (X in the numerator) and EU country i's imports from the world $M_{.i} = M_{EU}+M_{non\text{-}EU}$ (in the denominator). Due to missing data, we consider only Chile's market shares in France (FRA), the Netherlands (NDL), Germany (DEU), Italy (ITA), UK (GBR), and Spain (ESP). Market shares are computed for seven sectors at the two-digit HS chapters, namely fish (03), fruit (08), beverages (22), ores (26), wood (44), pulp of wood (47) and copper (74). Sources of the data are outlined in the Appendix. The period covered goes from 1988 to 2002. Thus, we obtain a maximum of 6 cross-sections and 15 years, resulting in a maximum of 90 observations per sector. The number of observations varies depending on the sector studied. A log-log specification was chosen for Chile's market share in the EU market.

The market share of the country under investigation in country i in sector s at time t is modelled as:

$$lshw_{ist} = \alpha_{is} + \beta_i lreer_{ist} + \gamma_i lreer_{ist}* + \mu_{ist} \quad (1)$$

where

i = 1, 2,…, 6; it represents the cross-sections: FRA, NDL, DEU, ITA, GBR and ESP (according to World Bank abbreviations);

[6] It is obvious that equations (1) and (2) do only hold if market shares are mainly determined by observable economic fundamentals, e.g. the real effective exchange rates. They do not apply if market share dynamics are purely represented by a stochastic model.

t = 1988, 1989, …, 2002 are years (annual observations) and
s = 03, 08, 22, 26, 44, 47 and 74 are the sectors (according to the two digit HS classification). $lshw_{ist}$ stands for Chile's market share in EU country i in sector s at point t. $lreer_{ist}$ is Chile's real effective exchange rate, prevailing in country i and in sector s and $lreer_{ist}*$ is Chile's competitor (*) real effective exchange rate, prevailing in country i and in sector s. Equation (1) will be applied in section 4. 1.

According to Cable (1997) the market shares can best be modeled by means of a autoregressive distributive lag model (ARDL) with lag length k.[7] Cable selects a geometric lag model (Equation (2)) in order to model the reaction of market shares in the short and in the long run.[8] In this model changes in the real effective exchange rate in the more distant past have a smaller impact on changes in market share than exchange rate changes of the more recent past. The ARDL model will be utilized in section 4. 2.

$$shw_{ijst} = \alpha_{ijs} + \beta_0 \lambda^0 lreer_{ijst} + ... + \beta_k \lambda^k lreer_{ijst-k} + \gamma_0 \lambda^0 lreer_{ijst} * + ... + \gamma_k \lambda^k lreer_{ijst-k} * + \mu_{ijst}$$

(2)

3. Estimation Techniques for Non-Stationary Panel Data Controlling for Endogeneity

3.1 Unit Root Based Techniques

Before turning to the econometric analysis, the time series properties of the data (all in natural logs) were tested. All series, i.e. market shares (lshw), Chile's real effective exchange rate (lreer) and Chile's competitors' real effective exchange rates (lreer*) for all country-pairs were subject to tests on non-stationarity (panel unit root tests) in a first step. This procedure had to be applied to all seven sectors under investigation. The possible existence of structural breaks in the series was neglected for two reasons: First, consideration of structural breaks would further complicate the econometric analysis from a technical point of view at this point of time (Stock, 1994).[9] Second, neither fundamental, abrupt changes in economic policy nor tremendous exogenous shocks could be detected in the period of 1988-2002. The governments of Aylwin, Frei and Lagos continued the economic policy of the Pinochet

[7] There are two types of autoregressive distributed lag models: the geometric lag model and the transfer function model,also known as ARMAX model (for an application see Nowak-Lehmann D., 2004 and Greene, 2000)
[8] Geometric lag models are also known as partial adjustment models.
[9] Unit root test considering structural breaks are intensively discussed and applied by Herzer and Nowak-Lehmann D. (forthcoming).

government. Big shocks (the Tequila crisis in 1994, the spillover effects of the Asian crises of 1998 and the collapse of the currency board in Argentina in 2001/2002) seem to have been adequately reflected in the market share and real effective exchange rate variables in the period of 1988-2002.

In the statistical analysis we allowed for different unit root processes in the panel, i.e. individual, cross-section specific (country-specific) unit roots. We applied the Im, Pesaran and Shin (2003) panel unit root test on all series thus considering the possibility of individual unit roots of our panel data. All variables (lshw, lreer, and lreer*) were non-stationary, integrated of order one (I(1)) with a p-value of 0.00 (exception: lrpcopper with p= 0.02). As to market shares, this finding supports more Schumpeter's view on market shares. According to Schumpeter, gains in market shares are of temporary value. Monopolistic positions have to be defended, otherwise they are lost quite fast. This view seems to especially apply to the fish, fruit, beverages ores, and the copper sector. In the wood sectors (44 and 47), market shares appeared more stable, but still non-stationary according to the tests. Table 2 presents the results.

Table 2: Results from the Im, Pesaran, Shin (2003) Panel Unit Root Test stating t-bar values

IPS Panel Unit Root Test Based on Individual Unit Roots **H_0: Residual has a unit root (residual is non-stationary)[10]**			
Sector 03	**Fish and crustaceans, molluscs**		
	Lshw03	Lreer03	Lreer03*=Lreer03nor
Series in levels Δ Series[f]	-1.81 -4.36	-1.58 -3.42	-1.94 -3.47
Sector 08	**Edible Fruit and nuts**		
	Lshw08	Lreer08	Lreer08*=Lreer08aus
Series in levels Δ Series	-1.68 -5.90	-1.58 -3.42	-2.53 -4.11
Sector 22	**Beverages, spirits and vinegar**		
	Lshw22	Lreer22	Lreer22*=Lreer08saf

[10] This is equivalent to H_0: The variables of interest are not cointegrated for each member of the panel and H_1: For each member of the panel there exists a single cointegrating vector, although this cointegrating vector needs not to be the same for each member (Pedroni, 1999).

[f] Series in first differences.

Series in levels Δ Series	-1.62 -4.25	-1.58 -3.42	-0.92 -3.34
Sector 26	**Ores, slag and ash**		
	Lshw26	Lreer26	Lreer26*=Lreer26bra
Series in levels Δ Series	-1.29 -4.18	-1.58 -3.42	-2.26 -7.43
Sector 44	**Wood and articles of wood**		
	Lshw44	Lreer44	Lreer44*=Lreer44nor
Series in levels Δ Series	-1.83 -2.80	-1.58 -3.42	-1.94 -3.47
Sector 47	**Pulp of wood**		
	Lshw47	Lreer47	Lreer47*=Lreer47nor
Series in levels Δ Series	-1.68 -2.93	-1.58 -3.42	-1.94 -3.47
Sector 74	**Copper and articles of copper**		
	Lshw74	lrpcopper[11]	
Series in levels Δ Series	-1.34 -4.22	-1.58 -3.42	----------

Given that the variables lshw, lreer and lreer* were all I(1), panel cointegration tests were performed. We relied on a residual-based cointegration test[12]. The idea of the residual-based cointegration test goes back to Engle and Granger (1987) who applied this test to time series. As to regressions with time series, if the residual (u_t) of a regression, which is built around variables with the same order p of integration (i.e. the variables $\approx$ I(p)), is stationary (i.e. $u_t \approx$ I(0), it is said that the I(p) variables are cointegrated, and therefore a long-run relationship does exist. However, these tests do not only tend to suffer from unacceptably low power when applied to series of only moderate length but must also use special critical values (e.g. Kapetanios' critical values[13]) if stationarity of the residuals is to be tested (Kapetanios, 1999).

Pooling data across individual members of a panel when testing for cointegration is therefore advantageous. Pooling increases the power of the unit root test by making available

[11] Lrpcopper serves as an indicator of Chile's real copper production costs. It is used instead of lreer in the market share analysis.
[12] See Breitung's and Pesaran's overview of 'Unit Roots and Cointegration in Panels', 2005.
[13] MacKinnon's critical values cannot be used when testing the non-stationarity of residuals. In this case adjustments for the number of regressors in the regression equation are necessary and different critical values result..

considerably more information regarding the cointegration hypothesis (Pedroni, 1999). But testing for cointegration in a panel setting becomes also more complicated since two types of cointegration can be present: First, cointegration between the series over time (this is the type of cointegration prevailing in time series) and second, cointegration between cross-sections (this is the type of cointegration that can exist in a panel setting) must be taken into account (Breitung and Pesaran, 2005). We controlled for the second type of cointegration by building a system of equations around eq. (1). Thereupon we applied Seemingly Unrelated (SUR) estimation methods that took cross-section correlation of the residuals into account by weighting the matrix with the regressors (X'X).

As in time series analysis, standard unit roots tests on the residuals[14], which use inadequate test statistics (MacKinnon, 1991), cannot be utilized. First of all they do not account for the number of regressors in eq. (1) and second, they have not been adjusted for heterogeneous intercepts and heterogeneous deterministic trends and are therefore too rough (Pedroni, 1999).

Pedroni's (1999) cointegration test statistic solves those problems. Following Pedroni's panel cointegration test (1999), we allowed for a maximum of heterogeneity between countries and flexibility by formulating eq. (1) with cross-section specific intercepts (α_i) and cross-section specific coefficients (β_i and γ_i). Thus we are able to take country-specific cointegration vectors into account. Finally, we derived the residuals from this system, obtaining u_{i03t}, u_{i08t}, u_{i22t}, u_{i26t}, u_{i44t}, u_{i47t} and u_{i74t} for the seven sectors under investigation. We applied and programmed Pedroni's (1999) formulas for a residual-based panel unit-root test and computed the test statistics, which follow a standard normal distribution. Pedroni's test revealed that the residuals of all sectors were stationary and the variables lshw, lreer and lreer* were cointegrated (p-value: 0.00) and therefore in long-run equilibrium. The program and the results are available upon request.

Given that cointegration exists, the regression coefficients can be estimated by different methods. First, the regression coefficients can be estimated by the Johansen-method. This method is based on a Vector Error Correction Model (VECM). It applies Maximum Likelihood (ML) estimation and yields consistent estimates. By having on the right hand side of the VECM only lagged first differences and the EC term, this approach is also able to deal

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[14] Out of curiosity we performed 'invalid' unit-root tests (pre-tests of non-stationarity assuming individual unit root processes) on the residuals of eq. (1) by utilizing both the ADF-Fisher Chi-square test and the PP-Fisher-Chi-square test. Both tests rejected the null hypothesis of individual unit root processes with p-values of 0.00 for all seven sectors. These pre-tests showed that the residuals were stationary and hinted to cointegration..

with endogenous variables (Johansen, 1988). Second, regression coefficients can be estimated in the error-correction (ECM) framework developed by Stock (1987) who utilizes Non-Linear Least Squares. If, however, regressors are endogenous, the estimates will be biased. The use of instrumental variables could solve this problem. Third, the long-run regression coefficients can be estimated with the Dynamic Ordinary Least Squares (DOLS) approach that was proposed by Stock and Watson (1993, 2003). This approach takes endogenity of the regressors into account and therefore yields consistent estimates. We follow this most recent approach for estimating the long-run regression coefficients.

However, before doing so, we set up panel error correction models (ECM) of the Stock-type for all sectors[15]. This procedure allows for another check of cointegration. We obtained coefficients belonging to the error correction term (EC term) that carried the correct (negative) sign and were significant at a p-value of 0.00 for all seven sectors. A significant and negative sign indicates the existence of a cointegrating relationship as we know from time series analysis (Banerjee, Dolado and Mestre, 1998; Ericsson and MacKinnon, 2002).

We did not utilize the ECM estimates for further analysis due to correlation between the autocorrelated disturbances and the lagged endogenous variable which would cause biased estimates, but apply DOLS instead. The DOLS approach led to equation (1’):

$$lshw_{it} = a + b\ lreer_{it} + c\ lreer^*_{it} + \sum_{k=-1}^{k=1} \beta_k \Delta lreer_{it-k} + \sum_{k=-1}^{k=1} \gamma_k \Delta lreer^*_{it-k} + u_{it} \quad (1')$$

b and c represent the long-run coefficients and β_k and γ_k represent adjustments of $lshw_{it}$ with respect to past, present and future values of the change in lreer and lreer*. Corrections for autocorrelation were made whenever necessary. According to Stock and Watson (2003) statistical inferences about the parameters in eq. (1’) based on autocorrelation-consistent standard errors are valid. Furthermore, eq. (1’) was estimated with SUR thus controlling for cross-section correlation of the disturbances. When utilizing DOLS, statements on the short- and medium-run relationship between the dependent variable lshw and the independent variables lreer and lreer* are not possible. Only the long-run relationship can be identified. This failure can be adequately addressed when using a distributed lag model (ARDL, see section 3.2). Results obtained by means of an ARDL will be presented in section 4.2 and 4.3.

3.2 Feasible Generalized Least Square (FGLS) Based Approaches

[15] An application can also be found in (Hendershott et al. (2002).

The cointegration approach is not the only approach that allows one to deal with non-stationary series and to yield unbiased and efficient estimates. FGLS is another possibility as is known from time series analysis. FGLS can also be applied to panel data and works very well in dynamic models. These advantages will be exploited by the authors. In contrast to the dynamic panel analysis literature (Baltagi, 2005), we will stress the time series properties of the series more than it is usually done. The dynamic panel analysis literature usually abstracts from autocorrelation of the disturbances in order to elaborate more the characteristics of one-way error component models in which cross-section specific random effects are present. We take a different route for several reasons: First, we work with a fixed effects model since our cross-sections were not randomly drawn, but selected on purpose. If cross-section specific disturbances $\mu_i \approx$ IID (0; σ_μ^2) should additionally exist, we think that the cross-section specification should be improved. Second, we try to account for time series properties because our time dimension exceeds our cross-section dimension and therefore time series problems should obtain more weight. These considerations lead us to an alternative method of dealing with non-stationary series in a panel regression framework, namely to FGLS estimation techniques. FGLS in a panel analysis setting works analogously to the one in the time series setting. The idea remains the same: Non-stationarity of the series in a regression equation is reflected in the autocorrelation ρ of the residuals over time[16]

$u_{it} = \sum_{k=1}^{K} \rho_{ik} u_{it-k} + e_{it}$ (3),

with $e_{it} \approx N(0; \sigma_{ei})$ and k = 1, 2,…K number of lags. I.e. autocorrelation of the residuals is the mirror image of non-stationary series.

Besides, FGLS has the tremendous advantage to work well in dynamic regression models, such as autoregressive distributed lag models (ARDL models, in our case the geometric lag model in eq. (2)). ARDL models are able to describe the reaction of the dependent variable of a regression very precisely over time (in the short, medium and long run) whereas eq. (1) is basically a semi-static model.

The FGLS method works as follows: First, the residuals of eq. (1) are computed by means of SUR. Second, the order (first order, second order, or p-order) of autocorrelation is tested in eq. (3). 1st order autocorrelation of the type $u_{it} = \rho_i u_{it-1} + e_{it}$ turned out to be present and dominant. Third, the variables of eq. (2) are transformed into $lshwz_{it} = lshw_{it} - \rho_i lshw_{it-1}$,

[16] It is usually well below 1 so that first differencing is a very rough method to get rid of stationarity.

$lreerz_{it}$ = $lreer_{it}$- ρ_i $lreer_{it-1}$, $lreerz_{it}$* = $lreer_{it}$*- ρ_i $lreer_{it-1}$* and e_{it} = u_{it}- ρ_i u_{it-1} thus generating variables in soft or quasi first differences. Eq. (2) can then be estimated on basis of the transformed variables applying the Cochrane-Orcutt method (Stock and Watson, 2003). The endogenity problem of the lagged dependent variable ($lshw_{it-1}$), which is caused by first order correlation of the residuals, requires either the use of the Three-Stage Least Squares or the use of the GMM (Generalized Method of Moments) technique. Modern computer programs (e. g. EViews 5.1) allow one to generate the variables in soft first differences directly in eq. (2) by adding e.g. an AR(1) term for first order autocorrelation and to simultaneously apply methods to control for the endogeneity of the regressors (see sections 4.2 and 4.3).

4. Empirical Analysis of Market Shares

In the econometric part of this study we used EUROSTAT's trade data base COMEXT (Intra- and Extra-EU Trade, Supplement 2, 2003). The analysis had to be restricted to six EU countries, France, Germany, Italy, the Netherlands, Portugal, Spain and the UK. Incompleteness of the data led to the exclusion of nine EU-15 countries and all ten EU-10[17] countries from the analysis. Data and computation of the variables are described in Appendix 1.

In the following sections a fixed effect model was estimated allowing for cross-section specific intercepts. This model could still be enriched by estimating cross-section specific slope parameters for lreer and lreer*. However, since our focus at this stage is on comparing estimation techniques (DOLS, ARDL estimated by 3SLS, ARDL estimated by GMM), we capture country-specific effects only through cross-section specific intercepts and try to save degrees of freedom by modeling common slope parameters.

4.1 Estimating the Impact of Price Competition on Market Shares Using the Cointegration-Approach

Table 3 presents the results for the market share model estimated by means of DOLS controlling for inter-temporal (inserting an AR(1) term) and cross-section correlation (estimating the DOLS by SUR). Sector-results are shown in lines.

Table 3: Results for the market share model estimated by DOLS

[17] The E-10 countries have not yet been integrated into the COMEXT trade statistics thus impeding their analysis.

	Regression coefficients[♣] **Equation (1)**			**Goodness of fit measures**		
	Long-run impact of lreer	**Long-run impact of lreer***	**AR-term AR(1)**	**R^2adjusted**	**S.E. of regression**	**Durbin Watson stat.**
Results for 03	-0.63 (0.34)	-0.91 (0.25)	0.43*** (0.00)	0.97	1.03	2.12
Results for 08	1.75*** (0.00)	-0.62 (0.38)	0.60*** (0.00)	0.99	1.07	2.26
Results for 22	-4.39*** (0.00)	4.90*** (0.00)	0.60*** (0.00)	0.99	1.06	2.37
Results for 26	2.69*** (0.00)	0.29*** (0.00)	0.64*** (0.00)	0.95	1.07	2.12
Results for 44	0.99*** (0.00)	-5.74*** (0.00)	___ AR-term not sign.	0.98	1.03	2.05
Results for 47	-1.51*** (0.00)	-0.59*** (0.37)	0.45	0.97	1.09	1.98
Results for 74	Lrpcopper -2.09*** (0.00)	___	0.74*** (0.00)	0.99	1.06	2.21

An increase in price competition of Chilean exporters has the expected positive impact on Chile's market shares in the fruit (08), the ores (26), and the wood (44) sector. Increasing foreign price competition has the expected negative impact in the wood (44) and pulp of wood (47) sector. Rising Chilean real copper prices are bad for Chile's market share, as expected. Interestingly, we get significant (but not the expected signs) for the beverages sector, which is

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[♣] p-vales in brackets.

dominated by wine exports. The opposite signs make economic sense if low prices are interpreted as an indicator of low quality (and vice versa) by the consumers. Therefore, we consider this result as plausible and in line with economic expectations. This result is repeated by the techniques utilized in sections 4.2 and 4.3.

4.2 Estimating the Impact of Price Competition on Market Shares Utilizing the FGLS-Approach (Soft First Differences-Approach) in a Dynamic Model

In the dynamic model a new problem arises: When a lagged endogenous variable appears at the right hand side of a regression equation (as in the geometric lag model of eq. (2)) and when the disturbances are autocorrelated (this phenomenon goes hand in hand with non-stationary series), the lagged endogenous variable is automatically correlated with the disturbance term and thus becomes endogenous.

Endogenity and cross-section correlation of the disturbances are controlled by instrumental variables in the framework of the system Three-Stage Least Squares (3SLS) technique which is the SUR version of Two-Stage Least Squares (see EViews 5: User’s Guide, 2004, p. 700) and autocorrelation is controlled by means of an AR-term. In Table 4 the impact of price competitiveness on market shares in a dynamic model (ARDL model) is summarized.

Table 4: Results for the dynamic market share model estimated by panel-3 SLS

	Regression coefficients♣ Equation (2)				**Goodness of fit measures♦**		
Sector-results	**Impact of lreer**	**Impact of lreer***	**Adjustm. Coeff.**	**AR-term**	**R^2adjusted**	**S.E. of regression**	**Durbin Watson stat.**
03 short run	0.82** (0.02)	-0.72 (0.19)	-0.19 (0.20)	0.68*** (0.00)	0.97	1.02	2.15

♣ p-vales in brackets.
♦ Taken from OLS estimation. In 3SLS the adjusted R^2 is negative at times. Besides, it is unclear how the goodness of fit measures of the different cross-sections are to be weighted in order to derive an overall goodness of fit measure.

03 long run	------------	----------	-----------	---------	0.97	1.02	2.15
08 short run	1.82** (0.02)	-0.14 (0.85)	-0.07 (0.70)	0.69*** (0.00)	0.99	1.05	1.99
08 long run	------------	----------	-----------	---------	0.99	1.05	1.99
22 short run	-2.09*** (0.01)	2.01*** (0.01)	0.62*** (0.00)	-0.08 (0.64)	0.98	1.05	2.04
22 long run	-6.96***	6.04***	--------	--------	0.98	1.05	2.04
26 short run	1.83*** (0.00)	0.06 (0.42)	0.70*** (0.00)	-0.29* (0.07)	0.96	1.02	2.06
26 long run	6.10***	0.20	---------	--------	0.96	1.02	2.06
44 short run	0.35 (0.76)	-2.35 (0.13)	0.46*** (0.00)	0.60*** (0.00)	0.94	1.06	2.36
44 long run	0.65	-4.37	----------	---------	0.94	1.06	2.36
47 short run	-1.20*** (0.00)	-0.27 (0.42)	0.37*** (0.00)	0.01 (0.91)	0.99	1.07	1.87
47 long run	-1.90***	-0.43	---------	--------	0.99	1.07	1.87
74 short run	-0.45*** (0.00)	--------	0.80*** (0.00)	-0.07 (0.66)	0.99	1.04	2.16

74 long run	-2.25***	--------	---------	---------	0.99	1.04	2.16

We find a significant positive impact of increased Chilean price competition on market shares in the fish (03), the fruit (08) and the ores (26) sector but no significant negative impact of foreign price competition on market shares in the seven sectors under study. As to beverages, we find a negative impact of competitive (low) Chilean prices and a positive impact of low foreign prices on market shares. This latter result was obtained in section 4.1, too. Adjustment to the long-run equilibrium was significant in the beverages (22), the ores (26), the wood (44), the pulp of wood (47) and the copper (74) sector whereas no significant adjustment took place in the fish (03) and the fruit (08) sector.

4.3 Estimating the Impact of Price Competition on Market Shares Utilizing the GMM-Approach in a Dynamic Model

Alternatively to 3SLS, we estimate the dynamic model by GMM. The special Arellano and Bond (1991) estimator (see Baltagi, 2005) is not applicable in our case since the number of instruments created by the GMM technique exceeds the number of observations. Nonetheless, the classical GMM technique allows one to control for the correlation between the lagged endogenous variable and the autocorrelated error terms. Judging from the way GMM works, this approach should have a comparative advantage over 3SLS at controlling endogenity. However, efficiency is lost by creating a tremendous amount of moment conditions that have to be respected. In our case we get 210 moment conditions, i.e. 210 restrictions, highlighting the computational burden of this approach (Schmidt et al., 1992).

Table 5: Results for the dynamic market share model estimated by panel-GMM

	Regression coefficients[♣] **Equation 2**				**Goodness of fit measures**		
Sector-results	**Impact of lreer**	**Impact of lreer***	**Adjustm. Coeff.**	**AR-term**	**R^2adjusted**	**S.E. of regression**	**Durbin Watson stat.**

[♣] p-vales in brackets.

03 short run	-0.20 (0.24)	-0.78*** (0.00)	0.64*** (0.00)	-0.24** (0.02)	0.98	1.04	2.11
03 long run	-0.55	-2.17***	----------	------	0.98	1.04	2.11
08 short run	2.29* (0.07)	-0.15 (0.90)	-0.15 (0.42)	0.69*** (0.00)	0.99	1.10	1.98
08 long run	---------	--------	---------	--------	0.99	1.10	1.98
22 short run	-2.53*** (0.00)	2.29*** (0.00)	0.58*** (0.00)	-0.13 (0.41)	0.98	1.06	2.08
22 long run	-6.02***	5.45***	--------	--------	0.98	1.06	2.08
26 short run	0.32 (0.52)	-0.17 (0.13)	0.71*** (0.00)	-0.28* (0.06)	0.89	1.04	2.04
26 long run	1.10	0.24	-----------	---------	0.89	1.04	2.04
44 short run	-1.22** (0.04)	-0.98 (0.14)	0.74*** (0.00)	-0.37*** (0.00)	0.90	1.06	2.26
44 long run	-4.69**	-3.77	-----------	---------	0.90	1.06	2.26
47 short run	-1.07** (0.05)	-0.31 (0.52)	0.40*** (0.00)	-0.05 (0.80)	0.74	0.26	1.87
47 long run	-1.78**	-0.52	-----------	----------	0.74	0.26	1.87

74 short run	-1.45** (0.02)	--------	0.37*** (0.03)	0.49*** (0.00)	0.99	1.18	2.01
74 long run	-2.30				0.99	1.18	2.01

In table 5 we discover a positive relationship between an increase in Chilean price competitiveness and market share in the fruit sector (08) and a negative relationship between low Chilean wine prices (sector 22) and high Chilean copper prices (sector 74) and respective market shares. Foreign relative prices have a significant and plausible impact in the fruit (03) and beverages (22) sector. In the latter sector the quality aspect in the wine sector is dominant.

To sum up: All estimations (4.1, 4.2 and 4.3) have very respectable adjusted R^2 measures, low standard errors and Durbin-Watson (DW) statistics around 2. Even though the DW must be adjusted in the presence of a lagged endogenous, the DW statistic is still able to roughly indicate problems of misspecification and autocorrelation of the disturbances. Price or quality competition is always relevant in the wine sector. We find in all estimations that low wine prices (standing for poor quality) are bad for Chile's market share in the EU and that vice versa Chile can take advantage of low quality wine exports of its competitors. The short-run price elasticity is around -2 in both the 3SLS and the GMM estimations and the long-run price elasticity is very high. It is around -4 in the DOLS and -6 in the 3SLS and the GMM approach. Chilean relative prices significantly influence Chile's market share in the fruit (08) and the copper (74) sector in all estimations. The impact of foreign price competitiveness is not significant in most sectors and also not robust when comparing different estimation techniques. The role of prices in the wood (44) and the pulp of wood (47) sector might be severely impeded by illegal logging and illegal imports of wood products. This phenomenon can be observed in the dynamic models that contain also the short- and medium run view. Illegal logging distorted official trade flows not only of all timber products (roundwood, sawnwood, veneer, plywood, boards, semi-finished and finished products, and furniture, but also of pulp, paper, printed products and cellulose). Illegal logging is estimated to comprise up to 50% of all logging activity in the key countries of Eastern Europe and Russia, up to 94%

in the key Asian countries, up to 80% in the key African countries and up to 80% in the key Latin American countries (WWF, 2005; FERN, 2004).

5. Conclusions

In econometric terms, the DOLS approach using the usual semi-static model is inferior to the ARDL specification since it does not allow to draw inferences about the short-run. The ARDL specification solves the problem of having non-stationary series by intensively utilizing the FGLS technique. Applied to a system of equations, this technique transforms the variables in the regression equation through weighting the regressor matrix with a weight matrix that can control for autocorrelation of the disturbances, for heteroscedasticity of the variance of the residuals and for cross-section correlation of the disturbances. The endogenity problem is taken care of by building in instrumental variables in either a 3SLS or a GMM approach. Both techniques are able to produce efficient and consistent estimates. In terms of good estimation properties, the DOLS estimator is a fine estimator, too. It delivers efficient estimates in large samples and valid statistical inferences when heteroscedasticity- and autocorrelation-consistent (HAC) standard errors are used.

In economic terms, we find that market shares are subject to ups and downs and are therefore more of the Schumpeterian type. They have to be permanently defended and entrepreneurs are under constant pressure to innovate and to perform well. As to market shares in the wood (44) and the pulp of wood (47) sector, they could only be poorly explained by price competitiveness due to a worldwide problem of illegal logging. Product quality determines market shares in the wine sector (beverages 22) with customers asking for good or high quality products. The 3SLS approach, which we consider superior to the GMM approach, underlines the positive role of Chile's price competitiveness for its market share in the EU with respect to fish, fruit, ores and copper. Estimation results obtained by DOLS or GMM were less conclusive.

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Appendix 1

Description of Data

In the following, the variables: sheu, shnoneu, shw, lreer, and lreer* will be described in original form (not in logs). All data run from 1988 to 2002.

In our case, six cross-sections (6 EU countries: Germany, Spain, France, UK, Italy, the Netherlands) had basically complete time series.[18]

(1a) Chile's market share in the EU with respect to the EU countries: sheu

$sheu_{ist}$ measures the share of Chilean exports (x) of sector s in EU country i at time t when competing against imports (m) from EU countries only:

$Sheu_{ist} = x_{ist}/m_{EUist}$

(1b) Chile's market share in the EU with respect to the non-EU countries: shnoneu

$shnoneu_{ist}$ measures the share of Chilean exports of sector s in EU country i at time t when competing against imports (m) from non-EU countries only:

$shnoneu_{ist} = x_{ist}/m_{non\text{-}EUist}$

(1c) Chile's market share in the EU with respect to the world (EU and non-EU countries): shw

shw_{ist} measures the share of Chilean exports of sector s in EU country i at time t when competing against imports (m) from EU and non-EU countries:

$shw_{ist} = x_{ist}/m_{EU+non\text{-}EUjst}$

(2) The Chilean real effective exchange rate: reer

reer is the bilateral real effective exchange rate between Chile and the EU countries (price quotation system), taking Chile's point of view. It consists of the real exchange rate (rer) and basic indicators of EU protection such as EU-tariffs (t) and EU-subsidies (s).

It is computed (all data for 'rer' are taken from World Development Indicators CD ROM of 2005) as:

$rer = e \cdot P_{EU}/P_{Chile}$ with

rer = real bilateral exchange rate between Chile and relevant EU country

e = nominal exchange rate (x Chilean Peso/1EUR) between Chile and relevant EU country

P_{EU} = GDP deflator of the EU country under consideration with 1995 as base year (1995 $\widehat{=}$ 100)

P_{Chile} = GDP deflator of Chile with 1995 as base year (1995 $\widehat{=}$ 100)

[18] Due to missing data, Austria, Belgium, Finland, Luxemburg and Sweden were excluded from the analysis.

rer has been adjusted for EU tariff protection (in terms of average EU tariff rate (t)) and non-tariff protection (in terms of EU subsidy rate (s). Tariff rates prevailing in the EU can be found in Trade Policy Review European Union, Volume 1, 2000, pp. 88-101 (WTO) and rough subsidy equivalents are based on qualitative information on non-tariff protection collected, explained and nicely put together for UNCTAD by Supper (2001).

So we get:

$reer = rer \cdot (1-s)/(1+t)$

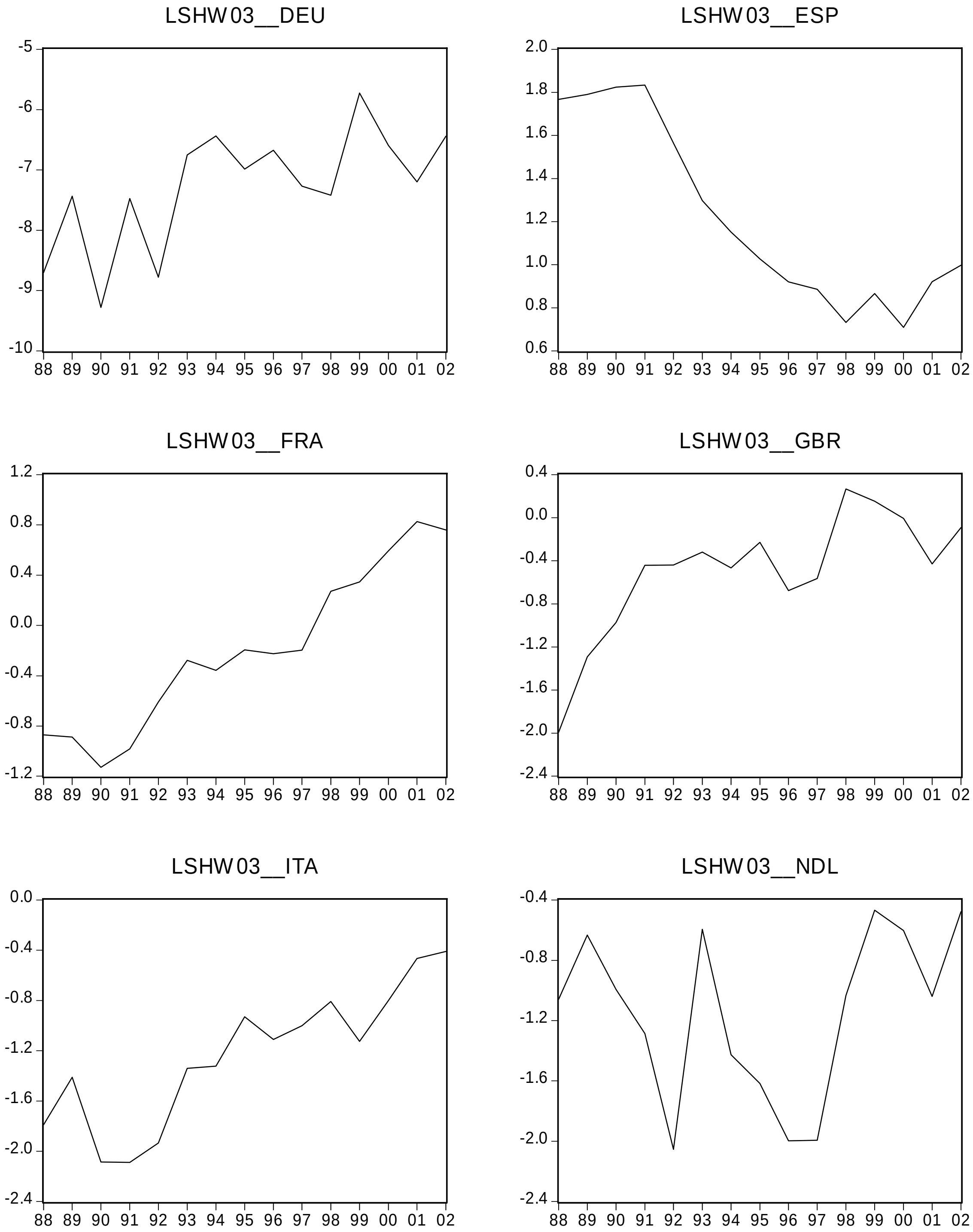
For the simulations, we assume that the FTA between Chile and the EU brings tariffs down to zero.

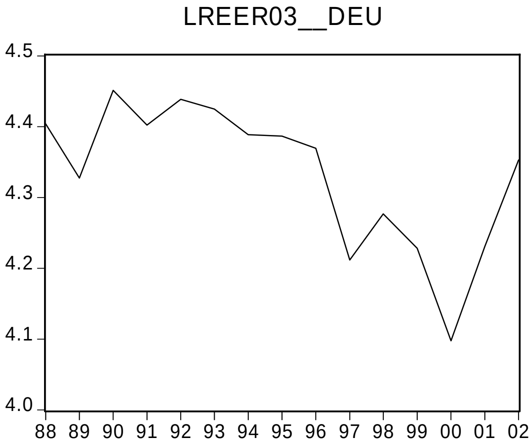
(3) Chile's competitors (*) real effective exchange rates :reer*

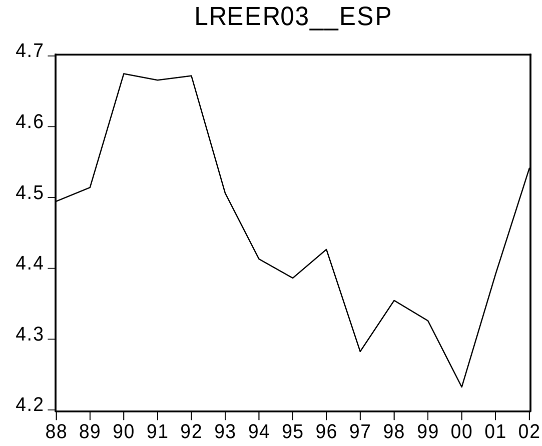
In analogy to (2) the real effective exchange rates of Chile's main competitors Norway, Australia, South Africa, Brazil are computed. Nominal exchange rates, Norway's, Australia's, South Africa's, and Brazil's GDP deflators are computed from World Development Indicators CD ROM 2005. Tariff and subsidy rates are borrowed from WTO and UNCTAD (see (2)).

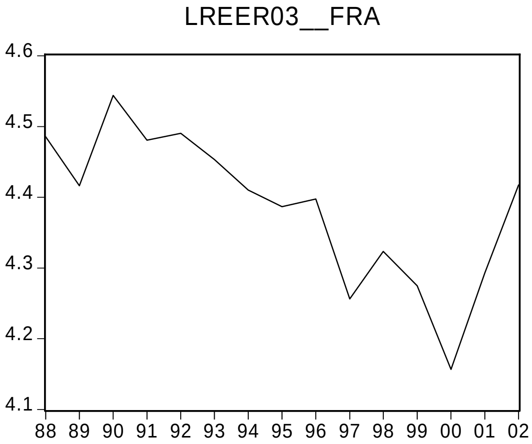
Appendix 2

Line graphs of the variables entering the market share model → the fish sector (03) serving as an example




LREER03__DEU
4.5
4.4
4.3
4.2
4.1
4.0
88 89 90 91 92 93 94 95 96 97 98 99 00 01 02


LREER03__ESP
4.7
4.6
4.5
4.4
4.3
4.2
88 89 90 91 92 93 94 95 96 97 98 99 00 01 02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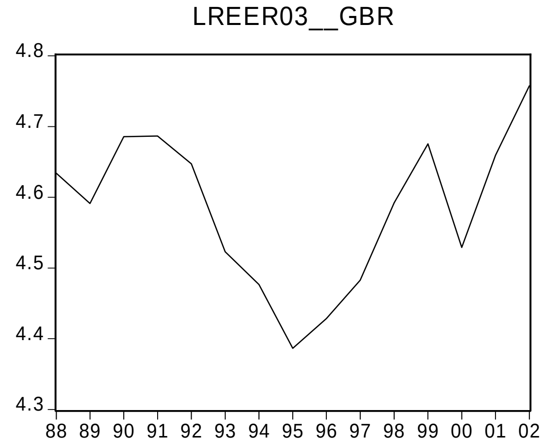
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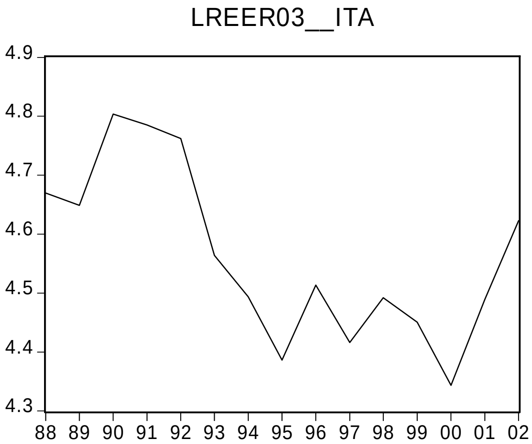
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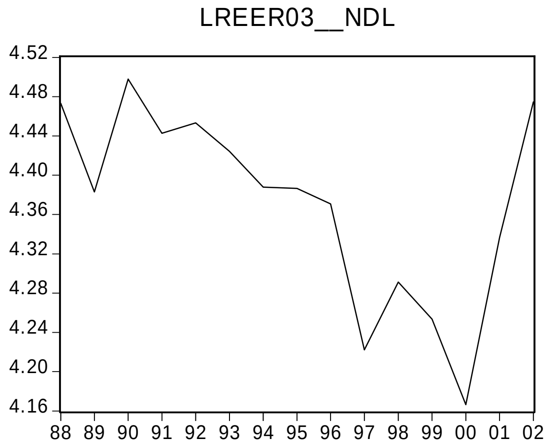
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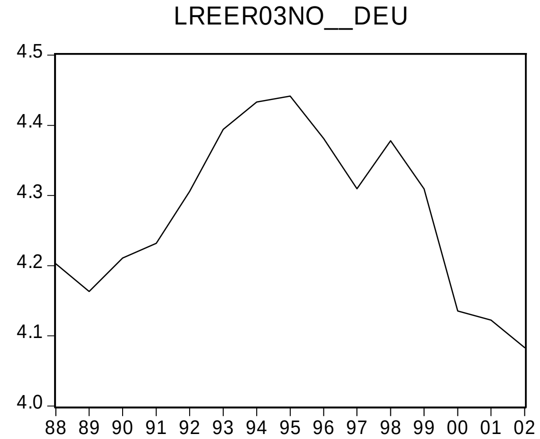
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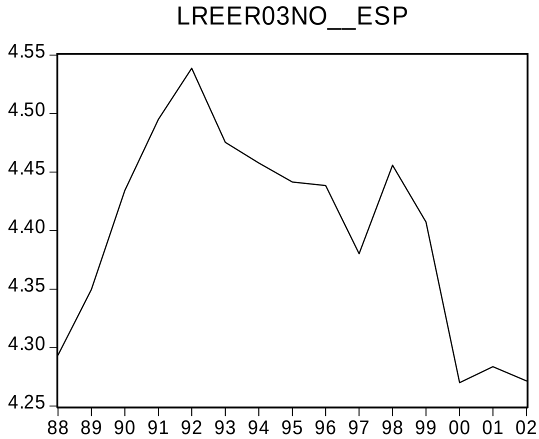
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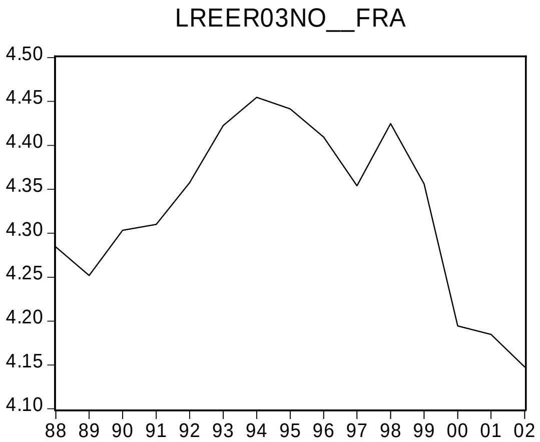
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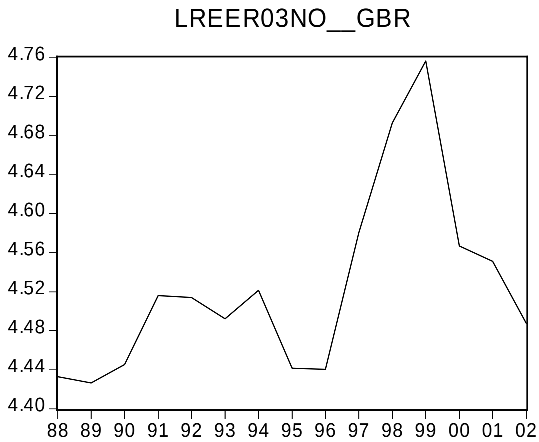
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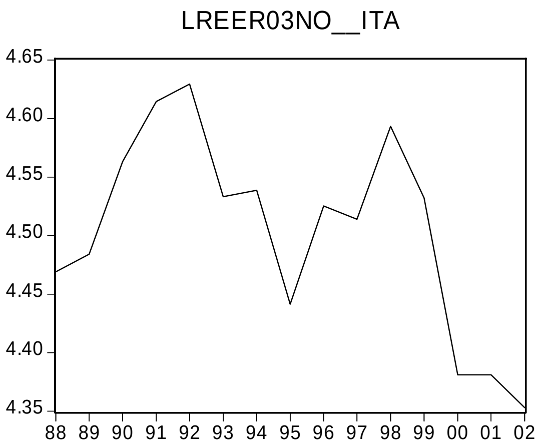
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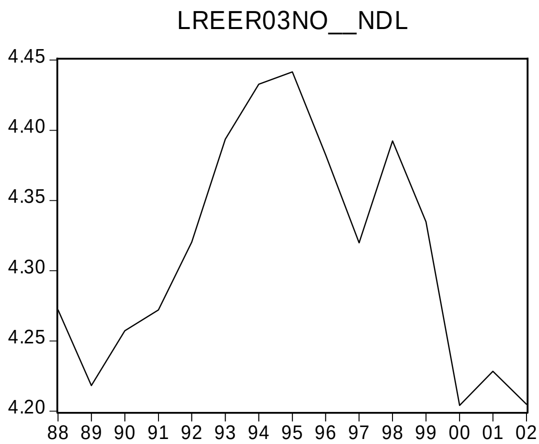
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