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Unit Values, Productivity, and Trade - Determinants of Spanish Export Strength

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Abstract

In this paper we assess the current relevance of different sources of international competitiveness. Relative prices, labor costs, and productivity are evaluated as determinants of a country's international competitiveness at the industry level. Working with detailed data on unit values and with industry data on productivity, we empirically implement a MacDougall-type model for Spanish and French trade to Brazil, China, Japan, and the U.S. The period under study is 1980 to 2001 and we distinguish in our analysis between homogenous, reference-priced, and differentiated goods. Our results indicate that cost competitiveness factors are only valid for explaining trade with developing countries while other factors are of importance for developed economies. Overall price competitiveness is of importance, but for differentiated goods, factors distinct from prices seem to determine export success.

KEYWORDS: Spain, France, competitiveness, unit values, comparative advantage

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1 Introduction

As a consequence of the globalization process (progressive deregulation of trade achieved in multilateral trade negotiation rounds, by regional and bilateral trade agreements, and by implementing integrated production systems), trade flows have increased 22 fold since 1970, much more than the GDP during the same period. Additionally, international trade flows have changed as dramatically in content and direction as they have in size over the past three decades. What is the response of national economies to globalization in terms of trade? International trade theories (both classical and new) predict that increasing globalization is associated with a higher production concentration of certain economic activities, and therefore increased specialization, according to comparative advantage (Ricardo-type models) and economies-of-scale criteria (Krugman, 1991). Whereas Ricardian models are generally concerned with non-differentiated goods with a high degree of substitutability, trade theories based on monopolistic competition explain trade with differentiated products where the substitutability of goods is typically low (Gros, 1987). The particular features of these models-product differentiation, increasing returns to scale, and monopolistic competition-make them useful in analyzing trade between industrial countries. Recent empirical evidence shows that trade in the extensive margin (a wider set of goods) is the dominant trend for large economies (e.g., Hummels and Klenow, 2005).

We will focus on the first class of trade models to analyze the role productivity differences plays in influencing international competitiveness. With respect to the second class of models that refer to differentiated products, we include export unit values as indicators of product characteristics (product quality) since product quality and product design are barely quantifiable.

To date, there has been little investigation into the relationship between productivity and competitiveness. Since the early studies by MacDougall (MacDougall, 1951, 1952 and MacDougall et al., 1962), as well as those by Stern (1962), Balassa (1963), and McGilvray, J. and Simpson, D. (1973), only a few authors have recently evaluated this relationship from an empirical standpoint.

Golub and Hsieh (2000) assessed the contemporary relevance of the classical model for U.S. trade over the period from 1970 through 1992. They found some evidence supporting the theory, but much of the sectoral variation in trade remained unexplained. Choudhri and Schembri (2002) used a modern adaptation of the Ricardian model, which incorporates monopolistic competition, and derived a MacDougall-type relationship. They tested this relationship for Canada and the U.S. using panel data for 1966 through 1990 for

40 industries. Their results also support the validity of the Ricardian model, although other factors, such as trade liberalization, also play an important role in explaining market shares. This paper extends and updates the existent literature using a different set of countries and time frames. Since most of the empirical evidence in this field is related to U.S. international trade, we endeavor to extend the evidence to other countries, and specifically to north-south trade.

We focus on Spain's relative export strength for several reasons. First, over the last 30 years, Spain has experienced strong economic growth with an overall tendency to catch up, in real terms, with developed countries. Second, the relative size of high-technology industries is greater in the EU than in Spain, where the low-technology industries represent a higher proportion of the total value added. Finally, the difference between Spain and the EU in the distribution of value added among industries has remained nearly constant over the past two decades. This fact shows that Spanish industry retains a severe structural problem with industrial development due to the reduced size of the technology and equipment sectors and an excessive dependence upon traditional industrial sectors.

Now, we briefly describe the evolution of industrial specialization and competitiveness of Spanish industry. With respect to the specialization patterns, over the last two decades, the manufacturing sector has experienced substantial changes. The value added of high and low technology industries has experienced a rate of growth above the average (2.26% and 1.21%, respectively). Within the former group, the manufacturing of general office and computing, and accounting machinery is the only industry where the value added has decreased since 1985. Within the second group, the high rate of growth has been mainly due to the industries of food, beverages, and tobacco, as well as the paper manufacturing and printing industries; the rest of the industries within this group have decreased in absolute and relative size. Average-technology industries, which display a growth rate of only 0.5%, have not changed their relative position, apart from some industries which have lost position such as metallurgy, shipbuilding, and metallic products. Between 1973 and 1985, the real export growth rate averaged 8.2% per year. However, this pattern changed after 1985, mainly due to the Spain's incorporation into the European Community in 1986. On one side, trade barriers were gradually eliminated, giving rise to a large increase in imports. On the other, internal production levels experienced a moderate increase since the new state provided a greater market with more opportunities. The rate of growth in export levels was reduced to 5.4% (its lowest level since the 1960s), since the exchange rate policy no longer compensated for the losses in competitiveness stemming from the inflation differential between Spain and other European countries. Consequently, export propensity registered an important reduction explained by the losses in competitiveness of industry in the internal market and by the stagnant trend of exports. In just five years, the industrial sector lost the momentum observed in the preceding decade. This led to a considerable external disequilibrium.[1] Finally, in 1992, when the monetary authorities could no longer maintain the over-valued exchange rate, the specialization levels of the 1970s were restored. The dynamic evolution of exports in recent years has been the primary cause of the recovery of the propensity to export.

Having identified the specialization patterns of the industrial sectors, we now characterize the comparative advantage underlying these patterns. We observe a positive trade balance in most industries for the early 1980s, going from the low technology and the average technology industries to the motor vehicles industry. This balance offset the deficits in oil products, chemical industry and equipment. The comparative advantage is gradually focused upon oil refining, basic metallurgy, minerals, motor vehicles, metal products, and traditional industries, such as food, beverages and tobacco, and clothes and footwear. This pattern was broken with Spain's entry into the EC due to the need for restructuring in the industrial sector, together with the sensitiveness of the competitive advantages, features that were hidden until that time. Hence, in the late 1980s, most industries displayed a trade deficit since the comparative-advantages hold in many sectors vanished, particularly, in traditional industries and oil products. Only average-technology industries and motor vehicle industries managed to maintain a positive balance. Presently, Spain's comparative advantage is more similar to the dominant pattern in the most developed countries in Europe. However, Spain still has a long way to go to achieve convergence.

Given these developments, and in order to analyze the determinants of Spain's relative export strength over the last few decades, we propose estimating a model that includes relative productivity, relative labor compensation, and relative unit values as the factors influencing export levels.

[1] The trade imbalance at the beginning of the 1990s was 29 billion U.S. dollars, the highest, in relative size, among the Organisation for Economic Co-operation and Development (OECD) countries.

2 Theoretical framework: comparative and competitive advantage

The principle of comparative advantage is historically tied to the Ricardian model. According to the Ricardian model of free trade, countries tend to export those goods which have the lowest relative costs in autarky. In its simplest form, comparative advantage is defined in terms of unit labor requirements in a world of two goods and two countries. Assuming that labor is the only factor of production, the supply of labor is fixed in each country and perfect competition prevails in all markets; Country 1 has a comparative advantage in producing Good i, compared to Country 2 and Good j, if it can produce Good i with less labor relative to Good j, compared to Country 2. Thus,

$$\frac{a_i^1}{a_j^1} < \frac{a_i^2}{a_j^2} \tag{1}$$

It can be shown that world output increases if one or both countries specialize in producing the good in which they have comparative advantage. The Ricardian model can easily be generalized to multiple goods, $i = 1, \ldots, N$. This extension was first demonstrated by Dornbusch, Fischer, and Samuelson (1977). A ranking can be constructed over the N goods' relative labor requirements in the two countries. The new formulation in terms of Country 1's labor requirements is given by

$$\frac{a_1^1}{a_1^2} < \frac{a_2^1}{a_2^2} < \ldots < \frac{a_N^1}{a_N^2} \tag{2}$$

Country 1 specializes in goods that lie to the left in this chain, whereas Country 2 specializes in goods that lie to the right. Equation 2 could be used to make partial statements about patterns of trade. In a world of many goods and countries, specialization is associated somehow with low unit labor requirements (Dornbusch, Fischer, and Samuelson, 1977).

Although the Ricardian model is static in nature, recent theoretical developments which integrate trade models and economic growth models (e.g., Lucas, 1988-Ricardian model with learning-by-doing-driven technical progress) indicate that specialization enhances technical progress in exporting industries, reinforcing comparative advantage. Cuñat and Maffezzoli (2007) also present a dynamic comparative advantage model to analyze the effects of falling trade barriers on trade volumes over time.

Although the trade literature has usually linked the principle of comparative advantage to Ricardian and Hecksher-Ohlin-type trade, a more general

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interpretation of the principle suggests that a producer has comparative advantage if its production costs, in terms of equilibrium factor prices, are lower than those of an international competitor. The source of this advantage could be based upon technological differences, the relative abundance of some inputs, the scale of production, product quality, or any combination of these sources. The product cycle theory (Vernon, 1979) is a good example of the wider definition of comparative advantage. The concept of competitiveness is even more ambiguous than the concept of comparative advantage. A narrow definition could be related to strong performance in exports; this is the concept used by Dollar and Wolff (1993), who proposed measuring it in terms of productivity.

3 Data sources and empirical implementation

3.1 Data sources and variables

The main problem faced by researchers when attempting to test the Ricardian theory is that autarky prices are not observable; hence, the theory of comparative advantage cannot be directly tested. However, there are other factors which may be observable and help to explain which goods countries trade; autarky prices then could be explained with country-specific characteristics. Therefore, we do not try to test the Ricardian theory. Instead, we focus on differences in price competitiveness and productivity which could explain the performance of different exporters in different markets.

The main data sources we use are the Groningen Growth and Development Centre (GGDC)[2] for productivity and labor compensation data, at the industry level, and the United Nations Commodity Trade Statistics Database (COMTRADE) for disaggregated exports in value and volume. The GGDC carries out comparative analysis of levels of economic performance and differences in growth rates in the world economy. The International Comparisons of Output and Productivity by Industry Database (ICOP) consists of data on levels of productivity and labor compensation for 20 manufacturing industries in 14 countries in the European Union, as well as the United States. The data are based primarily on 1997 benchmark comparisons. The current contents of this database are equal to the Manufacturing Productivity and Unit Labour Cost Database (MPULCD), part of a joint study by the GGDC and the National Institute of Economic and Social Research described in O'Mahony and van Ark (2003). Variables covered include current value added, value-added

[2] http://www.ggdc.net/

deflators, persons engaged, number of employees, hours worked and labor compensation for the period of 1979 to 2001. For most variables and countries, the OECD Structural Analysis (STAN) database is taken as the point of departure, which is largely based upon national accounts of individual OECD member states. The STAN data are complemented and updated by the use of information from industry surveys and from national accounts of individual countries. The variables used in this research are defined below.

Value added per hour worked is current gross value added, measured at producer or at basic prices (depending on the valuation used in the national accounts), in U.S. dollars (at current exchange rates), divided by average annual hours worked per employee. Labor compensation per hour worked is current price labor costs borne by the employer, in U.S. dollars (at current exchange rates), divided by average annual hours worked per employee. This includes wages, as well as the costs of supplements, such as employers' compulsory pension and medical payments. Unit labor costs is labor compensation divided by the value added.

Exports values and quantities were extracted from the UN COMTRADE. The level of disaggregation is four digits, according to the Standard International Trade Classification (SITC), Revision 2. Unit values are calculated as export values divided by export quantities. Since exports are classified according to the SITC classification (Revision 2), whereas production data are derived from the The International Standard Industrial Classification of All Economic Activities ISIC (Revision 2) at three-digit industry level, a conversion table taken from the Jon Haveman web page has been used.[3]

3.2 Empirical implementation

We perform a panel analysis of French exports relative to Spanish exports over the period of 1980 to 2001. Following MacDougall (1951, 1952), Stern (1962), and Balassa (1963), we use export ratios as a measure of trade. As in Balassa, we use exports to third markets. The independent variables considered are relative productivity, relative labor compensation, and relative unit values. Following Rauch (1999), we classify sectors into three different groups, namely homogeneous (Rauch 1), reference-priced (Rauch 2), and differentiated goods (Rauch 3). Rauch 1 and Rauch 2 belong to the category of standard products that are expected to have a negative price impact. In our estimations, we include dummies for the different groups or restrict our sample to one of the three groups to acknowledge the differences between these types of goods. We

[3] http://www.haveman.org/

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would expect that price competitiveness is less important for differentiated goods than for homogeneous or reference-priced goods. Other factors like quality, variety, or uniqueness should be more important for these types of goods. We set up the following specifications to capture the model described above:

$$\log\left(\frac{X_{ijkt}}{X_{ljkt}}\right) = \alpha_j + \beta_j \log\left(\frac{UV_{ijkt}}{UV_{ljkt}}\right) + \lambda_j \log\left(\frac{ulc_{ikt}}{ulc_{lkt}}\right) + \mu_{jkt} \tag{3}$$

$$\log\left(\frac{X_{ijkt}}{X_{ljkt}}\right) = \alpha_j + \beta_j \log\left(\frac{UV_{ijkt}}{UV_{ljkt}}\right) + \chi_j \log\left(\frac{a_{ikt}}{a_{lkt}}\right) + \delta_j \log\left(\frac{w_{ikt}}{w_{lkt}}\right) + \varepsilon_{jkt} \tag{4}$$

where X_{ijkt} (X_{ljkt}) denotes exports from Country i (l) to Country j, for Sector k in Period t. UV_{ijkt} and UV_{ljkt} denote French (i) and Spanish (l) export unit values to Destination j, for Sector k in Period t. a_{ikt} and a_{ljkt} denote French (i) and Spanish (l) labor productivity for Sector k in Period t. w_{ikt} and w_{lkt} denote French (i) and Spanish (l) labor compensation per employee for Sector k in Period t. ulc denotes unit labor costs and is calculated as (w/a). As destination markets j, we chose Japan, the U.S., Brazil, and China-two large developed economies, as well as two important emerging markets. One should note that the unit values differ across sectors and destination markets, whereas the productivity and labor cost data are constant across destination markets and only differ across sectors. We expect a positive impact of relative labor productivity on relative exports, a negative impact of relative wages and relative unit labor costs on relative export strength, and a negative impact of relative unit values on relative exports when trade with standard products is considered.

Next, comparative advantage can also be understood as a dynamic process. The pattern of specialization today depends on past specialization. Countries' relative exports and the degree to which they specialize in producing a given good are not independent from the "recent history". To capture these dynamics, we estimate a dynamic version of Model 4 that includes a lagged dependent variable as an additional regressor:

$$\log\left(\frac{X_{ijkt}}{X_{ljkt}}\right) = \alpha_j + \varphi_j \log\left(\frac{X_{ijk(t-1)}}{X_{ljk(t-1)}}\right) + \beta_j \log\left(\frac{UV_{ijkt}}{UV_{ljkt}}\right) + \chi_j \log\left(\frac{a_{ikt}}{a_{lkt}}\right) + \delta_j \log\left(\frac{w_{ikt}}{w_{lkt}}\right) + \varepsilon_{jkt} \tag{5}$$

4 The econometric model and results

In the empirical application, we simplify the terms used in Equations 3 and 4 which have France in the numerator and Spain in the denominator. lxv stands for relative (France over Spain) export strength in logs, luv is utilized for relative unit values in logs, lw is relative labor compensation, and lva is relative productivity in logs. j characterizes the destination market, k stands for sector, and t stands for time. We obtain the following Equations 6 and 7:

$$lxv_{ijkt} = \alpha_j + \beta_j luv_{ijkt} + \lambda_j lulc_{ikt} + \mu_{jkt} \quad (6)$$

$$lxv_{ijkt} = \alpha_j + \beta_j luv_{ijkt} + \chi_j lva_{ikt} + \delta_j lw_{ikt} + \varepsilon_{jkt} \quad (7)$$

To control for cross-correlation between destination markets j, we estimate Specifications 6 and 7, respectively, as a system, with one equation for each destination market, using seemingly unrelated regression (SUR). In prior estimations, we allow for country-specific constants and country-specific coefficients. However, testing for equality of the coefficients using a Wald test indicates that the differences between the coefficients are not significant in all cases. We therefore estimate Equations 6 and 7 with common coefficients and country-specific constants. Autocorrelation is addressed by the inclusion of $AR(1)$ terms. It appears that heteroskedasticity does not affect the estimated coefficients; all SUR results presented are robust compared to GLS approaches. The dynamic specification is given by

$$lxv_{ijkt} = \alpha_j + \varphi_j lxv_{ijk(t-1)} + \beta_j luv_{ijkt} + \chi_j lva_{ikt} + \delta_j lw_{ikt} + \varepsilon_{jkt} \quad (8)$$

Instrumental-variable techniques are required to remove the econometric problem of joint endogeneity in Equation 8. We estimate Equation 8 in levels using instruments for the lagged dependent variable. As demonstrated by Baltagi and Griffin (1983) and Baltagi, Bresson, Griffin, and Pirotte (2003), this model performs better than the model in first differences in terms of out-of-sample forecast accuracy.

First, we present the results for the static model. Table 1 reports the results for France's, relative to Spain's, exports to four destination markets: the U.S., Brazil, Japan, and China . The period under study is 1980 to 2001. At a first glance, these results support the broad notion of comparative and competitive advantage; the coefficients for unit labor costs, labor compensation, and value added are significant and show the expected sign (negative signs for Unit Labor

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Table 1: Determinants of France's Export Strength Relative to Spain's Export Strength for Brazil, China, Japan, and the U.S.

Dependent variable: *lxv*. Estimation method: SUR.				
	Equation 6		Equation 7	
	Coefficient	p-value	Coefficient	p-value
lulc	-0.229	0.022		
lw			-0.231	0.117
lva			0.228	0.060
luv	-0.039	0.000	-0.039	0.000
AR(1)	0.749	0.000	0.749	0.000
Rauch 1	-1.478	0.000	-1.479	0.000
Rauch 2	-0.429	0.000	-0.429	0.000
Constant Brazil	1.066	0.000	1.068	0.000
Constant China	1.482	0.000	1.484	0.000
Constant Japan	2.304	0.000	2.305	0.000
Constant U.S.	1.792	0.000	1.793	0.000
Brazil				
Observations	4352		4352	
Adjusted R^2	0.513		0.513	
Durbin-Watson	2.166		2.166	
China				
Observations	2468		2468	
Adjusted R^2	0.310		0.309	
Durbin-Watson	2.394		2.394	
Japan				
Observations	6060		6060	
Adjusted R^2	0.641		0.641	
Durbin-Watson	2.068		2.068	
U.S.				
Observations	8178		8178	
Adjusted R^2	0.647		0.647	
Durbin-Watson	2.158		2.158	

Costs and Labor Compensation and a positive sign for Value Added). The coefficient of the unit values is significant with the expected sign, as well, but it is rather small. The negative and significant coefficients of the Rauch 1 and Rauch 2 dummies indicate that France has an advantage over Spain in exporting differentiated goods compared to homogenous and reference-priced goods. Compared to other studies[4], the explanatory power of our estimates is somewhat high, which might be due to the fact that this study, in contrast to previous ones, evaluates the time-series properties of the data.

In a next step, we estimated the model for reference-priced and differentiated goods, separately. The results are shown in the second and third columns

4 i.e. Golub and Hsieh (2000)

Table 2: Determinants of France's Export Strength Relative to Spain's Export Strength for Brazil China, Japan, and the U.S. (Rauch 2 and Rauch 3)

Dependent variable: lxv. Estimation method: SUR.				
	Rauch 2		Rauch 3	
	Coefficient	p-value	Coefficient	p-value
lw	-1.139	0.006	-0.283	0.080
lva	-0.329	0.285	0.412	0.002
luv	-0.283	0.000	0.022	0.043
AR(1)	0.721	0.000	0.734	0.000
Constant Brazil	1.679	0.000	0.956	0.000
Constant China	1.394	0.000	1.521	0.000
Constant Japan	2.453	0.000	2.270	0.000
Constant U.S.	2.147	0.000	1.692	0.000
Brazil				
Observations	1076		3198	
Adjusted R^2	0.540		0.491	
Durbin-Watson	2.043		2.187	
China				
Observations	599		1832	
Adjusted R^2	0.230		0.325	
Durbin-Watson	2.202		2.392	
Japan				
Observations	1263		4637	
Adjusted R^2	0.617		0.629	
Durbin-Watson	2.100		2.025	
U.S.				
Observations	1801		6136	
Adjusted R^2	0.623		0.655	
Durbin-Watson	2.055		2.121	

of Table 2. Since our productivity data mainly include manufacturing, only a relatively small number of observations is available for homogeneous goods, excluding most agricultural products.

Consequently, we prefer to not draw conclusions from a sub-sample, including only Rauch 1 goods. For reference-priced goods, we find that that labor compensation and unit values have a greater impact than they have for all goods, whereas productivity turns out to be insignificant. In contrast to differentiated goods, unit values have a positive sign, indicating that other factors, apart from price competitiveness, seem to play a role. While labor compensation is only weakly significant, both labor compensation and productivity carry the expected signs.

We expect differences in the validity of the empirical model between developed and developing economies. As Hummels and Klenow (2005) have shown,

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Table 3: Determinants of France's Export Strength Relative to Spain's Export Strength for Brazil and China

Dependent variable: *lxv*. Estimation method: SUR.				
	Equation 6		Equation 7	
	Coefficient	*p*-value	Coefficient	*p*-value
lulc	-0.688	0.002		
lw			-0.803	0.017
lva			0.642	0.007
luv	-0.054	0.005	-0.054	0.005
AR(1)	0.650	0.000	0.650	0.000
Rauch 1	-2.476	0.000	-2.485	0.000
Rauch 2	-0.377	0.012	-0.382	0.011
Constant Brazil	1.221	0.000	1.298	0.000
Constant China	1.603	0.000	1.681	0.000
Brazil				
Observations	4352		4352	
Adjusted R^2	0.515		0.515	
Durbin-Watson	1.954		1.954	
China				
Observations	2468		2468	
Adjusted R^2	0.339		0.339	
Durbin-Watson	2.234		2.234	

it is the extensive margin, a larger variety of goods exported, which determines export success among developed economies. Therefore, it can be expected that the theory of comparative advantage and specialization in production might still explain trade with developing countries, but not trade between developed economies. To examine these differences we first estimate the model including only Brazil and China as destination markets (Table 3). In this case, the results are perfectly consistent with the model specification; all coefficients are significant and show the expected sign. Once more, the Rauch 1 and Rauch 2 dummies are negative and significant.

The results for the two developing countries differ from what we find when we restrict the sample to Japan and the U.S. (Table 5). Neither the coefficients of unit labor costs nor productivity nor labor compensation is significant. Only price competitiveness seems to play a role, but the estimated coefficient is rather small. Hence, the estimation results for the developed countries in our sample do not support the theory of comparative advantage and specialization in production.

The dynamic model estimation results are presented in tables 6 through 8. Table 6 shows the estimates of Equation 8. The main result is that dynamics

Table 4: Determinants of France's Export Strength Relative to Spain's Export Strength for Brazil and China (Rauch 2 and Rauch 3)

Dependent variable: *lxv*. Estimation method: SUR.				
	Rauch 2		Rauch 3	
	Coefficient	*p*-value	Coefficient	*p*-value
lw	-1.973	0.012	-0.767	0.041
lva	0.447	0.391	0.752	0.005
luv	-0.368	0.000	0.041	0.064
AR(1)	0.636	0.000	0.639	0.000
Constant Brazil	1.858	0.000	1.154	0.000
Constant China	1.556	0.000	1.696	0.000
Brazil				
Observations	1076		3198	
Adjusted R^2	0.537		0.492	
Durbin-Watson	1.854		1.976	
China				
Observations	599		1832	
Adjusted R^2	0.262		0.349	
Durbin-Watson	2.054		2.229	

are important, since the coefficient of the lagged dependent variable is always significant and positive, indicating that past relative export strength influences current export strength. The short-run coefficients of wages, productivities, and unit values show slightly lower magnitudes than in the static model (Table 1).

When we compare the results obtained from the reference-priced and differentiated goods sub-samples (Table 4), we find that competitiveness in labor compensation and unit values is of major importance for reference-priced goods, while productivity turns out to be insignificant. For differentiated goods, both labor compensation and productivity are significant and show the expected signs. In contrast, the unit-value coefficient has a positive and weakly significant sign, indicating that it is not price competitiveness that explains export success for this type of goods.

Table 7 displays the estimates for the two sub-samples-Brazil and China results in Column 2 and Japan and the U.S. results in Column 3. Relative wages and relative productivities are significant for Brazil and China, whereas relative wages and unit values are significant for Japan and the U.S.

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Table 5: Determinants of France's Export Strength Relative to Spain's Export Strength for Japan and the U.S.

Dependent variable: lxv. Estimation method: SUR.				
	Equation 6		Equation 7	
	Coefficient	p-value	Coefficient	p-value
$lulc$	-0.132	0.229		
lw			-0.117	0.467
lva			0.143	0.291
luv	-0.034	0.002	-0.034	0.002
AR(1)	0.784	0.000	0.784	0.000
Rauch 1	-1.324	0.000	-1.322	0.000
Rauch 2	-0.472	0.000	-0.471	0.000
Constant Japan	2.258	0.000	2.245	0.000
Constant U.S.	1.752	0.000	1.740	0.000
Japan				
Observations	6060		6060	
Adjusted R^2	0.643		0.643	
Durbin-Watson	2.153		2.154	
U.S.				
Observations	8178		8178	
Adjusted R^2	0.648		0.648	
Durbin-Watson	2.249		2.249	

Table 6: Determinants of France's Export Strength Relative to Spain's Export Strength for Brazil, China, Japan, and the U.S.: Dynamic model

Dependent variable: lxv. Estimation method: FE & 3SLS.				
	Equation 8, FE		Equation 8, 3SLS	
	Coefficient	p-value	Coefficient	p-value
lw	-0.220	0.001	-0.169	0.007
lva	0.114	0.008	0.084	0.056
luv	-0.017	0.022	-0.008	0.284
$lxv(-1)$	0.847	0.000	0.859	0.000
AR(1)	-0.275	0.000	-0.278	0.000
Rauch 1	-0.281	0.000	-0.211	0.000
Rauch 2	-0.064	0.002	-0.026	0.209
Constant Brazil	-0.109	0.000	0.169	0.000
Constant China	-0.042	0.000	0.254	0.000
Constant Japan	0.078	0.000	0.349	0.000
Constant U.S.	0.008	0.000	0.279	0.000
Observations	18410			
Brazil Observations			3104	
China Observations			1527	
Japan Observations			4826	
U.S. Observations			6890	

Table 7: Determinants of France's Export Strength Relative to Spain's Export Strength for Brazil and China/Japan and the U.S.: Dynamic model

Dependent variable: *lxv*. Estimation method: 3SLS.				
	Brazil and China		Japan and the U.S.	
	Coefficient	*p*-value	Coefficient	*p*-value
lw	-0.321	0.068	-0.139	0.031
lva	0.185	0.075	0.054	0.234
luv	0.005	0.779	-0.014	0.100
$lxv(-1)$	0.795	0.000	0.884	0.000
AR(1)	-0.260	0.000	-0.282	0.000
Rauch 1	-0.512	0.003	-0.153	0.007
Rauch 2	-0.040	0.375	-0.026	0.230
Constant Brazil	0.278	0.001		
Constant China	0.387	0.000		
Constant Japan			-0.139	0.031
Constant U.S.			0.054	0.234
Brazil Observations	3104			
China Observations	1527			
Japan Observations			4826	
U.S. Observations			6890	

Table 8: Determinants of France's Export Strength Relative to Spain's Export Strength for Rauch 2 and Rauch 3: Dynamic model

Dependent variable: *lxv*. Estimation method: 3SLS.				
	Rauch 2		Rauch 3	
	Coefficient	*p*-value	Coefficient	*p*-value
lw	-0.632	0.143	-0.103	0.534
lva	-0.258	0.436	0.259	0.066
luv	-0.235	0.000	0.041	0.000
$lxv(-1)$	0.847	0.000	0.863	0.000
AR(1)	-0.266	0.000	-0.277	0.000
Constant Brazil	1.672	0.000	0.860	0.001
Constant China	1.742	0.006	1.840	0.000
Constant Japan	2.941	0.000	2.539	0.000
Constant U.S.	2.168	0.000	1.955	0.000
Brazil Observations	770		2292	
China Observations	362		1148	
Japan Observations	975		3727	
U.S. Observations	1465		5249	

Finally, Table 8 shows the estimates for different types of products. Only relative export unit values are significant (and have a negative coefficient) for referenced price goods (Rauch 2), indicating that price competitiveness is the main force determining dynamic comparative advantage. Relative productivities and relative export unit values are significant for differentiated goods (Rauch 3), but the estimated coefficient for relative export unit values is positive. This could indicate that, in the case of exports of differentiated goods, unit values may be a proxy for better quality products.

5 Conclusions

The objective of our study is to explain export performance using variables related to productivity and cost competitiveness for different types of destination markets. Brazil and China are representatives of emerging/developing markets, whereas Japan and the U.S. represent highly industrialized countries. Theory would lead us to expect more inter-industry (Ricardo-type) trade between France and Spain and developing countries and to observe more intra-industry trade between France and Spain and industrialized countries. Furthermore, according to the theory, inter-industry trade is driven by price competitiveness factors, whereas intra-industry trade is driven primarily by factors related to differences in taste, product variety, and product quality.

In fact, our empirical analysis indicates that Spain's exports to developing countries (Brazil and China), relative to French exports to those countries, can well be explained by labor compensation and labor productivity (unit labor costs). In contrast, Spanish exports to developed countries, relative to French exports, are not so much determined by unit labor costs but rather by product characteristics. This conclusion is supported by the high proportion of intra-industry trade among industrialized countries. Products are imported because consumers of developed countries desire variety and are willing to pay more for a product with certain characteristics.

The empirical evidence shows that the simpler model, with common coefficients for destination markets, provides more robust results than the model with destination-market-specific coefficients. However, there are some interesting differences in the coefficients when different types of products are investigated. Relative exports of products in the categories homogenous goods (Rauch 1) and reference-priced goods (Rauch 2) depend upon price advantages and are therefore governed by price competitiveness factors. In contrast, relative exports of differentiated products (Rauch 3) are positively related to unit values. For this type of good, a higher relative price seems to be an indicator of higher quality or superior product properties, explaining why relative exports rise with increasing prices.

Modeling dynamics is also important and the results obtained when estimating the dynamic specification support the evidence found when estimating the static model. In summary, the results in this paper further support to the results showing that the unit cost criterion is valid to explain north-south EU trade and that the dynamics are important. Although price competitiveness is almost always an issue, other factors, aside from price differences, are probably more relevant in determining export success for differentiated goods. Consequently, "new" trade theories, related to monopolistic competition and economies of scale, are certainly more appropriate to explain trade among developed countries.

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