THE SPANISH INTERREGIONAL TRADE COLLAPSE

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Final Year Project

Academic Course 2016/2017

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Abstract

After a period of economic expansion, lasting from 2000 to 2007, where both Spanish GDP and interregional trade volume were growing at high rates, an economic contraction occurred affecting the majority of countries in the world, including Spain. This led to the greatest and quickest trade collapse ever seen. This paper analyzes data for 16 Spanish industry sectors for 14 years (2000-2013), comparing the effects of the crisis on trade within Spain with the effects observed by other papers at a global scale. The results of this study confirm the existence of a Spanish internal trade collapse, showing a 23% drop in interregional trade, exceeding the fall in Spanish GDP, -3.6%, by a factor of 6. These findings are supported by the estimation of a Gravity Model of trade in order to determine which factors influence trade between *Comunidades Autónomas*. We also examine the alleged causes of the Great Trade Collapse and their applicability to the Spanish case. All in all, the reduction in consumption, investment and credit concession to private sector are the main determinants of the Spanish Trade Collapse.

Keywords: economic crisis, *Comunidades Autónomas*, Gravity Model of Trade, industry sectors, interregional trade, trade collapse.

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1. INTRODUCTION

In September 2008, after Lehman Brothers' bankruptcy filing, the global economy collapsed, and the world trade dropped during the last months of 2008 and the beginning of 2009 by about 20%, falling more than the world GDP in the same period. This phenomenon, known as the Great Trade Collapse, has been widely studied by many economists in order to determine its causes.

Influential economic papers have stated that the most important cause of the trade collapse was a sudden and sharp decrease in demand for goods, especially durable goods, as a result of increasing economic uncertainty. Other authors have argued that the credit crunch that followed the crisis had an effect on the global volume of trade, since both households and firms faced important restrictions to access credit. However, no consensus has been reached on this topic as of 2016.

The object of this paper is to analyze the effects of this crisis on trade from a local perspective. To do that, we use data for interregional trade at industry sector level within Spain, from 2000 to 2013 gathered by the C-Intereg project[1]. In the first place, to examine whether there was a trade collapse in Spain and whether it was similar to the one that occurred at a global level, we describe and discuss the causes and effects of the Great Trade Collapse, argued by the authors of the most relevant papers in this field. We analyze Spanish sector level data with trade interactions between regions for 16 industries for 14 years (2000-2013). In the Pre-Crisis study, we determine the most important sectors and regions. Then, in the Post-Crisis case, we prove the existence of an internal trade collapse. To do so, we study the relationship between regions and sectors, that is, we examine whether the *Comunidades Autónomas* mainly devoted to sectors which trade levels have fallen the most are the ones with the largest drops in exports, by comparing pre-crisis and post-crisis values.

From 2000 to 2007 interregional trade within Spanish regions in the industrial sector experienced a huge increase of 44.7%, with an average interannual growth rate of 6%. The background economic situation accompanied this trend, with an expansion of the economy, shown among others by an average yearly GDP growth of 3.7%, surpassing the EU average. This increase was headed partially by the real

[1] C-Intereg is a research Project founded by seven Spanish regional governments to gather interregional trade data. Information available at: www.c-intereg.es

estate bubble, as we can observe in the growth rate of trade in the Spanish metallurgic sector, which is one of the most important suppliers in construction and increased at a year-on-year rate of 9.8%. The results of this study confirm that a collapse occurred at a national level, with a fall of about 23% in interregional trade between 2007 and 2008, which implies a EUR 1 billion drop. Our findings suggest this was partially driven by demand side shocks and a credit shortage, similarly to the rest of the world. This paper aims at achieving a better understanding of the global trade collapse adding a national-level study to the analysis.

To analyze the Spanish interregional trade, we distinguish between Pre-Crisis and Post-Crisis periods. In each case, we characterize the trade by estimating a Gravity Model of Trade, in order to determine whether the trade patterns coincide with the ones obtained in other studies for international trade. Note that this model has not been used before to estimate the effects of the financial crisis on trade between *Comunidades Autónomas* in Spain. These estimations serve to understand trade flows within Spanish regions and the model allows controlling for some factors such as the economic crisis, the existence of common borders, as well as determining their effects on interregional trade. Secondly, we observe the evolution of the trade to GDP ratio over time, to document the Spanish collapse. Finally, we check if the main arguments used to justify the Great Trade Collapse can be applied at an internal level to the Spanish case. For that, we analyze possible shocks affecting interregional trade both from the demand and the supply side.

2. THE GREAT TRADE COLLAPSE

The financial crisis in 2008, brought about by the subprime crisis in the United States, led to a global recession that lasted from 2008 to 2011. Following this crisis, from 2008 to 2009[2] imports and exports in EU27 and 10 other nations that represent three quarters of the world trade fell by about 20-30%[3]. According to

[2] There is not an agreement about the exact dates of the collapse. BALDWIN, R. states that it lasted from Q3 2008 to Q2 2009, while BEMS, R., JOHNSON R. and YI, K., consider it lasted from Q1 2008 to Q1 2009.

[3] Information obtained from: http://voxeu.org/article/great-trade-collapse-what-caused-it-and-what-does-it-mean [Visited: 11th July 2016]

Antràs[4], the global world trade experienced a fall around 16-20% in 2008, exceeding by at least 5 times the fall in the GDP, which was around 3-4%. In the Spanish case, trade fell by 23%, whereas the fall in GDP was 3.6%, roughly 6 times less. Interregional trade represented 44.8% of the Spanish GDP in 2008, dropping by 9 points in 2009, with a 35.8% ratio.

Even though there have been some episodes of global trade collapse before[5], this time the collapse has been especially sudden, great –regarding its magnitude- and synchronized across countries compared to the previous ones. Since then, trade has increased, but the growth is unusually weak, compared to pre-recession values.

2.1. Stylized facts

The collapse affected both developed and emerging economies. During this period, the imports and exports of 104 countries dropped, according to WTO data.

The Great Trade Collapse was not symmetric across sectors, as trade in goods fell more than trade in services. Regarding the latter, we have to take into account that some sectors not only didn't fall, but experienced an increase in trade, such as business services.

According to Bems, Johnson and Yi[6], in the United States, imports fell especially in the sectors of automotive industry (-47%) and industrial supplies (-34%). Consumer goods imports also fell but by much less (-12%), and the drop was larger in durable than in nondurable goods.

Regarding exports, non-automotive consumer durables fell (-24.5%), whereas nondurables rose.

In the case of Belgium, a country with intensive international trade, exports of consumer nondurable goods and consumer durables dropped -2% and -36% respectively, while the decrease in imports of consumer nondurable goods and consumer durables was -36% and -39% respectively.

[4] See ANTRÀS P. conference XXXII Reunión Círculo de Economía.

[5] Three times since World War II: (i) Oil-shock recession in 1974-1975: (ii) Inflation-defeating recession in 1982-1983 and (iii) Tech-Wreck recession in 2001-2002.

[6] See BEMS, R., JOHNSON R. and YI, K. (2012), *The grade trade collapse.*

In addition to that, another distinction shall be done between manufactures and commodities. Commodities like food, raw materials and oil experienced a sharp increase in prices in early 2008. Given that these products account for a big part of global trade, the increase in prices affected the trade volume. However, the big part of the trade collapse was not caused by prices, since other non-commodity sectors, for instance the manufacturing sector, didn't experience such an increase. The collapse was primarily caused by a reduction in the amount of goods traded, not by a sudden increase in prices.

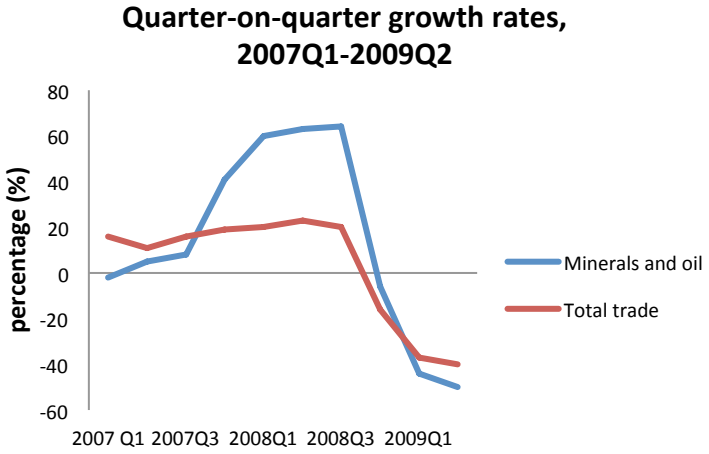

Figure 1. Source: ITC online database.

2.2. Causes

There is not an absolute consensus about the causes of the great trade collapse. Bems, Johnson and Yi present three causes: (i) Changes in real final expenditure; (ii) Financial shocks and (iii) Changes in trade policy. Regarding the first cause, they argue that it played a central role, because the spending on final goods decreased significantly, particularly durable goods. The second cause played a secondary role, as it disturbed export supply and blocked international transactions. Finally, the third cause played no role according to these authors, as no shift towards protectionism occurred during the collapse.

As Baldwin points out, when there is a sharp drop in sales, one has to find whether it was due to a demand or a supply shock. Regarding the great trade collapse, the fall in international sales was huge, and economists around the world agree that it came from a demand shock, even though there were some supply factors that also played a role.

The demand shock was produced by two different means: (i) Commodity prices: in Q1 2008 prices were really high, but then the price bubble burst in middle 2008. In addition to that, the demand for commodities diminished, so there was a reduction in both the value and the volume of commodities traded; (ii) Households and firms postponed consumption and investment, mostly in durable goods, as there was a period of uncertainty and an increased difficulty to access credit. These "postponeable" investments make up a large part of the world trade.

2.3. The magnitude of the collapse

As we have mentioned before, the fall in international trade was bigger than the fall in GDP, and this can be explained, following Baldwin, by the interaction between the demand shock with both a compositional and a synchronicity effect.

Regarding the compositional effect, Antràs focuses the attention on analyzing the change of the world trade to GDP ratio, specifically on how each component of the GDP has evolved. One of the main components is investment, which is highly related to international trade, because investment has to do with the purchase of capital goods and intermediate goods. As there was a demand shock, investment decreased and so did international trade.

On the other hand, the origin of the synchronicity effect is found in the fast growth in the world trade to GDP ratio during the 90s, due to the presence of international supply chains. The international supply chains is a phenomenon starting in the 90s by which firms, instead of producing at a local level, follow a trend of global level production, producing and trading intermediate goods in different locations. The appearance of these chains was due mainly to the drop of the technological barrier to trade, the liberalization of trade regulation and political changes. Basically, there was a reduction in the technological transportation costs, free trade agreements and firms realized that it was possible to operate in distant markets that offered cheaper conditions.

International chains are characterized as follows: in order to generate added value, firms use components from different countries, which produces a lot of gross trade flows, and this increases the world trade to GDP ratio. This deep internationalization facilitated the coordination and rapid transmission of demand shocks. During the collapse, these chains experienced a sudden stop. Given their exposure to intermediate goods demand, a lot of deceleration exists in such trade

chains. After the crisis, firms decreased the usage of foreign suppliers; therefore, each trade flow includes less foreign value added. After all, the level of international trade has declined.

In the following sections, we will start our analysis of the Spanish case. We distinguish two periods: Pre-Crisis and Post-Crisis. We describe the evolution of trade between Spanish regions in each period and we estimate a Gravity Model in order to characterize trade factors.

3. TRADE DURING THE PRE-CRISIS PERIOD

3.1. Descriptive analysis

From 2000 to the 2007, there is a clear growing trend in interregional exports. In *Figure 2* [7], we can observe the changes in the levels of trade over time for all the Spanish regions. In this Pre-Crisis period, the interregional exports have been headed by Catalunya (21.6%), Andalucía (11.6%), Comunidad Valenciana (9.9%), Comunidad de Madrid (9.7%) and País Vasco (8.1%)[8]. Therefore, the export patterns that these regions follow will highly influence the global Spanish trade evolution, especially if a trade collapse has occurred.

However, as we can see in *Figure 3* [9], the trade to GDP ratio kept stable. This means that the GDP and the exports were growing at a similar pace. This is different from what happened at a global scale, where the ratio increased in the years previous to the crisis. Following Antràs, this increase was probably due to high levels of outsourcing to developing countries for intermediate goods. Given that we analyze interregional trade, this kind of outsourcing is likely to have happened also to developing countries and not between regions.

Regarding the sectors with the highest volume of trade relative to the total volume, according to our database they are: the agro-alimentary sector (16%), the metallurgical sector (14%), the energy sector (11%), the agriculture, silviculture and fishing sector (8%), the oil and gas extraction and refinery sector (8%) and the transport equipment manufacturing sector (7%). We will need to look at these sectors later on to determine whether they have driven the fall in trade in Spain.

[7] See Figure 2 in Section 4.

[8] See Table 2.

[9] See Figure 3 in Section 4.

3.2. The Gravity Model of Trade

The Gravity Model of Trade[10] has been widely used in the field of social sciences to explain a range of economic facts. In international economics, gravity equations make predictions on the bilateral trade flows, relating observed outcome to the economic size and distance between two countries or other economic units, such as regions.

$$T_{EXP,IMP} = \frac{A \times (GDP_{EXP})^{\propto} \times (GDP_{IMP})^{\beta}}{(DIST_{EXP,IMP})^{\varphi}}$$

Following this equation, the model foresees that trade ($T_{EXP,IMP}$) will be greater the greater are the economic masses of the countries, usually measured by their GDP, and the closer together they are, in absolute terms. For instance, the level of trade between two economic units, labeled exporter (*EXP*) and importer (*IMP*), depends positively on the product of their GDP (also multiplied by a constant, *A*) and it is inversely proportional to the geographical distance between them ($DIST_{EXP,IMP}$), measured in kilometers.

This statement can be extended to include additional variables, which can have an effect on the level of trade between two regions, such as a common border or language, how the goods are transported or the influence of factors like an economic crisis or a free trade agreement between two countries.

The Gravity Model has been applied in different studies to analyze the bilateral trade relationship, using both cross-section and panel data approaches. Rahman (2003)[11] uses panel data to examine Bangladesh trade, considering both economic and natural factors. The study covers data of 35 countries for 28 years (1972-1999). Hassan (2000, 2001 and 2002)[12] analyzes the effects of regional trade on bilateral

[10] As stated by CHANEY, T. in the paper *The gravity equation in international trade: an explanation*, Jan Tinbergen in 1962 used an analogy with Newton's universal law of gravitation to describe the patterns of bilateral aggregate trade flows between two countries, here EXPORTER and IMPORTER. Newton's gravity law in physics states that two objects attract each other proportionally to the product of each body's mass divided by the square of the distance between their respective centers of gravity.

[11] See MAFIZUR, M. research *Australia's Global Trade Potential: Evidence from the Gravity Model Analysis*, p. 9.

[12] *Ibid.*

trade of 27 countries using cross-section data. Guttman and Richards (2004)[13] examine Australia's trade openness, finding that its great size and its geographical location, as it is isolated and therefore far from other countries, lead to a low trade level comparing to its GDP.

3.2.1. Methodology and data for the estimation of the Gravity model for interregional trade in Spain

The aim of this paper, as we have already pointed out, is to examine the effect that the crisis had in interregional trade in Spain. To do so, we first have to construct a Gravity Model to analyze the determinants of trade within Spanish regions. There are 17 autonomous regions (*Comunidades Autónomas)*, and 2 autonomous cities, Ceuta and Melilla, these computed as one unit for simplicity. The next step is then to study the effect of the crisis, that is, whether it has had an effect on the trade flows between regions. For that, we estimate one Gravity Model for the period 2000 to 2007, Pre-Crisis. Then we estimate a full model for the whole period from 2000 to 2013, including a dummy variable controlling for the economic crisis.

We use panel data for imports and exports between regions from 2000 to 2013, for 16 different industry sectors. To simplify the estimations, we take the aggregate values of imports and exports, for all sectors in one year. This yields 4285 observations for all possible pairs of importer and exporter over 14 years.

Rationale and Explanation of Explanatory Variables

$GDP_{EXPORTER}$: this is defined as the natural logarithm of the exporter's GDP for a given year. The larger the GDP, we expect a higher volume of exports and therefore of trade between two regions.

$GDP_{IMPORTER}$: this is defined as the natural logarithm of the importer's GDP for a given year. The larger the GDP, we expect a higher volume of imports, because of a greater domestic demand.

DISTANCE: it measures the distance between capitals of the different regions in kilometers, and it is expressed in natural logarithms[14]. Traditionally, the Gravity Model estimates this coefficient to be negative because larger distances imply

[13] See BATTERSBY, B. and EWING, R. study *International trade performance: the Gravity of Australia's remoteness,* p. 6.

[14] Data from *Instituto Nacional de Cartografía.*

higher transportation costs and therefore less trade. Linnemann (1966)[15] stated that there are three types of transportation costs: physical shipping costs, time-related costs and costs of cultural unfamiliarity. However, in the case of Spain, there are no significant cultural differences and distances are not as large as in traditional models, which study trade between countries all around the world.

In relation to that, we have included some dummy variables to control for some aspects of trade costs.

BORDER: dummy variable specifying if two regions share a common border. The value is 1 if they do, and 0 otherwise.

PENINSULA: dummy variable determining if transportation can be carried out on road. The value is 1 if two regions are connected by land, and 0 if there is insularity or isolation from the rest of the country.

CRISIS: dummy variable controlling for the crisis period starting from 2008 onwards. The value is 1 if year is 2008 or later. We add this variable in order to isolate this effect from the expected drop in GDP.

Methodology and selected model

In order to define the model, we first take the original basic equation and transform it to get a linear form. The model is derived as follows:

$$Log\ EXPORTS = \alpha + \beta_1 \times \mathrm{GDP_{EXP}} + \beta_2 \times \mathrm{GDP_{IMP}} + \beta_3 \times \mathrm{DIST} + \beta_4 \times \mathrm{BORDER} + \beta_5 \times \mathrm{PENINSULA} + \beta_6 \times \mathrm{CRISIS} + \varepsilon$$

This is the traditional approach, taking natural logarithms for all continuous variables on both sides of the equation, that is, exports level, GDPs and distance, where α and β have to be estimated. There are other factors that influence trade levels, as well as an error term ε, that we should take into account in the regression. This model allows us to test for p-values to estimate the statistical relevance of the variables.

In order to estimate the coefficients, we run different regressions. The OLS method is the most basic estimation procedure, and it has been widely used in the

[15] See ZHANG, J. and KRISTENSEN, G. paper *A Gravity Model with Variable Coefficients: The EEC Trade with Third Countries.*

literature[16]. Nevertheless, OLS usually presents some econometric issues that must be addressed and therefore, as we will justify in the next section, we also use GLS and PPML regressions to estimate the model.

3.2.2. Pre-Crisis results

	OLS	GLS	PPML
GDP EX	1.502***	1.237***	0.809***
	(0.0411)	(0.0951)	(0.0181)
GDP IM	1.059***	0.794***	0.727***
	(0.0341)	(0.0567)	(0.0164)
DIST	-0.725***	-0.637***	-0.329***
	(0.0732)	(0.165)	(0.0342)
BORDER	1.158***	1.269***	0.863***
	(0.0727)	(0.151)	(0.0465)
PENINSULA	1.029***	1.368***	0.284***
	(0.128)	(0.285)	(0.0793)
Constant	-17.65***	-13.09***	-8.161***
	(0.708)	(1.419)	(0.362)
Observations	2392	2392	2448
R-squared	0.685		0.753

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 1: Ordinary Least Squares (OLS), Generalized Least Squares (GLS) and Poisson Pseudo Maximum Likelihood (PPML) estimations.

First of all, regarding the OLS regression, we obtain positive and significant estimations of the GDP coefficients. The effect of the exporter's GDP on the level of trade is bigger than the effect of the importer's GDP. For instance, we can expect to have a higher volume of trade between Catalunya and Madrid than between Catalunya and Extremadura, as the formers have greater GDP, holding other factors constant. Since the data is expressed in terms of logarithms the estimated coefficients have to be interpreted as percentage changes.

[16] SARKERA, and JAYASINGHE (2007), PAPAZOGLOU (2007), KANG and FRATIANNI (2006), among others. Information obtained from: http://benthamopen.com/contents/pdf/TOECONSJ/TOECONSJ-3-1.pdf [Visited: 12th July 2016]

Secondly, as we expected, the distance has a negative and significant effect on the level of trade between two regions, because the greater the distance, the higher the transportation costs. The distance coefficient is -0.73, to be interpreted as an elasticity. A 1% increase in the distance between regions leads to a decrease of 0.73% in their bilateral trade. Our regression yields a lower coefficient than the one in the Meta-analysis done by Disdier and Head[17]. In their study, the mean of the estimated distance coefficient is -0.91, which implies we are on the left side of the Density Function they calculate. Other authors like Llano, Esteban, Pérez and Pulido find a value of -1.07[18]. This negative effect implies that, e.g., if the distance between Catalunya and Galicia is around 1100 kilometers, and between Catalunya and Navarra is 435 kilometers, c*eteris paribus*, the volume of trade is expected to be greater in the latter case.

Related to that, the border variable has a positive and relevant effect on trade. We estimate 1.16% more trade between adjacent regions compared to non-adjacent regions. Disdier and Head find a coefficient of 0.5. Therefore, at a regional level this effect is clearly more relevant. In addition to that, the fact that two regions are connected by land also has a positive effect of 1.03% increase in trade. This is probably true because the distances within regions are relatively small and therefore, the land transportation costs might be smaller than maritime transportation costs.

That being said, the OLS model might produce biased estimations in the presence of heteroskedasticity, i.e. when errors are not randomly distributed, which tends to happen when panel data is used. In order to control for this, we use the GLS estimator, which yields the results listed in the second column of *Table 1*. The results are highly similar, meaning that the OLS estimations might not be too affected by heteroskedasticity.

Nevertheless, both previous models may not be efficient in the presence of zero trade values, i.e. when some observations have a value of zero. Zeros can be explained by three different reasons: (i) There is no trade between two regions; (ii)

[17] See DISDIER, A. and HEAD, K. paper *The Puzzling Persistence of the Distance Effect on Bilateral Trade*, page 40.

[18] See LLANO, ESTEBAN, PÉREZ AND PULIDO paper *Opening the Interregional Trade "Black Box": the C-Intereg Database for the Spanish Economy (1995-2005).*

there is no data for a specific year; (iii) there are rounding errors when trade flows are very small or close to zero. When we take logarithms, these values are excluded from the regression and therefore we may lose valuable information. If zero values are randomly distributed, OLS can yield consistent results but, otherwise, it can cause biased estimations because of omitted values. In order to solve this problem, Santos Silva and Tenreyro (2006)[19] use the PPML method as a robust approach when there is heteroskedasticity, which is usually true in trade data. It is important to point out that this is not a log-log model, since the value of exports is taken in absolute terms. The resulting equation takes the form of a level-log regression:

$$EXPORTS = exp\ [\ \alpha + \beta_1 \times \mathrm{GDP_{EXP}} + \beta_2 \times \mathrm{GDP_{IMP}} + \beta_3 \times \mathrm{DIST} + \beta_4 \times \mathrm{BORDER} + \beta_5 \times \mathrm{PENINSULA} + \beta_6 \times \mathrm{CRISIS}\ ] \times \varepsilon$$

Regarding the results shown in the third column of *Table 1*, this model takes into account all the observations, including the ones with zero values. The regression yields a higher R-squared[20] in comparison to the one obtained in OLS and GLS. In general there are not big changes, as all the coefficients –which are also expressed in terms of natural logarithms– have the same sign as previous estimators.

Having said all that, given the higher R-squared value of the PPML model, we conclude that it is the best estimator for our Gravity Model of Trade.

4. THE SPANISH TRADE COLLAPSE: A POST-CRISIS ANALYSIS

4.1. The Spanish Great Trade Collapse

In this section we examine the evolution of the Spanish interregional trade from 2000 to 2013 in order to determine whether there is a trade collapse as a consequence of the economic crisis, similar to the one that occurred at international level, as we have seen in Section 2. The data used in this section covers the imports and exports in EUR Millions between *Comunidades Autónomas* from 2000 to 2013, for 16 industry sectors.

[19] See SILVA and TENREYRO study *The log of gravity*.

[20] The R-squared, or coefficient of determination, can be defined as the number that indicates the proportion of the variance in the dependent variable that is predictable from the independent variable. Source: http://stattrek.com/statistics/dictionary.aspx?definition=coefficient_of_determination [Visited: 11th July of 2016]

First of all, we analyze the evolution of the interregional trade in aggregated levels and then, if there is such a trade collapse, we will determine the industry sectors that have contributed more to it, taking into account their relative weight to the total volume of trade within Spain.

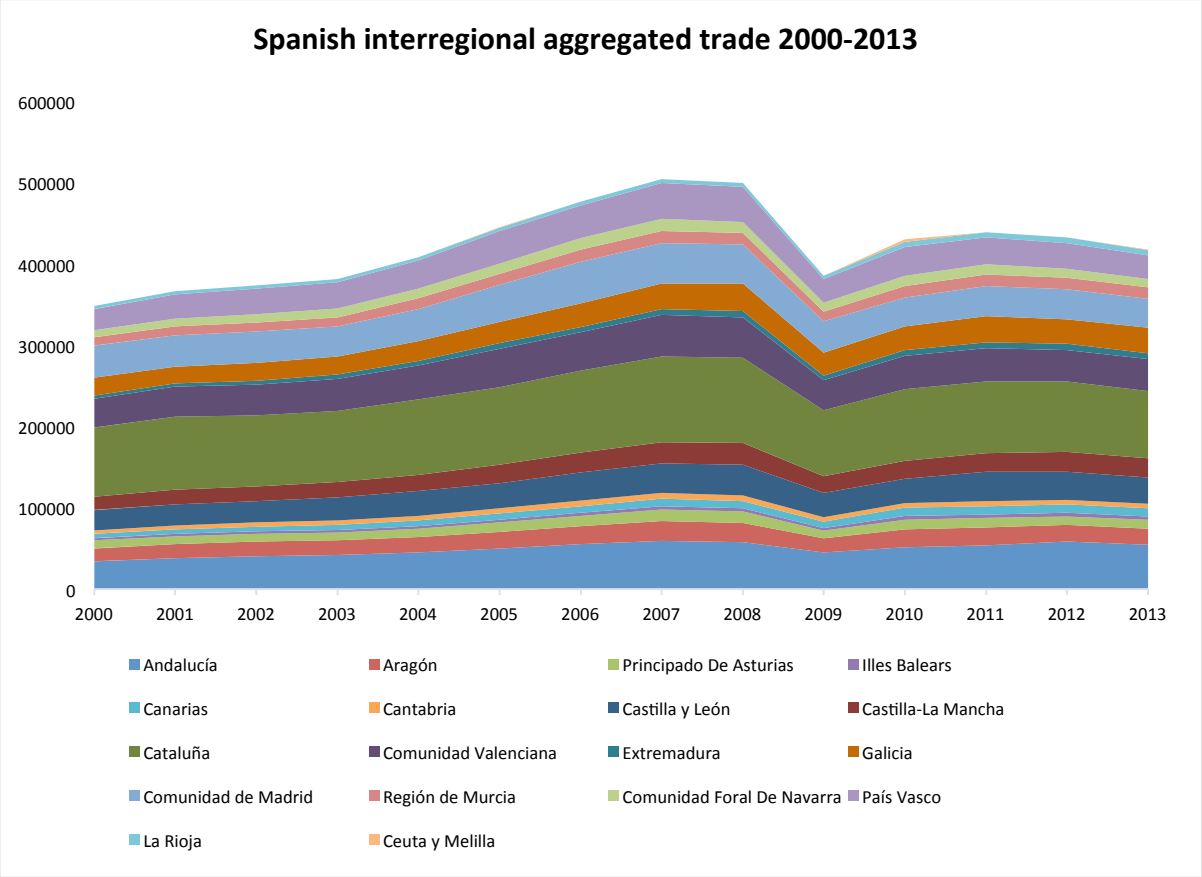

Figure 2.

From 2000 to the 2007 there is a clear growing trend, which got stuck from 2007 to 2008 when the total value of interregional exports slightly exceeded EUR500 billion at its peak, before falling about 23% from 2008 to 2009. This is consistent with the global pattern described by other authors[21] in the international trade after the crisis, which shows a decrease from 20 to 30% in the same period of time. We can see a small recovery from 2009 to 2010, where trade volume increased again, but then it stagnated for the following years, never reaching pre-crisis values. We can see a drop of approximately 1 billion in exports compared to 2007.

[21] Information obtained from: http://voxeu.org/article/great-trade-collapse-what-caused-it-and-what-does-it-mean [Visited: 11th July 2016]

The following chart shows the evolution of the trade to GDP ratio for the full period studied.

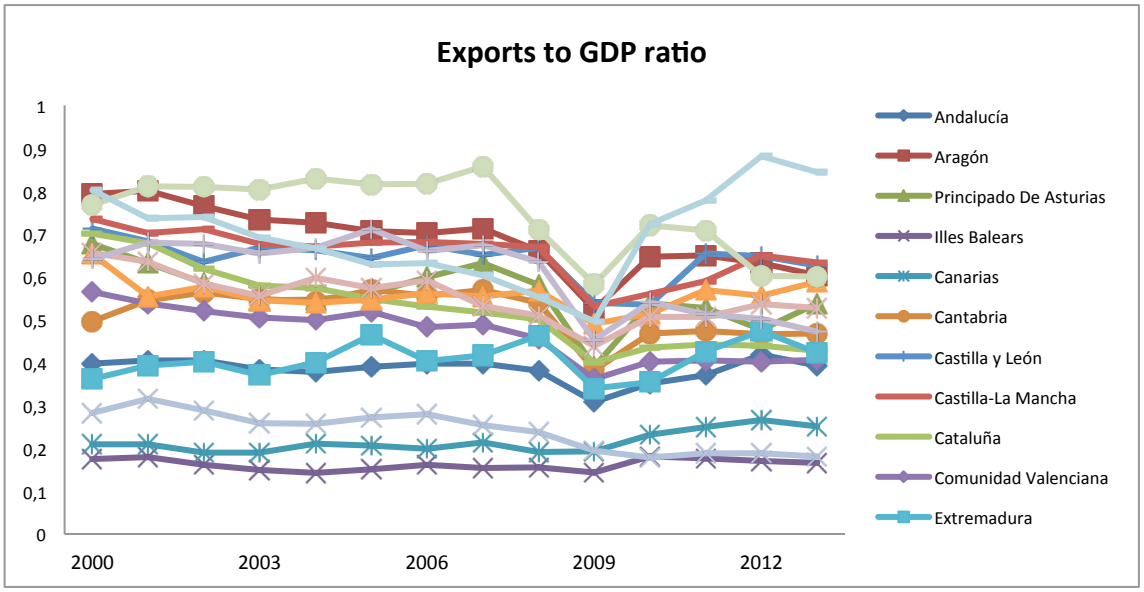

Figure 3.

For the majority of the regions, there is a decrease in the ratio between 2008 and 2009. This means that interregional exports lost weight relative to the total GDP. Following the global trend, the fall in trade figures was larger than the fall in the GDP of the regions. **This confirms the existence of an internal trade collapse in Spain.** Starting in 2009 there is a recovery, but the ratio seems to stay stable at lower than Pre-Crisis values.

Comunidad Autónoma	Year-on-year change (2008-2009)	Relative weight to total trade (on average)
Andalucía	-22.4%	11.6%
Aragón	-24.1%	4.8%
Principado de Asturias	-36.5%	2.6%
Illes Balears	-11.1%	0.9%
Canarias	-3.7%	1.9%
Cantabria	-31.6%	1.4%
Castilla y León	-21.4%	7.5%
Castilla-La-Mancha	-23.0%	5.1%
Catalunya	-22.7%	21.6%
Comunidad Valenciana	-25.0%	9.9%
Extremadura	-28.1%	1.5%
Galicia	-16.2%	6.5%
Comunidad de Madrid	-19.2%	9.7%
Región de Murcia	-17.8%	3.1%
Comunidad F. de Navarra	-20.2%	2.8%
País Vasco	-31.6%	8.1%
La Rioja	-13.8%	1.1%
Ceuta y Melilla	-50.1%	0.1%

Table 2.

From *Table 2* we can infer the average 2008-2009 year-on-year change in exports for all *Comunidades Autónomas* was negative, confirming the existence of a great trade collapse. The 5 heading regions experienced a drop of 24.2%, similar to the average fall in aggregated trade for all the regions. The regions that experienced the greatest drops are the ones located in the North of Spain[22]: País Vasco (-31.6%), Principado de Asturias (-36.5%) and Cantabria (-31.6%), where metallurgy is the main industrial sector exporting to other regions. On the other hand, Canarias (-3.7%) Illes Balears (-11.11%), La Rioja (-13.8%), Galicia (-16.2%) and Región de Murcia (-17.8%) are the regions with smallest drops in exports, principally engaged in the agro-alimentary sector.

Once we know which regions have suffered from a more severe trade collapse, and what sectors they are engaged in, we should analyze the evolution of the volume of exports for each sector, to see whether there is a correlation with the export

[22] We exclude Ceuta y Melilla, which experienced a fall of 50% but their weight relative to the total trade is almost 0.

pattern for each region. The following graphs show the change in total level of exports of all regions for different sectors, from 2000 to 2013[23]:

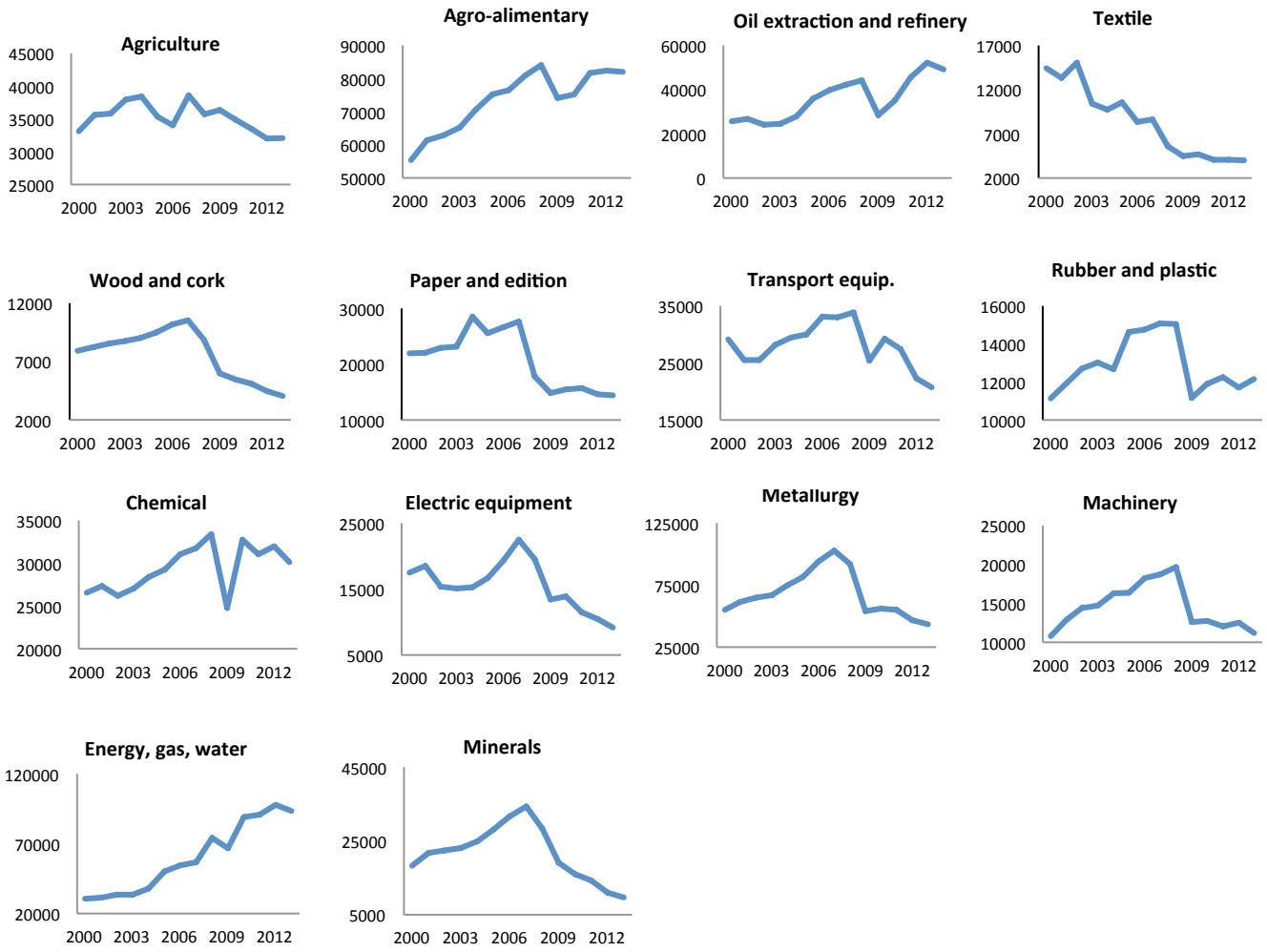

Figure 4. Each chart shows the evolution of trade in each sector.

There is a clear decline in all industries between 2008 and 2009 being the drop more pronounced in some sectors than in others. For instance, while the metallurgy, the transport equipment manufacturing or the machinery industries fall abruptly and keep falling in the subsequent years, others like the agro-alimentary, the refinery or the chemical sectors rapidly recover and reach pre-crisis or even higher trade levels in one or two years after the shock.

We now analyze the most important industry sectors in Spain to decompose the aggregated effect of the crisis and see how individual industries have performed. The following table shows, for each industry sector, the 2008-2009 year-on-year

[23] The vertical axis is expressed in millions €.

change and its relative weight to the total volume of trade in 2007, just before the beginning of the crisis.

Industry Sector	Year-on-year change (2008-2009)	Relative weight to total trade (2007)	Relative contribution to the collapse
Agriculture	+1.6%	8%	0.13%
Refinery	-35.7%	8%	-2.86%
Agro-alimentary	-11.8%	16%	-1.89%
Textile	-19.1%	2%	-0.38%
Leather	-15.9%	1%	-0.16%
Wood	-32.5%	2%	-0.65%
Paper	-16.5%	5%	-0.83%
Chemical	-26.0%	6%	-1.56%
Metallurgy	-40.8%	14%	-5.71%
Rubber	-25.8%	3%	-0,77%
Machinery	-35.7%	4%	-1.43%
Minerals	-32.5%	7%	-2.28%
Electric materials	-31.1%	4%	-1.24%
Transport equipment	-24.9%	7%	-1.74%
Diverse industries	-17.9%	2%	-0.36%
Energy, gas, water	-10.2%	11%	-1.12%

Table 3.

Of the most important sectors, metallurgy is the one in which exports have fallen the most (-40.8%), while energy industry is the one that have fallen less (-10.6%). It is also important to point out that the agriculture sector didn't fall in this period.

However, it is key to understand the magnitude of the fall of each sector relative to its relevance. The third column represents these magnitudes, as they are the sum of the 23% total fall in trade. For instance, we can see that the metallurgic sector has by far contributed the most, followed by extraction, refinery and minerals.

Regarding the fall in exports that the regions experienced, we find a correlation: the regions engaged in the sectors that have decreased the most are the ones with the biggest drops in exports, suffering more from the trade collapse.

Given the relevance of Catalunya for both GDP and level of interregional exports we find it interesting to analyze what happened in this region. Its main industry sectors are the chemical and the agro-alimentary. Exports in both sectors have fallen by -26% and -11.8% respectively, and that is the reason why it has suffered moderately from the trade collapse.

4.2. The Gravity Model of Trade: Full period results

In order to confirm the previous estimations we run a Gravity Model for all years, from 2000 to 2013, with 4285 observations. This leads to a more reliable and complete analysis. As we can see in *Table 4,* we get similar results since the coefficients of trade factors are akin. We also include a dummy variable controlling for the crisis, which is significant and has a negative effect on trade, as expected.

	OLS	GLS	PPML
GDP EX	1.558***	1.339***	0.815***
	(0.0342)	(0.0968)	(0.0144)
GDP IM	1.054***	0.815***	0.716***
	(0.0261)	(0.0559)	(0.0129)
DIST	-0.783***	-0.699***	-0.301***
	(0.0572)	(0.166)	(0.0260)
BORDER	1.198***	1.312***	0.928***
	(0.0567)	(0.155)	(0.0363)
PENINSULA	0.890***	1.230***	0.251***
	(0.102)	(0.282)	(0.0603)
CRISIS	-0.694***	-0.607***	-0.342***
	(0.0556)	(0.0543)	(0.0262)
Constant	-17.71***	-13.87***	-8.279***
	(0.547)	(1.393)	(0.284)
Observations	4168	4168	4284
R-squared	0.664		0.727

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 4: Ordinary Least Squares (OLS), Generalized Least Squares (GLS) and Poisson Pseudo Maximum Likelihood (PPML) estimations.

5. FINDINGS AND CONJECTURES

After having observed the effects of the economic crisis in interregional trade in Spain, we now need to address the questions about the causes of the trade collapse. We will examine the arguments used to justify the global trade collapse and check their applicability to the Spanish case.

5.1. Demand side

Most economic papers have stated that the most important cause of the trade collapse was a sudden and sharp decrease in demand for goods. In Spain, trade volume between regions fell in almost all sectors and in some cases by large figures. We will now look at the evolution of average prices in the biggest sectors mentioned in the previous section in order to determine whether there is an effect of prices on demand. The following charts show the evolution of prices in the main 6 sectors.

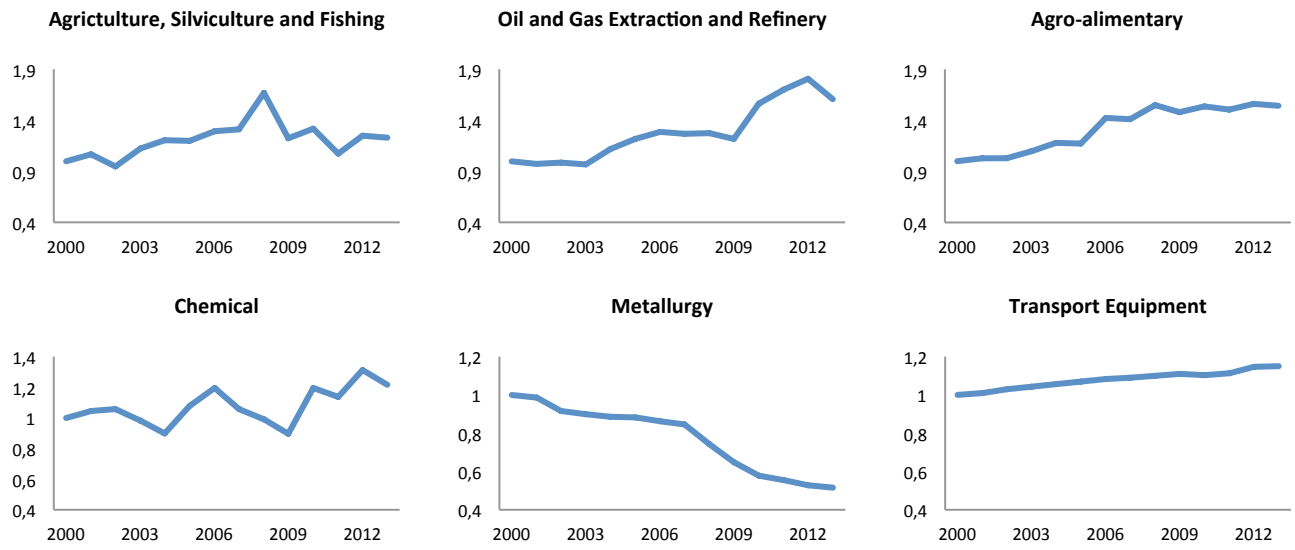

Figure 5. Each chart shows the evolution of prices in the main sectors. Prices are normalized to 1 for year 2000.

The prices show different patterns across sectors and therefore different relations with the level of trade of each sector. We cannot see a clear trend in prices that could explain the trade collapse, because prices fall in some sectors, while they increase or stay constant in others. For instance, in the agricultural sector, we can see an increase in 2008 followed by a steep decrease in 2009 but the price level stays at a more or less stable level compared to previous years. This is consistent with the fact that there has been no decline in agriculture exports within Spain. A similar explanation could be used for the agro-alimentary sector, which

experienced a relatively small drop. We see that the prices remain at a constant level. We can therefore infer that demand for agriculture and agro-alimentary goods didn't suffer a significant change following the crisis, because we assume households keep consuming the goods produced by these industries as they are not postponeable goods. The following charts show the total household spending for food and beverages and for restaurant, bars and hotels[24].

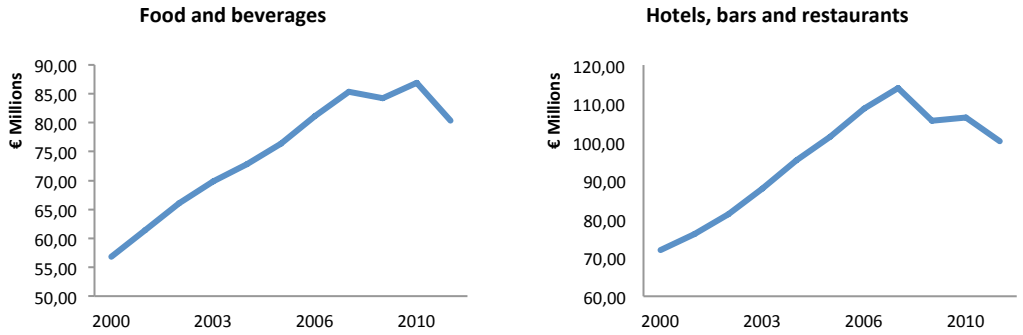

Figure 6. Evolution of household consumption in food and beverages and hotels, bars and restaurants.

We can see that household expenditure on food stagnated in 2009, but there is no significant drop. However, the restoration sector saw the private spending fall, so people reduced demand for leisure goods in order to smooth their consumption of first necessity goods after seeing their disposable income decline.

In the oil and gas extraction sector, the prices are consistent with the global trend observed for the same period. After a small decrease in prices in 2009, we observe a quick increase in the following years. Domestic demand barely has an effect on the price of these products, since the global demand for oil is what determines prices. Therefore, we cannot conclude that demand-side factors determine the interregional drop in trade in this sector.

The metallurgy sector shows convincing results. This is the sector with the largest drop in exports and we can see in the chart that prices fall significantly in 2009 and keep falling in the following years. The metallurgical sector was deeply affected by the real estate bubble in Spain, because the products manufactured by this industry serve principally for construction. After the bubble burst, demand for housing fell abruptly and construction licenses dropped from 175.000 in 2007 to

[24] Household spending data obtained from INE. Available at: http://www.ine.es/ [Visited: 13th July 2016]

81.000 in 2009[25] (*Figure 7*), a 53.7% fall in just 2 years. This decrease in demand caused a collapse in the metallurgic sector and this explains the decline in prices.

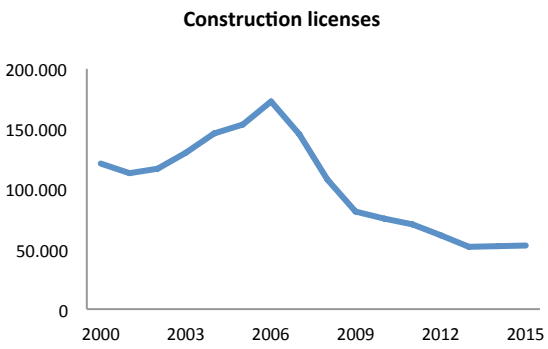

Figure 7.

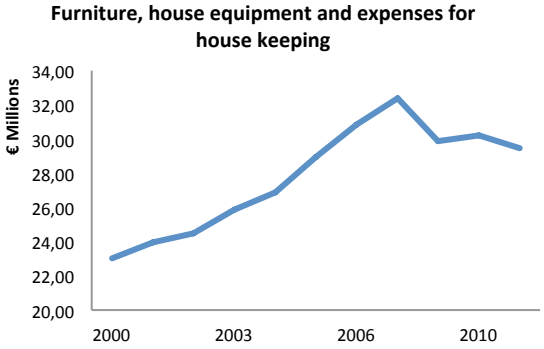

Figure 8.

Figure 8 shows a sharp decline in demand for house equipment, durable goods, for which people decided to postpone investment just after the crisis, following the global trend and driving down interregional trade for these goods.

The non-metallic minerals production sector produces principally cement, asphaltic and fireproof products, as well as glass for construction purposes. It shows an important decline and is the third most important contributor to the total collapse. Similarly to the metallurgical sector, the real estate crisis might have driven the exports down.

The transportation sector, which includes vehicle and boat production, features a steady increase in prices in the years previous to the crisis. After that, prices slightly fall and increase again. We can see that prices fall far less than interregional trade, which can be caused by the effect of external demand for Spanish produced vehicles, which might have had a smaller decline. In the following graph we can appreciate the drop in demand for vehicles in Spain in 2009, which also includes Spanish produced vehicles. Although demand falls in that year, it increases again in 2010, so domestic demand issues might not account for the total interregional trade loss. Some policies applied in the years after the crisis, like the Plan PIVE, aimed at recovering the demand for private vehicles, could have helped keep prices stable.

[25] Data obtained from Ministerio de Fomento de España. Available at: http://www.fomento.gob.es [Visited 12th July 2016]

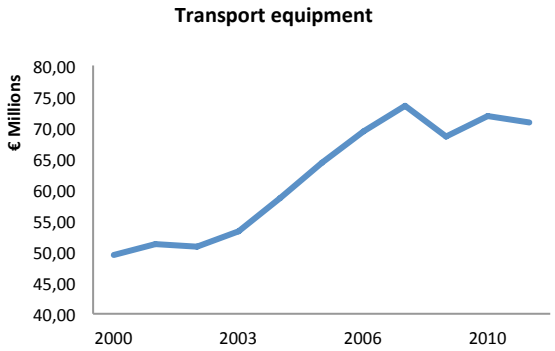

Figure 9. Household consumption in transport

5.2. Financial shock and exports

Many authors have argued that the credit crunch that followed the fall of Lehman Brothers also had an effect on the global volume of trade, since both households and firms saw their possibilities to access credit heavily reduced. Bems, Johnson and Yi argue that exporter companies are more likely to be affected by credit disruptions than domestic companies, since they rely more on credit to carry out investments in foreign countries. However, Spain is a country with a much extended use of banking and the evolution of credit tends to follow the same trend like the GDP, since credit flows to companies and households have highly contributed to its recent economic development[26]. Credit had been growing steadily at high rates during many years before the financial crash, but stopped abruptly in 2009.

The following chart shows the growth of credit conceded to households and firms from 2000 to 2013.

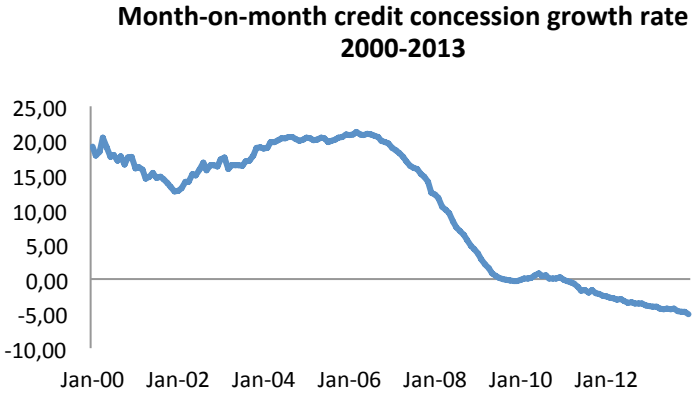

Figure 10.

[26] See *Un análisis de la situación del crédito en España,* Boletín Económico, Banco de España, October 2013.

Credit grew at 20% and above during the years previous to the crisis, collapsing in 2009. Following the banking crisis, banks where more reluctant to offer credit compared to the previous years as uncertainty rose.

According to the Bank of Spain, the interannual growth rate of credit to the industrial sector went from growing about 10% to diminishing at a -5% rate in just one year.

Credit droughts affect more in sectors that rely more on financing than others, primarily those that are capital intensive, like for instance the manufacturing or the extractive industries. We have seen that sectors like metallurgy, machinery manufacturing, transport equipment or mineral extraction suffered the largest drops in exports in 2009, coinciding with the decline of the credit concession growth rate. We can infer that those industries were therefore more damaged by the credit restrictions and thus interregional trade fell the most in those sectors.

It is difficult to assess the magnitude of the financial shock effect on interregional exports. Bems, Johnson and Yi quantify the effect of this shock in global trade collapse to be at around 15-20% of the total fall. While we have observed declines in exports in some sectors like the metallurgy that can be partially explained by a decline in real estate demand, other sectors that have experienced significant trade declines like the transport equipment manufacturing industry don't seem to be so much affected by internal demand issues. The increased difficulty to access credit and therefore to make investments might have had a bigger effect on this kind of industries.

In the metallurgy sector, both the drop in demand for housing and the tightened credit conditions to both construction companies and households could have potentially had the biggest effect on internal trade in Spain.

6. CONCLUDING REMARKS

Interregional trade within Spain grew heavily from 2000 to 2007, with an average interannual growth rate of 6%. The country was experiencing an economic expansion, and the Spanish GDP grew more than the EU GDP, partially due to the real estate bubble.

Nevertheless, in 2008 the global economy collapsed, and so did the world trade during the last months of 2008 and the beginning of 2009 by about 20%, originating what is known as the Great Trade Collapse. Such episode has been object of several economic papers, which aimed to determine the causes, even though no total agreement has been reached among authors.

After having analyzed the data for interregional trade at industry level, we can affirm that there has been a Spanish Great Trade Collapse, as the trade of almost every sector heavily fell from 2008 to 2009, especially the metallurgical sector.

The *Comunidades Autónomas* País Vasco, Cantabria and Principado de Asturias, mostly engaged in the metallurgic and extractive industries, are the ones with the largest drops in exports and therefore, the ones that have suffered most from the trade collapse.

Finally, regarding the factors that led to the collapse, we find that there was a demand shock characterized by a decline in consumption and investment by the households, as they decreased their demand for leisure goods, housing and durable goods. This shock affected some of the most important sectors of the Spanish economy driving down trade figures. However, the fact that some regions are highly concentrated in agricultural and agro-alimentary production, the domestic demand for which didn't change significantly, kept trade in those sectors stabilized.

In addition to that, as far as the supply side is concerned, the financial shock in Spain was reflected by a drop in credit concession to the private sector, both to firms and households. Capital intensive sectors experienced the highest drops in interregional exports, which can be explained by a higher sensitivity to credit restrictions and credit market distortions. The heightened difficulty to access credit has been estimated to justify 15% of the trade loss globally. In the Spanish case, given the importance of the housing market and the construction bubble, the credit crunch might even account for a larger share of the collapse.

All of this allows us to state that the determinants that caused the Great Trade Collapse can be applied analogously to the Spanish case, even though in Spain is highly probable that the financial shock played a more important role than at international level.

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