Foreign Labor Cost Reforms and Domestic Export
Evidence from French Exports relative to German labor cost

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Abstract

This paper investigates the impact on the French European market shares of the labor market reforms launched in Germany in 2003, which result in an important gain in cost-competitiveness. In order to capture the French market share sensitivity to the German labor cost, we build a competition indicator which weights the relative unit labor cost between France in Germany by the capital intensity and a market proximity measured based on Hummels and Levinshon (1995). Focusing on the manufacturing industry using a product-destination level database, we first show that the change in our competition indicator is negatively correlated with the change from 2000 to 2010 in French market shares on European non-German markets. We then use the generalised propensity score (GPS) methodology, developed by Hirano and Imbens (2004), to account for potential bias linked to the endogeneity of the competition intensity indicator. The change in German labor cost is then the countinuous treatment to which the French market share faced on markets where German and French competitors were close. We estimate the GPS and the dose-response function of the relative variation of French market shares to the relative variation of German unit labor cost between 2002 and 2010. We find an increasing relation between the decrease in German labor cost and the French loss in market shares until the decrease in German labor cost reaches a threshold.

JEL classification: F14, F16, C21.
Keywords: Market Share, Competitiveness, Unit Labor Cost, Fiscal Devaluation.

1 Introduction

In a globalised world, macroeconomic shocks are rapidly spread into every countries' performance indicators. This is all the more true in the European Union where economic interdependencies are so strong that the lack of cooperative policies is dramatically felt as a more and more serious problem. Independent structural policies in a country can have large positive or negative consequences in other countries. This paper deals with labor market policies aiming at moderating wage increase and at increasing cost-competitiveness. Among those policies, one has received specific attention from government and researchers, the fiscal devaluation.

Fiscal devaluation appeared particularly relevant in the context of a monetary union such as the Eurozone, where many governments wanted to boost their export competitiveness in a monetary environment which makes exchange rate devaluation impossible. A fiscal devaluation is a joint decrease of Social Contribution paid by employers and increase in value added taxes (VAT). An increase in the VAT in a trade partner country implies that consumer prices will increase which will affect both domestic producer and foreign exporters. When this increase is doubled – even compensated – by a decrease in social contributions paid by employers, then the increase in VAT modifies the foreign/domestic relative price. The double instrument policy is named fiscal devaluation as it implies an increase in import prices relative to domestic prices everything else equal. This artificial change in cost-competitiveness is however perceived as a permanent change by competitors since it results from a change in regulation. Foreign exporters may adjust their markups to partially pass though the VAT change into their prices (Andrade *et al.*, 2010), but in case price elasticity of local demand is not totally rigid, foreign export price will rise and quantity will finally adjust and decrease.[1] Then a likely consequence of fiscal devaluation is to affect the bilateral volume of trade as well as the competition on third markets.

We focus in this paper on the trade competition between France and Germany to test the impact of labor reforms in Germany which induced a dramatic gain in cost-competitiveness relative to France.

Actually, the fiscal devaluation in Germany was part of a broader reform concerning the labor market: the Hartz labor market reforms implemented in 2003-2005 by the Schroder government. The German coalition decided in 2005 a rise in the VAT of 3 points (from 16 to 19%) to start in 2007 and one third of this rise was due to finance a decrease in social contribution of 1.6 points. The Hartz labor market reforms led to moderate the wage growth and reduce the German labor cost relative to its partners labor cost during the first decade of the 2000s. Dustmann *et al.* (2014) show that the real wages at the

[1] The fiscal devaluation makes also domestic producers more competitive as their export price can reflect the decrease in labor cost if labor cost has stayed unchanged meanwhile in the market destination.

bottom of the wages distribution has dramatically declined in Germany since 2003. The authors also claim that the Hartz reforms were only part of the explanation of the wage moderation. Major changes in labor market governance have induced new channels of adjustment of wages. Other studies point the weakening of the workers' bargaining power since the reunification which facilitated the wage moderation (Burda and Hunt, 2011).

The German decrease in labor cost is finally a mix of several coincinding changes in the German Labor market. For Krebs and Scheffel (2013), "the Hartz reforms constitute one of the most ambitious attempts in recent history of restructuring the labor market of an advanced economy." Not only the unemployment rate fell from almost 11% to 5.5% between 2005 and 2012, but it has also a strong impact on real wages Krebs and Scheffel (2013). Meanwhile as the real wage did not change as much or did inversely in Germany's main partners, the real effective exchange rate, deflated using unit labor costs of the whole economy, of Germany, which is a measure of German global cost competitiveness , has experienced a fall of more than 6 % between 2000 and 2012. Over the same period, this index has recorded an increase of more than 10 %[2] The decrease recorded in Germany cannot have been neutral on European trade flows. However there are not a lot of empirical evidence of the impact of the cut in labor cost on export which could provide quantitative predictions.

In the empirical literature, the relation between cost and export has been soon challenged by Kaldor (1978), who showed in cross-country comparisons the evidence of simultaneous decrease in cost-competitiveness and increase in market shares. This result, known as the Kaldor paradox, led to the conclusion that major industrialized countries do not base their export performance on cost-competitiveness. On the recent period, studies linking different measures of competitiveness and export performance are however scarce (see Brander 1985; Fagerberg (1988); Amable and Verspagen (1995) at the country level; Ioannidis and Schreyer (1997); Carlin *et al.* (2001) at the industry level, or Berman *et al.* (2012) at the firm-level). When trade is mostly intra-industry trade the competition is not anymore driven on Ricardo comparative advantage. Intra-industry trade is theoretically related to trade theory with preferences for variety where the unit labor cost is supposed to be comparable between trade partners because they share the same technology.

Since the Euro adoption the French export market share has strongly declined on the global market. It has decreased from around 6 % in 1990 to 5 % in 2000 and to around 3 % in 2012. The fall in French export market shares from 2000 to 2013 concerns almost all manufacturing sectors. There is also no destination to where French market shares resisted to the decline. If we focus on the European Union market, the market share decrease is also clear.

Numerous analysis have tried to explain the fall in French market shares since 2000.

[2]These figures are calculated using the *Eurostat* database on exchange rates.

From the insufficient number of export firms to the weakness of non-cost competitiveness (see Artus and Fontagné (2006); Bellas *et al.* (2010)), the diagnosis often lies on the comparison with the German exporters (see Fontagné and Gaulier (2006). Especially, the argument of the French cost competitiveness' weakness relative to Germany has been highlighted to explain the evolution of the French export market share on the global market. Indeed, Bussière *et al.* (2014) indicate that the increase of French unit labor costs in the whole economy is one of the explanation of the decline in French export market shares since 1999. The German partner for French exports has always been very important. Though this importance is reciprocal since the French market is the first destination of German exports, trade is far from being balanced. French-German bilateral trade is typically intra-industry trade and competition is tough and used to turn at the advantage of German exporters. The interdependency – though asymmetrical – makes any structural change in relative competitiveness an inevitable shock toward each partner. In this context, the change in relative unit labor induced by a major change in German labor governance leading to a clear wage moderation while French labor cost did not change or slightly increase may have constitute a major shock faced by French exporters.

However, did this shock constitute a main cause of the French market shares decline in the European Union? This paper wants to investigate the impact of a structural change in cost-competitiveness on market shares when trade partners are close in terms of specialisation and in terms of production cost and when most trade is intra-industry trade. Our question is embedded in the broader question of the role of the labor cost in a competition among differentiated products. Do we have to discard the labor cost competition to explain trade balance when partners are nearly identical and trade same variety products? Are European trade imbalances the results of non cooperative policies of fiscal devaluation ?

To test the impact of labor cost reforms in Germany on French trade, we will consider the German policy as a policy treatment applied at different degrees to French export sectors. The intensity of the treatment will depend on an ex-ante indicator of "Labor Cost Competition" between France and Germany defined at the sector level. Using the propensity score matching methodology, we will test whether the German policy impacted the French market shares in European third market and in German market.

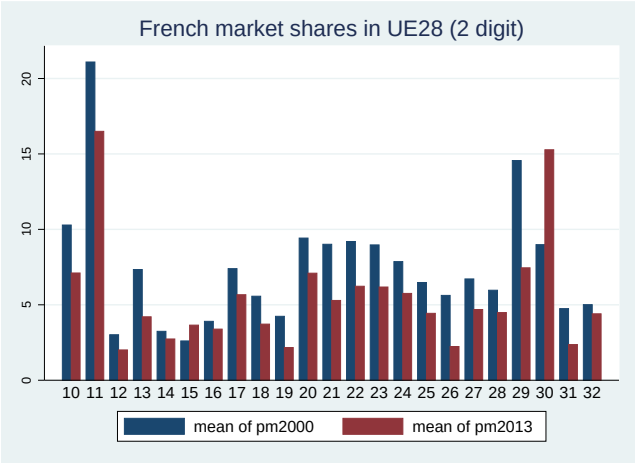
2 The French-German Trade: Stylised Facts

Due to the rise of emerging markets, most of developed countries have lost export market shares in the good sector. Indeed, if the United States (U.S.) and the European Union (E.U.) are still the main trading countries on the global market, their share is declining in favor of emerging countries. Among EU countries, the loss in export market shares

concerns almost all countries with the strong losses recorded by France (-2 percentage points) and Italy (-1 percentage point) between 2000 and 2012 on the world market. However, the case of Germany seems to be the exception among developed countries. German export market shares remained relatively stable during this period, with even a slight growth recorded between 2000 and 2007.

This global trend is confirmed when focusing only on the French and German manufacturing exports to the European market. Figures 1 and 2 show the change in market shares in the European Union (EU28) of France (Figure 1) and of Germany (Figure 2) by manufacturing sectors in 2000 and in 2013. Each bar indicates the market shares of France and Germany in each sector of the ISIC 2-digit classification. For France, the market shares decreased in all sectors except in leather products and other transport equipments. The strongest declines are observed in the motor vehicles, trailers and semi-trailers (-7.1 percentage points), beverages (-4.6 percentage points) and pharmaceutical products (-3.7 percentage points).

Figure 1: French export market shares, in 2000 and 2013 by sectors, over 28 EU destinations (Isic rev4, 2-digit)

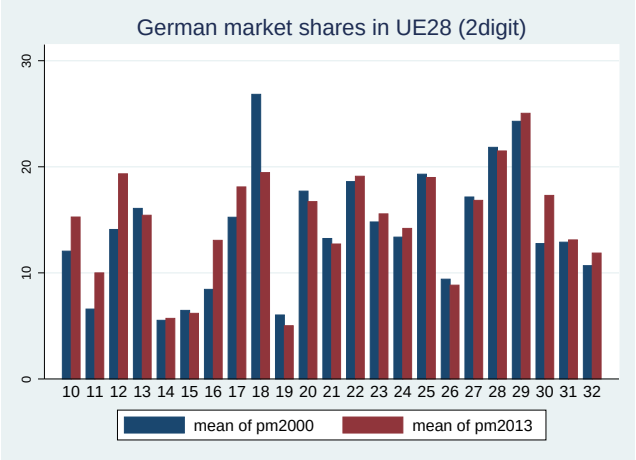


On the contrary, Germany maintained its position or even gained export market shares on almost all manufacturing sectors during the same period, with only a strong fall in the German export market share in the printing sector (-7.5 percentage points).

Figure 3 depicts the relative variation of the French unit labor cost relative the German unit labor cost during the period 2002-2007. We focus, here, on the period between the 2002, a year before the implantation of the Hartz reforms, and 2007, before the financial crisis.

We observe that the French cost competitiveness relative to Germany decreased in almost all manufacturing sectors. In particular, the relative unit labor cost index increased

Figure 2: German export market shares, in 2000 and 2013 by sectors, over 28 EU destinations (Isic rev4, 2-digit)



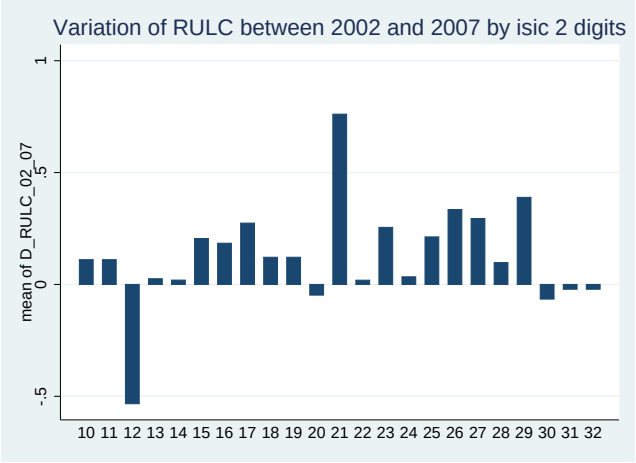
in around 70 % in the pharmaceutical industry, 40 % in motor vehicles, trailers and semi-trailers, 34 % in computer, electronic and optical products and 30 % in electrical equipment. The only significant improvement in French cost competitiveness relative to Germany is recorded for tobacco products (-53 %).

We want to investigate whether the contingency of the two phenomenons – decrease of the French relative to German market shares and increase in German cost competitiveness – is the illustration that French exporters faced with difficulty the change in German labor cost policy. Two reasons can explain that the policy leads to a more stringent competition for French exporters: first because Germany is the first French trade partner, but second because it is, most of the time, its first direct competitor on third markets. To do so we will first compute an indicator of competition intensity to unveil which sector was the more likely sensitive to the German policy change. The indicator is meant to capture the market share proximity. Then we test the sensitivity of sectors to the indicator in a simple parametric regression. To go further, we define an experiment environment where the German policy of reduction in labor cost is a continuous treatment to which French exporters are confronted. Our outcome variable is then the change in the French market share by product-destination.

3 The competition intensity

The sensitivity of French exports to the decline in the relative unit labor cost depends on the competition intensity and specifically on the labor cost-competition intensity henceforth, LCC. Several elements are going to impact the LCC: 1) the concentration of market

Figure 3: Annual growth mean rate of Relative Unit Labor Costs between 2000 and 2007 (Isic rev4, 2-digit)



shares; 2) the proximity between French rank and German rank of exporters; 3) the proximity of French and German Market shares; 4) the importance of labor cost in the production cost; 5) the extent of the change in the sector unit labor cost. The LCC has to increase in the German competitiveness.

We want to build an indicator that will capture the sensitivity of exports to a change in the relative labor cost of the main competitor. We start first from the change in the relative unit labor cost in a sector i. We scale the change in relative unit labor cost by the capital intensity of the industry i in the French sector. In other words, the German competitiveness is minored by the importance of capital relative to labor in the French industry i, k_i^F.

$$\frac{\Delta RULC_i}{k_i^F} = \Delta \left(\frac{ULC_i^F}{ULC_i^G} \right) \times \frac{1}{k_i^F}$$

This scaled relative unit labor cost is not sufficient because it does not account on the market structure which determines the extent of the competition between France and Germany before the "labor cost policy" treatment.

The extent of the competition depends on the substitutability between German and French export products. The more the products are substitutable, the strongest the competition is. We suppose that a signal of strong competition is the proximity of the market shares. First, market shares unveils the preferences from the demand of the importing country, d. Second, market shares reflect the market power of exporters and then the level of their markups. When market shares are close, it means large proximity between the characteristics of products as well as of exporters.

An indicator of the market shares proximity is directly inspired by the GDP proximity indicator proposed by Hummels and Levinsohn (1995). It is given by:

$$m_{id} = 1 - \left(\frac{s_{id}^G}{s_{id}^G + s_{id}^F}\right)^2 - \left(\frac{s_{id}^F}{s_{id}^G + s_{id}^F}\right)^2$$

Where s_{id}^F and s_{id}^F are respectively the market shares in the destination d and sector i of France and Germany. It is comprised between 0 and 0.5. The null value is taken either when Germany has no export towards destination d and industry i, whichever the amount of the share of France or on the contrary when French exporters have no exports in the industry i, whichever the amount of the share of Germany. The market proximity is then null. It is equal to 0.5 when market shares are exactly equal. The proximity rises with m_{id}. Note that this indicator does not give information on how much the two countries cover the total d market: m_{id} equals 0.5 both in the situation where Germany and France have 50% each of the market, or only 1% each. The closer to 0.5 m_{id} is, the closer the two countries are in terms of market shares.

We want then, that this indicator increases with a decrease in German unit labor cost relative to French unit labor cost: for two sectors with the same m_{id}, the German competitiveness will be positively affected by a decrease in the German unit labor cost relative to French Labor cost or an increase in the relative unit labor cost as defined above. Moreover, we scale the proximity indicator to make it equal to 1 when market shares are equal.

Our final indicator is :

$$LCC_{id} = \frac{m_{id}}{k_i^F} \Delta RULC_i$$

The final indicator depends on the destination market, via the m_{id}, as well as on the industry i.

The m_{id} indicator is time-invariant, we will fix it at the beginning of the period before the treatment policy. Graph 2 displays the change in the proximity indicator by comparing its value in 2000 and in 2013. The change in relative unit labor cost is also time invariant because we compute the change from 2003 to 2006.

The LCC indicator will be used to estimate the sensitivity of the French market share to the change in the German labor cost policy conditionnally on the proximity in market shares and capital intensity of the sector.

We will estimate the following equation:

$$\Delta log(s_{id}^F) = \beta_1 \log(LCC_{id}) + c + \gamma_i + \epsilon_{id} \tag{1}$$

which is equivalent to:

$$\Delta log(s_{id}^F) = \beta_2 \log(m_{id}) - \beta_3 \log(k_s^F) + \beta_4 \log(\Delta RULC_s) + \alpha_d + \gamma_i + \epsilon_{id} \tag{2}$$

in which we constraint $\beta_1 = \beta_2 = \beta_3$.

In both equation, α_d is a set of destinations fixed effects, γ_i, a set of product fixed effects and last ϵ_{id} a set of idiosyncratic i.i.d errors.

Equation 1 can be augmented by a set of covariates traditionnally included to explain the change in market share and specifically to capture the non price (non-cost) competitiveness: ΔRD_s^F and the change in R&D intensity in sector s The effective exchange rate is not included given that we focus on bilateral trade between France and Germany. Destination fixed-effects will capture change in exchange rate parity in non eurozone country (like Denmark for instance which is included in our panel of destinations).

4 Data

4.1 Data Sources

We first use trade data made available by the CEPII which provides a full dataset of trade flows at the 6 digit of the Harmonised System classification of products based on the United Nations Comtrade data (BACI data). We use correspondences tables to match product classification and sector-level classification in order to merge trade data with data on unit labor cost provided by the OECD which are available at the sector level of the ISIC rev4 classification at the 2 digit level.

We focus on export flows from France and Germany. We restrict the analysis to European market destinations. The reasons of this restriction are threefold. First, European market destinations present common traits as trade costs, tariffs, rules, consumer habits and macroeconomic shocks that we can consider very close if not identical. Then, we won't have to control for them when explaining changes in export. Second, 75% of French exports are shipped to the European Union market. Third, it discards to deal with the euro exchange rate.

Unit labor costs indices are computed using informations from the STAN database provided by the OECD. Unit labor costs are calculated at the industry-level as the ratio between labor compensation measured at current prices and the value added volumes of the sector. Then, the series are presented as indices (base index 100) using 2000 as the reference year. We also rely to the STAN database developed by the OECD to compute the Research and Development (R&D) intensity of each French sectors. This variable is calculated as the ratio between R&D expenses and value added at current prices for each sector at the 2 digit level of the ISIC rev4 classification. Finally, we document the capital intensity of each French sectors at the 2 digit level using informations from the French national institute of statistics and economic studies.

4.2 Data Description

Table 1 presents statistics at the 2-digits Industry classification level to brush the cost-competition at play between Germany and France. Capital Intensity differs from one sector to another meaning that the complementary share of labor is also very different conditional on the sector. Consequently labor cost changes affects at different degrees the production cost of a sector. For instance, the Computer & electronic products is likely to be much less sensitive to labor cost with a capital intensity of 24% – than the sectors of Textiles (from 13-15) with a capital share of 2%. Regarding the market proximity indicator, we observe that German and French export shares on the overall EU market are most often very close. Given the 2-digits level of disaggregation, France and Germany are the closest in Food Products, Coke and refined petroleum products and Other transport equipment. On the contrary, there are very far in Machinery and Equipment, Printing and Media, Beverage, Tobacco Products and Fabricated Metal Products (all below 0.4). We observe that some sectors where proximity is high are also likely to be less sensitive to labor cost such as the computer and electronic products sectors justifying that we weight the proximity indicator by the capital intensity. Finally, the fourth column provides the relative change in relative unit labor cost from 2002 to 2007. As we defined the relative unit labor cost, a positive change is an increase in German competitiveness relative to France in the sector. There are 5 sectors over the 24 manufacturing sectors which experienced an increase in French competitiveness. For the others, German competitiveness has increased relative to French labor cost. This is clear that the overall gain in German competitiveness during this period has impacted very differently French exporters depending on their sector. We observe also that the change in relative unit labor cost will drive the direction of the LCC indicator.

At the 4 digits level, which is the highest level of disaggregation which allows us to match relative unit labor cost and market shares, there is more variance in these indicators. We expect that the variance increases with the level of disaggregation. The Table presents some statistics to describe the distribution of the m_{id} and LCC_{id} indicators at the 4-digits level.

Table 1: Indicators of Labor-cost competition between France and Germany in the EU market at the 2-digit industry classification level

ISIC	Sector name	k_s^F	m_{id}	$\Delta RULC$	Share	AAGR
10	Food products	0.06	0.50	0.11	9.10	-2.77
11	Beverages	0.06	0.36	0.11	1.53	-1.83
12	Tobacco products	0.06	0.29	-0.53	0.10	-2.72
13	Textiles	0.02	0.43	0.03	2.46	-4.39
14	Wearing apparel	0.02	0.47	0.02	1.19	-1.56
15	Leather products	0.02	0.41	0.21	0.43	2.42
16	Wood products	0.06	0.43	0.18	0.64	-1.15
17	Paper products	0.06	0.44	0.27	2.18	-2.06
18	Printing and media	0.06	0.28	0.12	0.02	-5.32
19	Coke and refined petroleum products	0.36	0.48	0.12	7.42	-4.05
20	Chemicals and chemical products	0.14	0.45	-0.05	11.53	-2.74
21	Basic pharmaceutical prod. & preparations	0.21	0.48	0.76	2.41	-3.75
22	Rubber and plastics products	0.05	0.44	0.02	3.15	-2.97
23	Other non-metallic mineral products	0.05	0.47	0.26	1.35	-3.11
24	Basic metals	0.06	0.47	0.03	4.36	-2.22
25	Fabricated metal prod.	0.06	0.38	0.21	1.76	-3.28
26	Computer, electronic & optical prod.	0.24	0.47	0.33	19.47	-8.01
27	Electrical equipment	0.04	0.40	0.29	3.79	-3.01
28	Machinery and equipment n.e.c.	0.05	0.34	0.10	5.45	-2.24
29	Motor vehicles, trailers and semi-trailers	0.15	0.47	0.39	16.47	-3.75
30	Other transport equipment	0.15	0.48	-0.07	3.34	2.66
31	Furniture	0.04	0.39	-0.02	0.49	-5.64
32	Other manufacturing	0.04	0.43	-0.02	1.35	-1.54

Note : k_i^F and m_{id} are 2000 indicators.

5 Parametric Estimation of the Market Share

We present the results of the cross-section estimates of Equation 1 when market shares are computed at the HS6 level in absolute variation (Table 2) and in growth rate (Table 3). We expect the coefficient to be negative since an increase in LCC means an increase in German competitiveness. As the LCC indicator is in log, the estimated parameter is then the percentage point change in market share given by a 1% change in LCC.

In Table 2, the coefficient of interest is negative whatever the fixed-effects introduced

Table 2: Change in French Market Shares at the HS6 level and Competition Indicator

Dependent variable: Absolute Change in MS between 2000 and 2010					
	(1)	(2)	(3)	(4)	(5)
Ln (LCC_{id})	-0.554***	-0.524***	-0.958***	-0.944***	-0.953***
	(0.167)	(0.177)	(0.228)	(0.229)	(0.234)
Intercept	-3.013***	-3.179***	-3.631***	-3.614***	-3.691***
	(0.199)	(0.208)	(0.740)	(0.742)	(0.775)
Destination FE	No	Yes	Yes	Yes	Yes
HS2 FE	No	No	Yes	No	No
HS3 FE	No	No	No	Yes	No
HS4 FE	No	No	No	No	Yes
Observations	55613	55613	55613	55613	55613

Note: Δ MS is expressed in percentage

Robust standard errors (clustering by partner) in parentheses

*, **, ***, denote significance at the 1 %, 5 %, and 10 % levels, respectively.

in the regression. The destination fixed effects capture what is common to the destination as the GDP growth which boosts the import demand. The product fixed effects capture the common dynamics in product demand over all destinations such as for instance technological/quality changes which affect overall demand. Results highlight that the increase of the German cost competitiveness, conditionally of the capital intensity and proximity of market shares, significantly and negatively affected the French market shares on the EU markets. This result is robust to the introduction of different sets of fixed-effects.

Table 3: Growth in French Market Shares at the HS6 level and Competition Indicator

Dependent variable: Growth of MS between 2000 and 2010					
	(1)	(2)	(3)	(4)	(5)
Ln (LCC_{id})	-2.699***	-2.808***	-4.209***	-4.174***	-4.213***
	(0.350)	(0.348)	(0.511)	(0.502)	(0.505)
Intercept	-0.539*	-1.579***	-6.208***	-6.168***	-9.185***
	(0.292)	(0.409)	(1.318)	(1.353)	(2.289)
Destination FE	No	Yes	Yes	Yes	Yes
HS2 FE	No	No	Yes	No	No
HS3 FE	No	No	No	Yes	No
HS4 FE	No	No	No	No	Yes
Observations	55613	55613	55613	55613	55613

Robust standard errors (clustering by partner) in parentheses

*, **, ***, denote significance at the 1 %, 5 %, and 10 % levels, respectively.

Table 3 shows that a positive change in LCC is also negatively correlated with the

growth in market share during the period. These partial negative correlations support the intuition that given the proximity in competition between France and Germany, the general decline in German labor cost has impacted negatively the French market shares[3] .

To further investigate a more causal relationship, we use the General Propensity Score methodology that we first present in the next Section.

6 General Propensity Score methodology

The propensity score matching method allows to estimate the effect of receiving treatment without randomly assignments of the treatment. The continuous Treatment approach is a generalization of the binary approach proposed by Rosenbaum and Rubin (1983). Our variable of continuous treatment is the change in relative unit labor cost between Germany and France. In case of continuous treatment, we do not need a population of non treated: each firm received a dose of treatment.

6.1 The propensity score with continuous treatments

Our variable of interest, s_{id}^F, is the French market share in product SH6, i and by destination in the European Union, d. Pre-treatment covariates X_i, are the variables which explain the French market share before the treatment. The treatment received by i, T_i depends on the change in the relative unit labor cost. The value of the outcome variable associated with this treatment is $Y_{id}(t)$ the change in market share after receiving the treatment dose t. $Y_{id}(t)$ is the unit level dose-response function. In other words, if the relative unit labor cost decreased of 20% in sector i, $Y_{id}(t)$ gives the impact on the French market share of the product i in the destination d. The average dose-response function is $\mu(t) = E\{Y_{id}(t)\}$.

The propensity function, as defined by Hirano and Imbens (2004) is the conditional density of the treatment given the observed covariates. It is the density of the change in relative unit labor cost given the covariates that may explain the market shares. The conditional density of the treatment given the covariates must verify two hypothesis. First, the probability that the treatment takes a particular value $T = t$ must be independent of the covariates X. It is the balancing property .

Each sector at the 4-digits of the ISIC classification is given a score which is the probability that the sector experienced a greater treatment, depending on its characteristics. The estimated propensity score $e(x_i)$ for sector i is the conditional probability of being assigned to a particular treatment given a vector of covariates x_i (Rosenbaum and Rubin (1983)). What is important regarding the econometrics based on treatment effect is that

[3]Other estimations of the relationship without the logarithmic transformation of LCC (Tables 6 and 7) or using the 4-digits level of product disaggregation (Tables 8 and 9) are available in appendix.

the determinants of the change in relative unit labor cost is mostly due to the German labor market causes and specific changes in German governance and policies which impacted differently the sectors. We can defintely suppose that internal German policy is independent on the determinants of the French market shares. But the extent to which a restriction on labor cost has been acknowledged by the social partners is likely not to independent on German market share which in turn may be affected by French market share. Then, it is necessary to account for possible bias and estimate a propensity score conditional on the French market shares covariates.

The covariates are the variables that determines the change in French market share: growth of the destination market demand (destination fixed effect), the change in RD intensity (OECD isic share), the change in capital intensity, and the proximity (degree of competition with first competitors).

Following Hirano and Imbens (2004), the first step consists in estimating the conditional distribution of the treatment variable given the covariates. We start by dividing the range of the change in the German ULC into four groups based on the German ULC quartiles. And then we estimate the general propensity score conditional on the covariates previously defined. We obtain the dose response plot which gives the mean effect of the Treatment on the change in market share.

7 Results of the GPS analysis

As a first step, we focus the analysis only on market share observations concerned by both a loss in relative level between 2000 and 2010 and a decrease in the German unit labor cost between 2002 and 2007. Indeed, in this paper, our aim is to evaluate the causality between the German competitive deflation related to the labor market reforms and the decrease of the French export performance on the European market. As discussed in the previous section, the method implies three steps. First, the conditional distribution of the treatment – i.e. the relative variation of the German unit labor cost in each sector between 2002 and 2007 given the covariates – is estimated by maximum-likelihood.
Table 4 reports results from the first step of the method developed by Hirano and Imbens (2004). It shows that all the covariates are significant at the 1 percent level highlighting the bias associated with difference in covariates. To remove this bias the GPS is computed using the conditional distribution estimated in the first step. Note that the Shapiro-Francia test validates the assumption of the normality of the distribution. Finally, to test the balancing property of the GPS, a two-sided t-test, which tests that the conditional mean of the pre-treatment variables given the GPS is not different between products which belong to a particular treatment interval and products which belong to all other treatment intervals, is implemented. It indicates that the balancing property is verified at the level of 1 %.

Table 4: Maximum-likelihood estimation of the conditional distribution of the relative variation of German ULC between 2002 and 2007

Dependent variable: Relative variation of German ULC between 2002 and 2007		
Variable	Coefficient	Standard errors
m_{id}	-0.0133	0.0023***
k_s^F	-1.1827	0.0071***
Relative variation of French ULC_s	0.1942	0.0016***
Relative variation of French RD_s	-0.0232	0.0004***
Constant	0.0820	0.0003***
Destination FE		Yes
Observations		44473
Shapiro-Francia test		$W^{'}$=0.913640

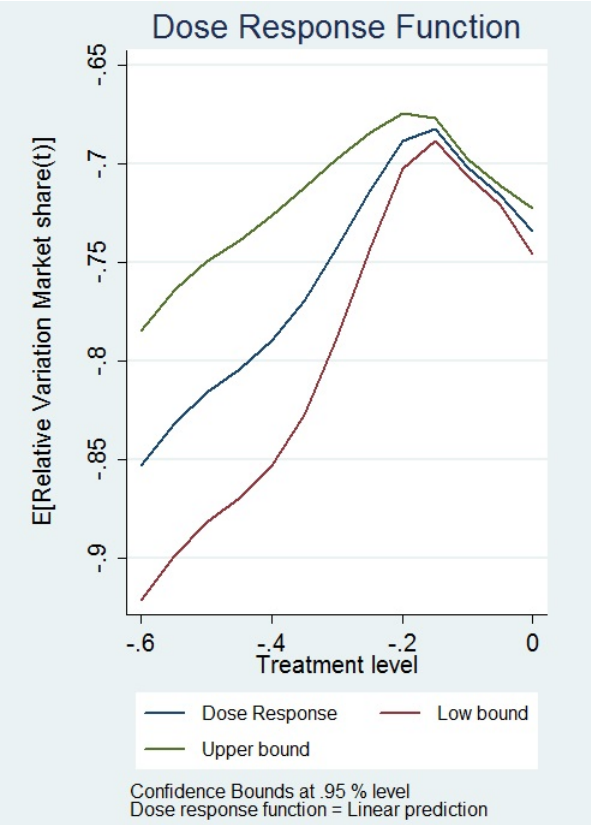
*, **, ***, denote significance at the 1 %, 5 %, and 10 % levels, respectively.

In the second step, the conditional expectation of the relative variation of French market shares between 2000 and 2010, given the treatment and the GPS is modelled as a quadratic function of these two variables. Finally, the dose-response function is estimated using the average expected conditional relative variation of French market shares between 2000 and 2010 for each of level of the treatment. The vector $T = \{-0.6, -0.55, -0.50, \cdots, 0\}$ represents the different level of treatments investigated in our analysis.

The dose-response function is depicted in 4.

At first glance, the dose-response function seems to confirm our expectations. Higher levels of treatment, i.e. higher decrease in German unit labor cost, are associated with higher loss in French export market shares. In other words, when the growth of German unit labor cost falls, the loss of French export market shares is less pronounced. It then supports that the German gain in cost competitiveness had a significant impact on the French export performance within the European Union. However, the dose-response function is not monotonous and is close to an inverted U-shaped form. After a threshold treatment around -0.175, a lower level of treatment, i.e. a lower decrease of the German unit labor cost, is associated with a fall in French export market shares. This counter-intuitive result could be linked to the German non-cost competitiveness and caused by omitted variables in the covariates. The threshold may reflect a lower increase in German competitiveness – i.e. a lower treatment – which is caused by non-price competiveness

Figure 4: Estimated dose-response function



factors which may raise the German Labor cost and minored the effect of the German cut-in-labor-cost policy. For instance, some sectors may have experienced an increase in technological intensity which costs more in skilled workers. And it is likely that this upgrading of the products negatively impacted French market shares. As a consequence, the analysis have to be refined with more accurate covariates, such as export unit values, capturing the non-price competitiveness of Germany.

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Appendix

Table 5 gives the description and the sources of variables. Tables 6 and 7 present the regressions from 5 when the LCC competition indicator is not in logarithm transformation. Tables 8 and 9 report the regressions using the 4-digits level of product disaggregation.

Table 5: Variables, Definition and Sources

Name	Definition	Range of variation	Cross-section unit	Source
ΔULC_s^G	Relative variation of the German Unit Labor Cost	2000-2010	sector (s) isic	OECD STAN database
ΔULC_s^F	Relative variation of the French Unit Labor Cost	2000-2010	sector (s) isic	OECD STAN database
Δs_{id}^F	Relative variation of the French market share in market d of product i	2000-2012	product-destination (id)	BACI (UNcomtrade)
ΔRD_s^F	Relative variation of the French RD intensity in sector s	2000-2010	sector (s) isic	OECD STAN database
m_{id}	Index of proximity between French and German share in market d of product i	2000-2012	product-destination (id)	BACI (UNcomtrade)
k_s^F	Capital intensity of sector s in France	2000-2010	sector (s) isic	INSEE

Table 6: Change in French Market Shares at the HS6 level and Competition Indicator

Dependent variable: Δ MS between 2000 and 2010					
	(1)	(2)	(3)	(4)	(5)
LCC_{id}	0.047	0.100	-0.873**	-0.880**	-0.933**
	(0.187)	(0.181)	(0.374)	(0.371)	(0.370)
Intercept	-3.086***	-3.261***	-9.197**	-3.724***	-3.810***
	(0.242)	(0.086)	(3.687)	(1.099)	(1.106)
Destination FE	No	Yes	Yes	Yes	Yes
HS2 FE	No	No	Yes	No	No
HS3 FE	No	No	No	Yes	No
HS4 FE	No	No	No	No	Yes
Observations	74201	74201	74201	74201	74201

Note: Δ MS is expressed in percentage

Robust standard errors (clustering by partner) in parentheses

*, **, ***, denote significance at the 1 %, 5 %, and 10 % levels, respectively.

Table 7: Change in French Market Shares at the HS6 level and Competition Indicator

Dependent variable: Relative growth of MS between 2000 and 2010					
	(1)	(2)	(3)	(4)	(5)
LCC_{id}	-1.635***	-1.649***	-3.260***	-3.235***	-3.252***
	(0.149)	(0.152)	(0.271)	(0.273)	(0.276)
Intercept	3.367***	3.065***	-0.095	-0.844**	-0.784***
	(0.255)	(0.073)	(5.122)	(0.352)	(0.350)
Destination FE	No	Yes	Yes	Yes	Yes
HS2 FE	No	No	Yes	No	No
HS3 FE	No	No	No	Yes	No
HS4 FE	No	No	No	No	Yes
Observations	74201	74201	74201	74201	74201

Robust standard errors (clustering by partner) in parentheses

*, **, ***, denote significance at the 1 %, 5 %, and 10 % levels, respectively.

Table 8: Change in French Market Shares at the HS4 level and Competition Indicator

Dependent variable: Δ MS						
	(1)	(2)	(3)	(4)	(5)	(6)
LCC_{id}	-0.6521***	-0.5803***	-2.1655***	-2.0291***	-2.0148***	-2.9482***
	(0.1283)	(0.1274)	(0.3045)	(0.3282)	(0.3398)	(0.4170)
Intercept	-1.2707***	-0.9913***	-5.4942***	-0.9637	-9.9506	0.3369
	(0.1715)	(0.0931)	(1.3989)	(1.4104)	(7.2109)	(0.7480)
Destination FE	No	Yes	Yes	Yes	Yes	No
HS2 FE	No	No	Yes	No	No	No
HS3 FE	No	No	No	Yes	No	No
HS4 FE	No	No	No	No	Yes	No
Imp*HS2 FE	No	No	No	No	No	Yes
Observations	2961	2961	2961	2961	2961	2961

Robust standard errors (clustering by partner) in parentheses

*, **, ***, denote significance at the 1 %, 5 %, and 10 % levels, respectively.

Table 9: Change in French Market Shares at the HS4 level and Competition Indicator

Dependent variable: growth of MS						
	(1)	(2)	(3)	(4)	(5)	(6)
LCC_{id}	-0.7582**	-0.7606**	-2.4214*	-2.4937*	-1.93973**	-3.87446*
	(0.3146)	(0.3495)	(1.3261)	(1.4234)	(0.9293)	(2.1354)
Intercept	1.3590**	1.6670	3.7359**	0.13217	0.7413**	-17.5098*
	(0.5953)	(0.1930)	(1.5457)	(0.2122)	(0.3171)	(9.0994)
Destination FE	No	Yes	Yes	Yes	Yes	No
HS2 FE	No	No	Yes	No	No	No
HS3 FE	No	No	No	Yes	No	No
HS4 FE	No	No	No	No	Yes	No
Imp*HS2 FE	No	No	No	No	No	Yes
Observations	2934	2934	2934	2934	2934	2934

Robust standard errors (clustering by partner) in parentheses

*, **, ***, denote significance at the 1 %, 5 %, and 10 % levels, respectively.