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Made in China: Export competition and structural changes in the OECD countries*

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Abstract

This paper assesses the existence and extent of transition cost for the OECD economies associated with the increasing Chinese competition in the export markets. We find that intensified Chinese competition is an important factor in explaining structural changes not only within the manufacturing sector but also of the economies as a whole. In our empirical analysis which is guided by a simple extension of the Melitz Model we employ panel data at multiple levels of aggregation. The data reveal considerable adverse effects on export volume and industry-specific output in OECD countries as a result of increased Chinese competition. These distortions originating from the export market also affect structural variables within the manufacturing industries. Even at a regional level, changes in socioeconomic indicators can be associated with intensified Chinese export competition. Within the framework of our theoretical model, the mechanisms behind these observations are the following: The increased Chinese competition leads to a decline in exports and overall output, implying a decrease in average productivity and wages. This induces the reallocation of labor to the low-wage service sector, which in turn results in a reduction of average household income.

JEL classification: F12, F14, F16

Keywords: China, Export Competition, Deindustrialization

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1 Introduction

The emergence of China as a major player on the world market for manufactured goods is well documented. Driven by institutional changes, the successive adoption of new technologies and the existence of a vast pool of labor, China's exports have increased rapidly along the intensive as well as the extensive margin. In 1995, the volume of China's manufacturing exports relative to the exports of the OECD countries amounted to 5%. By the year 2010 this ratio had grown to 22%.[1] The economic size and the momentum of such an export growth are - in this combination - unprecedented. The result is a considerable increase in competition in the global market for manufactured products.

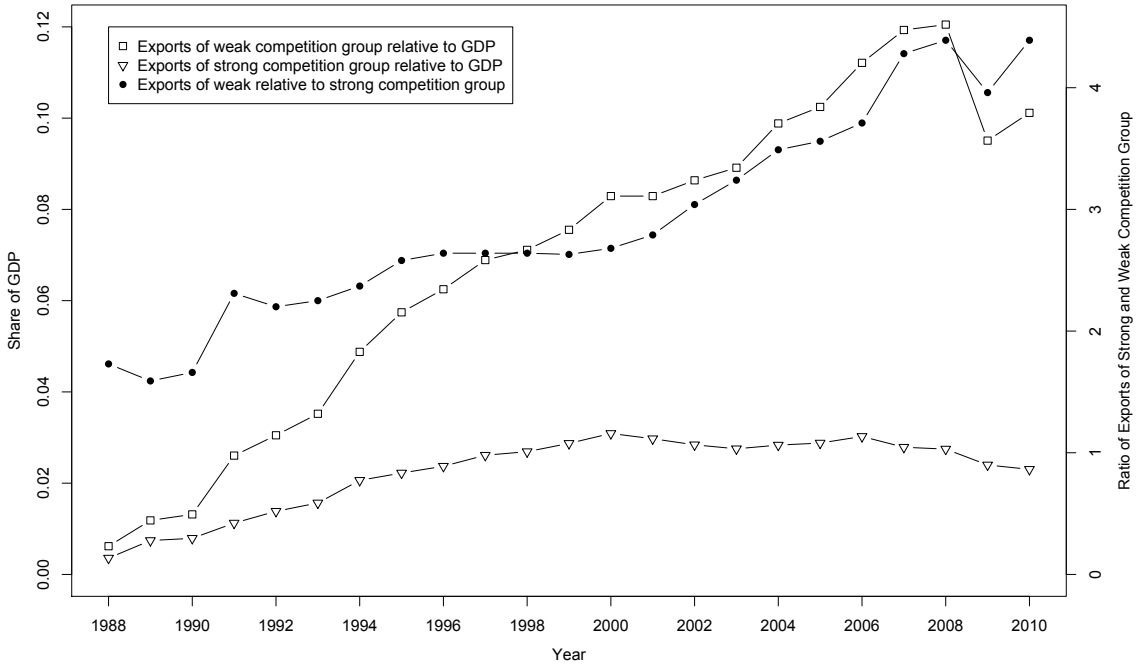
So far however, the analysis of potential effects for developed countries resulting from tougher Chinese competition in the export market has received little empirical attention. A cursory review of the manufacturing exports of the OECD countries does not reveal any negative effect of increased Chinese competition. In fact, OECD exports have even grown relative to GDP over time (Bergoeing et al., 2004). However, if one divides the manufacturing products of the OECD members into two groups, one facing strong and another facing weak Chinese export competition, diverging patterns emerge. As Figure 1 shows, the value of exports of the strong competition group relative to GDP increased marginally between 1988 and 2000 and has subsequently decreased, despite a continuous decline in transport costs. On the other hand, the exports of manufacturing products facing only weak competition have grown considerably relative to GDP. Additionally, Figure 2 shows that the share of OECD manufacturing export products that face strong Chinese competition has steadily increased over time. The two graphs suggest that the strong Chinese competition in the world market leads to a decline in OECD manufacturing exports and that the range of products facing strong competition has increased.

Considering the important role of the export sector in explaining structural changes within industries (Melitz, 2003) and the findings of Bernard et al. (2003), that even for a relatively closed economy, changes in the export market can have considerable effects on firm productivity and labor turnover, the lack of research directed towards the analysis of the effects for developed countries associated with increased Chinese competition in the export markets is surprising. This paper contributes to filling this gap.

The goal of this study is to investigate the extent to which shocks in the export market for manufacturing goods, induced by increased Chinese competition, carry over to the industry

[1] Source: UN Comtrade Database.

Figure 1: Weak and Strong Chinese export Competition Shares

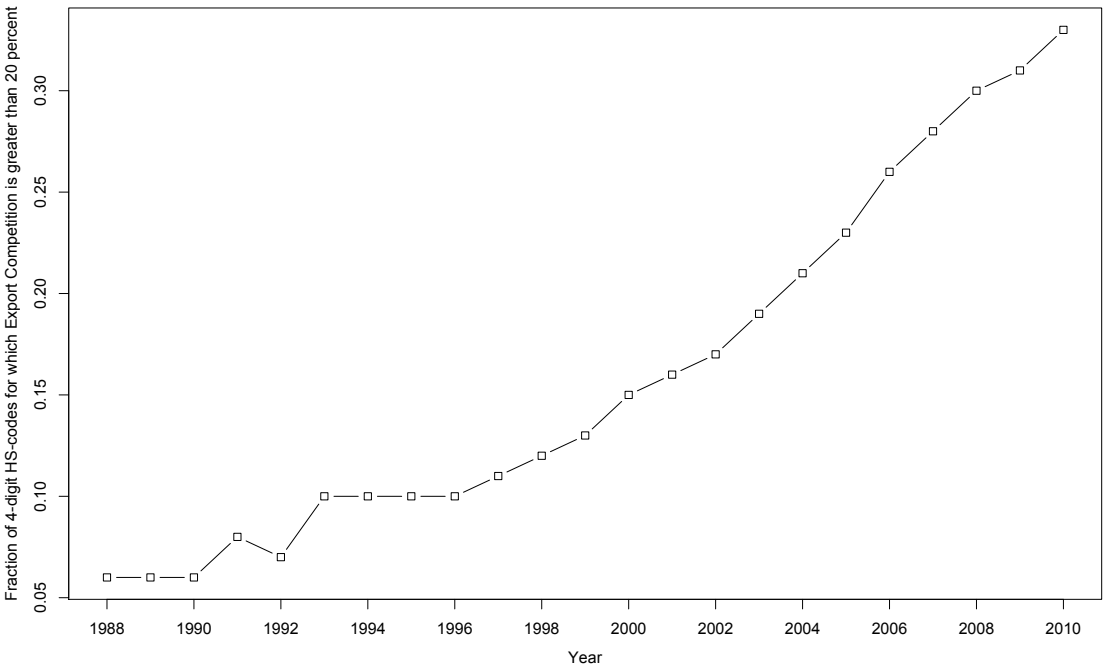


Note: The strong (weak) competition group is categorized as follows: Industries for which export competition, as defined by Eq. (3), is above (below) average.

level and to the economy of developed countries as a whole. The main focus thereby lies on the empirical investigation. To embed our regression analysis in a theoretical context we develop a simple extension to the Melitz Model (Melitz, 2003) presented in Redding (2010). This model provides us with qualitative predictions and allows for an economic interpretation of the regression results.

Based on the theoretical model we expect that increased Chinese export competition results in a reduced export volume, leading to a drop in manufacturing wages along with a decline in average productivity. These changes result in the contraction of the manufacturing labor force, inducing an aggravated decline of total manufacturing output. Additionally, the structure within an individual manufacturing industry is affected by the increased export competition. In particular, our model predicts that the average firm size decreases as a consequence of the reduced average productivity. Within the framework of the model a decreasing wage rate will induce reallocation of labor to the low-pay service sector, resulting in an overall income loss. The magnitude of these distortions will depend on the size of the initial manufacturing labor force. These qualitative predictions imply that the Chinese export competition is likely to have a broad distortionary impact on OECD economies,

Figure 2: Export Competition at the Product Level



Note: Export competition is defined according to Eq. (1).

ranging from the manufacturing export sector through to the average household income.

To empirically assess the effects of Chinese export competition we employ panel data at different levels of aggregation. By progressively inspecting different economic constituents of industrial activity in our empirical analysis we hope to unfold a consistent picture of how the Chinese competition effect in the export market is transmitted to more aggregated levels. To our knowledge, we give the first extensive account of transition costs faced by OECD countries associated with the emergence of China as a global player in the manufacturing export market.[2]

In the first step of the empirical analysis we use bilateral export data for the OECD countries and find that Chinese export competition, measured by the import share of Chinese products in the export market (i.e. of the trade partner country), has a significant effect. An increase of 1 percentage point in Chinese export competition leads to a decline in the home country's export volume of about 0.5%, constituting a considerable impact.

In a second step, we investigate whether increased Chinese export competition is associated with a decrease in total output of the manufacturing industries. In line with the theoretical

[2]In our analysis, it is not possible to derive any implications regarding the effects on total welfare.

predictions, we find a negative relationship. Moving from the lowest to the highest quintile in Chinese export competition is associated with a reduction in output of roughly 21%, signifying a considerable distortion of industrial production. We also find substantial effects on structural variables at the industry level of the EU countries.[3,4] As expected, increased Chinese export competition is associated with a reallocation of labor, a decline of average productivity, a drop in the wage rate and a decrease in average firm size.

In a third step we construct a measure for Chinese export competition faced by regions within the individual EU countries. We then investigate how the changes within the industrial sector associated with increased Chinese export competition influence the regional socioeconomic characteristics. In line with the qualitative predictions of our theoretical model we observe that regions faced with intensified competition experience a reallocation of labor from the manufacturing to the service sector as well as a drop in per capita household income. The results therefore indicate that the increased Chinese competition is an additional source of explanation for the increasing relative importance of the service sector in developed countries. Lastly, we also find a negative association between the export competition measure and outward migration at the regional level.

In all the regression setups we additionally include a measure for Chinese import competition which is defined as the imports from China as a share of the home country's total imports. The results confirm the presence of significant import competition effect at some aggregation levels. However, we find that the Chinese export competition effect is dominating and able to explain a higher share within the variation. Overall, our theoretical and empirical results indicate that the transition costs associated with the intensified Chinese competition - specifically in the export market - are considerable.

The paper is structured as follows: First we review the literature related to our analysis. Second, we briefly describe the most important features of our theoretical model and present the qualitative predictions derived. Since the focus of this paper lies on the empirics, the detailed presentation of the model is deferred to the appendix. Third, the data are described. In a fourth step, the empirical analysis is carried out and results are presented. Section 5 concludes.

[3]When referring to the EU, we explicitly mean the EU countries within the OECD. We additionally include Norway and Switzerland in order to increase our sample size. The results below are not driven by the inclusion of these two countries.

[4]The restriction to EU countries within the OECD is dictated by data limitations.

2 Related Literature

The literature revolving around the emergence of China as a major player on the world market for manufactured goods is vast. However, studies specifically concerned with assessing the effects working through the export market channel have mostly been restricted to the quantification of the crowding-out effect for developing countries specializing in the production of labor-intensive goods. Generally, the effects found are rather small. Hanson and Robertson (2008) estimate that the percentage of forgone exports in the years 2000-2005 due to increased Chinese competition is between 0.5% and 1.6%. For the consumer goods exports of Asian countries, evidence for a crowding-out effect is found by Eichengreen et al. (2007). A crowding-out effect for Asian countries is also documented by Xing (2011) in the market for information communication technology products. Regarding the substitution of Latin American imports for Chinese products in the U.S. market, Moreira (2006), López-Córdova et al. (2008) and Montenegro et al. (2010) find small or non-significant effects. Using an alternative measure for competitive threat, the results of Jenkins (2008) indicate that the negative impact on Latin American exports could be considerably stronger than found in the studies mentioned above.

For OECD countries, possible effects from increased export competition from Chinese products have received little attention, although Schott (2008) documents an increasing coincidence between export bundles of the OECD countries and China. In addition, Cadot et al. (2011) document an increase in the concentration of imports of the OECD countries with respect to their geographical origin starting around the year 2000. This concentration process is entirely attributable to China's growing import share in OECD countries. To the authors' knowledge, the issue of whether home industries or labor markets are being affected by increasing Chinese competition in the export market has only been addressed in Autor et al. (2012). They incorporate the growth of Chinese imports in third markets within a measure for local labor market exposure to Chinese products. However, the assessment of the relative importance of the export sector is not possible within this framework.

The analysis of potential effects associated with increased Chinese competition in home markets - i.e. import competition - has attracted more interest. Regarding the impacts on the labor markets, studies consistently find a negative correlation between manufacturing employment and exposure to imports from China. Using information on local U.S. labor markets, Autor et al. (2012) find that increased exposure to Chinese imports is negatively

associated with the share of workers employed in the manufacturing sector. In line with the results of Bernard et al. (2006), indicating that industrial plant growth and survival are negatively associated with exposure to imports from low-wage countries, Bloom et al. (2011) , Mion and Zhu (2011) as well as Álvarez and Claro (2009) find evidence that import exposure to Chinese products is associated with lower plant-level employment growth. Álvarez and Claro (2009) and Sargent and Matthews (2009) additionally find a positive correlation between Chinese import penetration and the market exit probability of firms in the manufacturing sector for developing countries. On the basis of industry-level data for 10 European countries operating in selected manufacturing sectors, Peltonen et al. (2008) establish a negative association between the import penetration of Chinese products and company profitability.

Regarding the impact on manufacturing wages, the results are mixed. Alvarez and Opazo (2008), in line with the predictions of the Heckscher-Ohlin model, attribute a negative wage effect in the manufacturing sector to the import penetration of Chinese products. On the other hand, several studies document skill and technology upgrading as a reaction to increased import competition (see e.g., Mion and Zhu (2011), Bloom et al. (2011) or Alvarez and Opazo (2008)). This implies a positive effect on productivity and wages. In line with these results, Isgut (2006) finds a positive wage effect for Canada's manufacturing workers. Autor et al. (2012) do not find a significant effect on the wages in the manufacturing sector.[5]

These inconclusive results regarding the manufacturing wages also relate to the strand of literature documenting wage rate rigidities, implying employment adjustments instead. For example Babecký et al. (2010) assess downward wage rigidity in real and nominal terms for a set of European firms. Similarly, Druant et al. (2012) find that the manufacturing sector in European countries adjusts wage rates less frequently than prices.

An additional field related to our study is the ongoing discussion about the causes of the continuing relative growth of the service sector in developed economies (see e.g. Autor and Dorn (2012)). These studies find, that the impact of trade - most prominently offshoring - plays only a minor role in explaining the cross-sectoral labor movements.

All in all, the literature analyzing the effects of increased Chinese competition working through the export channel and focussing on developed countries is scarce. This paper

[5]However, the reader should bear in mind that the impact on wages can only be measured for the workers remaining in the manufacturing sector. The effects for workers leaving the sector can be quite different, as documented by Ebenstein et al. (2009).

aims - starting with the next section - at filling this gap.

3 The Theoretical Model in a Nutshell

In this section we briefly outline the main properties of our theoretical model which we use to derive qualitative predictions for the regression analysis. Our model builds on the seminal work of Melitz (2003) and the repsective versions of the Melitz model in Arkolakis et al. (2008) and Redding (2010). Since the focus of the paper lies on the empirical investigation, we defer the detailed analytical presentation to the Appendix A.

The model includes three countries: Home, Foreign and China, where the first are two representative developed (OECD) economies. The production side of Home and Foreign consists of three sectors: First, a Walrasian service sector producing a non-tradable homogeneous good. Second, a manufacturing sector producing a single differentiable and tradable good under Melitz type conditions, e.g., the firms are heterogeneous with respect to productivity. The third sector, a Walrasian high-tech sector, produces a tradable homogeneous good. The manufacturing as well as the high-tech goods are classified as industrial products. The two sectors combined can be thought of as the secondary sector.

The labor pool in Home and Foreign is of fixed size and consists of two types of workers: high-skilled and low-skilled workers. The former are all employed in the high-tech sector. The low-skilled workers have two choices: either work in service or in manufacturing. To qualify for the jobs in the manufacturing sector, however, they have to invest in a fixed upgrade cost. The workers are heterogeneous in terms of this cost. The labor supplies in the service and manufacturing sector therefore depend on the wage differential between those two sectors, implying that supply is elastic for these two sectors.

The demand in Home and Foreign is derived from an upper tier logarithmic utility function which only comprises the service and the manufacturing goods. This means, the high-tech good will not be consumed in the developed countries.

For reasons of simplicity and tractability, we assume that China only produces varieties of the manufacturing good. Hence, it creates competition solely in the manufacturing sector. The Chinese demand side is kept equally simple: only the high-tech good is imported. This one-way trade between China and the two other economies implies that the developed countries pay their imports of Chinese manufacturing varieties with the exports of high-tech products. By fixing the Chinese exports to the high-tech imports the competition from

China in the manufacturing sector is exogenous. Thus, the characteristics of the Chinese manufacturing sector are exogenous with respect to the ones in Home and Foreign. This exogeneity assumption can be rationalized with the continuous low level of Chinese wages (e.g. Ceglowski and Golub (2011)) and the fact that Chinese exports are influenced by state interventions.[6]

The setup described above allows us to derive qualitative predictions for the impact of increased Chinese export competition, defined as the import share of Chinese products in Foreign.[7] All the results analogously apply to an increase in Chinese import competition.

The key consequence of an increased Chinese export competition is the decline in foreign expenditure on products from Home. The lower levels of exports lead to a drop in employment in the more productive export sector, resulting in a decline in the manufacturing wage rate and a decrease in average productivity of the manufacturing firms. These changes could be characterized as 'reversed Melitz effects'. The decline in the wage rate leads to a reduction in labor supply in the manufacturing sector, resulting in a decrease of total income and contraction of total output.

Regarding the number of active firms in the sector, two opposing effects are at work. The decreased wage rate allows the entry of less productive firms implying an increase in the number of enterprises. The lower wage rate, however, is associated with a labor force contraction in the manufacturing sector. Thus, no clear prediction can be derived for the number of active firms. The direction of the effect depends on the relative size of the output elasticity and the wage rate elasticity (both with respect to Chinese export competition) in the manufacturing sector.

For the economy as a whole, we observe a reallocation of labor from the manufacturing to the low-pay service sector as a reaction to increased Chinese export competition. This rise in the service labor supply implies a decline in the wage rate for the employees in service. Together with the decreased manufacturing wage rate, these effects result in a decline of average income of the economy. However, because we have classified the manufacturing as well as the high-tech goods as industrial products, the wage effect in the secondary sector as a whole is not clear. The direction of the effect depends on ratio of labor supply and wage rate elasticities with respect to Chinese export competition in the manufacturing sector.

[6] E.g. the exchange rate regime. Figure 3 in Ceglowski and Golub (2011) clearly illustrates the effect regime changes have on relative unit labor costs.

[7] Export (import) competition is denoted by vc_F (vc_H) in the theoretical model.

Summing up, within the framework of our model the increased Chinese competition in the export markets affects several important economic variables. Starting with the next section, we will investigate the extent to which our theoretical predictions are reflected in the data.

4 Data

As mentioned in the introduction, we analyze the impact of Chinese export activity for OECD countries[8] for different levels of data aggregation: the product level, the industry level and the regional level. To do so, we construct four different datasets whose structure we will explain in the following.

4.1 Product-Level Data

The product-level data is extracted from the UN Comtrade Database and categorized according to the four-digit Harmonized Commodity Description and Coding System (HS).[9] Each observation originally contains the following information: The value that is exported from a home country (the exporter) to the partner country (the importer), measured in current US dollars within a given product code and year. Depending on the quantity of partners, the number of observations within a given product code and year varies for the exporters. As mentioned previously, we restrict our attention to the exports of manufacturing goods[10] of the OECD countries. Consequently, we drop all exporters not belonging to the OECD. Also, we do not include observations, where China is the trade partner. In a next step, we augment the dataset by adding total exports, exports to China, total imports, and imports from China to the home and the partner countries. Additionally, we also include country-specific information on GDP levels. The last information is part of the World Development Index. The final dataset includes the years 1988 to 2010.

All variables used in the analysis at the product level along with their descriptive statistics as well as their sources are listed in Table C.1 in the appendix.

The information contained in the dataset described above is used for the construction of

[8] A list of the countries for which data are available at the different levels of aggregation and which can thus be included in the analysis is given in Table C.5. We do not include countries that have joined the OECD in 2010 or later.

[9] An analysis using more detailed trade data is not possible due to the scarcity of such information.

[10] More specifically, four-digit HS codes between 2800 and 9700 are included in the analysis.

the remaining three datasets. However, some intermediate steps have to be taken in order to adapt the information for use, which we describe in the following.

4.2 Industry-Level Data

For the analysis at the industry level, we construct two datasets using two additional sources. The UN Industrial Commodity Production Statistics Database provides information on the output of various industries within a given nation for a wide range of countries. The industries are categorized according to the UN List of Industrial Products which is based on the Central Product Classification (CPC Ver 1.1). The values reported are measured in current US dollars. Unfortunately, this source does not provide information on structural characteristics of manufacturing industries, such as employment or earnings. This kind of information is available from the Eurostat Statistics Database.[11] The data in this database are restricted to the EU-27 countries, Norway and Switzerland. Subsequently, when talking about EU countries, we refer to Norway, Switzerland as well as the EU-27 countries that are members of the OECD. The Eurostat industry classification differs from the UN categorization. The measures are grouped according to the statistical classification of economic activities in the European Community (NACE Rev. 1.1).[12]

Since the trade data presented in Section 4.1, in addition to being reported on a more disaggregated level, are categorized according to a different classification, the trade flows have to be matched into industries in order to analyze the effects of changing trade volumes on industry-level indicators. In our case, we have to assign the HS codes to the UN and the Eurostat industry categorizations, respectively. Problems arise whenever a trade-data category cannot be assigned to a single industry. In such cases, we are unable to determine what portion of the total trade flow reported for a particular, not uniquely assignable HS code, pertains to which industry. The procedures employed when facing this problem are described in Appendices B.1 - B.2.

After having constructed the correspondence tables, we are able to aggregate the trade data to industry levels. We build sums whenever the product-level information is of absolute value and take averages if the information is in relative terms. Again, we augment the

[11] The Eurostat Database also includes information on output levels. Because of the restriction to the EU countries and the more cumbersome matching process (see B.2), we choose to use the UN data for the output analysis.

[12] The NACE classification encompasses not only manufacturing, but also other sectors. Again, we restrict the analysis to the manufacturing sector, implying the inclusion of the NACE codes 17 - 37.

datasets by adding country-specific information about GDP levels. Both final datasets span the years from 1995 to 2008. Descriptive statistics of the dataset resulting from the two matching procedures are provided in Tables C.2 - C.3 in the appendix.

4.3 Region-Level Data

Socioeconomic indicators, such as sector-specific compensation, employment or information on migration are not differentiated with respect to industries but with respect to geographical areas. More specifically, the variables provided by Eurostat are grouped according to the Nomenclature of Statistical Territorial Units (NUTS). For our purposes, we use the NUTS 2 level, which subdivides Norway and the 27 EU member countries into 277 regions. We connect the product-level data from Section 4.1 to the NUTS-level observations by first using the HS-NACE correspondence table to aggregate the trade data. The resulting variables are at the country level. Here however, we operate at a regional level. Therefore, we need to construct region-specific measures for the exposure to trade. The details of the procedure are described in Section 5.5. The dataset is augmented by country-and NUTS-specific control variables. Again, the variables are available for the years 1995 - 2008. Descriptive statistics on this dataset are depicted in Table C.4.

5 Empirical Analysis

5.1 Setup and Definitions

Before discussing specific regression specifications and presenting results, we want to clarify the general terminology and methodology employed in the following analysis.

5.1.1 Terminology

Exports are defined as the flow of products from the home country to the (trade) partner country. The exporting home country (industry) faces competition from China through two channels: Firstly, increased imports from China can put pressure on domestic producers; e.g., by offering products at low prices. Changes resulting from increased import competition will subsequently be referred to as the 'import-competition' effect. Secondly, producers in Home can be affected by Chinese competition in the export market - i.e. in the market in the trade partner countries - resulting in a decrease of exports. This effect

will be called the 'export-competition' effect. Henceforth, when talking about import or export competition, we explicitly refer to competition from China. In this study, we are particularly interested in the analysis of the impact of the later effect. That is, we want to assess to which extent export competition influences the export volume as well as economic variables on more aggregated levels of the developed home country.

5.1.2 General Methodological Remarks

Our measure for the degree of export competition (EC) is a partner country's share of imports from China relative to its total imports within a given product category. In turn, import competition (IC) is defined as the share of imports from China to the home country relative to the total imports within a given product category. Thus, we argue that in markets with a high share of imports originating in China, the competition is fierce, whereas in markets with a low share of Chinese products, the competition is moderate. The measures defined are consistent with the definitions in our theoretical model. They are based on the observation that the price of Chinese products is relatively low compared to products originating from OECD countries (see e.g., Schott (2008)). Formally, the measures can be expressed as:

$$\begin{aligned} EC_{i,j,k,t} &= \frac{\mathrm{Im}^{C}_{j,k,t}}{\mathrm{Im}^{T}_{j,k,t}}, & & \text{home country: } i = 1,..,I \\ & & \text{with} & \text{partner country: } j = 1,..,J \\ IC_{i,k,t} &= \frac{\mathrm{Im}^{C}_{i,k,t}}{\mathrm{Im}^{T}_{i,k,t}} & & \text{product: } k = 1,..,K \\ & & & \text{time: } t = 1,..,T, \end{aligned} \tag{1}$$

where $\mathrm{Im}^{C}_{j,k,t}$ are the imports of partner country j from China in the product class k at time t, and $\mathrm{Im}^{T}_{j,k,t}$ are the total imports from partner j in product category k at time t. Since we conduct the empirical analysis at various data-aggregation levels, we postpone the detailed explanation of the econometric model and the construction of explanatory variables to the respective sections. However, at all stages of the analysis we add fixed effect-specific variables in such a way that each observation point in the data is fully identified by the time index and the fixed effects index. Therefore, we will only exploit variation over time and do not rely on any variation between the identifiers. Thereby we avoid any endogeneity issues stemming from time-invariant unobserved effects on, for example, the

home-partner-product level. To eliminate country time-variant effects, such as trends in demand or technology, we augment each regression by country-specific time trends. In doing so, we hope to solely capture general effects and economic mechanisms that are valid across countries under the assumptions of panel data models. Additionally, we always add time-fixed effects and cluster the standard errors at the respective identifier level. Our panel data are sufficiently disaggregated at the country level[13] to allow for enough degrees of freedom for such an exercise. Also, they are not restricted to an individual country. This is an enhancement compared to existing studies. A final general remark concerns the robustness of our estimations: Since we drop China from the potential partner country list, we note that all our results are robust to the inclusion of the log of exports to China on the respective aggregation level. Also, we include the total volume of exports in all regression settings in order to control for the importance of the export market.

5.2 Chinese Competition and the Export Volume

A crucial building block of our study is the empirical validation of the negative impact of Chinese competition on the export volume of the OECD countries. Our theoretical model predicts that an increased export competition will result in a decline in demand for home-country goods as a higher portion of the export market is served by Chinese manufacturing goods.

We test this hypothesis using the most disaggregated information available: product level data. The regression model with $EX_{i,j,k,t}$, the exports of the home country i to the trade partner (export market) j in product class k as the dependent variable is the following:

$$\ln(EX_{i,j,k,t}) = \beta_0 + \beta_1 EC_{i,j,k,t} + \beta_2 IC_{i,k,t} + \beta' \mathbf{X}_{i,j,k,t} + v_{i,j,k,t}, \tag{2}$$

The error term $v_{i,j,k,t} = \mu_{i,j,k} + u_t + \epsilon_{i,j,k,t}$ consists of a country-partner-product-specific effect ($\mu_{i,j,k}$), a time effect (u_t), and an idiosyncratic error term ($\epsilon_{i,j,k,t}$). $EC_{i,j,k,t}$ is the measure for the export competition within a given fixed effects group over time. Also included in Eq.(2) is the measure $IC_{i,k,t}$ for direct import competition. Finally, $\mathbf{X}_{i,j,k,t}$ constitutes a set of control variables including absolute trade volumes as well as the GDP per capita for the exporter and partner country (both in log).[14]

[13] We additionally have an industry and a regional dimension.

[14] Because we employ fixed effects estimations we do not need to control for the actual size of the countries.

Table 1: Chinese Competition and Export Volumes of the OECD (EU) Countries

Dependent variable: Log exports						
	OECD					EU
	(1)	(2)	(3)	(4)	(5)	(6)
Export competition	-0.507***	-0.466***	-0.646***	-0.426***	-0.490***	-0.573***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.007)
Import competition		-0.264***	-0.430***	-0.220***	-0.351***	-0.185***
		(0.008)	(0.008)	(0.007)	(0.007)	(0.010)
Log GDP p. capita of home country	1.241***	1.236***	0.790***			1.389***
	(0.024)	(0.024)	(0.024)			(0.029)
Log GDP p. capita of partner country	1.529***	1.530***	0.949***			0.970***
	(0.007)	(0.007)	(0.007)			(0.008)
Log imports from China of home country			0.026***			0.019***
			(0.001)			(0.001)
Log total imports of home country			0.227***		0.266***	0.295***
			(0.002)		(0.001)	(0.002)
Log imports from China of partner country			0.035***			0.029***
			(0.000)			(0.001)
Log total imports of partner country			0.309***		0.372***	0.304***
			(0.001)		(0.001)	(0.001)
Obs.	10431524	10431524	10431524	12424602	12424602	7881099
adj.-R^2	0.82	0.82	0.82	0.81	0.81	0.82
F-Test	9228.142	9068.791	11612.902	9593.407	13733.230	11374.207

Notes: Robust standard errors clustered at the identifier level in parentheses;* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; FE estimator regressions in all columns with time dummies, home-partner-product-specific effects and country-specific time trends. Columns 1 to 5 refers to the full OECD sample. Column 6 makes use of the restricted EU sample. Log GDP per capita is in constant international US dollars. The log import variables, both for the home-country and the partner-country, are at product-level.

The reduced form model in Eq. (2) includes the exports ($EX_{i,j,k,t}$) as log on the LHS as well as part of the export competition measure ($EC_{i,j,k,t}$). This has to be evaluated from an econometric perspective in the context of the reflection problem in Manski (1993). Clearly, the measure $EC_{i,j,k,t}$ is *not* linear in the log of $EX_{i,j,k,t}$, which is sufficient for identification in our case (Brock and Durlauf, 2001).[15]

Table 1 depicts the results of the regression Eq.(2). As mentioned in the previous section, we have included time dummies, home-country-specific time trends and home-partner-product-specific fixed effects in all regression setups. Columns 1-5 exploit the full OECD sample, whereas the data in column 6 is restricted to the EU countries.

Column 1 shows the result of our base regression when the measure for export competition

[15]The same holds true in the case of the log of the world exports (Jensen's inequality).

and the GDP per capita variables are included. The coefficient of the GDP per capita variables are positive and with magnitudes in line with the literature on gravity equations; e.g., Rose (2004), indicating that the model is appropriate. The value of the EC coefficient implies that a 1 percentage point increase in the share of imports from China in the trade-partner country results in a decrease of -0.51%[16] in the export volume of the home country. As the share of imports from China has increased steadily across most trading partners, this finding indicates a considerable cumulative effect for the exports of the developed countries.[17] The effect is further amplified by the fact that Chinese exports grow not only within but also across industries.

In column 2, we include the import competition measure in the regression model. This variable is not partner-specific, and hence the variation is limited to the home-country-product level. Because of the large number of observations and the resulting precise estimates, we are confident that problems regarding multicollinearity are negligible, despite a strong correlation between the export and import competition measures. The import competition variable is revealed to have a negative and significant effect on the exports. The magnitude is fairly constant across the different setups. Reverting to the theoretical model, the negative IC coefficient can be explained as follows: Increased import competition results in a decline in domestic sales for firms and thereby lowers average productivity. This also reduces the export volume. According to our estimates in column 2, a 1 percentage point increase in the share of imports from China in the home country triggers a change in the export volume of -0.26%. The magnitude of the IC coefficient is smaller than the one of EC measure in all the regressions reported in Table 1.

In the remaining columns 3-6 we estimate different setups to test for robustness and consistency. With the introduction of several import volume measures, column 3 shows that it is not the absolute volumes of imports from China that matter, but its share of total imports. This supports our choice of relative measures for the export competition and import competition. Higher import volumes from China might simply be a result of increased demand equally affecting all trade partners.

Column 6 reveals that the effects for the EU countries within the OECD sample are similar to the findings obtained when using the unrestricted dataset. We additionally note that

[16] $100\left(\exp^{-0.507/100}-1\right)=-0.51\%$

[17] To obtain a feeling for the economic magnitude of the effect we can calculate average loss in export volume (in thousand U.S. dollars) associated with a 1 percentage increase in EC. Using the mean (log) export value from Table C.1 we get: $-0.507^{\exp^{11.38}}/_{100}=-443$. In other words, a loss of 6 % in average export volume.

the results are robust with respect to the time periods included in the regression.[18]

Overall, our findings show that export competition due to Chinese products causes a significant reduction in the exports of the OECD countries and, consequently, a decline in bilateral trade among these countries. Whether these results carry over to more aggregate levels will be analyzed in the following sections.

5.3 Chinese Competition and Industry Output

In this section we examine whether the Chinese export and import competition effects are economically meaningful enough to explain variation in the aggregated output of manufacturing industries within the OECD countries. Given the results in the previous section, combined with the analytical results of our theoretical model, we expect that this will indeed be the case. According to the model, the impact of export competition on total output of individual manufacturing industries should be more pronounced compared to the effect for export volume.

Confined by the availability of data, we now have to operate at a more aggregate level compared to the HS classification. The industry-specific output data is categorized according to the UN classification. We therefore have to aggregate the product classes of the trade data to the industry level according to the procedure described in Appendix B.1. Since an industry's output cannot be apportioned to the different export partners of a home country, we additionally have to aggregate the trade variables within a given industry classification over the trade partners. This aggregation is trivial in regard to absolute volumes, where we merely sum across the trade partners. The relative measure for export competition is constructed in the following manner:

$$WEC_g = \sum_{k=1}^{K} \mathbb{1}\{k \in g\} \frac{EX_k^T}{EX_g^T} \sum_{j=1}^{J} \frac{Im_{j,k}^C}{Im_{j,k}^T} \frac{EX_{j,k}}{\sum_{j=1}^{J} EX_{j,k}} \quad \begin{array}{l} \text{partner country: } j = 1, .., J \\ \text{with product: } k = 1, .., K \\ \text{industry: } g = 1, .., G. \end{array} \tag{3}$$

where for notational convenience, time and home country dimensions were omitted. WEC_g is the weighted export competition (WEC) measure for a given industry in the home country. $\mathbb{1}\{k \in g\}$ is the function indicating whether the product k belongs to the industry

[18]Specifically, when taking the time span 1995-2008 - the period for which the data is available in the Sections 5.3 to 5.5 - the results are very similar. Eg., the point estimate of the EC coefficient in column 3 is -0.617 in that case.

g. EX_k^T is the sum of home country's exports of product k across all trade partners.[19] EX_g^T is the total value of the home country's exports within the industry class g.[20] The first ratio in Eq. (3) therefore represents the weight of the individual product classes with respect to the total industry exports. The partner country's share of total imports originating from China is given by the second ratio. This import share is weighted according to the relative importance of the trade partner for the home country which is measured by the percentage of total exports destined for partner country j. By construction, WEC_g is between 0 and 1 and can therefore be interpreted as the weighted average share of imports from China across all partners and products.[21] To construct the weighted import competition measure (WIC) at the industry level we apply the following procedure, where again, time and home country dimensions have been omitted:

$$WIC_g = \sum_{k=1}^{K} \mathbb{1}\{k \in g\} \frac{Im_k^C}{Im_k^T} \frac{Im_k^T}{Im_g^T} = \frac{Im_g^C}{Im_g^T} \quad \text{with} \quad \begin{array}{l} \text{product: } k = 1, .., K \\ \text{industry: } g = 1, .., G, \end{array} \tag{4}$$

WIC_g therefore represents the home country's percentage of total imports originating from China that falls into the industry class g.

Having aggregated the trade data, no distinction between individual trade partners can be made any more. Therefore, we drop the term 'Partner Country' and subsequently speak of 'Export Market' instead.

We set out to test whether WEC and WIC have a significant impact on the output of manufacturing industries in the OECD (EU) by using the following regression model:

$$\ln(O_{i,g,t}) = \beta_0 + \beta_1 WEC_{i,g,t} + \beta_2 WIC_{i,g,t} + \beta' \mathbf{X}_{i,g,t} + v_{i,g,t}, \tag{5}$$

where the error term $v_{i,g,t}$ has a similar structure as in Eq.(2), except now the identifier is at the country-industry level. $O_{i,g,t}$ is the output of industry g in country i in the year t. The set of controls $\mathbf{X}_{i,g,t}$ includes country-specific variables and the absolute amounts of industry-specific trade data.

Table 2 displays the estimation results. The coefficients listed in columns 1-3 are obtained using the whole sample, whereas for the regression results presented in column 4 only the

[19] Formally: $EX_k^T = \sum_{j=1}^{J} EX_{j,k}$

[20] Written formally: $EX_g^T = \sum_{k=1}^{K} \mathbb{1}\{k \in g\} \left(\sum_{j=1}^{J} EX_{j,k}\right) = \sum_{k=1}^{K} \mathbb{1}\{k \in g\} EX_k^T$

[21] In probabilistic terms, this measure corresponds to the expectation across partners and products with the weights as distributions.

Table 2: Chinese Competition and the Output of Manufacturing Industries

Dependent variable: Log industry output				
	OECD			EU
	(1)	(2)	(3)	(4)
Weighted export competition	-1.693***	-1.439***	-1.357***	-1.718***
	(0.112)	(0.119)	(0.119)	(0.180)
Weighted import competition		-0.516***	-0.714***	-0.718***
		(0.100)	(0.100)	(0.153)
Log imports from China of home country			0.037***	0.036***
			(0.004)	(0.005)
Log total imports of home country			0.225***	0.191***
			(0.015)	(0.019)
Log imports from China of partner country			0.029***	0.022**
			(0.009)	(0.011)
Log total imports of partner country			-0.013	-0.007
			(0.017)	(0.021)
Obs.	31293	31293	31293	25306
adj.-R^2	0.96	0.96	0.96	0.96
F-Test	218.876	214.969	209.477	239.897

Notes: Robust standard errors clustered at the identifier level in parentheses;* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; FE estimator regressions in all columns with country-industry-specific effects; country-specific time trends; the GDP per capita and the aggregated GDP per capita of the trade partner both in log of constant international US dollars and time dummies. Columns 1 to 3 refers to the full OECD sample. Column 4 makes use of the restricted EU sample. The log import variables, both for country and partner are at industry level and aggregated across products and trade partners.

restricted EU sample is used. Column 1 reports the separate effect of WEC on an industry's output. The estimated coefficient is statistically significant and indicates that an increase in the WEC of 1 percentage point results in a decline in the industry's output of -1.68%. The size of the coefficient is reduced when the WIC measure is included in the regression (column 2), but still remains at -1.439. Column 3 reports the value of the point estimates when the trade volume control variables are included in the regression. The values of the coefficients of export and import competition converge somewhat, but remain quite stable and significant.

In all the setups, the point estimates of WEC are substantially larger than the ones for WIC. The WEC coefficient of -1.357 translates into a decline in the industry output of 21% when moving from the lowest to the highest quintile. Hence, a strong increase in China's competitiveness implies a severe distortion of the output in the affected industries. The magnitude of the WEC coefficient also indicates that the elasticity of the total output

with respect to WEC is higher than elasticity of the export volume.[22] This is in line with the predictions of our theoretical model.

The significant coefficient of WIC is compatible with our theoretical model. The increased competition in the home market leads to a decline in sales which is accompanied by a decrease in average productivity. Even though the magnitude of the coefficient of WIC (-0.713) is smaller than for the WEC, the implied economic impact is non-negligible. Moving from the lowest to the highest quintile in WIC results in a decline of output of -9.8%.

Looking at column 4, we can see that the effects of the export and the import competition measure are stronger when reducing the sample to the EU countries, despite the restricted dataset exhibiting a slightly lower exposure to import competition.[23]

We conclude that the increasing relative share of Chinese exports has a harmful effect on the production volume of manufacturing industries in OECD (EU) countries, both via the export as well as the domestic market. According to our point estimates, the indirect effect is dominating, stressing the importance of the export market. Within the framework of our theoretical model, this implies that average productivity of the firms and the size of the labor force in the respective industry are more sensitive to shocks in the export markets than to changes in the home market. The considerable distortion in the output volumes suggests that structural variables within the industries faced with increased Chinese competition will also be influenced. We investigate the existence of such effects in the next section.

5.4 Chinese Competition and EU Industry Aggregates

From the theoretical model presented in Section 3 we expect the following changes in structural variables for industries faced with increased Chinese competition in the export market: The wage rate declines as the export sector contracts. This induces workers to leave the industry and additionally allows less productive firms to enter the (domestic) market, thereby lowering average productivity within a given industry. This in turn results in a decrease in average firm size. A straightforward prediction regarding the effect on the number of active firms is not possible because of two counteracting effects: reduced productivity and diminished labor supply. The first is associated with an increase, the

[22] Cf. Section 5.2

[23] On average, EU countries have a lower exposure with respect to import competition, but a more pronounced exposure to WEC.

Table 3: Chinese Competition and the Structure of Manufacturing Industries

Dependent variable:	Log compensation per employee (1)	Log employment (2)	Average labor productivity (3)	Log employees per firm (4)	Log number of enterprises (5)
L. Weighted export competition	-0.295***	-1.969***	-69.328***	-1.228***	-0.782***
	(0.103)	(0.262)	(17.035)	(0.271)	(0.217)
L. Weighted import competition	0.011	0.035	43.668**	-0.490**	0.551***
	(0.117)	(0.237)	(18.579)	(0.220)	(0.193)
L. Log imports from China of home country	0.008**	0.023***	-4.562**	0.001	0.015*
	(0.003)	(0.007)	(2.050)	(0.008)	(0.008)
L. Log total imports of home country	0.023***	0.075***	2.988	0.016	0.045***
	(0.008)	(0.015)	(2.041)	(0.018)	(0.017)
L. Log imports from China of partner country	-0.030***	0.079***	9.924**	0.006	0.083***
	(0.007)	(0.015)	(4.973)	(0.018)	(0.018)
L. Log total imports of partner country	-0.006	-0.037**	-0.799	-0.023	-0.012
	(0.009)	(0.017)	(2.618)	(0.021)	(0.019)
Obs.	4053	4130	3344	4130	4361
adj.-R^2	0.99	0.99	0.87	0.96	0.99
F-Test	775.788	27.110	17.546	41.556	56.762

Notes: Robust standard errors clustered at the identifier level in parentheses;* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$;FE estimator regressions in all columns with country-industry-specific effects; country-specific time trends; the GDP per capita and the aggregated GDP per capita of the trade partner both in constant international US dollars and log and time dummies. The log import variables, both for country and partner, are at industry level and aggregated across products and trade partners (if necessary) according to the Eurostat classification. All LHS variables are on annual basis. The lagged value is indicated by L..

latter with a decrease in the number of enterprises. Given the strong impact of export competition on an industry's total output, however, it is to be expected that the number of firms will decline.

Due to the availability of data, the subsequent empirical analysis is restricted to the EU countries within the OECD. The EU data on the characteristics of industries are categorized into broader classes compared to the UN classification (see Section 4). Nevertheless, the data-aggregation process is analogous to the one described in Section 5.3. The regression model is equivalent to Eq.(5). However, in this section we will be using industry structure measures as dependent variables. Because we assume that changes in the composition of trade materialize with a time lag subsequent to changes in an industry's structure, we use the first lag of the explanatory variables.[24]

Table 3 presents regression results. Lagged WEC enters significantly in all regressions.

[24]In the previous sections, we have assumed that import and export competition directly (contemporaneously) affect the dependent variables. Using lagged values on the explanatory does not qualitative change the results of the regression models Eqs.(2) and (5).

Also, the results regarding the WEC coefficient are robust with respect to the exclusion of the WIC variable and the control variables for absolute trade volumes in all setups.

Column 1 shows the negative impact of WEC on the average annual compensation per employee.[25] The coefficient implies a -0.30% decline as a consequence of a 1 percentage point increase in WEC. Compared to the WEC coefficient of -1.969 in column 2, where we use the log of the industry-specific employment as the dependent variable, the wage effect is small. In terms of our theoretical model this finding can be explained with the elastic labor supply, which dampens the wage effect through labor force adjustments. When moving from the lowest to the highest quintile in WEC, the wage rate decreases by -2.6% whereas an industry's employment decreases by 17.4%. Looking at the beta coefficients (not reported here) shows that the standard deviation specific effect of WEC is two times higher than the GDP per capita effect.

Regarding the labor productivity measured in thousand euros per person employed, a 1 percent point increase in WEC yields a reduction in the apparent labor productivity of roughly 0.7 thousand euros.[26] This translates into a decrease in productivity of about 6.1 thousand euros when moving from the lowest to the highest quintile in WEC. According to our theoretical model, the decrease in productivity is associated with a decline in the average firm size. Indeed, as shown in column 4, we find that the average number of employees per firm decreases by -1.22% when WEC increases by 1 percentage point.[27]

In column 5, WEC enters significantly and negatively. An increase in Chinese export competition of 1 percentage point leads to a reduction in the number of firms within an individual industry of -0.78%.[28] Arguing within the framework of our theoretical model, this indicates that labor elasticity with respect to export competition is high enough to

[25] Compensation is defined as the wage rate plus the employers' social security contributions. Using the (net) wage rate as dependent variable yields very similar results.

[26] Since labor productivity and its log transformation are only correlated with 0.26 across the sample and 0.03 within the fixed effects groups, we do not use the transformation here. Additionally, using the log transformation of the labor productivity results in a non-linear relationship with WEC. The results in this case are qualitatively similar when augmenting the regression model by a non-linear effect.

[27] Additionally, the theoretical prediction of decreasing profits can also be verified empirically. In regressions not reported here, we find that a 1 percentage point increase in WEC is associated with a -2.43% decline in gross operating surplus.

[28] For the illustration of the economic magnitude of the effects presented in Table 3, we take the mean of the dependent variables from Table C.3 to calculate: average reduction of $-0.269\,{}^{\exp^{2.96}}/_{100} = -0.05$ thousand euros in the annual wage rate, average decrease of $-1.958\,{}^{\exp^{0.04}}/_{100} = -0.02$ percentage points in the employment within the industries, average reduction of $-1.228\,{}^{\exp^{3.13}}/_{100} = -0.28$ thousand workers per firm, average decline in the number of active firms of $-0.782\,{}^{\exp^{7.22}}/_{100} = -10.69$ associated with a 1 percentage point increase in WEC.

offset the change in the cut-off productivity for firm entry. Thus, even though a lower cut-off productivity allows low-productivity firms to enter the market, the dominating labor force contraction leads to a decline in the number of firms in the individual industries. This implies that the demand elasticity with respect to Chinese export competition is more sensitive than the wage elasticity, indicating that the demand for a given domestic firm's variety declines faster than its labor costs.

Compared to the results for the WEC, the estimates for the WIC coefficient do not accord quite as well with our theoretical predictions. We find no significant effect of WIC on the industry wage rate or on the industry employment. Based on our theoretical model, these results imply that WIC should not influence any variables at more aggregate levels, since all the effects in the model affecting the economy as a whole stem from changes in the wage rate induced by a reallocation of labor. Staying at the industry level, we find that WIC has explanatory power with respect to changes in labor productivity, average firm size and the number of active enterprises. As column 3 shows, a 1 percentage increase in WIC is associated with an increase in labor productivity of about 0.44 thousand euros per worker. This implies, that the productivity increases by 3.8 thousand euros when moving from the lowest to the highest quintile in WIC. The sign of the coefficient contradicts the theoretical predictions. However, the result is not robust to the exclusion of the export competition variable and therefore makes an interpretation of the WIC effect difficult. Again in line with our expectations is the result in column 4. Increasing import competition by 1 percentage point diminishes the average firm size by -0.49%. Finally, in column 5 we find that the number of active firms is positively associated with WIC, standing in contrast to the results for the export competition measure. This result is once again not robust to the exclusion of the WEC variable.

Summing up, the results presented in this section indicate that Chinese competition in the export market is an important factor in explaining structural changes within manufacturing industries in the EU countries. Import competition on the contrary only plays a secondary role. Given the relatively small fraction of people employed in the manufacturing sector[29] it will be interesting to investigate whether the strong effects found at the industry level affect the (regional) economies as a whole.

[29] In the EU approximately 21% of the employees work in manufacturing (Eurostat Database).

5.5 Chinese Competition and Socioeconomic Changes at the Regional Level

Up to now, our analysis of the effects resulting from increased Chinese competition has been restricted to the manufacturing sector. In this section we investigate whether the distortions within this sector result in observable effects at a regional level detached from any industrial classifications. More specifically, we investigate whether a reallocation of labor takes place from the manufacturing to the service sector and whether average wages in these two sectors are affected. Also, we analyze whether aggregate employment figures, income and migration behavior are influenced by Chinese competition. The data used as dependent variables are collected at regional (NUTS[30]) level and consequently do not allow for differentiation among industries. Instead of within-industry variation, we will now exploit within-NUTS variation. This allows us to control for country and NUTS-specific effects as well as for country-specific time trends. Hence, we are able to determine systematic effects that are independent of country-specific features.

In order to use the trade data together with the variables reported at the NUTS level, we have to construct regional-specific measures for the impact of trade activity. Information on the relative importance of a given industry within a NUTS region allows us to weight the trade data accordingly. The weighting procedure employed is illustrated for the export competition measure. Analogy applies to the construction of the import competition measure.

$$WEC_{i,z} = \sum_{g=1}^{G} WEC_{i,g} \frac{Emp_{i,z,g}}{Emp_{i,z}} \quad \forall\ z \in i, \quad \text{with} \quad \begin{array}{c} \text{country: } i = 1,..,I \\ \text{NUTS: } z = 1,..,Z \\ \text{industry: } g = 1,..,G. \end{array} \tag{6}$$

$WEC_{i,g}$ is the country-industry-specific weighted export competition measure from Eq.(3), $z = 1,..,Z$ are the regions according to the Eurostat classification, $Emp_{i,z}$ is the total labor in manufacturing of the NUTS region and $Emp_{i,z,g}/Emp_{i,z}$ represents the NUTS-specific employment share of industry g.[31] Hence, we weight the country-specific variable $WEC_{i,z}$

[30] More precisely, we conduct our analysis at the NUTS 2 level. For notational ease, we drop the numeric term. The regional NUTS classification is discussed in more detail in Section 4.

[31] Again it might help to picture the weighting in terms of a discrete sample space, where each industry carries a probability (the labor share). Thus, the weighted export competition (WEC) is similar to an expected value. Since we have information on total manufacturing labor, we can assign to each industry its weight within the sample space. Then, it does not matter if some industries have missing data. In this

with the employment share of a given NUTS region under the constraint that $z \in i$. By weighting all trade variables in such a manner, we transform trade-related data at the country level to the NUTS level. The variation in the data now stems from the assumption that trade activity within a given industry is more relevant to NUTS regions with a high employment share in the affected industry.

Since we use within-NUTS variation, the size of the NUTS region relative to the country does not matter. Only the manufacturing employment structure, that is the employment share of a given industry within the NUTS region, is relevant. The relative effect is therefore the same across differently sized NUTS regions, as long as the employment structure is similar.

The testable predictions derived from our theoretical model are the following: As a consequence of the increased Chinese export competition we expect the wage rate in the (low-skilled) manufacturing sector to decline and therefore labor to reallocate towards the service sector. The higher labor supply in service is associated with a decrease in the service wage rate. The average household income is also expected to fall. Bearing in mind that we have defined the high-tech as well as the manufacturing sector as pertaining to the secondary sector, we cannot - in contrast to the service sector - derive a clear-cut prediction about the effect on the wage rate. The direction of the competition effect depends on relative size of the labor supply elasticity and the wage rate elasticity of the manufacturing sector with respect to Chinese competition. Given the moderate wage effect found in Section 5.4 and keeping in mind the sticky European wage rates, we surmise that the labor supply elasticity will be dominating. Therefore, we do not expect a negative association between the overall industrial wage rate and increased export competition. Because we did not find a significant effect of WIC in Section 5.4 neither on the industry-specific wage rate nor on the industry labor allocation, we do not expect any effect of WIC at the regional level. In the model, changes affecting the economy as a whole are driven by alterations in wage rate consequently resulting in labor reallocation.

To asses the effects of Chinese competition observable at the regional level, we estimate the following regression equation:

$$y_{i,z,t} = \beta_0 + \beta_1 WEC_{i,z,t} + \beta_2 WIC_{i,z,t} + \beta' \mathbf{X}_{i,z,t} + v_{i,z,t}, \tag{7}$$

where $y_{i,z,t}$ are the different dependent variables. The error term $v_{i,g,t}$ has a similar structure

case we set the weight to zero without affecting the other industry weights.

Table 4: Chinese Competition and Regional Labor Market effects

Dependent variable:	Industrial labor share	Service labor share	Log industrial compensation per employee	Log service compensation per employee
	(1)	(2)	(3)	(4)
L. Weighted export competition	-0.318***	0.456***	-0.473	-0.129
	(0.071)	(0.103)	(0.533)	(0.282)
L. Weighted import competition	-0.011	0.026	0.270	0.394
	(0.062)	(0.086)	(0.469)	(0.271)
Obs.	1946	1946	1946	1946
adj.R^2	0.99	0.99	0.99	1.00
F-Test	99.725	119.876	458.642	859.106

Notes: Weighting is according to Eq.(6). The individual dimension is the NUTS level. Robust standard errors clustered at the identifier level in parentheses;* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; FE estimator regressions in all columns with NUTS-level-specific effects; country-specific time trends; the GDP per capita on country and NUTS level and the aggregated weighted GDP per capita of the trade partner all in constant international US dollars and log; the weighted imports from China and world imports aggregated over products and the weighted imports from China and world imports of the partners aggregated over products and partners (all in log); log population at the NUTS level and time dummies. The lagged value is indicated by L..

as in Eq.(2), except now the individual dimension is the NUTS level and therefore includes NUTS-specific fixed effects. The control variables again include country-specific time trends and time dummies.

The results in Table 4 show a significant labor-reallocation effect from the industrial to the service sector as a consequence of stronger export competition. A look at the magnitude of the coefficient reveals that the economic effect is substantial. Increasing WEC by 1 percentage point induces a decline in the share of persons employed in the industry sector of -0.32 percentage points. This translates into a decrease of -1.12 percentage points when moving from the lowest to the highest quintile in WEC.[32] The same shift in WEC induces a rise in the share of people employed in the service sector of 1.15 percentage points. The results presented above are robust to the exclusion of the WIC. Thus, as the Chinese competition in the manufacturing export market increases, the NUTS regions experience a remarkable change in the employment structure. This result therefore can be interpreted as an additional source of explanation for the increasing importance of the service sector. In contrast to previous findings (e.g. Autor and Dorn (2012)) we find that competition from a low-wage country like China has a considerable effect on the labor allocation. Within the framework of our theoretical model this result can be interpreted

[32]The difference in WEC between the 2 quintiles is 3.52 percentage points.

as the a low-skilled labor being pushed from the better paid manufacturing sector into the low-wage service sector as a consequence of increased export competition.

Turning to the analysis of wage effects, we first look at the development of the compensation rates in the industrial and service sector when exposed to Chinese competition. Column 3 shows no significant effect of the WEC on the industry wage rate. This result is robust to the exclusion of WIC. Hence, the industry-specific effect in Table 3 does not carry over to the aggregated data. The interpretation along the lines of our theory is that low-skilled labor elasticity exceeds low-skilled wage elasticity with respect to Chinese competition. As more low-skilled labor leaves manufacturing, the sector becomes relatively more high-skilled labor intensive, offsetting the decline in the industry-specific low-skilled wage rate. The statistically insignificant coefficient in column 3 is therefore compatible with the decrease in the (low-skilled) manufacturing wage rate found in the previous section as long as low-skilled and high-skilled industries are distinct.

In the case of the compensation rate in the service sector, we find no evidence of an effect of WEC. This is not consistent with our theoretical model. A possible explanation is that productivity systematically differs between workers from the two sectors (Acemoglu and Autor, 2011). It might be that workers shifting from the industrial to the service sector are more productive than the average service sector worker, but together with the labor supply increase, the effects cancel each other.

In line with our theoretical predictions, no significant relationship of the WIC variable with any dependent parameter listed in Table 4 can be established.

Table 5 provides evidence for the impact of increased import and export competition on the income and population composition at NUTS level. Again, the all results are regarding WEC are robust to the exclusion of WIC. Our theoretical model allows us to interpret the behavior of household income with respect to export competition. However, it cannot be used to derive qualitative predictions about unemployment or population dynamics.

Column 1 reveals a substantial leverage effect of WEC on real household (HH) GDP per capita, indicating that the average household member experiences a drop in income due to Chinese export competition. The coefficient of -1.914 translates into decline in real HH-GDP per capita of -6.73% when moving from the lowest to the highest quintile in WEC.[33] According to the theoretical model, this is a results of the workers shifting from the better

[33]For the economic magnitude we calculate: average reduction of $-1.914\, e^{9.5}/100 = -256$ euros in purchasing power standards based on final consumption per inhabitant due to an increase in WEC of 1 percentage points.

paid industrial jobs to the low-wage service sector. This leads to a higher proportion of the population being employed in the service sector and a drop in average household income.[34] Additionally, as can be seen from column 2, an increase in WEC of 1 percentage point triggers a drop in the employment rate of -0.29 percentage points which further depresses average per capita income. Thus, there exists a second labor market mechanism which lies outside the scope of our theoretical model. Apart from entering the service sector, workers who have left manufacturing may also drop out of employment altogether. With the data available, we cannot not asses the relative importance of these two mechanisms.[35] The observed unemployment effect could be the caused by labor market frictions, such as the industry workers not meeting job requirements of the service sector, and hence not being able to switch to this sector. It might also be the result of the reservation wage being breached for some workers.

Regarding the effect of WIC, we see that the coefficient is statistically significant in column 1, contradicting the model predictions. However, excluding the WEC from the regression model renders the coefficient of WIC insignificant. An interpretation therefore is again difficult. In column 2-4 the coefficient is not statistically significant.

The last column of Table 5 is concerned with the population dynamics at the NUTS level. Our model does not allow us to derive any predictions regarding this dimension. However, we expect that the decline in the industry sector, accompanied by the drop in real GDP per capita together with a worsening outlook for the labor market would motivate emigration. Indeed, column 3 shows a positive and significant impact of Chinese export competition on the log of outward migration. The coefficient of 3.209 implies an emigration of 3.2% when the WEC increases by 1 percentage point. Such a strong effect helps to explain the withering of regions with a dominating industrial sector that now faces fierce competition in the export market.

6 Conclusion

The emergence of China as a dominating producer of manufacturing goods raises questions about the consequences for the industrialized world. Contrary to the existing literature

[34] As a consequence the functional form of the model also suggest that the wage rate in service drops which we do not observe in the data.

[35] Because the labor supply remains elastic,the existence of second mechanism does not influence the theoretical predictions regarding the manufacturing sector (exports, output and industry structure).

Table 5: Chinese Competition and Regional Socioeconomic Effects

Dependent Variable:	Log HH-income per capita (PPP) (1)	Employment rate (2)	Log outwards migration (3)
L. Weighted export competition	-1.914***	-0.291***	3.209***
	(0.377)	(0.102)	(0.948)
L. Weighted import competition	0.639**	-0.042	0.062
	(0.290)	(0.086)	(0.651)
Obs.	2013	2011	684
adj.R^2	0.99	0.98	0.99
F-Test	1526.279	210.314	39.917

Notes: Weighting is according to Eq.(6). The individual dimension is the NUTS level. Robust standard errors clustered at the identifier level in parentheses;* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; FE estimator regressions in all columns with NUTS-level-specific effects; country-specific time trends; the GDP per capita on country and NUTS level (except in column 1) and the aggregated weighted GDP per capita of the trade partner all in constant international US dollars and log; the weighted imports from China and world imports aggregated over products and the weighted imports from China and world imports of the partners aggregated over products and partners (all in log); log population at the NUTS level (except in column 3) and time dummies. The lagged value is indicated by L..

this study focuses on the analysis of transition costs stemming from changes in the export market. Using panel data covering several countries at multiple levels of aggregation, we are able to produce a comprehensive picture of the effects of Chinese export competition. The construction of an export as well as an import competition measure allows for the separation of the two channels through which trade with China can affect a (home) country. By including fixed effects variables and country-specific time trends in all regressions, we hope to identify effects that are generally valid. Our empirical analysis is guided by a simple extension of the Melitz-framework which allows us to interpret our results in a theoretical context.

At the most disaggregated level available, the product level, we find a substantial effect of increased export competition on the export volume of the OECD countries. The effect found on the industry level is even stronger. There, the industry-specific output declines by -20% when moving from the lowest to the highest quintile in our export competition measure. Within the framework of the theoretical model, these strong effects can be interpreted as the disintegration of the more productive export sector. The average productivity therefore drops along with the wage rate in the manufacturing industries. This in turn results in a reallocation of labor. Based on the model, we therefore expect Chinese export competition to affect structural variables within the manufacturing industries. Our empirical analysis indeed supports these qualitative predictions of the model. We find that

an increase in Chinese export competition not only induces a decline in the average firm size, but also leads to a drop in productivity as well as in the industry-specific wage rate.

Moving to the more aggregate regional level, the data analysis shows that regions within the EU that are exposed to increased Chinese export competition experience a substantial decline in average household income and are confronted with considerable deindustrialization. This in turn forces more labor into the service sector. The mechanics in our theoretical model explaining these findings are the following: The wage rate in the manufacturing sector declines and thereby induces reallocation of labor to the service sector. This in turn causes the service wage rate to decline. These reinforcing effects lead to an overall decrease in household income. The results regarding inter-sectoral labor reallocation in connection with increased Chinese competition provide an additional explanation for the continuously increasing share of people employed in the service sector.

Additional insights - outside the scope of the theoretical model - are revealed by the data. We find that regions facing an intensified Chinese export competition experience a drop in the employment rate and a surge in outwards migration.

Regarding the effects of direct Chinese import competition, we find mixed results. The effects found are not always statistically significant and sometimes contradicting our theoretical predictions. However, in all the regression settings the coefficient of the measure for Chinese import competition is substantially smaller than the coefficient for export competition. Also, the latter explains a higher share within the variation.

Overall, our paper demonstrates two things: First, it stresses the importance of the export sector in explaining structural changes within and across industries. Second, it shows that the developed countries are affected in various ways by the emergence of China as a dominant player on the global market for manufactured goods and are forced to adapt their production portfolios. Some of the costs associated with this transition process are analyzed in this study. However, implications for total welfare can not be derived. This constitutes an interesting aspect for future research.

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Appendices

A The Theoretical Model

In this section, we present a simple extension of the Melitz Model (Melitz, 2003) and its generalization in Arkolakis et al. (2008) presented in Redding (2010). The model embeds our empirical analysis in the theoretical trade literature and provides us with qualitative predictions regarding the implications of increased Chinese (export) competition for the OECD economies. More precisely, we are interested in analyzing how the increased competition affects the export volume and the total output of the manufacturing sector and how these changes influence structural variables within and across sectors. We therefore have to equip the model with a sufficiently sophisticated structure to achieve these goals.

The model is specifically designed to analyze the impact of China - a country standing apart from the rest of the world due to its sheer size[36] and its state-regulated[37] economy - on the developed countries. It therefore by no means claims generality.

A.1 Setup

There are two representative OECD countries[38]: Home and Foreign denoted with the subscripts H and F, respectively.[39] These countries exhibit similar consumption and production patterns but may differ in size and prevailing wage rates. On the production side, the OECD economies consist of:

- a Walrasian service sector producing a non-tradable homogeneous good,
- a manufacturing sector, producing a single differentiable and tradable good according to the Melitz type definitions (heterogeneous firm productivities),
- a Walrasian high-tech sector producing a tradable homogeneous good.

Both the manufacturing and the high-tech good are assumed to belong class of industrial products.

[36] With the exception of India.
[37] Including its export oriented policies.
[38] Extending the model to multiple countries is easily done. However, no additional insight is gained.
[39] The terms 'Foreign' and 'Trade Partner' are used interchangeably.

On the labor market, we find a pool of low-skilled workers with mass $\bar{L}$ and a pool of high-skilled workers with mass L^T. The tasks in the high-tech sector require high-skilled labor. Since we assume that the high-tech sector pays the highest wages and do not allow an upgrade from low-skilled to high-skilled, the high-tech sector is closed and employs all high-skilled workers.

Tasks in the service sector can be performed by all low-skilled workers, whereas the entry into the manufacturing sector is associated with a fixed cost to qualify (upgrade) for the tasks of the manufacturing sector. The low-skilled workers are heterogeneous in terms of this fixed cost.[40] By assuming that the upgrade cost is positive, we find that wages in manufacturing are higher than in service. As a result, a shift in labor between the service and the manufacturing sector is observed at the margin of the cut-off fixed cost, as the relative wage rate between the sectors changes.

The OECD countries consume services and the varieties of the manufacturing good while exporting the manufacturing varieties to each other. However, for reasons of simplicity and tractability, they fo not consume the high-tech good.[41]

Since we are interested in analyzing the effects within the OECD countries, we endow China solely with a manufacturing sector which exports varieties of the manufacturing good to the OECD countries. Therefore, China creates competition in these markets, but does *not* import the manufacturing good from either Home or Foreign.[42] On the other hand, China imports the high-tech good from both of the OECD countries. The one-way trade of the high-tech good allows for a positive trade balance, implying that the OECD countries pay their imports of the manufacturing good from China with high-tech products. Through these assumptions we fix Chinese exports to the Chinese high-tech imports, thus making the competition from China in the manufacturing sector exogenous. It follows that Chinese manufacturing characteristics are exogenous with respect to those in Home and Foreign. Considering the sustainably low level of Chinese wages (Ceglowski and Golub, 2011) and the export volume that is influenced by state interventions[43] the assumption of exogeneity is quite realistic.

[40] The fixed costs capture, for example, the notion of some learning ability.

[41] An economic argument for this simplification is that the high-tech product sold to China has to be adapted to the Chinese market in such a way that it is not possible to sell it domestically. In this case, we could allow for the consumption of a domestic high-tech product and a Chinese market high-tech product without affecting the model results or the tractability.

[42] This strong assumption is plausible in the light of the (still) heavily protected Chinese consumer market.

[43] E.g., the exchange rate regime.

The simplifications described above allow us to obtain an analytical solution as well as to break the symmetry imposed by the trade balance condition in the case of a single good. Subsequently, we focus on the description and analysis of the home country.

A.2 Demand

Consumers in the OECD countries derive utility according to an upper tier logarithmic function and a CES sub-utility function over the manufacturing varieties j in the set Ω:

$$U_i = \beta\, ln(S_i) + \alpha\, ln(M_i) \;\text{ where }\; \left(M_i = \int_\Omega q(j)_i^{\frac{\sigma-1}{\sigma}} dj\right)^{\frac{\sigma}{\sigma-1}} \;\text{ and } i = H, F \tag{8}$$

where S and M are the measures for the service good and the manufacturing good consumption, respectively; $q(j)_i$ is the quantity consumed of variety j; $\sigma > 1$ is the elasticity of substitution and $\alpha + \beta = 1$ are the expenditure shares. Total income is given by: $Y_i = L_i^S\, r_i + L_i^M\, w_i + L_i^T\, h_i$, where $r_i < w_i < h_i$ are the wage rates and L^S, L^M, L^T are the labor masses in service, manufacturing and high-tech in country i respectively. The expenditure structure is given by Eq. (9), where for notational ease, the country index is dropped.

$$E(S) = Y\, \frac{\beta}{\alpha+\beta} = Y\, \beta,\; E(M) = Y\, \frac{\alpha}{\alpha+\beta} = Y\, \alpha,\; \text{with } q(j) = E(M)\, \left(\frac{p(j)}{P}\right)^{-\sigma}, \tag{9}$$

with $E(S)$ and $E(M) = M \times P$ are the expenditure for the service and the manufacturing good, respectively; P is the price index for the manufacturing good; and $q(j)$ is the demand for a representative variety in the manufacturing sector.

For the high-tech sector, we assume that each OECD country produces a single distinct good which is exclusively sold to China. Hence, the entire high-tech good output is exported to China. Further, we assume that the high-skilled labor force in Home and Foreign is of equal size. $L_C\; w_C\; \gamma_H$ is the Chinese expenditure share for the high-tech good of Home, where we assume $\gamma = \gamma_H = \gamma_F$. Thus, we can treat the wage rate in the high-tech sector, both in Home and Foreign, as numeraire and set $h = 1$. $L_C\; w_C\; \gamma$ also fixes the trade balance between Home (Foreign) and China. This implies that the manufacturing export volume of China is independent of the market mechanisms in the manufacturing sector of Home and Foreign.

A.3 Low-skilled Labor Allocation

Low-skilled workers of aggregate mass $\bar{L} = L^S + L^M$, select themselves into the service sector, earning wage rate r, or the manufacturing receiving wage w. While entry into the service sector comes at no cost, entering into the manufacturing sector is costly. Each low-skilled worker is associated with a unique fixed cost $\frac{a}{\theta}$ which depends on a latent ability θ, uniformly distributed across $[0, u]$. This implies an elastic labor supply for the service and the manufacturing sector, which is governed by the cut-off fixed cost $\bar{\theta} = \frac{a}{w-r}$. The labor supply in the two sectors is given by:

$$L^S = \min\{\bar{L}, \frac{A\bar{L}}{w-r}\} \text{ and } L^M = \max\{\bar{L} - \frac{A\bar{L}}{w-r}, 0\} \text{ with } \bar{L} = L^S + L^M,\ A = \frac{a}{u} \tag{10}$$

where we restrict the analysis to interior solutions. Due to the static nature of our model and because each worker perceives the wage rates as given, in equilibrium there is no incentive for any worker to change from service to manufacturing or vice versa. Eq. (10) also implies that $w > r + A$. Otherwise, no worker will pay the fixed costs. Hence, production in manufacturing requires at least a wage premium A in order to attract the worker with the lowest upgrade costs, i.e. the most suited worker for manufacturing. As the manufacturing labor force expands, the wage premium has to increase along the upgrade-cost distribution of the low-skilled labor force.

A.4 Production in the Service Sector

The service sector employs low-skilled service labor L^S and produces a homogeneous good with technology $y^S = p^S\, q^S - q^S\, r$ where q^S is the quantity produced and p^S is the selling price. The CRS-technology implies $p^S = r$. Using the demand for services from Eq. (9), the country GDP and the wage rate in the service sector can be written as:

$$\begin{aligned} Y =& (-A\,\bar{L} + L^T + \bar{L}\,w) \\ r =& \frac{A\,\bar{L}\,w}{A\,(\beta-1)\bar{L} - \beta(L^T + \bar{L}\,w)} + w \end{aligned} \tag{11}$$

A.5 Production in the Manufacturing Sector

The fundamental part of the model is the manufacturing sector. All the effects analyzed will stem from Chinese competition within this sector at home and abroad. We assume that the OECD countries are symmetric, but allow for differences in low-skilled labor force

and wage rates w and r.[44]

Technology in the manufacturing sector is the same for each country. We assume that each firms draws its labor productivity ϕ from a Pareto distribution with parameter $k > \sigma - 1$ and support $[1, \infty)$ paying a sunk fixed cost f_e. Production requires the investment of fixed cost f. In case the firms decide to export, they incur an additional fixed export market entry cost f_X, which is due in the foreign country. We further assume that trade is costly and exhibits iceberg transport costs $\tau > 1$ which are symmetric between Home and Foreign. Given the cost function of an exporting firm in the home country $c_H^X(q) = \frac{w_H \tau}{\phi} q + f_X$ and the demand in Eq. (9) the equilibrium pricing, output and profit conditions yield:

$$\begin{aligned} p_H(\phi) &= \frac{w_H}{\rho\,\phi},\ p_H^X(\phi) = \frac{\tau\, w_H}{\rho\,\phi} \\ q_H(\phi) &= E(M)_H\, P_H^{\sigma-1} \left(\frac{w_H}{\rho\,\phi}\right)^{-\sigma},\ q_H^X(\phi) = R_F\, P_F^{\sigma-1} \tau \left(\frac{w_H\,\tau}{\rho\,\phi}\right)^{-\sigma} \\ \mu_H(\phi) &= \frac{r_H(\phi)}{\sigma} - f\, w_H,\ \mu_H^X(\phi) = \frac{r_H^X(\phi)}{\sigma} - f_X\, w_F \end{aligned} \tag{12}$$

where superscript X denotes the export case: $\mu_H(\phi)$ and $r_H(\phi)$ are the profits and revenues, respectively; P_H and $E(M)_H$ are the price index in Home and the expenditure of Home on the manufacturing good respectively; and $\rho = \frac{\sigma}{\sigma-1}$ is the mark-up. The profit functions together with the demand in Eq. (9) yield the following cut-off productivities:[45]

$$\begin{aligned} \left(\bar{\phi}_H\right)^{\sigma-1} &= \frac{f\,\sigma\, P_H^{1-\sigma}\, \rho^{1-\sigma}\, w_H^{\sigma}}{\alpha\left(-A\,\bar{L}_H + L_H^T + \bar{L}_H\, w_H\right)} \\ \left(\bar{\phi}_H^X\right)^{\sigma-1} &= \frac{f_X\,\sigma\, w_F\, P_F^{1-\sigma}\, \rho^{1-\sigma}\, \tau^{\sigma-1}\, w_H^{\sigma-1}}{\alpha\left(-A\,\bar{L}_F + L_F^T + \bar{L}_F\, w_F\right)} \\ \left(\bar{\phi}_{CH}^X\right)^{\sigma-1} &= \frac{f_X\, \tau_{CH}^{\sigma-1} \left(\bar{\phi}_H\right)^{\sigma-1} w_C^{\sigma-1} w_H^{1-\sigma}}{f} \end{aligned} \tag{13}$$

where $\left(\bar{\phi}_{CH}^X\right)$ is the cut-off productivity of Chinese firms exporting to Home. τ_{CH} are the iceberg costs for exporting from China C to Home H. Thus, firms with productivity $\phi < \bar{\phi}_H$ will not start production at all, whereas firms with productivity $\bar{\phi}_H < \phi < \bar{\phi}_H^X$ serve only the domestic market, but do not export to Foreign. We assume $\bar{\phi}_H^X > \bar{\phi}_H$ from here on. By symmetry, the above conditions are analogous for the foreign country. Next, the free entry condition $\bar{\mu}\left(\bar{\phi}_H\right)^{-k} = f_e\, w_H$, with $\bar{\mu}$ denoting average profits, can be written as

$$f_e\, \left(\bar{\phi}_H\right)^k - \frac{f(\sigma-1)}{k-\sigma+1} = \frac{f_X(\sigma-1) w_F \left(\bar{\phi}_H\right)^k \left(\bar{\phi}_H^X\right)^{-k}}{w_H(k-\sigma+1)}. \tag{14}$$

The price index of the manufacturing good, where N_i are the number of active firms, is

[44] We do not solve for the endogenous Chinese variables here. Given the setup of the model this could be easily done. Because these variables are uncoupled from factors in the manufacturing sector of Home and Foreign, they do not influence the results, however.

[45] Setting $\mu(\bar{\phi}) = 0$.

defined as:

$$P_H^{1-\sigma} = \frac{k\ \rho^{\sigma-1}}{k-\sigma+1} \sum_{i,j} N_i \left(\frac{\bar{\phi}_i}{\bar{\phi}_j^X}\right)^k \left(\frac{\tau_{ij} w_i}{\bar{\phi}_j^X}\right)^{1-\sigma} \quad \text{where } i,j = H,F,C \tag{15}$$

Using the cut-off conditions, the price index and the free-entry condition, the manufacturing labor market clearing, yields the following expression:

$$N_H = \frac{\rho\left(\bar{\phi}_H\right)^{-k}}{f_e\ k\ w_H}\left(E(M)_H - \frac{L^T\ k}{(k+1)\rho}\right) = \frac{\rho\left(\bar{\phi}_H\right)^{-k}}{f_e\ k\ w_H}\left(\alpha\ \bar{L}_H(w_H - A) + L^T\left(\alpha - \frac{k}{(k+1)\rho}\right)\right). \tag{16}$$

Under the assumptions that China does not import the manufacturing good and that the high-tech goods of Home and Foreign are distinct, and additionally having fixed the Chinese demand for the high-tech good as a share of Chinese income, we can write the trade balance between China and Home as:

$$L_C\ w_C\ \gamma = L^T = N_C\left(\bar{\phi}_C\right)^k\left(\bar{\phi}_{CH}^X\right)^{-k}\int_{\bar{\phi}_{CH}^X} k\ E(M)_H\ \phi^{-k-1}\left(\bar{\phi}_{CH}^X\right)^k P_H^{\sigma-1}\left(\frac{\tau_{CH}\ w_C}{\rho\ \phi}\right)^{1-\sigma} \mathrm{d}\phi. \tag{17}$$

Next, we define our measures for Chinese competition in the domestic and the export market in terms of the shares of total consumption of Chinese products in Home and Foreign:

$$vc_i = \frac{X_{Ci}}{\alpha\ \left(-A\ \bar{L}_i + L_i^T + \bar{L}_i\ w_i\right)} = \frac{L_C\ w_C\ \gamma}{\alpha\ \left(-A\ \bar{L}_i + L_i^T + \bar{L}_i\ w_i\right)} \quad \text{where } i = H,F \tag{18}$$

where X_{Ci} is the export value from China to Home (Foreign). The denominator represents the income share spent on manufacturing goods. Because the high-tech good is exclusively sold to China we can directly link the high-tech demand to the share of imports from China. From Eq. (18) we can see that the only free variable, w_i, governs vc_i. Since we have fixed the demand for the high-tech product, this implies that an increase of vc_i is automatically associated with a decline in the manufacturing sector relative to the high-tech sector. Hence, a rise in vc_i is only possible if w_i decreases. This in turn implies a contraction of the manufacturing labor force as a result of the elastic labor supply in Eq. (10).

The conditions in Eqs. (17)-(18), together with the assumption that $L^T = L_C\ w_C\ \gamma$ for both Home and Foreign, allow us to write the wage rate in Home and Foreign as a function of the respective shares of imports from China:

$$w_H = A + \frac{\gamma\ L_C\ w_C - \alpha\ L^T\ vc_H}{\alpha\ \bar{L}_H\ vc_H} = A + \frac{\gamma\ L_C\ w_C}{\bar{L}_H}\left(\frac{1}{\alpha\ vc_H} - 1\right) \tag{19}$$

which defines the wage rate as a function of the share of imports from China in the domestic market. In order to get an expression for the wage rate hinging on the export market share, vc_F, we plug Eqs. (13) - (16) into the definition of the share of imports from

China of Foreign in Eq. (18), solve for w_H^{1+k}, and plug the solution into the Home trade balance in Eq. (17). Solving for the wage rate w_H and substituting for w_F using Eq. (19) results in:

$$w_H = A - \underbrace{\frac{X_{FH}\left(\tau^{2k}\left(\frac{f_X}{f}\right)^{\frac{2k}{\sigma-1}-2}-1\right)}{\alpha\,\bar{L}_H}}_{\text{return effect}} + \underbrace{\frac{\gamma\,L_C(1-vc_F)w_C\,\left(\frac{\tau\,\tau_{CH}}{\tau_{CF}}\right)^k\left(\frac{f_X}{f}\right)^{\frac{k}{\sigma-1}-1}}{\alpha\,\bar{L}_H\,vc_F}}_{\text{competition effect}} + \frac{(1-\alpha)\gamma\,L_C\,w_C}{\alpha\,\bar{L}_H}. \tag{20}$$

Here X_{FH} are the imports of H from F and are defined as:

$$X_{FH} = \frac{\gamma^2 L_C^2\left(\frac{\tau_{CF}}{\tau}\right)^k w_C^{k+2}\left(\bar{\phi}_C\right)^{-k}\left(k(\sigma-\sigma\,vc_F-1)+\sigma-1\right)\left(A+\frac{\gamma\,L_C\,w_C(1-\alpha)\,vc_F}{\alpha\,\bar{L}_F\,vc_F}\right)^{-k-1}}{f_e k(k+1)N_C\sigma\,vc_F}. \tag{21}$$

In order to ensure a positive trade volume between Home and Foreign, we have to restrict vc_F to the interval $(0, \frac{(k+1)(\sigma-1)}{k\sigma})$. This is necessary to avoid a prohibitive manufacturing wage rate in Home as $vc_F \to 0$.[46] At the other extreme, as $vc_F \to \frac{(k+1)(\sigma-1)}{k\sigma}$, the Chinese competition in Foreign is too strong, resulting in a wage rate w_F which does not attract enough labor for production in Foreign to allow for a positive trade balance between Home and Foreign.[47]

The Chinese competition in the export market affects the wage rate in Home w_H through two channels. First, there is the direct competition effect in the export market, constituting is a pure crowding out effect.[48] Second, there is an indirect 'return-effect', which arises because the Chinese import competition in the export market, vc_F, also affects the export volume of the trading partner, X_{FH}, and thereby the firm structure of the foreign export sector. It is shown in Appendix A.9.1 that the marginal change in the wage rate with respect to both, vc_H and vc_F, is strictly negative on $(0, \frac{(k+1)(\sigma-1)}{k\sigma})$, but not constant due to these opposite effects. Further, Appendix A.9.1 shows that the competition effect dominates the return effect in absolute value.

Using the first equality in Eq. (18) and the export volume $X_{HF} = X_{FH}$ of Home allows us to write the total sales in the domestic-market as

$$X_{HH} = X_{HF}\left(\frac{f_X}{f}\right)^{\frac{k}{\sigma-1}-1}\left(\frac{\tau\,\tau_{CH}}{\tau_{CF}}\right)^k. \tag{22}$$

[46] Note that the wage rate w_F has to move towards infinity as China's trade share in Foreign tends towards zero ($vc_F \to 0$). Hence, no firm will pay the sunk cost in order to enter the manufacturing export market.

[47] In fact, it does not allow for manufacturing production in Foreign at all.

[48] The competition-effect also depends on some remoteness parameter, as described in (Chaney, 2008).

The equation states that the domestic sales are proportional to the export volume. Thus, to discuss total manufacturing output, it suffices to analyze the behavior of the export volume. The argument for domestic sales follows immidiately. Hence, we have specified the endogenous variables in terms of the respective share of imports from China in the domestic- and export market.

A.6 Model Caveat and Restrictions

Before proceeding to the discussion of the different effects of increased Chinese competition on the wage rate, we have to discuss a caveat of the model.

As pointed out in Eqs. (21)-(22), production in Home becomes zero, as either $vc_F \to 0$ or $vc_H \to 0$. This stems from a prohibitive wage rate, since in both cases $w_H \to \infty$ and $w_F \to \infty$ (Eqs. (19)-(20)), which is an implication of the fixed Chinese export volume in Eq. (17).[49] The relevant model-mechanism can best be illustrated by evaluating the cut-off productivities. Using $\alpha\ vc_H(-A\ \bar{L}_H + \gamma\ L_C\ w_C + \bar{L}_H\ w_H) = \gamma\ L_C\ w_C$ and the definition of the price index, we obtain:

$$\left(\bar{\phi}_H\right)^k = \frac{\left(\frac{f}{f_X}\right)^{\frac{k}{\sigma-1}-1} f\ k\ \sigma\ w_H^{k+1}\ \tau_{CH}^{-k}\ N_C\ w_C^{-k-1}\left(\bar{\phi}_C\right)^k}{\gamma\ L_C\ (k-\sigma+1)} \tag{23}$$

and

$$\left(\bar{\phi}_H^X\right)^k = \frac{f_X\ k\ \sigma\ w_H^k\ w_F\ \left(\frac{\tau}{\tau_{CF}}\right)^k\ w_C^{-k-1}\ N_C\left(\bar{\phi}_C\right)^k}{\gamma\ L_C\ (k-\sigma+1)}, \tag{24}$$

where we assume $w_F\ \left(\frac{\tau}{\tau_{CF}}\right)^k > w_H\ \tau_{CH}^{-k}\ \left(\frac{f}{f_X}\right)^{\frac{k}{\sigma-1}}$ to assure that not all active firms export. Both cut-off productivities are positively related to w_H and w_F, since the export fixed costs have to be paid in Foreign. In particular, a (positive) one-to-one relationship exists between the wage rates, cut-off productivities and the expenditure.[50] Thus, when we analyze the behavior of the wage rate, the behavior of the latter two follow. Now, both cut-off productivities[51] move towards infinity when either $vc_F \to 0$ or $vc_H \to 0$. This requires that the expected profits for firm entry also move towards infinity. That is indeed the case, since expenditure on the manufacturing good moves towards infinity as $w_H \to \infty$, to ensure that the income share spend on Chinese products approaches 0. As a result, we

[49] Thus, the only adjustable variable, is the wage rate.

[50] As the wage rate decreases $\Rightarrow$ profits rise $\Rightarrow$ labor demand for entry costs, f_e, rises $\Rightarrow$ wage rate rises. Thus, in order to break this chain and induce the wage rate to fall, we require the cut-off productivities to fall and thereby average productivity to fall.

[51] Note, that the cut-off productivities governs average productivity.

find that all labor is used on the fixed entry costs f_e, but no production takes place, since no firm pays the fixed costs of production f. Appendix A.9.1 shows that the wage rate is inversely related to vc_i. Hence, as these shares increase away from zero, the wage rate and therefore, both, expenditure and cut-off productivities fall and production starts (Eq. (22)). Simultaneously, the trade volume between Home and Foreign increases (Eq. (21)).

We know from Eq. (10) that as the wage rate declines, manufacturing labor contracts, implying that manufacturing labor is at its peak at $vc_i = 0$. As the shares vc_i increase, additional firms become active[52] ($\phi > \bar{\phi}_H$) and more labor is used on production relative to entry costs because the expected profits decrease simultaneously. Nevertheless, total manufacturing labor demand declines and hence the manufacturing labor force steadily decreases.

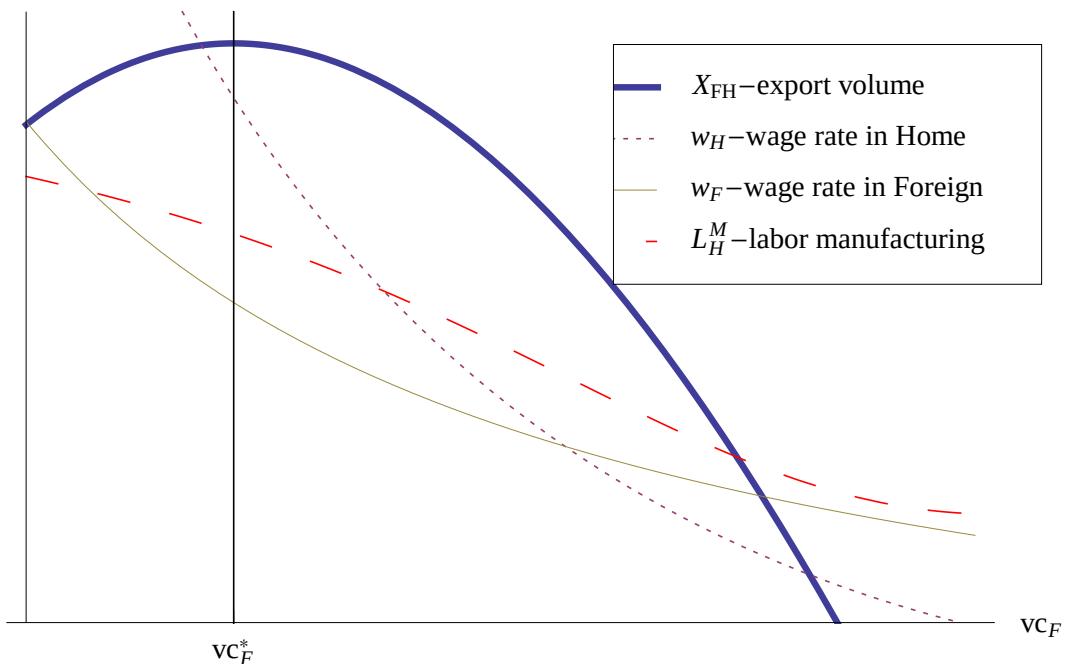
Along with the wage rate decline, total income is reduced (one-to-one relation) and hence the expenditure share on OECD manufacturing goods decreases (Chinese export volume is fixed). Thus, we have (a) a cut-off productivity effect, allowing more firms to produce (labor used on entry costs declines in relative terms) and (b) an expenditure/labor effect which decreases spending and the available labor force. These are two opposite forces working on the manufacturing output.[53] Figure 3 depicts a numerical example for the relevant function with respect to the export competition measure vc_F.

Starting at $vc_F = 0$, at first the positive effect (relatively more labor in production) is dominant and production and exports increase. This means the elasticity of the cut-off productivity exceeds the labor supply elasticity despite the expenditure decline, preventing labor shortage. That is, the absolute value of the marginal change in labor reallocation (within manufacturing) from entry costs to production exceeds the absolute value of the marginal change in labor reallocation from the manufacturing to the service sector (which is equivalent to the manufacturing labor demand decline). Finally, as we continue to increase vc_F, we move along the interval $(0, \frac{(k+1)(\sigma-1)}{k\sigma})$ to the right, and the labor contraction becomes noticeable and prevails at $vc_F^* \in (0, \frac{(k+1)(\sigma-1)}{k\sigma})$. From this point on, the wage rate contraction leads to a drop in total output as more and more varieties are forced out of the market. These varieties vanish from the market because income declines along with the wage rate, resulting in a smaller expenditure spent on the manufacturing goods of the OECD countries H and F in addition to the labor supply decrease. This cannot any

[52] Additionally, due to the Pareto distribution, a fixed share also enters the export market ($\phi > \bar{\phi}_H^X$).

[53] Note, since exports and domestic sales are proportional to total output, it is sufficient to discuss total output.

Figure 3: Functional Form



Note: The figure presents a numerical example of the respective functions. The graphs of the functions are scaled such that they can be represented in the same graphic. Thus, the relative magnitude is not preserved.

longer be compensated by movements in the cut-off productivities. Finally, at $\frac{(k+1)(\sigma-1)}{k\sigma}$ production in the OECD ceases again, resulting in a zero trade balance between Home and Foreign. At $\frac{(k+1)(\sigma-1)}{k\sigma}$ all manufacturing labor is used by Chinese firms which have to pay their export fixed costs in the export market. At this point the wage rate is constant because we have fixed the export volume of Chinese manufacturing varieties and all manufacturing expenditure goes to Chinese firms. Appendix A.9.2 shows that vc_F^* is unique. The argument in the case of vc_H^* then follows immediately.

From here on, we restrict our model to the interval $vc_i \in (vc_i^*, \frac{(k+1)(\sigma-1)}{k\sigma})$ in order to avoid economically conflicting effects due to the functional form, in particular, the fixed Chinese trade balance of the model. This restriction is supported by the data which document existing intra-industry trade among OECD countries and further suggests a declining trade volume induced by Chinese competition.

A.7 Qualitative Analysis

Using the results above, we now derive qualitative predictions for the impact of increased Chinese competition on the export volume as well as structural variables within the manufacturing sector. We additionally analyze if these changes can result in inter-sectoral labor reallocations and alterations of average income. Since all the effects in the model are driven by changes in the wage rate of the manufacturing sector, we start by analyzing how an increase in the share of imports from China will affect the wage rate w_H. As discussed above, we restrict the model analyses to $(vc_i^*, \frac{(k+1)(\sigma-1)}{k\sigma})$.

A.7.1 Chinese Competition and the Manufacturing Wage Rate

From the setup of the labor market, we know that A is the minimum wage premium in manufacturing that has to be paid in order to attract the worker with the lowest upgrade costs from the service sector. Looking at Eq. (19) reveals that the wage rate in manufacturing can be written as a mark-up over that minimum wage premium. Thus, as manufacturing labor demand increases, firms need to pay higher mark-ups in order to attract labor along the upgrade cost distribution.

The first equality of Eq. (19) can be written as $E(M)_H \; vc_H = \alpha \; vc_H(L_H(w_H - A) + L^T) = \gamma \; L_C \; w_C$. The equality states that the expenditure on the Chinese manufacturing good must correspond to the export value from the high-tech good in the trade balance. Thus, as we increase the fraction of income spent on the Chinese product, the wage mark-up decreases under the trade balance constraint as the manufacturing labor demand in Home has to decline.

We are particularly interested in the effect of changes in the share of imports from China in Foreign, vc_F, on the wage rate in Home, w_H. From Eqs. (20) -(21), we see that the competition-effect has an unambiguously harmful impact on the wage rate. As demonstrated in Appendix A.9.1, the return-effect term in Eq. (20) is dominated by the competition effect. Therefore, w_H declines as vc_F increases. Note however, that there are two opposite forces in the foreign manufacturing market acting through vc_F on the wage rate. First of all, an increase in vc_F leads to a stronger competition-effect reducing w_H, as the export sector declines and average productivity in Home and manufacturing output is reduced (reversed Melitz effect). Thus, the competition-effect works through the export sector of Home and is a result of a lower average productivity. More specifically, as the export market sales decline, the more productive export firms lay off labor and wage rate

decreases, allowing low productivity firms to enter the manufacturing market. The impact on average productivity is even amplified as the fixed costs of exporting decline, resulting in a decreasing average productivity of the exporting firms.[54] Second, an increase in the share of imports from Chinain Foreign, vc_F, has the opposite effect[55] on the exports from Foreign to Home (return-effect) and hence by the trade balance also on the exports from Home to Foreign. Note, that the return-effect emerges solely due to the interaction of the foreign manufacturing sector with the share of imports from China in the foreign market. Hence, the return-effect affects the manufacturing sector in Home only indirectly through the foreign export sector. An increase in vc_F additionally, leads to a displacement of foreign varieties by Chinese manufacturing products. This is not, however, an export competition effect, but a labor market (income) effect. In particular, as the wage rate w_F decreases, less labor is available to foreign firms, because labor relocates to the service sector. This in turn reduces foreign production and hence the exports from Foreign to Home, as more and more varieties of Foreign are forced out of the market. This mechanism reduces the pressure from foreign firms on the domestic market in H. Thus, we find that competition from Foreign also affects firms that only serve the domestic market in H.

Summing up, we find that the competition-effect has a negative effect on the wage rate w_H through the export sector, but the return-effect has a positive effect on w_H, since the competition from Foreign is reduced. However, the competition effect prevails. Rephrased, the model mechanisms imply that the prospering of the high-tech sector (vc_i increases) is fueled at the cost of the manufacturing sector.

A.7.2 Chinese Competition and the Export Volume

We now look at the marginal change of the export volume from Home to Foreign, X_{HF}, caused by a rise in Chinese competition in the domestic ($vc_H \uparrow$) or the export market ($vc_F \uparrow$). In the light of the discussion in the previous subsection this is straightforward. The export volume can be written in terms of the wage rate w_H, where the first inequality holds by assumption of an equalized trade balance,

$$X_{HF} = X_{FH} = \frac{\gamma\, L_C\, w_C^{k+1} w_F^{-k-1} \left(\bar{\phi}_C\right)^{-k} \left(\frac{\tau_{CH}}{\tau}\right)^k \left((k+1)(\sigma-1)E(M)_F - \gamma\, k\, L_C\, \sigma\, w_C\right)}{f_e k(k+1) N_C\, \sigma} \tag{25}$$

[54] It is then not exactly a reversed Melitz effect, since we observe a decreasing export cut-off *and* a decreasing export volume in vc_F. This happens if the entry cut-off decreases faster and the number of active firms decline or either of these two.

[55] Remember that we restrict the shares to $vc_i \in (vc_i^*, \frac{(k+1)(\sigma-1)}{k\sigma})$

where $E(M)_F = (-A\,\bar{L}_F + L^T + \bar{L}_F\,w_F)\alpha$ and we know that on $vc_F \in (vc_F^*, \frac{(k+1)(\sigma-1)}{k\sigma})$

$$\frac{\partial X_{FH}}{\partial vc_F} < 0 \text{ and by the chain rule } \frac{\partial X_{HF}}{\partial w_F} = \frac{\partial X_{FH}}{\partial w_F} = \frac{\frac{\partial X_{FH}}{\partial vc_F}}{\frac{\partial w_F}{\partial vc_F}}. \tag{26}$$

Since $\frac{\partial w_F}{\partial vc_F}$ is negative, we conclude that the income effect in Eq. (26), through $E(M)_F$, w.r.t. w_F, dominates the effect through w_F^{-k-1} (export fix costs) and we find $\frac{\partial X_{HF}}{\partial w_F} > 0$ on $vc_F \in (vc_F^*, \frac{(k+1)(\sigma-1)}{k\sigma})$.

A.7.3 Chinese Competition and the Manufacturing Output

We have already established that the domestic sales contract proportionally to the export volume in the case of increased export competition vc_F. Given the equalized trade balance, Eqs. (26)-(22) also imply $\frac{\partial(X_{HH}+X_{HF})}{\partial vc_F} < \frac{\partial X_{HF}}{\partial vc_F} < 0$ on $vc_F \in (vc_F^*, \frac{(k+1)(\sigma-1)}{k\sigma})$. Thus, increased Chinese export competition leads to a decline in total output in Home. Additionally, the model suggests that the contraction in total output exceeds the contraction in the export volume, since both domestic and export sales are affected.

A.7.4 Chinese Competition and the Number of Active Firms

There are two opposite effects which determine the number of firms. First, the lower cut-off productivities increase the probability of a firm becoming active. In addition, the reduction in average productivity in the market decreases the mean firm size, allowing more firms to operate. On the other hand, the lower wage rate which is accompanied by an increase in Chinese competition reduces available manufacturing labor, as workers shift to the service sector. Thus, the overall effect of increased Chinese competition is ambiguous. Formally, the number of active firms can be expressed as

$$N_H = \frac{X_{HF}\; f\;(k-\sigma+1)\left(\frac{f_X}{f}\right)^{\frac{k}{\sigma-1}-1}\left(\frac{\tau\;\tau_{CH}}{\tau_{CF}}\right)^k}{k\;\sigma\;w_H} \tag{27}$$

where Eq. (27), under the assumption of an equalized trade balance $X_{HF} = X_{FH}$, implies that the direction of the change in the number of firms with respect to vc_F depends on the magnitude of the respective derivatives of $\frac{\partial w_H}{\partial vc_F}$ and $\frac{\partial X_{FH}}{\partial vc_F}$ (both being negative).

A.8 Chinese Competition and Socioeconomic Effects

In this subsection, we examine the effects of increased Chinese competition on the overall economy, in particular the average income and the labor allocation. We restrict the analysis

to the case where competition increases in the export market. The effects of intensified Chinese competition in the domestic market can be derived analogously.

A.8.1 Chinese Competition and the Labor Allocation

Since there exists a one-to-one relationship between the wage rate and the size of the labor force in service and manufacturing respectively, the analysis is straightforward. An increase in Chinese competition on the interval $vc_F \in (vc_F^*, \frac{(k+1)(\sigma-1)}{k\sigma})$, leads to a reallocation from manufacturing to the lower-wage service sector. This is a result of worker heterogeneity with respect to the upgrade cost. As the wage rate w_H declines, fewer low-skilled workers are attracted to the manufacturing sector, since their fixed costs of entering the manufacturing sector increase along the upgrade-cost distribution. Thus, we find a contracting manufacturing labor force and an expanding service-sector labor force as a result of increased export competition vc_F.

A.8.2 Chinese Competition and the Service Sector Wage Rate, Total Average Income

A decrease in manufacturing wage rate w_H, due to a rise in export competition, vc_F, induces an increase in labor supply in the service sector. As a result the service wage rate r_H drops. This is an implication of Eq. (11). From that it follows that the overall impact of the increased export competition on the total income of low-skilled labor is composed of three reinforcing effects. First, the wage rate of manufacturing labor declines. Second, the wage rate of the service sector decreases as well. Third, labor reallocates from the better paid manufacturing sector to the low-wage service sector. Put together, the export competition has a negative effect on the total income. However, since we assume that both, the high-tech good and the manufacturing good are classified as industrial goods it is possible that the overall wage rate per industrial labor unit $\frac{h_H\ L_H^T + w_H\ L_H^M}{L_H^M + L_H^T}$ increases. This is the case when the labor supply elasticity is high, implying that the proportion of high-skilled workers in the industrial sector significantly increases.

A.9 Proofs

A.9.1 Proof 1

Proof that the competition-effect dominates the return-effect and that the wage rate is inversely related to the export competition measure. Write Eq. (20) as

$$\alpha Y_H = vc_H\ \alpha\ Y_H - X_{FH}\left(\tau^{2k}\left(\frac{f_X}{f}\right)^{\frac{2k}{\sigma-1}-2} - 1\right) + \frac{\gamma\ L_C(1-vc_F)w_C\left(\frac{\tau\ \tau_{CH}}{\tau_{CF}}\right)^k\left(\frac{f_X}{f}\right)^{\frac{k}{\sigma-1}-1}}{vc_F}, \tag{28}$$

where we used the fact that $L_C\ w_C\ \gamma = E(M)_H\ vc_H = Y_H\ \alpha\ vc_H$ and the definition of income in Eq. (11). Hence, as we require that $Y_H\ \alpha \geq Y_H\ \alpha\ vc_H$, the Proof of part 1 follows. Taking the derivatives w.r.t. vc_F and substituting $\frac{\gamma\ L_C\ (1-vc_F)\ w_C\left(\frac{f_X}{f}\right)^{\frac{k}{\sigma-1}-1}\left(\frac{\tau\ \tau_{CH}}{\tau_{CF}}\right)^k}{vc_F} = A1 > B1 = X_{FH}\left(\tau^{2k}\left(\frac{f_X}{f}\right)^{\frac{2k}{\sigma-1}-2} - 1\right)$, Eq. (28) also implies

$$\frac{\partial w_H}{\partial vc_F} = -\frac{\frac{B1\ vc_F\ \frac{\partial X_{FH}}{\partial vc_F}}{X_{FH}} + \frac{A1}{1-vc_F}}{\alpha\ L_F(1-vc_H)vc_F}, \tag{29}$$

where the restriction $X_{FH} > 0 \Rightarrow \frac{\frac{\partial X_{FH}}{\partial vc_F}}{X_{FH}} > -1$ and hence implies $\frac{\partial w_H}{\partial vc_F} < 0$.

A.9.2 Proof 2

Proof that $vc_F^* \in (0, \frac{(k+1)(\sigma-1)}{k\sigma})$ exists and is unique. Setting the first-order derivative of Eq. (21) to zero, and solving for vc_F yields

$$vc_F^* = \frac{\gamma\ k\ L_C(\sigma-1)w_C}{\alpha\ A\ L_F(\sigma-1) + \gamma\ L_C\ w_C(-\sigma\ \alpha + \alpha + k\ \sigma)} \tag{30}$$

which can be shown to lie within the interval $(0, \frac{(k+1)(\sigma-1)}{k\sigma})$. Additionally, we know that $\frac{\partial X_{FH}}{\partial vc_F} > 0\ \forall\ vc_F \in (0, vc_F^*)$ and $\frac{\partial X_{FH}}{\partial vc_F} < 0\ \forall\ vc_F \in (vc_F^*, \frac{(k+1)(\sigma-1)}{k\sigma})$ which concludes the proof.

B Constructing Correspondence Tables

B.1 Matching HS Codes into the UN Industry Classification

Accompanying the industry-specific output data, the UN provides a correspondence table for the UN industry and the HS classifications. Using this table we assign the four-digit HS codes to the six-digit UN industry classifications. 41 percent of the HS codes cannot

be uniquely assigned to an industry. These industries and their corresponding outputs are aggregated into new industries.[56] Proceeding in this manner, of the 569 original industry codes, 233 were merged into 76 new industries. In over 70 percent of the cases, fewer than 4 industry codes had to be merged. The maximum number of codes combined is 14, the average being 3.1. A table depicting which codes were merged to new industries is available upon request. Since we control for country-industry fixed effects, we do not expect any problems arising from this aggregation procedure, as the classification remains constant.

B.2 Matching HS Codes into the Eurostat Industry Classification

The matching of the HS codes into the NACE classification is more troublesome than the procedure described above. Firstly, no single correspondence table exists relating the NACE classification to the HS codes. However, a table can be constructed using the correspondence between the HS classification and the ISIC (Rev 3.1) notation together with the table linking the ISIC classification to the NACE industries. Both these tables are available from the UN classifications registry homepage.[57] Secondly, were the approach described in Section B.1 to be used, the number of resulting industries - and thus observations available for the empirical analysis - would be very low, with each industry encompassing a large number of HS codes. This is due to a number of the HS codes spreading over various industries. Through these codes, a lot of industries are intertwined, implying the need for a considerable aggregation. This problem becomes more pronounced, the more digits are included in the industry classification. Even at the two-digit level, multiple assignments still exist. However, the number of HS codes creating the problem is relatively low (32 codes, representing 3 percent of the total[58]). Dropping these codes allows for an exact matching of the remaining HS codes into the original two-digit NACE classification. By excluding the codes, we ignore a certain amount of trade that has actually been reported. Therefore, the results presented in Sections 5.4 to 5.5 can be regarded as the effects when trade is at its lower bound. In order to check whether the method of creating the correspondence critically affects the results, we employ a different method for the construction

[56] A newly defined industry includes all the original industries associated with the HS code that matches into multiple industries. If other HS codes correspond to one of the industries affected, the correspondence table has to be adapted accordingly. In doing so, one has to take into account the possibility that one of these HS codes may also not be uniquely assignable. In this case, the new industry definition has to encompass these additional industries.

[57] `http://unstats.un.org/unsd/cr/registry/`

[58] A table listing the industries together with the omitted codes originally assigned to them are available from the authors.

of the correspondence table. In contrast to Section B.2 we do not drop the HS codes that cannot be assigned to a single industry. Instead, we assign the trade volume reported for such a HS code to all the industries over which it spans. This multiple assignment creates more trade volume than originally reported by the Comtrade Database. The effects found in the empirical analysis using this correspondence table can therefore be interpreted as the impact when trade is at its upper bound.

First, we construct the explanatory variables using the new correspondence table for the matching process. When we compare the variables to the regressors used in the main part, we find that the correlation coefficient exceeds 0.99 for all the variables. On these grounds, we do not expect the results to change significantly. Indeed, when re-running the regressions of Sections 5.4 -5.5, we find that the results for the coefficients of the weighted export competition and the weighted import competition measures are qualitatively equivalent. Quantitatively, the effects are also very similar. The output tables of the alternative approach are available from the authors upon request.

C Descriptive Statistics

Table C.1: Descriptive Statistics Product-Level Dataset

Variable	**Mean**	**SD**	**Min.**	**Max.**	**N.Obs.**	**Source**
Log bilateral exports	11.38	3.05	0.00	24.53	12424602	Comtrade
Export competition	0.12	0.18	0.00	1.00	12424602	
Import competition	0.11	0.17	0.00	1.00	12424602	
Log imports from China of home country	14.55	2.92	0.00	24.62	12424602	
Log total imports of home country	18.25	1.88	4.80	25.65	12424602	
Log imports from China of partner country	16.47	2.35	0.00	25.65	12424602	
Log total imports of partner country	112.91	3.05	0.00	24.62	12424602	
Log GDP p. capita of home country	10.20	0.34	8.89	10.81	10596365	WDI
Log GDP p. capita of partner country	9.41	1.04	5.22	11.21	10431524	

WDI: World Development Index

Table C.2: Descriptive Statistics UN-Industry-Level Dataset

Variable	**Mean**	**SD**	**Min.**	**Max.**	**N.Obs.**	**Source**
Log industry output	3.06	3.16	-10.62	12.60	31293	UN Stat
Weighted export competition	0.10	0.13	0.00	1.00	37616	Comtrade
Weighted import substitution	0.09	0.15	0.00	1.00	37616	
Log imports from China of home country	14.20	3.13	0.69	24.58	37616	
Log total imports of home country	18.28	1.78	6.95	24.67	37616	
Log imports from China of export markets	19.24	2.32	3.22	26.03	37616	
Log total imports of export markets	22.24	1.62	7.06	28.11	37616	
Log GDP p. capita of home country	10.11	0.35	9.21	10.78	37616	WDI
Log GDP p. capita of export markets	9.86	0.23	7.25	10.85	37616	

UN Stat: UN Industrial Commodity Production Statistics Database
WDI: World Development Index

Table C.3: Descriptive Statistics Eurostat-Industry-Level Dataset

Variable	**Mean**	**SD**	**Min.**	**Max.**	**N.Obs.**	**Source**
Log compensation per employee	3.23	0.73	-0.22	4.90	4241	Eurostat
Log employment in industry	10.41	1.42	2.64	13.95	4337	
Apparent labor productivity	63.18	461.54	-76.70	23694.10	4070	
Log employees per firm	3.13	1.04	-1.84	7.84	4337	
Log number of enterprises	3.13	1.04	-1.84	7.84	4337	
Weighted export competition	0.07	0.07	0.00	0.44	5318	Comtrade
Weighted import competition	0.06	0.07	0.00	0.48	5318	
Log imports from China of home country	17.76	2.30	5.49	23.25	5318	
Log total imports of home country	18.44	1.46	13.79	23.26	5318	
Log imports from China of export markets	22.77	1.70	8.18	25.98	5318	
Log total imports of export markets	25.49	1.09	18.83	27.90	5318	
Log GDP p. capita of home country	10.15	0.35	9.10	10.81	5318	WDI
Log GDP p. capita of export markets	9.92	0.16	9.28	10.50	5318	

WDI: World Development Index

Table C.4: Descriptive Statistics Regional-Level Dataset

Variable	**Mean**	**SD**	**Min.**	**Max.**	**N.Obs.**	**Source**
Industrial labor share	0.21	0.08	0.01	0.42	2241	Eurostat
Service labor share	0.69	0.09	0.46	0.94	2241	
Log industrial compensation rate	3.64	0.62	1.23	5.93	2241	
Log service compensation rate	3.22	0.49	1.04	4.14	2241	
Log HH-Income per capita (PPP)	9.52	0.37	8.20	10.46	2391	
Employment rate	0.63	0.08	0.37	0.80	2303	
Log outwards migration	9.28	0.90	5.39	11.58	764	
Log total population of NUTS region	14.10	0.85	10.17	16.27	2447	
Log GDP p. capita of NUTS region	9.83	0.54	7.65	11.48	2420	
Weighted export competition	0.04	0.02	0.00	0.15	2462	Comtrade
Weighted import competition	0.04	0.02	0.00	0.14	2462	
Log imports from China of home country	19.09	1.42	13.33	21.87	2462	
Log total imports of home country	19.23	1.34	13.58	22.17	2462	
Log imports from China of export markets	23.10	0.85	18.12	24.78	2462	
Log total imports of export markets	25.67	0.69	20.40	27.18	2462	
Log GDP p. capita of home country	10.19	0.27	9.27	10.80	2462	WDI
Log GDP p. capita of export markets	9.53	0.30	7.06	10.10	2462	

WDI: World Development Index

Table C.5: Countries for Which Data Are Available

Home countries	**Product-level dataset**	**UN-industry-level dataset**	**Eurostat-industry-level dataset**	**Regional-level dataset**
Australia	✗			
Austria	✗		✗	✗
Belgium	✗		✗	✗
Canada	✗	✗		
Czech Republic	✗	✗	✗	✗
Denmark	✗	✗	✗	
Finland	✗	✗	✗	✗
France	✗	✗	✗	✗
Germany	✗	✗	✗	✗
Greece	✗	✗	✗	✗
Hungary	✗	✗	✗	✗
Iceland	✗	✗		
Ireland	✗	✗	✗	✗
Italy	✗	✗	✗	✗
Japan	✗	✗		
Mexico	✗	✗		
Netherlands	✗		✗	✗
New Zealand	✗			
Norway	✗	✗	✗	✗
Poland	✗	✗	✗	✗
Portugal	✗	✗	✗	✗
Republic of Korea	✗	✗		
Slovakia	✗	✗	✗	✗
Spain	✗	✗	✗	✗
Sweden	✗	✗	✗	✗
Switzerland	✗		✗	
Turkey	✗			
United Kingdom	✗	✗	✗	✗
United States of America	✗	✗		

Table C.6: Variables, Auxiliary Variables and Sources

Name in text	Name in Stata Code	Variables used for construction	Unit	Source	Section
GDP per capita (home partner)	GDP_perCapita (Home/Partner)		current US dollar	Development indicators	5.2-5.5
trade volume data (e.g. export volumne)	Exports, Imports, etc (Home/Partner)		current US dollar	Comtrade	5.2-5.5
industry output	IndustryOutput		millions national currency	UN_General Industrial Statistics	5.3
employees per firm	Empl_perFirm		head count		5.4
	Nr_Employees	number of persons employed	head count	eurostat sbs_na_2a_dade	
number of firms	Nr_Enterprises	number of enterprises	head count	eurostat sbs_na_2a_dade	5.4
apparent labor productivity	Productivity		thousand euros per head	eurostat sbs_na_2a_dade	5.4
compensation per employee	CompEmp		thousand euros per head		5.4
	personnelcosts	Personnel costs	millions of euros	eurostat sbs_na_2a_dade	
	Nr_Employees	number of persons employed	head count (000)	eurostat sbs_na_2a_dade	
employment in industry	numbersofpersonsemployed		head count	eurostat sbs_na_2a_dade	5.4
industry labor share	ShareLaborIndustry		fraction		5.5
	TotalLaborNace	Total labor - all NACE activities	head count (000)	nama_r_e3empl95	
	IndustryLabor	industry (except construction) labor	head count (000)	nama_r_e3empl95	
service labor share	ShareLaborService		fraction		5.5
	TotalLaborNace	Total labor - all NACE activities	head count (000)	eurostat nama_r_e3empl95	
	ServiceLabor	Services labor	head count (000)	eurostat nama_r_e3empl95	
industry compensation per employee	CompRateIndustry		thousand euros per head		5.5
	Comp_perEmpInd	compensation of employees industry (except construction)	millions of euros	eurostat nama_r_e2rem	
	IndustryLabor	industry (except construction) labor	head count (000)	eurostat lfst_r_lfe2en1	
service compensation per employee	CompRateService		thousand euros per head		5.5
	Comp_perEmpServ	compensation of employees service	millions of euros	eurostat nama_r_e2rem	
	ServiceLabor	Services labor	head count (000)	eurostat lfst_r_lfe2en1	
real household income per capita	IncomePPP_perCapita		purchasing power standard based on final consumption per inhabitant	eurostat nama_r_ehh2inc	5.5
employment rate (15-64 years)	EmploymentRate15_64		fraction	eurostat lfst_r_lfe2emprt	5.5
outward migration	DepartureMigration		head count	migr_r_2dep	5.5
population (NUTS2 level)	Pop_Nuts		head count (000)	eurostat demo_r_d3avg	5.5
GDP per capita (NUTS level)	GDP_perCapita_Nuts		euro	eurostat nama_r_e3gdp	5.5