The Rise of the East and the Far East: German Labor Markets and Trade Integration *

Wolfgang Dauth
IAB

Sebastian Findeisen
University of Zurich

Jens Suedekum
University of Duisburg-Essen

June 23, 2012

Abstract

We analyze the effects of the unprecedented rise in trade between Germany and "the East" – China and Eastern Europe – in the period 1988–2008 on German local labor markets. Using detailed administrative data, we exploit the cross-regional variation in initial industry structures and use trade flows of other high-income countries as instruments for regional import and export exposure. We find that the rise of "the East" in the world economy caused substantial job losses in German regions specialized in import-competing industries, both in manufacturing and beyond. Regions specialized in export-oriented industries, however, experienced even stronger employment gains and lower unemployment. In the aggregate, we estimate that this trade integration has caused some 493,000 additional jobs in the economy and contributed to retaining the manufacturing sector in Germany. We also conduct our analysis at the individual worker level, and find that trade had a stabilizing overall effect on employment relationships.

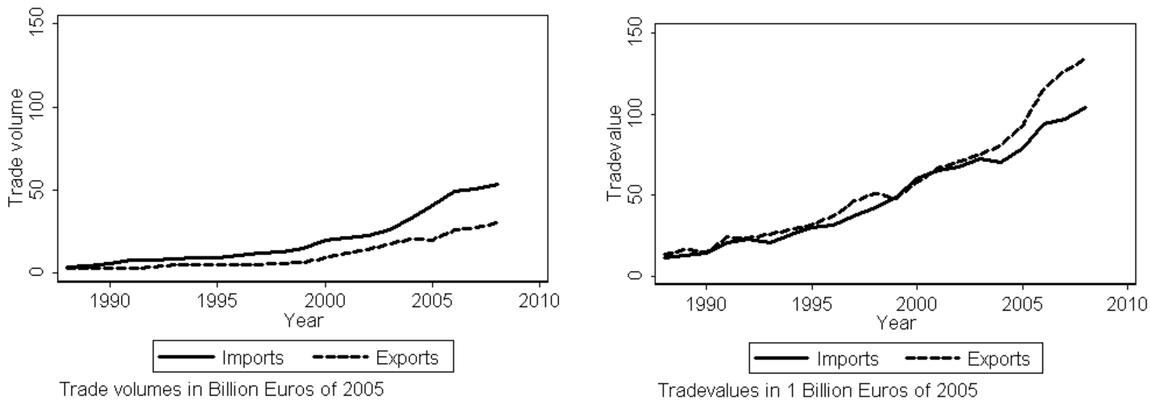
JEL-Classification: F16, J31, R11
Keywords: International Trade, Import Competition, Export Opportunities, Local Labor Markets, Employment, China, Eastern Europe, Germany

*Email contacts: wolfgang.dauth@iab.de, sebastian.findeisen@uzh.ch, jens.suedekum@uni-due.de.
We thank David Autor, Fabrizio Zilibotti and participants of various seminars for helpful comments. The usual disclaimer applies.

1 Introduction

One of the central forces of globalization in the last decades is certainly the rise of Eastern Asian countries, especially China, in the world economy. The substantial rise of trade with China, and its perceived competitiveness, have led to major concerns in Western market economies about possible adverse effects for domestic labor markets. This "fear" is particularly high on the agenda in the United States, and numerous studies have addressed the impacts of this trade integration on the US economy.[1]

From the perspective of Germany, which consistently ranks among the most open economies in the world and for a long time held the unofficial title of the export world champion, China's rise also had a major impact. Starting from almost zero trade in the late 1980s, the German import volume from China has risen dramatically to more than 50 billion Euros in 2008 (see Figure 1).



(a) China (b) Eastern Europe

Figure 1: German trade volumes with China and Eastern Europe, 1988-2008.

This corresponds to a growth rate of 1608 percent, which is far higher than for any other trading partner (see Table 1). However, although Germany runs a trade deficit vis-a-vis China despite an overall trade surplus, the magnitude of this deficit is much smaller than in the US case. This is because German exports to China have also risen by about 900 percent, from almost zero in 1988 to some 30 billion Euros in 2008, which is much faster than the rise of US exports. The "rise of China" therefore led to two major impacts for the German economy: Increased import competition particulary in such sectors as textiles, toys, or lower-tier office and computer equipment, but at the same time a substantial rise in market opportunities for the classical German export sectors, most notably automobiles, specialized manufacturing, and the electronic and medical industries.

[1]See, among others, Feenstra and Hanson (1999); Harrigan (2000); Feenstra and Wei (2010); Harrison et al. (2010); Ebenstein et al. (2011).

Table 1: Changes in German trade volumes, 1988-2008 (in Billion Euros of 2005)

	China		Eastern Europe	
Period	Imports	Exports	Imports	Exports
1988	3.1	3.0	11.0	13.3
1998	12.9	5.6	42.0	51.0
2008	53.1	30.1	103.8	134.0
Growth	**1628.3%**	**893.2%**	**843.9 %**	**905.3%**

	Other Asian dev. countries		Rest of the World	
Period	Imports	Exports	Imports	Exports
1988	5.0	5.1	289.4	402.1
1998	12.5	7.5	357.7	506.9
2008	20.0	16.3	490.2	842.7
Growth	296.5 %	219.0 %	69.4 %	109.6 %

Source: Own calculations based on United Nations Commodity Trade Statistics.

In addition to the "rise of China", Germany was affected by another major facet of globalization that at least economically had a much milder impact in North America, namely the fall of the Iron Curtain with the subsequent transformation of the former socialist countries into market economies. Overall, the rise of German exports to Eastern Europe even outpaced export growth to China. Import growth from Eastern Europe also has been substantial, exceeding 800 percent during the period 1988-2008.[2] For the German economy, import competition and export market opportunities therefore increased not only from the Far East, but also from the East closer by.

In this paper, we analyze the impacts of these major trade liberalizations from the perspective of small-scale German regions. There is substantial variation in sectoral employment patterns at the regional level, also within the manufacturing sector where commodity trade occurs. Given these initial specializations, regions are differently exposed to import competition and export opportunities arising from Eastern European and Asian countries. Regions that are strongly specialized in export-oriented industries, say "automobile regions", may benefit from the rise of new markets, while regions specialized in import industries, say "textile regions", may see their labor markets put under strain by the rising exposure to foreign competition. In

[2] To obtain a geographically stable region, we consider Eastern Europe to comprise the countries Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia, and the former USSR or its succession states Russian Federation, Belarus, Estonia, Latvia, Lithuania, Moldova, Ukraine, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. The increase in trade volumes between the US and these countries is negligible, at least in comparison to the German numbers. The sectoral structure of German trade with Eastern Europe differs from trade with China – see Tables A.2 and A.3 in the Appendix. Although the export sectors are mostly the same, there is more intra-industry and vertical trade as the top imported items are automobile parts and electric apparatus.

our aggregate analysis, we relate changes in key local labor market variables to measures of import and export exposure that reflect the local industry mix. Afterwards, we adopt a complementary, more disaggregate approach at the level of individual workers, analyzing how trade exposure affects employment stability within regions, local industries, and plants.

In the literature, there are several approaches to identifying the impacts of trade shocks. One approach uses industries at the national level as the unit of observation and analyzes the general equilibrium impacts of trade, taking into account that intersectoral labor mobility may also involve a loss of specific human capital (Feenstra and Hanson; 1999; Harrigan; 2000; Robertson; 2004; Poletaev and Robinson; 2008; Blum; 2008). This literature is based on the view that labor markets adjust instantaneously or very rapidly to a new equilibrium, even after major perturbations. Another prominent approach looks at finer levels of disaggregation and is based on the presumption that the adjustment to major trade shocks is sluggish and may require more time. In that case, the differential impacts on firms, occupations or regions may be informative about the short- to medium-run effects of trade liberalization. Within that string of literature, Bernard et al. (2006), Verhoogen (2008), Amiti and Davis (2012), and Bloom et al. (2011) have analyzed trade shocks at the level of plants and firms, whereas Artuc et al. (2010), McLaren and Hakobyan (2010), and Ebenstein et al. (2011) use the industry and occupation level.

Our work is most closely related to the literature that identifies the impact of trade shocks at the regional level, see Chiquiar (2008), Kovak (2011), Topalova (2010), and in particular, Autor, Dorn and Hanson (2012). The latter (henceforth labeled as *AHD*) separate the US into 722 regions and analyze the differential performance of these regions depending on their exposure to import competition from China. To account for unobserved shocks that simultaneously affect imports and regional performance, they use imports of other high-income countries to construct an instrument for US regional import exposure. Their main finding is that regions strongly exposed to Chinese import competition have experienced severe negative impacts on their labor markets, such as rising unemployment or lower labor force participation. At the same time, they find that Chinese trade shocks induced relatively small cross-regional population shifts. This low labor mobility, in turn, supports the view that regions can be treated as "sub-economies" across which the adjustment to trade shocks works far from instantaneously, so that the cross-regional variation in import exposure and labor market performance is a useful source of identification. Our analysis for German regions makes use of this empirical approach pioneered by *AHD*. Since regional labor mobility in Germany is traditionally much lower than in the US (Bertola; 2000), that approach indeed seems especially well applicable in our context.

In our empirical analysis, we pay particular attention to the overall exposure of

German regions to trade with "the East", that is, China and Eastern Europe. The rise of China, facilitated by substantial productivity gains and the Chinese WTO accession, and for that matter also the rise of Eastern Europe that was due to similar causes, not only imply an exogenous increase in import exposure from the point of view of a single German region; they also imply an increase in new export opportunities that regions specialized in the "right" type of industries can take advantage of. Our results suggest that this latter aspect is in fact crucial for understanding how German local labor markets were affected by, and adjusted to trade exposure in the past two decades. Consistent with *AHD*, we also find a negative *causal* effect of import exposure on manufacturing employment in German regions.[3] That is, regions specialized in import competing sectors saw a decline in manufacturing employment attributable to the impact of trade. Yet, this negative impact is on average offset by a positive *causal* effect of export exposure, as the respective export oriented regions build up manufacturing employment as a result of the new trade opportunities.[4] In addition, we find that trade integration with Eastern Europe had a much bigger impact on Germany than the rise of China.

Next, we move beyond manufacturing and investigate how local labor markets responded more broadly to the increase in trade exposure, shedding light on such questions as what happens to the workers displaced by trade exposure, or to what extent do the trade effects spill over to other (non-manufacturing) sectors in the economy. We find that trade exposure affects total regional employment in a significant and economically meaningful way. Regions specialized in classical German export industries saw significant total employment gains and reductions in unemployment, whereas import competing regions lost out. In the aggregate, we estimate that the rise of "the East" has created some 493,000 jobs in Germany in the period 1988–2008. Those gains clearly occur within the manufacturing sector, which is retained in Germany as a result of the deepening of trade, but employment in complementary business related services (such as accounting or consulting) also gained notably.

Finally, our analysis at the individual level allows for an even more detailed look on the causal effects of trade. Here, we use cumulative spell information from administrative social security data. We find that a higher export exposure of the own job raises the probability of staying employed in the same plant or local industry. Analogously, higher import exposure raises the probability that a job is terminated. Overall, however, we find that trade has led to a higher stability of employment relationships.

[3] To control for unobserved demand and supply shocks, we implement an instrumental variable strategy using trade flows from other high-income countries with Eastern Europe and China as an instrument for German import and export exposure. Our identification strategy is discussed in Section 2.

[4] This finding differs substantially from *AHD*'s main conclusion for the US. They find a much stronger negative impact for import penetration from China, also when they "net out" import and export exposure. That is, manufacturing employment in US regions did not seem to benefit significantly from export opportunities in China.

The rest of this paper is organized as follows. Section 2 describes the empirical approach. Section 3 is devoted to the analysis of manufacturing employment at the regional level, while Section 4 looks at further regional labor market outcomes. Section 5 presents the worker level analysis, and Section 6 concludes.

2 Estimation Strategy

2.1 Trade Exposure Across Local Labor Markets

Our empirical strategy is closely linked to the approach by *ADH* which exploits the variation in initial industry specialization across local labor markets at the onset of the economic rise of a trading partner, in our context Eastern Europe and China.

We first consider the import exposure of a German region i from "the East". Using *ADH*'s approach, which is based on a monopolistic competition model of international trade with cross-country productivity differences, this import exposure can be written as follows:

$$\Delta(ImE)_{it}^{EAST} = \sum_{j} \frac{E_{ijt}}{E_{jt}} \frac{\Delta Im_{jt}^{EAST}}{E_{it}}, \tag{1}$$

where ΔIm_{jt}^{EAST} is the total change in imports from the East to Germany (in constant Euros of 2005) that was observed in industry j between time periods t and $t+1$.[5] E_{ijt}/E_{jt} represent region i's share of national industry employment in j, and E_{it} is total manufacturing employment in period t and region i. This measure thus captures the *potential* increase in import exposure of a region i given its initial sectoral employment structure, as it apportions the *national* change in imports to the single German regions according to the regions' shares in national industry employment.

Figure A.1 in the Appendix illustrates this import exposure across German regions for the period 1998 to 2008, both with respect to China and Eastern Europe. As can be seen from the maps, there is strong regional variation in these exposure measures, reflecting substantial differences in sectoral structures across regions. It stands out that the industrial structure of Eastern Germany in 1998 was apparently such that there was little potential import competition, neither from China nor from Eastern Europe. The West was, by and large, exposed more strongly although there is substantial regional variation within Western Germany. Notice also, that the correlation between Chinese and Eastern European import exposure across German regions is only about 0.3. That is, many regions were exposed quite strongly to imports from one area, but not from the other. The average increase in exposure to Chinese imports over that

[5] In the benchmark specification below we consider that China and Eastern Europe together form "the East", so that ΔIm_{jt}^{EAST} refers to the joint increase of German imports from both areas. In further specifications, we consider import exposure from China and Eastern Europe separately.

time period was €1,903, while for Eastern Europe it was €1,848. To capture regional export exposure, we derive an analogous measure:

$$\Delta(ExE)_{it}^{EAST} = \sum_j \frac{E_{ijt}}{E_{jt}} \frac{\Delta Ex_{jt}^{EAST}}{E_{it}}, \tag{2}$$

which captures the potential of regions, given their initial sectoral employment patterns, to benefit from rising demand from the "East" for German manufacturing products. Figure A.2 in the Appendix illustrates the increase in potential export exposure of German regions, both with respect to China and Eastern Europe. The mean export exposure for China was €1,037, while for Eastern Europe that number reached €3,714. The map again shows that Eastern Germany is relatively little affected. Within Western Germany, there is substantial regional variation in the exposure to new export opportunities, yet with a clearly visible concentration in the south and southwest where the automobile and machinery sectors are highly concentrated.

2.2 Instrumental variable strategy

In the empirical analysis we aim to identify the causal effect of the rise of the East on the economic performance of German regions. More specifically, we regress the change of regional manufacturing employment, and other variables, between t and $t+1$ on the change of regional import and export exposure over the same time period.

The main challenge for this exercise is the endogeneity of trade exposure, in particular the presence of unobserved supply and demand shocks that simultaneously affect import/export exposure and regional economic performance. To address these concerns, we employ an instrumental variable (IV) strategy that is close in spirit to the approach by *ADH*. To instrument German regional import exposure from the East, we construct the following variable for every German region i:

$$\Delta(ImE_{Inst})_{it}^{EAST} = \sum_j \frac{E_{ijt-1}}{E_{jt-1}} \frac{\Delta Im_{jt}^{EAST-other}}{E_{it-1}}. \tag{3}$$

Here, $\Delta Im_{jt}^{EAST-other}$ are changes in trade flows of industry j's goods from the East (China and Eastern Europe) to other countries (see below). Similarly, for regional export exposure we construct the following instrumental variable that uses changes in exports of other countries to China and Eastern Europe:

$$\Delta(ExE_{Inst})_{it}^{EAST} = \sum_j \frac{E_{ijt-1}}{E_{jt-1}} \frac{\Delta Ex_{jt}^{EAST-other}}{E_{it-1}}. \tag{4}$$

The identification strategy (3) is based on the idea that the rise of Eastern Europe/China in the world economy induces a supply shock and rising import penetration for *all* trading partners, not just for Germany. Constructing a regional measure of import exposure by using those import flows of other countries therefore identifies the exogenous component of rising competitiveness in the East, and purges the effects of possible other shocks that simultaneously affect German imports and regional performance variables.[6] The logic of the instrumental variable (4) is similar. As the East rises in the world economy, it becomes a more attractive export destination for *all* countries, not just for Germany. Using (4) as an instrument for (2) thus purges the impacts of other unobservable shocks, and thus identifies the causal impact of the rise of export opportunities in the East on German local labor markets.

The quality of the instruments hinges, in particular, on three important conditions. First, they must have explanatory power in order to avoid a weak instrument problem. Second, the supply and demand shocks in those other countries should not be too strongly correlated with those of Germany, since otherwise the instruments do not purge the internal shocks so that the estimated coefficients are still biased. Third, in order for the exclusion restriction not to be violated, there should not be an independent effect of the trade flows of those other countries with China and Eastern Europe on the German regions, other than through the exogenous rise of the East.

To take those conditions into account, it is important to consider which countries are included in the "instrument group" whose trade flows are used to construct (3) and (4). We adopt the following approach: We focus on developed countries with a similar income level as Germany, but we exclude all direct neighbors as well as all members of the European Monetary Union. This is for two reasons. First, supply and demand shocks in such countries (e.g., France or Austria) are likely to be too similar to those in Germany, hampering the identification. Second, since those countries are highly integrated with Germany in an economic union where exchange rate alignments are impossible, it is likely that changes in trade flows between those countries and China/Eastern Europe also directly affect regional performance in Germany. We also do not consider the United States in the instrument group, because of its high significance in the world economy that is likely to violate the exclusion restriction. Our final "instrument group" consists of Australia, Canada, Japan, Norway, New Zealand, Sweden, Singapore, and the United Kingdom. Below we conduct several robustness checks where we change the countries that are included in the instrument group.

[6]Notice that the import values of the other countries are distributed across the German regions according to *lagged* sectoral employment shares from period $t-1$. This is done in order to tackle potential issues of measurement error or reverse causality, if employment reacted to anticipated trade. In practice using lagged or contemporaneous employment to construct the instrument turns out to have no significant impact on the results.

3 Trade exposure and manufacturing employment

3.1 Data

For the analysis at the regional level, we combine two main data sources. The German labor market data at the regional and local industry level come from the IAB-Establishment History Panel (BHP, see Spengler; 2008) which includes the universe of all German establishments with at least one employee subject to social security. This data set consists of an annual panel with approximately 2.7 million yearly observations on establishments aggregated from mandatory notifications to social security in the years from 1975 to 2008. Due to the administrative origin, the data are restricted to information relevant for social security (structure of workforce with regard to age, sex, nationality, qualification, occupation, wage) but at the same time are highly reliable and available on a highly disaggregated level.

Detailed data for regional sectoral employment is available from 1978 onwards. Since much of the rise of China and Eastern Europe occurred after 1990, we use 1988 as our starting point and thus observe data for two time periods (1988 to 1998 and 1998 to 2008) for each region. This timing also allows us to use employment lagged by ten years in the construction of our instruments as discussed above. Eastern German regions are only included for the second decade 1998 to 2008, because sectoral employment data for these regions only became available in the mid-1990s.

Information on international trade is taken from the United Nations Commodity Trade Statistics Database (Comtrade). This data contains annual international trade statistics of over 170 reporter countries detailed by commodities and partner countries. Trade flows are converted into Euros of 2005 using exchange rates supplied by the German Federal Bank. We merge these two data sources by harmonizing industry and product classifications. The correspondence between 1031 SITC rev. 2/3 product codes and the employment data (101 NACE 3-digit equivalent industry codes) is provided by the UN Statistics Division and allows unambiguously matching 92 percent of all commodities to industries. Trade values of ambiguous cases are partitioned into industries according to national employment shares in 1978.

3.2 Baseline specification: Manufacturing employment growth

We estimate the effect of trade exposure on local labor markets by running specifications of the form:

$$\Delta Y_{it} = \gamma_t + \beta_1 \Delta (ImE)_{it}^{EAST} + \beta_2 \Delta (ExE)_{it}^{EAST} + X_{it}' \beta_3 + e_{it}. \quad (5)$$

That is, we relate changes in the regional outcome variable Y_{it} between time periods t

and $t+1$ to changes in (potential) regional import and export exposure from the East (i.e., Eastern Europe and China) during the same time period, while controlling for start-of-period regional control variables X'_{it}. In the baseline specification of this section, the dependent variable is the decennial change in manufacturing employment as a share of the working age population in region i, $Y_{it} = E_{it}^{M/WP}$. In the next section we consider further outcome variables.[7]

In the most parsimonious specification the vector X'_{it} includes dummies for the 16 German federal states and a time dummy γ_t to capture decade specific trends. Furthermore, we control for the overall regional employment shares of tradeable goods industries since our approach exploits the detailed regional variations of employment structures *within* the manufacturing sector. In more comprehensive specifications, we then add further controls for the initial composition of the local labor force, namely the start-of-period share of high-skilled workers, foreigners and women. Furthermore, motivated by the literature on job off-shoring (e.g. Antras et al.; 2006; Grossman and Rossi-Hansberg; 2008), we include the percentage of routine intensive occupations (represented by basic activities in the taxonomy of Blossfeld (1987)). Table A.1 in the appendix reports some descriptive statistics for the main variables.

Main results The first three columns of Table (2) show OLS specifications where we do not instrument for import and export exposure. Column 1 includes only the parsimonious set of controls. As can be seen, export exposure is estimated to have a positive and significant relationship with manufacturing employment growth, whereas the relationship with import competition is not statistically different from zero. We also find a trend of mean reversion of manufacturing employment, since growth is negatively related to the initial employment share of tradeable goods industries. In column 2 we add the further regional control variables, and we find that this leaves the results for the central variables (import and export exposure) unaffected. These coefficients for those controls have the expected sign: A higher share of high-skilled, foreign and female workers in the local labor force is negatively related to manufacturing employment growth, since those groups are more prevalent in service industries. For the share of routine occupations we find no clear relationship. Finally, in column 3 we use interacted federal state $\times$ time period dummies instead of separate state/time dummies. This specification is the most demanding one, as it is only identified by within state-time variation. As can be seen, the coefficients for trade exposure as well as for the other control variables remain stable.

The OLS coefficients reported in the first three columns are confounded with unobservable supply and demand shocks that can simultaneously affect employment

[7] To account for spatial and serial correlation, we cluster the standard errors at the level of 50 high-order labor market areas as defined in Kropp and Schwengler (2011) in all specifications.

Table 2: Trade Exposure and Manufacturing Employment

	Dependent variable: 10-year change manufacturing employment / working age pop. in %-points					
	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
Δ import exposure	-0.047	-0.053	-0.068	-0.083	-0.154**	-0.177***
	(0.06)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
Δ export exposure	0.352***	0.444***	0.418***	0.184	0.415**	0.387**
	(0.11)	(0.11)	(0.11)	(0.17)	(0.18)	(0.18)
% Manuf. of tradable goods	-0.079***	-0.091***	-0.087***	-0.054***	-0.078***	-0.073***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
% routine occupations		-0.073*	-0.072		-0.067*	-0.066
		(0.04)	(0.04)		(0.04)	(0.04)
% high skilled		-0.164***	-0.170***		-0.162***	-0.168***
		(0.04)	(0.04)		(0.04)	(0.04)
% foreigners		-0.061***	-0.059***		-0.060***	-0.059***
		(0.01)	(0.01)		(0.01)	(0.01)
% women		-0.038	-0.032		-0.031	-0.025
		(0.04)	(0.04)		(0.03)	(0.03)
Federal state dummies	Yes	Yes	-	Yes	Yes	-
Time dummy	Yes	Yes	-	Yes	Yes	-
State x time interactions	-	-	Yes	-	-	Yes
R-squared	0.338	0.477	0.496	0.192	0.365	0.264
First stage (KP)				20.232	18.294	17.203

Observations: 739. Standard errors clustered at spatial level (50 regions) in parentheses. All control variables are shares in total employment. % high skilled of labor force defined as the fraction of the workforce with a university degree. % routine occupations defined as basic activities according to Blossfeld (1987). Levels of significance: *** 1 %, ** 5 %, * 10 %.

and trade flows in Germany. To address this bias, we now turn to the IV strategy described before. When using the instrumental variables (3) and (4) for (1) and (2), we find that the impact of import exposure is now both statistically and economically highly significant. The results indicate that the sources of bias for the OLS estimates of import exposure seem to be quantitatively important and responsible for driving the OLS estimates towards zero.[8] The coefficient for export exposure, on the other hand, remains in the same ballpark as before. Table 2 also reports the Kleibergen-Paap Wald rk F statistic to diagnose a potential weak instrument problem.[9] With values in the order of 20, the results suggest that we face no such weak instrument bias – the values are well above the critical values compiled by Stock and Yogo (2002) (for the i.i.d. case) and the rule-of-thumb value of 10 suggested by Staiger and Stock (1997).

[8] *AHD* also find that the absolute size of the import exposure coefficient rises in the IV specification.

[9] The Kleibergen-Paap statistic (Kleibergen and Paap; 2006) is appropriate for use in the presence of non-i.i.d. errors, as opposed to the Cragg-Donald F statistic for the i.i.d. case.

Eastern Europe versus China The results so far refer to the joint impact of trade exposure with China and Eastern Europe. In Table (3) we consider the impact of trade exposure separately for Eastern Europe and China. We henceforth only report the IV estimates for the same three specifications as in columns 4 to 6 of Table (2), and for brevity we focus on the results for the main variables while omitting the other coefficients.[10]

Table 3: Trade exposure with Eastern Europe and China

	Dependent variable: 10-year change manufacturing employment / working age pop. in %-points					
	Eastern Europe trade			China trade		
Δ import exposure	-0.760*	-0.911**	-0.929**	-0.079	-0.121	-0.162*
	(0.44)	(0.40)	(0.37)	(0.07)	(0.07)	(0.08)
Δ export exposure	0.626*	0.905***	0.897***	-0.025	0.756	0.536
	(0.32)	(0.31)	(0.31)	(0.85)	(0.92)	(0.97)
Federal state dummies	Yes	Yes	-	Yes	Yes	-
Time dummy	Yes	Yes	-	Yes	Yes	-
State x time interactions	-	-	Yes	-	-	Yes
Further control variables	-	Yes	Yes	-	Yes	Yes
R-squared	0.155	0.287	0.166	0.157	0.376	0.261
First stage (KP)	12.697	12.482	13.227	11.983	10.528	10.268

Observations: 739. Standard errors clustered at spatial level (50 regions) in parentheses. IV estimates, including federal state and time interactions and all controls described in the benchmark specification. Levels of significance: *** 1 %, ** 5 %, * 10 %.

Table (3) suggests that trade exposure with Eastern Europe had much stronger and more significant impacts on German manufacturing employment than trade exposure with China. For China, the coefficients are small and not (or only marginally) significant. For Eastern Europe, we find highly significant effects that are larger in absolute terms than the overall effects reported in Table (2). This suggests that the global effects of trade exposure with the East are actually driven by the import and export exposure with respect to Eastern Europe. A potential problem of this specification, however, is omitted variable bias since we consider trade exposure just with respect to one area while leaving out the (potentially relevant) exposure of the other area.

Net export exposure We tackle this issue in Table (4). Here we consider *net* export exposure of Germany with respect to China and Eastern Europe, which are now included in the same regression. For consistency, we instrument German net exposure with the net exports of the instrument countries vis-a-vis Eastern Europe and China, respectively. The message of Table (4) is consistent with our previous findings. The

[10]The instruments are now constructed consistently from the import and export flows of the countries in the instrument group with Eastern Europe and, respectively, with China.

Table 4: Net Trade exposure and manufacturing employment

	Dependent variable: 10-year change manuf. emp. / working age pop. in %-points		
Δ net exposure to	0.671*	0.838**	0.825**
Eastern Europe trade	(0.40)	(0.38)	(0.38)
Δ net exposure to	-0.037	0.069	0.079
China trade	(0.14)	(0.13)	(0.13)
Federal state dummies	Yes	Yes	-
Time dummy	Yes	Yes	-
State x time interactions	-	-	Yes
Further control variables	-	Yes	Yes
R-squared	0.160	0.301	0.188
First stage (KP)	58.664	66.871	79.910

Observations: 739. Standard errors clustered at spatial level (50 regions) in parentheses. IV estimates, including federal state and time interactions and all controls described in the benchmark specification. Levels of significance: *** 1 %, ** 5 %, * 10 %.

positive impact of export exposure seems to dominate the negative effect of import exposure on manufacturing employment in Germany. Furthermore, net export exposure only has a significant effect for Eastern Europe, but not for China, again suggesting that the impact of trade with the former area is economically more important for Germany.

Benchmarking the impact of trade on manufacturing employment What do these empirical results imply quantitatively? The results from Table (2) clearly suggest, that the rapid increase of trade integration with the East in the last 20 years had a positive overall effect and strengthened manufacturing employment in Germany. This can be seen from the higher estimated effect of exports relative to imports, and from the relatively stronger increase in export exposure relative to import penetration.

Our preferred estimates from column 6 of Table (2) imply that a 10-year change of € 1,000 per worker in import exposure reduces manufacturing employment relative to working age population by 0.177 percentage points in the aggregate, whereas export exposure increases this share by 0.387 percentage points. Taking into account that export exposure per worker increased by € 7,060 from 1988-2008 and import exposure by € 6,147, we can calculate that the new export opportunities increased normalized manufacturing employment by 2.73 percentage points. Import competition reduced it by "only" 1.09 percentage points, thus leading to a net increase in manufacturing employment in the economy as a result of the deeper trade integration.

To set these numbers into perspective, it is important to note that the manufacturing sector has been declining in Germany over the period 1988 to 2008 overall, representing a general trend of structural change away from manufacturing and towards modern service industries. Figure 2 shows that, in Western Germany, the share of manufacturing employment (measured in full-time equivalents) in the working age population dropped from 16 percent in 1988 to around 12 percent in 2008. This downward trend happened mostly in the first decade and then slowed down somewhat. Our estimates indicate that trade integration with Eastern Europe and China has slowed down this general trend, that is, it has retained manufacturing in the German economy in the past two decades. Below we conduct some additional quantitative explorations, where we benchmark the overall impact of trade on total employment in Germany (see Section 4.2.).

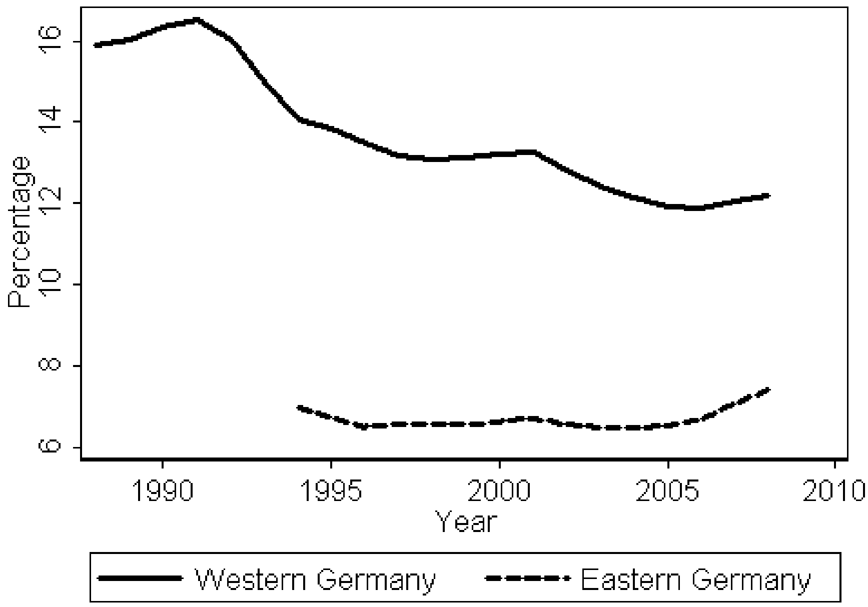


Figure 2: Percentage of manufacturing employees in working age population

3.3 Robustness checks

3.3.1 Identification

How robust are our results with respect to the definition of the "instrument group" of countries whose trade flows with China and Eastern Europe are used in the definition of (3) and (4)? To address this point, we re-estimate our baseline model with varying instruments (see Table 5).

In column 1, we first specify an over-identified model instead of the just identified IV model used as the benchmark. This approach exploits the detailed variation of the trade flows of the single instrument countries with China/Eastern Europe instead of adding up those trade flows. As can be seen, the results are similar as before, and the

Table 5: Robustness checks: Variations in instrumental variables

	Dependent variable: 10-year change manufacturing employment / working age pop. in %-points			
	Over-identified	Leave out UK	Add USA	Placebo CY, IS, UAE
Δ import exposure	-0.116**	-0.175***	-0.188**	-0.124
	(0.05)	(0.07)	(0.08)	(0.13)
Δ export exposure	0.377**	0.385**	0.362*	0.282
	(0.15)	(0.19)	(0.19)	(0.25)
R-squared	0.269	0.264	0.261	0.260
First stage (KP)	58.993	12.607	18.623	3.659
p Hansen	0.113			

Observations: 739. Standard errors clustered at spatial level (50 regions) in parentheses. IV estimates, including federal state and time interactions and all controls described in the benchmark specification. Levels of significance: *** 1 %, ** 5 %, * 10 %.

Hansen's J test which we can now perform further corroborates the validity of our instrument set (although not by a huge margin).

In columns 2 to 4 we change the countries that are included in the instrument group. Recall that the validity of our identification approach hinges on the ability of the instrument to purge domestic shocks that simultaneously affect German regional employment and trade patterns. As explained above, we have therefore excluded direct neighbors of Germany as well as members of the European Monetary Union. There is still the concern that there might be an independent effect of the trade flows between China/Eastern Europe and those "instrument group" countries on German regions, which in turn would violate the exclusion restriction. This may be particularly relevant for the United Kingdom, which among the countries in the instrument group is the most important trading partner of Germany. We therefore drop the UK from the instrument group and re-estimate the (just identified) baseline specification. The results in column 2 show, however, that the estimation results are almost the same as in the baseline specification. In column 3 we add the USA to the instrument group, but again this hardly affects our estimation results. Finally, in column 4, we consider a placebo test by including only such countries in the instrument group, whose economic structures are totally dissimilar from Germany's, namely Cyprus, Iceland and the United Arab Emirates. As expected, the Kleibergen-Paap statistics indicate that these results are strongly biased due to weak instruments. Summing up, Table 5 suggests that our baseline specification indeed leads to a credible identification, as the adopted baseline instrument has both explanatory power in the first stage and does not violate the conditions for validity.

Another concern for identification is that the changes in manufacturing employment and trade exposure may be simultaneously driven by a common long-run trend.

For example, employment in some manufacturing industries may have been on a secular decline even before the rise of the East kicked in, and the decreasing domestic production may then have been substituted by imports from the East. Similarly, industries may have boomed even before the mid-1980s, so that export exposure with the East was rather a symptom than a cause of domestic employment gains in manufacturing. The results in Appendix Table A.4 suggest, however, that this is actually not the case. There we have considered a falsification test, where the change in manufacturing employment lagged by 10 years is regressed on the contemporaneous trade exposure with the East. The results show that lagged employment changes do not "predict" future regional trade exposure; in fact, coefficients are insignificant or even change sign. This robustness check thus further corroborates that our main results capture the *causal* effect of trade exposure on domestic manufacturing employment.

3.3.2 Particular industries

Next, we check the sensitivity of our results to the omission of specific industries. We re-estimate the baseline model and drop, in each specification, one industry from the data set which is among the top ten sectors when it comes to bilateral trade values in 2008 (Table A.5 in the appendix). We find that leaving out the automobile industry or its most important suppliers (which constitute by far the most important export sector for the German economy) strongly decreases the coefficients for both import and export exposure. This highlights the importance of the car industry for both German manufacturing employment and trade. Omitting other industries, however, does not lead to a notable change in our estimated IV coefficients, compared to the baseline findings, although increasing standard errors sometimes render the estimated coefficients insignificant.

3.3.3 Regional classification

In the baseline specification, we have included all 413 (Eastern and Western) German regions in the analysis. Since we have data for Eastern Germany only after the German reunification, there are thus only 326 regions available in the first period. As a robustness check, we exclude all Eastern German regions also in the second period. The coefficients in Table A.6 (columns 1–3) in the appendix are similar as in our baseline estimation, so that all conclusions are qualitatively unchanged.

Finally, we investigate the robustness of our results with respect to the regional level of analysis. As an alternative to the 413 administrative NUTS-3 regions, we consider 50 aggregate labor market regions (Kropp and Schwengler; 2011), which are comparable constructs to the US commuting zones used by *AHD*. The resulting coefficients in columns 4–6 of Table A.6 are also similar to our baseline specification, though standard errors are larger. We thus prefer to stick to the more detailed regional level that offers more heterogeneity.

4 Other regional labor market outcomes

In this section we consider the impact of the rise of the East on other labor market outcomes across German regions.

4.1 Population shifts

The first important question is whether trade exposure induces population shifts across regions. In fact, if labor were perfectly mobile across space, workers should respond instantaneously to trade shocks by relocating between regions. The differential response of employment across local labor markets would then be less informative about the effects of trade liberalization, while the impacts would become visible in regional migration patterns or adjustments of local population sizes. In their analysis on the impact of Chinese import exposure, *AHD* emphasize that there seems to be a sluggish adjustment of population across local labor markets in the US. That is, labor markets seem to have adjusted mainly at the employment margin while there have been little population shifts in response to the (potential) Chinese import competition. In this subsection we analyze if a similar pattern emerges in the German case. Moreover, recall that the main outcome variable in the analysis above is the share of regional manufacturing employment in the total working age populations. To disentangle the impact of trade exposure on this outcome variable, it is therefore important to study the effects on regional population shifts.

The estimation results are reported in Table 6, column 1.[11] As can be seen, the impact of overall export exposure on the 10-year change in (log) regional working age populations is statistically not different from zero. That is, regions with industrial structures more strongly exposed to the new export opportunities in the East did not experience significant inward migrations, or other forms of population gains. For import exposure, we find a slightly negative impact on regional population sizes. This impact is weak at best, however, and significant only at the 10% level.

These findings, in combination with our baseline results from above, thus suggest that the adjustment in the German labor markets occurred mainly at the employment margin, that is, via the creation or destruction of manufacturing jobs, while there have been little or no induced population shifts. This interpretation is also consistent with the results reported in Appendix Table A.7, where we re-estimate the baseline

[11] All specifications in Table 6 are analogous to the baseline IV regression from column 6 of Table 2. For brevity we again focus on the main variables and omit the coefficients for the other controls.

Table 6: Other labor market indicators

	Dependent variables: 10-year change			
	log working age population	Total emp.	Unemployment	Non-manuf. emp.
		/ working age pop. in %-points		
Δ import exposure	-0.242*	-0.333**	0.005	-0.156
	(0.14)	(0.11)	(0.02)	(0.11)
Δ export exposure	0.244	0.663**	-0.097**	0.276
	(0.19)	(0.27)	(0.04)	(0.19)
R-square	0.151	0.103	0.070	0.177

Observations: 739. Standard errors clustered at spatial level (50 regions) in parentheses. IV estimates, including federal state and time interactions and all controls described in the benchmark specification. Levels of significance: *** 1 %, ** 5 %, * 10 %.

specification from above using the log change in *absolute* regional manufacturing employment, not divided by regional working age population, as the outcome variable. We obtain coefficients that are qualitatively in line with our main results.

Our finding that trade exposure has mainly affected employment rather than population sizes in German regions is in line with *ADH*'s results for the US case, which is plausible since it has been frequently argued in the literature that regional labor mobility is even lower in Germany than in the US (Bertola; 2000).

4.2 Total regional employment and unemployment

Columns 2 and 3 of Table 6 show that higher export exposure raises *total* regional employment, again measured relative to working age population, and lowers regional unemployment. However, non-manufacturing employment is not significantly positively affected by export exposure as is shown in column 4. That is, the rise of the East seems to benefit regions with export oriented industrial structures mainly through additional manufacturing jobs, which in turn raises the overall regional employment rate and reduces unemployment. Local "spillovers" of export exposure to the non-manufacturing sector may exist, for example, through a higher demand for services from the expanding manufacturing sector, since the impact of export exposure on non-manufacturing employment is estimated to be positive. Yet, standard errors are fairly large so that evidence does not generally support the hypothesis that export opportunities in the East also generate jobs beyond the tradable goods sector. We return to this issue in the next subsection, where we further disentangle employment reactions in different non-manufacturing industries that are not directly affected by the new market opportunities in the East, but that may be indirectly affected.

Turning to the impact of import exposure, we obtain results that largely mirror these effects. Regions with industrial structures more strongly exposed to import competition saw a stronger decline not only in manufacturing employment, but also in the total employment rate. Non-manufacturing employment also seems to be negatively affected, but the respective coefficient is again not significant. In short, import penetration from the East has caused job losses, clearly so in the manufacturing sector and possibly beyond. However, one dimension along which the results for import and export exposure seem to differ, is that a higher import exposure apparently does not increase regional unemployment. The estimated coefficient is positive, but it is fairly small and statistically insignificant. There are two possible explanations for this finding. First, in Germany, there are numerous active labor market policies that target workers who have been laid off (or face a substantial risk thereof). These programs may cushion possible adverse import shocks, as workers prone to becoming unemployed are either retained in their original job via measures such as *Kurzarbeit* where they reduce hours but remain with their original firm, or they may be transferred into an active labor market measure fairly quickly, in which case they are not counted as unemployed. Second, recall that we have found at least a small impact of import exposure on population shifts (see column 1 of Table 6), which suggests that at least some workers respond to local import shocks with migration to other regions with more favorable industrial structures.

Benchmarking the impact of trade Summing up, trade exposure seems to have broad employment effects on the affected regions such that export oriented regions experienced a net gain from the rise of the East, while import competing regions faced comprehensive job losses. Multiplying the coefficients from column 2 of Table 6 with the average observed increase in trade exposure per worker, we can calculate that export exposure increased total employment over working age population in the average region by 4.68 percentage points, while import exposure lowered it by 2.05 points. This suggests that there is a sizeable positive net impact of the rise of the East on total employment in Germany, somewhere in the ballpark of 1 million additional jobs that were created between 1988 and 2008 as a result of trade.

However, as we argued above, we employ our IV strategy to recover the causal effect of export and import exposure across local labor markets. Still, the exposure variables as constructed in (3) and (4) may contain German supply and demand shocks in addition to the exogenous component, namely the rise of the East in the world economy. Our back-of-the-envelope calculations are, hence, likely to overstate the effect of trade integration on normalized employment changes. To address this, we follow *ADH* and employ a simple decomposition exercise. The idea is to isolate the share of the exposure variables (3) and (4), which is driven by the exogenous forces of increased trade exposure.[12] This gives a more conservative estimate of the impact of exports on employment over working age population of 2.34 percentage points. Analogously, this procedure yields an estimate of -1.38 percentage points for the impact of imports. These estimates together imply a net gain of 492,455 full-time equivalent jobs in the period 1988-2008 that would not exist without the rise of the East.

4.3 Disentangling the impact of non-manufacturing industries

In the last step of the aggregate analysis, we investigate in greater detail the impact of trade exposure on employment in non-manufacturing industries. Recall that we have not found statistically significant effects when lumping all non-manufacturing activities together (see column 4 of Table 6). However, those coefficients for the overall effects may mask more specific impacts of trade on particular industries within that category. In Table A.8 in the Appendix we distinguish four different non-manufacturing sectors (construction, personal services, business services and the public sector) and re-estimate our baseline specification for each of those industry groups.

As can be seen, there are virtually no effects on local employment in construction or personal services, neither with respect to import nor with respect to export exposure. However, we do find sizable and statistically highly significant employment effects in business service industries that go into the same direction as the employment effects in the manufacturing sector. More specifically, a region strongly exposed to exports to the East not only experienced job gains within the tradable goods sector (manufacturing) but also in local business services. The reason is likely a localized cross-industry demand spillover: As manufacturing industries expand in Eastern markets, they not only build up domestic employment in the own industry but also require further intermediate inputs such as business services. The induced demand generates jobs in those service industries, and this effect seems to be locally tied to the rise of the downstream manufacturing sector. Analogously, regions with higher import exposure experienced stronger job losses not only in the manufacturing sector that is directly affected by the displacement from Eastern import penetration, but also suffer from complimentary job losses in business services. For personal services and construction, we do not find evidence for such spillovers of trade on employment, at least these spillover effects do not appear to be localized in the German case.

As for the impact of trade exposure on local public sector employment, we find that it is also virtually nil. On the one hand, demand spillovers from manufacturing to the public sector are very unlikely to play a role, which is consistent with our empirical findings. Yet, the government may try to compensate job losses in private industry

[12] The decomposition relies on the relationship between the IV and the OLS estimators. See *AHD* for details. Performing the exercise separately for exports and imports, we estimate that the fraction in the export exposure variables that is explained by exogenous forces to be 0.499 and 0.675 for imports.

by expanding public employment particularly in such locations that face stiff import penetration. However, for the case of Germany we do not find evidence for such a causal effect of trade on public sector jobs.

5 Worker level evidence

The analysis so far has focussed on the impact of trade exposure on regional labor market aggregates. In this final section, we extend our analysis along the lines of Autor, Dorn, Hanson and Song (2012) to the individual level, using detailed micro data on employment histories of German manufacturing workers.

From the perspective of a single worker, trade liberalization may increase the risk of displacement, if the own job is subject to high (potential) import competition. An extensive literature (Topel; 1990; von Wachter and Bender; 2006; Sullivan and von Wachter; 2009) documents that, if displaced workers have to find new jobs and acquire human capital specific to their new employers, this in turn can lead to adverse effects on employment biographies in terms of reduced employment and earnings spells. On the other hand, export opportunities can have a countervailing stabilizing effect on individual employment relationships. Workers who are involved in the production of goods that are increasingly in demand from abroad, might face a lower probability of job termination. Holding everything else constant, they may even be able to accumulate firm- and industry-specific human capital and raise their long-term labor market prospects.

5.1 Data and variables

We use the Sample of Integrated Labour Market Biographies (SIAB, cf. Dorner et al.; 2010). This data stems from all German social security notifications in the years 1975 to 2008. A two percent random sample has been drawn from all persons who have either been employed or officially registered as job-seekers resulting in an individual-level spell data set with information on age, sex, nationality, qualification, occupation, spell durations, etc. This data is highly accurate even on a daily base due to its original purpose of calculating retirement pensions. Since the notifications of employees are passed by their employers, establishment level data from the Establishment History Panel (BHP) can be merged to this data set. To be consistent with the periods considered at the regional level, we analyze individuals who have been employed in the manufacturing sector either in 1988 or 1998 and construct our dependent variable as cumulative days in employment over the following ten years. We only consider working age persons (22 – 64 years) in the respective period.

The trade exposure indices are constructed similarly as before. Yet, we now construct them at the *industry* level, in order to measure trade exposure at the level of an individual worker. The intuition is that manufacturing workers often have acquired sector- and occupation-specific human capital, so that they cannot switch instantaneously between occupations and industries. The change in import penetration per worker from both China and Eastern Europe (indexed by k) over the period $t = \{1988 - 1998, 1998 - 2008\}$ in a German industry j is defined as

$$\Delta IP_{jt} = \frac{\Delta Im_{jt}^{EAST}}{E_{jt}}, \tag{6}$$

where ΔIm_{jt}^{EAST} is the change in imports from China and Eastern Europe to Germany over period t, and E_{jt} is total employment in industry j at the beginning of the period. Analogously, the change in export opportunities per worker in industry j is

$$\Delta EP_{jt} = \frac{\Delta Ex_{jt}^{EAST}}{E_{jt}}, \tag{7}$$

where ΔEx_{jt}^{EAST} is the respective change in exports of industry j from Germany to China and Eastern Europe. See Table 7 for an overview of the data.

Our focus is the identification of the causal effect of the rise of the East on individual worker biographies in German manufacturing. Hence, we again rely on a instrumental variable approach for identification. We construct the following instruments:

$$\Delta IP_{ijt} = \frac{\Delta Im_{j-3t}^{EAST-other}}{E_{j-3t-3}} \quad \text{and} \quad \Delta EP_{ijt} = \frac{\Delta Ex_{j-3t}^{EAST-other}}{E_{j-3t-3}} \tag{8}$$

where we use the trade flows of the same set of countries as in the previous section. We use lagged employment shares of the sectors where workers were employed three years prior to the start of the period to avoid a possible influence of sorting of workers due to anticipation of future trade exposure.

In the regression, we again control for the regional shares of tradeable goods industries and interaction terms for federal states and time periods. Additionally, we use standard Mincerian individual-level variables in the list of controls, as well as dummies to control for year of birth. Since import and export exposure only vary across industries, one could worry that they capture industry-level effects that correlate with the change in trade exposure. To mitigate this multi-level problem, we also include further industry-level control variables (Herfindahl-Index, the Ellison and Glaeser (1997) agglomeration-index, share of plants younger than two years, average establishment size, share of highly qualified employees, and share of employees older than 50) in the regression. Throughout, we cluster standard errors at the industry-time level.

Table 7: Means and standard deviations of main variables for manufacturing workers

	1988-1998		1998-2008	
	Outcome variables			
Cumulative years of employment	7.50	(3.03)	7.85	(2.96)
Cumulative years of employment in original establishment	5.68	(3.72)	5.58	(3.90)
Cumulative years of employment in original 3-digit industry	6.10	(3.67)	6.21	(3.82)
Cumulative years of employment in original labor market region	7.04	(3.28)	7.17	(3.39)
	Trade exposure			
Δ imports per worker$_{t=0}$				
Eastern Europe	4.74	(4.92)	6.61	(9.42)
China	1.55	(3.85)	6.60	(20.26)
Both	6.32	(7.25)	13.24	(22.80)
Δ exports per worker$_{t=0}$				
Eastern Europe	5.92	(5.54)	13.16	(10.81)
China	0.39	(0.96)	3.86	(4.40)
Both	6.29	(5.93)	17.33	(13.44)

Trade exposure measured in €1,000 per worker

5.2 Results

The first two columns in Table 8 display the effects of an increase in Eastern trade exposure on the total number of days in employment over a 10 year period. While column (1) refers to the OLS estimation, we implement our IV strategy in column 2. The interpretation of the export exposure coefficient in column 2 is that a €1,000 increase in industry exports per worker increases the expected time of employment over 10 years by 3.32 days ($= 0.91 \cdot \frac{365}{100}$), ceteris paribus. Given that the average worker in manufacturing has faced an increase of export exposure by more than €17,000 over a ten year period, this implies that expected employment at the worker level has increased by about 56 days due to increasing export exposure. At the same time, an increase in import exposure has an opposing negative effect on job stability. For a worker who faces the average increase in imports by €6,290 in the second period, we estimate that time of employment over 10 years is reduced by 8.3 days. These results imply that the rise of the East overall has stablized employment relationships and reduced the individual risk of job termination. This confirms our previous findings at the regional level, namely that exports opportunities on average more than offset the negative effects of rising import competition from the East.

Our data permits us to further disaggregate the effect, and to investigate how trade exposure affects job stability for individual workers at the plant-, industry-, or region-

Table 8: Eastern trade exposure and individual employment

	Dependent variable: 100 x cumulative years of employment over 10 year period				
	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)
	total	total	plant	3-digit ind.	region
Δ Imports	-0.17	-0.36**	-1.04***	-0.92***	-0.61***
per worker$_{t=0}$	(0.11)	(0.17)	(0.30)	(0.34)	(0.24)
Δ Exports	0.85***	0.91***	1.36	1.11	1.46***
per worker$_{t=0}$	(0.19)	(0.35)	(0.90)	(0.89)	(0.48)
Employed in tradable	5.23	5.33	14.93	-18.43*	9.11
goods industry in $t = 0$	(5.58)	(5.79)	(10.24)	(10.08)	(6.56)
Female	-182.27***	-181.99***	-127.36***	-146.56***	-160.01***
	(3.91)	(3.81)	(5.18)	(4.87)	(4.24)
Foreign citizen	-52.78***	-52.70***	-27.94***	-36.41***	-39.69***
	(2.86)	(2.86)	(4.16)	(4.19)	(3.34)
Low skilled	-29.25***	-29.02***	-16.19***	-21.98***	-17.86***
	(2.07)	(2.05)	(2.97)	(2.92)	(2.43)
High skilled	32.90***	32.99***	-43.89***	-23.64***	-32.74***
	(3.45)	(3.41)	(5.24)	(7.17)	(5.87)
Industry level controls	Yes	Yes	Yes	Yes	Yes
R-square	0.197	0.112	0.085	0.087	0.086
First Stage (KP)		4.537	4.537	4.537	4.537

Observations: 185,335. Standard errors clustered by 186 industry × start of period cells in parentheses. Control variables include dummy variables for start of period tenure, plant size, year of birth and federal state × period fixed effects. Models (3) – (5) consider cumulative employment only within the original establishment, 3-digit industry, and region, respectively. * p ≤ 0.10, ** p ≤ 0.05, *** p ≤ 0.01

level. Such effects might not be visible when looking only at total employment, since individuals might have changed jobs across plants, industries, or regions without a notable unemployment spell. The results reported in columns 3–5 indeed show that trade exposure with the East has caused significant job turnover that is not observable at the aggregate level. Increased exposure to import competition by € 1,000 reduces the expected time spent with the original employer by 3.8 days and, respectively, the original 3-digit industry by 3.4 days. That is, import exposure has causally increased job churning both within and across industries. On the other hand, rising export exposure has a converse but imprecisely estimated effect on those job stability indicators. Furthermore, we find that employees in industries with high export exposure are significantly less likely to relocate to other regions. These findings are in line with and complementary to the aggregate results discussed before.

6 Discussion and conclusion

The past decades have seen a strong increase in the volume of international trade. Deregulation and the abolishment of trade barriers as well as drastic reductions in transport costs have led to a steadily increasing integration of national economies. In this paper, we focus on two major facets of globalization: China's explosive ascent and the rise of Eastern Europe after the fall of the Iron Curtain. Understanding the consequences of those developments for the labor markets in the traditional Western market economies is crucial, both from an economic and a political point of view.

We analyze the *causal* impact of the rise of China and Eastern Europe on the performance of local labor markets in Germany during the period 1988 to 2008, using an instrumental variable approach pioneered by Autor, Dorn and Hanson (2012). At the regional level, Germany is characterized by a substantial variation in local industrial structures. These initial structures determine how the regions were affected by the rising trade exposure that kicked in since the mid 1990s.

Two main messages can be derived from our analysis: First, the rise of Eastern Europe had much more immediate consequences for the German economy than the rise of China. Second, overall, the rise in trade exposure has led to substantial employment gains in the German economy, but these gains are highly unevenly distributed across space. In fact, some regions have lost jobs as a result of the deeper trade integration, both in the manufacturing sector and beyond. But those losses were, in the aggregate, more than offset by additional jobs created in regions with industrial structures that allowed them to take advantage of the new export opportunities in the East. In our analysis at the individual level we complement this aggregate picture and show that trade exposure has, overall, led to more stable employment relationships by reducing the risk of job termination. However, trade again produces winners and losers, since workers in import competing industries indeed faced an increased risk of job churning and lower overall employment spells.

Our results for the German economy differ quite substantially from the findings of Autor, Dorn and Hanson (2012) for the United States. Trade liberalization with China is likely to bring about welfare gains also for the US case, for example through gains in productivity or consumption diversity. Yet, these authors stress that in the short-to-medium run, the US economy has to face severe adverse effects on local labor markets, even when taking into account that the rise of China not only creates import penetration but also new export opportunities. The situation of Germany seems to be quite different, at least on average, as the overall labor market consequences are largely positive even in the medium run. This finding may be explained by the fact that overall trade with China is much more balanced in the German than in the US case. Furthermore, our analysis suggests that focusing only on China provides an incomplete picture. The rise of Eastern Europe had a much stronger impact on German local labor markets than the rise of China, possibly reflecting the fact that the Eastern European markets are located (much) closer by.

In our main analysis, we assign sector level trade data to German regions according to their initial industrial structures. This approach has the caveat that we can only observe the *potential* trade exposure with the East. It is not possible to directly relate trade flows to specific firms or local industries. Hence, we have to assume that all German firms in a given sector are affected more or less uniformly by the rise of the East. An advantage of our approach is that it allows to analyze the local adjustments to trade exposure along many different margins. Our main focus on manufacturing employment is interesting, because in most industrialized countries there has been a long-run trend of structural change where employment secularly shifted away from the manufacturing sector and towards modern service industries. Our results suggest that trade with the East has per se decelerated this declining trend, and contributed to retaining the manufacturing sector in the German economy.

References

Amiti, M. and Davis, D. R. (2012). Trade, firms, and wages: Theory and evidence, *Review of Economic Studies* **79**(1): 1–36.

Antras, P., Garicano, L. and Rossi-Hansberg, E. (2006). Offshoring in a knowledge economy, *Quarterly Journal of Economics* **121**(1): 31–77.

Artuc, E., Chaudhuri, S. and McLaren, J. (2010). Trade shocks and labor adjustments: A structural empirical approach, *American Economic Review* **100**(3): 1008–1045.

Autor, D. H., Dorn, D. and Hanson, G. H. (2012). The china syndrome: Local labor market effects of import competition in the united states, NBER Working Paper No. 18054.

Autor, D. H., Dorn, D., Hanson, G. H. and Song, J. (2012). Trade adjustment: Worker level evidence, Working paper presented at the 2012 SOLE Annual Meetings.

Bernard, A. B., Jensen, J. B. and Schott, P. K. (2006). Survival of the best fit: Exposure to low-wage countries and the (uneven) growth of u.s. manufacturing plants, *Journal of International Economics* **68**(1): 219–237.

Bertola, G. (2000). Labor markets in the european union, ifo Studien 1/2000, pp. 99-122.

Bloom, N., Draca, M. and Van Reenen, J. (2011). Trade induced technical change? the impact of chinese imports on innovation, it and productivity, NBER Working Paper No. 16717.

Blossfeld, H.-P. (1987). Labor market entry and the sexual segregation of careers in the federal republic of germany, *American Journal of Sociology* **93**(1): 89–118.

Blum, B. S. (2008). Trade, technology, and the rise of the service sector: The effects on us wage inequality, *Journal of International Economics* **74**(2): 441–458.

Chiquiar, D. (2008). Globalization, regional wage differentials, and the stolper-samuelson theorem: Evidence from mexico, *Journal of International Economics* **74**(1): 70–93.

Dorner, M., Heining, J., Jacobebbinghaus, P. and Seth, S. (2010). The sample of integrated labour market biographies, *Schmollers Jahrbuch - Journal of Applied Social Science Studies* **130**(4): 599–608.

Ebenstein, A., Harrison, A., McMillan, M. and Phillips, S. (2011). Estimating the impact of trade and offshoring on american workers using the current population surveys, Working Paper.

Ellison, G. and Glaeser, E. L. (1997). Geographic concentration in u.s. manufacturing industries: A dartboard approach, *Journal of Political Economy* **105**(5): 889–927.

Feenstra, R. C. and Hanson, G. H. (1999). The impact of outsourcing and high-technology capital on wages: Estimates for the u.s., 1979-1990, *Quarterly Journal of Economics* **114**(3): 907–940.

Feenstra, R. C. and Wei, S.-J. (2010). *China's Growing Role in World Trade*, NBER and University of Chicago Press.

Grossman, G. M. and Rossi-Hansberg, E. (2008). Trading tasks: A simple theory of offshoring, *American Economic Review* **98**(5): 1978–1997.

Harrigan, J. (2000). International trade and american wages in general equilibrium, 1967-1995, *in* R. C. Feenstra (ed.), *The Impact of International Trade on Wages*, University of Chicago Press, pp. 171 – 196.

Harrison, A., McLaren, J. and McMillan, M. (2010). Recent findings on trade and inequality, NBER Working Paper No. 16425.

Kleibergen, F. and Paap, R. (2006). Generalized reduced rank tests using the singular value decomposition, *Journal of Econometrics* **133**(1): 97–126.

Kovak, B. K. (2011). Local labor market effects of trade policy: Evidence from brazilian liberalization, mimeo, Carnegie Mellon University.

Kropp, P. and Schwengler, B. (2011). Abgrenzung von arbeitsmarktregionen * ein methodenvorschlag, *Raumforschung und Raumordnung* **69**(1): 45–62.

McLaren, J. and Hakobyan, S. (2010). Looking for local labor market effects of nafta, NBER Working Paper No. 16535.

Poletaev, M. and Robinson, C. (2008). Human capital specificity: Evidence from the dictionary of occupational titles and displaced worker surveys, 1984-2000, *Journal of Labor Economics* **26**(3): 387–420.

Robertson, R. (2004). Relative prices and wage inequality: evidence from mexico, *Journal of International Economics* **64**(2): 387–409.

Spengler, A. (2008). The establishment history panel, *Schmollers Jahrbuch - Journal of Applied Social Science Studies* **128**(3): 501–509.

Staiger, D. and Stock, J. H. (1997). Instrumental variables regression with weak instruments, *Econometrica* **65**(3): 557–586.

Stock, J. H. and Yogo, M. (2002). Testing for weak instruments in linear iv regression, NBER Technical Working Paper No. 284.

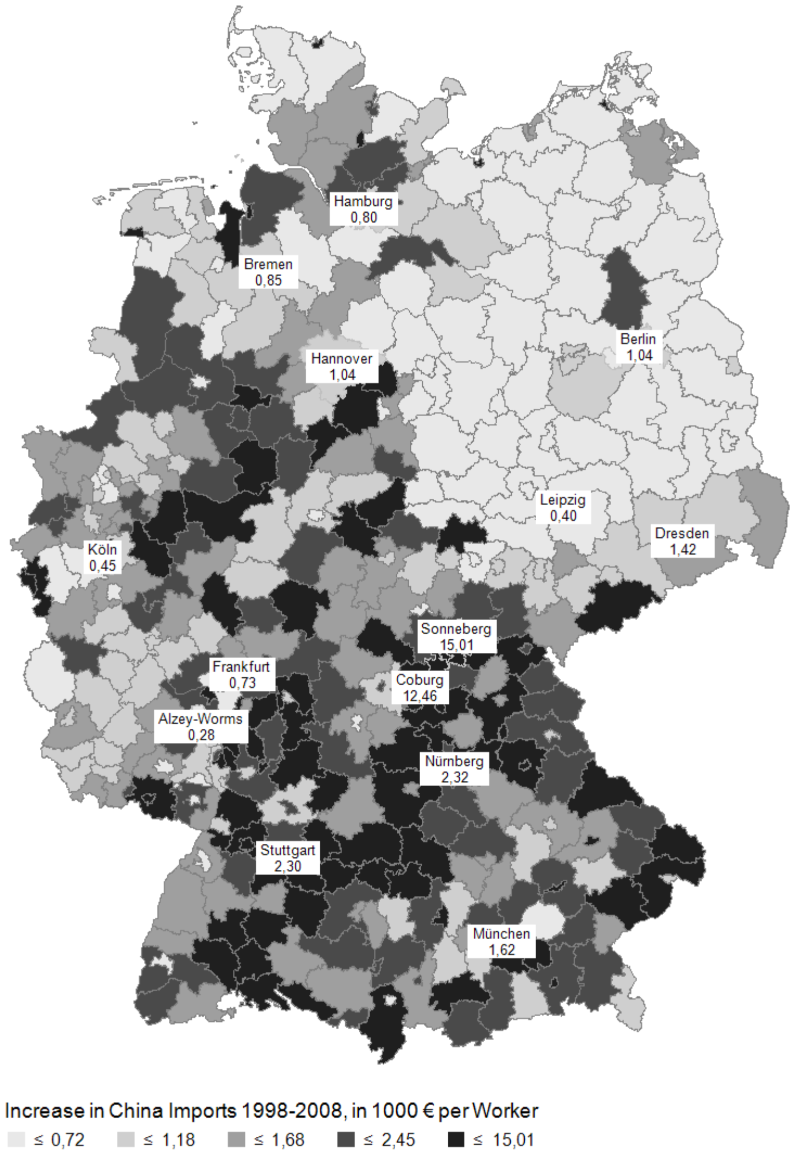
Sullivan, D. and von Wachter, T. (2009). Job displacement and mortality: An analysis using administrative data, *Quarterly Journal of Economics* **124**(3): 1265–1306.

Topalova, P. (2010). Factor immobility and regional impacts of trade liberalization: Evidence on poverty from india, *American Economic Journal: Applied Economics* **2**(4): 1–41.

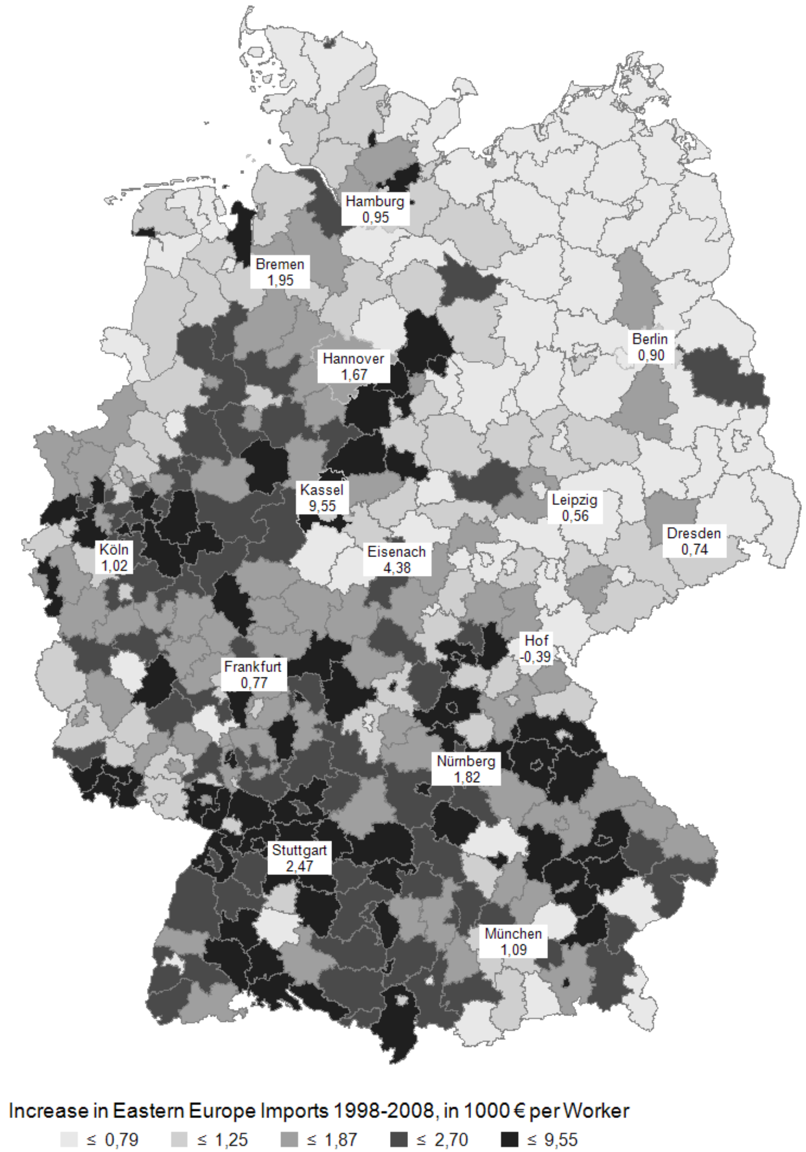
Topel, R. (1990). Specific capital and unemployment: Measuring the costs and consequences of job loss, *Carnegie-Rochester Conference Series on Public Policy* **33**(1): 181–214.

Verhoogen, E. (2008). Trade, quality upgrading, and wage inequality in the mexican manufacturing sector, *Quarterly Journal of Economics* **123**(2): 489–530.

von Wachter, T. and Bender, S. (2006). In the right place at the wrong time: The role of firms and luck in young workers' careers, *American Economic Review* **96**(5): 1679–1705.

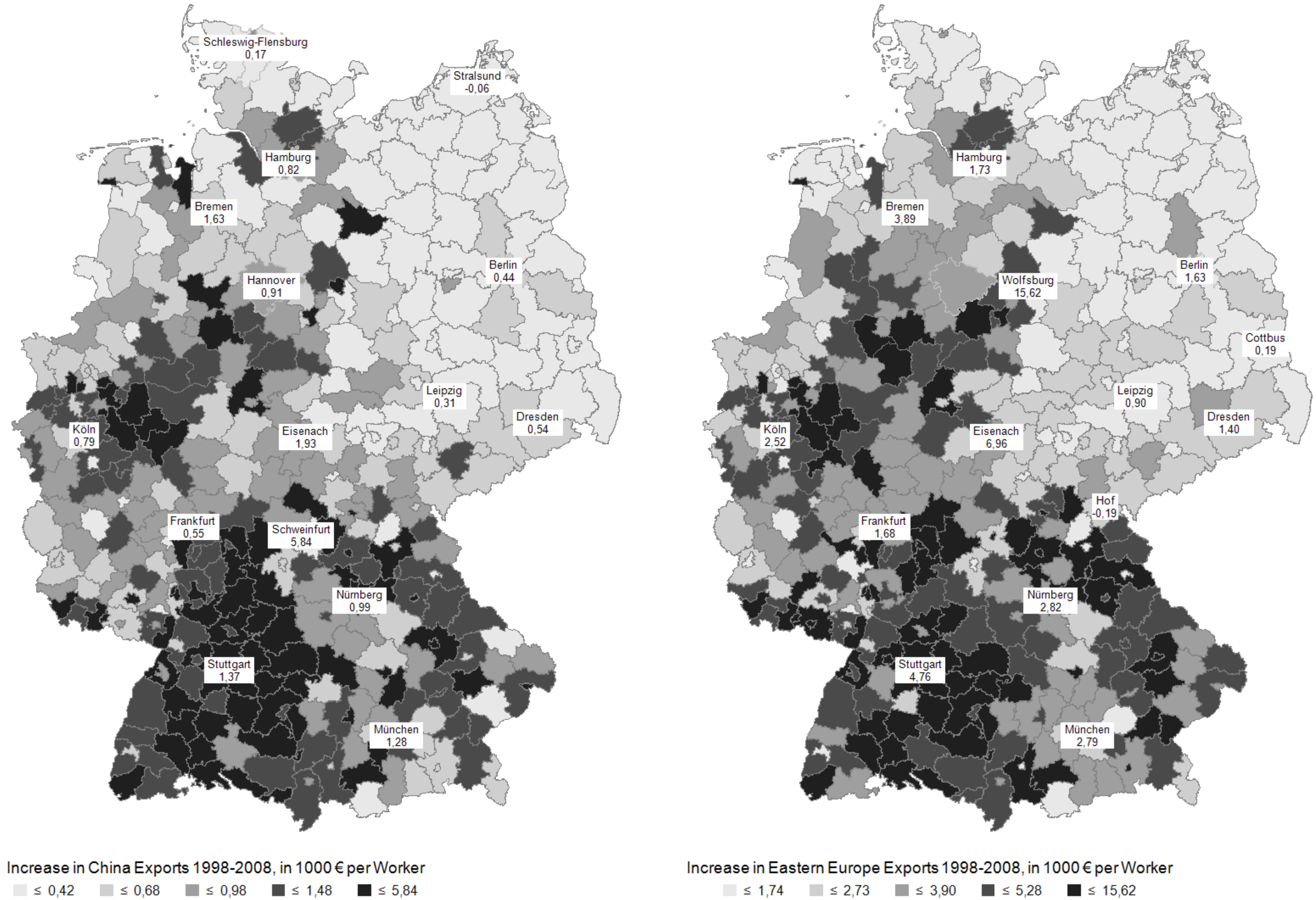


(a) China



(b) Eastern Europe

Figure A.1: Change in import exposure 1998-2008



(a) China

(b) Eastern Europe

Figure A.2: Change in export exposure 1998-2008

Appendix Tables

Table A.1: Means and standard deviations of main variables

	1988-1998		1998-2008	
	Outcome variables			
10-year change manuf. employment / working age pop. in %-points	-2.51	(2.71)	-0.15	(2.21)
	Trade exposure			
Change in import exposure				
Eastern Europe	1.80	(1.00)	1.85	(1.30)
China	0.59	(0.52)	1.90	(1.88)
Both	2.40	(1.32)	3.75	(2.65)
Change in export exposure				
Eastern Europe	2.17	(1.01)	3.71	(2.27)
China	0.13	(0.11)	1.04	(0.82)
Both	2.31	(1.05)	4.75	(3.00)
	Control variables			
Initial shares in total labor force				
Manuf. of tradable goods	35.52	(12.81)	27.42	(12.69)
Routine occupations	41.34	(4.46)	36.42	(4.41)
High skilled	4.30	(2.43)	7.09	(3.76)
Foreigners	6.46	(3.71)	5.86	(4.26)
Women	38.50	(13.98)	40.41	(13.35)

Trade exposure in € 1,000 per worker. Control variables in percent.

The sectoral composition of German trade

Table A.2: Trade volumes of the top ten sectors in trade with Eastern Europe

	Industry	2008	1998	1988
Imports from Eastern Europe				
111	Extraction of crude petroleum and natural gas*	20700	2340	1460
341	Manuf. of motor vehicles	7100	4440	76
343	Manuf. of parts and accessories for motor vehicles and their engines	6830	1610	11
274	Manuf. of basic precious and non-ferrous metals	4280	1940	992
271	Manuf. of basic iron and steel and of ferro-alloys (ECSC1)	3510	949	402
316	Manuf. of electrical equipment n.e.c.	3350	1260	26
361	Manuf. of furniture	3260	2260	449
291	Manuf. of machinery for the production and use of mechanical power, except aircraft, vehicle and cycle engines	3080	727	85
241	Manuf. of basic chemicals	3010	1300	442
287	Manuf. of other fabricated metal products	2500	1190	75
Exports to Eastern Europe				
341	Manuf. of motor vehicles	13300	3970	248
343	Manuf. of parts and accessories for motor vehicles and their engines	9180	2610	92
295	Manuf. of other special purpose machinery	7830	3400	1250
291	Manuf. of machinery for the production and use of mechanical power, except aircraft, vehicle and cycle engines	5390	1500	413
252	Manuf. of plastic products	5280	2090	577
241	Manuf. of basic chemicals	4990	1540	989
292	Manuf. of other general purpose machinery	4500	1710	447
287	Manuf. of other fabricated metal products	4030	1360	128
244	Manuf. of pharmaceuticals, medicinal chemicals and botanical products	3950	1000	245
312	Manuf. of electricity distribution and control apparatus	3900	1440	155

Trade volumes measured in Million Euros of 2005. *: This industry and all other industries related to agriculture, mining and fuel products are omitted in the empirical analysis.

Table A.3: Trade volumes of the top ten sectors in trade with China

	Industry	2008	1998	1988
Imports from China				
300	Manuf. of office machinery and computers	8630	1160	12
182	Manuf. of other wearing apparel and accessories	4950	1900	704
365	Manuf. of games and toys	3280	658	46
323	Manuf. of television and radio receivers, sound or video recording or reproducing apparatus and associated goods	2930	700	171
321	Manuf. of electronic valves and tubes and other electronic components	2920	123	2
322	Manuf. of television and radio transmitters and apparatus for line telephony and line telegraphy	1740	172	8
287	Manuf. of other fabricated metal products	1510	390	40
177	Manuf. of knitted and crocheted articles	1360	199	24
241	Manuf. of basic chemicals	1200	335	115
297	Manuf. of domestic appliances n.e.c.	1190	392	10
Exports to China				
341	Manuf. of motor vehicles	3530	238	209
295	Manuf. of other special purpose machinery	3220	1050	590
291	Manuf. of machinery for the production and use of mechanical power, except aircraft, vehicle and cycle engines	2740	248	108
294	Manuf. of machine-tools	1900	376	306
312	Manuf. of electricity distribution and control apparatus	1650	277	54
343	Manuf. of parts and accessories for motor vehicles and their engines	1640	114	31
292	Manuf. of other general purpose machinery	1570	388	112
353	Manuf. of aircraft and spacecraft	1310	182	11
332	Manuf. of instruments and appliances for measuring, checking, testing, nav. and other purposes, except industrial process control equipment	1220	168	84
311	Manuf. of electric motors, generators and transformers	1200	83	26

Trade volumes measured in Million Euros of 2005.

Further results

Table A.4: Falsification: Lagged change in manuf. employment and future trade exposure

	Dependent variable: Lagged 10-year change manufacturing employment / working age pop. in %-points					
	Joint		Eastern Europe trade		China trade	
Δ import exposure	0.080	0.105*	0.542**	0.482*	-0.131	-0.053
	(0.06)	(0.05)	(0.24)	(0.26)	(0.08)	(0.06)
Δ export exposure	-0.064	0.005	-0.152	-0.058	-0.881*	-0.512
	(0.12)	(0.11)	(0.16)	(0.16)	(0.45)	(0.49)
Lagged control vars.	-	Yes	-	Yes	-	Yes
R-squared	0.196	0.355	0.215	0.370	0.223	0.359

Observations: 652. Standard errors clustered at spatial level (50 regions) in parentheses. OLS estimates, including federal state and time interactions and all controls described in the benchmark specification. Levels of significance: *** 1 %, ** 5 %, * 10 %.

Table A.5: Robustness checks: Drop most important industries for trade with Eastern Europe and China

	Dependent variable: 10-year change manufacturing employment / working age pop. in %-points				
Omitted industry	Motor vehicles	Spec. purp. machinery	Parts for motor vehicles	Mach. for prod. of mech. power	Basic chemicals
Δ import exposure	-0.110	-0.171***	-0.112	-0.149**	-0.166***
	(0.08)	(0.07)	(0.07)	(0.07)	(0.06)
Δ export exposure	0.141	0.354	0.220	0.180	0.616***
	(0.29)	(0.23)	(0.23)	(0.22)	(0.20)
R-square	0.273	0.255	0.275	0.240	0.281
First Stage (KP)	8.288	14.894	15.936	14.294	11.328
Omitted industry	Office machines	Wearing apparel	Communication devices	Electrical equipment	Furniture
Δ import exposure	-0.114	-0.136**	-0.121*	-0.120*	-0.082
	(0.09)	(0.06)	(0.07)	(0.06)	(0.07)
Δ export exposure	0.353	0.305	0.281	0.338	0.253
	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)
R-square	0.275	0.267	0.261	0.283	0.279
First Stage (KP)	13.144	15.380	15.077	15.715	16.280

Observations: 739. Standard errors clustered by administrative districts and years in parentheses. IV estimates, including federal state and time interactions and all control variables. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$

Table A.6: Robustness checks: Regional Classification

	Dependent variable: 10-year change manufacturing employment / working age pop. in %-points					
	(1)	(2)	(3)	(4)	(5)	(6)
	Western Germany only			50 labor market regions		
Δ import exposure	-0.124*	-0.204***	-0.229***	-0.170	-0.004	-0.092
	(0.06)	(0.07)	(0.07)	(0.15)	(0.19)	(0.18)
Δ export exposure	0.217	0.446**	0.418**	0.367***	0.296*	0.321**
	(0.17)	(0.18)	(0.18)	(0.13)	(0.17)	(0.15)
% Manuf. of tradable goods	-0.059***	-0.081***	-0.075***	-0.065**	-0.009	-0.008
	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)
Further controls	-	Yes	Yes	-	Yes	Yes
Federal state dummies	Yes	Yes	-	Yes	Yes	-
Time dummy	Yes	Yes	-	Yes	Yes	-
State and time interaction	-	-	Yes	-	-	Yes
R-squared	0.212	0.389	0.287	0.530	0.692	0.457
First stage (KP)	20.523	18.347	16.886	54.511	26.832	20.803

Observations: 652/100. Standard errors clustered by labor market regions in parentheses. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$

Table A.7: Alternative definition of dependent variable

	Dependent variable: 10-year change ln employment in manufacturing	non-manufacturing	total	ln un-employment
Δ import exposure	-1.480***	-0.761*	-0.945**	-0.196
	(0.54)	(0.45)	(0.43)	(0.44)
Δ export exposure	1.638**	1.287**	1.175***	-1.237*
	(0.66)	(0.61)	(0.39)	(0.66)
R-squared	0.164	0.148	0.155	0.045
First stage (KP)	17.203	17.203	17.203	17.203

Observations: 739. Standard errors clustered by 50 labor market regions in parentheses. Coefficients and standard errors multiplied times 100. IV estimates, including federal state and time interactions and all controls described in the benchmark specification. Levels of significance: *** 1 %, ** 5 %, * 10 %.

Table A.8: Impact on non-manufacturing industries

	Dependent variables: 10-year change in employment / working age pop. in %-points			
	cons-truction	personal services	business services	public sector
Δ import exposure	0.011	-0.056	-0.101*	-0.014
	(0.01)	(0.04)	(0.06)	(0.02)
Δ export exposure	0.021	-0.000	0.260***	-0.007
	(0.02)	(0.06)	(0.10)	(0.02)
R-squared	0.159	0.113	0.396	0.095
First stage (KP)	17.203	17.203	17.203	17.203

Observations: 739. Standard errors clustered by 50 labor market regions in parentheses. IV estimates, including federal state and time interactions and all controls described in the benchmark specification. Levels of significance: *** 1 %, ** 5 %, * 10 %.