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Trade and manufacturing jobs in Germany

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DICE DISCUSSION PAPER

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Trade and Manufacturing Jobs in Germany *

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January 2017

Abstract

The German economy exhibits rising service and declining manufacturing employment. But this decline is much sharper in import-competing than in export-oriented branches. We first document the individual-level job transitions behind those trends. They are *not* driven by manufacturing workers who smoothly switch to services. The observed shifts are entirely due to young entrants and returnees from non-employment. We then investigate if rising trade with China and Eastern Europe causally affected those labor flows. Exploiting variation across industries and regions, we find that globalization did not speed up the manufacturing decline in Germany. It even retained those jobs in the economy.

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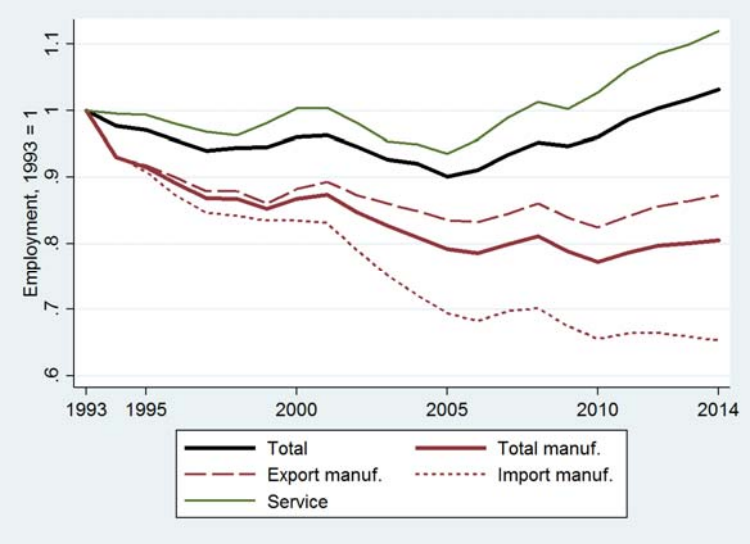
1. Introduction

Recently there has been vast interest in the decline of manufacturing in the United States. Although the share in real output is roughly constant since 1960, the share in aggregate employment has been constantly decreasing over time (Bailey and Bosworth 2014). In absolute terms, the US has around 5 million manufacturing jobs less in 2014 than in 2000.

One popular explanation for this pattern is labor-saving technological progress. This is explicated in theories of structural change, which predict a secular decline of manufacturing employment in rich countries.[1] But a recent literature argues that rising trade with China also contributed substantially to the manufacturing decline, especially after 2000 (Autor et al. 2013, 2016; Pierce and Schott 2016). That conclusion may be quite specific to the US case, however, given the large and persistent trade deficit vis-à-vis China. To grasp the broader picture how globalization hit industry jobs, it is important to also consider Western countries with more balanced trade.

In this short paper we focus on Germany, which runs an overall current account surplus, and has relatively closed balances with China and emerging economies in Eastern Europe.

Figure 1. Manufacturing and Service Employment in Germany, 1993-2014



Note: Total number of full- and part-time workers subject to social security (excluding "mini-jobs") in different sectors, normalized by respective base year value (1993=1). Export/import manufacturing defined by above/below-median net export exposure from China and Eastern Europe of the 3-digit NAICS industry (see Section I).

[1] See Herrendorf et al. (2014) for a survey. Also see Rodrik (2016) who discusses various channels for de-industrialization.

Figure 1 provides some background about the German labor market. The solid black line depicts all regular jobs subject to social security from 1993 to 2014. Coming out of the post-reunification boom, there was first a long stagnation period where Germany was often labelled "the sick man of Europe". This changed after 2005, where the country entered a phase of robust positive employment growth that was even mostly unaffected by the great recession (Dustmann et al. 2014).

Some important compositional shifts occurred during those 21 years. The green and the red solid lines illustrate employment growth in the service and the manufacturing sector, respectively. Services are on a secular upward trend, while manufacturing jobs declined mainly during the first decade (from around 8.1m to 6.4m). But parallel to this overlying expansion of services there were also marked changes *inside* manufacturing. The dotted and the broken lines show that industries with strong import-exposure declined much faster than export-oriented manufacturing industries, especially after 2000. Job losses in the former group of industries continued even after 2005, while the number of jobs in the latter is, in fact, roughly stable since 1997 (at around 4.9m).

The aim of this paper is twofold. First, we document which labor market transitions at the individual worker-level are behind those broad sectoral trends. Our analysis shows that Figure 1 is *not* driven by incumbent workers who smoothly change jobs from import- to export-manufacturing or to services. The observed shifts are almost entirely due to young entrants who take their first job, and by unemployed workers who return to a job in a different than their previous industry. Both groups have, indeed, a (re-)entry probability into the service sector well beyond the average employment share, thus fueling its expansion.

Second, we investigate if rising trade with China and Eastern Europe causally affected those important flows.[2] Exploiting variation across industries and local labor markets, we find that rising net export opportunities pulled both groups into the manufacturing sector at large, and into the export-oriented branches in particular. Unlike in the case of the US, globalization therefore did not speed up the manufacturing decline in Germany, but it even retained those jobs in the economy. Put differently, the expansion of services in Germany, which is driven by a general technology trend, would have been even larger without the rising net export exposure.

[2] In two related papers we study the impact of rising trade exposure on individual earnings profiles of incumbent manufacturing workers and on total manufacturing employment across German regions (see Dauth et al. 2016, 2014). In this paper we emphasize the effects of the same trade shocks on job (re-)entrants, who seem to play a key role in driving aggregate sectoral employment trends.

2. Labor Market Transitions

2.1. Data

We use administrative data from the Institute of Employment Research (IAB) that covers the universe of all workers in Germany subject to social security.[3] Data for former East Germany is available from 1993 onwards, which sets the starting point for our analysis and coincides with the period where the economic rise of China and Eastern Europe gained momentum.

In every year t, we observe all jobs as of June 30. All workers i are followed over time who are ever recorded as employed in the data. We document the entry year, all job changes, and periods of non-employment if worker i does not hold a job on that day in year t.

We distinguish 222 (3-digit) industries, 101 of which belong to manufacturing and 84 to services; the remaining 37 are agricultural and public sectors. For 93 manufacturing industries we can then merge trade volumes from the United Nations' *Comtrade* data base. Export-industries in Figure 1 are those with above-median, and import-industries those with below-median net export exposure with respect to China and some 21 countries in Eastern Europe. Here, industry-level trade exposure is defined as in Dauth et al. (2016),

$$(1) \quad NET_j = \frac{\Delta EXP_j^{D \to EAST} - \Delta IMP_j^{EAST \to D}}{w_{j0} L_{j0}},$$

i.e., by the 1994-2014 change in Germany's total net export volume to that area in industry j, divided by the aggregate wage bill in the base year to account for industry size.

2.2. Descriptive Results

Table 1 reports average annual flows between different labor market states. To construct this table, we added for every year t all workers who are employed in t, in $(t-1)$, or both. On average, these are roughly 29.22m persons per year. The bold figures are the absolute number of

[3] The data set does not include civil servants and the self-employed. It also does not report working hours but distinguishes full-time and part-time work. From 1999 onwards, the dataset also covers workers in marginal employment ("mini jobbers", defined as workers with monthly salaries below a threshold of currently 450 Euros). We consider full- and regular part-time workers as job holders, but classify marginal workers as non-employed in order to sustain a consistent time series that also corresponds to officially used definitions.

workers (in 1000s) for every possible flow, and in italics we report shares (in percent) by origin and destination.

Table 1: Labor Market Transitions

				Destination in t		
Origin in (t-1)	Service	Exp-manuf	Imp-manuf	Other jobs	Non-empl.	**Total Origin**
Service	**10,870**	**135**	**62**	**102**	**1,579**	**12,747**
orig %.	*85.3*	*1.1*	*0.5*	*0.8*	*12.4*	*[43.6 %]*
dest %	*84.8*	*2.8*	*3.2*	*1.5*	*54.6*	
Exp-manuf	**117**	**4,341**	**28**	**18**	**383**	**4,888**
orig %	*2.4*	*88.8*	*0.6*	*0.4*	*7.8*	*[16.7 %]*
dest %	*0.9*	*89.5*	*1.5*	*0.3*	*13.2*	
Imp-manuf	**62**	**30**	**1,670**	**9**	**184**	**1,956**
orig %	*3.2*	*1.5*	*85.4*	*0.5*	*9.4*	*[6.7 %]*
dest %	*0.5*	*0.6*	*87.3*	*0.1*	*6.4*	
Other jobs	**112**	**18**	**8**	**5,828**	**748**	**6,712**
orig %	*1.7*	*0.3*	*0.1*	*86.8*	*11.1*	*[23.0 %]*
dest %	*0.9*	*0.4*	*0.4*	*86.3*	*25.8*	
New entry	**428**	**97**	**41**	**228**		**793**
orig %	*54.0*	*12.2*	*5.1*	*28.7*		*[2.7 %]*
dest %	*3.3*	*2.0*	*2.1*	*3.4*		
Returnees	**1,223**	**230**	**101**	**567**		**2,124**
orig %	*57.6*	*10.8*	*4.9*	*26.7*		*[7.3 %]*
dest %	*9.5*	*4.7*	*5.5*	*8.4*		
Total dest	**12,811**	**4,850**	**1,913**	**1,686**	**2,895**	**29,220**
[share total]	*[43.9 %]*	*[16.6 %]*	*[6.6 %]*	*[23.1 %]*	*[9.9 %]*	

Notes: Absolute numbers in 1000s in bold, row and column percentages below. New entrants are employed in t but not in (t-1), and never appear before in IAB data since 1978. Returnees are not employed in (t-1), but are employed in t and in at least one previous year since 1978. Non-employed have worked in (t-1) but not in t. This includes permanent exits and workers who return to jobs in later years.

For example, the first line shows that 12.747m persons worked in the service sector in the representative origin year. Of those, 10.870m (85.3 percent) are still in services the next year, 135,000 (1.1 percent) moved to export-manufacturing, and so on. Analogously, the first column shows that, of the 12.811m service employees in the representative destination year, 1.223m (9.5

percent) are returnees from non-employment, 428,000 (3.3 percent) are new labor market entrants, etc.[4]

This transition matrix conveys several important messages. First, observe that sectoral mobility appears to be everything but smooth. The vast majority of employed workers remains on a job in the same sector. But conditional on leaving, the probability to move into non-employment is in all cases higher than for a direct and smooth transition into a different sector the next year.[5] Second, the gross flows between import- and export-manufacturing are substantially smaller than the gross flows towards services. But a surprising insight is that the corresponding *net* flows are essentially zero (62-62) for import- and even negative (117-135) for export-manufacturing.[6] Hence, the aggregate rise of the service sector as observed in Figure 1 does *not* come from workers who directly switch out of manufacturing without undergoing an unemployment spell. It comes solely from young labor market entrants and returnees out of non-employment. Those groups have a 54-58 percent probability to start in services, which is substantially larger than the average service employment share.[7] Moreover, conditional on (re-)entering into manufacturing, the chance to start in export-oriented industries is more than twice as large than in import-competing ones.

3. Impact of Trade on (Re-)Entry Flows

New labor market entrants and returnees from non-employment apparently play a key role for the broad sectoral employment trends ("structural transformation") shown above in Figure 1. In this Section, we investigate the effect of rising international trade exposure on those important labor flows in more detail.

[4] By subtracting exits into non-employment from new entries and returns, Table 1 predicts an average annual increase of total employment by around 22,500 workers, or 450,000 over 21 years. This corresponds to the aggregate trend shown in Figure 1, where total employment has increased from 27,6m to 28,05m in absolute terms. Note that 1993 is defined as the first pre-year (t-1) which we need to construct the first wave of entrants. All regressions thus start in 1994.

[5] This result remains valid when we separate temporary and permanent exits into non-employment (such as retirement), and only compare the former with smooth annual transitions probabilities into different sectors. Moreover, notice that smooth transitions also include those with unemployment spells below one year, such that the respective worker is employed on June 30 both in t and (t-1). Table 1 may therefore even understate disruptions in individual job biographies.

[6] Notice that the average annual net flow from import- to export-manufacturing is just 30-28=2 thousand workers per year. This suggests that also the compositional shifts within manufacturing are typically not composed of smooth job transitions between industries.

[7] Analogously, entrants and returnees account for larger shares of service employment than direct switchers from import- or export-manufacturing (3.3 and 9.5 versus 0.5 and 0.9 percent).

3.1. Industry-level analysis

We start with an analysis at the industry-level and focus on (re-)entrants into manufacturing. First, we compute the change in the (log) number of new entrants and returnees out of non-employment into manufacturing industry j over the period 1994-2014. We then regress this on the industry-level net export exposure from eq. (1), and on further initial industry characteristics that may influence individual entry decisions.

Table 2: Industry-level Analysis

	(1) OLS	(2) 2 SLS	(3) OLS	(4) 2 SLS
	100 x Δ (log new entrants into j)		100 x Δ (log returnees out of non-employment into j)	
net export	0.102**	0.181***	0.120***	0.111**
exposure of j	(0.05)	(0.07)	(0.04)	(0.05)
other controls	yes	yes	Yes	yes
N	93	93	93	93

Notes: Dependent variable is 100 times the change of the log total number of entrants/returnees into j, between 1994 and 2014. Net export exposure is defined as in eq. (1). As the instrument in the 2SLS specifications, we use an analogously defined measure for trade flows of 6 other countries (UK, CAN, SWE, NOW, AUS, NZ) with respect to China and Eastern Europe. We control for industry average firm size, share of newly founded firms, share of workers older than 50, share of workers in routine jobs, and dummies for the industries manufacturing of knitted and crocheted articles and processing and preserving of fish products, which have extreme outliers in the instruments. Robust standard errors in parentheses. Levels of significance: *** 1%, ** 5%., * 10%.

Those entries may also be affected by unobserved shocks that affect manufacturing industries differentially. To address this issue, we follow the seminal paper by Autor et al. (2013) and use third-country trade flows of other high-income countries vis-à-vis China and Eastern Europe in j as an instrument for industry-level trade exposure, thereby purging the estimates of Germany-specific shocks.

Table 2 summarizes the results. We find that both groups are systematically pulled into more export-oriented branches. An increase of net export exposure by one percentage point raises the mass of new and of re-entrants by 0.181 and 0.111 percent, respectively. From here we can calculate that a manufacturing industry at the 75th percentile of net export exposure (with NET_j =29.8) has received around 13.3 percent more new entrants and 8.1 percent more returnees out of non-employment than an industry at the 25th percentile (with NET_j = -43.4). This

indicates that the differences in entry probabilities into export- and import-manufacturing reported in Table 1 do not only reflect unobserved industry trends. They are at least partly driven by differences in industry-level export exposure.

3.2. Local Labor Market Analysis

The previous analysis conditions on (re-)entry into manufacturing. Hence, it does not yet allow us to infer how trade has affected the sectoral worker flows at large, i.e., whether it has fueled or slowed down the overall manufacturing decline.

To address this question, we now explore (re-)entry patterns across German local labor markets. The idea here is that all regions are similarly exposed to aggregate technology, which drive the expansion of services. They differ, however, in their local specialization patterns within the manufacturing sector and, thus, in their exposures to trade shocks. This regional variation is informative to gauge the total effect of trade on manufacturing employment when inter-regional adjustments through migration are sluggish, and most adjustments take place at the local level between industries.[8]

Germany is divided into 402 local labor markets indexed by r. We then compute the change in the local manufacturing shares of new labor market entrants over the 1994-2014 period (analogously for the returnees out of non-employment), and regress those changes in manufacturing (re-)entry shares on various initial regional controls. In particular, we include a measure for local trade exposure,

$$(2) \quad NET_r = \sum_j \frac{L_{rj}}{L_j} \cdot \frac{\Delta EXP_j^{D \to EAST} - \Delta IMP_j^{EAST \to D}}{L_r},$$

which apportions aggregate trade volumes across regions according to (lagged) industry employment shares. Again we construct instruments for NET_r from third-country trade flows with China and Eastern Europe.

[8] This empirical strategy is based on Autor et al. (2013, 2016), who study the effect of rising Chinese import competition on total manufacturing employment across commuting zones in the United States. In Dauth et al. (2014) we conduct a similar analysis for German regions. This paper is complimentary and focuses on labor market entrants and returnees out of non-employment, but otherwise stays close to the original specifications to ensure comparability of results.

Table 3: Local Labor Market Analysis

	(1) OLS	(2) 2 SLS	(3) OLS	(4) 2 SLS
	Δ (new entrants manuf / all new entrants in region r)		Δ (returnees manuf / all returnees in region r)	
net export exposure of r	0.190**	0.289**	0.535***	0.560***
	(0.09)	(0.12)	(0.10)	(0.15)
other controls	yes	Yes	yes	yes
N	402	402	402	402
avg. implied effect		0.265		0.514
conservative effect		0.130		0.252

Notes: Dependent variable is the total number of entrants/returnees into manufacturing divided by the total number of entrants/returnees in region r in 2014 minus the analogous local shares in 1994. Further control variables are employment shares in manuf. of consumption, production, or capital goods and manuf. of cars, and employment shares of workers with university degree, workers in routine occupations, women, and foreigners. Standard errors clustered at the level of 50 aggregate labor market regions in parentheses.

The estimation results are summarized in Table 3. We find that an increase in local net export exposure by 1000€ raises the local manufacturing share for new labor market entrants by almost 0.29 percentage points, and for returnees by 0.56 percentage points.[9]

To translate this into economically meaningful magnitudes, we multiply those coefficients with the observed increase in average net export exposure across regions, which is 917€ over the 1994-2014 period.[10] This back-of-the-envelope calculation suggests that the rising trade exposure with China and Eastern Europe has increased the transition probability into manufacturing by 0.265 percentage points for young German labor market entrants, and by 0.514 percentage points for returnees out of non-employment.

In a more conservative benchmarking exercise, we separate the total observed change in net exports over time into two parts: (i) the part caused by the exogenous rise of China and Eastern Europe, and (ii) a residual part that may be explained by other causes, such as unobserved demand shocks. This decomposition, which has been suggested by Autor et al. (2013), essentially relies on the comparison of the ordinary least squares (OLS) and the

[9] When using total regional manufacturing employment over population as the dependent variable, we obtain a (highly significant) coefficient of 0.2010 (std. error 0.083) which is similar to the results in Table 2 of Dauth et al. (2014). Our previous results therefore remain robust, although we consider here a slightly different observation period that is not sliced into subintervals, and we consistently include East German regions in the analysis.

[10] Notice that average net exports are positive, which reflects the fact that Germany exhibited a moderate current account surplus even with respect to China and Eastern Europe over the observation period.

instrumental variable (2SLS) coefficients reported in Table 3, and yields smaller implied changes in manufacturing shares by 0.130 and 0.252 percentage points for entrants and returnees, respectively.

Next, we use those numbers and the matrix from Table 1 to calculate counterfactual transition probabilities into manufacturing for the two groups of (re-)entrants. In the baseline, those are 12.2 + 5.1 – 0.256 = 17.044 percent for the new entrants, and 10.8 + 4.9 – 0.514 = 15.186 percent for the returnees. With the conservative benchmarking those numbers are 17.170 and 15.448 percent, respectively.

Finally, we use those counterfactual probabilities for entrants and returnees to project the sectoral employment composition holding the growth of aggregate employment constant. This exercise implies that the long-run growth rate of manufacturing jobs would have been between 1.58 and 3.11 percentage points lower via the (re-)entry channel.

In other words, as of 2014, Germany would have between 128,000 and 259,000 fewer manufacturing jobs without the rising trade exposure from China and Eastern Europe. Those jobs would, instead, be in services (or the public/agricultural sector), because entrants and returnees would not have been pulled by the rising net export opportunities.

4. Conclusions

The German economy faces a trend of structural transformation with a secular decline of manufacturing and rising service employment. This is similar as in many other high-income countries, and is supposedly driven by a general technology trend. Yet, unlike in the case of the US, rising trade with emerging low-wage countries (like China or Eastern Europe) did not speed up this trend in Germany. Trade, in fact, slowed it down because rising exports to the new markets stabilized industry jobs.

The other main message of this paper is that the shift from manufacturing to services does not happen smoothly at the micro-level. We find little evidence that the rise of the service economy comes from incumbent manufacturing workers who directly switch jobs. The rise is, instead, almost entirely driven by young entrants who exhibit different sectoral entry behaviors than previous generations, and by returnees out of non-employment who take up jobs in different

industries than their previous ones. To the best of our knowledge, this paper is the first to study the impact of trade on the labor market transitions for those groups.

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