Journal of Public Economics 127 (2015) 137–144

Contents lists available at ScienceDirect

Journal of Public Economics

journal homepage: www.elsevier.com/locate/jpube

Made in China, sold in Norway: Local labor market effects of an import shock[☆]

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ARTICLE INFO

Article history:
Received 1 January 2013
Received in revised form 20 August 2014
Accepted 23 August 2014
Available online 16 September 2014

JEL classification:
F16
H53
J23
J31

Keywords:
Import competition
Local labor markets
Norway
Nordic model

ABSTRACT

We analyze whether increased exposure to import competition from China threatens the Nordic model. We find negative employment effects for low-skilled workers, and observe that low-skilled workers tend to be pushed into unemployment or leave the labor force altogether. We find no evidence of wage effects. We partly expect this in a Nordic model where firms are flexible at the employment margin, while centralized wage bargaining provides less flexibility at the wage margin. The import shock is smaller, and our estimates suggest that import competition from China explains almost 10% of the reduction in the manufacturing employment share from 1996 to 2007 which is half of the effect found by Autor et al. (2013) for the US.

1. Introduction

The rise of China as a major exporter in the world economy is an important feature of the current globalization process. Between 1993 and 2010, the share of world merchandize exports originating in China grew from 2.5% to 10.6%, making China in 2010 the largest exporter in the world. Parallel to this increase in exports from low-cost countries, scholars have pointed out that imports from developing countries in general, and from China in particular, could have disruptive effects on labor markets in developed countries and especially harm low-skilled workers in industries competing with imports from low-cost countries.

In this paper, we investigate the impact in Norwegian labor markets of the increased exposure to imports from China. Together with the other Nordic countries, the social and economic system of Norway has been termed the Nordic model. Salient features of the Nordic model are labor market institutions that include strong labor unions and employer associations, and centralized wage bargaining that produces a relatively compressed wage structure (Aaberge et al. (2000), Hægeland et al. (1999), and Kahn (1998)).[1] At the same time, the rules for employment protection have few limitations preventing firms from dismissing workers collectively when under stress. In the case of dismissal, generous unemployment benefits and disability pensions provide workers with insurance from the negative income consequences.[2] To finance the generous welfare state, the Nordic model relies on high labor force participation and therefore emphasizes policies to support this. By assessing the impact of the Chinese trade shock on employment and on other labor market outcomes, we consider to what extent could the Chinese trade shock threaten the Nordic model.

Until recently there has been limited evidence finding clear labor market effects of trade shocks Krugman (2008). The main conclusion from the earlier literature using data from the 1980s and early 1990s was that the rising wage inequality observed in many countries was mainly because of skill-biased technological change and not trade Berman et al. (1998).[3] As trade has increased between developed

☆ We acknowledge the Norwegian Research Council (Grant number 202445) for its financial support and thank participants at a conference on the Nordic model held in Oslo in September 2012 and two referees for their helpful comments and suggestions.

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[1] Moene and Wallerstein (1997) and Agell and Lommerud (1997) discuss various consequences of low wage inequality for growth and innovation.

[2] Indeed, Andersen et al. (2007) argue that the key feature of the Nordic model is the mutually supportive interaction of risk sharing and globalization.

[3] Salvanes and Førre (2004) reach a similar conclusion using data from Norway for the period 1986–94.

http://dx.doi.org/10.1016/j.jpubeco.2014.08.006
0047-2727/

countries and low-cost countries, a number of recent studies have found labor market effects of trade shocks. In Norway, the total import share from low-wage countries increased from 7% in 1996 to 13% in 2007, with most of this increase coming from China.

A growing body of research examines the regional dimensions of trade shocks by taking into account the fact that regional differences in the production and employment structure within countries tend to make some regions more susceptible to trade shocks. Our analysis is based on the approach developed by Autor et al. (2013), who investigate the impact of increased exposure to imports from China on various labor market outcomes in US commuting zones. Autor et al. (2013) (hereafter ADH) find quite large labor market effects. They estimate that around 20% of the reduction in the employment share of manufacturing in the US from 1990 to 2007 resulted from the increase in import competition from China during the period.[4] The results in ADH complement the industry-level analysis of Bernard et al. (2006), who find that US manufacturing plant survival and growth are negatively associated with industry-level exposure to import competition from low-wage countries. Several studies focusing on wage effects of trade shocks find evidence of larger effects for the more exposed firms or occupations.[5]

Like most OECD countries, Norway has also experienced reductions in manufacturing employment together with increases in imports from China. Fig. 1 compares these developments in Norway and the US. As shown, in both countries imports from China have increased more than sixfold, while the manufacturing employment share has declined. We expect that increased imports from China have affected labor markets also in Norway, but the differences in institutions between the US and Norway could lead to different outcomes. The limited wage flexibility arising from centralized wage bargaining, combined with flexibility in employment adjustment and a generous welfare state, lead us to expect a clear impact of trade shocks on employment, but a more limited impact on earnings. In addition, the composition of the manufacturing sectors in the US and Norway are rather different. Compared to the US, Norwegian manufacturing is more resource based, exports a larger share of its production, but has lower R&D intensity. In addition, at the national level, Norwegian manufacturing employment has been relatively less important in the sectors where Chinese export capacity has increased the most.

We find a negative impact of exposure to competition from China on the manufacturing employment share in Norwegian local labor markets. This is related to imports of intermediate products, rather than imports of products for final consumption. Further, competition from China in Norwegian export markets plays a limited role. First, we find that the import shock is smaller than for the US. The median regional labor market in Norway has an import exposure to of 4000 NOK per worker, which is about one third of the exposure for the median region in the US. Secondly, we find that the total effect is smaller than for the US although the structure of the effect is similar. We find that an increase in regional exposure to imports from China of 10,000 Norwegian kroner (NOK) per worker results in a decline in the manufacturing employment share of 0.125 percentage points. As a point of comparison, ADH find for the US that an increase in exposure to imports from China of 1000 US dollars (USD) (equal to approximately 7000 NOK) results in a decline in the manufacturing employment share of about 0.6 percentage points. In a similar analysis for Spain, Donoso et al. (2014) find a large negative effect on manufacturing employment that is about twice the impact identified by ADH for the US. In the German case, Dauth et al. (forthcoming) find that increased exposure to imports from China reduces the manufacturing employment share in local labor markets by about 0.14 percentage points, although Germany's improved export opportunities thanks to the rise of China compensate for this negative effect. We do not find that export opportunities to China compensate for the negative impact of import competition in the case of Norway. Further, we find that unskilled workers, who to some extent are pushed into unemployment or out of the labor force altogether, bear the brunt of the reduction in manufacturing employment caused by the Chinese import shock. However, as opposed to the US case, we do not find negative wage effects. These latter results are to be expected in a Nordic welfare state with central wage bargaining and flexible rules for employment adjustment.

The remainder of the paper is structured as follows. Section 2 provides a brief comparison of several different countries and their exposures to the increase in Chinese export capacity. Section 3 presents our empirical strategy. We provide a brief description of our data sources in Section 4, along with descriptive statistics for our measures of regional exposure to competition from China, and we document the regional differences in manufacturing employment structure. Section 5 presents our estimation results and Section 6 concludes. We refer at various points to the accompanying online appendix to the paper for further details.

2. Chinese export capacity and the industry structure of importing countries

The increase in Chinese exports has not been uniform across industries and products. Countries that in 1996 had a large share of manufacturing employment in industries that experienced subsequent large increases in Chinese export capacity are likely to be more exposed to competition from China. We compare different countries' exposures to competition from China by computing the within-country correlation coefficient between the manufacturing employment share in each of 20 industries and the change in the value of Chinese exports of products from that industry. Fig. 2 plots the resulting correlation coefficients for OECD countries, where Norway appears to be the least-exposed country.[6] Norway has a correlation coefficient of just −0.284, whereas the corresponding value for the US is 0.154.[7]

On the one hand, the composition of Norwegian manufacturing in 1996 was such that the subsequent rise of China is likely to have generated less competitive pressure on manufacturing production than in many other OECD countries. One reason is that Norway is largely a resource-based economy and a large share of Norwegian exports rely on transforming raw materials to other products through energy-intensive production processes. The rise of China has contributed to increasing the demand for many of the raw materials Norway exports. On the other hand, the R&D intensity of Norwegian manufacturing is low relative to the OECD average. In evidence, according to Eurostat, R&D expenditure in the private sector in Norway in 2009 was some 0.95% of GDP, while the OECD average was 1.25% and that for the most R&D-intensive European Union (EU) countries was 2%. Such low R&D intensity could contribute to making Norwegian industries more vulnerable to competition from China than similar industries with higher R&D intensities in other OECD countries.[8]

[4] Early studies exploiting regional variations in exposure to trade shocks largely focus on trade shocks arising from changes in trade policy; see e.g. Topalova (2010), Chiquiar (2008), and Kovak (2013).

[5] For firm level studies, see for example Verhoogen (2008), Amiti and Davis (2012), Hummels et al., (2014), while Ebenstein et al. (2011) analyze the effects of trade shocks at the occupation level.

[6] Country data for each industry's employment share (i.e. the percentage of the total employment in manufacturing) are from the OECD STAN indicators database, while the data for total exports from China across the 20 different industries are from the OECD STAN bilateral trade database.

[7] Fig. 1 in the online appendix plots the data that provide the basis for the correlation coefficients for Norway and the US in Fig. 2.

[8] See, for instance, Bloom et al. (2011), who find that competition from China in OECD countries has led to the reallocation of labor toward more innovative and technologically advanced firms that are better able to survive the competition from low-cost countries.

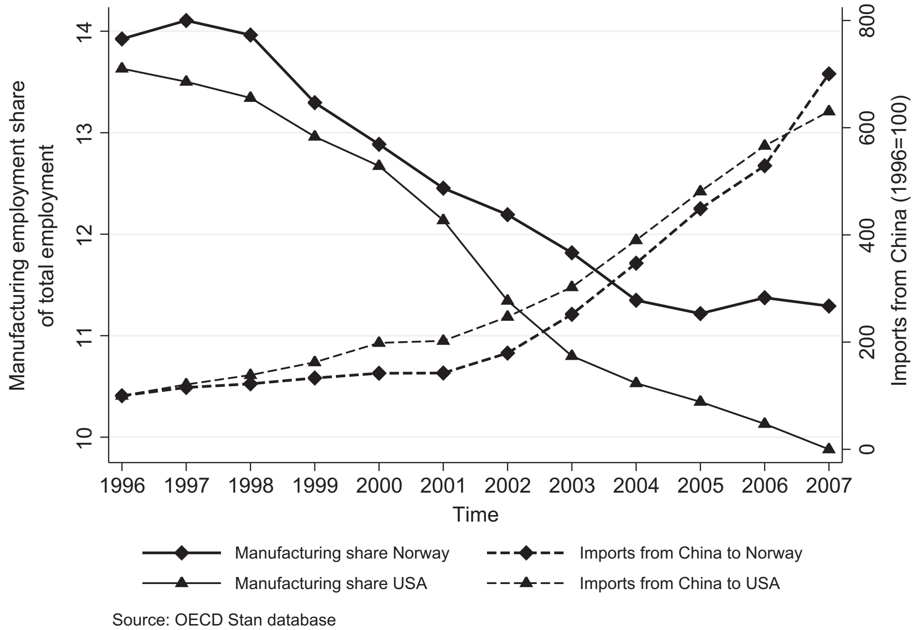

Fig. 1. Manufacturing employment shares and imports from China.

3. Empirical approach

Even if Norway, according to the measure reported in Fig. 2 is less exposed to competition from China than other OECD countries, regional differences in manufacturing employment structure will mean that some labor market regions are more exposed to competition from imports from China than others. This local labor market perspective, based on the theoretical and empirical framework developed in ADH, is the basis for our empirical analysis. The main emphasis in ADH is to provide a framework for representing the Chinese supply shock as one that affects the demand for products manufactured by each regional labor market. The Chinese supply shock can be seen as arising from a combination of the reduced trade costs China faced after accession to the WTO in 2001 and the increase in both productivity and production capacity following economic reforms in China since the late 1980s. This supply shock may affect a given labor market region in Norway by generating increased competition in those markets where the producers of that region sell their products. At the same time, falling trade costs and economic growth in China may increase Chinese demand for the region's products.

Consider the effect of the Chinese supply shock on employment in the Norwegian manufacturing sector. The increase in Norwegian imports from China of products from industry i affects labor demand only in those regions where industry ti is located. Thus, we allocate the increase in imports of industry i's products over a period t to region r according to the region's share of total national employment in industry i at the beginning of the period. We then take the sum of the import changes over all industries to arrive at a measure for each region that accounts for the increase in exposure to domestic imports from China. We then scale the total increase in import value by the total employment in region r at the beginning of period t (L_{rt}), yielding a measure of the increase in imports per worker as follows, which we designate as *domestic exposure to China*:

$$\Delta DEC_{rt} = \frac{1}{L_{rt}} \sum_i \frac{L_{rit}}{L_{it}} \Delta M_{it}. \tag{1}$$

According to the measure in (1), a region whose employment structure at the beginning of period t is dominated by industries in which imports from China increase very little during the period will get a low value of the measure in (1). By contrast, regions that at the beginning of period t have a large share of domestic output in industries in which Chinese imports increase substantially are more exposed to competition from China.

Domestic producers may also be affected by competition from China in their export markets. As an example, this could occur if an aluminum producer located in region r has a large market share in Germany at the beginning of period t, and if Germany during period t substantially increases its imports of aluminum from China. The magnitude of the increase in exposure to competition from China then depends on both the initial market share in Germany of region r and the increase in imports of aluminum from China to Germany during period t. For each region, summing over all industries and all export markets, we arrive at our measure of the region's *export market exposure to China*:

$$\Delta EEC_{rt} = \frac{1}{L_{rt}} \sum_i \left(\sum_k MS_{kirt} \Delta M_{kit} \right). \tag{2}$$

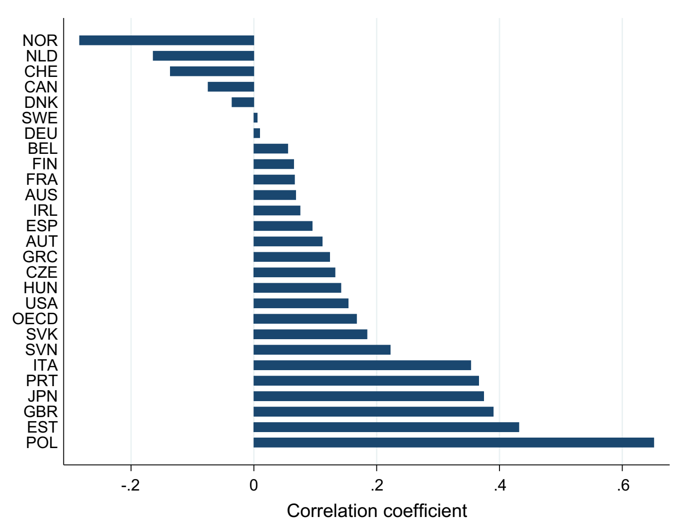

Fig. 2. Correlation between industry employment shares in 1996 and the change in total Chinese exports in 1996–2007 for 20 manufacturing industries.

In Eq. (2), MS_{kirt} is the initial 'market share' of region r in country k for products from industry i. The term ΔM_{kit} captures the change in imports from China to market k of products from industry i. The premise of the measure of competition in Eq. (2) is that a labor market region r with a large market share in Germany, for instance, in 1996 will be more exposed to competition from China if Germany subsequently increases its imports from China of the products exported to Germany by region r in 1996.[9]

Some domestic producers may benefit from the new market opportunities caused by the rise of China. We allocate the increase in Norwegian exports to China of the products of industry i to regions according to each region's share of the national employment in industry i at the beginning of the period. The change in exports per worker from each region to China is then:

$$\Delta X_{rt} = \frac{1}{L_{rt}} \sum_i \frac{L_{rit}}{L_{it}} \Delta X_{it}. \tag{3}$$

The main purpose of our analysis is to investigate the extent to which the change in exposure to competition from China affected manufacturing employment in the regional labor markets of Norway. Our main regressions are variants of the following equation:

$$\Delta MfS_{rt} = \beta_1 \Delta CNexposure_{rt} + \gamma_t + \gamma_R + X_{rt}^{'}\beta_2 + \epsilon_{rt}, \tag{4}$$

where ΔMfS_{rt} is the change in the region's share of the working-age population employed in manufacturing, measured as the percentage point change from the start to the end of period t. $\Delta CNexposure_{rt}$ represents measures of change in exposure to competition from China. Our main measure of exposure to competition from China is given in Eq. (1). As alternative measures of exposure to competition from China, we also use the sum of domestic and export market exposure in Eqs. (1) and (2), and the sum of domestic and export market exposure net of exports to China, i.e. (1) + (2) − (3).

Our data cover the period 1996–2007, and our main specifications split this period into two shorter periods: 1996–2001 and 2002–2007. Thus, we include a period dummy γ_t when estimating Eq. (4) in first differences. The vector γ_R contains five dummies for the different parts of Norway. Given that our regressions are in first differences, these dummies correspond to controlling for region-specific trends in the development of manufacturing employment. The vector X_{rt} contains the start-of-period share of the population employed in manufacturing. This is a proxy for the role of manufacturing in the region and should ensure that our variables for import exposure to China do not pick up the general trend of a decline in the role of manufacturing—a trend that is likely to be stronger in regions more dependent on manufacturing. We also include a variable for the share of the regional population with a college education.

Unobserved demand and supply shocks at the regional level could simultaneously affect both the exposure to competition from China and regional economic performance, making the trade exposure measure in Eq. (1) endogenous. In order to address this potential endogeneity and identify the causal impact of the Chinese supply shock, we follow the instrumental variable strategy in ADH. This strategy rests on the assumption that the Chinese supply shock has created similar bundles of exports from China to the most developed countries, while the increase in imports from China in other developed countries is uncorrelated with labor demand shocks in Norwegian labor market regions. Thus, we create an instrument for domestic exposure in Eq. (1) by replacing the change in Norwegian imports from China in Eq. (1) with the change in imports from China to 17 other OECD countries.[10] As argued by ADH, if expected future increases in imports from China affect industry employment, then simultaneity bias could also affect our instrument. To address this concern, we lag the output shares used in the instrument by using output shares three years prior to the beginning of the period.[11]

We are not overly concerned with the endogeneity of the exposure to competition from China in Norwegian export markets, as the components of the measure in Eq. (2) are arguably determined independently of Norwegian trade and labor market shocks. As increases in exports to destinations other than China could counteract the effect of import competition from China on employment, we add a control variable capturing the total change in regional exports per worker (excluding exports to China). This control variable could also be endogenous, but our main results are unchanged if we do not include this control variable.

4. Data and descriptive statistics

4.1. Data sources

We draw on a combination of data sources for our analysis. First, we use the Norwegian customs data from Statistics Norway to identify imports from China.[12] The customs data are at a very detailed product level, but we aggregate imports into the product categories produced by each NACE four-digit industry. In order to aggregate the detailed product codes in the customs data into outputs at the four-digit industry level, we use the correspondence table produced by Statistics Norway mapping between the commodity codes at the Harmonized System (HS) eight-digit level and the Statistical Classification of Products by Activity in the European Economic Community (CPA) codes at the six-digit level. The CPA codes at the four-digit level correspond to the four-digit codes in the NACE.

Next, we calculate both import and export measures at the four-digit industry level for each of 160 labor market regions in Norway, and then weigh them using the regional employment shares in each four-digit industry, as calculated from the Norwegian employer–employee data. The Norwegian employer–employee data contain information on the entire population between 16 and 74 years of age and the identity of the employers of those who work. For each four-digit industry, we calculate the total national employment as the number of people employed by firms in this industry, and the industry employment share of each region as the share of national employment in firms located in the region. The Norwegian employer–employee data are also used to calculate our start-of-period control variables in Eq. (4). From this source, we have information about education and can calculate the share of the working-age population (aged between 16 and 67 years) with a college education. From the employer ID in this data source, we can also calculate the manufacturing employment share in the region, which is required for both the start-of-period control variable and our dependent variable in Eq. (4).

We divide Norway into labor market regions using the classification developed in Gundersen and Jukvam (2013). This division uses information about commuting patterns. Data on the international trade of countries other than Norway are from the United Nations Commodity Trade Statistics Database (Comtrade). We use the HS commodity classification at the six-digit level, and harmonize the different HS classifications over time using the concordance developed by Beveren et al. (2012). We then aggregate these commodity codes into the four-digit

[9] An explanation of how we calculate the market shares in Eq. (2) can be found in the online appendix.

[10] The countries we use in the instrument are Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Ireland, the Netherlands, New Zealand, Portugal, Spain, Sweden, Switzerland, Great Britain, and the US. We have experiment by limiting the number of countries included in our instrument by dropping Australia, New Zealand, and Portugal. This does not affect our results.

[11] The starting year for our analysis, 1996, corresponds to a change in the industry classification system in Norway from the International Standard Industrial Classification (ISIC) to NACE. A correspondence going backward would imply an unfortunate increase in the level of industry aggregation. To avoid this, we calculate the output shares in 1993 using only the plants from 1996 that were also in operation in 1993 and assuming they had the same NACE four-digit industry classification as in 1996.

[12] For details on the development of overall Norwegian imports from China, see Fig. 2 in the online appendix.

NACE industry classifications using the same HS-to-CPA correspondence we used for the Norwegian customs data. Finally, we convert all dollar values in the Comtrade database and the World Bank development indicators to NOK using the average annual exchange rates available on the Norwegian Central Bank's Web page.[13]

4.2. Local labor market exposure to China

The measure of exposure to domestic import competition in (1) makes it clear that the sources of regional variation in import exposure are the regional differences in the shares of employment in manufacturing and the specialization of manufacturing employment in import-intensive industries. As a starting point, a simple decomposition of variance indicates that while there are differences in the manufacturing employment shares across regional labor markets, the start-of-period manufacturing employment share explains only about 12% of the variation in the change in exposure to imports from China, suggesting that regional specialization is the more important factor in determining the import exposure of different regions. On average, manufacturing shares have declined by almost 2 percentage points from 1996 to 2007. Only a few regions have experienced an increase in manufacturing shares—nearly always regions with very small populations. The five regions with the largest decreases in manufacturing employment shares are dominated by processing industries related to fisheries.[14]

There are large differences in the exposure to imports from China. The median region has a calculated increase in import exposure of only 4000 NOK per worker, while the region at the 75th percentile experienced an increase of 12,000 NOK over the 11-year period. At the 90th percentile, this increase is 27,000 NOK.[15] Table 1 provides summary statistics for the different measures of exposure to the Chinese supply shocks in Eqs. (1)–(3). The exposure to competition from China in export markets, shown in the second row of Table 1, is of lower magnitude than the direct competition from imports to Norway.[16] For some regions, the new markets in China are more important than the increase in imports from China, as the net import exposure measure in the second-last row of Table 1 is negative at the 25th percentile. The bottom row of Table 1 shows the change in total exports per worker (excluding exports to China).[17]

Table 1
Change in trade exposure 1996–2007: 1000 NOK per worker.

	min	p25	p50	p75	max
Exposure through total imports from China	0	1	4	12	112
Exposure to China in export markets	0	0	0	0	24
Exposure in both imp. and exp. market	0	1	4	12	112
Change in exports to China	0	0	2	6	44
Net import and export m. exposure	−40	−1	2	10	101
Change in other exports	−10	9	32	79	1099

5. Results

We start by estimating the relationship in Eq. (4), using the measure defined in Eq. (1) as the measure of exposure to imports from China. Table 2 reports the results from the OLS regressions on the first differences for each of the 160 regions. In all of the regressions, we weigh our observations by the initial population size, and the standard errors are clustered at the county level (yielding 20 clusters). Columns 1–3 of Table 2 exhibit evidence of a negative correlation between manufacturing employment shares and increased exposure to imports from China. In Columns 2 and 3 of Table 2, we add controls that may reflect other changes at the regional level that may be correlated with both changes in imports and the manufacturing employment share; the share of the population with a college education, and the increase in total exports from the region.[18] We also include a dummy for the second period and five regional dummies to control for region-specific trends affecting the manufacturing employment share, e.g. differences in the importance of the oil industry, internal changes in the demand for Norwegian-produced goods, or particular regional changes in the composition of the workforce. Adding these controls does not affect the coefficient for total imports.

The measure of import exposure in Eq. (1) does not distinguish between imports of final and intermediate goods. Although an increase in all imports will contribute to increasing the exposure to China, the impacts on employment may well differ between imports of final and intermediate goods. On the one hand, while imports of final goods will be in direct competition with the products of region r, imports of intermediate goods may be used as intermediate inputs by manufacturing firms located in the region. Consequently, intermediate imports could lower the costs of local manufacturing and make the industry more competitive. On the other hand, many manufacturing firms have intermediate inputs as their main products, and thus imports of intermediate inputs could be in direct competition with the commodities produced by these firms. In this case, imports of final and intermediate goods may have similar effects on local labor markets. To investigate this, we split the import exposure measure in (1) into imports of final and intermediate goods.[19] The results, shown in Columns 4–6 of Table 2, suggest that the negative coefficient for total import exposure in Columns 1–3 is mainly driven by imports of intermediate goods. This can be explained by the fact that the main products from many of the large manufacturing industries in Norway are intermediate goods to be used in other industries. As the classification of products into intermediate and final goods relies on less-than-perfect correspondence tables that leave some classifications open to question, we combine these two types of products into a single measure of total imports in the remaining analysis.

Table 3 presents our instrumental variable (IV) results.[20] The reported coefficient in the first column of Panel A is the IV coefficient for the change in total domestic imports from China. As shown, the estimated coefficient does not change much from the analogous OLS estimates in Column 3 of Table 2. In Columns 2–4 of Table 3, we report the results for different measures of regional exposure to increased competition from China. In Column 2, we use the change in net imports from China, by subtracting our measure of regional exports to China from our measure of imports from China. In addition to import competition, we argued in Section 3 that competition from Chinese products may also affect Norwegian local labor markets via their export markets.

[13] http://www.norges-bank.no/.

[14] Table 1 in the online appendix lists the labor market regions with the smallest and largest manufacturing employment shares.

[15] Comparing these numbers with the calculations made by ADH for the US, the increase in import exposure to China for Norwegian labor market regions is somewhat smaller than for regions in the US. For instance, ADH report that the commuting zone at the median experienced an increase in exposure to total imports from China per worker of 2100 USD (roughly 12,000 NOK) in 2000–07. This is about three times larger than the increase in exposure for the median region in our data set. For the region at the 90th percentile, the increase in exposure to China is about the same in Norway and the US.

[16] The population-weighted average exposure to competition from China increases by 45% when including the exposure to competition from China in Norwegian export markets. This is higher than what ADH find for the US, which is to be expected, given the greater export orientation of the Norwegian economy.

[17] Section 4 of the online appendix provides more detail on the regional distribution of exposure to competition from China.

[18] The variable capturing the change in total exports from each region is potentially endogenous. None of our results on the effect of the change in import exposure is affected by whether we use this variable as a control.

[19] We allocate each six-digit HS code to either a final good or an intermediate input using the correspondence tables for the HS and the Broad Economic Categories (BEC) codes from Eurostat (http://ec.europa.eu/eurostat/ramon/). We classify capital goods as intermediate inputs.

[20] Plots of the OLS reduced form regression and first stage results can be found in Fig. 5 and Table 3 of the online appendix. Our first-stage results indicate that our instrument is a good predictor of Norwegian imports.

Table 2
Change in manufacturing employment share and imports from China, OLS estimates.

	(1)	(2)	(3)	(4)	(5)	(6)
Δ Domestic exposure to China:						
Total imports	−0.144**	−0.137**	−0.147**			
	(0.057)	(0.056)	(0.059)			
Intermediates				−0.214**		−0.218***
				(0.076)		(0.066)
Final goods					−0.144	0.017
					(0.145)	(0.090)
Controls:						
Manuf empl/pop	−0.032	−0.070*	−0.078*	−0.079*	−0.083*	−0.079*
	(0.023)	(0.037)	(0.040)	(0.040)	(0.040)	(0.041)
College/pop		−0.027	−0.027	−0.027	−0.024	−0.026
		(0.019)	(0.019)	(0.020)	(0.019)	(0.019)
Δ Export			0.011*	0.013*	0.008	0.014*
			(0.006)	(0.006)	(0.010)	(0.007)
Region dummies	No	Yes	Yes	Yes	Yes	Yes
Period dummy	No	Yes	Yes	Yes	Yes	Yes
Observations	320	320	320	320	320	320
R^2	0.079	0.160	0.164	0.170	0.139	0.168

Dependent var. is % pts change in the share of working-age population employed in manufacturing.
Each regression contains two observations per region, each weighted with start of period population.
Standard errors in parentheses are clustered by county. *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Column 3 of Table 3 reports the estimated combined effect from these two sources of exposure to increased imports from China.[21] Finally, in Column 4, we subtract exports to China from the measure used in Column 3. As shown, the four estimated coefficients reported across Panel A of Table 3 are relatively similar, and the negative effect of increased exposure to competition from China appears to arise mainly from the increase in domestic imports.

The 10 regions that experienced the largest increases in exports to China per worker are small coastal communities where fish processing is the dominant manufacturing activity. To an increasing extent, the Norwegian fishing industry ships minimally processed fish to China (and some other Asian countries) for filleting and packaging, before the processed products are re-exported from China to Europe. This has led to a large contraction of the fish-processing industry in many communities where this used to be the main source of employment. At the same time, these regions have less exposure to imports from China. To document that this is not affecting our results, we report in Panel B of Table 3 results without these 10 regions included.

In Panel C of Table 3, we drop an additional three labor market regions—those that experienced the largest population growth over the period of analysis, namely, Oslo, Trondheim, and Stavanger. The main reason for doing this is that these regions have large corresponding weights in our regressions and have experienced population growth that is part of a strong trend toward urbanization in Norway. In addition, migrants to Norway tend to settle in the larger cities, particularly Oslo. The large population growth in these regions will necessarily lead to a reduction in the manufacturing employment share, even if no manufacturing jobs are lost, and thus including these regions in our regressions may lead to overestimation of the negative effect of import exposure on manufacturing employment. We obtain slightly smaller estimates of the exposure to import competition from China in all of the specifications. Hence, hereafter we base our estimates on the sample used in Panel C.[22]

To assess the economic significance of our results, we can compare the estimated trade-induced reduction in manufacturing employment shares with the actual decrease over the period 1996–2007. As stated by ADH, such an exercise assumes that trade with China affects the absolute level of manufacturing employment in Norway and not only relative manufacturing employment across labor markets. Our preferred specification in Panel C of Table 3, implies that a 10,000 NOK increase in exposure to total imports from China reduces the manufacturing employment share by 0.125 percentage points. Chinese import exposure rose by 2700 NOK per worker between 1996 and 2001 and by an additional 10,100 NOK per worker in the six-year period between 2001 and 2007. Hence, using the estimated coefficient, the increased exposure to Chinese imports reduced manufacturing employment as a proportion of the working-age population by 0.03 percentage points in the first five-year period, and then by an additional 0.13 percentage points in the following six-year period.

At the same time, the manufacturing employment share of the working-age population fell by 0.78 percentage points between 1996 and 2001 and by 0.75 percentage points between 2002 and 2007. Thus, according to these calculations, the increased exposure to Chinese import competition explains only 4% of the manufacturing employment decline in the first period, 17% of the decline in the second period, and

Table 3
Change in manufacturing employment share and different measures of change in exposure to competition from China, 2SLS estimates.

Domestic exposure	Net domestic exposure	Domestic + intl exposure	Net domestic + intl exposure
(1)	(2)	(3)	(4)
Panel A: full sample with N = 320			
−0.139***	−0.152***	−0.139***	−0.152***
(0.039)	(0.044)	(0.039)	(0.044)
Panel B: dropping 10 fish-processing regions N = 300			
−0.139***	−0.151***	−0.140***	−0.152***
(0.042)	(0.046)	(0.042)	(0.046)
Panel C: dropping from panel B the three largest cities N = 294			
−0.125**	−0.136**	−0.126**	−0.137**
(0.041)	(0.045)	(0.041)	(0.045)

Dependent var. is % pts change in the share of working-age population employed in manufacturing.
Each regression contains two observations per region, each weighted with start of period population, and contains the same control variables as column 3 of table 2.
Standard errors in parentheses are clustered by county. *$p < 0.10$, **$p < 0.05$, and *** $p < 0.01$.

[21] We also entered the exposure measures defined in Eqs. (1) and (2) separately in the regression. However, the estimated coefficients for exposure in export markets were very small in magnitude, and not significantly different from zero, while the estimated coefficient for exposure to domestic imports from China was negative and significant.

[22] Table 4 of the online appendix reports results using our preferred sample of 147 regions for different time-periods. These results indicate that the negative effect of import competition is particularly pronounced in the period after China's accession to the WTO.

Table 4
Labor market response: change in labor market status and imports from China, 2SLS estimates.

	Manufacturing	Public empl	Other	Unemployed	Outside
	(1)	(2)	(3)	(4)	(5)
All workers					
ΔDom exp to China	−0.779*	0.094	0.460***	1.592*	0.125
	(0.447)	(0.228)	(0.165)	(0.939)	(0.173)
Observations	293	294	294	294	294
R^2	0.113	0.164	0.252	0.079	0.431
Non-college educated					
ΔDom exp to China	−0.768*	−0.242	0.498***	1.846*	0.291*
	(0.454)	(0.338)	(0.176)	(1.017)	(0.166)
Observations	293	294	294	294	294
R^2	0.089	0.132	0.254	0.053	0.385
College educated					
ΔDom exp to China	−0.547	0.337***	0.153	−1.162	−1.011**
	(0.803)	(0.095)	(0.202)	(1.175)	(0.396)
Observations	273	294	294	271	294
R^2	0.062	0.028	0.071	0.205	0.072

Dependent var. is 100 × log change in head counts of group indicated in column heading.
Each regression contains the same control variables as column 3 of Table 2.
Standard errors in parentheses are clustered by county. $*p < 0.10$, $**p < 0.05$, and $***p < 0.01$.

10.5% of the decline in the entire sample period.[23] ADH's comparable estimate for the US is that 44% of the US decline in manufacturing over the period from 1990 to 2007 can be explained by increased imports from China.

We use the actual increase in imports from China when calculating that increased imports from China account for about 10% of the reduction in manufacturing employment shares in Norway from 1996 to 2007. The increase in imports from China to Norway has come about due to a combination of supply and demand forces. Thus, if the employment effect of demand-driven increases in imports is less negative than supply-driven increases, this may overestimate the causal effect of the Chinese supply shock on Norwegian manufacturing employment. ADH discuss how to isolate the variation in the import exposure measure that is driven by supply shocks by using the relationship between the OLS and 2SLS estimates. For the US case they then estimate that about half of the variation in the increase in imports from China to the US is driven by the exogenous supply shock, and thus they more conservatively conclude that 21% of the US decline in manufacturing over the full period from 1990 to 2007 can be explained by increased imports from China. Following their suggestion, we find that most of the decline in Norwegian manufacturing share found above is explained by the supply-driven increase in imports from China to Norway. According to our data, 91% of the variation in the increase in imports from China to Norway is driven by the exogenous supply shock, thus 9.5% of the decline in the Norwegian manufacturing share over the period from 1996 to 2007 can be explained by increased imports from China. This measured economic effect is about half the size of the effect for the US as found by ADH.[24]

5.1. Other outcomes

The negative impact on the manufacturing employment share of exposure to imports from China would be difficult to interpret if increase in exposure has an impact on labor mobility between regions, but we find no significant mobility effect of the increased exposure to imports from China.[25] In Table 4, we report results investigating other labor market outcomes at the local labor market level. The five columns of Table 4 have as their dependent variable the log point change in the number of people in each of five labor market statuses: employed in manufacturing, employed in the public sector, other private employment, unemployed, or not in the labor force. The middle and lower panels detail the outcomes for people without and with a college education, respectively. First, we note that the negative impact of exposure to China primarily affects workers without a college education. For workers without a college education, an increase in import exposure of 10,000 NOK per worker reduces manufacturing employment by about 0.8%, increases unemployment by 1.8%, and increases the number of people outside the labor force by 0.3%. Some of the displaced workers find employment in other private sectors. With the very generous welfare state in place in Norway, we would expect the displacement of workers to increase both the number of unemployed people and the number of people leaving the labor force.[26]

When it comes to wage effects, Table 5 presents the results of regressions where the dependent variable is the change in regional average earnings. In contrast to the results for the US reported in ADH, we do not find any effect on wages in Norway. This finding is also in accordance with existing results regarding job displacement in Norway Huttunen et al. (2011), while for the US, strong and persistent negative wage effects are found for displaced workers von Wachter and Bender (2006).

6. Conclusion

This paper analyzed to what extent the emergence of China as the world's largest manufacturing exporter has affected regional labor markets in Norway. From 1996 to 2007, Norwegian imports of products from China increased more than sixfold, but different labor market regions can have different exposures to the increase in import competition from China because of differences in regional industry structure. We analyzed whether regional exposure to import competition from China affects manufacturing employment, and assessed to what extent the increased exposure to competition from China can explain the decrease in the manufacturing sector's employment share in Norway over the period from 1996 to 2007.

To account for the possible simultaneity of import demand and labor demand shocks, we instrumented Norwegian import growth from

[23] The mean changes in import exposure and employment shares referred to here are weighted by the population in 1996 for the first period and 2001 for the second.

[24] Our estimated effects using the OLS and IV specifications are relatively similar, while ADH finds for the US that the IV coefficient is much larger than the OLS coefficient. Thus, it makes sense that we find that almost all of the of the variation in the increase in imports from China to Norway is driven by the exogenous supply shock.

[25] The results are reported in Table 5 of the online appendix.

[26] This is in line with previous findings on displacement for Norway. See Huttunen et al. (2011).

Table 5
Wage response: change in log earnings and imports from China, 2SLS estimates.

	Manufacturing			Private sector
	All	Non-college	College	All
	(1)	(2)	(3)	(4)
Δ Domestic exposure to China:				
	0.001	0.000	0.004	−0.005***
	(0.002)	(0.003)	(0.003)	(0.001)
Controls	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes
Period dummy	Yes	Yes	Yes	Yes
Observations	289	289	262	294
R^2	0.013	0.013	0.008	0.297

Dependent var. is change in log earnings of group indicated in column heading.
Each regression contains the same control variables as column 3 of table 2.
Standard errors in parentheses are clustered by county. *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

China by using the increase in similar imports from China to other developed countries. We found a negative impact of regional exposure to competition from China on the manufacturing employment share in local labor markets. Further, this effect stemmed mostly from the import of intermediate goods rather than final goods, and from exposure to imports from China to Norway rather than competition with China in common export markets. Our estimates suggested that almost 10% of the reduction in the manufacturing employment share from 1996 to 2007 can be explained by increased import competition from China. This is about half of the magnitude found by Autor et al. (2013) for the US.

The reduction in manufacturing employment that we found for Norway because of the Chinese import shock primarily affects workers without a college degree, who find themselves partly pushed into unemployment, partly out of the labor force, and partly into employment in other private sectors. Despite differences between the US and Norway in terms of manufacturing structure, openness to trade, and labor market institutions, manufacturing employment in both countries has been negatively affected by the Chinese export supply shock since the early 1990s, although to a much smaller degree in Norway than in the US. In contrast to the findings for the US, we did not find any negative wage effects. These latter results are to be expected in a Nordic model where wage flexibility is low, and thus where we instead expect the margin of adjustment to be on employment.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jpubeco.2014.08.006.

References

Aaberge, R., Bjorklund, A., Smith, N., 2000. Unemployment shocks and income distribution: how did the Nordic countries fare during their crises? Scand. J. Econ. 102 (1), 77–99.
Agell, J., Lommerud, K.E., 1997. Minimum wages and the incentives for skill formation. J. Public Econ. 64 (1), 25–40.
Amiti, M., Davis, D.R., 2012. Trade, firms, and wages: theory and evidence. Rev. Econ. Stud. 79 (1), 1–36.
Andersen, T.M., Holmström, B., Honkapohja, S., Korkman, S., Söderström, H.T., Vartiainen, J., 2007. The Nordic model: embracing globalization and sharing risks. Report, The Research Institute of the Finnish Economy.
Autor, D.H., Dorn, D., Hanson, G.H., 2013. The China syndrome: local labor market effects of import competition in the United States. Am. Econ. Rev. 103, 2121–2168.
Berman, E., Bound, J., Machin, S., 1998. Implications of skill-biased technological change: international evidence. Q. J. Econ. 113 (4), 1245–1279.
Bernard, A.B., Jensen, J.B., Schott, P.K., 2006. Survival of the best fit: exposure to low-wage countries and the (uneven) growth of US manufacturing plants. J. Int. Econ. 68 (1), 219–237 (URL http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=0823760&site=ehost-live).
Beveren, I.V., Bernard, A.B., Vandenbussche, H., 2012. Concording EU trade and production data over time. nBER Working Paper Series 18604.
Bloom, N., Draca, M., Reenen, J.V., 2011. Trade induced technical change?. January The Impact of Chinese Imports on Innovation, IT and ProductivityWorking Paper 16717. National Bureau of Economic Research (URL http://www.nber.org/papers/w16717).
Chiquiar, D., 2008. Globalization, regional wage differentials and the Stolper–Samuelson theorem: evidence from Mexico. J. Int. Econ. 74 (1), 70–93 (URL http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=0976407&site=ehost-live).
Dauth, W., Findeisen, S., Suedekum, J., 2014. The rise of the east and the far east: German labor markets and trade integration. J. Eur. Econ. Assoc. 4 (forthcoming).
Donoso, V., Martín, V., Minondo, A., 2014. Do differences in the exposure to Chinese imports lead to differences in local labour market outcomes? An analysis for Spanish provinces. Reg. Stud. 1–19.
Ebenstein, A., Harrison, A., McMillan, M., Phillips, S., 2011. Estimating the impact of trade and offshoring on American workers using the current population surveys. the World Bank, Policy Research Working Paper Series: 5750 (URL http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1258208&site=ehost-live).
Gundersen, F., Jukvam, D., 2013. Inndelinger i senterstruktur, sentralitet og BA regioner. nIBR-rapport 2013-1.
Hægeland, T., Klette, T.J., Salvanes, K.G., 1999. Declining returns to education in Norway? Comparing estimates across cohorts, sectors and over time. Scand. J. Econ. 101 (4), 555–576.
Hummels, D., Jorgensen, R., Munch, J., Xiang, C., 2014. The wage effects of offshoring: evidence from Danish matched worker-firm data. Am. Econ. Rev. 104 (6), 1597–1629.
Huttunen, K., Møen, J., Salvanes, K.G., 2011. How destructive is creative destruction? Effects of job loss on mobility, withdrawal and income. J. Eur. Econ. Assoc. 9 (4), 840–870.
Kahn, L., 1998. Against the wind: Bargaining recentralisation and wage inequality in Norway 1987–91. Econ. J. 108, 603–645.
Kovak, B.K., 2013. Regional effects of trade reform: what is the correct measure of liberalization? Am. Econ. Rev. 103, 1960–1976.
Krugman, P.R., 2008. Trade and wages, reconsidered. Brook. Pap. Econ. Act. 39 (1), 103–154.
Moene, K.O., Wallerstein, M., 1997. Pay inequality. J. Labor Econ. 15 (3), 403–430.
Salvanes, K.G., Førre, S.E., 2004. Effects on employment of trade and technical change: evidence from Norway. Economica 70, 293–329.
Topalova, P., 2010. Factor immobility and regional impacts of trade liberalization: evidence on poverty from India. Am. Econ. J. Appl. Econ. 2 (4), 1–41 (URL http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1124130&site=ehost-live).
Verhoogen, E.A., 2008. Trade, quality upgrading, and wage inequality in the Mexican manufacturing sector. Q. J. Econ. 123 (2), 489–530 (URL http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=0977149&site=ehost-live).
von Wachter, T., Bender, S., 2006. In the right place at the wrong time: the role of firms and luck in young workers' careers. Am. Econ. Rev. 96 (5), 1679–1705.