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Workers Beneath the Floodgates: Low-Wage Import Competition and Workers' Adjustment

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Abstract

Using employee-employer matched data for the period 1999 to 2010, I analyze the impact of a low-wage trade shock on manufacturing workers in a high-wage country, Denmark, and how they adjust to the shock over a decade. To derive causal effects I exploit the dismantling of import quotas on Chinese products with China's accession to the WTO as a quasi-experiment and utilize within-industry, within-occupation heterogeneity in workers' exposure to this trade shock. Showing significant negative effect on workers' earnings and employment trajectories over the decade, the study identifies job instability in the service sector as a main adjustment friction which is concentrated among workers with manufacturing specific education and occupation. The results establish the importance of specific human capital in trade adjustment and provide evidence of skill upgrading at the individual level as workers re-build lost human capital through education.

JEL-Codes: F160, F660, J600, J240, J310, L670.

Keywords: workers' adjustment to trade shock, globalization, earnings trajectories, specific human capital, job mobility, unemployment, low-wage country competition, multi-fibre arrangement, China.

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1 Introduction

Waning of stable manufacturing jobs is causing considerable anxiety in advanced countries. The consequences of rising trade with China and how workers and society can best adjust are primary topics of current debate. Recent research has made great progress in understanding the consequences of the rising trade with low-wage countries on firms and industries and documented significant labor reallocation as a result (e.g. Bernard, Jensen, Schott (2006), Khandelwal (2010), Autor, Dorn, Hanson (2013), Utar and Torres-Ruiz (2013), Utar (2014), Pierce and Schott (2016), Bloom, Draca, Van Reenen (2016)). But labor does not reallocate instantaneously and costlessly as predicted by traditional trade theories. The salient question is what happens to the workers when they are displaced from their workplaces due to import competition from low-wage countries.[1] If workers can efficiently switch to another job within the same industry, the earnings (and broader welfare) consequences are small. But what are the options available to manufacturing workers when facing low-wage import competition and what are their adjustment costs in reality? Are the possible paths of adjustment different for workers depending on their individual investments in human capital - reflected in their education and occupation - and how do these differences affect the cost of adjustment?

Addressing this, I study the impact of a Chinese import shock on workers' earnings and employment trajectories in a high-income country, Denmark and study workers' adjustment experience in a quasi-experiment that measures the causal effects of a trade policy change impacting a classic manufacturing industry. China benefitted from trade liberalization in the form of import quota removals in textiles on her entry into the World Trade Organization (WTO), which provides a very suitable lens through which to study the effect of the China shock.[2] By using longitudinal employee-employer

[1] It has been shown that involuntary job displacement due to plant downsizing can have lasting negative effect on workers' earnings for years after the event and can even have non-pecuniary negative effects such as reduced life expectancy (Jacobson, LaLonde and Sullivan (1993) and Sullivan and von Watcher (2009)).

[2] The plausibly exogenous increase in import competition due to removal of the Multi-fiber Arrangement (MFA) quotas for China have been used as an identification strategy before at industry (Bloom, Draca, and van Reenen, 2016)

matched data from 1999-2010 that follows individuals from job to job, sector to sector but also in and out of education or unemployment, this study provides a true-to-life documentation of manufacturing workers' adjustment to the trade shock over the decade that follows.

To measure the exposure to the trade shock at the individual level, I first use detailed product and firm level domestic production data to identify firms domestically producing products subject to import quotas for China. The matched employee-employer data allows me to identify workers employed in the firms that will subsequently be hit by cheaper imports from China. Measuring differential labor market trajectories of the exposed workers relative to other workers initially employed in the same industry after controlling for potentially unobserved worker and workplace characteristics by worker fixed effects affords me a powerful tool to get causal evidence.

Technological forces are among important factors that cause decline in manufacturing employment in advanced countries (Machin and Van Reenen (1998)). Especially, labor-intensive industries have been restructuring since the 1960s due to factors that include both low-wage competition and technological changes. By directly utilizing a discrete change in trade policy and within-industry, within-occupation heterogeneity in exposure to the resulting import competition, the empirical strategy in this paper disentangles the effects of the trade shock from potentially important technology and demand factors.

I show that increased competition with China leads to substantial earnings reductions, on average of 89% of workers' initial annual wage over the nine years after the WTO accession. The effect on earnings was mainly due to reduction in hours worked instead of hourly rates, consistent with the general structure of the Danish labor market, which is characterized by liberal hiring-firing regulations (as in the US) with a high degree of unionization.[3]

or firm (Utar, 2014) level. See also Harrigan and Barrow (2009) and Khandelwal, Schott, Wei (2012) for price and productivity consequences of the event.

[3]The Global Competitiveness Report 2013-2014 ranks Denmark 6th among 148 countries at hiring and firing practices, indicating a very de-regulated market (The US is ranked 9th in the same ranking), while it is ranked 93rd for flexibility of wage determination.

Workers exposed to the competition have higher likelihood of unemployment and shorter future employment spells. The trade shock affects them mainly via shorter employment at the initial firm and subsequent job instability experienced especially within the service sector. The initial impact of trade is fairly homogenous across workers regardless of education or occupation. Whether a secretary, machine operator, or manager at the exposed firm, and whether college educated or not, the trade shock affects workers similarly at the exposed firm, causing an average reduction in length of employment there of more than a full year over the nine years following. For workers of all educations and occupations, the growing service sector provides the most viable path to new employment, as the trade shock significantly increases the likelihood of moving there for all types of workers. But after the move out of manufacturing into the service sector, workers' paths of adjustment diverge, resulting in very heterogeneous long-run outcomes. College educated workers fully recover the initial earnings loses, but high-school educated workers suffer earnings losses of 143% of a pre-shock annual wage over the decade.

This paper belongs in the recent literature that documents the role of low-wage country trade in the evolution of industry and labor markets in advanced country economies[4] and is most closely related to Autor, Dorn, Hanson and Song (2014) who provide the first worker-level study on Chinese import competition and document that American workers under direct threat from Chinese import competition have lower cumulative earnings and higher risks of exiting the labor force. The costs of adjustment, they find, are disproportionately borne by low-wage workers, who stay within manufacturing, while high-wage workers, who have higher likelihood of moving out of manufacturing, adjust successfully. Their results imply that a necessary condition for a successful adjustment is being able to move out of manufacturing. But their results do not answer whether the costs of adjustments are limited to the frictions that slow down or prevent workers' move to new sectors and whether moving

[4]Examples are cited above. Studies also document wage changes in response to the recent wave of globalization within firms (e.g. Hummels, Jørgensen, Munch, Xiang (2014)) or within local labor markets (e.g. Hakobyan and McLaren (2016)).

out of manufacturing, in itself, is a sufficient condition for a smooth recovery.[5] Studying the adjustment experience of workers in a European country with active labor market policies where full-time employment outside of manufacturing is within reach for all types of workers, my results show that adjustment costs are substantial even after moving out of manufacturing to the service sector.

It is the adjustment costs, experienced especially after moving to the service sector, that determine the differences in workers' outcome over the medium to long term. And worker's initial investment in human capital as reflected in education and occupation plays a major role in determining the distribution of these costs. A decade after the trade shock a typical machine operator's earnings loss remained at one year's annual wage, while a typical secretary fully recovered earnings, despite the same impact to both occupations at the exposed firm. Examining outcomes among vocationally educated workers, I find that the field of education is also an adjustment cost determining dimension of human capital, independent of education level. Workers with manufacturing focused vocational education face job instability and frequent unemployment spells in the service sector, while workers with service-specific vocational education fully avoid any trade-induced unemployment. The adjustment problems persist for workers who lose a substantial part of their human capital in their new environment, such as craft workers and machine operators, and I show that the trade adjustment costs are dominated by forgone human capital specific to the initial industry. Generally, I show that human capital specificity, and particularly specificity to manufacturing, is the main determinant of workers' cost of adjustment to an import shock from China.

Motivated by many of the trade liberalization episodes in developing countries with rigid markets, much of the trade adjustment literature focuses on mobility frictions that slow down or prevent resources from allocating efficiently in the new environment.[6] Focusing on labor reallocation in

[5] Their results further raise the question of why the transition out of manufacturing is easier for high-wage workers than for low-wage workers and what underlying characteristics of workers drive the difference.

[6] See Goldberg and Pavcnik (2007) for a review. Recent examples include Menezes-Filho and Muendler (2011) that use matched data to documents sluggish labor reallocation in response to trade liberalization in Brazil. See also Dix-Carneiro and Kovak (2017) focusing on regional dynamics in response to trade liberalization in Brazil.

response to trade liberalization and employing empirical structural models, some studies aim at recovering mobility costs that workers face to switch sectors (e.g. Artuç, Chaudhuri and McLaren (2010), Dix-Carneiro (2014)) or analyze the relationship between trade and wage inequality in the presence of search frictions (e.g. Helpman, Itshoki, Muendler and Redding (2014)). Among them this paper is most related to Dix-Carneiro (2014) who introduces human capital with differential returns across sectors, finding substantial heterogeneity in adjustment frictions across workers. I add quasi-experimental evidence and show that it is important to consider workers occupations to tease out the full role of industry specific human capital. [7] Contrary to what studies so far suggested, this paper shows that trade-induced adjustment problems do not end once workers find full-time jobs in the growing sectors and bring into light a new facet of the nature of these frictions.

The idea that the specific aspect of human capital could be an important barrier to labor reallocation from shrinking sectors to growing ones is not new. Since Becker (1964) studies focus on human capital that may be specific to firm, industry and occupation (Topel (1991), Neal (1995), Parent (2000), Poletaev and Robinson (2008), Kambourov and Manovskii (2009)). This literature either looks at plant closings regardless of reason or focus on job switches that are endogenous to characteristics of workers and their employers. Exploiting the removal of import quotas that led to a decline in labor demand I advance this literature by offering a plausibly exogenous driving force for job mobility. As in Poletaev and Robinson (2008) I find that industry and occupation specificity of human capital interplays with each other. More specifically, using a triple difference method, I show that workers' occupations are a very important determinant of trade-induced adjustment costs to the extent that occupation is specific to manufacturing.

Finding that the right skill set and the ability to adapt to the new environment are important determinants of recovery from the trade shock, I examine if the import shock leads to investment in human

[7] While Dix-Carneiro (2014) finds a dominating role for moving frictions in the context of Brazil, a relative abundance of labor market frictions in Brazil in comparison to Denmark could be one reason for a larger role of moving barriers there.

capital through education.[8] This relates to the important question of whether trade with low-wage countries alters the demand for skill in advanced countries and in their offshore locations. Recent studies show supporting evidence for skill upgrading at the firm and establishment level (Bloom, Draca, van Reenen (2016), Utar (2014), Utar and Torres-Ruiz (2013)). I find that the trade shock causes workers to seek further education and that this effect is stronger with decreasing education level, but also with increasing mis-match of the initial education with the new environment. Thus this paper shows the first direct evidence that trade with low-wage countries can lead to skill upgrading at the individual level and thereby potentially increase the supply of skill.[9] By showing that trade can induce potential adjustment also in the *supply* of skill, this paper points to a factor that mitigates the effect of trade causing wage disparity.[10]

In the next section, I describe the data used in this study and lay out the framework of the empirical analyses with background information on the import quotas and Danish institutions. A description of the empirical strategy is provided in Section 3. I present and discuss my results on the impact of the trade shock and workers' subsequent adjustment to it in Section 4. Heterogeneity of trade-induced adjustment is examined in Section 5. The section uncovers the role of the loss of specific human capital as an adjustment hurdle to manufacturing workers. It is then shown how this causes workers to rebuild human capital through education. I conclude in Section 6. A number of additional results and a more detailed description of the data are relegated to the Online Appendix.[11]

[8]Nelson and Phelps (1966) emphasize the role of education in the ability to adjust to changing conditions. Bartel and Sicherman (1998) show that changing technological conditions may induce investment in human capital.

[9]Looking at a potential effect of trade on the supply of skill from a different angle, in a recent study Atkin (2016) shows that export expansion triggered by the trade reforms in Mexico causes school dropouts.

[10]A link between trade and skill is mostly drawn in a Heckscher-Ohlin framework via trade's effect on returns to skill (the Stolper-Samuelson effect). Earlier literature investigating whether trade with lower wage countries was an important factor in driving the increase in income inequality in many advanced countries in the 1980s and 1990s did not find strong empirical support in comparison to alternative explanations such as technology factors. In the US, for example, the share of income received by the lowest quintile of households fell from 4.4% in 1977 to 3.6% in 1997, while the share of income received by the highest quintile of households has risen from 43.6 to 49.4% over the same period (Feenstra (2000)).

[11]The Online Appendix is accessible via `https://sites.google.com/site/haleutar/papers/OnlineAppendix_Utar_WorkersAdj.pdf`.

2 Empirical Framework and Worker-level Data

The removal of the MFA quotas for China is used as identification strategy. This section briefly introduces this empirical framework, shows how the removal of import quotas led to increased competition, describes the data used and provides information on the Danish labor market. Further details are provided in the online appendix.

2.1 The Surge of Import Competition from China through the Quota Removals

The Multi-fibre Arrangement was introduced in 1974 to govern the world trade in textiles with the purpose of protecting high-income countries against competition from low-wage countries through quantitative restrictions. In 1995 it was agreed that the MFA would gradually be lifted in so-called Phases of liberalization. But China's non-WTO status rendered it ineligible to benefit from the liberalization, which changed only once China had joined the WTO in December 2001. The subsequent dramatic surge of Chinese textiles and clothing (T&C) exports into Denmark and the resulting increase in competition provides me a plausibly exogenous source of shifts in employment trajectories among Danish workers.

As one of the smaller members of the EU, the coverage of quotas was largely exogenous to Denmark's industrial structure, as it was determined in EU level negotiations throughout the 1960s and 1970s. The empirical strategy focuses on China because, although the removal of the import quotas started in 1995, Phase I and II removals did not effectively trigger increased competition. First, this is because the law allowed the EU to choose the products to be integrated into the normal system, and the EU started with inactive, non-binding quotas. Then, among the exporting countries subject to the MFA quotas, China stood out as facing the largest number of quotas with the highest quota

utilization rates (SIGL). The countries with the highest quota utilization after China were India, Pakistan and Indonesia, none of which had any active quotas removed in Phase I or II.

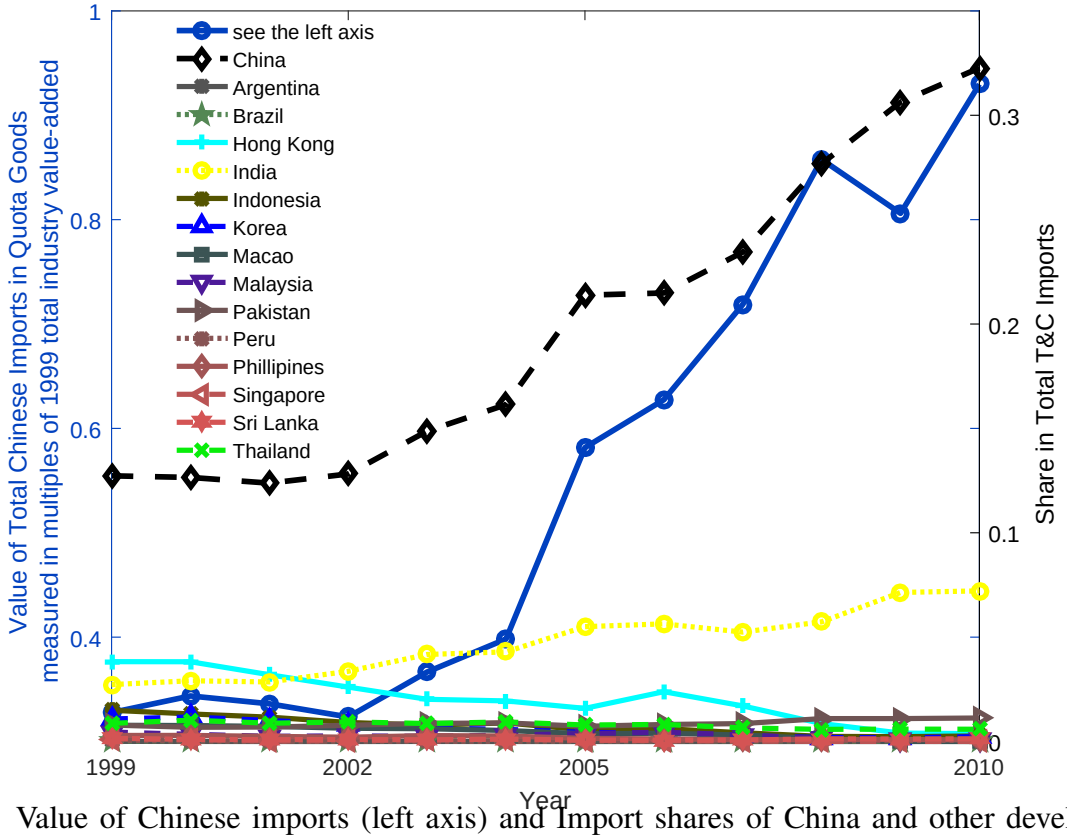


Figure 1: Value of Chinese imports (left axis) and Import shares of China and other developing countries subject to MFA quotas in Danish Textile and Clothing Imports 1999-2010 (right axis)

There was considerable uncertainty as to whether the negotiations for China's WTO membership would succeed, which they did in December 2001. In January 2002 China's quotas on Phase I, II and III goods were removed immediately leading to a dramatic surge in Chinese T&C imports into the formerly protected countries. Now a WTO member, China also benefitted from the last phase in January 2005.[12] In 1998, China's share of T&C import in Denmark was a little over 10% compared to 2.8%, 0.7% and 1.3% respectively for India, Pakistan and Indonesia. Figure 1 shows

[12]Due to a surge of Chinese imports in the first few months of 2005 at European Union (EU) ports in response to the final phase of the quota removal, the EU retained a few of the quota categories until 2008. Since the sample period extends over 2008, these quotas are also included in the current analysis.

the evolution in T&C import shares of China compared to other developing countries subject to MFA quotas throughout 1999 to 2010. By 2010 China's share reached 32%, while the respective shares of India, Pakistan and Indonesia were 7%, 1%, and 0.3%. The blue line with circles in figure 1 illustrates the magnitude of the shock by showing the evolution of the value of Chinese imports in MFA goods expressed in multiples of the 1999 total T&C value added, which was around 1.1 billion current euros. The image of floodgates opening is an apt one.[13]

2.2 Employee-employer matched data

The main database used in this study is the Integrated Database for Labor Market Research (IDA) of Statistics Denmark. It contains administrative records on all individuals who are between 15 and 74 years old and all jobs and establishments that are active in the last week of November each year. The IDA database provides a yearly snapshot of the labor market by reporting primary positions of each individual living in Denmark as of November. For each individual I observe annual labor earnings, hourly wage, annual hours worked, industry and occupation in these primary employment.[14] I also observe workers' highest attained education, age, gender, immigration status, personal income and total earnings from all jobs within a year as well as the overall position with respect to the the labor market such as employed employee, retiree or in education. Occupation and education information on individuals follow the International Standard Classification of Occupations (ISCO), and International Standard Classification for Education (ISCED) and are administrative as they influence workers' wages due to a collective bargaining system.

The Danish production database, VARES, is used to identify firms domestically producing the goods

[13]Using transaction-level import data, Utar (2014) shows that the MFA quotas were binding for China and both the 2002 and the 2005 abolishments caused a very significant surge of MFA goods from China in Denmark with associated decline in unit prices of these goods. Decline in prices were driven by the efficiency gain in Chinese exports, Khandelwal, Schott, and Wei (2013) finds, that misallocation of the MFA quotas by the Chinese government during the quota regime played an important role in the resulting surge of lower priced Chinese goods.

[14]The primary employment of a worker is the worker's most important job in terms of earnings and hours worked.

that were subject to the import quotas for China. This data-set provides information on industrial goods produced within the country at the detailed product level and is the basis for the industrial commodity production statistics of Denmark. Firms, that in 1999 domestically produce 8-digit Combined Nomenclature (CN) goods subject to the MFA quota removal for China, are identified and mapped with worker-level information through the unique firm identification numbers.[15]

Table 1: Worker Characteristics in 1999

	Age	Female	Immigrant	Union Membership	Unemployment Insurance Membership	College Education	Vocational Education
Mean	38.783	0.571	0.062	0.800	0.896	0.114	0.350
Std	10.264	0.495	0.241	0.400	0.305	0.318	0.477
N	10511	10511	10511	10511	10511	10511	10511

	Treated: Employed in T&C firms with domestic production of MFA goods as of 1999		Control: Employed in other T&C firms as of 1999			
	Mean	SD	Mean	SD	Mean Difference	t-test
Number of obs	4,917		5,594			
Age	38.879	10.192	38.700	10.328	0.179	0.891
Immigrant	0.051	0.220	0.071	0.257	-0.020*	-4.357
Experience†	14.713	5.879	14.156	5.789	0.557*	4.850
Past Unemployment Spells†	1.131	1.623	1.400	1.981	-0.268*	-7.534
Negative Trend at Workplace	0.432	0.495	0.450	0.498	-0.019	-1.925
with College Education	0.128	0.334	0.102	0.303	0.025*	4.068
with Vocational Education	0.352	0.478	0.348	0.476	0.004	0.467
Machine Operator (ISCO 82)	0.349	0.477	0.350	0.477	-0.002	-0.167
Annual (Primary) Wage	214,967.9	132,948.2	215,047.3	130,458.8	-79.320	0.031
Total Annual Wages	228,866.2	134,376	128,441.4	228,930.3	-64.072	0.025
1996-1999 Average Annual Wage	203,869.6	122,648.3	204,145.8	122,658.1	-276.179	0.115

Notes: †: expressed in years. Values are expressed in year 2000 Danish Kroner. * indicates significance at the 5 % level. Negative Trend at Workplace is an indicator variable that takes one if the total employment of worker *i*'s workplace declined at least 5 % compared to year 1998.

There are around 13,000 workers employed in the T&C sector in 1999. I focus here on workers of

[15]Information on MFA quotas is reported in the Système Intégré de Gestion de Licenses (SIGL) database of the European Commission and is publicly available. See the online appendix for details on the mapping of the quotas with CN products.

working age (17 to 67 years) throughout the whole sample period. Table 1 presents sample information from the 1999-cross section of workers' demographic, education, occupation and workplace characteristics. With an average age of 39, an average worker was roughly in the middle of his/her career span. The share of female workers is 57%, and 6% are immigrants. In 1999, about half of the workers (47%) are exposed to increased import competition by being employed at a firm that will subsequently be affected by quota removals when China joins the WTO.

Table 1 reports the characteristics of workers initially employed at firms that were exposed to import competition, versus workers that were not exposed to import competition. Workers have similar age, experience, education and wage levels in both groups. The percentage of machine operators in both the treated and untreated groups is the same at 35%, showing that production workers make up a substantial part of the workforce in both groups. Table 1 also shows that workers' initial firms face similar employment trends before the shock regardless of whether they produce quota products.

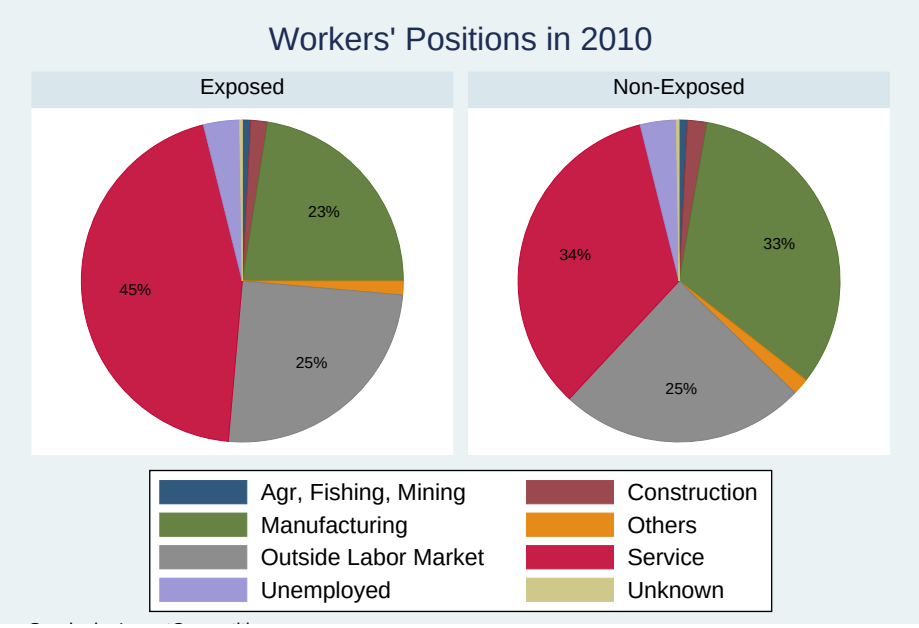


Figure 2: Labor Market Positions of the Workers in 2010 By Trade Exposure

To gain an aggregate perspective, Figure 2 shows the distribution of workers at the end of the sample period over different labor market positions by exposure to the trade shock. By 2010, 34% of the

control group had primary employment in the service sector whereas among exposed workers this ratio is much higher at 45%. 25% of both groups were outside of the labor market in 2010. The figure makes clear that the analysis controls for the secular declining trend of the industry and concentrates on the pure trade effect even if this may underestimate the effect of trade, since the secular declining trend in the industry may in part be caused by globalization. In the following I will provide brief information on the structure of the labor market in Denmark.

2.3 Labor Market

The labor market in Denmark is characterized by liberal hiring and firing regulations for firms combined with a high level of publicly provided social protection for workers. Denmark is one of a few countries with estimated redundancy/firing costs of zero (World Economic Forum, 2013).[16] The hiring and firing flexibility in combination with a high level of tax funded social protection is often described as a 'flexicurity' system. In particular, Denmark has very comprehensive and large scale ALMP with a history back to the late 1970s. Any unemployed worker is subject to the ALMP measures which include job search assistance. As a result, the long term unemployment rate (in total unemployment) is generally low in Denmark compared to the OECD average. In 2008, it was 13.5%, compared to, for example, 52.5 and 10.6% for Germany and the US respectively (OECD Employment Database 2013). There is no minimum wage in Denmark, but reference wages are to a great extent determined by collective wage bargaining agreements, covering 85% of all wage and salary earners (Visser, 2013).

[16]Firms are not burdened by monetary compensation when firing, and in lay-offs advance notification is not required to non-salaried workers regardless of their tenure. Collective bargaining agreements may contain provisions for tenure dependent advance notification.

3 Empirical Strategy

To derive a causal relationship between trade and workers' outcomes, I exploit the exogenous trade shock due to China's accession to the WTO which triggered the removal of the MFA quotas for China. I start with measuring differential labor market outcomes among workers under direct threat of increased competition through the quota removals in comparison to other textile workers using a simple difference in difference (DID) analysis as follows:

$$\ln X_{it} = \alpha_0 + \alpha_1 CompExp_i^Z * Post02_t + \delta_i + \tau_t + \varepsilon_{it} \tag{1}$$

where $Post02_t = 1$ when year $\geqslant 2002$ and 0 otherwise. X_{it} is worker i's outcome in year t. These are annual labor earnings, annual income, hourly wages, annual hours worked, and the percentage of time spent as unemployed within a year. $CompExp_i^Z$ is the worker-level measure of exposure to competition where superscript $Z = \{D, C\}$ indicates whether it is defined as a discrete, D, or a continuous, C, variable. To limit any anticipation effects, the year 1999 is used to determine workers' subsequent exposure to the quota removal. The discrete treatment variable, $CompExp_i^D$, takes the value of one if in the year 1999 worker i is employed in a firm that domestically manufactures a product that with China's entry into the WTO is subject to the abolishment of the MFA quotas for China, and zero otherwise. The continuous treatment variable, $CompExp_i^C$, is the revenue share of these goods in the year 1999 of worker i's employer. This way, exposed workers employed in firms domestically producing quota products with a small share of revenue will be given less weight than exposed workers whose workplaces concentrate heavily on domestic MFA good production. The treatment variable is interacted with a time indicator for China's post-WTO accession years, $Post02_t$, to capture the variation in the outcome variable between pre- and post-shock years specific to *exposed* workers compared to other textile workers.[17]

[17] Utar (2014) documents a significant overlap between firms that were affected by the two quota removals for China

The aggregate trends in the industry and in the labor market are controlled for by using year fixed effects, τ_t. It is possible that workers employed by the exposed firms are systematically different than the rest of the T&C workers or that the exposed firms were systematically different from other T&C firms. All time-invariant differences across workers and across their initial firms such as gender, occupation, age, education, initial wage, organizational and technological structure of initial firms are controlled for by worker fixed effects, δ_i. The coefficient estimates for α_1 will measure the impact of the trade shock on workers' outcomes due to the textile quota abolishments for China in the years after its entry into the WTO.

An important challenge for empirical strategies that rely on industry-wide import measures to identify the impact of trade with China is that industries subject to greater import competition may be exposed to other shocks that can be correlated with trade with China. For example, advances in communication technology or in transportation that lower the cost of offshoring would affect labor-intensive industries more, driving up their import from China disproportionately. The empirical strategy here is free from this potential contamination because it utilizes within-industry across firm differences in exposure to trade with China due to a discrete policy change. The other factors including technology shocks and the secular declining trend in the industry are conditioned out by focusing on the differential outcomes among textile workers with differing exposure to the trade shock after controlling for aggregate shocks and worker fixed effects. These estimates on the other hand can be viewed as a lower bound of the low-wage competition impact because they are conditioned out of the general declining trend of the industry even if this is partly caused by trade factors.[18]

In a firm-level analysis Utar (2014) shows that the MFA quota removal for China leads to a significant decline in employment. In the presence of labor market frictions, the displaced workers

in 2002 and 2005. The majority, 87 percent, of the firms that produced goods subject to 2002 quota removal (Phase I-II-III) were also producing goods subject to Phase IV quota removal.

[18]It is also possible that the decline in prices of quota goods as a result of the shock depresses prices of non-quota goods or that labor shed by the quota producing firms causes decline in labor market opportunities of other textile workers. All these factors would potentially lead to under-estimation of the effect.

from these firms are likely the ones who experience disproportionate decline in their earnings. But they will also switch to other jobs, and subsequently partially or fully compensate for their initial loss. Equation 1 is at worker-level, following the workers wherever they go as they adjust to the shock. The impact that is captured by α_1 is an average impact over the nine years period. In order to disentangle the impact across different jobs that workers hold subsequently in different sectors and examine the nature of adjustment frictions, I divide the sample into pre- (1999-2001) and post- (2002-2010) WTO accession periods and use the following baseline regression:

$$\tilde{X}_{is} = \beta_0 + \beta_1 CompExp_i^Z * Post02_s + \beta_2 Post02_s + \delta_i + \varepsilon_{is}, \;\; s = 0, 1 \;, \tag{2}$$

where $s = 0$ indicates the pre-shock and $s = 1$ refers to the post-shock period. In this regression $\tilde{X}_{is}$ is the cumulative outcome variable, say wage earnings of worker i over the 1999-2001 ($s = 0$) and 2002-2010 ($s = 1$) periods. Since potential zero observations are an important part of the adjustment analysis, instead of taking logarithmic transformations of the earnings and hours variables, I normalized them with workers' own pre-shock average annual outcome variables.[19] As before, $Post02_s$ takes one during the post-shock period ($s = 1$), and δ_i denotes worker fixed effects.

The cumulative outcome contains the sum of shocks over the periods of abolishment and afterwards. The estimates of β_1 will capture the cumulative impact of the low-wage import shock specific to exposed workers over the nine post-shock years in comparison to other workers employed in the same initial industry. Once capturing the long-run effect with an estimate of β_1, I will then examine workers' adjustment by decomposing the cumulative effect captured by β_1 across different jobs or labor market positions that workers hold subsequently.

[19] All long-run earnings and hours worked variables are expressed in multiples of worker i's own 1996-1999 average annual earnings and hours worked measures respectively. More specifically, $\tilde{X}_{i0} = \frac{\Sigma_{t=1999}^{2001} X_i}{\overline{X_i}}$, $\tilde{X}_{i1} = \frac{\Sigma_{t=2002}^{2010} X_i}{\overline{X_i}}$, where $\overline{X_i}$ is the average of X_i over 1996-1999.

4 Effects of Import Competition from China and Workers' Adjustment

4.1 The Impact on Workers' Future Earnings and Employment

4.1.1 Average Effects

Table 2 presents two DID coefficient estimates of equation 1, discrete and continuous, for every dependent variable. The estimation sample contains all workers born between 1943 and 1982 with primary employment in the textile and clothing sector in 1999. Results in Panel A show that workers directly threatened by the removals of import quotas for China experienced a significant decline in annual earnings relative to other textile workers. The decline in annual earnings from workers' primary employment was about 5% (Panel A, column 1). Utilizing additional cross-sectional variation in the degree of exposure to the shock at the initial firm, the coefficient -0.126 (A,2) indicates that a worker in a firm with half its revenue from products subject to the quota removal experienced a 6.3% decline in annual wage compared to a worker whose firm was not producing these products. The impact on total labor earnings, the sum of all wages from all jobs held within a year, is also significant, showing 3.2% decline on average (column 3). Unemployed workers receive compensating benefit from unions and the government, and adjustment to the shock could also involve self-employment or early retirement. Examining the impact on personal income (columns 5 & 6), which includes self-employment, personal business income, pension income, unemployment insurance, government transfers, and other cash benefits as well as labor income, the results show an around 1% decline and indicates that these potentially compensating benefits, on average, largely cover the loss in annual labor earnings caused by the trade shock.

The negative effect on labor earnings could be due to a decline in hourly wages and/or a decline

Table 2: Impact of the Chinese Import Shock on Earnings, Income, Employment, and Unemployment

Sample Period 1999-2009		Dependent Variable											
		Annual Wage		Total Annual Earnings		Personal Income		Annual Hours Worked		Hourly Wage		Annual Unemployment	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Z=	*D*	*C*	*D*	*C*	*D*	*C*	*D*	*C*	*D*	*C*	*D*	*C*
Panel A.													
		Annual data											
$CompExp_i^Z * Dum02_t$		-0.051***	-0.126***	-0.032***	-0.077**	-0.012*	-0.014	-0.044***	-0.124***	0.008	0.042**	0.108***	0.368***
		(0.011)	(0.038)	(0.008)	(0.030)	(0.006)	(0.020)	(0.007)	(0.024)	(0.004)	(0.015)	(0.030)	(0.108)
N		109,487	109,487	109,487	109,487	109,487	109,487	105,709	105,709	105,709	105,709	109,487	109,487
Panel B.													
		Data aggregated into two (pre- and post-) periods											
$CompExp_i^Z * Dum02_s$		-0.055***	-0.139***	-0.035**	-0.080	-0.012	-0.006	-0.055***	-0.165***	0.004	0.027	0.185***	0.585***
		(0.011)	(0.038)	(0.013)	(0.048)	(0.007)	(0.023)	(0.007)	(0.025)	(0.005)	(0.018)	(0.045)	(0.160)
N		21,506	21,506	21,506	21,506	21,506	21,506	20,978	20,978	20,978	20,978	21,506	21,506
Sample Period 1990-1999		Falsification Tests: Pre-Sample Period											
Panel C.													
		Annual Data											
$CompExp_i^Z * Dum95_t$		0.018	0.062	0.007	0.017	0.002	-0.007	0.010	0.028	-0.004	-0.016	-0.026	-0.122
		(0.011)	(0.037)	(0.009)	(0.031)	(0.008)	(0.027)	(0.006)	(0.022)	(0.005)	(0.016)	(0.030)	(0.104)
N		103,318	103,318	103,318	103,318	103,318	103,318	96,875	96,875	96,875	96,875	103,318	103,318
Panel D.													
		Data aggregated into two (pre- and post- Phases Liberalization) periods											
$CompExp_i^Z * Dum95_s$		0.017	0.073	-0.004	-0.015	0.001	-0.010	0.012	0.038	0.001	0.009	-0.052	-0.108
		(0.013)	(0.045)	(0.013)	(0.046)	(0.010)	(0.037)	(0.008)	(0.027)	(0.006)	(0.022)	(0.045)	(0.157)
N		19,983	19,983	19,983	19,983	19,983	19,983	19,389	19,389	19,389	19,389	19,983	19,983

Notes: Estimation of equation 1. All regressions include year and worker fixed effects. A constant is included but not reported. All dependent variables are in logarithmic form and are listed in the table. The unemployment variable is defined as the fraction of working time that a person spent as unemployed within a year. Robust standard errors clustered at worker-level are reported in parentheses. *, ** and *** indicate significance at the 5 %, 1% and 0.1% levels respectively.

in the number of hours worked within a year. Results on annual hours worked and hourly wages (columns 7-10) show that the trade shock causes decline in labor earnings through a decline in the number of hours worked, not of hourly wages. The reduction in the number of hours worked is not a voluntary development as evidenced by the significant increase in the annual unemployment, defined as the fraction of working time spent as unemployed within each year (columns 11 & 12). The import competition causes a significant average increase in unemployment.

The impact of competition on hourly wages is estimated to be positive and significant (column 10). With a long time dimension of data, possible serial correlations in the hourly wage variable may lead to under-estimation of standard errors in a difference-in-difference setting (Bertrand, et al. (2004)). To address this, the analysis is repeated with data which is averaged over the two periods: pre- and post-WTO accession. These results (Panel B) show no significant effect on hourly wages and otherwise agree with the results in Panel A.

To ascertain that the results are not driven by potential existing trends that for some reason are felt disproportionately among quota-producing firms or among their employees, I follow the workers backward in time and estimate equation 1 in a pre-sample period of 1990-1999. In this analysis every variable is defined as before except the post-shock dummy which is replaced with a dummy, *Dum*95, that takes 1 on and after 1995. The period 1995-1999 spans Phase I and II removals, so any potential effects of these and concurrent events, such as the import liberalization for the Eastern European originated goods via the Europe Agreement, would be captured. As shown in Panel C of Table 2, there is no disproportionate impact of such events on workers who will subsequently be exposed to the competition with China. In Panel D, the same analysis is executed with data averaged over the two periods (pre- and post 1995), the results are not driven by potential pre-trends.

The literature on trade adjustment costs (Menezes-Filho, Muendler (2011), Utar (2009), Autor et al. (2014)) emphasizes moving frictions that slow down workers' movement toward growing sectors. It is also possible that workers face adjustment frictions in their new environment *after* making the

transition to a growing sector, which is a friction that has not been in focus in the literature so far. In the following we will take a closer look at displaced workers' adjustment experience to understand the relative importance of both types of friction.

4.2 Workers' Adjustment by Moving across Jobs within and between Sectors

In the rest of the paper I adopt the continuous measure of competition exposure. To assess the economic magnitudes of the estimates from the continuous treatment, I compare workers at the 25th and the 75th percentile of exposure to import competition.[20]

Table 3: Workers' Recovery across Jobs within and between Sectors

	All Employers	Initial Firm	other T&C	other Manuf	Service	Other
	(1)	(2)	(3)	(4)	(5)	(6)
	A. Cumulative Labor Earnings (in initial annual wage)					
$CompExp^C * Post02$	**-3.133*** **	-4.555***	0.256	-0.593	2.376***	-0.617**
	(0.761)	(0.324)	(0.245)	(0.335)	(0.671)	(0.200)
	[**-0.810**]	[-1.191]	[0.039]	[-0.145]	[0.602]	[-0.115]
	B. Cumulative Employment					
$CompExp^C * Post02$	**-0.184**	-3.721***	0.474***	-0.032	3.213***	-0.118
	(0.174)	(0.180)	(0.135)	(0.143)	(0.200)	(0.064)
	[**-0.011**]	[-0.924]	[0.098]	[0.008]	[0.823]	[-0.016]
	C. Cumulative Hours Worked (in initial annual hours worked)					
$CompExp^C * Post02$	**-1.857*** **	-4.180***	0.329	-0.297	2.483***	-0.192
	(0.373)	(0.223)	(0.187)	(0.211)	(0.342)	(0.100)
	[**-0.456**]	[-1.062]	[0.055]	[-0.068]	[0.655]	[-0.036]

Notes: Estimations of Equation 2. DID coefficient estimates for $CompExp^D * Post02$ are provided in square brackets. All regressions include worker fixed effects, the post WTO accession period indicator, $Post02$, and a constant. In panels A and B the number of observations is 21,022. In panel C the number of observations is 20,860. Robust standard errors are clustered at worker-level and are reported in parentheses. *, ** and *** indicate significance at the 5%, 1% and 0.1% levels respectively.

[20]Exposure to import competition is defined as the revenue share from the quota goods as of 1999. The 75/25 percentile difference compares a textile worker initially employed at a firm with 28.4% of the revenue in domestically produced quota goods with another textile worker whose firm does not produce any quota product. The rest of the paper uses the 75/25 percentile difference in assessing the magnitude of estimates from the continuous treatment.

To focus on workers' adjustment to the shock I now separate the initial effect of the shock from the subsequent adjustment of workers. First, changes in workers' cumulative outcomes due to trade are estimated via equation 2. For each worker cumulative variables are constructed by summing workers' annual earnings, employment, and annual hours worked in their primary employment over the pre- and post-shock years of the sample period.[21] To separate the initial impact of the trade shock from workers' subsequent adjustment to it, I decompose the cumulative earnings, employment and annual hours across different jobs that workers hold throughout the period: at their initial employers, at other employers in the T&C industry, in other manufacturing industries, in the service sector and all other sectors, which includes agriculture, fishing, mining, and construction. The results are presented in Table 3, showing the estimates of the DID coefficient "β_1" in equation 2 for the dependent variables indicated in the panel and column headings. If a worker has kept her/his initial job throughout 2000-2009, the dependent variables in columns (2)-(6) are all zero for this worker. Since all potential sources of employment and labor earnings are covered, coefficients of the cumulative outcome variables in columns (2) through (6) will sum to the overall trade effect in column (1).

A,1 of Table 3 shows that the competition from China causes a decline in earnings over the nine years of -3.133*0.284 = 89% of a pre-shock annual wage.[22] Results in column (2) show that a much stronger negative effect on earnings of 130% of a pre-shock annual wage was experienced at the initial employer, which was then partly compensated for over the decade. The partial recovery happened mainly by workers' movement to service sector jobs (A,5). Competition leads to an increase in earnings obtained from service sector jobs amounting to 2.376*0.284 = 67% of a pre-shock annual wage. Earnings recovery within the initial industry, on the other hand, is quite limited (column 3) and statistically insignificant.

[21] Descriptive statistics of these variables are presented in Table 3 in the online appendix.

[22] Since the coefficients obtained with the discrete exposure variable shows the economic magnitudes transparently, I provide these coefficients in square brackets in Table 3. In column 1 the coefficient -0.81 in square brackets means that, on average, exposed workers have 81% of a pre-shock annual wage less cumulative earnings over the post-shock years because of competition.

To see the impact on the job trajectories of workers, I use two employment measures. The main variable is the cumulative hours worked, the sum of annual hours worked in primary employment over pre- and post-shock years. In order to disentangle moving frictions that slow down workers' movement to growing sectors from adjustment frictions experienced within the destination sectors I use an employment indicator variable that takes one if a worker is registered with a primary employment with positive earnings in the November record. Then the cumulative employment variable shows the number of years a worker is employed regardless of how long that employment is within a year while the cumulative hours worked measure takes into account the length of that employment if shorter than one full year. The result in B,1 show that competition makes no significant difference in the number of years employed over nine years after the first abolishment of quotas. On the other hand, estimates in B,2 show that the competition from China causes a significant loss of employment of workers at their initial (exposed) employers amounting to one year. B,3 and B,5 show that affected workers offset their employment loss at the initial firm by moving across jobs within their initial industry, but to a much larger extent by moving to the service sector. Switching jobs within the initial industry does not help recovery of initial earnings losses either (Panel A).

Though there is no significant impact of the cumulative years of employment, the coefficient in C,1 shows that the China shock causes significant decline in the cumulative number of hours worked, amounting to 53 % of initial annual hours worked.[23] Why is that? Exposed workers experience a disproportionate decline in hours worked at the initial, exposed firms amounting to 1.2 pre-abolishment year of hours worked, which is similar to the loss experienced at the initial firm in terms of years of employment. Exposed workers also work relatively more hours in service sector jobs following the trade shock. However, comparing the estimates in B,5 and C,5 indicates that exposed workers work less hours per year of employment in the service sector. Results presented in the online appendix on hours worked per year of employment confirm this. Comparing earnings and employment effects at

[23] As before exposed workers refer to workers at the 75th percentile of exposure to import competition (compared to workers at the 25th percentile). The discrete difference between exposed and non-exposed workers amounts to 46% of initial annual hours worked (the coefficient -0.46 in the square bracket).

the initial firm and at the service sector also indicates that workers' earnings per year of employment decreases once workers move to the service sector due to competition. So although the service sector is the main destination for the displaced workers, workers move to a less well-paying situation there. Comparing the effects of the competition on earnings and hours at the service sector (2.4 and 2.5 respectively) reveals that the less well paying situation in the service sector is due to a lower number of hours worked in service sector jobs.[24]

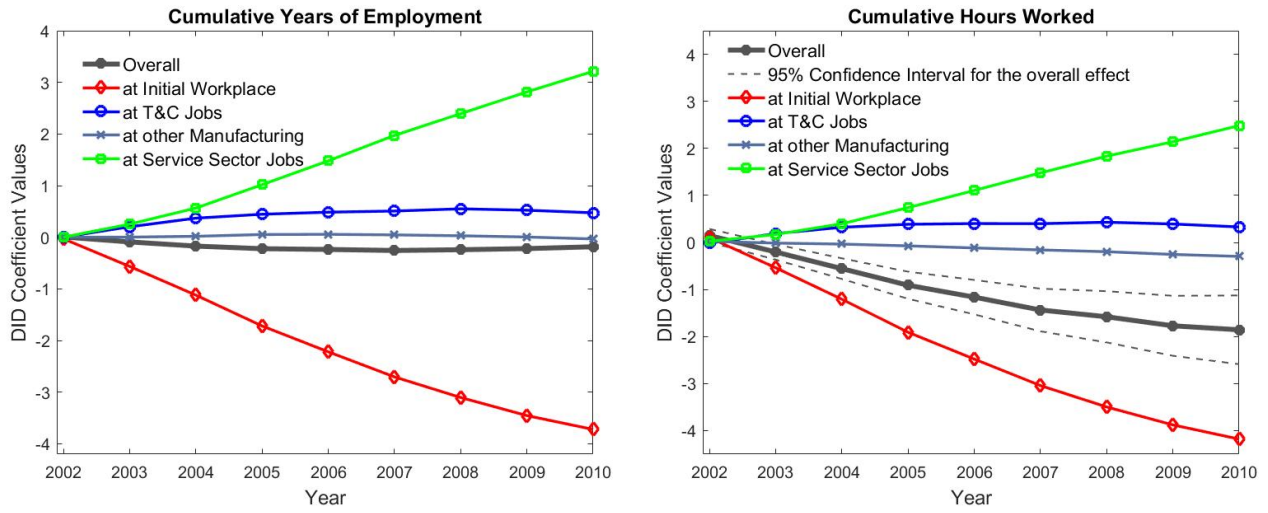
To see the cumulative impact of import competition over time, equation 2 is estimated separately for each post-shock year from 2002. In these regressions the cumulative outcome variable for the pre-abolishment years is the same as before, but the cumulative outcome for the post-WTO accession years is the cumulative sum of the outcome variables from 2002 until the year of the regression. The DID coefficient estimates from the decomposition analysis are displayed in Figure 3-(a). After the first few years, finding employment in the initial industry is not a viable option for workers to compensate for their initial employment loss, and from 2005 onwards the service sector rises as the main absorber of workers displaced from their exposed employers. It is also clear that other manufacturing jobs are never, even initially, an important source of employment recovery.[25]

Figure 3-(b) shows that as opposed to the effect of trade on cumulative employment, the overall effect on cumulative hours worked is a continuous decline over the nine years period. Reading the effects on cumulative employment and hours worked at the service sector in Figure 3 together brings the important adjustment friction into sharper focus. Moving to the service sector is not a smooth transition. It does not secure a full recovery in hours worked.

Investigating trade-induced reallocation within the service sector, I show in the Online Appendix (Table 6) that workers overwhelmingly move to the wholesale and retail trade sectors. Results on

[24]Results on hours worked per year of employment and hourly wage per year of employment across different sectors confirm this conclusion (Table 5 in the online appendix).

[25]Interested readers are referred to the online appendix for the annual evolution of the change in the cumulative outcome variables where the post-shock cumulative variable is divided by the number of years elapsed since the first phase of the removal.



(a) Impact on Cumulative Years with Employment (b) Impact on Cumulative Hours Worked

Figure 3: Year by Year Impact of Trade on the Cumulative Employment

All regressions include worker fixed effects and the post-WTO period indicator.

reallocation between detailed manufacturing industries presented in the Online Appendix confirm that there is no significant reallocation towards any manufacturing industry and show that the trade shock leads to a minor reallocation towards the leather and shoes industry, but also decreases workers' likelihood of moving to the publication, chemicals, and mineral products industries. That is, normally printing and publication, chemicals and mineral products would to some extent be on a normal career path of textile workers (Neffke and Henning (2013)), and the trade shock interrupts this path.

4.3 The Service Sector: A Safe shore, fraught with perils

While competition causes increased employment in the service sector, at the same time it leads to decreased hours worked per year of employment in these jobs. So either the service jobs that exposed workers take must be mostly part-time or the exposed displaced workers must experience

frequent unemployment in the service sector or both.[26] Utilizing IDA information on job types, I decompose the cumulative earnings, employment, and total labor income obtained in the service sector into full-time and part-time service jobs and estimate the effect of import competition on part-time versus full-time service jobs using equation 2. This shows that the competition induced earnings and employment gain in the service sector is entirely driven by full-time jobs (Table 4, Panel A). So the China import shock leads to movement of workers towards full-time, not part-time, service sector jobs.

Table 4: Part-Time Jobs or Frequent Unemployment Disruptions in the Service Sector?

	(1)	(2)	(3)	(4)
Panel A.				
	All Types Service Jobs	Full-Time Service Jobs	Part-Time Service Jobs	Unknown Types Service Jobs
Dep. Var. **Cumulative Earnings in the Service Sector**				
$CompExp^C$*Post02	2.376***	2.508***	-0.134	0.002
	(0.671)	(0.650)	(0.106)	(0.002)
Dep. Var. **Cumulative Employment in the Service Sector**				
$CompExp^C$*Post02	3.213***	3.128***	0.076	0.008
	(0.200)	(0.193)	(0.055)	(0.005)
Dep. Var. **Cumulative Total Labor Earnings in the Service Sector**				
$CompExp^C$*Post02	3.265***	3.296***	-0.146	0.054
	(0.647)	(0.614)	(0.124)	(0.033)
Panel B.				
Dep. Var. **Cumulative Unemployment Spells (expressed in months)**		depending on the sector of last employment		
	All U. Spells	Textile	Manuf.	Service
$CompExp^C$*Post02	3.368***	0.671	-0.323	3.185***
	(0.677)	(0.455)	(0.236)	(0.451)

Notes: Estimations of Equation 2. The number of observations is 21,022 in all regressions. All regressions include a constant, the post-shock period indicator and worker fixed effects. Robust standard errors reported in parentheses are clustered at worker-level. *, ** and *** indicate significance at the 5%, 1% and 0.1% levels respectively.

[26] Using the US Displaced Workers Survey, Farber (2005) documents that during 2001-2003, 13% of workers displaced from full-time jobs were reemployed in part-time jobs.

Next I estimate the impact on the cumulative unemployment spells, the summation of unemployment spells within a year (measured in months) during pre- and post-shock years for each worker. The DID coefficient in B,1 shows that the competition causes unemployment. The increase in the cumulative unemployment spells for a textile worker at the 75th percentile of exposure a decade after the shock amounts to one month more than the increase experienced by a textile worker at the 25th percentile. I then decompose the cumulative unemployment spells depending on the last sector of employment before the spell and estimate the effect separately across sectors (columns 2-4). This shows that import competition induces unemployment spells especially within the service sector.[27]

Figure 4 shows the yearly evolution of the impact of the trade shock on the cumulative unemployment spells. Unemployment increases until 2006 due to import competition, but after 2006 trade shock induced relative unemployment subsides, and the cumulative effect starts decreasing after 2007. This shows that the unemployment induced by the China shock is not due to effects of the Great Recession. A year after the first removal competition induced unemployment spells following service sector employment is basically zero, but increases rapidly as workers move to the sector, until it stabilizes after 2007.[28]

Thus the results so far show that import competition causes: 1) workers to move to the service sector, 2) full-time jobs in the service sector 3) less hours worked annually in the service sector, 4) spells of unemployment within the service sector. A picture emerges that exposed workers have difficulty in keeping *stable* employment in the service sector and that a main friction is frequent unemployment spells between service sector jobs. These findings puts a spotlight on the adjustment frictions faced by workers, as they seek to adapt to a new type of work in the service sector following a trade shock, and highlights the difficulty or slowness in making such a transition even in an environment with a relatively low unemployment rate and full-time jobs available.

[27] Additional analysis, available upon request, show that most of the unemployment spells experienced in the service sector are short-term spells.

[28] I provide annual average evolutions of unemployment spells across sectors in the online appendix (Figures 3 and 4), showing that the trade-induced unemployment within the initial industry starts subsiding after 2003.

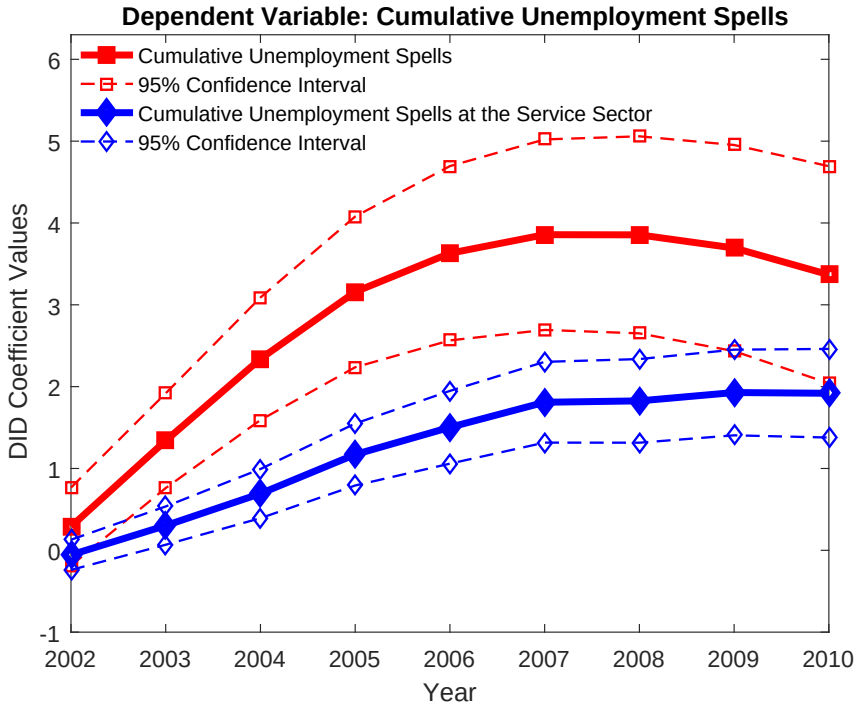


Figure 4: Trade-Induced Unemployment Spells

All regressions include worker fixed effects and the post-WTO accession period indicator.

5 Heterogeneity in Workers' Adjustment to the Trade Shock

A broad sector switch is likely to render the part of a worker's human capital tied to the initial sector obsolete (Neal, 1995; Parent, 2000; Poletaev and Robinson, 2008), and this may be a reason for the adjustment frictions experienced after moving to the service sector. To pin down the determinants of workers' adjustment frictions, in this section I study heterogeneity in adjustment paths of workers with different sensitivity to the potential loss of human capital reflected in their education and occupation.[29]

[29]Results on additional dimensions of heterogeneity including workers' age are presented in the online appendix.

5.1 Education and Workers' Adjustment

Workers are sampled according to their highest attained education and equation 2 is estimated separately across workers with different education levels: college education, vocational education and at most a (non-technical) high school degree. The DID coefficient estimates are presented in column 1 of Table 5. As in section 4.2, the impact on cumulative earnings and hours worked is decomposed into its additive components at the initial firm, other T&C jobs, other manufacturing jobs, service sector jobs, and other sectors (columns 2-6).

The impact of the low-wage import shock is not homogeneous across workers with different education levels. The negative impact increases with decreasing education level (Panels A-C, column 1). College educated textile workers exposed to the shock do not have significant changes in earnings and hours worked, but exposed workers with vocational and high-school education experience significant declines in cumulative earnings of 44% and 143% of a pre-shock annual wage.

Decomposition into initial impact and subsequent adjustment shows that the impact of the shock at the initial employer is negative and significant for workers of all levels of education. In fact college educated workers incur larger earnings losses at the initial employer than workers with less education (Table 5, A.I,2). Coefficient -7.104 means that, if not for the trade shock, exposed college educated workers would have earned an additional 200% of a pre-shock annual wage at their initial firms. For workers with vocational and high-school education, the effect is 122% and 111% respectively. The effect on earnings may be larger for the college educated because, absent the shock, they would have experienced a steeper earnings profile at the initial workplace.[30]

For all education levels, the main reason for the negative effect on earnings at the initial firm is shortened tenure there, as evidenced by the results on the cumulative hours worked. For college educated workers the trade shock causes a decline in hours at the exposed firm of 140% of pre-

[30]This is in line with Topel (1991) who emphasizes the importance of firm-specific human capital and the idea that such firm-specific knowledge is more important among higher educated.

Table 5: Workers' Adjustment by Education

	(1) All Employers	(2) Initial Firm	(3) other T&C	(4) other Manuf	(5) Service	(6) Other
Sample: College Educated Workers (N=2,398)						
	A.I Cumulative Labor Earnings (in initial annual wage)					
CompExp^C*Post02	**0.182**	-7.104***	0.841	-1.924*	8.364***	0.006
	(2.323)	(1.350)	(1.453)	(0.900)	(1.634)	(0.173)
	A.II Cumulative Hours Worked (in initial annual hours worked)					
CompExp^C*Post02	**1.034**	-4.984***	0.515	-0.767	6.208***	0.062
	(1.453)	(0.694)	(1.037)	(0.817)	(1.060)	(0.162)
Sample: Workers with Vocational Schooling (N=7,352)						
	B.I Cumulative Earnings (in initial annual wage)					
CompExp^C*Post02	**-1.551***	-4.302***	0.559	-0.203	2.656***	-0.261
	(0.636)	(0.435)	(0.343)	(0.382)	(0.570)	(0.196)
	B.II Cumulative Hours Worked (in initial annual hours worked)					
CompExp^C*Post02	**-2.075*****	-4.137***	0.602*	-0.312	2.058***	-0.285
	(0.456)	(0.365)	(0.286)	(0.288)	(0.429)	(0.183)
Sample: Workers with at most a High School Degree (N=10,774)						
	C.I Cumulative Earnings (in initial annual wage)					
CompExp^C*Post02	**-5.038*****	-3.911***	-0.251	-0.696	0.788	-0.968**
	(1.264)	(0.372)	(0.277)	(0.539)	(1.168)	(0.358)
	C.II Cumulative Hours Worked (in initial annual hours worked)					
CompExp^C*Post02	**-2.664*****	-3.914***	-0.003	-0.252	1.677**	-0.171
	(0.554)	(0.305)	(0.215)	(0.293)	(0.539)	(0.145)
Sample: Workers with Manufacturing Specific Vocational Schooling (N=2,584)						
	D.I Cumulative Earnings (in initial annual wage)					
CompExp^C*Post02	**-2.674**	-5.036***	-0.632	-1.642**	4.644***	-0.009
	(1.644)	(0.694)	(1.322)	(0.624)	(1.052)	(0.212)
	D.II Cumulative Hours Worked (in initial annual hours worked)					
CompExp^C*Post02	**-2.654***	-4.431***	-0.404	-1.203**	3.407***	-0.023
	(1.133)	(0.592)	(0.975)	(0.452)	(0.755)	(0.181)
Sample: Workers with Service Related Vocational Schooling (N=5,356)						
	E.I Cumulative Earnings (in initial annual wage)					
CompExp^C*Post02	**0.704**	-3.800***	0.945*	0.014	3.669***	-0.125
	(0.767)	(0.538)	(0.373)	(0.455)	(0.736)	(0.213)
	E.II Cumulative Hours Worked (in initial annual hours worked)					
CompExp^C*Post02	**-0.399**	-3.707***	0.846**	0.083	2.494***	-0.116
	(0.589)	(0.439)	(0.313)	(0.445)	(0.538)	(0.176)

Notes: All regressions include worker fixed effects, the post WTO accession period indicator, *Post*02, and a constant. Robust standard errors reported in parentheses are clustered at worker-level. *, ** and *** indicate significance at the 5%, 1% and 0.1% levels respectively.

shock annual hours worked (A.II,2), and for vocational and high-school educated workers the effect is 120% and 110% respectively.

If the shock affects workers similarly at their exposed employer regardless of education level, the difference in outcome over the following decade stems from their ability to compensate afterwards. The shock increases the likelihood of switching to service sector jobs regardless of workers' education (column 5), and service sector employment is the main source of employment recovery for workers at all education levels. But for workers without college education, employment in the service sector does not offer a full recovery from the initial impact over the following years. Comparing coefficients in A.I,2 and A.I,5 indicates that the trade induced sector switch may even be a blessing in disguise for the college educated, as the earnings gain in the service sector due to competition amounts to 230% of a pre-shock annual wage, slightly more than the wage loss due to shortened tenure in the initial firm (200%). As the broad sector switch involves organizational and technological changes, these results are in line with the idea that highly educated workers have a comparative advantage when adjusting to new knowledge and technologies (Bartel and Lichtenberg, 1987). This all suggests that results at the region, industry and firm-level can (mis)lead to the conclusion that college educated workers are immune to the negative employment effect of trade shocks. It is shown here that successful *adjustment* to the shock is the primary reason for the different aggregate outcomes between college and non-college educated workers.[31]

Vocationally educated workers adjust better in the service sector than high-school educated workers. They compensate for 50% (2.06/4.14) of their initial earnings losses and 62% (2.66/4.30) of their initial employment in terms of hours worked, while these numbers are 43% and 20% for the high-school educated. As in many European countries vocational education is an important institution for non-academic education in Denmark. After nine years of obligatory schooling, typically 3-4 years of

[31] Using aggregate data Autor, Dorn, and Hanson (2015) show that the effect of Chinese imports on local labor markets tends to be stronger for non-college educated employment. Utar (2014) finds at the firm-level that the negative effect of the import shock is concentrated on non-college educated employees.

education is offered in a wide variety of vocations. It combines formal school periods with practical apprenticeships, giving an intermediate level of education for specific vocations. While college education increases the adaptability of workers, vocational education carries a risk for workers of losing their investment in human capital, if it is specific to their initial industry. On the other hand, these are highly skilled workers and the education could help them adapt to new environments, especially if their training is not specific to the manufacturing industry.

To examine this I further partition the sample of vocationally educated workers and analyze their adjustment depending on whether the field of vocational education is specific to manufacturing (e.g. textile operator, cutting machine operator, garment technician) or service related (e.g. office worker, technical designer, decorator, IT-technician).[32] The results in the last four rows of Table 5 reveal substantial heterogeneity among vocationally trained workers. Workers educated for manufacturing specific vocations incur large earnings losses due to foregone opportunities not only at the initial firm but also at other manufacturing jobs, where their human capital is a better fit. A decade after the shock these workers still have significantly less employment because of the competition, amounting to 75% of pre-shock annual hours worked. In contrast, workers with service focused vocational education suffer no significant change in cumulative hours worked despite a likewise substantial loss of employment at the initial firm. This is because of more successful adjustment at the service sector, but also because other T&C jobs provide a path of compensation for them, in line with Utar (2014) documenting trade-induced restructuring in this industry away from manufacturing towards service activities.

Figure 5 shows the effect of the shock on the cumulative unemployment spells across workers with different education. Workers with service focused vocational education fared best in terms of unemployment followed by college educated workers. Competition induced unemployment is the most severe, not on the least educated (workers with at most a high-school diploma), but on workers with

[32]Not all vocational education topics can be clearly classified as manufacturing or service focused, and the analysis excludes such cases.

manufacturing focused vocational education. Results presented in the online appendix decomposing the unemployment effect depending on the last sector of employment shows that unemployment is mainly experienced following a service sector employment and only workers with service-specific vocational education fully escape the trade-induced unemployment in the service sector. These results establish that both the level (Dix-Carneiro, 2014) but also the *field* of education are important determinants of trade-induced adjustment costs.

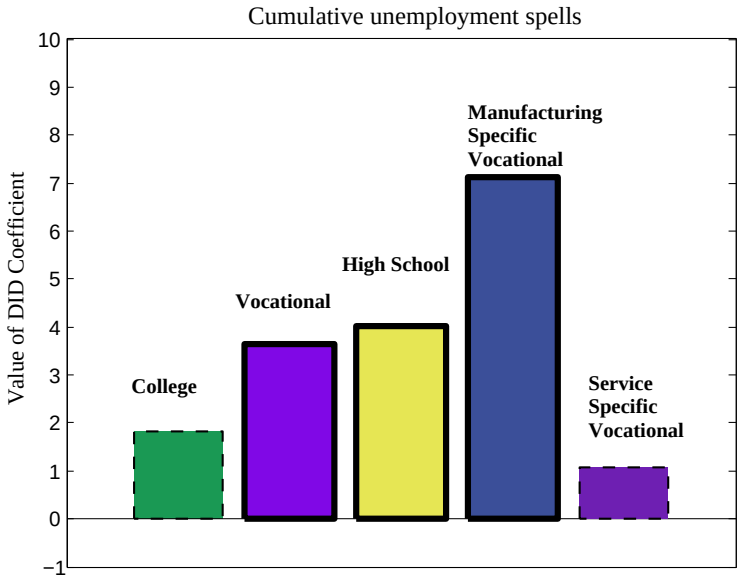


Figure 5: Trade-induced Unemployment and Workers' Education

The dependent variable is the cumulative unemployment spells expressed in months. Estimation of equation 2 across education samples as indicated by bar headings. Solid frames indicate statistical significance at the 5% or less. All regressions include worker fixed effects and the post-WTO period indicator.

Education is not the only component of human capital, occupational experience is another. The effect of the occupational experience component of workers' human capital on their adjustment to the trade shock is studied next.

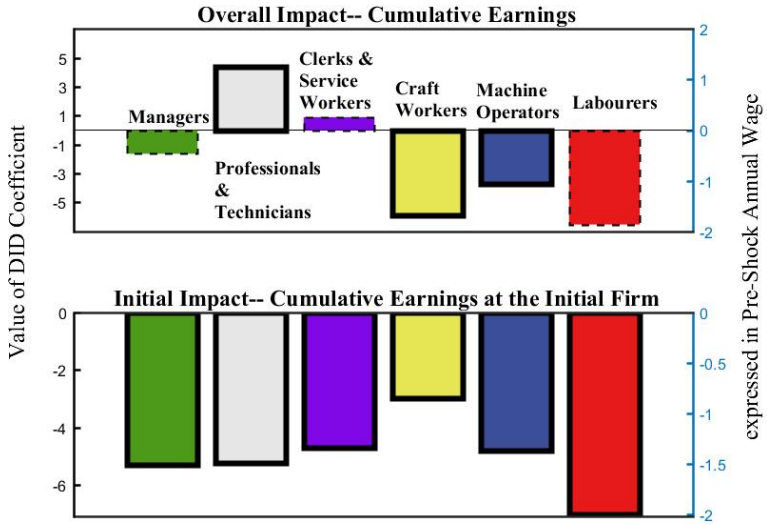
5.2 Occupation-Specific Human Capital and Workers' Adjustment

The sample is partitioned according to workers' initial occupations and equation 2 is estimated separately for Managers, Professionals and Technicians, Clerks, Craft Workers, Machine Operators, and Labourers. Figure 6(a) presents the DID coefficient estimates for cumulative earnings from all employment (top) and from the initial employer (bottom).[33] Over the decade following the import shock, competition from China causes large significant declines in earnings among craft workers and machine operators, but not among clerks and service workers or managers (top). Professionals and technicians even benefit from this shock with significantly higher cumulative earnings amounting to 120% of a pre-shock annual wage. Workers with elementary occupations incur large negative earnings losses, but the effect is statistically insignificant, implying heterogeneous outcomes within the group. These results reveal substantial heterogeneity in the impact of the low-wage import shock on workers with different occupations.

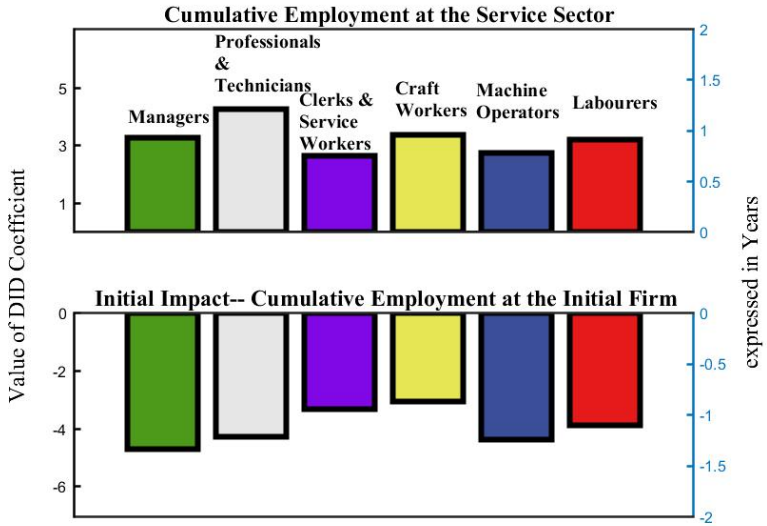
Comparing top and bottom of Figure 6(a), the overall effect of the shock on workers with different occupations clearly depends on differences in success of adjustment to the initial shock, rather than differences in initial impact. The initial impact of the shock ranges across all occupations between 84% and 200% of an initial annual wage. The effects of the shock experienced by clerks and service workers as well as operators and assemblers at their initial exposed workplaces were, for example, all almost the same, around 130% of a pre-shock annual wage. But, while clerks recovered this initial loss over the decade, machine operators incur an overall loss of 100% of a pre-shock annual wage (coefficient -3.7).[34]

[33] Occupation classifications follow International Standard Occupational Classification (ISCO-88) major groupings. Details are provided in the online appendix.

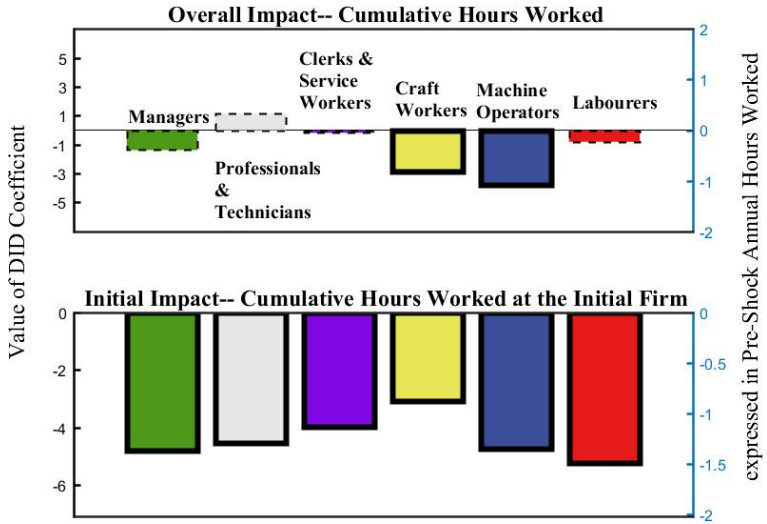
[34] Clerks and service workers include secretaries, office clerks and security service personnel. Operators and assemblers include weaving, knitting, cutting operators, other machine operators and assemblers. The vast majority are operators.



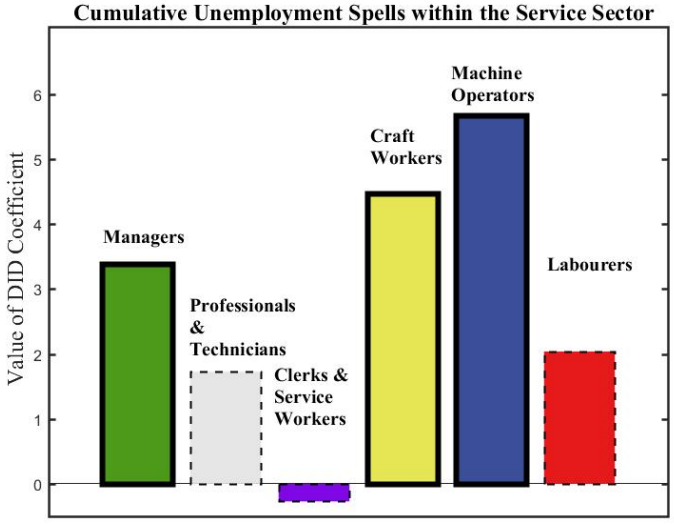
(a) Cumulative Earnings



(b) Cumulative Employment



(c) Cumulative Hours Worked



(d) Cumulative Unemployment within the Service Sector

Figure 6: Workers' Occupation and Their Adjustment

Estimation of equation 2 across occupation samples as indicated by bar headings. Bar heights shows the value of the DID coefficient for the corresponding sample. The dependent variables are given as the plot titles. Solid frames indicate statistical significance at the 5% or less. The numbers of observations are 1066, 2948, 2730, 1780, 9106, and 1812 from left (managers) to right (labourers) respectively. All regressions include worker fixed effects and the post-WTO accession period indicator. The right axis shows the coefficient values based on the 75/25 percentile exposure difference.

Competition also causes a significant decline in cumulative employment at the initial firm for all occupations (Figure 6(b) and (c), bottom). Craft workers experience the smallest employment decline at the initial firm of 88% of pre-shock annual hours worked (Figure 6(c), bottom). The largest effect is on manufacturing laborers with a decline of 150% of pre-shock annual hours worked.[35] At the same time movement to the service sector is strong and similar across all occupations (Figure 6(b), top). However, the success of workers in these service sector jobs varies across occupations. Professionals and technicians as well as clerks and service workers fully recover the work hours lost at the exposed employer (Figure 6(c)), while machine operators and craft workers suffer significant loss of hours worked.

The occupations with the most successful recoveries are clerks and service workers. They were affected as badly as machine operators and assemblers at the initial workplace, but their subsequent recovery was much better and workers in this group compensate for their initial loss similarly well in other T&C jobs, other manufacturing firms or in the service sector, as shown in detail in the online appendix. If the human capital accumulated through work experience is substantially specific to a firm or an industry, workers displaced from their jobs are likely to experience larger losses. Clerks are probably the occupation with the least industry specific skills and have a high level of transferability especially compared to craftsmen and machine operators.[36]

The dependent variable in Figure 6-(d) is the cumulative unemployment spells experienced within the service sector measured in months. It highlights the human capital dependent adjustment frictions showing that unemployment after moving to the growing sector is concentrated among machine operators, craft workers and managers – occupations sensitive to losing industry-specific human capital.

[35]This is in line with the trade-induced customization documented in Utar (2014).

[36]Neal (1995) finds industry-specific knowledge to be an important part of human capital. The results in this paper highlight that industry specific human capital is important in trade adjustment. The importance of industry specific human capital in workers' adjustment is occupation dependent. Some occupations are more sensitive to the loss of industry-specific knowledge than others.

Autor, Dorn, Hanson and Song (2014) show that low-wage workers tend to stay within manufacturing where they were repeatedly exposed to the import shock and identify being able to move out of manufacturing jobs as an important factor in determining the success of American workers' adjustment to the Chinese import shock. The results presented here show that even if workers are able to move out of manufacturing jobs, they continue to face significant adjustment costs in the form of job instability. The importance of workers' occupation specific skill-match in subsequent service jobs to their recovery trajectory suggests that policies, such as ALMP, that could facilitate entry into a new sector, may not be enough to provide smooth adjustments for all workers.

5.3 Industry-specificity of occupation

I construct a measure of industry-specificity for each four digit ISCO occupation, j. I define an occupation's specificity to workers' initial industry, $IndSpec_j$, as the ratio of the number of workers with occupation j in the industry to the total number of workers with occupation j in the overall economy in the initial year, 1999. Since the adjustment frictions are mainly observed to be associated with the switch from the manufacturing to the service sector, I define two measures, one for the textile and clothing industry, $TexSpec_j$, and the other for the overall manufacturing sector, $ManuSpec_j$.[37] I then map this information to the workers via their four-digit initial occupation and run the following triple-difference equation.[38]

$$\begin{aligned} \tilde{X}_{is} = \beta_0 + \beta_1 CompExp_i * Post02_s + \beta_2 Post02_s + \beta_3 Post02_s * IndSpec_i + \\ \beta_4 CompExp_i * Post02_s * IndSpec_i + \delta_i + \varepsilon_{is}, \;\; s = 0, 1 \end{aligned} \tag{3}$$

[37] More formally, $TexSpec_j = \frac{\text{number of workers in occupation } j \text{ employed in T\&C as of 1999}}{\text{total number of workers in occupation } j \text{ in 1999}}$, and $ManuSpec_j = \frac{\text{number of workers in occupation } j \text{ employed in manufacturing as of 1999}}{\text{total number of workers in occupation } j \text{ in 1999}}$.

[38] The number of observations is fewer than the whole sample in this analysis, because not all workers' four digit occupation codes can be identified by administrative sources.

The coefficient of interest, β_4, measures the variation in the cumulative outcome variable, $\tilde{X}_{is}$, of worker i particular to exposed workers with an initial occupation that is specific to the initial industry (relative to exposed workers with an industry non-specific occupation) in the period after the WTO accession of China.

Table 6: Trade Adjustment and Specific Human Capital

Cumulative Labor Earnings (expressed in pre-shock annual wage) obtained from:			
	All Employers	Initial Firm	Service
	(1)	(2)	(3)
Panel A.			
$CompExp^C$*Post02 (β_1)	1.420	-5.386***	6.227***
	(1.788)	(0.821)	(1.609)
Post02*ManuSpec (β_3)	-3.693***	-1.225***	-2.980***
	(0.570)	(0.273)	(0.476)
$CompExp^C$*Post02*ManuSpec (β_4)	-7.330**	0.753	-6.613**
	(2.540)	(1.158)	(2.234)
N	19,550	19,550	19,550
Panel B.			
$CompExp^C$*Post02 (β_1)	-0.519	-4.746***	4.467***
	(1.030)	(0.459)	(0.918)
Post02*TexSpec (β_3)	-5.278*	-0.450	-4.778**
	(2.099)	(0.999)	(1.848)
$CompExp^C$*Post02*TexSpec (β_4)	-4.265***	-1.080***	-3.031***
	(0.417)	(0.219)	(0.351)
N	19,550	19,550	19,550

Notes: All regressions include worker fixed effects, the post-shock period indicator, Post02, and a constant. Robust standard errors reported in parentheses are clustered at worker-level. *, ** and *** indicate significance at the 5%, 1% and 0.1% levels respectively.

Table 6 presents the triple difference results for cumulative earnings. In Panel A industry specificity is measured as the manufacturing specificity of occupations. The coefficient in column (1), the overall effect, is positive and significant. Workers under direct exposure to competition have significantly larger losses the more specific their occupations are to the manufacturing sector. Columns 2 and 3 present the effect at the initial firm and the service sector.[39] The impact at the initial firm

[39]See the online appendix for the full decomposition result as well as the results on the cumulative years of employ-

does not depend significantly on whether a worker's occupation is specific to manufacturing or not, but the potential earnings recovery at the service sector is lost with a purely manufacturing specific occupation. So the significant differences in cumulative earnings between manufacturing specific occupations and other, less specific, occupations are entirely due to the difference in adjustment to the initial shock. Results in Panel B on the textile and clothing specificity of occupations shows similar patterns, but also shows that the initial impact hits workers with textile specific occupations harder. Comparing results in Panel A and B indicates that an occupation's specificity to manufacturing in general is a more important determinant of adjustment costs than the specificity of occupations to their initial industry within manufacturing.[40] These results establish that workers' successful adjustment depends (crucially) upon the degree to which their human capital is either relevant to work in the service sector or is lost because of the trade shock.

5.4 Trade-induced Skill Upgrading at the Worker Level

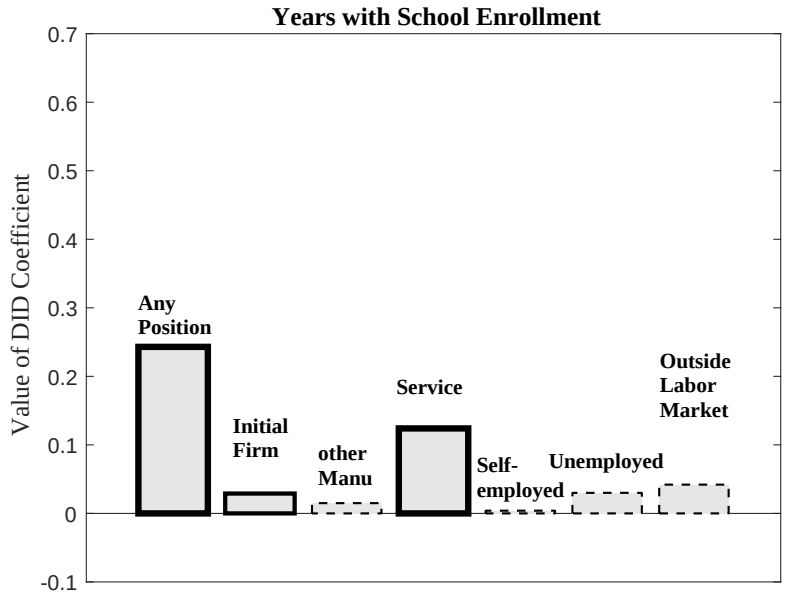
I show that workers' adjustment costs are very heterogeneous across different educations and occupations and the lack of the right skill set is an impediment to recovery for workers whose human capital is specific to the sector they left. This may induce workers to re-build human capital through education. Workers can enroll in short-term or part-time education while being in the labor market or enroll in full-time education outside the labor market. In Denmark workers receive an education allowance from the UI if they enroll in school to increase their job prospects. Making use of this information, I analyze the effect of increased import competition with China on the number of years with school enrollment by estimating equation 2 with the cumulative years with education allowance as the dependent variable. These results are shown in Figure 7 with full results presented in the on-

ment and annual hours worked.

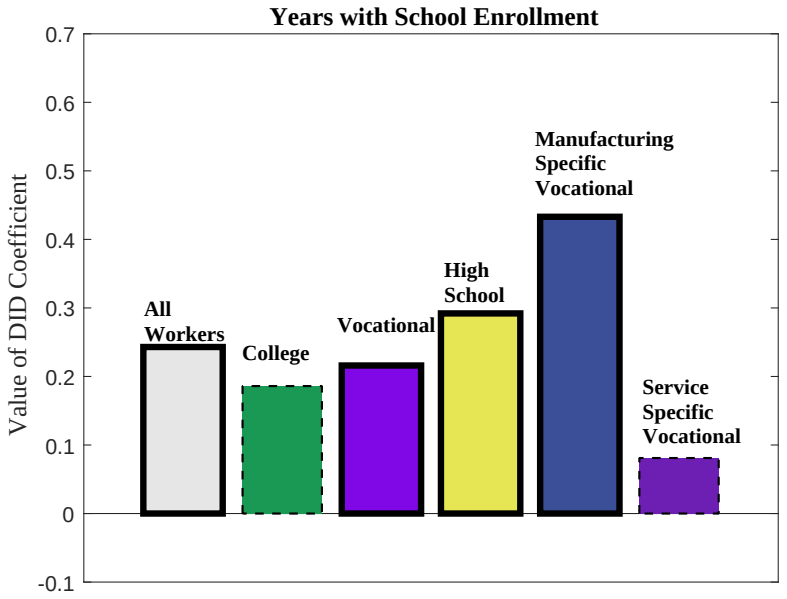
[40]Investigating the potential interaction between routine-ness of occupations and workers' adjustment, I estimate equation 3 using the routine task intensity of occupations and show in the online appendix that occupation's routine-ness does not interplay with workers' trade-induced adjustment.

line appendix. The first bar in Figure 7-(a) shows that trade causes workers to enroll in education. It implies a trade shock driven increase of school enrollment amounting to about a month. The dependent variable is then decomposed depending on worker's primary labor market position in a given year and equation 2 is estimated separately across mutually exclusive positions of workers to decompose the trade effect. The decomposition analysis shows that trade induces workers to further their education mostly after they have moved to the service sector. This suggests that workers seek to acquire skills through education to become better suited for jobs in their new work environment and implies that the trade shock's effect on school enrollment may depend on their existing education and skill gap. To test that, workers are re-sampled according to education and the analysis is conducted separately across college, vocational, and high-school educated workers (Figure 7-(b)). Workers increasingly seek further education the less educated they are initially. To further examine the role of skill mismatch the sample of vocationally educated workers is divided like in section 4.1 according to field of education and the analysis is conducted separately for the manufacturing focused and service focused vocationally educated (the last two bars in the figure). Indeed the skill mismatch with the service sector is the main driver of trade induced school enrollment. The import shock induces significantly more school enrollment among workers with manufacturing specific vocational education while it does not cause an increase among workers who already have service focused vocational education. The impact among manufacturing-specific vocationally educated workers is almost twice the average effect. These findings show that the incentive to rebuild human capital is strongest for those who are least able to retain their human capital in the service sector.

While recent studies provide evidence of skill upgrading at the firm-level as a result of increased Chinese imports (Bloom, Draca, Van Reenen (2016) and Utar (2014)), whether the import from China can lead to skill-upgrading at the individual level is an important yet unanswered question. These findings point to a new and interesting channel through which imports from low-wage coun-



(a) Impact across different labor market positions



(b) Impact across workers with different initial education

Figure 7: Impact of Trade Shock on School Enrollment

In both figures the height of each bar represents the value of the DID coefficient estimate of equation 2. In (a) the dependent variables are the cumulative years with education allowance conditional on worker's primary labor market position in that year. In (b) equation 2 is run across different education samples with the dependent variable is the cumulative years with education allowance. Solid frames indicate statistical significance at 5% level or less. All regressions include worker fixed effects and the post-WTO accession period indicator.

tries can shape the structure of advanced economies, as not only firms but also individuals respond by upgrading their skills. Looking at a potential effect of trade on the supply of skill from a different angle, in a recent study Atkin (2016) shows that export expansion triggered by the trade reforms in Mexico causes school dropouts. Complementing this, the present results provide evidence that decline in labor demand due to increased import competition causes school enrollment in Denmark.

6 Summary and Concluding Remarks

The effect of increasing trade with China and other low-wage countries on advanced country manufacturing industries and workers is a prominent topic of current public debate. With the decline of manufacturing employment in advanced economies, whether and how the transition of the most impacted workers can be eased becomes an important economic policy question. This paper studies the impact of a Chinese import shock on workers' earnings and employment trajectories in a European country with a generous social net and active labor market policies in a quasi-experiment that measures the causal effects of a trade policy change impacting a classic manufacturing industry. By directly comparing say, a clerk to a clerk, or a machine operator to a machine operator that are all initially employed in the same industry, but differ only by exposure to the trade shock, this study disentangles the effects of the trade shock from potentially important technology factors.

The increased import competition resulting from the abolishment of quotas for China had substantial negative effect on Danish workers' earnings and employment trajectories. Shorter employment spells at the initial firm and unstable subsequent employment disrupted with frequent unemployment are the main channels through which workers are affected from the trade shock. The service sector is the main absorber of displaced workers and the ability of workers to recover from the trade shock depends on how well suited they are for service sector jobs. Adjustment problems do not end once workers find full-time jobs in the growing sectors. Workers' ability to recover from the shock

depends on the degree to which their human capital is either relevant to work in the service sector or is lost because of the trade shock. The results bring the distributional consequences of trade with low-wage countries into light. By showing that the trade shock increases incentives to acquire further education, this paper also provides a first worker-level evidence on skill acquisition in response to increased competition from China.

Active labor market policies combined with a relatively well functioning unemployment insurance system may be one reason behind mobile Danish workers. The results suggest that effective ALMPs may ensure faster movement towards growing sectors, but this itself does not provide for a smooth adjustment experience as workers still face challenges in adapting to the new environment. These results shed light on the nature of difficulties that advanced countries face on the path of employment de-industrialization and inform policy makers about the most vulnerable.

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