The Wage and Employment Effects of Outsourcing: Evidence from Danish Matched Worker-Firm Data

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Abstract: We employ a unique matched worker-firm dataset from Denmark to measure how importing and exporting shocks affect wages and employment at the firm and worker level. Using information on the specific products and origin/destination of trade for Danish firms, we construct instruments for the extent of importing and exporting that are time varying and exogenous to the firm. We find that exogenous shocks to importing at the firm level have a profound effect on the number and composition of employees and worker wages. College educated workers enjoy significant wage gains from an increase in importing while the employment of high school educated workers contracts and wages of workers who remain employed within the firm fall. In contrast, exogenous exporting shocks raise employment and wages uniformly across all education types. We track outcomes for workers after a job spell and find that workers displaced from outsourcing firms suffer greater wage losses than workers displaced for other reasons, and that low education workers suffering greater and more persistent losses than high education workers. Finally, we relate wage effects to occupational characteristics to identify which tasks are relatively sensitive to outsourcing shocks. Conditioning on skill intensity, wage gains are largest for occupations that intensively use language and social science skills while wage losses are greatest for occupations in which workers are subjected to hazardous working conditions.

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I. Introduction

A key feature of global trade in the new century is the rapid growth of outsourcing (Feenstra and Hanson 2003, Grossman and Helpman 2002), and trade in intermediate goods (Hummels et al. 2001, Yi 2003). How has outsourcing affected workers' wages and employment opportunities? The answer to this question is not theoretically obvious. At some level purchasing an input from a foreign source must replace a task previously done by a domestic worker, which would suggest displacement and lower wages. However the ability to use foreign inputs may lower a firm's costs and raise its productivity (Amiti and Konings 2007; Kasahara and Rodrigue 2007; Grossman and Rossi-Hansberg 2008), allowing it to expand output and employment and raise wages. Nor is the causality easy to sort out: a firm enjoying increased productivity may expand outsourcing, output and wages simultaneously.

The empirical literature has shed light on the interactions between globalization and key labor market outcomes. Using industry-level data, Feenstra and Hanson (1997, 1999) and Hsieh and Woo (2005) examine the effect of outsourcing on the demand for skilled labor relative to unskilled labor in Mexico, the US, and Hong Kong; Bergin, Feenstra and Hanson (2009) study the relationship between outsourcing and changes in employment volatility; and Amiti and Wei (2006, 2007) study how services outsourcing affects industry productivity. Using firm-level data, Biscourp and Kramarz (2007) study the effects of final goods imports on firm-level employment, and Amiti and Davis (2008) examine how imports of intermediates affect average wages at the firm level.

While much has been learned from this work, the empirical literature on outsourcing to date lacks data on individual workers, their wages, characteristics and occupations. This creates three difficulties. One, previous authors cannot separate changes in wages for individual workers from changes in the composition of the workforce within a firm, except by employing relatively simple controls such as the share of skilled workers in employment. Two, they cannot assess labor market outcomes for workers who are displaced from outsourcing firms, a group for which wage effects might be especially pronounced. Three, they cannot perform detailed analysis of how wage changes are affected by workers' characteristics such as education or occupation.

As a consequence, little is known about the characteristics of the tasks offshored by firms: whether they are routine or non-routine, manual or cognitive, or intensively employ skilled or unskilled labor. This is unfortunate because recent trade models with heterogeneous workers such as Yeaple (2005) and Antras, Caricano and Rossi-Hansberg (2006) argue that the effects of trade shocks depend on worker characteristics and may vary across employees within the same firm. And the predictions of explicit models of offshoring depend on the characteristics of tasks offshored. (Feenstra 2008, Grossman and Rossi-Hansberg 2007, 2008, 2009).

Further, there is growing evidence that specific worker characteristics might be essential for understanding labor market outcomes. For example, Autor, Katz and Kearny (2006) show that the earnings of the middle class grew more slowly than both the rich and the poor in the 1990s in the U.S., and argue that the nature of the tasks that workers perform (whether they are routine or non-routine) is central to understanding the "polarization" of the labor market.[1]

[1] Goos and Manning (2007) and Manning, Goos and Salomons (2009) show that labor markets are also polarized in U.K. and Europe.

The relationship between outsourcing and task specialization is also of considerable policy interest, as reflected by repeated efforts to measure how many U.S. jobs have been lost to outsourcing, and to understand which occupations are most easily outsourced (e.g. Blinder 2005). Using subjective rankings, Blinder (2007) argues that the "offshorability" of an occupation has little correlation with its skill requirement. Jensen and Kletzer (2007) use geographical concentrations to measure "offshorability" and produce a different ranking across occupations. Not surprisingly, no consensus has emerged.

In this paper we overcome these difficulties by employing matched worker-firm data from Denmark that is linked to firm-level data on imports and exports. Our worker-firm data cover the *population* of the Danish labor force (all Danish individuals aged 15-74 and employees in all plants in Denmark during 1995-2006).[2],[3] This broad coverage allows us to assess whether a change in outsourcing status affects wages for a given worker, and how these wage effects relate to that worker's characteristics. For example, by observing how the effects of outsourcing vary with worker characteristics we are able to infer the characteristics of the tasks offshored. Further, since we see specific workers before, during, and after their employment in specific firms we can also assess labor market transitions associated with outsourcing.

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[2] This firm-worker data set has been used previously in the labor literature (e.g. Eriksson and Westergaard-Nielsen 2007). Our contribution in this context is to link the worker-firm data with product (HS6)-level trade data from Danish customs.

[3] Ours is not the first study to employ matched worker-firm data in a trade context. Menezes-Filho and Muendler (2007) study the effect of trade liberalization on labor reallocation across industries in Brazil. Their data include the firm's exporter status but they lack firm-level data on imported inputs. Kramarz (2008) has worker-firm data from France along with data on imported inputs but focuses on a setting with imperfect labor markets where firms and unions bargain over wages. Hakkala, Heyman and Sjoholm (2009) study the effects of multinational activities and foreign acquisitions on relative labor demand at the firm level in Sweden.

Our product-level trade-data includes detailed information on the inputs these firms purchase – which goods and from which sources – and the products these firms sell, both domestically and abroad. This allows us to solve a final significant problem with efforts to associate wage and employment effects with outsourcing at the firm level. The literature on heterogeneous firms suggests that high productivity firms are different from low productivity firms in almost every measurable respect. High productivity firms produce higher quality goods, engage in more R&D, use more capital, and critically for this paper, are more likely to pay higher wages and both export and buy imported inputs.

To combat this problem we employ time varying data on the source country and specific inputs being imported and the destination country and products being exported by the firm. We construct instruments that are correlated with a firm's decision to increase outsourcing and/or exporting, but are not correlated with the firm's ability level or its wage structure. Our instruments include tariffs, the exchange rate between Denmark and partner country, fitted measures of transportation costs, and world-wide shocks to export supply and import demand for the relevant partner country x product being traded. These instruments enable us to trace out patterns of firm-specific outsourcing and exporting that are time varying and exogenous to the firm in question.

We employ these data to estimate how an exogenous shock to outsourcing and exporting affects firm characteristics, as well as the wages of individual workers. We examine how these estimates depend on the educational and occupational characteristics of the workers. This allows us to paint a picture of which workers and occupations are most sensitive to outsourcing.

Our key findings are these. One, an exogenous increase in outsourcing leads to a rise in firm sales, accounting profits and average wage bill. Employment contracts sharply, with the share of low-skill (high-school educated) workers falling and the share of high-skill (college educated workers) rising. An exogenous increase in exporting leads to a rise in firm sales, accounting profits, and employment of all worker types, but has no affect on the average wage bill. Two, controlling for the endogeneity of outsourcing and exporting when identifying wage effects within job-spells is critical. Our instrumental variables estimate of the elasticity of wages respect to importing switches sign and is an order of magnitude larger than estimates using OLS or worker-firm fixed effects. Pooling across all workers, doubling imports lowers wages within a job-spell by 3.5% and doubling exports raises wages 5.5%.

Three, the wage effects of importing differ profoundly across educational and occupational categories. Doubling imports lowers low-skill worker wages by 7.3% and raises the wages of high-skill workers by 8.5%. In contrast, exporting raises wages across all education groups, but more strongly for low- and medium-skill workers. When we go to individual occupations, the dispersion in wage effects are even more pronounced, with the best-off occupation gaining 18% and the worst-off occupation losing 32%. Occupational wage changes are positively correlated with occupation skill-intensity (in contrast to Blinder's 2007 conjecture), and the share of employment outside manufacturing. Controlling for these characteristics, we identify two additional and unique relationships. First, occupations that expose workers to potentially unsafe working condition experience relatively large wage drops after outsourcing. Second, not all degrees are created equal. Occupations that intensively employ knowledge sets from social science and languages systematically gain from outsourcing shocks, while those that employ knowledge sets from natural sciences and engineering do not.

Finally, we can track workers before, during and after job-spells which allows us to analyze the effects of displacement on wages and earnings and to compare it to wage losses for non-displaced workers. We find that displacement from a firm with rising outsourcing generates larger and more persistent wage and earnings losses than those suffered by other displaced workers. Both high-skill and low-skill workers suffer initial wage losses but high-skill workers suffer smaller losses and recover to pre-displacement wages much faster. The most pronounced effects are found in earnings, which incorporate lost hours as well as lowered wages conditional on re-attachment to the workforce. One year out, skilled workers displaced from rising outsourcing firms lose 19 percent of their predisplacement earnings while unskilled workers lose 28 percent. The latter effect is four times larger than the effect suffered by unskilled workers who remain employed within an outsourcing firm.

The paper proceeds as follows. Section II describes the Danish labor market and discusses our data on firms, workers, trade. Section III provides a simple model to guide our empirical work, discusses our specification and our instruments for importing and exporting at the firm level. Section IV analyzes changes in firm outcome variables and estimates within job-spell wage effects as a result of exogenous shocks to importing and exporting. Section V provides a detailed analysis of outsourcing effects across occupations and task characteristics. Section VI analyzes wage effects for laid-off workers. Section VI concludes.

II. The Danish Labor Market and Data Sources

Botero et al (2004) systematically examine labor market regulations in many countries. They classify the Danish labor market as having one of the most flexible labor markets in the world, comparable to the US. Unlike other continental European labor markets employment protection is relatively weak. Danish firms may adjust employment with relative ease. As compensation for high job turnover workers receive relatively generous UI benefits when unemployed, but incentives to search for jobs during unemployment are reinforced by monitoring and sanctions. Together these ingredients form what has been called the 'flexicurity' model. This labor market model has led to turnover rates and an average tenure which are in line with those of the Anglo-Saxon countries. In 1995 the average tenure in the Danish labor market was the lowest in continental Europe with 7.9 years just exceeding the number for UK (7.8 years) while average tenure in the German labor market was 9.7 years, cf. OECD (1997).

The Danish labor market is strongly unionized even by European standards. More than three quarters of all workers are union members and bargaining agreements are extended to cover most of the labor market. There are three different levels at which wages can be negotiated: the Standard-Rate System, the Minimum-Wage and Minimum Pay System; and Firm-level Bargaining. Under the Standard-Rate System the wages of workers are set by the industry collective agreement and the wages are not modified at the firm level. The Minimum-Wage System and the Minimum-Pay System are two-tiered systems in which wage rates negotiated at the industry level represent a floor which can be supplemented by local firm-level negotiations. Under Firm-Level Bargaining wages are negotiated at the firm level without any centrally bargained wage rates.

The Danish labor market has been undergoing a process of decentralization. Since 1991 less than 20 percent of the private labor market is covered by the Standard-Rate System and an increasing share of wage contracts are negotiated exclusively at the worker-firm level. As a consequence, while the influence of unions means that the Danish wage structure is still relatively compressed, the decentralization process has implied that wages are more in accordance with individual workers' marginal productivity. Dahl et al. (2009) show that decentralization has increased wage dispersion in the Danish labor market.

Data Sources and Description

Our data on firms, workers and trade are drawn from several administrative registers in Statistics Denmark. At the core of the data is the FIDA data, a matched worker-firm longitudinal dataset covering the total Danish population of workers and firms for the years 1995-2006. Workers and firms are associated with a unique identifier, and all employed workers are linked with a firm identifier. FIDA contains firm-level data on total sales, number of full-time employees and a six digit NACE industry code. From the Account Statistics Register we construct the firm's capital stock defined as the value of land, buildings, machines, equipment and inventory.

The worker data is extracted from the Integrated Database for Labor Market Research (IDA), which contains a long list of socio-economic characteristics at annual frequencies. As outcome measures we focus on individual worker wages and labor market status. The hourly wage rate is calculated as annual labor income plus mandatory pension fund payments divided by annual hours. Labor market status (employed, unemployed or out of the labor force) is recorded in week 48 each year. In addition we use control variables such as age, sex, education, labor market experience, tenure and occupation.

We will distinguish between high-skilled, medium-skilled and low-skilled workers. High-skilled workers refer to persons with a tertiary education corresponding to the two highest categories (5 and 6) in the International Standard Classification of Education (ISCED). Medium-skilled workers have a vocational education defined as the final stage of secondary education that prepares students for entry into the labor market. As a result, persons with the equivalent of high school education or less are classified as low-skilled workers. Labor market experience is measured as actual time in employment since 1964. Tenure is measured as time in the job since 1980. The occupation variable is based on a Danish version of the International Standard Classification of Occupations (ISCO-88) developed by the International Labour Office (ILO).

Of particular interest is data for firm level international trade. The Danish External Trade Statistics Register provides product-level origin/destination country-specific import and export data for the years 1990-2006. Trade flows are recorded according to the eight-digit Combined Nomenclature product code which encompasses approximately 10,000 different product categories. For comparability to other data sources employed in our instruments we aggregate these flows to the six-digit Harmonized System. For each trade flow there is information about the trade value in DKK (fob for exports and cif for imports) and the weight in kilos. The External Trade Statistics Register is compiled in two systems; Extrastat (trade with non-EU countries) and Intrastat (trade with EU countries). The coverage rate in Extrastat is close to complete as all trade flows with non-EU countries are recorded by customs authorities. For intra-EU trade firms are only obliged to report trade if the annual trade value exceeds a threshold value.[4] Some firms fail to report data to the Intrastat system, and as a result around 90 percent of intra-EU trade by value is captured in Intrastat.

In our main specifications we focus on those firms with at least 600,000 Danish Kronor worth of imports, roughly the annual wages of two manufacturing workers. This de minimis restriction eliminates very small firms (which tend to have significant data quality issues) from the sample, as well as focusing our attention on those firms with enough foreign purchases to affect employment opportunities within the firm. Note that our approach focuses on the intensive margin of importing and exporting decisions, rather than on firms who discretely change from having no foreign input purchases to a positive quantity. The reason is that firms that discretely change their importing status tend to be small and the associated import volumes are very small.

After merging data on workers, firms, and trade flows, we have a combined dataset that is described in Table 1. We have 2.4 million worker-years and 23, 304 firm-years in our sample. This represents between 50 and 70 percent of all manufacturing employment in Denmark, depending on the year, and roughly 20 percent of all private sector employment. Consistent with other firm-level datasets, firms that are globally engaged in trade tend to be much larger than other firms.

Manufacturing firms in our sample purchase 21 percent of total Danish imports and supply 50 percent of Danish exports. Figure 1 reports the total value of imports and exports by firms within our sample and shows that in this period total imports more than doubled and exports more than tripled. The regional source of imports is largely

[4] In 2002 the thresholds were DKK 2.5 million for exports and DKK 1.5 million for imports.

unchanging over the 12 years of our sample, with 85 percent of imports coming from European sources, 6 percent from North America, 6 percent from Asia, and 3 percent other. While Denmark has seen a sharp increase in imports from China in this period, these are primarily final consumer goods and not purchased directly by manufacturing firms.

In our main specifications we define imports for a firm j at time t as the total material inputs purchased, summing over all products and partners, and similarly for exports. For the mean firm in the sample, imports represent 41 percent of materials purchased, and 22 percent of gross output, while exports are 35 percent of sales. All these variables exhibit substantial variation across firms and within firms over time. For example, we calculate the percentage deviation of imports for firm j at time t relative to the over-time average imports for that firm. The mean deviation is 56 percent for imports and 54 percent for exports.

Firms in our samples buy foreign inputs from many sources, with the median firm reporting purchases in 20 distinct exporter-HS6 categories (the mean firm 35). However, these purchases are concentrated in just a few key inputs. For the median firm the top 2 inputs represent 63 percent of import value and the top 5 represent 85 percent of import value. Numbers are nearly symmetric on the exporting side, with the median firm reporting 19 distinct importer-HS6 export categories, the top 2 of which comprise 59 percent of export value and the top 5 comprising 80 percent of import value. Finally, Danish firms in our sample are highly specialized in the sense that they share relatively few inputs and relatively few outputs in common. To see this, we examine the number of distinct Danish firms that import the same product from the same source country. The modal number of firm purchases is 1; the median number is 3. The same pattern (mode 1, median 3) is found when counting the number of firms who sell the same product to the same destination country.

III. Framework and Specification

In this section we outline a production function framework for understanding how changes in import use affect labor demand and wages, describe the resulting specification, and our instrumental variables approach to estimation.

III.1 Framework

Let j index firms and t index years. The production function for firm j in year is

$$Y_{jt} = A_{jt} K_{jt}^{\alpha} C_{jt}^{1-\alpha}, \quad \text{where } C_{jt} = \left(L_{jt}^{\theta} + M_{jt}^{\theta} \right)^{1/\theta}, \text{ and } \theta = \left(\sigma - 1 \right) / \sigma, \tag{1}$$

where Y_{jt} is output, A_{jt} is productivity, K_{jt} is capital, and C_{jt} is a composite input. C_{jt} is produced with CES technology using labor, L_{jt}, and imported inputs, M_{jt}, and $\sigma > 0$ is the substitution elasticity for labor and imported inputs. Here we consider only a single labor type, but show in an appendix that the basic intuition of our framework goes through with multiple labor types.

The marginal product of labor by firm j, MPL_{jt}, is

$$\frac{\partial Y_{jt}}{\partial L_{jt}} = (1-\alpha) A_{jt} K_{jt}^{\alpha} C_{jt}^{\frac{1}{\sigma}-\alpha} L_{jt}^{-\frac{1}{\sigma}}. \tag{2}$$

Equation (2) says that MPL_{jt} is increasing in productivity and capital and decreasing in labor due to diminishing returns. The marginal product of imported inputs is symmetric. It is straightforward to show that a rise in productivity for the firm simultaneously raises both labor and imported input use.

What happens when a firm increases its use of imported inputs? An increase in imported inputs, M_{jt}, decreases MPL_{jt} if $1/\sigma - \alpha < 0$. The intuition is that as material purchases rise, diminishing returns to the composite input C set in at a rate $-\alpha$. When labor and imported inputs are perfect substitutes ($1/\sigma \to 0$), this is the only effect. When labor and imported inputs are imperfect substitutes the effect is weaker and could actually be positive.

Let ψ_{jt} be a reduced-form representation for the demand for firm j's output (e.g. ψ_{jt} is the price for firm j's output if the output market is perfectly competitive).[5] Then the demand for labor by firm j is its marginal revenue product and we have

$$\psi_{jt} MPL_{jt} = (1-\alpha)\psi_{jt} A_{jt} K_{jt}^{\alpha} C_{jt}^{\frac{1}{\sigma}-\alpha} L_{jt}^{-\frac{1}{\sigma}} \quad . \tag{3}$$

We assume that firm j faces the following reduced-form labor supply

$$w_{jt} = c_0 (L_{jt})^{\gamma}, \text{ where } c_o, \gamma > 0 . \tag{4}$$

In Figure 2 we plot equation (3) as the downward-sloping labor demand curve LD_0 in and equation (4) as the upward-sloping labor supply curve LS. Of course, if the firm faces a perfectly elastic labor supply curve, then shocks to labor demand will result in employment responses but no wage responses within the firm.

Figure 2 is the framework for our comparative statics for an increase in imported inputs, M_{jt}. First, if labor and imported inputs are highly substitutable (i.e. if $\sigma > 1/\alpha$), then *ceteris paribus*, labor demand and wages decrease. We capture this direct effect of outsourcing in Figure 2 as the shift of the labor demand curve from LD_0 to LD_1, holding

[5] If firm j faces a downward sloping demand curve for its output, then ψ_{jt} is the marginal revenue. For our empirical exercises we can be agnostic about the structure of firm j's output market, but we need an exogenous increase in firm j's exports to be a positive demand shift for firm j's output.

constant capital, K_{jt}. Let γ_M denote the elasticity of wage with respect to imported inputs in this case. Using equations (3) and (4) we show that

$$\gamma_M = \frac{\partial \ln w_{jt}}{\partial \ln M_{jt}}|_{K \text{ constant}} = -\frac{(\alpha - \sigma^{-1})(1-c_0)}{B},$$

where $c_0 \in (0,1), B = 1 + \frac{1}{\gamma}[\frac{1}{\sigma} + c_0(\alpha - \sigma^{-1})] > 0$. (5)

There is also a secondary effect, much emphasized in the trade literature. The increase in foreign inputs may make the firm more profitable (either by raising productivity or by lowering production costs). The firm will respond by increasing output and input of all types. We capture this productivity effect of outsourcing in Figure 2 as the secondary shift of the labor demand curve from LD_1 to LD_2. The productivity effect of outsourcing tends to raise labor demand, thereby diminishing or potentially even eliminating the negative direct effect of outsourcing on wages. Let γ_M^* denote the elasticity of wage with respect to imported inputs inclusive of the productivity effect. To solve for γ_M^*, we assume that firm j takes the rental rate for capital, r_t, as given, and that firm j increases capital input, K_{jt}, until the marginal revenue product of capital equals the rental rate r_t. We show that

$$\frac{\partial \ln K_{jt}}{\partial \ln M_{jt}} = 1 - c_0 > 0, c_0 \in (0,1). \quad (6)$$

Using equations (3), (4) and (6) we show that

$$\gamma_M^* = \frac{\partial \ln w_{jt}}{\partial \ln M_{jt}} = \frac{(1-c_0)}{\sigma B^*}, \ c_0 \in (0,1), B^* = 1 + \frac{1-c_0}{\gamma\sigma} > 0 \quad (7)$$

Equations (5) and (7) imply that $\gamma_M < \gamma_M^*$,[6] and Figure 2 illustrates this prediction. The change captured in γ_M corresponds to the shift from LD_0 to LD_1, but the change captured in γ_M^* corresponds to the shift from LD_0 to LD_2. To estimate γ_M, we must hold capital and other inputs fixed. To estimate γ_M^*, however, we must allow firm j to adjust capital and other inputs.

When firm j uses multiple types of labor (each type can be a skilled group or an occupation) in production, our results hold up for each type of labor, as we show in the Theory Appendix. In particular, an increase in imported inputs, M_{jt}, increases the demand for a type of labor if this type of labor is highly substitutable with M_{jt}. This implies that in response to increased outsourcing, the wages of some workers may rise (those who are poor substitutes for M_{jt}) while the wages of the others fall (those who are good substitutes for M_{jt}). We further examine this point in our estimates below.

Finally, it is straightforward to see from equation (3) that an exogenous rise in demand facing the firm will boost labor demand and wages. In the empirics we will capture this demand using shocks to the firm's exports.

III.2 Specification

To motivate our specification we derive the explicit expressions for wage, with and without the productivity effect. Equations (3) and (4) jointly determine the wage for one unit of labor. We assume that each worker *i* has productivity h_{it} in year t and $h_{it} = \exp(\beta_1 x_{it} + \eta_{ij})$, where x_{it} represents observable worker characteristics (e.g. education, tenure), β_1 is a

[6] Equation (7) also implies that $\gamma_M^* > 0$. This prediction might not hold if there is adjustment cost for changing capital input and K_{jt} rises by less than equation (6) suggests. However, the prediction $\gamma_M < \gamma_M^*$ is robust to such adjustment cost.

vector of coefficients, and η_{ij} represents unobservable worker ability specific to firm j. Then worker i has wage $w_{ijt} = w_{ij}h_{it}$. This, together with equations (3) and (4) implies that

$$\ln w_{ijt} = \gamma_M \ln M_{jt} + \gamma_2 \ln \psi_{jt} + x_{it}\beta + b_k K_{jt} + b_0 + v_{jt} + \eta_{ij} + \varepsilon_{ijt},$$

$$\text{where } v_{jt} = \gamma_2 \ln A_{jt}, \gamma_2 = b_A = \frac{1}{B}, b_K = \frac{\alpha}{B}, \qquad (8)$$

b_0 is a constant, B is as defined in equation (5), and ε_{ijt} is an error term that is uncorrelated with the regressors. The coefficient γ_M is the elasticity of wage with respect to outsourcing net of the productivity effect, and by equation (5), $\gamma_M < 0$ if labor and imported inputs are highly substitutable. The estimation of equation (8) corresponds to the shift from LD_0 to LD_1 in Figure 1. Suppose that there are time varying unobserved shocks to productivity at the firm level. A firm with higher productivity will import more inputs, and so the omitted variable, v_{jt}, is likely to have positive correlation with imported inputs, $\ln M_{jt}$. Therefore, the estimate for γ_1 from OLS is likely to be biased upwards. To address this issue we construct instruments (described in the next section) that are correlated with the firm's decision to increase purchases of imported inputs but uncorrelated with firm ability.

In equation (8) we hold constant input uses by firm j. When firm j is able to adjust capital and other inputs we use equations (3), (4) and (6) to show that

$$\ln w_{ijt} = \gamma_M^* \ln M_{jt} + \gamma_2^* \ln \psi_{jt} + x_{it}\beta + \gamma_3^* r_t + b_0^* + v_{jt}^* + \eta_{ij} + \varepsilon_{ijt}^*,$$

$$\text{where } v_{jt}^* = \gamma_2^* \ln A_{jt}, \gamma_2^* = \frac{1}{B^*(1-\alpha)}, \gamma_3^* = -\frac{\alpha}{B^*(1-\alpha)}, \qquad (9)$$

b_0^* is a constant, B^* is defined in equation (7), r_t is the rental rate for capital, and ε_{ijt}^* is an error term that is uncorrelated with the regressors. The coefficient γ_M^* is the elasticity of wage with respect to outsourcing including the productivity effect, and by equations (5) and (7), $\gamma_M < \gamma_M^*$. The estimation of equation (9) corresponds to the shift from LD_0 to LD_2 in Figure 1.

To implement (8) and (9) in the data, we add the following. One, we incorporate industry, region and year fixed effects to control for the components of A_{jt} and ψ_{jt} that are industry, region and year specific, and to control for the rental rate r_t. Two, we use job-spell fixed effects to absorb η_{ij}, the unobserved worker-i ability specific to firm j (see e.g. Abowd et al. (1999).), The job spell fixed effects also absorb the components of A_{jt} and ψ_{jt} that are worker-firm specific. Time varying shocks to worker productivity are captured by including worker-level characteristics such as experience, job tenure, union status, marital status, and education (some college = high skill; vocational education = medium skill; high school only = low skill), in x_{it}. Three, we use EXP_{jt}, the value of firm j's exports in year t, as a measure for one component of ψ_{jt}. Since the decision to export may be correlated with unobserved firm productivity, A_{jt}, we construct instruments for exports. Finally, we include other firm-control variables (e.g. firm size), in addition to capital to examine effects on labor demand net of the productivity effect. These modifications yield two estimating equations

$$\log w_{ijt} = \alpha_{ij} + \gamma_1 \ln(IMP_{jt}) + \gamma_2 \ln(EXP_{jt}) + x_{it}\beta_1 + z_{jt}\beta_2 + \varphi_t + \varphi_{IND} + \varphi_R + \varepsilon_{ijt} \quad (10)$$

$$\log w_{ijt} = \alpha_{ij} + \gamma_1^{'} \ln(IMP_{jt}) + \gamma_2^{'} \ln(EXP_{jt}) + x_{it}\beta_1 + \varphi_t + \varphi_{IND} + \varphi_R + \varepsilon_{ijt}, \quad (11)$$

where α_{ij} is job-spell fixed effects, z_{jt} is the vector of firm-control variables, and φ_t, φ_{IND}, and φ_R are year, industry and region fixed effects.

We summarize the predictions of our framework as follows. If labor and imported inputs are highly substitutable, $\gamma_M < 0$. If the productivity effect boosts labor demand and wages, then $\gamma_M < \gamma_M^*$., and if exogenous changes in exports raise output demand, $\gamma_2, \gamma_2^* > 0$.

III.3. Instruments

In our empirical specifications we will relate time varying labor market outcomes to time varying firm-level measures of outsourcing in an effort to identify how rising outsourcing affects these outcomes. This relationship would not be identified if firms experience demand or productivity shocks that affect both outsourcing and wage setting or employment. To address this problem, we construct four instruments for the outsourcing variable that are correlated with the decision to outsource but uncorrelated with changes in the firm's ability and wage structure.

The instruments are exchange rates (E), tariffs (τ), transport costs (tc), and world export supply (WES). The first three capture shocks to the delivered price of inputs purchased by Denmark. The last captures changes in comparative advantage for the exporting country, whether arising from changes in production price, product quality, or variety. Details on each instrument follow, but first we discuss aggregation.

We calculate each variable specifically for every source country x HS 6 product that the firm buys. We then aggregate across inputs to get a single value for each firm using a share weighted average of the importance of each input in the firm's purchase bundle. These shares are based on firm-specific sourcing patterns in pre-sample years and are fixed over time for the firm so that time series change in the aggregated instrument arises from underlying changes in exchange rates, tariffs, transport costs, and world export supply.

However, there is variation across Danish firms in the importance of each input, and this share weighting causes the time series change to impact each firm differentially.

The idea behind this strategy is the following: for some reason firm *j* sources a particular input *k* from country *c*. Firm *j* may have a long standing business relationship with a firm in *c*, or the inputs that *c* makes might be a particularly good fit for firm *j*. That relationship is set in the initial year. Then over time there are shocks to the desirability of purchasing input *k* from country *c*. Perhaps country *c* experiences changes in its production costs, production variety or quality that are exogenous to firm *j*, and these are reflected in changing export supply to the world as a whole. Because firm *j* intensively uses input *k* from country *c* more than other firms it disproportionately benefits from that growth. (And recall that in the modal case, firm j is the *only* firm that buys input k from country c.) Similarly, an appreciation of the DKK against currency *c*, or a decline in tariffs or transport costs for input *k* from country *c* will disproportionately benefit firms that intensively use that input.

More formally, let I_{ckt} represent instrument $I \in (tc, \tau, E, WES)$ for exporting country c, selling HS 6 product k, at time t, and let s_{jck} represent the share of *c*-*k* in total materials imports for firm j in the pre-sample years (1992-1993). Then to construct a time varying instrument for firm j we have

$$I_{jt} = \sum_{c,k} s_{jck} I_{ckt}$$

We now discuss each particular instrument. The exchange rate E_{ct} is the annual average rate, denoted in foreign currency *c* per DKK so that an increase in E_{ct} is an appreciation of the DKK. Since we are aggregating over source countries, we normalize

E_{ct} by its over-time mean value to remove unit differences. Tariffs, τ_{ckt}, are taken from TRAINS data on Danish MFN tariffs which vary by product and time period. In addition, tariffs vary over source countries for a given product and time period due to zero tariff EU preferences. For some Eastern European countries that join the EU within our sample, tariffs switch from MFN rates to the EU zero tariff in 2004. World export supply WES_{ckt} is country c's total supply of product k to the world market (minus its supply to Denmark) in period t. These data are constructed from COMTRADE bilateral trade data at the HS6 level.

Finally, we construct transport costs that are country c, product k, time t specific. Following Hummels (2007) we estimate transport cost functions in which the dependent variable is the ad-valorem transportation charge for product k shipped from c at time t in mode m (air, ocean, rail, truck). These charges depend on transport mode, a product category fixed effect, product weight/value, the distance the product is shipped, oil prices, and an interaction between distance and oil prices. All estimated coefficients are mode-specific. Full details on this estimation are captured in an appendix.[7] The key factor for our purposes is the estimates show a pronounced difference between modes in the interaction between oil prices and distance and that, during our sample period, fuel prices fell and then rose sharply. Rising fuel prices have similar effects on air and ocean costs for countries at the distance mean (8000 km), but the interaction effect is much stronger for air. This implies that changes over time in fuel prices affect the level of costs, the relative cost of

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[7] To construct the instrument for Danish firms, we calculate the predicted value of ad-valorem costs for an input, $\hat{\tau}_{tck}$, given the transport mode, oil prices in that time period, product weight/value, and distance to partner using the transport cost coefficients estimated above. The transport mode and product weight/value are set in the base year.[7] For reference, in 2000, 15.1 percent of Danish imports arrived by air; 60.6 percent by ocean; and 24.4 percent by rail & truck.

employing air v. ocean v. land transport and the relative cost of distant versus proximate partners.

Two final notes on our instruments are in order. First, some of our firms either enter or begin outsourcing within sample. For these firms we use sourcing patterns in their first year of outsourcing and employ data from year 2 and onwards for the wage and firm outcome regressions. Second, we include firm-level exports in all of our second-stage regressions, and construct analogous instruments for exports. That is, we observe the value of exports from firm *j*, to importing country *i*, in HS6 product *k* at time *t*. We employ exchange rates, tariffs facing Danish exporters, constructed measures of transport costs for these exports, and world import demand (importer i's purchases of product k from all sources other than Denmark) that are specific to each *i*-*k*-*t*. We then weight these by the share of *i*-*k* in firm j's exports in pre-sample years to construct an aggregated instrument.

IV. The effect of trade on firm outcomes

We begin by describing firm outcome variables and their correlation with importing and exporting behavior in Table 2. The first column reports the result of simple regressions at the firm level using all manufacturing firms in Denmark. The dependent variable is a firm characteristic (output, accounting profits, employments, average wage bill, skill shares) and the explanatory variable is an indicator for whether the firm is an importer. Coefficients are interpreted as percentage differences, so that importers have 254% higher employment than non-importers. Indeed, importers are different in every respect – they have higher sales, more employment, more skilled employment, a larger capital/worker ratio, and pay a higher average wage.

The second column restricts the sample to only those firms engaged in importing and repeats these regressions with firm fixed effects in order to relate within-firm changes in outcomes to changes in importing over time. Rising importing is correlated with rising employment, sales, capital per worker, average wage bills and accounting profits. As we note above, these differences suggest an important identification problem. It may be that importing causes these firms to be better: larger, more profitable, and able to pay higher wages. Or it may be that all these outcomes are jointly determined as a result of variation across firms in productivity or demand for their products. If so, correlations between outsourcing and wages do not indicate a causal effect.

We repeat this exercise, this time instrumenting for our trade variables. In column three we report the coefficients from firm outcome regressions in which we include only imports (instrumented). As in the preceding columns, an exogenous increase in imports leads to a sharp rise in sales, accounting profits, capital per worker and average wage bill. However, we now see a steep decline in employment, with an elasticity of -0.16, which occurs primarily through reducing the numbers of low-skill workers. The rising share of high skill workers and falling share of low skill workers suggests that the sizeable increase in average wages is driven by compositional change within the firm.

In columns four and five we report coefficients from including instrumented imports and exports together as explanatory variables. The coefficients on imports are similar to what we had in column three, though the employment effects are now considerably larger. Rising exports lead to rising sales, profits, capital per worker and employment, but have minimal effects on the composition of the workforce.

In this table we can see many of the key features of our simple section III model. When we correlate firm outcomes with indicators for importing status, or with within-firm changes in the extent of importing, we find that "better" firms import and that importing is correlated with increases in employment. However, when we isolate exogenous shocks to the importing decision that are uncorrelated with firm's ability in levels or in changes then we see a very different picture. Exogenous increases in importing improve sales and profitability outcomes for the firm, but lead to sharp contractions in employment.

Do these imported materials represent outsourcing activities of the firm, or something else? Consider three reasons that a firm might increases foreign purchases. One, the firm may be expanding sales due to rising productivity and/or increased demand for its goods and require more inputs of all types, including imported inputs. Two, the firm might be substituting foreign inputs for inputs previously purchased from another Danish firm. Three, the firm might be substituting foreign inputs for inputs previously produced within the firm, that is to say, outsourcing. Our instrumenting strategy rules out the first possibility and the estimated employment effects rule out the second possibility. Put another way, switching from a domestic to a foreign supplier may well have important benefits for the firm in terms of sales and profitability, but it should have no effect on employment within the firm. We should only see employment effects if the firm is substituting foreign inputs for its own labor.

V. The effect of trade on worker wages within job-spells.

Our empirical strategy is to relate changes in individual worker's wages to exogenous changes in importing and exporting activity by the firms that employ them, after controlling for worker-firm "job-spell" fixed effects and time varying characteristics of the worker. We estimate equations (10) and (11) basing identification on within-firm, over-time variation in imports and exports and include only those workers staying in the firm. Including firm variables controls for changes in labor demand arising from a productivity effect, that is, the measured wage elasticity is net of the productivity effect. Excluding these variables allows for time-varying changes to firm outcome variables as a result of the import and export shocks and measures both direct and indirect effects on worker wages.

Table 3 reports results of the first stage for imports and exports for specifications with and without firm controls. Recall that these regressions include job-spell fixed effects and so relate within-firm changes in imports to changes in the instruments, and similarly for exports. In the import regressions, changes in world export supply, tariffs and transportation costs have the predicted sign and are all significantly correlated with growth in imports for the firm. In the export regressions, all variables are highly correlated with growth in exports and world import demand has a very strong and correctly signed effect. The "strongest" instruments, in terms of the variation they explain, are the world export supply and transportation cost instruments. This is likely because they exhibit much more time-series variation across inputs and source countries. In contrast, exchange rates and tariff rates are both identified primarily from intra-EU v. extra-EU variation and so have similar effects, and tariffs move over time only for Eastern European countries that receive EU membership late in the sample.

Table 4 compares within-job spell wage regressions in which we pool over all workers. We provide OLS, fixed effect, and fixed effect-IV estimates both with and without additional firm controls. In the OLS specifications we treat importing and exporting as exogenous and omit worker job spell fixed effects so that we are exploiting variation over all workers, firms and time periods. In the fixed effect specifications we include job-spell fixed effects so that we exploit only within worker-firm variation but treat changes in imports and exports within the firm as exogenous. Finally, the fixed effect-IV specification includes job-spell fixed effects and instruments for imports and exports.

In the OLS and fixed effect specification we find very small wage effects from both importing and exporting – elasticities on the order of .004 -- and these estimated effects switch signs across specifications. In contrast, when we instrument we find effects that are an order of impact larger. Doubling imports lowers a worker's wage by 3.5 to 4.5% (though these are only marginally significant), while doubling exports raises a worker's wages by 4.6% to 5.5%. This effect is comparable to losing (for imports) or gaining (for exports) 10 years of employment in the firm. Recall that firms in our sample are changing their trade exposure substantially – the average deviation of log imports from the firm means is 56 percent, and similarly for exports – so this represents a sizeable impact on workers. Note also that the negative effect of imports is larger when we control for firm outcome variables and so eliminate the channel in which imports boost productivity and labor demand indirectly.

In Table 5 we report similar specification, except that now we interact imports and exports with worker education levels. As before we report OLS, FE, and FE-IV estimates. We add a fourth specification in which we drop a small number of workers who switch educational categories within a job-spell and so the level effect of education level on wages is absorbed by the job-spell fixed effect. Here we see pronounced differences by worker type. Focusing on the regressions without additional firm controls, low skill workers see a 7.3% drop in wages from importing while high-skill workers see a pronounced wage increase of 8.5%. That is, doubling imports results in nearly a 16 percent increase in the relative wage of skilled workers. Here the differences between including and excluding firm controls become stark. When we net out the productivity effect of imports by including firm controls, high skill workers gain by a statistically insignificant 2.1%. This is consistent with the framework displayed in Figure 2.

Turning to the export interactions, we see that rising exports raises wages across all skill groups, with the largest increase enjoyed by low skill workers. These within-job spell wage effects are consistent with changes in employment composition at the firm level – an exogenous shock to imports raises the high-skill share of employment and high-skill wages while lowering the low-skill share and low-skill wages. Meanwhile, exports are a rising tide that lifts all boats.

VI. Wage Effects by Occupation and Task Characteristics

Our data also contains information on the occupations of each worker, which we can use to separately identify the impact of outsourcing by occupational category and associated characteristics. We interact outsourcing with occupational categories and estimate

$$\log w_{ijt} = \alpha_{ij} + \sum_p \gamma_{1p} D_p \ln(OUTS_{jt}) + \sum_p \gamma_{2p} D_p \ln(EXP_{jt}) + x_{it}\beta + \varphi_t + \varphi_{IND} + \varphi_R + \varepsilon_{ijt}, \qquad (12)$$

where p indexes occupations and D_p's are occupational dummies. The coefficients γ_{1p} and γ_{2p} are occupation-specific wage elasticities for imports and exports, respectively. We estimate regression (12) under the fixed effects-IV specification for the 50 largest 4-digit (ISCO-88) occupations, as ranked by total manufacturing employment. Of these 50, 18 are white-collar (the first digit of the occupation code is 1-4) and 32 are blue collar (first digit 5-9).

In Table 6 we list these 50 occupations sorted from largest positive to largest negative elasticity of wages with respect to importing. We report coefficient estimates for γ_{1p} and γ_{2p}, putting the statistically significant estimates in boldface. The wage elasticities for imports vary much more (standard deviation is 0.115) across occupations than those for exports (standard deviation is 0.061). The wage elasticities for imports are significant for 29 of 50 occupations, with 19 of the 29 showing a negative effect. The white collar/blue collar distinction is important, with import wage elasticities being positive for 17 out of 18 white collar occupations and import wage elasticities being negative for most blue-collar occupations (29 out of 32). In comparison, the wage elasticities for exports are significant for only one occupation. This is consistent with our earlier finding that rising exports raise wages by similar magnitudes for all workers; by not pooling over all workers or across broad skill groups we lose useful variation and statistical significance.

Table 6 makes clear that there are large differences across white-collar occupations and across blue-collar occupations, but there are also differences within these broad groups. An analysis-of-variance shows that the white-blue collar distinction explains only 40% of the variation in the wage elasticities for imports. To further explore this point we report the share of high-skilled workers by occupation in the last column of Table 6. The wage elasticity of outsourcing has a correlation of 0.484 with the share of high-skilled workers. Are there occupational characteristics that can explain the variation in the wage elasticity for outsourcing, conditional on the share of high-skilled workers?

To answer this question we draw on the O*NET data.[8] For each of the 50 occupations, we observe a broad range of occupational attributes that may help us to explain the variation in coefficients found in Table 6. There are 232 characteristics, and so to reduce the dimension of our occupational-attribute data, we first group the attributes that may be relevant for our analyses into six categories. These are manual attributes (e.g. multi-limb coordination, manual dexterity, trunk strength), exposure to on-the-job hazard (e.g. wearing safety and protective gear), mental and analytical attributes (e.g. critical thinking, originality, mathematical reasoning), communication and language skills (e.g. oral expression, reading comprehension, deal with external customers), knowledge of natural science (e.g. physics, chemistry, engineering and technology), and knowledge of social science (e.g. economics and accounting, history and archeology, sales and marketing). We then perform principal component analyses for each category and use the first principal component of that category in our analysis.

For our six categories, the first principal components are qualitatively similar to the simple average across attributes by category, and they capture, on average, 54% of the variation in the correlation-coefficient matrix of the attributes by category. The first principal component of a category is also robust to the addition or removal of one or a few attributes from this category. To facilitate the comparison across categories and interpretation of our results, we re-scale the principal components to have mean 0 and

[8] We map the O*NET data into the ISCO-88 classification system using the crosswalk at the National Crosswalk center. ftp://ftp.xwalkcenter.org/DOWNLOAD/xwalks/.

standard deviation of 1. For example, for mechanical engineers (2145), the metrics for job-hazard and mental-attributes are -0.23 and 1.92, respectively. This means that for mechanical engineers, the frequency of exposure to job hazard is 0.23 standard deviations below the mean but the importance of mental abilities is 1.92 standard deviations above the mean.

The first panel of Figure 3 plots the wage elasticity of imports for an occupation against the importance of communication and language in that occupation. The plot shows a clear positive correlation. This is not purely a white/blue collar divide. Communication and language are more important for electrical mechanics (7241) than for metal-, rubber- and plastic-product assemblers (8284) among blue-collar occupations, and more important for technical and commercial sales representatives (3415) than for administrative secretaries (3431) within white-collar occupations.

Similarly, the second panel of Figure 3 plots the wage elasticity of outsourcing against the frequency of exposure to on-the-job hazard. The plot shows a clear negative correlation.

To be more systematic, we estimate the following regression across 4-digit occupations *p*,

$$\gamma_p = \alpha_1 + \alpha_2 SHARE\_h + \delta O_p + \varepsilon_p, \qquad (13)$$

The dependent variable is the wage elasticity of outsourcing taken from estimation of equation (12), SHARE_h is the share of high-skilled workers, and O_p includes one or several of our six occupational characteristics. Since some of the γ_p estimates are statistically insignificant we weigh each observation by the absolute value of the t-statistic of γ_p.

In column 1 of Table 7 we estimate regression (4) without the variable O_p, as a benchmark. The high-skilled share has a significant coefficient of 0.307 and the R^2 is 0.257. In columns 2-7 of Table 7 we include our six categories separately in the estimation of regression (4). Job hazards have a negative and significant coefficient of -0.063, and its inclusion in the regression reduces the coefficient of high-skilled share by about one-third and increases the R^2 by over one-half. This coefficient implies that a one-standard-deviation increase in the frequency of exposure to job hazards decreases the wage elasticity of imports by 0.063. This is a substantial effect, considering that the 25th and 75th percentiles of distribution of the wage elasticity of imports are -0.132 and 0.050, respectively. Manual attributes also have a negative and significant coefficient.

Communication and language have a positive and significant coefficient of 0.085; i.e. a one-standard-deviation increase in the importance of communication and language skills increases the wage elasticity for imports by 0.050. Natural science, however, has a negative and significant coefficient. This counter-intuitive result is probably due to the positive correlation between natural science and job hazards (0.479).

On the other hand, mental attributes and social science have insignificant coefficients. To check for within-category heterogeneity we estimate (10) for each occupational characteristic in the two categories of mental attributes and social science. We again re-scale the characteristics to have mean 0 and standard deviation of 1. We report the coefficient estimates for δ and its t-statistics in Table 8. The left panel of Table 8 shows that most characteristics in the category of mental attributes have negative and significant coefficients. This result is surprising to the extent that these characteristics represent analytical skills. However, mathematical reasoning and number facility have significant coefficients of 0.057 and 0.047, respectively. The right panel of Table 8 shows that for the social science category, the characteristics that require communication skills (e.g. customer and personal service, foreign language) or numerical skills (e.g. economics and accounting) have positive and significant coefficients, while the others have insignificant coefficients (e.g. fine arts) or negative and significant coefficients (e.g. philosophy and theology).

The results in Tables 7 and 8 suggest that the workers who are exposed to job-related hazards more often tend to have larger wage reductions from outsourcing. They also shed some light on the nature of worker skills in the global economy. Knowledge and skills in communication and language help alleviate the negative impacts (or magnify the positive impacts) of outsourcing on wages. Numerical analytical skills and knowledge in economics and accounting also help. However, workers employed in occupations that require knowledge of natural sciences and engineering are no more, or even less, insulated from outsourcing shocks than the typical manufacturing worker.[9] Not all skills are created equal.

V. Worker outcomes after layoffs

This section studies how earnings of displaced workers evolve over time. In particular we want to know how earnings losses depend on the change in outsourcing in the predisplacement firm, and how these losses interact with worker skill types. One may expect that earnings losses are more pronounced for workers that separate from firms that

[9] For the category of natural science and engineering, most characteristics have negative and significant coefficients. Mathematics has a coefficient of 0.361, significant at the 10% level.

increase outsourcing because they have obsolete skills or have specialized in doing tasks that are now imported from abroad.

There is a substantial literature on the earnings losses of displaced workers. Jacobson, Lalonde and Sullivan (1993) is an important early contribution that studied a sample of workers in Pennsylvania for 1974-1986 and showed substantial earnings losses from mass layoffs.[10] Studies based on European data also find long-term negative effects of displacement but most studies find more modest effects.[11] For example, Albæk, van Audenrode and Browning (2002) find that Danish workers earn around 6 percent less than nondisplaced workers three years after displacement. This holds for both wages and earnings suggesting that reductions in hours worked are a less important component of earnings adjustment.

Our data share many similarities with Jacobson et al. (1993). They have also access to a 12 year register based panel data set with a large number of displaced and non-displaced workers. We follow their empirical approach, and so the model we estimate is the following:

$$\log y_{it} = \alpha_i + \gamma_t + x_{it}\beta + \sum_{k \geq -m} D_{it}^k \delta_k + F_{it}^1 c_i \varphi_1 + F_{it}^2 c_i \varphi_2 + F_{it}^3 c_i \varphi_3 + \varepsilon_{it} \tag{14}$$

where y_{it} is the wage of worker i in year t. We focus on three different wage outcomes: hourly wage rates, annual labor earnings and annual gross earnings. Annual labor earnings

[10] They find that high-tenure workers experience substantial earnings losses (around 25 percent of predisplacement earnings) when they leave their jobs due to mass layoffs. These losses are long-term with little evidence of recovery after the third year and arise even prior to workers' separations.

[11] Results for Scandinavian countries are of particular relevance to our work as they are found in similar labor markets and are based on administrative data rather than surveys. For Sweden, Eliason and Storrie (2006) find permanent earnings losses of almost 10 percent. For Norway, Huttunen, Møen and Salvanes (2009) find long-term earnings losses of 3 percent for those who remain in the labor force. They also show that displacement increases the long run probability of leaving the labor force by 31 percent.

will capture effects on both the hourly wage rate and hours worked, and annual gross earnings are the sum of labor earnings, unemployment insurance benefits, social assistance and other income transfers. The dummy variables, D_{it}^{k}, $k = -3, -2, -1, 0, 1, 2, .., 5$, jointly represent the event of displacement. In particular, δ_k, is the effect of displacement on a workers earnings k years following its occurrence. That is, the specification allows displacement to affect earnings three years prior to separation and up to five years after displacement. c_i are individual characteristics (or characteristics of the predisplacement firm), and the F variables are defined as follows:

$F_{it}^{1} = t-(s-4)$, if worker i is displaced at time s and $s-3 \leq t \leq s$, and $F_{it}^{1} = 0$ otherwise
$F_{it}^{2} = 1$, if worker i is displaced at time s and $t \geq s+1$, and $F_{it}^{2} = 0$ otherwise
$F_{it}^{3} = t-(s+2)$, if worker i is displaced at time s and $t \geq s+3$, and $F_{it}^{3} = 0$ otherwise

The model forces the gap between the losses of two workers (i) to be zero in the period more than three years prior to separation, (ii) to grow or decline linearly during the period from three years before separation until the displacement year, (iii) to be constant from the displacement year to three years after displacement, and (iv) to grow or decline linearly from its value three years after separation until the end of the sample period.[12] By construction, baseline values for wages and earnings are those of non-displaced workers with particular characteristics, and the model estimates differences from that baseline for displaced workers with similar characteristics.

In addition, we want to compare earnings losses of displaced workers whose predisplacement firm was hit by an exogenous outsourcing shock (outsourcers) with

[12] A potentially important source of bias in this model is if firms selectively lay off workers whose performance was unusually poor in the years around the time of separation. Couch and Placzek (2010) used propensity score matching to control for selection and obtained similar results.

earnings losses of other displaced workers (non-outsourcers). We do this by interacting the spline variables, F^1, F^2 and F^3, with a variable indicating whether the predisplacement firm had an increase in predicted outsourcing (taken from the first stage regression in Table 3) between the predisplacement year and the displacement year.

With access to administrative data it is typically not possible to distinguish between quits and layoffs. In keeping with the literature we define displacement as workers who separate from firms with mass layoffs. Mass layoffs are commonly defined in the literature (see e.g. Kletzer (1998) and Couch and Placzek (2010)) as workers separating from firms whose employment in the year following separation was 30 percent or more below their initial employment level. Because we have access to the full population of workers and firms we can relax this definition and define displacement in terms of gross flows. So in the following displacement is defined as workers separating from firms where at least 30 percent of the particular workers in the initial year are no longer employed by the firm the following year.[13]

Following Jacobson, Lalonde and Sullivan (1993) we further restrict our sample of workers in the following way. We focus on manufacturing workers who, in at least one of the years 1997-2000, have at least six years of tenure. We further require that the worker does not die, emigrate or turn 61 during the sample window 1995-2006. Finally, we require that the worker be employed by a firm that imports at least DKK 600,000 to be consistent with our estimation of within-job spell wage changes in previous sections, and to eliminate very small firms and those with minimal global engagement from the analysis. Approximately 11 percent of our sample (8,840 workers in total) are displaced at least

[13] The results are similar if we use the same definition as in the literature.

once over the years 1998-2006. However, nearly half of the displaced workers do not have an observed change in predicted outsourcing in the predisplacement firm. This is due to missing instruments for some firms and to the fact that some of the predisplacement firms closed down. Of the remaining 4,600 displaced workers, 25 percent worked pre-displacement for firms that had an increase in predicted outsourcing.

We graphically summarize the results in Figure 4. The three top panels show the evolution of log wage rates, earnings and gross earnings (or labor earnings plus income transfers, social assistance, and unemployment insurance) for high skill workers. Changes in earnings and gross earnings are measured in levels of DKK rather than in percentage terms so as to include those workers who exhibit zero labor income. Each panel displays results labeled "outsourcers" and "non-outsourcers". "Outsourcers" are workers displaced in a mass layoff event from firms that were increasing their outsourcing. "Non-outsourcers" are individuals displaced in a mass layoff event from firms that were not increasing their outsourcing.

The top left panel shows that high-skill non-outsourcers suffer small and very temporary wage losses relative to non-displaced workers, reaching 1.8% of pre-displacement wages one year after displacement and recovering to the pre-displacement levels four years after displacement. High-skill outsourcers suffer much deeper and more persistent wage losses, reaching 6.4% of pre-displacement wages and recovering five years after displacement. The top row, middle panel shows that there are pronounced drops in earnings for both outsourcers and non-outsourcers, peaking the year after displacement with average losses of almost 80,000 DKK and 40,000 DKK, respectively. The average high skill wage in the sample is 420,000 DKK so these losses represent 9% of pre-displacement earnings for non-outsourcers and 19% of pre-displacement earnings for outsourcers. The percentage loss in earnings substantially exceeds the percentage losses for wages for both displacement types, suggesting that both groups experience significant reductions in hours worked. The top right panel shows that even after accounting for income transfers during unemployment the earnings losses from displacement are still substantial. Outsourcers in particular lose almost DKK 60,000 the year after displacement, or 14% of predisplacement earnings.

Results for low skill workers are shown in the bottom panels of Figure 4. Wage losses are more severe than for high skill workers and outsourcers suffer greater losses than do non-outsourcers (9.5% versus 4.6%). One year after displacement, low skill workers displaced from outsourcing firms suffer earnings losses 60 percent greater than low skill workers displaced in other mass layoff events (DKK 73,000 compared to DKK 45,000). This gap persists throughout the 5 year post displacement period, and their recovery rate is much slower than high-skill outsourcers. In absolute terms the earnings losses are comparable to high skill workers, but since low skill workers have lower earnings (260,000 DKK on average), earnings losses in year one correspond to 17% (non-outsourcers) and 28% (outsourcers) of predisplacement earnings. As with high skill workers, these losses are not fully compensated by income transfers -- the year one gross earnings losses are 10% and 17% of predisplacement income.

It is useful to contrast the wage and earnings loss for low skill workers displaced from outsourcing firms with the wage losses for their colleagues who are not displaced. The former suffer a wage loss of 9.5% while the latter have a wage loss of 7.3% (inclusive of the productivity effect) if their employers double outsourcing within a year. The earnings losses for the displaced low skill workers, which includes the effect of reduced hours, are 28%, or about 4 times larger, than the wage losses for their colleagues who remain employed. The comparison is starker for high skilled workers. Those who remain employed with an outsourcing firm have a wage *gain* of 8.5% (inclusive of the productivity effect) if their employer doubles outsourcing in a single year. Meanwhile, their colleagues who are displaced suffer a wage loss of 6.4% and an earnings loss of 19%.

VI. Conclusions

We employ a unique matched worker-firm dataset from Denmark to measure how outsourcing shocks affect wages and employment at the worker level. Because we observe the specific products and source countries for imported inputs purchased by Danish firms we can construct instruments for outsourcing decisions that are time varying and exogenous to the firm. This allows us to identify the causal effect of outsourcing on worker's wages and employment transitions.

Our key findings are these. One, controlling for the endogeneity of trade events is critical. Instrumental variables estimates of the effect of imports and exports on wages yield different signs and coefficients an order of magnitude larger than those found when estimating these effects using OLS or worker-firm fixed effects. Two, exogenous outsourcing shocks have profoundly different wage effects across educational groups, raising skilled labor wages 8.5 percent and lowering wages by 7.3 percent for unskilled workers. In contrast, exporting is a rising tide that lifts all boats. Three, the disparities in wage impacts from imports are even more pronounced across occupational groups, with a

50 percent relative wage change between the most helped and hardest hit occupations. These effects are partly explained by a traditional white collar/blue collar divide and by the share of high-skill workers in each occupation. Exploring occupational characteristics allows us to identify two additional and unique relationships. Occupations that expose workers to potentially unsafe working condition experience wage drops after outsourcing, and not all degrees are created equal. Occupations that intensively employ knowledge sets from social science and languages are systematically less affected by outsourcing shocks, while those that employ knowledge sets from natural sciences and engineering are no more or less insulated from outsourcing shocks than the average manufacturing worker.

Fourth, we track workers before, during and after job-spells and find that displacement from a firm with rising outsourcing generates larger and more persistent wage and earnings losses than those suffered by other displaced workers. Both high-skill and low-skill workers suffer initial wage losses but high-skill workers suffer smaller losses and recover to pre-displacement wages much faster. The most pronounced effects are found in earnings, which incorporate lost hours as well as lowered wages conditional on re-attachment to the workforce. One year out, skilled workers displaced from rising outsourcing firms lose 19 percent of their predisplacement earnings while unskilled workers lose 28 percent. The latter effect is four times larger than the effect suffered by unskilled workers who remain employed within an outsourcing firm.

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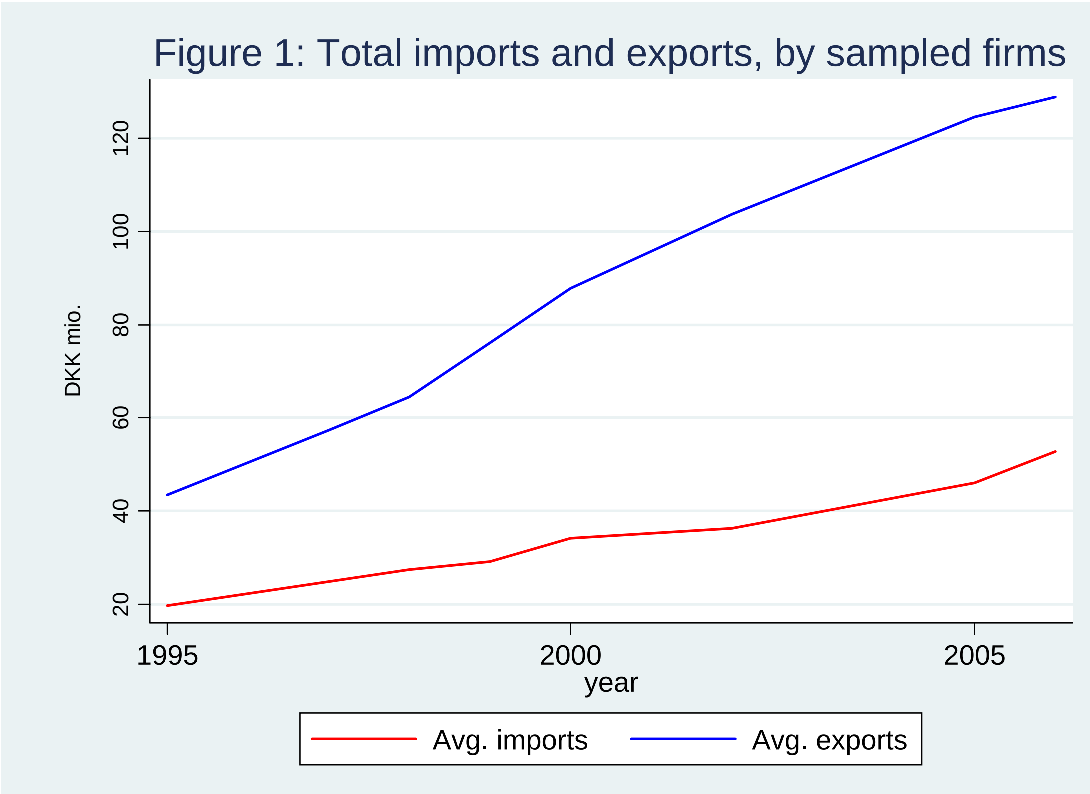
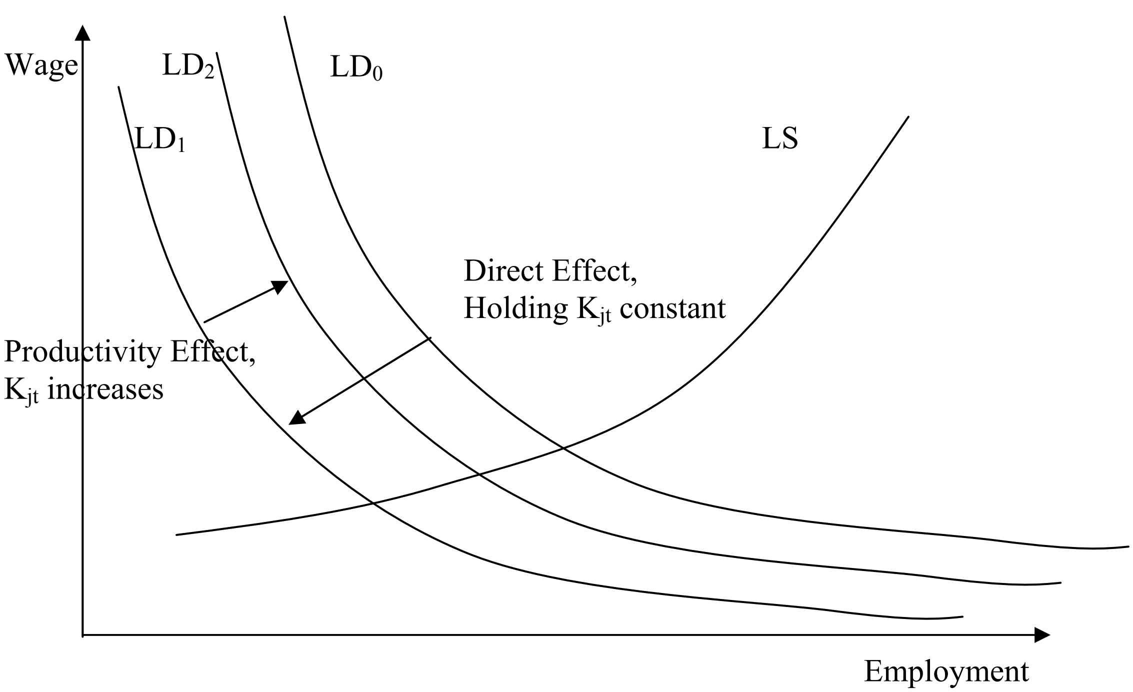


Figure 1: Total imports and exports, by sampled firms
DKK mio.
20
40
60
80
100
120
1995
2000
2005
year
Avg. imports
Avg. exports

Figure 2



Wage
LD2
LD0
LD1
LS
Direct Effect,
Holding Kjt constant
Productivity Effect,
Kjt increases
Employment

Figure 3: Wage Effects by Occupations and their Characteristics

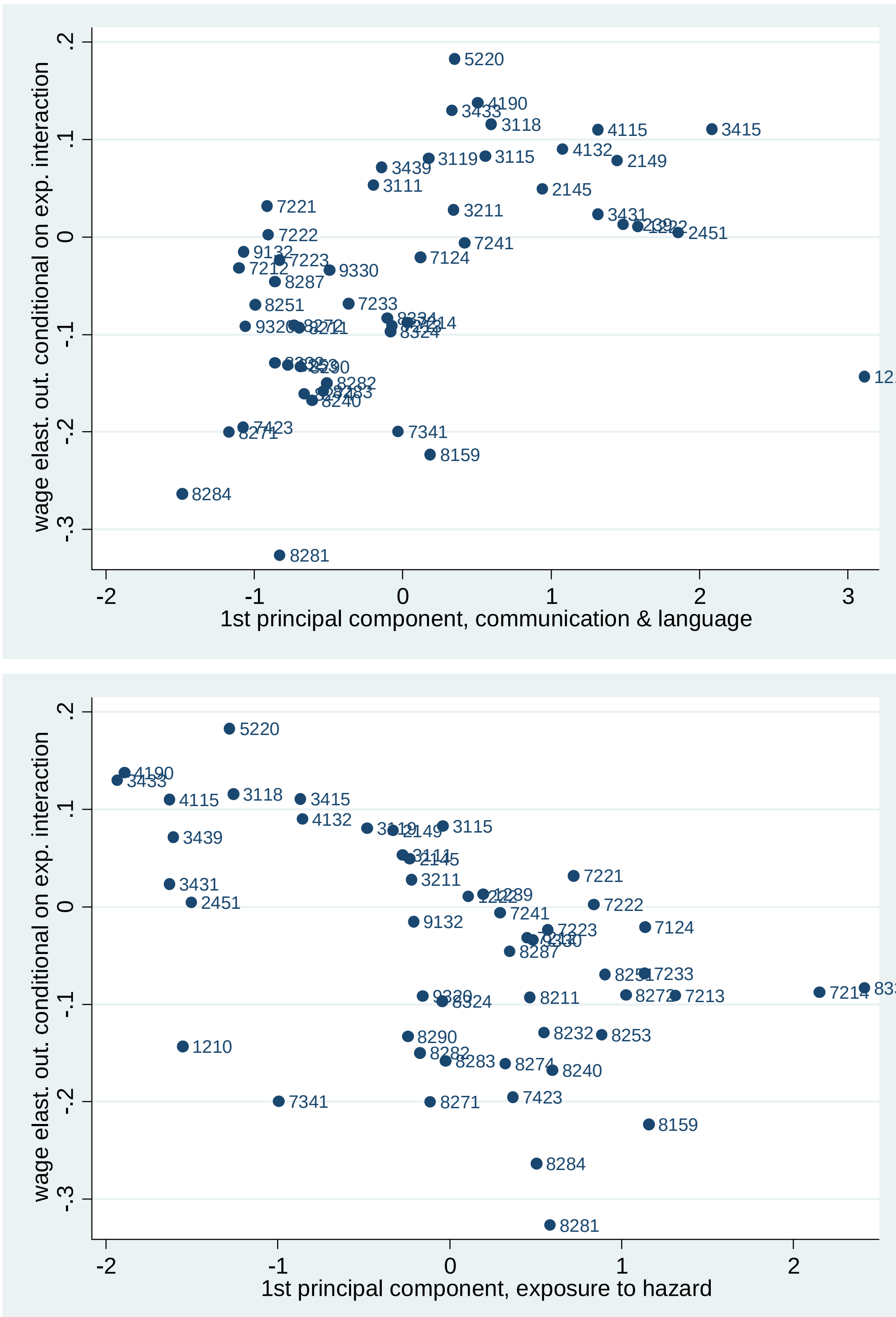


Figure 4: Wages and Earnings for Displaced Workers

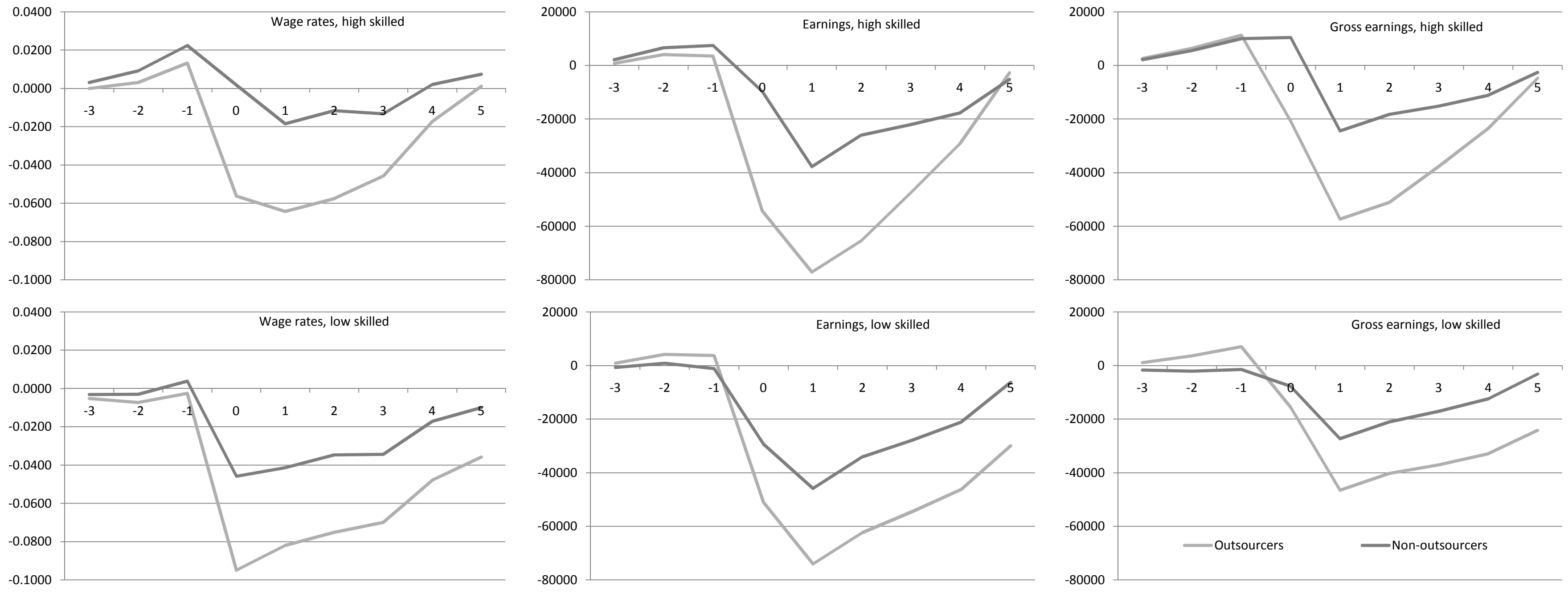


Table 1: Descriptive Statistics

	Obs	Mean	Std. dev.
In logs…			
Employment	23,304	3.76	1.34
Gross Output	23,271	17.75	1.37
Capital per worker	23,089	12.22	1.11
Average wage bill per worker, wage income	23,152	12.52	0.29
Average wage bill per worker, hourly wage	23,152	12.68	0.28
Accounting Profits	18,440	7.89	1.87
Skill shares			
High-skill	23,151	0.15	0.14
Medium-Skill	23,151	0.43	0.16
Low-skill	23,151	0.42	0.18
Firm-level trade data			
Imports/material purchases	20,611	0.41	0.26
Imports/gross output	23,092	0.22	0.18
Exports/gross output	22,597	0.35	0.32
Log(imports)	23,304	15.91	1.53
Log(exports)	21,002	16.14	2.51
Imports, log deviation from firm mean	23,304	0.56	0.68
Exports, log deviation from firm mean	21,002	0.54	0.70

Table 2: Firm-level effects of trade

	OLS	Firm FE	Firm FE-IV	Firm FE-IV, imports & exports in regression	
	Importer dummy	log(imports)	log(imports)	log(imports)	log(exports)
Log(employment)	2.538	0.255	-0.163	-0.479	0.465
Log(gross output)	2.947	0.257	0.564	0.309	0.321
Log(capital per worker)	0.397	0.021	0.316	0.183	0.225
Log(annual results)	3.270	0.238	0.781	0.210	0.539
Log(wage bill per worker), wage income	0.114	0.045	0.320	0.317	-0.014
Log(wage bill per worker), hourly wage	0.084	0.041	0.350	0.338	-0.014
Share of high-skilled workers	0.061	0.002	0.130	0.136	-0.002
Share of medium-skilled workers	-0.065	0.006	0.004	0.004	-0.004
Share of low-skilled workers	0.004	-0.008	-0.134	-0.140	0.006

Notes:
Columns 1,2,3 are from regressions of each firm outcome variable on a single (import) variable
Columns 4, 5 include both imports and exports in regression

Table 3: First stage FE-IV regressions

Dependent variable:	Log(imports)		Log(exports)	
Log WES, imports	0.0216***	0.0641***	-0.0385***	0.0075***
	[12.18]	[32.17]	[-13.84]	[2.58]
Log(1+tariff), imports	-2.7806***	-1.2611***	1.8814***	4.5009***
	[-8.23]	[-3.44]	[3.57]	[8.46]
Log exchange rates, imports	-0.1281***	-0.2732***	-0.0129	-0.1010***
	[-22.28]	[-42.36]	[-1.41]	[-10.54]
Log transport costs, imports	-6.1282***	-8.3349***	-1.2038***	-2.2421***
	[-60.63]	[-73.30]	[-7.62]	[-13.53]
Log WID, exports	-0.0233***	0.1184***	0.2457***	0.3872***
	[-16.39]	[74.89]	[109.81]	[166.91]
Log(1+tariff), exports	2.6049***	2.0174***	0.7927***	0.4947***
	[98.80]	[68.17]	[19.20]	[11.44]
Log exchange rates, exports	0.1781***	0.4431***	0.4797***	0.5500***
	[29.89]	[69.42]	[51.85]	[59.54]
Log transport costs, exports	5.1044***	8.3535***	1.2312***	3.6701***
	[39.57]	[57.42]	[6.11]	[17.31]
Additional Firm Controls	Yes	No	Yes	No
Industry fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	2543320	2575830	2503536	2535206
Number of firms	2964	3007	2892	2932
R-squared	0.2508	0.0758	0.1170	0.0414

*** p<0.01, ** p<0.05, * p<0.1

Notes: Excluded instruments only reported

Table 4: Worker-level Wage Regressions

Dependent variable:	Log(hourly wage)					
	OLS (Full sample)		FE (Full sample)		FE-IV (Full sample)	
Log(imports)	-0.0105***	0.0048***	0.0004	0.0039*	-0.0450*	-0.0351
	[-6.94]	[3.18]	[0.27]	[1.96]	[-1.74]	[-1.27]
Log(exports)	-0.0029***	-0.0001	0.0033*	0.0044**	0.0461***	0.0546***
	[-2.82]	[-0.06]	[1.69]	[2.11]	[5.83]	[5.47]
Log output	0.0540***		0.0159***		0.0223	
	[8.13]		[4.30]		[1.60]	
Log employment	-0.0306***		0.0129***		0.0074	
	[-5.21]		[3.72]		[0.62]	
Log capital per worker	0.0094***		0.0036***		0.0055***	
	[6.11]		[3.18]		[3.97]	
High-skill share	0.3273***		0.0399***		0.0335	
	[24.13]		[2.68]		[1.40]	
Med-skill share	0.4303***		-0.0200**		0.0070	
	[30.83]		[-2.06]		[0.29]	
High-skilled worker	0.3057***	0.3301***	0.3388***	0.3393***	0.3400***	0.3403***
	[93.65]	[101.23]	[63.00]	[63.44]	[61.99]	[62.34]
Medium-skilled worker	0.0720***	0.0908***	0.3623***	0.3621***	0.3627***	0.3626***
	[74.76]	[77.00]	[66.17]	[66.68]	[65.09]	[65.59]
Experience	0.0161***	0.0170***	0.0073***	0.0075***	0.0073***	0.0076***
	[99.44]	[96.55]	[17.88]	[18.38]	[17.89]	[18.49]
Experience2	-0.0003***	-0.0003***	-0.0004***	-0.0004***	-0.0004***	-0.0004***
	[-67.30]	[-64.89]	[-65.73]	[-67.74]	[-63.76]	[-65.66]
Tenure	0.0081***	0.0081***	0.0045***	0.0046***	0.0045***	0.0047***
	[30.80]	[25.20]	[19.63]	[19.93]	[19.17]	[19.52]
Tenure2	-0.0003***	-0.0003***	-0.0002***	-0.0002***	-0.0002***	-0.0002***
	[-25.88]	[-23.68]	[-20.19]	[-21.76]	[-19.54]	[-21.16]
Union member	-0.1010***	-0.1007***	0.0045***	0.0047***	0.0045***	0.0047***
	[-70.27]	[-66.80]	[4.94]	[5.18]	[4.76]	[5.04]
Married	0.0246***	0.0225***	0.0049***	0.0049***	0.0049***	0.0050***
	[39.08]	[33.19]	[10.33]	[10.48]	[10.38]	[10.55]
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Job spell fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2475253	2493140	2475253	2493140	2398626	2416388
Number of job spells			672274	679701	0.2082	0.2052
R-squared	0.3324	0.3013	0.2067	0.2041	642004	649323

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Worker-level Wage Regressions: Skill interactions

Dependent variable:	Log(hourly wage)							
	OLS (Full sample)		FE (Full sample)		FE-IV (Full sample)		FE-IV (Excl. educ. switchers)	
Log(imports) x low-skilled	-0.0049***	0.0037*	-0.0018	0.0015	-0.0593***	-0.0628***	-0.0645***	-0.0729***
	[-3.79]	[1.87]	[-0.97]	[0.67]	[-6.25]	[-5.52]	[-3.50]	[-3.64]
Log(imports) x medium-skilled	-0.0096***	0.0028*	-0.0016	0.0017	-0.0501***	-0.0556***	-0.0469**	-0.0466**
	[-7.64]	[1.84]	[-0.96]	[0.81]	[-5.38]	[-4.84]	[-2.53]	[-2.31]
Log(imports) x high-skilled	-0.0128***	-0.0026*	0.0092***	0.0134***	-0.0266***	-0.0277**	0.0214	0.0851***
	[-7.82]	[-1.75]	[7.97]	[11.72]	[-2.91]	[-2.47]	[1.26]	[4.75]
Log(exports) x low-skilled	-0.0030***	-0.0009	0.0048**	0.0059***	0.0492***	0.0626***	0.0527***	0.0597***
	[-2.75]	[-0.53]	[2.31]	[2.61]	[7.58]	[9.03]	[6.95]	[7.26]
Log(exports) x medium-skilled	-0.0035***	-0.0019**	0.0022	0.0032	0.0356***	0.0497***	0.0413***	0.0495***
	[-3.52]	[-2.04]	[1.15]	[1.58]	[5.80]	[7.48]	[5.68]	[5.95]
Log(exports) x high-skilled	0.0024*	0.0085***	0.0032***	0.0048***	0.0313***	0.0445***	0.0095	0.0235***
	[1.71]	[6.04]	[4.01]	[5.75]	[5.11]	[6.66]	[1.14]	[2.97]
Other firm-level controls	Yes	No	Yes	No	Yes	No	Yes	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Job spell fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	2475253	2493140	2475253	2493140	2398626	2416388	2327590	2345101
No. job spells			672274	679701	642004	649323	628422	635705
R2	0.3328	0.3015	0.2070	0.2044	0.2088	0.2057	0.1508	0.1484

Table 6: Wage effects by Occupations

Code	Name	Imports	Exports	Skill share
5220	Shop salespersons and demonstrators	**0.1830**	-0.0805	0.090
4190	Other office clerks	**0.1375**	-0.0450	0.111
3433	Bookkeepers	**0.1297**	-0.0728	0.205
3118	Draughtspersons	**0.1157**	-0.0487	0.278
3415	Technical and commercial sales rep.	**0.1106**	-0.0451	0.348
4115	Secretaries	**0.1101**	-0.0428	0.212
4132	Production clerks	**0.0897**	-0.0416	0.181
3115	Mechanical engineering technicians	**0.0827**	-0.0602	0.696
3119	Other engineering technicians	**0.0807**	-0.0527	0.383
2149	Architects and other engineers	**0.0783**	0.0052	0.916
3439	Other admin. Associates	0.0716	-0.0491	0.297
3111	Chemical and physical technicians	0.0533	-0.0163	0.801
2145	Mechanical engineers	0.0489	-0.0120	0.907
7221	Blacksmiths and forging-press workers	0.0319	-0.0334	0.026
3211	Life science technicians	0.0280	0.0022	0.857
3431	Admininistrative secretaries	0.0232	-0.0204	0.576
1239	Other dept. managers	0.0128	0.0190	0.479
1222	Prod. and operat. dept. managers	0.0103	-0.0481	0.370
2451	Authors, journalists and other writers	0.0046	-0.0993	0.794
7222	Tool-makers and related workers	0.0022	-0.0107	0.024
7241	Electrical mechanics	-0.0064	-0.0053	0.130
9132	Helpers and cleaners	-0.0152	-0.0112	0.040
7124	Carpenters and joiners	-0.0206	0.0208	0.027
7223	Machine-tool setters and operators	-0.0234	0.0198	0.027
7212	Welders and flamecutters	-0.0321	-0.0105	0.022
9330	Transport labourers and freight handlers	-0.0342	-0.0047	0.032
8287	Composite products assemblers	-0.0458	-0.0859	0.041
7233	Ag. or ind.-machinery mechanics	-0.0682	0.0243	0.047
8251	Printing-machine operators	-0.0696	0.0000	0.011
8334	Lifting-truck operators	**-0.0837**	0.0215	0.016
7214	Structural-metal preparers and erectors	-0.0877	0.0371	0.027
8272	Dairy-products machine operators	-0.0908	0.1079	0.074
7213	Sheet metal workers	**-0.0912**	0.0196	0.028
9320	Manufacturing labourers	**-0.0916**	0.0360	0.032
8211	Machine-tool operators	**-0.0928**	0.0107	0.034
8324	Heavy truck and lorry drivers	**-0.0970**	0.0271	0.015
8232	Plastic-products machine operators	**-0.1292**	0.0171	0.037
8253	Paper-products machine operators	**-0.1316**	-0.0247	0.022
8290	Other machine operators and assemblers	**-0.1331**	0.0169	0.038
1210	Chief executives	**-0.1435**	0.0843	0.408
8282	Electrical-equipment assemblers	**-0.1498**	0.0226	0.033
8283	Electronic-equipment assemblers	**-0.1585**	0.0370	0.032
8274	Baked-goods machine operators	**-0.1613**	0.0774	0.032
8240	Wood-products machine operators	**-0.1679**	0.0349	0.025
7423	Wood. machine setters and operators	**-0.1953**	0.1053	0.029
7341	Compositors and typesetters	**-0.1998**	0.0756	0.022
8271	Meat- and fish-machine operators	**-0.2004**	0.1340	0.025
8159	Other chem.-plant operators	**-0.2232**	0.0838	0.062
8284	Metal, rubber and plas.-prod. assemblers	**-0.2636**	0.0542	0.032
8281	Mechanical-machinery assemblers	**-0.3268**	**0.2329**	0.032

Table 7: Explaining Occupational Wage Effects with their Characteristics

Share High Skill	0.307	0.143	0.205	0.347	0.169	0.397	0.238
	(4.08)	(1.80)	(2.91)	(3.54)	(1.89)	(5.19)	(2.81)
Manual Attrb.		-0.067					
		(-3.78)					
Job Hazard			-0.063				
			(-3.98)				
Mental Attrb.				-0.014			
				(-0.65)			
Comm. & Lang.					0.050		
					(2.54)		
Nat. Science						-0.052	
						(-2.93)	
Soc. Science							0.033
							(1.68)
constant	-0.116	-0.093	-0.106	-0.124	-0.091	-0.135	-0.102
	(-5.65)	(-4.87)	(-5.86)	(-5.10)	(-4.16)	(-6.70)	(-4.72)
# obs :	50	50	50	50	50	50	50
R2	0.257	0.43	0.444	0.264	0.347	0.372	0.299

Table 8: Mental and Analytical Attributes and Knowledge in Social Sciences

Mental and Analytical Attributes			Knowledge in Social Sciences		
Characteristic	delta	t-stat	Characteristic	delta	t-stat
Learning Strategies	-0.059	-4.02	Public Safety & Security	-0.049	-3.07
Monitoring	-0.054	-3.67	Education and Training	-0.044	-2.47
Active Learning	-0.063	-3.38	Philosophy and Theology	-0.033	-2.07
Inductive Reasoning	-0.066	-3.08	History and Archeology	-0.025	-1.06
Making Decisions and Solving Problems	-0.052	-2.98	Administration and Management	-0.008	-0.45
Developing Objectives and Strategies	-0.044	-2.67	Sociology and Anthropology	-0.009	-0.42
Deductive Reasoning	-0.066	-2.47	Fine Arts	-0.007	-0.33
Problem Sensitivity	-0.049	-2.41	Psychology	-0.005	-0.23
Information Ordering	-0.060	-2.24	Personnel and Human Resources	0.020	0.97
Fluency of Ideas	-0.048	-2.14	Law and Government	0.040	1.88
Thinking Creatively	-0.036	-1.76	Sales and Marketing	0.030	1.90
Originality	-0.033	-1.64	Communications and Media	0.050	2.26
Critical Thinking	-0.031	-1.61	English Language	0.049	2.43
Category Flexibility	-0.016	-0.77	Economics and Accounting	0.047	2.79
Updating and Using Relevant Knowledge	0.011	0.51	Foreign Language	0.053	3.21
Organizing, Planning, and Prioritizing Work	0.013	0.66	Telecommunications	0.096	5.82
Scheduling Work and Activities	0.021	0.92	Customer and Personal Service	0.080	6.01
Mathematical Reasoning	0.057	2.79	Clerical	0.089	6.45
Number Facility	0.047	2.89			