Import, Offshoring and Wages
Rent Sharing or Composition?

Fosse, Henrik Barslund; Maitra, Madhura

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BY

Henrik Barslund Fosse & Madhura Maitra

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Abstract: Offshoring firms are found to pay higher average wages than purely domestic firms. We provide a unifying empirical approach by capturing the different channels through which offshoring may explain this wage difference: (i) due to change in the composition of workers (skill composition effect) (ii) because all existing workers get higher pay (rent sharing effect). Using Danish worker-firm data we explain how much each channel contributes to higher wages. To estimate the causal effect of offshoring on wages we use China's accession to the WTO in December 2001— and the soon after boom in Chinese exports —as positive exogenous shocks to the incentive to offshore to China. Both skill composition and rent sharing effects are found to be important in explaining the resultant gain in wages. We also show that the firm's timing in the offshoring process determines the relative importance of a channel. For firms offshoring to China in 2002 but not in 1999, only rent sharing explains the gain in wages. For firms offshoring to China both before and after China's WTO accession the wage increase is explained mostly by the skill composition effect. Moreover, these patterns are not discernible from the measures of skill composition and rent sharing available in typical firm level datasets – like ratio of educated to uneducated workers and sales per employee.

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Authors Affiliations: Fosse: Copenhagen Business School. Maitra: Columbia University

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1. Introduction

One of the pertinent questions regarding globalization is: how does globalization affect wages? In this paper we address a particular aspect of that question: how does offshoring[1] affect firm level average wage? Offshoring firms are found to pay higher average wages than purely domestic firms (Bernard et al 2007). Guided by existing theory, we provide empirical analyses of different possible channels through which offshoring can cause firm average wage differentials. Offshoring may push up firm level average wage in different ways: first, if firms offshore low-skilled low-wage tasks that automatically increases the average wage of the remaining jobs. We call this the skill composition effect. Second, offshoring can be viewed as new technology that firms adopt to reduce costs and increase revenue and profits. In a labor market environment featuring search, screening and bargaining frictions, offshoring firms and their workers bargain over firm specific rents— offshoring induced rents can increase wages of all existing workers and thus increase average wages in these offshoring firms. We call this the rent sharing effect.

We explain how much each effect contributes towards higher average wages in offshoring firms. Papers in the offshoring literature look at one channel at a time but not both. It is possible that both effects exist in the data and looking at one channel by ignoring the other may confound the results. In the past few years offshoring has become a major trading activity. The impact of offshoring on parent country labor outcomes stirs public controversy. We carefully investigate Danish worker-firm data to disentangle the effects of the two suggested mechanisms on firm average wages. It is important to distinguish the two effects from one another as policy makers would draw diametrically opposite conclusions from either effect. While we document the presence of the skill composition effect, underlining that certain jobs in Danish firms do move out of the country, we also document that Danish firms benefit from increased profitability and share this increased profitability with workers, i.e. through rent sharing. Thus the presence of the one channel, skill composition, highlights what developed nations worry about, but there is also the rent sharing channel that tells a positive story about offshoring, and for some firms we find that the latter channel completely accounts for the differential wage gains from offshoring.

Identifying the causal relationship between offshoring and higher firm level average wage is difficult. First, firms endogenously select into offshoring: firms that offshore are, on average, larger, more productive, and tend to pay higher wages than smaller firms that are less productive

[1] Offshoring here refers to a fragmentation of the production process due to relocation of jobs from the home country to the foreign country.

and less likely to offshore. Second, higher skilled workers may select into offshoring firms because these firms are bigger and pay higher wages. Thus, separating the causal story from the selection story is important, i.e. to say whether the higher average wage paid in offshoring firms stems from offshoring per se or from higher productivity that simultaneously leads to more offshoring, higher output, and wages.

We use Danish worker-firm data that tracks the universe of Danish workers across the universe of Danish firms. This amazingly rich dataset provides detailed information on individual wage histories from which we are able to construct measures of skill composition effect and rent sharing effect at the firm level. Following Abowd, Kramarz, and Margolis (1999) (henceforth AKM), and Frias, Kaplan, and Verhoogen (2012),[2] we decompose the firm level average wage in each year into an average person component, reflecting the skill composition of the workforce, and a firm component which we interpret as the measure of time-varying firm specific rent sharing.

We use events in China to identify the causal effect of a change in the incentive to offshoring on firm level average wages. We argue that two possibly related events occurred: First, China's accession to the World Trade Organization (WTO) in December 2001 created a surge in foreign firms operating in China as well as new Chinese exporters. Upon accession, China made enormous changes to meet its WTO obligations including among other things restructuring industries, publishing previously internal laws and regulations, establishing formal procedures to adjudicate disputes, leveling the playing field for foreign firms, and giving all firms right to trade. These changes were phased in gradually over a transition period, usually within three years after accession, directly influencing firms' incentive to offshore to China. Second, there was a boom in Chinese world exports around 2003 driven by the structural changes undertaken by the Chinese government around that time. This led Chinese exports to more than double from 400 billion US dollars in 2002 to 900 billion in 2005. The surge in Chinese exports acted as an additional indirect incentive for firms in Denmark to source from China in order to maintain competitiveness with firms who would have cost advantage by sourcing cheaper Chinese resources. Thus, China's joining the WTO can be viewed as a shock to the trading environment in China and the observed Chinese export boom as a cost/technology shock, to which we expect Danish firms to respond. In fact, we do see a jump in the Danish share of imports from China in 2003, indicating that Danish firms were affected by the shock.

[2] For an extended and more detailed version, see Frias, Kaplan, and Verhoogen (2011).

The first step of our analyses is to ensure that within industries, firms offshoring to China were affected differently compared to firms who were not offshoring to China in the 2002-2005 period.[3] Next we check that the differential change was greater during the shock period, 2002 -2005, compared to an earlier period, 1999 -2001. This procedure ensures that we are identifying trend differentials between two completely different periods and thus not trend differentials, a priori, between two types of firms – the treatment and the control group.

We find that, between 2002-2005 average wage increased around 1.5 percent more in firms offshoring to China compared to the control group. The skill composition effect accounted for a quarter of the differential increase while the rest was explained by rent sharing. Our results are robust to controlling for underlying trend differences i.e. comparing the wage gain in 2002-2005 with an earlier period, 1999-2001. Splitting firms up by their offshoring status in China we find heterogeneous results: The differential wage increase between the two periods was the largest for the new offshorers i.e. firms offshoring to China in 2002[4] but not in 1999[5] and was explained by rent sharing only. The continuing offshorers i.e. firms that offshored to China in both 1999 and 2002 experienced differential wage increase between the two periods mostly through the skill composition effect. Firms offshoring to China in 1999 but not in 2002 showed no differential wage change in this period. These heterogeneous patterns are not discernable when we use common proxies for measures of skill composition and rent sharing available in the typical firm level datasets.[6] The difference in results when using measures of composition and rent sharing effects from the firm level data to those constructed from the worker-firm data shows that we should draw results from the typical firm level data (commonly used in the offshoring literature) with more caution.

In addition to papers that use linked worker-firm and firm level data our work is related to a number of papers using industry level data. Feenstra and Hanson (1996, 1997) show that offshoring affects firm level average wage by affecting the skill composition of the domestic workforce. Becker, Ekholm & Muendler (2009) find evidence that offshoring is associated with a shift towards more non-routine and interactive tasks as well as a shift towards more educated workers (skill composition effect) in German MNEs. In these models the labor market is assumed to be perfectly competitive and cannot account for possible rent sharing effects. Allowing for

[3] In particular the control group used in the results presented in this paper includes firms offshoring to other low middle-income countries but not China in 2002 and non-offshoring firms.

[4] i.e. the beginning of the defined shock period.

[5] i.e. the beginning of the defined pre-shock period.

[6] Such as ratio of educated to uneducated workers and sales per employee.

imperfectly competitive labor market, Bagger, Christensen & Mortensen (2010) find evidence of rent sharing in the Danish labor market, but their paper does not address the offshoring issue. Sethupathy's (2008) bargaining model assumes homogeneous labor and shows that offshoring increases productivity and profitability of offshoring firms compared to non-offshoring firms. The differential increases lead to higher domestic wages at offshoring firms through a positive rent sharing mechanism. Using US MNE firm level data he provides evidence that higher average wages at offshoring firms is consistent with a rent sharing mechanism. However, his outcome is also consistent with the skill composition effect and his results do indicate that the skill composition effect is present. Kramarz (2008) also uses a bargaining model to show that offshoring can affect wages directly by altering firms' threat point and thus changing the overall quasi-rent shared between firms and workers. His model shows that level of union strength matters, with firms facing stronger unions offshore more, decreasing the size of the quasi-rent to discipline workers. Using French worker-firm data he shows that firms facing stronger unions increased offshoring more with an associated decline in employment and rents. His results indicate that offshoring might have a dampening effect on wages through the rent sharing mechanism. His paper also assumes homogeneous labor and is silent about the skill composition channel.

Our data has rich information on worker types and jobs performed and would be able to address rent sharing and the composition effect simultaneously. Hummels et. al. (2010) analyze the relationship between offshoring and workers' wages and employment opportunities also using Danish employer-employee data. They find that exogenous import shocks increase wages of skilled labors and decrease wages of unskilled workers, whereas shocks to exporting increases wages of both types of workers. Our results complement their findings on wages and shocks to offshoring; we show that offshoring affects average wages through both skill composition and rent sharing effects, and how much each of the two channels contribute relative to each other. A paper close to ours in terms of econometric methodology is Frias, Kaplan & Verhoogen (FKV 2012),[7] and, in addition, we use their method for constructing measures of firm level skill composition and rent sharing effect from the worker level data.

The paper proceeds as follows. In section 2 we discuss the theoretical motivation behind our work. Section 3 describes the dataset. Section 4 discusses the econometric methodology and identification strategy. In section 5.1 we use firm level measures similar to what has been used in the offshoring literature in the absence of worker-firm data. In section 5.2 we make full use

[7] For an extended and more detailed version, see Frias, Kaplan, and Verhoogen (2011).

of the worker-firm data to decompose firm level average wage into a skill component and a rent sharing component and analyze how a shock in the incentive to offshoring affects average wages through these channels. Section 6 does robustness checks and section 7 concludes.

2. Theoretical Motivation

In this section we briefly sketch the theoretical motivation behind our work. Suppose there are heterogeneous firms who differ in terms of productivity; heterogeneous workers who vary at the skill level; imperfections in the labor market with presence of search costs, screening and wage bargaining leading to rent sharing between firms and workers. As a result, wage of each worker type depends on the share of firm-specific rents. We do not assume any particular form of rent sharing—i.e. the form can be profit sharing, revenue sharing or both.[8] Both high skilled and low skilled tasks are required for production of a good. Either type of task can be offshored which involves a marginal cost and a common fixed cost. Heterogeneous firms and fixed cost of offshoring imply that only the most productive firms can endogenously select into offshoring. The less productive firms must source from the home market.

A new offshoring opportunity can be viewed as new technology involving a fixed cost and a lower marginal cost compared to sourcing from the home market. Following a fall in the cost of offshoring, more firms will be able to take advantage of this technology but some firms will still not be productive enough to overcome the fixed cost. The new offshoring opportunity will imply displacement of jobs in firms that offshore. Thus, a fall in the cost of offshoring changes the skill composition in the offshoring firms compared to the non-offshoring firms. If relatively low skilled, low wage jobs are sent abroad then onshore skill composition increases. Because skilled labor earns higher wage, offshoring increases the average onshore wage through a pure composition effect. This effect was first suggested in Feenstra and Hanson (1996). We call this the skill composition effect on firm level average wage.[9]

We expect that firms become more cost efficient by taking advantage of new offshoring opportunities. This effect leads to a reallocation of production and profits towards the offshoring firms. If rent sharing exists between firms and workers then the wage of the average worker increases in offshoring firms and falls in the disadvantaged, non-offshoring firms. We call the

[8] Some commonly used, empirical proxies of firm specific rents are: sales per employee (revenue) or profits per employee (profit sharing).

[9] This effect works both ways for the skill composition: If high-skill jobs are offshored the skill composition falls onshore causing the average onshore wage to fall. Recent empirical evidence suggests that offshorability does not solely depend on the skill level of the task but rather on the degree of routineness and inter-activeness of the task. So offshoring can indeed decrease the onshore skill composition.

second effect the rent sharing effect. Thus both the skill composition and the rent sharing effects could be responsible for higher domestic wages at offshoring firms compared to non-offshoring firms. Our empirical approach in sections 4.2 and 5.2 investigates how much each channel contributes towards higher average wage in offshoring firms. While the skill composition effect provides evidence for the type of jobs offshored within firms, the rent sharing effect is evidence for the firms' profitability and their survival in the market. It is important to distinguish between the two effects, since these two effects will have different policy implications .

For a simple illustration of the two effects at work, let us consider the very simple case of two types of labor: low skilled (L) and high skilled (H) labor. Onshore firm level average wage $\bar{w}$ can be expressed as:

$$\bar{w} = \sum_{f=L,H} s_f w_f \ , \ f = \{L, H\}$$

where s_f is onshore skill type share and w_f is onshore skill type wage. We can decompose the discrete change in firm level average wage that we observe in the data as

$$\Delta\bar{w} = \sum_{f=L,H} s_f \Delta w_f + \sum_{f=L,H} w_f \Delta s_f \tag{1}$$

The first term on the right hand side is the change in firm level average wage due to a change in skill composition and the second term is the change in average wage brought about through a change in the wage of each type of worker, e.g. due to a rent sharing mechanism.

Many settings can lead to simultaneous increase of revenues and profits with wages. We suggest a causal explanation by using a shock in the incentive to offshore and splitting up the effect on firm average wages into two channels: 1) skill composition change that affects firm average wage and 2) changes in profits that are shared through rent bargaining leading to all wages increasing at the firm and thus also firm average wages.

Other possible explanations include that more productive firms induce higher learning and thus higher wages. Offshoring firms may transfer knowledge across the border and increase worker productivity locally, making their workers—otherwise identical to workers in lower productivity firms—more valuable and thus pay them higher wages (Malchow-Møller, Markusen & Schjerning, 2007). We believe that this possible explanation is not a likely concern in our setting: It is not obvious that sourcing from China generates these types of spill-over gains for workers, and certainly not in the first years following the broad opening up of China.

One might also think of compensating differentials: To take a job or stay in a job in a sector

or a firm where workers—due to offshoring—face the risk of being separated from their jobs or reallocated to less attractive job positions, the firm may have to offer workers a compensating differential. We consider this reasoning amounting essentially to a type of rent sharing: The management team at the firm still needs stable onshore labor, and workers use their bargaining power when they see profitability at the firm increases.

What we track in our estimates are changes to the level of firm fixed effects on firm average wages during a period. We do not track the composition of the level of worker-firm time-varying fixed effects. Thus, we stick to the concept of rent sharing when talking about estimated changes to worker-firm fixed effects. Note that the conclusions one draws form the two channels are diametrically opposite. The skill composition channel suggests what kind of jobs Danish firms offshore to China. This channel thus underlines an imminent concern for policy makers – how to compensate the workforce separated from their jobs as a result of offshoring. The rent sharing effect however underlines that there are positive sides to offshoring because it increases profitability of the firm and the firm shares part of the profits with its workers, thus contributing to improved welfare.

3. Data

Our main data source for this paper is the very rich, Danish, annual, matched, worker-firm panel from Statistics Denmark. The data currently spans from 1996-2008 and includes data from three linked databases, FIDA (1996-2008), IDA (1980-2008), and firm level External Trade Statistics (1990-2008). For our baseline results we use data on manufacturing firms only spanning from 1999-2005. All data are restricted and provided by Statistics Denmark.

FIDA is the Firm Integrated Database for Labor Market Research. It contains the (almost) full population of firms registered in Denmark. It provides accurate firm level data, including general, external accounting statistics, number of employees, and a record of individuals employed in the firms. Via a person key, FIDA can be linked to the Integrated Database for Labor Market Research (IDA), containing extensive information on socio-economic characteristics of the population of Danish residents. IDA variables include among others hourly wage, status on connection to labor market, age, sex, education, experience, tenure, and occupation. Education can broadly be classified in three categories: high skilled, requiring tertiary education; medium skilled, requiring vocational education defined as consumption of secondary education; and low skilled, defined as persons with short cycle education (typically 1-2 years) or high school education.

Via a firm key, we also link the worker-firm panel to firm level External Trade Statistics (1990-2008). This adds country-product level bilateral external trade data to our dataset.[10] Each trade flow contains information on the value of trade in DKK (f.o.b prices for exports and c.i.f prices for imports), the weight, and the volume. This dataset allows us to investigate the effect of a change in the incentive to offshore on firm level average wage.

Our main results are based on core manufacturing firms (NACE 15-36).[11] We consider firms with 10 or more employees. We also carry out robustness checks where we use our entire sample of firms. Our measure of offshoring is a broad one that includes firms' imports of both intermediate and consumption goods. For example a positive productivity or cost shock in China might affect offshoring decision of Danish firms, hence their imports and wages. In line with our theoretical motivation, firms that are able to import consumption and intermediate goods are able to expand their available potential technologies with associated increase in profitability that get translated into higher firm level average wage through rent sharing. Imports by manufacturing firms will also affect the kind of tasks (low skill and high skill) performed in the domestic firm and thus affect firm level skill composition. In our empirical analysis, imports as a share of sales proxy for offshoring at the firm level, and we proxy offshoring firms as those sourcing from abroad. Skill composition and rent sharing measures are constructed from the data using a worker level wage regression equation and explained in detail in the estimation strategy section. Table 1 provides comparison of firm level characteristics for the year 2005. Consistent with firm level findings in other countries, Danish firms that offshore are bigger in terms of employment and sales; have higher skill ratio (in terms of educated and non-educated workers), profits per employee and hourly wage, both on average and for each type of employee. For example offshoring firms have on average 85% higher employment and 36% higher sales than non-offshoring firms.[12] This result holds for other years in the sample as well. However, these results do not provide a causal mechanism from offshoring to higher wages, which we discuss in the following section.

4. Estimation

We are interested in assessing how a change in the incentive to offshore affects firm level average wage through the skill composition effect and the rent sharing effect. In the first step we show

[10] Product classification is the European Combined Nomenclature (CN), 8-digits. We use at the maximum 6-digit level which is consistent with HS-6 classification.

[11] Manufacturing firms best suit the underlying theoretical motivation and has often been used in empirical papers in the offshoring literature.

[12] The column to the far right of Table 1 presents results from simple mean difference regressions in Table 1 (i.e. statistical differences between means for offhoring firms and means for non-offshoring firms).

how firm level average wage can be split into a rent sharing component and a skill component. Our estimation strategy of decomposing firm level average wage essentially relies on the FKV technique. In the second step we relate the change in average wage and the two components arising from an exogenous shock in the incentive to offshore to China. We begin by discussing our second step: the identification strategy. Then we move on to our estimation method.

4.1. Identification Strategy. In this section we argue why we choose 2002-2005 as our shock period for our difference-in-differences estimations. 1999-2001 will act as our pre-shock period. In the following discussion we thus refer to the years 1999, 2001, 2002, and 2005 as they mark the beginning and the end of the two periods considered. We base our segregation of firms into control and treatment groups based on the firms' status in the first year of the two periods considered (i.e. 1999 or 2002).

To test how a change in offshoring opportunity affects firm level average wage through composition and rent sharing effects, we use events in China as exogenous shocks in the incentive to offshore to China. The events represent business condition, cost and productivity shocks in China and are likely to affect many local decisions of Danish firms. Our analysis does not compare the clean case of increasing wage differentials between firms offshoring and firms not offshoring. Instead, the estimations are carried out as increasing wage differentials between firms taking advantage of a new favorable offshoring destination and firms that do not.

China joined the WTO in December 2001, which was a very important event for the Chinese economy. An export boom occurred in China soon after China joined the WTO,[13] driven by the different policies undertaken by the Chinese government. These two events mark China's coming to the forefront as an important member in the global economy. China's accession to the WTO implied comprehensive liberalization, some of which would come into effect immediately whereas others were to be phased in over a period of typically less than three years. Some of the key components of China's accession to the WTO involved:

1. Gradual tariff reduction of agricultural and non-agricultural commodities. However the scope of tariff reduction was not massive, only 40% of about 10,000 products at HS8 level were eligible for tariff reductions over a period of five years with tariffs for the majority of the products being reduced by 2005.

[13] See Figure 1.

2. Services commitments involving substantial market opening of a broad range of service sectors, including banking, insurance, telecommunications, and professional services.

3. Phasing out of NTM such as licenses, quota, tendering state trading, export subsidy and removal of all WTO inconsistent non-tariff measures (NTMs) by 2005 as well as elimination of China's trade related investment measures (TRIMS).

4. Allowing all firms (whether domestic or foreign) the right to directly import from and export within three years from accession—also providing the right to engage in distribution of all products in China within three years of accession (except certain extended restrictions on chemical fertilizers, crude oil, and refined petroleum).

5. The provisions of systemic reforms involved broad reforms in the areas of transparency, notice and comment, uniform application of laws, and judicial review to help address barriers to foreign companies doing business in China.

6. China agreed to elimination of state-trading import monopolies for agricultural and industrial products and to the requirement that state-owned enterprises must make purchases and sales based solely on commercial considerations.

Accession to the WTO signaled credibility to the world that China was open for more foreign investment and trade. Given the enormous changes that were to take place to facilitate both foreign investment in China and imports from China to the rest of the world, China's accession to the WTO appears to be a shock of considerable magnitude to the incentive to offshore to China since it created a more conducive trading and business environment. This is the direct impact of China's joining the WTO on the offshoring incentive of Danish firms.

The WTO membership for China helped in spearheading further economic reforms, opened up the Chinese market for more international trade and higher levels of foreign investment, and opened up the world economy for Chinese exports. This, along with the various structural changes and liberalization policies adopted by the Chinese government around that time, led to a surge in China's exports soon after it joined WTO. Figure 1 shows that the surge in exports from China to the rest of the world was largest in 2003 and 2004. China's emergence as a major exporter has an indirect impact on firms' incentive to offshore from China from a third party competition angle. If a firm does not source inputs from China, but its rival firms (either in the same or a different country) do and reduce their costs and price, then the firm has to follow suit

or risk losing market share. Thus, as the rest of the world begins sourcing cheap inputs from China, we should expect firms in Denmark to behave similarly. One observation of interest is that though China joined the WTO in December 2001, we see exports increased the most from China to the rest of the world in 2003 and 2004. Two explanations are, first, that China had a transition phase to complete the liberalization, so the initial changes were not large enough to drive a large increase in exports immediately. Second, a small recession in the world economy in the post 9/11 crisis dampened the export growth from China in 2002. What is important in our context is that both these shocks, possibly related, and global in nature, are exogenous to a small open economy like Denmark and would not be affected by local firm behavior but would influence them.

From Figure 2 and Figure 3 we see that Danish firms, both manufacturing and non-manufacturing, reacted strongly to these episodes in China. Figure 2 shows the growth charts of Danish manufacturing imports from top non-EU15 partners and Eastern Europe. Imports from China (CN) by Danish manufacturing firms take off in 2003 while this is not true from Eastern European countries. These import responses are consistent with the surge in Chinese world exports.

Figure 3 shows the number of firms (manufacturing and non-manufacturing) importing from China as share of total firms, from 1999 to 2005. This pattern also holds for the number of firms importing from China, for example in 2002 both the total number of firms and manufacturing firms sourcing from China increased sharply, by 37% and 30%, respectively, by far the biggest increase during 1999-2005. From 2001 to 2005 the number of firms importing from China increased over two times from about 3000 to 7000, the corresponding numbers for manufacturing shows an increase by two times approximately from a little less than 500 firms in 2001 to about a 1000 in 2005 (tables not provided) . The above discussion indicates that Danish firms, both manufacturing and non-manufacturing, did respond to the shock of China's emergence as an emerging leading exporter following its accession to the WTO.

Because the number of firms sourcing from China has increased dramatically over a few years, we want to know about the nature of the firms that were sourcing from China before we see a surge in share of imports from China in 2003. We divide firms into the following four types: i) firms offshoring to China both in 2002 and 1999, ii) firms offshoring to China in 2002 but not in 1999, iii) firms offshoring to China in 1999 but not in 2002, and iv) firms offshoring to low middle-income countries but not China in 2002 and 1999 and non-offshoring firms, for the year 2002. In Table 2, a comparison of firm characteristics based on the types listed above, show

that the firms who were sourcing from China in 2002 but not in 1999 (new offshoring firms) are relatively smaller in terms of sales and employment compared to firms who were sourcing from China in both 1999 and 2002 (existing offshoring firms), as well as firms who were offshoring to China only in 1999 but not in 2002 (former offshoring firms). The omitted group consists of firms offshoring to low middle-income countries but not China and non offshoring firms in 2002 and 1999.

In Table 3a and Table 3b we present the growth rates (annualized) of imports in Danish manufacturing in 1999-2001 and 2002-2005, respectively. From these tables we see that the annualized growth rate in overall imports was lower in the 2002-2005 period than in the 1999-2001 period, when considering imports pooled across countries and also when we separate imports by high and low/middle income countries, except for China. The growth rate of imports from China was higher in 2002-2005 compared to 1999-2001. Moreover, the growth rate of total imports from China was 13 times the growth rate of overall imports in 2002-2005. The 1999-2001 annualized growth rate of overall imports from China was only about twice the growth rate of total imports. These tables also show the growing importance of Chinese imports in Danish manufacturing in 2002-2005 compared to 1999-2001. We also decompose the aggregate growth rate in each column into contributions from consumption goods and intermediate goods based on the BACI classification of HS6 products into stages of production . When comparing growth rates for consumption goods and intermediate goods for China with those of all countries (second column versus third), we again see that the growth rates of each type of good imported from China compared to other sources was higher in the 2002-2005 period, and of the total import growth rate 61-75 percent came from rising intermediate imports, the rest from consumption goods.

Unlike other papers in this literature, we do not restrict offshoring to be only intermediate goods imports for manufacturing firms; consumption goods imports are also considered as offshoring in this paper. In Table 4 and Table 5 we list consumption and intermediate commodities, respectively, based on the value imported in 2005 and 2001. Table 4a and Table 5a list top 20 commodities (based on their value of imports in 2005 in DKK) that are classified as consumption goods and intermediate goods respectively. For example Table 4a shows that boys jackets and trousers (HS6 products 620333 and 620343) are among the top products directly imported by Danish manufacturing firms from China in 2005. We consider this as offshoring: if the firms are making the garment designs in Denmark and producing the garments in China

and importing them back to Denmark, where they are labeled and packed then it constitutes as offshoring in our context because fragmentation of the production process occurs. Relocating production to China implies lower production costs, and that is likely to induce skill composition and rent sharing effects. Moreover many of the food products that are listed as consumption goods could very well be intermediate inputs in food manufacturing firms. Thus the fact that surge in imports from China to some extent is driven by consumption goods works well for the offshoring framework we have in mind. Table 6a indicates that most of the increase in Chinese imports was at the intensive margin; intensive margin being defined as commodities imported from China in 2002 as well as 1999 at the HS6 product category level.

Finally, Table 6b provides the decomposition by two broad firm categories those importing from China in 2002 and those not importing from China in 2002 but importing from China sometime between 2003 and 2005. We see that the former category contributes more towards the total change in imports from China between 2002-2005 period, mostly through the intensive margin; for the latter group, the entire change is by definition at the extensive margin.

4.2. Firm Level Average Wage Decomposition. We use the basic statistical framework of AKM for decomposing information on individual workers' wage into individual heterogeneity and firm heterogeneity. The linear worker-firm regression model of AKM with time-varying firm effect is

$$w_{it} = \alpha_i + x_{it}\beta + \psi_{j(i,t)} + \varepsilon_{it} \tag{2}$$

where i, j, and t are individuals, firms and time respectively. w_{it} is log wage; α_i is the time-invariant individual fixed effect. x_{it} is a vector of observable time-varying individual characteristics. So these components comprise the skill effect on individual wages. $\psi_{j(i,t)}$ is the time-varying firm effect. The function $j(i,t)$ indicates the firm in which worker i is employed in period t. We allow the firm effect $\psi_{j(i,t)}$ to vary over time to take into account changes in firms wage policies in response to trade shocks. ε_{it} is the residual, with the identifying assumption that $E[\varepsilon_{it}|i,t,x] = 0$ and is orthogonal to all other effects in the model.

Following FKV, we now decompose the firm average wage into an average rent sharing component and an average skill component. The way we do is by subtracting from the variables their mean across individuals at each point in time. Note from equation 2 that

$$\alpha_i = w_{it} - x_{it}\beta - \psi_{j(i,t)} - \varepsilon_{it}$$

Recalling that $E(\varepsilon_{it}) = 0$, we then define the mean deviation of α_i at time t as

$$\tilde{\alpha}_i \equiv \alpha_i - \bar{\alpha}_i = \alpha_i - E(w_{it} - x_{it}\beta - \psi_{j(i,t)}) - \varepsilon_{it}$$

The sample analogue of the expression above uses the estimated parameters $\hat{\alpha}_i$, $\hat{\beta}$, and $\hat{\psi}_{j(i,t)}$ of equation 2:

$$\widehat{\tilde{\alpha}}_i \equiv w_{it} - x_{it}\hat{\beta} - \hat{\psi}_{j(i,t)} - \bar{w}_{it} - \overline{(x_{it}\hat{\beta})} - \overline{\hat{\psi}}_{j(i,t)}$$

Define $\tilde{s}_{it} \equiv s_{it} - \bar{s}_t = \tilde{\alpha}_i + x_{it}\beta - \overline{x_{it}\beta}$ as the mean deviated value of s_{it} and introduce, as above, the sample analogue:

$$\hat{\tilde{s}}_{it} \equiv \hat{s}_{it} - \bar{\hat{s}}_t = \widehat{\tilde{\alpha}}_i + x_{it}\hat{\beta} - \overline{x_{it}\hat{\beta}}$$

Insert the expression for $\widehat{\tilde{\alpha}}_i$, reduce, and rearrange. We get the individual mean deviated wage as:

$$w_{it} - \bar{w}_t = \hat{\tilde{s}}_{it} + \left(\hat{\psi}_{j(i,t)} - \overline{\hat{\psi}}_t\right) \tag{3}$$

Taking the average across individuals within each firm j, we arrive at the split of firm average wage into an average skill component and a rent sharing component, expressed in values as mean deviated by individual means at time

$$\underbrace{\left(\frac{1}{N_{jt}}\sum_{i=1}^{N_{jt}} w_{it}\right) - \bar{w}_t}_{\text{firm avg. wage (deviated)}} = \underbrace{\left(\frac{1}{N_{jt}}\sum_{i=1}^{N_{jt}} \hat{\tilde{s}}_{it}\right)}_{\text{avg. skill comp. (deviated)}} + \underbrace{\left(\hat{\psi}_{j(t)} - \overline{\hat{\psi}}_t\right)}_{\text{rent sharing (devaited)}} \tag{4}$$

Denoting the mean deviated variables at the firm level in equation 4 as $\breve{y}_{jt} = y_{jt} - \bar{y}_t$, we now have the variables $\breve{w}_{jt}$, $\breve{s}_{jt}$, and $\breve{\psi}_{jt}$. Analogous to equation 2, we can write

$$\Delta\breve{w}_{jt} = \Delta\breve{s}_{jt} + \Delta\breve{\psi}_{jt}$$

where Δ indicates the time difference of the variables $\breve{w}_{jt}$, $\breve{s}_{jt}$, and $\breve{\psi}_{jt}$ from year $t-1$ to year t (i.e. our difference-in-differences observations of dependent variables in our analysis).

Using these three variables as our dependent variables in difference-in-differences estimations allows us to break down the coefficient on the treatment dummy in the $\Delta\breve{w}_{jt}$-regressions into

the coefficients of the treatment dummies in the $\Delta\check{s}_{jt}$- and $\Delta\breve{\psi}_{jt}$-regressions, respectively. Thus, we track changes in firm average wages and contribute the reason to either skill-compositional changes, rent-sharing effects from increased profitability, or both. Once again we underline that results from this split leads to completely different policy conclusions: Skill compositional changes underline that Danish firms do offshore low-skill jobs, but rent sharing effects increase wage for workers at the Danish firms which adds a positive welfare story to offshoring that has direct positive impact on workers at the firm.

4.3. Estimation Equations:. We test our theoretical motivation that we have boiled down to equation (1) in section 2, using two types of difference-in-differences (DiD) estimations and a set of outcome variables. Based on the identification discussion earlier we define our *shock period* to be 2002-2005 and a *pre-shock period*[14] to be 1999-2001. Our DiD equations are:

$$\Delta y_{kj} = \alpha + \beta + d\_2002 + D_j + \varepsilon_{kj} \tag{5}$$

$$\Delta y_{kj} = \alpha + \beta_1 d\_1999\_2002 + \beta_2 d\_0\_2002 + \beta_3 d\_1999\_0 + D_j + \varepsilon_{kj} \tag{6}$$

Δy_{kj} is the change in an outcome variable of interest for firm k in industry j (D_j captures industry fixed effects). We consider the difference over 2002-2005. In equation 5 d_2002 is a dummy variable for firms offshoring to China in 2002. Thus d_2002 is our treatment firms; control firms (omitted group) are firms who offshore to other low-middle income countries but not China as well as firms that do not source inputs from abroad in 2002.[15][16]

Equation 6 carries out difference-in-differences estimates by firm types, depending on when they were offshoring to China prior to 2003. As mentioned in the data section, the types that we consider are: d_1999_2002, firms sourcing from China in both 1999 and 2002; d_0_2002, firms offshoring to China in 2002 but not in 1999; d_1999_0, firms offshoring to China in 1999 but not in 2002. The omitted group is non-offshoring firms and firms not offshoring to China but other low middle income countries. The main outcome variables of interest are 1) firm level average wage, 2) skill composition, and 3) rent sharing. All results in the next section use Danish manufacturing firms only (NACE 15-36).

[14] *To test for trend differences in a DiDiD.*

[15] Results are similar using other treatment and control group. See Section 6 on robustness.

[16] We do not include firms importing from high income countries in our control group because the products they import might not be comparable to those obtained from low/middle income countries in terms of price and quality.

We carry out all estimations following two parallel tracks: One track utilizing only typical firm level information, and a second track making full use of the worker-firm matched data. Comparing these two approaches demonstrates the fruitfulness of having worker-firm matched data even though the scope is firm level analyses.

5. Results

5.1. Estimating Results from Firm Level Data. We begin by looking at firm level variables before decomposing firm level average wages into skill composition and rent sharing components from worker level regression. Typically, firm level datasets give skill ratio (skilled vs. unskilled), sales per employee (rent sharing). Apart from gauging the impact of the shock on various firm level outcomes, this exercise allows us to compare our results obtained from using more nuanced measures of skill composition and rent sharing effects by taking full advantage of linked worker-firm information with those that are commonly used in the literature and readily available in typical firm level datasets. The skill ratio that we use in this section is the traditional measure based on education of the employee; skilled labor being those having more than high school education and unskilled are those with high school or less than high school level of education.

Table 7 shows the estimation of equation 5. From columns 1 and 3 we see that average wage and skill ratio differentials changes are 1.5% and 3.6%, respectively, higher for firms offshoring to China in 2002 compared to the control group. Columns 2 and 5 indicate that employment and sales differentials are 6.2% and 5.1%, respectively, less for firms offshoring to China in 2002 compared to those who were not. The sales figure that we have represents export and domestic sales of the firm from Denmark, so one possible reason for negative differential increase in the value of sales[17] could be due to reduction of prices of commodities through reducing cost by offshoring to China.[18] Interestingly, there is no statistically significant change in sales per employee. If sales per employee is taken as a proxy for revenue based rent sharing then this result indicates that skill composition is the only channel through which wages are affected, due to offshoring, between treatment and control firms in this period. Column 6 indicates that imports as share of sales (offshoring) are 1% higher for treatment firms than for control firms during the 2002-2005 time period, showing that Danish firms offshoring to China in 2002 are

[17] I.e. treatment firm sales increase less from 2002 to 2005 than control firm sales do. Recall these are difference in differences in sales.

[18] It can also be offshore exports to third-party country.

better able to take advantage of the liberalized business environment change in China and hence fall in cost of offshoring to China.[19]Moreover, though Chinese trade has become important for Denmark over the years, it constitutes about 5% of manufacturing imports.

Since the number of firms importing from China has increased over the years we carry out the difference-in-differences estimation over 2002-2005 by breaking down types of firms depending on when they were offshoring to China and see if any differential results emerge among the types of firms. Table 8 shows our findings; the types we are interested here are firms offshoring to China both in 2002 and 1999; firms offshoring to China in 2002 but not in 1999; firms offshoring to China in 1999 but not in 2002; firms offshoring to low middle-income countries but not China and non-importing firms (the omitted group).

Results in Table 8 show that firms offshoring to China in 2002 but not in 1999 experience the highest differential wage increases. Firms present in China in both 1999 and 2002 also show increase in average domestic wages in this period but less than firms new to sourcing inputs from China. Similarly, the change in employment is stronger for the firms newly offshoring to China. Just as in Table 7, column 4 in Table 8 indicates no differential labor productivity (sales-per-employee) changes between the different types of firms in the 2002-2005 period.

Because China's joining the WTO was anticipated, we may worry that our treatment firms are responding to the shock by changing their technology before 2002 to take better advantage of cheaper Chinese resources. The findings in Table 8 alleviate that worry. Though the accession was anticipated, there was quite a lot of uncertainty in Denmark about the suitability of offshoring to China, apart from the various restrictions that were not to be dismantled till after China joined WTO. Likely, this uncertainty prevented firms from increasing the level of offshoring to China in anticipation of the future changes. Hence, although firms could foresee new offshoring opportunities due to long drawn WTO negotiations, it is unlikely that they could take advantage of it before the liberalizations came into effect. The results in column (6) provides support to this idea; since the change in offshoring was higher for the two types of firms importing from China in 2002,[20] compared to the omitted group, we can conclude that

[19]The control group includes non-offshoring firms, inflating the effect if they do not choose to offshore during the period. On the other hand, some of them could choose to offshore in 2003, 2004 or 2005, which could imply arbitrarily large jumps in import shares (from zero to something) compared to the treatment firms that mostly offshored to somewhere else than China at the beginning of 2002. Thus, presence of non-offshoring firms in the control group could also understate the effect. However, excluding these (few) non-importing manufacturers does not change results much. Thus, for consistency we decide to stick to the same sample as for the other estimations in Table XXXXXXXXXXX.

[20]i.e. firms continuing offshoring from China, and firm new to offshoring from China.

both types of offshoring firms responded to the shocks by increasing the share of imports from China in the 2002-2005 period. The results in this table also indicate that the wage increases we witness in Table 7 are most pronounced for the firms that decide to offshore to China around 2002. This finding coupled with results in descriptive statistics in Table 2 lends support to the idea that China's accession to the WTO and the soon after surge in Chinese exports was more important for the relatively smaller and less productive firms who could not take advantage of Chinese imports prior to 2002 because of restrictive business environment in China; they began offshoring to China once China joined the WTO and also saw a surge in exports soon after.

To ensure that the results observed in Table 7 and Table 8 are indeed driven by the shock and not by differential trend between the more productive treatment firms compared to the less productive control firms, we need to check that the observed change in the outcome variable was greater during the period 2002-2005 than in other periods.

We consider the pre-shock period 1999-2001. We estimate an equation similar to equation 6, taking the difference in the change in the outcome variable of interest over 2002-2005 from 1999-2001 and regressing it on the three types of firm dummies. This essentially leads to a triple-differences strategy which purges any differential trend for the firms. Results in Table 9 indicate that the differential change in average wage is the largest for firms new to offshoring from China in 2002 (d_0_2002). Average wage changed 3.6% more for these firms in the 2002-2005 period than in the 1999-2001 period compared to control firms. Skill ratio changes—though positive—are not significant. Differential change in sales per employee (column 4) between the two periods is not significant either for the new offshoring firms (d_0_2002) compared to the omitted group. To sum up, though we find that events in China caused differential outcomes in 2002-2005 between treatment and control firms over and above their basic underlying trend differences, using crude proxies for skill composition and rent sharing cannot explain what is driving the observed differential wage increase. Since skill includes much more than education and rent sharing might not just mean sharing revenue, we now use information on workers' wage histories in our worker-firm data to construct more rigorous measures of skill composition and rent sharing effects.

5.2. Estimating the Effects from a Worker-Firm Regression. We first estimate a standard AKM-type model (equation 2) with time-varying firm effects. The inclusion of time varying firm effects allows us to address changes in firm wage policies following trade shocks. As time varying returns to individuals we include linear and quadratic terms for experience and

age, and education (high skill: tertiary education; medium skill: vocational education; omitted group: high school or less). Table 10 shows the estimates from our worker-firm regression. As expected, more years of experience are associated with higher wages and there are diminishing returns to experience. Similar results are also true for age. Unsurprisingly, high skilled workers and medium skilled workers earn more than low—or unskilled—workers.

We then estimate the effect of the shock on firm level average wage through the two effects constructed from the worker-firm regression using estimation equations 5 and 6. Table 11 presents results for difference-in-differences estimates for equation 5 over the 2002-2005 period. In this section we now find that average wages (deviated from annual mean) increased 1.2% more for firms offshoring to China in 2002 than control firms and both skill composition and rent sharing are responsible for this increase—both significant at the 10% level. Skill composition increased 0.3% more for firms offshoring to China in 2002 and explains about 25% of the wage increase. Rent sharing increased 0.9% more for firms offshoring to China in 2002 and accounts for as much as 75% of the wage increase.

To ensure that the difference we observe is driven by the shock, we carry out a triple differences estimation similar to Table 9, by regressing the changes in our outcome variables of interest (firm level average wage, skill composition and rent sharing deviated from their respective annual means) between 2002-2005 and 1999-2001 periods, on the different firm dummies. The results for wages corroborate what we found earlier. Table 12 shows significant (at 10%-level) differential wage gains for firms new to offshoring from China (d_0_2002). Now we can say what is driving that wage differential: rent sharing only. Interestingly, for firms offshoring to China in both 1999 and 2002, the differential gain in wages between the two periods is explained more by skill composition effect—rent sharing though positive is insignificant. For firms offshoring to China only before 2002, all the outcome variables have negative sign, though none are significant. The fact that wages increased differentially for the firms offshoring to China in 2002 is in line with the underlying theory. Moreover, we arrive at the apparent puzzle: the mechanisms behind the differential wage increase between the two periods (2002-2005 and 1999-2001) is different for relatively the smaller firms offshoring to China in 2002 but not in 1999 and relatively larger firms offshoring to China in both 2002 and 1999. A glance at our data in Table 2 shows that the firms offshoring to China in 2002 and not in 1999 (d_0_2002) are smaller than firms offshoring to China in both 1999 and 2002 (d_1999_2002). Thus, the former firms are likely to have more homogeneous workers in terms of skill over the years and that could explain

why their differential change in skill composition between the two periods is small. Bigger firms continuing to offshore to China are likely to have more diverse workforce hence their wage increase is accounted for by both mechanisms. Again, comparing results in Table 9 and Table 12 suggest that using measures of skill composition and rent sharing using worker-firm matched data allows us to take into account aspects of average wage determination that is not captured by traditional measures of skill based on education and rent sharing based on revenue sharing.

5.3. Robustness Check. In this section we carry out different robustness tests to strengthen our main results.

As a first check we re-estimate our main equation using alternate firm dummies, to see whether there was any differential wage effect for firms who began offshoring from China between 2003-2005, though their decision to do so was possibly endogenous. The firm types that we consider are d_2002: firms offshoring to China in 2002; d_2003_2005: firms offshoring to China after 2002, i.e. sometime in 2003-2005 period but not doing so in 2002; the omitted group are firms not offshoring to China between 2002-2005 but offshoring to other low-middle income countries and non-offshoring firms. Table 13 provides qualitatively similar results for the firms offshoring to China in 2002 ($d\_2002firms$) as found in Table 11. Both skill composition and rent sharing effects explain the higher change in wages and the latter channel explains more of the increase for these firms. We also see that there are wage gains for firms offshoring to China after 2002 (d_2003_2005 firms), mostly via the skill composition effect, so firms that began offshoring to China later have also gained. Table 14 presents a triple differences estimate by comparing the differential change in the change in our outcome variables of interest over 1999-2001 period and 2002-2005 period. The results indicate that there are differential gains in wages between the two periods for both types of firms, and both channels matter.

We carry out our main estimation using manufacturing firms only. We re-run the main estimations with all firms: manufacturing, services and retail/wholesale firms. The reason is twofold. First, our data reveals that firms switch status over the years; so a manufacturing firm might become a service or retail firm by offshoring its manufacturing operations. These firms would drop from our manufacturing sample and thus might lead to under-estimation of the effects of offshoring on our variables of interest. Second, the impact of the shock was also very pronounced for non-manufacturing firms as discussed in section 4.1. The results, displayed in Table 15, are consistent with our main results presented in Table 10, though coefficient estimates are now larger. We see there was wage gain for firms offshoring to China in 2002, and relatively

more of that increase is explained through rent sharing. Triple differences estimation results in Table 16 again show that most of the differential increase is for the firms importing from China in 2002 but not 1999, but now only skill composition effects significantly explain that increase, and just roughly half of the differential gain. The other half cannot significantly be attributed rent sharing. There is also differential increase in wages observed for the firms importing from China in 2002 and in 1999, and that increase is still explained only through the skill composition effect and completely dominate the total effect on average wages.

What if the effects we see are not from the firms' new activities in China but instead from offshoring to other, similar countries? That is a very relevant concern. We have run our procedures on other similar countries and former Eastern European countries among which many are now part of the EU and not low-income countries anymore. We find no results. Recall that we have a well-sustained argument for an unanticipated shock for Danish firms, particularly for small firms—even though China's accession was anticipated. In fact, running our regressions on a subsample of small firms—10-50 employees—show even stronger average effects. We see no other shocks of arguably same scale. The case of the Czech Republic demonstrates nicely why effects must come from China's accession to the WTO acting as an unanticipated shock: very few of the treatment firms also offshore to the Czech Republic. The reason is that many of the firms are relatively new to offshoring and have few common source countries apart from China (see Table 18).

In 2005, growth in imports from Eastern European countries starts to pick up lowering the ratio of China imports relative to Eastern Europe import to 1.7.[21] To exclude this possible source of gains from offshoring to countries other than China from our results on the treated groups we run the estimations with the shock period defined as 2002 to 2004 instead of 2002 to 2005. Our qualitative results hold and estimates are—perhaps contrary to one's a priori beliefs—generally higher (see Table 19). Combined with the robustness check from other countries just discussed above in this section, we are confident that our results stem from the opening up of China as a sourcing destination and the dominating shock for our treatment groups. We do still refer to the results based on 2002-2005 as our main results because growth in imports from China still dominates any other sourcing destination in 2005 and thus define by when imports from China in an absolute amount truly takes off.

[21] The ratio ranges between 1.7 and 10 during the period 2002 to 2005, cf. Figure XXXX

6. Conclusion

This paper uses rich linked worker-firm data from Denmark to address how offshoring affects firm level average wage. We use China's accession to the WTO in December 2001 and the boom in Chinese exports soon after, as an exogenous shock to the incentive to offshore to China by Danish firms. This shock allows us to identify the causal effect of offshoring on wages.

Unlike other papers in this literature, we consider different possible channels– namely skill composition and rent sharing effects– to explain offshoring induced gains in firm average wages. A skill composition effect increases average wage if firms send low-skilled jobs abroad retaining high skilled workers at home who require higher pay. A rent sharing effect increases average wage if firms share offshoring induced increase in profits with all existing worker. Our findings show that firms sourcing from China in 2002 had higher increase in average wages between 2002 and 2005 compared to the control group.[22] We find that both skill composition and rent sharing effects significantly matter in explaining the wage gain. Moreover, it is important to separate out the effects of the two channels since they have different policy implications. While the presence of the skill composition effects does underline that Danish firms offshore certain jobs, the presence of the rent sharing effect highlights that firms offshoring to China also enjoy increased profitability and share that with employees. The important result to highlight here is that the timing of when a firm is exposed to a shock to the incentive to offshore matters. In our case: Firms present in China before China's accession to the WTO in December 2001 offshored jobs using relatively unskilled labor. Whereas, firms not present in China before the time of accession increased profitability and shared these increases with their employees, thus pointing to increased welfare. These firms however did not offshore relatively more any particular skill type of job. One possible explanation for this could be the size difference of the two types of firms and hence their workforce composition. Smaller manufacturing firms (less than thirty employees) are likely to have more homogeneous workforce and for them the average skill level of the workers might not change much over the years. Bigger firms already offshoring to China are likely to have more diverse workforce and hence for them both composition and rent sharing matter for the wage increase. However, the skill composition effect significantly explains about half that gain while the other half explained by the rent sharing effect is not statistically significant.

Though we carry out estimations at the firm level, we fully utilize the worker-firm match data. Following Frias, Kaplan & Verhoogen (2012) we decompose the effects on average wages

[22] Firms offshoring to low middle income countries but not China and non-offshoring firms.

into estimated effects due to skill composition changes and changes due to rent sharing. We compare these results with results obtained using measures of skill composition and rent sharing available from typical firm level data. We show that using linked worker-firm data allows us added insight behind the wage increase mechanism because, in our case, the two sets of results do not conform; ratio of educated to uneducated workers as a traditional measure for skill composition and sales per employee as a measure of rent sharing cannot explain the average wage increase. Our measure of composition and rent sharing constructed from the worker level wage regression of the AKM type do.

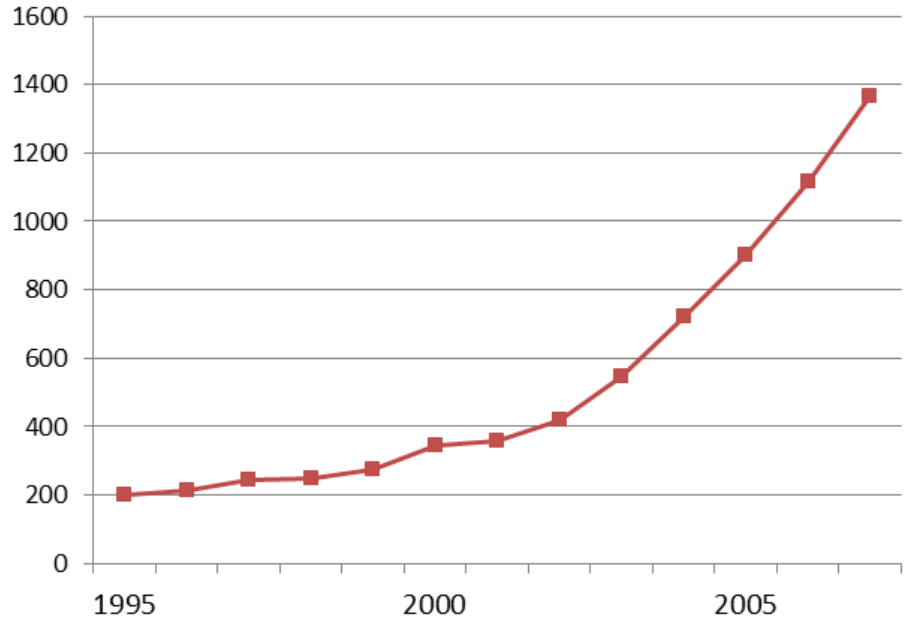
Appendix

Table 1: Comparison of manufacturing firm characteristics between offshoring and non-offshoring firms in 2005

	All firms	**Offshoring firms**	**Non-offshoring firms**	**Regr. Mean difference**
No. of firms	5281	3007	2274	
Means				
Log (employees)	3,41 (1)	3,78 (1,09)	2,93 (0,56)	0.85*** (0,02)
Log (sales)	17,05 (1,36)	17,70 (1,31)	16,19 (0,87)	1.20*** (0,03)
Skill ratio, edu/non-edu	3,65 (3,88)	3,76 (4,15)	3,50 (3,47)	0.26** (0,11)
Log (EBIT per worker)	10,83 (1,1)	11,08 (1,12)	10,51 (0,99)	0.36*** (0,04)
Log (hourly wage)	5,20 (0,19)	5,25 (0,17)	5,14 (0,21)	0.06*** (0,01)

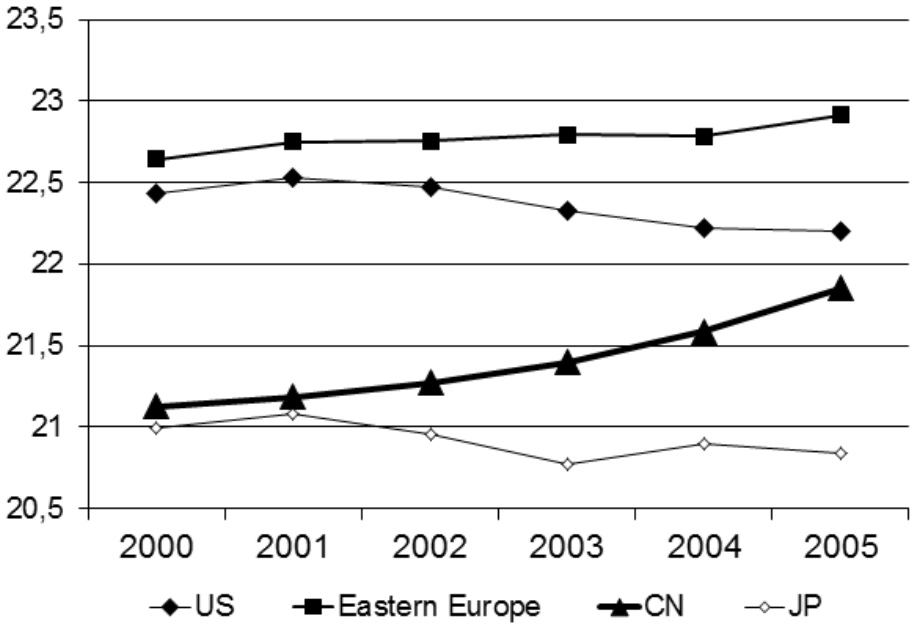
Note: Educated (edu.) means have more than high school education and non-educated (no edu.) refers to less than or equal to twelve years of education. The last column gives difference in the means between offshoring and non-offshoring firms; all regressions include industry fixed effect and employment is included as additional control in all regressions except log(employees).

Figure 1: Chinese Exports in Billions of US Dollars



Source:

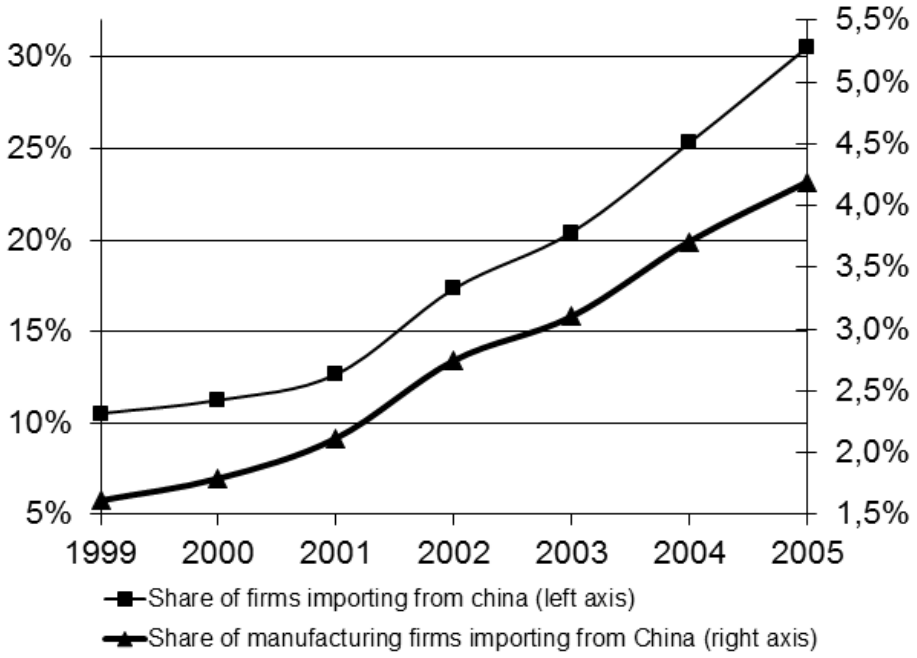
Figure 2: Danish manufacturing imports (in logs) from selected partners and groups of partners



Note: Growth rates of imports from China are between two and ten times the growth rates of imports from Eastern Europe between 2002 and 2005.

Source: External firm level trade statistics, Statistics Denmark, own calculations

Figure 3: Share of Danish Firms Sourcing from China



Source: External firm level trade statistics, Statistics Denmark, own calculations

Note: Values on left hand axis relate to share of all firms importing from China. Values related to share of manufacturing firms importing from China are on the right hand axis.

Table 2: Comparison of firm characteristic by type in 2002

	wage	sales/emp	sales	emp
Existing Offshoring	0.082***	0.621***	2.18***	1.56***
Firms	(0.012)	(0.041)	(0.112)	(0.096)
New Offshoring	0.049***	0.55***	1.88***	1.33***
Firms	(0.016)	(0.054)	(0.128)	(0.116)
Former Offshoring	0.084***	0.682***	2.12***	1.44***
Firms	(0.03)	(0.143)	(0.251)	(0.235)
N	3336	3337	3337	3337

Note: Robust standard error in the parenthesis. All regression includes industry fixed effects. The omitted group is firms not offshoring to China but offshoring to other low-middle income countries and non-offshoring firms in 1999/2002.

Table 3: Import growth contributions

Table3a: Import growth contributions (annualized) in per cent of base total (1999-2001)

	All	**China**	**Low/med income**	**High income**
Consumption	2.1	6.2	3.1	2.0
Intermediate	8.6	18.2	12.7	8.3
Total	10.7	24.4	15.8	10.3

Source: External firm level trade statistics, Statistics Denmark, own calculations
Notes: Classification of consumption goods and intermediate goods follow the BACI classification from CEPII. Low/med income group excludes China.

Table 3b: Import growth contributions (annualized) in per cent of base total (2002-2005)

	All	**China**	**Low/med income**	**High income**
Consumption	0.1	10.5	-1.7	0.1
Intermediate	2.0	17.0	12.1	1.1
Total	2.1	27.5	10.3	1.2

Source: External firm level trade statistics, Statistics Denmark, own calculations
Notes: Classification of consumption goods and intermediate goods follow the BACI classification from CEPII. Low/med income group excludes China.

Table 4: Ranking Imported Consumption Products

Table 4a: HS6 Manufacturing imported consumption goods		**2005**	**2002**	**Rank in 2002**
160540	Crustaceans nes, prepared or preserved	53340799	1311804	52
711719	Imitation jewellery nes of base metal including plate	43417328	9816229	6
940360	Furniture, wooden, nes	38544723	1117227	61
030420	Fish fillets, frozen	33941755	3303811	23
620333	Mens, boys jackets, blazers, synthetic fibre, not kni	33804627	179689	152
620343	Mens, boys trousers shorts, synthetic fibre, not knit	32858528	12386218	4
392690	Plastic articles nes	26146710	17187523	2
940179	Seats with metal frames, nes	24050163	908627	75
950390	Toys nes	23540912	5684666	15
940490	Articles of bedding nes	21799778	8238720	9
630790	Made up articles (textile) nes, textile dress pattern	21016679	8610865	8
490199	Printed reading books, except dictionaries etc	20984376	7848889	10
940140	Seats convertible into beds	20758743	10773086	5
902190	Orthopaedic appliances, nes	18376033	4452192	19
950330	Construction sets and constructional toys, nes	17444588	1008915	67
620332	Mens, boys jackets & blazers, of cotton, not knit	16619985	370365	122
940161	Seats with wooden frames, upholstered nes	16251353	600429	92
620462	Womens, girls trousers & shorts, of cotton, not knit	13046353	853358	77
851629	Electric space heating nes and soil heating apparatus	12438464		
611030	Pullovers, cardigans etc of manmade fibres, knit	10878943	1957272	37

Table 4b: HS6 Manufacturing imported consumption goods		**2001**	**1999**	**Rank in 1999**
850980	Domestic appliances, with electric motor, nes	25840768		
392690	Plastic articles nes	18687247	6150690	12
610711	Mens, boys underpants or briefs, of cotton, knit	16505069	18054200	3
030420	Fish fillets, frozen	14937704	136284	146
620343	Mens, boys trousers shorts, synthetic fibre, not knit	14733910	2602090	23
902190	Orthopaedic appliances, nes	12922589	6737316	9
950330	Construction sets and constructional toys, nes	11641092	3671195	19
040900	Honey, natural	9237678	4331478	18
030619	Crustaceans nes, frozen,	9110324	6118847	13
420231	Articles for pocket or handbag, leather outer surface	8706212	4630337	16
841840	Freezers of the upright type, < 900 litre capacity	8292136	1909480	33
940490	Articles of bedding nes	8131019	11693002	5
420292	Containers nes, outer surface plastic or textile	7603965	921955	51
950390	Toys nes	7148450	2346638	26
821599	Cutlery not in sets, not plated with precious metal	6836842	5752128	14
630790	Made up articles (textile) nes, textile dress pattern	6714122	21671684	2
640291	Boots, soles/uppers rubber or plastic, over ankle, ne	6486472		
611090	Pullovers, cardigans etc of material nes knit	6417276	611280	67
490199	Printed reading books, except dictionaries etc	5820386	6725830	10
660110	Garden and similar umbrellas	5793580	2503043	24

Source: External firm level trade statistics, Statistics Denmark, own calculations

Notes: Amounts are in DKK. . Classification of consumption goods and intermediate goods follow the BACI classification from CEPII. Rank gives the position of the commodity in DKK in the year 2002 and 1999.

Table 5: Ranking Imported Intermediate Products

Table 5a: HS6 Manufacturing imported intermediate goods		**2005**	**2002**	**Rank in 2002**
848180	Taps, cocks, valves and similar appliances, nes	126744085	31182357	9
870839	Brake system parts except linings for motor vehicles	107457536	34315	307
848190	Parts of taps, cocks, valves or similar appliances	99517689	71550756	2
853400	Electronic printed circuits	82899720	39798006	6
732510	Cast articles, of non-malleable cast iron nes	62931197	1049846	103
841391	Parts of pumps for liquids	49542779	44151963	5
730723	Pipe fittings, butt welding of stainless steel	47028226	10519817	23
350790	Enzymes nes, prepared enzymes nes, except rennet	45636175	20757774	15
940390	Furniture parts nes	40444629	5836004	32
852990	Parts for radio/tv transmit/receive equipment, nes	39835005	3784459	50
852190	Video record/reproduction apparatus not magnetic tape	36282907	2326	419
730890	Structures and parts of structures, iron or steel, ne	29505922	5427577	35
851890	Parts of non-recording electronic equipment	27387806	27234039	12
901920	Therapeutic respiration apparatus	27136114	3227836	54
848130	Valves, check	26261257	3844912	48
840999	Parts for diesel and semi-diesel engines	26028088	1760985	76
852090	Audio recording equipment without sound reproduction	25299813	4917146	39
850431	Transformers electric, power capacity < 1 KVA, nes	22112709	29551079	10
850440	Static converters, nes	20603780	54295373	4
853690	Electrical switch, protector, connecter for < 1kV nes	18316477	2005028	72

Table 5b: HS6 Manufacturing imported intermediate goods		**2001**	**1999**	**Rank in 1999**
851822	Multiple loudspeakers, mounted in single enclosure	114262840	32312257	6
760429	Bars, rods and other profiles, aluminium alloyed	67087534		
841391	Parts of pumps for liquids	56487117	29320032	7
853400	Electronic printed circuits	40652653	3689736	33
851890	Parts of non-recording electronic equipment	35982391	6541136	22
848180	Taps, cocks, valves and similar appliances, nes	34947270	150615	136
848190	Parts of taps, cocks, valves or similar appliances	33820169	5482547	23
851829	Loudspeakers, nes	28085847	343302	103
850431	Transformers electric, power capacity < 1 KVA, nes	27948139	586888	91
730729	Pipe fittings of stainless steel except butt welding	26270529	46720486	3
392340	Plastic spools, cops, bobbins and similar supports	26226470	32682536	5
293627	Vitamin C, derivatives, unmixed	23789420	21150890	8
121230	Apricot, peach and plum stones & kernels, human food	17860915	8777163	16
680100	Stone setts, curbstones, flagstones (except slate)	17197610	3743352	32
854441	Electric conductors, nes < 80 volts, with connectors	16348712	888264	74
902140	Hearing aids, except parts and accessories	16298009	33694520	4
871491	Bicycle frames and forks, and parts thereof	14209632	7315550	19
852290	Parts and accessories of recorders except cartridges	13885985		
900190	Prisms, mirrors and optical elements nes, unmounted	11352433	4741506	28
940520	Electric table, desk, bedside and floor lamps	10565394	566506	92

Source: External firm level trade statistics, Statistics Denmark, own calculations

Notes: Amounts are in DKK. . Classification of consumption goods and intermediate goods follow the BACI classification from CEPII. Rank gives the position of the commodity in DKK in the year 2002 and 1999.

Table 6: Decomposing imports

Table 6a: Decomposing imports from China (2002-2005)

	Change	**Margin shares of trade increase**	
	(M DKR)	Extensive	Intensive
Consumption	489	25%	75%
Intermediate	795	37%	63%
Total	1284	32%	68%

Source: External firm level trade statistics, Statistics Denmark, own calculations
Notes: Classification of consumption goods and intermediate goods follow the BACI classification from CEPII. Low/med income group excludes China.

Table 6b: Decomposing imports from China (2002-2005) by firm types

	Firms Offshoring to China in 2002			**Firms offshoring to China in 2003- 2005**		
	Change	**Margin shares of trade increase**		**Change (M**	**Margin shares of trade increase**	
	(M DKR)	**Extensive**	**Intensive**	**DKR)**	**Extensive**	**Intensive**
Consumption	350	30%	70%	139	100%	0
Intermediate	426	39%	61%	369	100%	0
Total	776	35%	65%	508	100%	0

Source: External firm level trade statistics, Statistics Denmark, own calculations
Notes: Classification of consumption goods and intermediate goods follow the BACI classification from CEPII. Last column contains firms offshoring to China in 2003-2005 period but not 2002.

Table 7: Difference-in-difference Estimate (2002-2005)

	1	2	3	4	5	6
	Δl(avgwage)	Δemp	Δsk_ratio	Δ(sales/emp)	Δsales	Δoffshore
Offshoring in 2002	0.015***	-0.062***	0.036***	0.011	-0.051**	0.010***
	(0.005)	(0.018)	(0.011)	(0.020)	(0.023)	(0.002)
N	2119	2119	2119	2119	2119	2119

Note: Robust standard error in the parenthesis. All regression includes industry fixed effects. ***,**,* indicate significance at 1,5,10 percent levels respectively. Dependent variable is differenced over 2002-2005 period.

Table 8: Difference-in-difference estimate by firm types (2002-2005)

	1	2	3	4	5	6
	Δ l(avgwage)	Δ emp	Δ sk_ratio	Δ sales/emp	Δ sales	Δoffshore
Existing Offshoring Firms	0.015**	-0.087***	0.048**	0.003	-0.084**	0.02***
	(0.006)	(0.027)	(0.020)	(0.028)	(0.036)	(0.005)
New Offshoring Firms	0.027***	-0.154***	0.041*	0.005	-0.148***	0.013***
	(0.009)	(0.038)	(0.022)	(0.040)	(0.050)	(0.004)
Former Offshoring Firms	0.003	-0.133	0.006	-0.061	-0.195***	0.004
	(0.016)	(0.092)	(0.033)	(0.106)	(0.067)	(0.002)
N	1915	1915	1761	1915	1915	1915

Note: Robust standard error in the parenthesis. All regressions include industry fixed effects. ***,**,* indicate significance at 1,5,10 percent levels respectively.

Table 9: Triple Difference Estimate by Firm Types

	1	2	3	4	5	6
	Δ l(avgwage)	Δ emp	Δ sk_ratio	Δ sales/emp	Δ sales	Δoffshore
Existing	0.007	-0.035	0.019	0.000	-0.035	0.018***
Offshoring Firms	(0.009)	(0.036)	(0.017)	(0.038)	(0.046)	(0.006)
New Offshoring	0.036***	-0.134***	0.013	0.019	-0.116*	0.014***
Firms	(0.012)	(0.045)	(0.021)	(0.059)	(0.068)	(0.005)
Former Offshoring	0.002	-0.084	-0.008	-0.172	-0.255***	0.022**
Firms	(0.022)	(0.106)	(0.040)	(0.133)	(0.096)	(0.01)
N	1293	1293	1293	1293	1293	1293

Note: Robust standard error in the parenthesis. ***,**,* indicate significance at 1,5,10 percent levels respectively.

Table 10: Worker Level Wage Regression

	age	age^2	experience	$experience^2$	high_sk	med_sk
log wage	0.041***	-.0003***	0.010***	-0.0003***	0.460***	0.395***
	(0.0004)	(0.000)	(.0003)	(0.000)	(.0106)	(.007)

Note: Standard errors in parenthesis estimated with 50 bootstrap replications, clustering at level of individuals. The regression includes time fixed effects. ***,**,* indicate significance at 1,5,10 percent levels respectively. Number of observations 1106744.

Table 11: Difference-in-difference Estimate Using Measures Constructed from Worker Level Wage Regression (2002-2005)

	1	2	3
	Δ avg(lwage)	Δ sk_comp	Δ rent_sh
Offshoring in 2002	0.012**	0.003*	0.009**
	(0.005)	(0.002)	(0.004)
N	1742	1742	1742

Note: Robust standard errors in the parenthesis. All regression includes industry fixed effects. **,**,* indicate significance at 1,5,10 percent levels respectively.

Table 12: Triple Difference Estimate Using Measures Constructed from Worker Level Wage Regression by Firm Types

	1	2	3
	Δ avg(lwage)	Δ sk_comp	Δ rent_sh
Existing Offshoring	0.012*	0.008*	0.005
Firms	(0.007)	(0.004)	(0.008)
New Offshoring	0.018*	0.001	0.017*
Firms	(0.01)	(0.005)	(0.01)
Former Offshoring	-0.027	-0.019	-0.008
Firms	(0.024)	(0.02)	(0.015)
N	1272	1272	1272

Note: Robust standard error in the parenthesis. ***,**,* indicate significance at 1,5,10 percent levels respectively.

Table 13: Difference-in-Difference Estimate Using Alternate Firm Types (2002-2005)

	1	2	3
	Δ avg(lwage)	Δ sk_comp	Δ rent_sh
Offshoring in 2002	0.013**	0.005*	0.008*
	(0.005)	(0.003)	(0.004)
Offshoring after 2002	0.011*	0.002	0.009*
	(0.007)	(0.004)	(0.006)
N	1742	1742	1742

Note: Robust standard error in the parenthesis. All regression includes industry fixed effects. ***,**,* indicate significance at 1,5,10 percent levels respectively.

Table 14: Triple Difference Estimate Using Alternate Firm Types

	1	2	3
	Δ avg(lwage)	Δ sk_comp	Δ rent_sh
Offshoring in 2002	0.016**	0.007**	0.009*
	(0.007)	(0.004)	(0.006)
Offshoring after 2002	0.017*	0.009*	0.008
	(0.010)	(0.005)	(0.009)
N	1483	1483	1483

Note: Robust standard error in the parenthesis. ***,**,* indicate significance at 1,5,10 percent levels respectively.

Table 15: Difference-in-Difference Estimate Using Manufacturing and Non-Manufacturing Firms (2002-2005)

	1	2	3
	Δ avg(lwage)	Δ sk_comp	Δ rent_sh
Offshoring in 2002	0.018***	0.005*	0.013***
	(0.004)	(0.003)	(0.004)
N	6253	6253	6253

Note: Robust standard error in the parenthesis. All regression includes industry fixed effects. ***,**,* indicate significance at 1,5,10 percent levels respectively.

Table 16: Triple Difference Estimate Using Manufacturing and Non-Manufacturing Firm

	1	2	3
	Δ avg(lwage)	Δ sk_comp	Δ rent_sh
Existing Offshoring	0.01*	0.012**	-0.002
Firms	(0.006)	(0.004)	(0.005)
New Offshoring	0.02**	0.012*	0.009
Firms	(0.01)	(0.007)	(0.08)
Former Offshoring	-0.026*	-0.013	-0.013
Firms	(0.013)	(0.012)	(0.013)
N	6808	6808	6808

Note: Robust standard error in the parenthesis. ***,**,* indicate significance at 1,5,10 percent levels respectively

Table 17: Firm share of imports coming from China (CN) between 1999 and 2005

	No. of firms*	**1999**	**2001**	**2002**	**2005**
Firms not present in CN in 2002	402	16%	10%		15%
Firms not present in CN in 2002 but not in 1999	294		5%	6%	13%
Firms present in CN in 2002	1803	16%	17%	15%	22%
Firms present in CN before, in, and after 2002	805	16%	20%	20%	26%
Firms present before 2002 and again in 2005	45	11%	4%		8%

* Based on 2002

Source: Statistic Denmark's firm level external trade statistics, own calculations

Table 18: Danish firms importing from China (CN) and the Czech Republic (CZ)

Number of manufacturing firms	**Imports from China..**		**Imports from CZ..**	
	..in total	**..and not CZ**	**..in total**	**..and not CN**
Importers in 2002	3995	3391	1637	287
Importers in 2005	7033	6539	872	98
Not importing from either two in 2002	3015		3015	
New to import from source	3038	580	-765	14

Source: Statistic Denmark's firm level external trade statistics, own calculations

Table 19: Using 2002-2004 as the shock period (triple difference estimates comparable with the main results of Table 12)

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