Education and labor market policies in an offshoring global economy

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Summary

With rising unemployment and increasing income inequality, the labor market consequences of globalization and offshoring are back in the headlines. This paper summarizes recent research using Danish matched worker-firm data to examine how offshoring affects labor market outcomes. First, a rise in offshoring leads to a shift in the composition of labor demand toward particular occupation types within skill groups. Second, workers displaced from offshoring firms suffer more significant income losses than workers displaced for other reasons. Finally, training programs are used more intensively by workers initially employed by offshoring firms and these workers become reemployed with manufacturing firms at a faster pace than other workers. These findings are used to draw some education and labor market policy implications.

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A key feature of global trade in the new century is the rapid growth of offshoring and trade in intermediate goods. A prominent example is the production of passenger vehicles. For a typical “American” car, 30 percent of its value goes to Korea for assembly, 17.5 percent to Japan for components and advanced technology, 7.5 percent to Germany for design, 2.5 percent to the UK for advertising and marketing services, with the remaining 37 percent generated in the US (Grossman and Rossi-Hansberg, 2007). Production is spread globally even for goods as simple as a plastic Barbie doll, which has value added from Taiwan, Japan, the Philippines, Indonesia, Malaysia, China and the US (Feenstra, 1998). These anecdotal cases reflect broader trends at work throughout the global economy. Hummels et al. (2001) estimate that vertical specialization (foreign value-added embodied in domestic production) accounts for over 30 percent of worldwide trade growth between 1970-1990. Feenstra and Hanson (2003) show that processing exports rose from one-third of China’s exports to over one-half between 1988 and 1998.

How does the rise of global offshoring affect the labor market? One simple tradeoff involves labor substitution versus productivity effects within firms. The decision to offshore production means that at least some work previously done within the firm will be done abroad, that is, foreign labor substituted for labor within the firm. But this reduction in labor demand could be offset by a productivity effect. If offshoring raises productivity or lowers input costs, firms will expand their production. If the effect is strong enough, labor demand for tasks that remain onshore could rise enough to offset substitution. This raises a fundamental and previously unanswered question: Does a rise in offshoring correspond to a rise or a fall in labor demand within the firm, and how does this affect the wages earned by these workers?

Offshoring may also change the composition of labor demand. In the preceding example, some tasks are offshored while some remain onshore, and there may be a systematic pattern to the types of tasks in each category. For example, it may be that tasks performed by unskilled labor are more likely to be offshored, while tasks performed by more highly educated workers remain onshore and indeed expand due to productivity effects. The offshored/onshore distinction may also go deeper than education levels. Particular occupational characteristics, such as the routineness of a task, may lend themselves especially well to offshoring, while other
occupational characteristics, such as knowledge of the local language, may be prohibitively difficult to offshore. Similarly, it may be that productivity effects of offshoring benefit certain categories of skilled workers more than others. This raises a second question: Do firms that offshore shift the composition of labor demand toward particular worker or occupation types, with discernible effects on the wages earned by those workers?

If offshoring leads to a net reduction of labor employed within the firm, or a change in the composition of the workforce, some workers will be displaced by the firm. Involuntary displacement is never a happy occurrence for workers. A large literature in labor economics pioneered by Jacobson et al. (1993) documents that the earnings losses from displacement are substantial. Displaced workers experience extended spells of unemployment and get lower wages when reemployed. But there is reason to think that displacement due to offshoring might be different, and worse, than displacement for other reasons. If a firm fails and lays off workers due to local competition, displaced workers may find employment with the local competitor. However, if certain tasks are systematically being offshored by many firms, displaced workers may find reduced demand for their skill set throughout the economy and suffer more significant losses upon displacement. A third question is then: Do workers displaced from offshoring firms suffer more significant wage or income losses than workers displaced for other reasons?

This brings us to policy. Rising income inequality is a major concern for policy makers in many countries. For those interested in slowing or reversing rising inequality, a first step is to diagnose its causes. Skill-biased technological change and import competition are candidates, but offshoring is a potentially important cause, especially if it raises demand for highly educated workers while lowering demand for the less educated, or if it leads to large displacement-related losses for already-low income workers.

More importantly, a better understanding of how labor markets are reshaped by offshoring can be critical to understanding possible cures. For example, many suggest that inequality can be reduced by increasing educational attainment. This seems perfectly sensible. If inequality results from a rising college wage premium, then boosting educational attainment should increase the number of households benefiting from that pre-
mium while also allowing supply to catch up with rising demand in order to slow growth in the premium itself.

However, there is a growing concern that college is not enough. Since 2000, inflation-adjusted earnings in the US have fallen for every educational group except for doctors, lawyers, MBAs and PhDs (Wessel, 2011). This has contributed to the perception that today’s college degrees may simply lead to jobs “that don’t exist or don’t pay middle-class wages” (Krugman, 2011). Offshoring may be a culprit. Firms in India and China have moved up the value chain from textiles and apparel into sectors that intensively use college-educated workers such as advanced electronics, alternative energy, and computer software. The question is then: What types of education are most valuable? Is it enough to simply send more kids to college, or should particularly valuable degree programs be emphasized as a solution to income inequality in the offshoring global economy?

Finally, if displacement due to offshoring is especially painful, is there anything that can be done to ameliorate the pain? The classical policy for reducing costs of adjustment is training. Most OECD countries subsidize worker training programs directly or indirectly. Denmark stands out as one of the countries investing most in such programs (see OECD, 1999 and Simonsen and Skipper, 2008). The training programs typically take place during working hours, and the firms receive generous wage subsidies. To what extent are these programs successful in maintaining and enhancing the skills of the working population, and/or in easing the transition between jobs?

For the rest of the paper we draw on Hummels, Jørgensen, Munch and Xiang (2011), and Hummels, Munch, Skipper and Xiang (2012) (henceforth HJMX 2011 and HMSX 2012, respectively), which address the questions posed above. We briefly explain our data, methodology, and identification strategy. A common theme in these papers is the use of matched worker-firm-trade data. That is, we observe the offshoring decisions of firms, and can track labor market outcomes for workers employed by these firms before and after changes in offshoring status. This allows us to measure the effects of offshoring on labor demand and wages, including compositional effects that are specific to education and occupational types. We can examine workers displaced after offshoring shocks, and see transitions back to the work force. We can also see how
these workers make use of job retraining programs and whether these programs lead to a more rapid return to the workforce.

A key issue throughout both papers is the need to separate two kinds of firms. The first kind of firm enjoys an increase in productivity and responds to it by increasing many kinds of activities. Firms with rising productivity grow, use more capital, engage in more R&D, and are more likely to import and export, and pay higher wages. Simply correlating rising levels of offshoring and wages within such a firm provides no useful information. The second kind of firm experiences an exogenous shock to its decision to offshore production caused by changes in the price or quality of foreign goods. By looking at changes in offshoring in this kind of firm, we are able to properly identify the effect of offshoring on worker outcomes.

This paper proceeds as follows. Section 2 describes Danish labor market policies. Section 3 describes Danish data on workers, firms, training, and trade. Section 4 summarizes results from HJMX 2011 that show how offshoring affects the composition of labor demand and wages within job-spells. Section 5 extends this work, focused on a sub-sample of displaced workers. Section 6 summarizes results from HMSX 2012 that show how training programs affect transitions from displacement. Section 7 provides a summary and policy conclusions.

1. Danish labor market policies

Denmark is a useful country for analyzing the impact of globalization on labor market outcomes and evaluating education and labor market policies. According to Botero et al. (2004) Denmark has one of the most flexible labor markets in the world. Unlike other continental European labor markets employment protection is relatively weak, and Danish firms may adjust employment with relative ease. As compensation for the high job turnover, workers receive relatively generous UI benefits when unemployed, but the incentives to search for jobs during unemployment are reinforced by active labor market programs, 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.
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 decentralization process. 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 the marginal productivity of the individual workers. Dahl et al. (2013) show that decentralization has increased the wage dispersion in the Danish labor market such that wages better reflect worker and firm characteristics.

Another distinguishing feature of the Danish labor market is that heavily subsidized training programs are available on a large scale. Unique among OECD countries, the Danish government provides and finances worker training at off-the-job training sites, and offers generous wage subsidies for firms offering training during working hours. This results in an unusually high incidence of training participation among employed workers. The government training expenses totaled around 0.5 percent of GDP in most years of our sample window. For more institutional details see Simonsen and Skipper (2008).
2. Data description

This section offers a brief description of our data. We explain our data sources, define our measure of offshoring and provide basic descriptive statistics. Additional details may be found in HJMX 2011.

2.1 Data sources

Our data on firms, workers, trade and training participation is drawn from several administrative registers in Statistics Denmark. We have access to a matched worker-firm dataset covering the total Danish population of workers and firms for the years 1995-2006. For the firms, we have information about total sales, the number of full-time employees, capital stock and a six-digit NACE industry code.

The worker data 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 four-digit ISCO occupation. We will distinguish between high-skilled and low-skilled workers where high-skilled workers are those with a college degree.

From the Trainee Register, we know the history of training including type of training, timing and duration. The training courses can be grouped into basic, vocational, and post-secondary training. Basic courses focus on literacy and basic skills (at the third to tenth grade level) and target adults with only little or obsolete education. Vocational courses represent most of the training activities in Denmark and account for about 77 percent of the government training expenditures. They last 2-3 weeks and cover firm-specific, industry- or occupation-specific materials. Vocational training typically requires employer sponsorship and takes place during working hours. The government covers most of the expenses and provides firms with subsidies of 60-80 percent of the wages during training, while the workers themselves pay only token tuition (EUR 25 per course per week). Post-secondary training typically takes place during off-work
hours and consists of polytechnical, college or MBA type of courses. They do not require employer sponsorship and have very low tuition fees.

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.

After merging data on firms, workers, training participation and trade flows, and imposing the sample selection criteria used in HJMX 2011, we have a combined dataset with approximately 1.95 million worker-firm-years and 9,800 firm-years. Our sample represents about 20 percent of the manufacturing firms, but between 50 percent and 70 percent of employment in manufacturing depending on the year.

2.2 Offshoring

A major advantage of the data is that we can construct a firm-specific measure of offshoring based on imported products that are used as inputs in the firm’s production process. We follow Feenstra and Hanson (1999) and define “narrow offshoring” as purchases of inputs in the same HS4 category as goods sold by the firm. The idea is that the closer the inputs are to the final outputs, the more likely it is that labor within the firm could have produced those inputs. In HJMX 2011, we present evidence that imports, measured as narrow offshoring, are likely to substitute for firms’ own labor. Of note, this measure captures a large fraction of the purchases by the firms but it excludes raw materials as well as machinery which could affect labor demand and wages through other channels.\(^1\)

\(^1\) We select all 20-60 year old full time manufacturing workers and drop all worker-firm-year observations where the employment relationship lasts a single year. We also drop firms with fewer than 50 employees and less than 0.6 million DKK in imports, which corresponds to the average annual wages for two manufacturing workers.

\(^2\) One concern is that the firm-level imports we observe may be final goods that the firm purchases for sale within Denmark rather than inputs into production. We capture this by measuring the value of inputs that are purchased and then sold by the firm with no value added. This
We now briefly summarize some descriptive statistics for the trading activities of manufacturing firms from HJMX 2011. The firms in our sample purchase 21 percent of total Danish imports and supply 50 percent of Danish exports. The regional source of imports is largely unchanging over the 12 years of our sample, with 85 percent of the imports coming from European sources, 6 percent from North America, 6 percent from Asia, and 3 percent from other sources. Asia as a source of imports has grown in significance (its share going from 5 percent to 8.5 percent) but remains a small portion of the total. Roughly 71 percent of the imports are within the same HS4 category as that firm’s outputs and will be counted as narrow offshoring. Narrow offshoring represents 12 percent of gross output and 27 percent of total (imported plus domestic) material purchases for the average firm. In addition, the offshoring variable exhibits substantial variation across firms and within firms over time, which will be useful in identifying its effect on worker outcomes.

Offshoring firms are different from non-offshorers. In HJMX 2011, we show that offshorers have higher sales, more employment, more skilled employment, a larger capital/worker ratio, and pay higher wages. These differences, consistent with findings in the literature from other countries, suggest an important identification problem. It may be that growth in offshoring causes these firms to be better: larger, more skilled and pay higher wages. Or it may be that all these outcomes are jointly determined as a result of time-varying shocks to the firm’s productivity or demand for their products. If so, correlations between offshoring and wages do not indicate a causal effect, so we need to identify exogenous variation in offshoring.

3. The effects of offshoring on wages within job spells

In this section, we draw on HJMX 2011 and briefly summarize the results from estimating the impact of offshoring on wages within job spells. As explained above, it is important to identify exogenous shocks to the firms’ offshoring activities. The key element in our approach is the ability to see firms changing their trading behavior due to external shocks, that

“retail share” represents only 2.9 percent of the imports for manufacturing firms in contrast to 35.5 percent for service firms.
is, changes in the foreign supply of inputs, or changes in the foreign demand for their output.

To be more specific, we construct three instruments for the offshoring variable that are correlated with the decision to offshore but uncorrelated with changes in the firm’s ability and wage structure. The instruments are exchange rates, transport costs, and world export supply. The first two 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. Additional details on the construction of these variables are found in HJMX 2011.

With the instruments for offshoring in hand, the next step is to relate changes in individual workers’ wages to exogenous changes in offshoring for the firms that employ them. We use a standard Mincer human capital wage equation approach where the worker-level (log) wage is regressed on instrumented offshoring controlling for worker-firm “job-spell” fixed effects (see e.g. Abowd et al., 1999), and time varying characteristics of the firm and worker.³

When running this regression on the sample of workers described in Section 3.1 HJMX 2011 find that offshoring raises the skilled wage premium, both by increasing wages (elasticity +3.6 percent) for high-skilled workers and lowering wages (elasticity -1.6 percent) for low-skilled workers. Over the 12 years of the sample, a firm that increases offshoring at the same annual rate (5.5 percent) as Denmark as a whole would raise the wages for high-skilled workers by 2.8 percent and lower the wages for other workers by 1.3 percent. These findings appear consistent with the older literature, that trade raises the skill wage premium and with it, inequality. But HJMX 2011 go further to understand other mechanisms at work.

The Danish data also contains information on the occupations of each worker, which we can use to separately identify the impact of offshoring by occupational category and associated characteristics. HJMX 2011 measure the on-the-job requirements for four categories of knowledge and skills that are closely related to college degrees and thereby to assess

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³ The control variables include experience, job tenure, and education for the workers and gross output, capital per worker, the share of high-skilled workers in employment and (instrumented) exporting for the firms.
which college degrees are valuable in a global economy. They find that offshoring has the largest positive effect on occupations that require communication and language (premium of +4.4 percent) followed by social sciences (+3.7 percent) and math (+2.7 percent). By contrast, the premium for natural sciences is close to 0. This may seem puzzling given the policy emphasis on STEM (Science, Technology, Engineering and Math) in many advanced countries, but if these knowledge groups are universal languages, jobs requiring them can be done anywhere with an educated workforce. On the other hand, these findings in HJMX 2011 suggest that workers doing communication intensive tasks become more valuable when offshoring rises. One reason may be that offshoring increases the interactions between domestic workers and foreign workers from different cultural backgrounds, which raises the communicating costs within the firm (Lazear, 1999). Domestic workers with strong communication and language skills and social scientists with knowledge of other cultures and societies may be useful in overcoming offshoring-induced costs of cross-cultural dealing.

4. Earnings losses after layoffs

HJMX 2011 study the wage effects of offshoring and exports for those workers who remain employed. We now examine how trade affects the earnings of displaced workers, drawing on the framework of Jacobson et al. (1993). The specifics of the estimation strategy and sample selection are described in the Appendix. Briefly, we follow a sample of workers who are in the data continuously from 1995-2006. We control for observable characteristics of workers (including worker-fixed effects) and compare the earnings-profile of non-displaced workers to workers who separate from the firm as part of a mass layoff event. We further distinguish between workers who were displaced immediately after their former employers substantially increased offshoring (labeled: offshorers) and all other displaced workers (labeled: non-offshorers). We also examine whether this comparison depends on worker skill levels.
Table 1. Displaced workers and changes in offshoring

<table>
<thead>
<tr>
<th>Change in offshoring</th>
<th>All workers</th>
<th>High skilled</th>
<th>Low skilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than -10%</td>
<td>0.60</td>
<td>0.65</td>
<td>0.59</td>
</tr>
<tr>
<td>Between -10% and 10%</td>
<td>0.22</td>
<td>0.18</td>
<td>0.22</td>
</tr>
<tr>
<td>More than 10%</td>
<td>0.18</td>
<td>0.18</td>
<td>0.18</td>
</tr>
<tr>
<td>Number of workers</td>
<td>3 301</td>
<td>359</td>
<td>2 942</td>
</tr>
</tbody>
</table>

Source: Own calculations based on data from Statistics Denmark.

Note: The change in predicted offshoring is measured between the predisplacement year and the displacement year.

We start with a data sample of all Danish manufacturing workers, and then cut down this sample to match the requirements imposed in Section 2.1. Further, following Jacobson et al. (1993), we focus on high-tenure workers because they are those most likely to have accumulated firm-specific human capital in the pre-displacement firm (see the Data Appendix for more details of the sample construction). We define displaced workers as those separating from firms where at least 30 percent of the particular workers in the initial year are no longer employed by the firm in the following year.\(^4\) We classify worker \(i\) as an offshorer if he/she is displaced in a mass layoff event from firms that were increasing their predicted offshoring by at least 10 percent between the pre-displacement year and the displacement year.\(^5\)\(^,\)\(^6\) Approximately 9 percent of the resulting sample (6 208 workers in total) are displaced at least once over the years 1998-2006. The low proportion of displaced workers is typical for the displacement literature, because mass-layoff events are uncommon.

\(^4\) Our definition uses gross flows, since our data has the full population of workers and firms. The literature (e.g. Jacobson et al., 1993) typically defines mass-layoff events using net flows. Net flows could miss displacement events if a firm substantially changes the composition of its employment, e.g. laying off unskilled workers while hiring more skilled workers. We also experimented with using net flows and obtained similar results.

\(^5\) Predicted offshoring is measured at the worker level, but predicted offshoring is only observed for displaced workers in the pre-displacement year. Therefore, we measure predicted offshoring in the displacement year for the pre-displacement firm as an average over all remaining workers in the firm. The change in predicted offshoring measured this way is valid, if the within-firm dispersion across workers in predicted offshoring is low. This is indeed the case – the median firm-level coefficient of variation of predicted offshoring is 0.004 with a maximum of 0.056.

\(^6\) We use the 10 percent cutoff because we want to focus on displaced workers that have been hit by a pronounced offshoring shock. Larger cutoffs become problematic because they cut down on the number of displaced workers from which to estimate the wage profile.
Almost half of the displaced workers do not have an observed change in predicted offshoring in the pre-displacement firm, due to missing instruments for some firms and to the fact that some of the pre-displacement firms closed down. 18 percent of the remaining 3,301 displaced workers are classified as offshorers, see Table 1.

Figure 1. Wages and earnings for displaced workers

Source: Own calculations based on data from Statistics Denmark.

We summarize our results in Figure 1. The three left panels show the profile of log hourly wage rate, annual labor earnings and annual gross earnings for high-skill workers. The panels in the right side show the same profiles for low-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 dis-
plays results for offshorers (light grey) and non-offshorers (black) separately. The comparison group in each case is non-displaced workers.

The top left panel shows that high-skill non-offshorers do not experience a reduction in the hourly wage rate (relative to non-displaced workers), while high-skill offshorers suffer small but persistent wage losses of 4 percent. The top middle panel shows that for high-skilled non-offshorers there are pronounced drops in annual labor earnings, peaking in the year after displacement at DKK 30 000. For high-skilled offshorers the drop in earnings is even steeper, peaking at DKK 64 000.

To put the numbers in perspective, the average high-skill wage in the sample is DKK 419 000 so the peak loss of DKK 30 000 for non-offshorers represents 7 percent of pre-displacement earnings and the peak loss of DKK 64 000 for offshorers represents 15 percent of the pre-displacement earnings. Combined with the small changes in hourly wages after displacement, we can conclude that losses in annual labor earnings are primarily driven by reductions in hours worked. Finally, the top right panel shows that even after accounting for income transfers during unemployment, the earnings losses from displacement are still substantial. Offshorers in particular lose DKK 52 000 the year after displacement, or 12 percent of predisplacement earnings.

Looking at the bottom left panel, we see that for low-skilled workers, offshorers suffer a larger wage loss (8 percent) than non-offshorers (5 percent), and a larger loss in labor earnings (DKK 60 000) than non-offshorers (DKK 44 000). The gap between these groups persists five years after displacement.

These losses in earnings are similar to those of displaced high-skill workers in absolute terms, but since displaced low-skilled workers have lower earnings (DKK 285 000 on average), their losses are higher in percentage terms. Non-offshorers lose 15 percent of their pre-displacement earnings and offshorers lose 21 percent. Finally, income transfers are not close to fully compensating for earnings losses. The bottom right panel shows that one year after displacement, annual gross earnings drop by DKK 30 000 (or 12 percent) for non-offshorers and DKK 50 000 (or 17 percent) for offshorers.

To summarize, Figure 1 shows that all displaced workers suffer substantial earnings losses. Offshorers, in particular, suffer greater earnings losses than non-offshorers of the same skill type. One explanation for this
finding is that offshorers have obsolete skills or have specialized in doing tasks that are now imported from abroad, so they tend to have worse reemployment opportunities in the Danish labor market. To explore this further, we track the labor market status in the year after displacement for offshorers and non-offshorers. We find that a higher proportion of offshorers remain unemployed (19 percent) or out of the labor force (10 percent) than non-offshorers (11 percent and 5 percent, respectively). Among the workers who are reemployed, a higher proportion of offshorers switch four-digit industries (92 percent) than non-offshorers (56 percent), although the proportion of reemployed workers who switch four-digit occupations is similar for offshorers (44 percent) and non-offshorers (43 percent). These numbers suggest that offshoring shocks entail a shared sectoral component and worsened market options for the displaced workers.

Using the results from Section 3, we compare the wage and earnings loss for workers who are displaced from offshoring firms with those for their colleagues who remain employed. For low-skilled workers, the displaced suffer a wage loss of 8 percent and an earnings loss of 21 percent, while the non-displaced have a wage loss of 1.6 percent (inclusive of the productivity effect) if their employers double offshoring within a year and do not enjoy an increase in exports. The comparison is starker for high-skilled workers. The displaced suffer a wage loss of 4 percent and an earnings loss of 15 percent, while the non-displaced enjoy a wage gain of 3.6 percent (inclusive of the productivity effect) if their employer doubles offshoring in a single year.

The magnitude of these losses, and the differences across displacement types, provide a useful comparison with existing studies. Jacobson et al. (1993) used data on mass layoffs for workers in the US, and found losses of around 25 percent of pre-displacement earnings. Studies based on European data have also found long-term negative effects of displacement but most studies find more modest effects. For example, Albæk et al. (2002) find that Danish workers earn around 6 percent less than nondisplaced workers three years after displacement. We find similarly modest displacement numbers in the non-offshorer group, and effects comparable to Jacobson et al. (1993) for the offshorer group.
5. Offshoring, transition and training

The profound earnings losses found for workers displaced due to offshoring documented in the previous section suggest that offshoring shocks may lead to economy-wide reductions in the demand for specific tasks. Re-attaching to the workforce may then require a more fundamental re-training of these workers. In HMSX 2012, we combine the matched worker-firm data with the training data described in Section 2 to investigate the relationship between offshoring, labor market transitions and training. This section summarizes those findings.

HMSX 2012 first examine whether workers in offshoring firms are more likely to enroll in training. As in the previous section, we focus on workers employed in firms that had mass-layoff events, but in addition to the displaced offshorers and non-offshorers, we now also consider the outcomes for workers staying in these firms.

HMSX 2012 use a Jacobson et al. (1993) estimating framework similar to the previous section, except that the dependent variable is participation in training programs. The sample of manufacturing workers matches the data requirements imposed in Section 2.1, but unlike in the previous section, short-tenured workers are included in the sample.

Recall from Section 2.1 that vocational training accounts for the major part of government training expenditures. Figure 2, taken from HMSX 2011, shows the vocational training take-up rate around the mass layoff event year $t$ (“x” indicates that the coefficients are significant at the five-percent level). The top graph shows staying workers in the mass-lay-off firms, and the bottom graph shows displaced workers. The comparison group in each case is workers unaffected by mass layoff events.

The first main finding to emerge from Figure 2 is that displaced workers substantially increase their training take-up rate in the displacement year.\(^7\) Training also spikes for workers displaced from non-offshoring firms, but the effect is almost three times larger for workers displaced from offshoring firms. Displaced workers from offshoring firms increase their training by 7 percent, which represents a training rate that is 36 per-

\(^7\) Workers displaced from offshoring firms also have a pronounced increase in training take-up in year $t - 2$. This pre-shock spike does not occur for other displaced workers or for workers staying with their firms. In HMSX 2012, we argue that a likely explanation is that there is some relationship between the worker, the need for training, and the offshorability of the task in question.
cent higher than for workers unaffected by mass layoff events. It is a novel finding that workers displaced from offshoring firms require retraining at substantially higher rates than other displaced workers. This is consistent with the finding from the previous section that workers displaced from offshoring firms suffer greater and more persistent earnings losses than other displaced workers. It suggests that offshoring is transforming job availability not only within the firm but throughout the labor market, making it more difficult for the workers to find employment with their existing skill set.

Figure. 2 Vocational training take-up rates

Source: Own calculations based on data from Statistics Denmark.

Another finding is that stayers in offshoring firms also increase their training rates sharply, an increase of over six percent in years t and t+1. In
contrast, the training take-up rate for stayers in non-offshoring firms is roughly constant. A likely reason is that offshoring involves reorganization of production within the firm such that the set of performed tasks changes. As a consequence, the firm may adjust its workforce both through lay-offs and by reshuffling the task assignments of staying workers. This reshuffling shows up as higher take-up rates in vocational training if such training helps workers learn their new tasks.

Post-secondary training may seem an especially attractive option for displaced workers since they face low tuition, do not require employer sponsorship and such training may open the door to employment in non-tradable service industries or the public sector, where the offshoring risk is lower. In addition, Section 3 showed that offshoring shocks raise the returns to post-secondary education within manufacturing both absolutely and relative to secondary education. Despite this, displaced workers, both offshorers and non-offshorers, are no more likely to take up post-secondary training than the general population.

We next examine the labor market transitions of displaced workers in the short and medium run. This allows us to assess whether there are differences in the types of employment that workers transition into depending on displacement type (offshorer, non-offshorer) and their history of training prior to displacement.

In Table 2, also taken from HMSX 2012, we track workers over time and examine their labor market status after displacement. We distinguish between four groups of workers, workers from offshoring and non-offshoring firms, and workers that are trained or not (whether or not they are trained, or completed vocational training in the predisplacement year). The top panel of Table 2 shows the short-run labor market status for displaced workers, which we classify into four categories: without employment (either unemployed or out of the labor force), and employment with public plus primary (i.e. agricultural) service, or manufacturing sectors. It is evident that workers from offshoring firms are more likely to be without employment in the year after displacement than workers from non-offshoring firms (24.6 percent versus 16.7 percent). These results are consistent with the findings in the previous section and suggest that offshoring shocks affect the availability of certain tasks economy-wide, reducing the likelihood that offshorers can find employment using the same skills in a new firm.
The bottom panel of Table 2 shows the medium-run (three years after displacement) labor market status. Comparing displaced offshorers with displaced non-offshorers, it is seen that the fraction of offshorers without employment (9.5 percent) is similar to non-offshorers (9.9 percent), and offshorers are more likely to become employed in manufacturing (70.4 percent) than non-offshorers (66.3 percent). Moreover, trained workers are less likely to be without employment than non-trained workers, less likely to become employed in service, and more likely to become employed in manufacturing. This may reflect worker self-selection. Another hypothesis is that readily-available and heavily-subsidized vocational training programs re-enforce these workers’ attachment to specific types of manufacturing jobs, making it more likely that they seek employment in manufacturing.

Table 2. Transitions for displaced workers

<table>
<thead>
<tr>
<th></th>
<th>One year after mass lay-off (%)</th>
<th>Three years after mass lay-off (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Offshorers</td>
<td>Non-offshorers</td>
</tr>
<tr>
<td></td>
<td>All Trained Non-trained</td>
<td>All Trained Non-trained</td>
</tr>
<tr>
<td>Without employment</td>
<td>24.6 27.5 23.8</td>
<td>16.7 14.3 17.2</td>
</tr>
<tr>
<td>Employed in…</td>
<td></td>
<td></td>
</tr>
<tr>
<td>public + primary</td>
<td>2.0 1.9 2.0</td>
<td>2.0 2.6 1.9</td>
</tr>
<tr>
<td>service</td>
<td>17.7 15.1 18.4</td>
<td>17.1 16.5 17.2</td>
</tr>
<tr>
<td>manufacturing</td>
<td>51.8 48.1 52.8</td>
<td>61.1 63.1 60.6</td>
</tr>
<tr>
<td>Sample size</td>
<td>1,241 258 983</td>
<td>8,675 1,603 7,072</td>
</tr>
</tbody>
</table>

Source: Own calculations based on data from Statistics Denmark.

6. Conclusions and policy implications

In several related papers, we have used a matched worker-firm dataset from Denmark to investigate the effects of offshoring on wages, earnings losses after layoffs, and enrollment in training. Consistent with a previ-
ous literature on trade and wages, HMJX 2011 show that the effect of offshoring on labor demand and wages within job spells depends on educational type: college-educated workers gain from offshoring while other workers lose. Taking this analysis further, we can identify additional dimensions along which workers are affected. HMJX 2011 show that, holding education constant, wage growth looks very different for workers depending on the type of firm (offshorer, exporter) in which they are employed, and depending on the specific characteristics of the jobs they hold. We show here that the wage losses after displacement are greater for workers displaced by offshoring firms than for workers displaced for other reasons. This displacement result holds for both unskilled and skilled (college-educated) workers.

What does this tell us about education and labor market policy in an offshoring global economy? First, increasing educational attainment is not a solution in and of itself. Increasing educational attainment does not completely insulate workers from displacement following adverse offshoring shocks. And even those college-educated workers who remain employed in offshoring firms experience uneven wage gains. HMJX 2011 show that in the firms that increase offshoring, the wages rise more for jobs that require communication, language, and social science skills than for those jobs that require natural science disciplines. This suggests that communication, language and social-science skills better insulate workers from offshoring shocks than natural-science skills. In the OECD countries, however, most of the policy discussions for education have focused on expanding the so-called STEM (science, technology, engineering and math) disciplines, leaving out communication, language and social sciences. Our results suggest that it could be useful to revisit the conventional wisdom according to which specific skills are most valuable in a globalizing world.

Displacement from a firm with rising offshoring generates larger and more persistent wage and earnings losses than those suffered by other displaced workers, and workers displaced from offshoring firms have higher rates of unemployment and are less likely to re-attach to firms within the same industry. This indicates that offshoring shocks result in sharp reductions in demand, economy-wide, for specific tasks. Re-attaching to the workforce may then require a more fundamental retraining of workers displaced due to offshoring shocks.
Training programs are widely available and heavily subsidized in Denmark. Most courses are of short duration and have a vocational content. Our stylized facts about the interaction between offshoring, labor market transitions and training participation show large differences between workers whose employers substantially increased offshoring prior to displacement. Workers displaced from offshoring firms train at much higher rates around the time of displacement, which we take as further evidence that offshoring has economy-wide labor market implications for the workers involved. In terms of policy, this might indicate that Denmark, and other OECD countries would benefit from adopting training programs that are targeted towards workers displaced by globalization, such as the Trade-Adjustment-Assistance programs in the US.

Workers displaced due to mass layoffs are no more likely to take up post-secondary training than other workers; instead, many of them enroll in vocational training courses and tend to become re-employed with manufacturing at higher rates than untrained workers. While this would seem to indicate clear benefits of vocational training, there remains a possible concern related to the types of jobs in question. If a two- to three-week vocational program offers sufficient training for a Danish worker to do a job, that same job can likely be taught to a foreign worker with relative ease. This raises the possibility that vocational training strengthens workers’ attachment to particular manufacturing jobs that are most likely to be hit by offshoring shocks in the future. Given these findings and the large sums spent on training programs in Denmark, it would be worthwhile to investigate whether these training programs offer only temporary relief from offshoring pressures. Perhaps more fundamental educational upgrading may be needed.

References

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Appendix

Following Jacobson et al. (1993), we restrict our sample in the following ways. We focus on manufacturing workers who, in at least one of the years 1997-2000, have at least six years of tenure. We 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 and has at least 50 employees to be consistent with our estimation of within-job spell wage changes in previous sections, and to eliminate very small firms and those with a minimal global engagement from the analysis.

For a sample of workers (displaced and non-displaced), we estimate

$$
\log y_{it} = \alpha_i + x_i \beta + \sum_{k=-3}^{0} D_{it}^k \delta_k + F_{it}^1 c_i \phi_1 + F_{it}^2 c_i \phi_2 + F_{it}^3 c_i \phi_3 + e_{it},
$$

where $c_i = (S_i, OFF_i, S_i \cdot OFF_i)$.

$y_{it}$ represents the earnings of worker $i$ in year $t$. We employ three measures: the hourly wage rate (the variable used in Sections 5 and 6), annual labor earnings and annual gross earnings. Annual labor earnings capture the effects on both the hourly wage rate and hours worked, and annual gross earnings are the sum of annual labor earnings, unemployment insurance benefits and social assistance. The vector $c_i$ consists of the dummy for high-skilled worker, $S_i$, an offshorer dummy $OFF_i$, and their product. $\alpha_i$ and $\alpha_t$ represent worker and year fixed effects, and $x_i$ is a vector of time-varying worker characteristics (e.g. union, marriage and education status) as controls. Conditional on the control variables $\alpha_i$, $\alpha_t$, and $x_i$, equation (A.1) estimates the profile of $y_{it}$ for the nine years surrounding the event of displacement: three pre-displacement years ($k=-3,-2,-1$), the displacement year ($k=0$), and five post-displacement years ($k=1,...,5$). This assumes that earnings are the same for $k<-3$ given the controls $\alpha_i$, $\alpha_t$, and $x_i$. The dummy variables, $D_{it}^k$, jointly represent the event of displacement, with $\delta_k$ measuring the effect of displacement on a worker’s earnings $k$ years following its occurrence. Equation (A.1) imposes two types of restrictions on the evolution of $y_{it}$. First,
it allows \( y_{it} \) to differ in level over time, as captured by \( D_{it}^k \), assuming that the level difference is the same across workers for given \( k \). Second, the regression also imposes three restrictions on the rate of change for \( y_{it} \) in order to distinguish between different types of displaced workers as captured by the vector \( c_i \). (i) \( y_{it} \) grows or declines linearly from three years before displacement until the displacement year. (ii) \( y_{it} \) is constant from the displacement year to three years after displacement. And (iii) \( y_{it} \) grows or declines linearly from its value three years after displacement until the end of the sample period. The restrictions (i)-(iii) are captured, respectively, by the linear variables \( F_{it}^1, F_{it}^2, F_{it}^3 \), where \( F_{it}^1 = t - (s - 4) \), 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, and \( F_{it}^3 = t - (s + 2) \), if worker \( i \) is displaced at time \( s \) and \( t \geq s + 3 \), and \( F_{it}^3 = 0 \) otherwise.

The baseline values for \( y_{it} \) are those of non-displaced workers (given controls \( \alpha_i, \alpha_t, \) and \( x_{it} \)), and the estimates of \( \delta_i \) and \( \varphi \) show the differences in earnings of displaced workers relative to the baseline values. In addition, the coefficient vector \( \varphi \) shows differences in the rate of change for \( y_{it} \) across unskilled and skilled workers, and across offshorers and non-offshorers. Our results in Figure 1 are based on OLS estimates of \( (A1) \). The OLS estimates might be biased if firms selectively lay off workers whose performance is unusually poor in the years around separation. Couch and Placzek (2010) address this issue using propensity score matching (PSM), and show that the PSM estimates are similar to the OLS estimates.
Comment on Hummels, Munch and Xiang: Education and labor market policies in an offshoring global economy *

Oskar Nordström Skans**

It is well known from the vast stock of research building on Davis et al. (1998) that labor markets are characterized by massive amounts of simultaneous job destruction and job creation, and that most of this restructuring is unrelated to structural change as measured by regional or sectoral mobility. Recently, the literature has seen a number of examples, trying to provide a better understanding of the underlying sources of this churning process (see e.g. Foster et al., 2008). In this context, the impressive research agenda summarized by Hummels, Much and Xiang is a very important addition. Its focus on offshoring shocks provides insights into a part of the labor restructuring process where too little has been known before. My reading of the results of the paper is that offshoring shocks have a very clear restructuring component, which makes the results even more important. In this comment, I will primarily focus on the policy aspects of the paper as well as touch on some aspects of how the results can be interpreted.

As a first comment, I think it is important to note that the contribution of the paper is to document the consequences of offshoring shocks, but it does not show to what extent offshoring shocks are an important contributor to job loss on the labor market in general. This is important since

* This comment is written in response to a version of the paper dated November 2012.
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the extent to which general policies should be adjusted to accommodate the impact of offshoring shocks naturally depends on what fraction of overall layoffs that can be attributed to offshoring shocks.\footnote{The relative sizes of the number of displayed offshorers and non-offshorers studied in the paper suggest that offshoring is a relatively marginal source of layoffs, but it is possible that this depends on some specific aspects of the sample construction.} Given the title of the paper, it would be interesting to know if the public employment services of the Nordic countries live in a global offshoring economy.

An interesting follow-up question, in particular if offshoring shocks show to be a relatively infrequent source of displacement and relative wage adjustments, is whether researchers should care more about changes in relative wages or employment opportunities arising from offshoring, than we care about similar changes arising from other shocks to firms’ economic environment. One reason why we should pay particular attention to this process is that people appear to care. According to Calmfors et al. (2012), Swedish survey respondents have substantially more adverse sentiments towards layoffs arising from offshoring than towards layoffs arising from product import competition. Although this result appears somewhat irrational from an economic perspective, it clearly shows the usefulness of a proper documentation of the real impacts of offshoring shocks.

The paper analyzes the wage impact on workers within firms that off-shore due to changes in exchange rates, transport costs and world export supply. This is a clever approach which isolates changes in offshoring that are unrelated to internal changes (such as, e.g., technology shocks or shortage of labor) within the studied firms. A drawback of the approach, although carefully executed, is that it relies on aggregate disturbances, thus making it difficult to separate internal adjustments within the firm from market responses. As shown by Carlsson et al. (2011), wages respond substantially more to productivity shocks that are shared with other similar firms than to purely idiosyncratic shocks, suggesting that changes in workers’ outside options are an important element in firm-level wage setting. With the set-up of this paper, it is conceivable that the positive wage impact of high-skilled workers is partly driven by changes in the profitability of the firms that make up the workers’ outside options. This will be the case if workers’ (potential) mobility patterns are related to the cross-firm correlations in changes in exchange rates, transport costs and
world export supply. If, for example, some high-skilled workers have skills that are particularly useful when trading with Japan on the chemicals market, then it is likely that changes in the exchange rate between the Yen and the Danish Krona will not only affect the chemicals firm in which (s)he is employed, but also his or her ability to find a high-paid job in an alternative firm. Here it is, however, important to note that the potential for an outside option interpretation of the wage impact primarily matters for the interpretation of the underlying mechanisms. It does not question the overall impression that shocks which make it more profitable for firms to offshore affect relative wages in the direction suggested by the estimates.

The paper shows interesting and sometimes surprising patterns of labor demand effects across education groups. These are particularly useful as a warning against too simplistic ideas regarding the fields on which Nordic education policies should focus in the future. However, there is a number of reasons why we should be cautious when thinking about these results in a policy context. First of all, it is not clear that one should pay more attention to changes in labor demand that are driven by offshoring than changes in labor demand that are driven by other processes. Second, the analysis is done for the manufacturing sector, and it is not obvious that changes in the occupational content within a single sector provide a good diagnostic for the best way of designing the education system as a whole. Third, and as should be evident from other contributions to this volume, it is not clear that Denmark’s comparative advantages will be the same in the (even near) future.

An interesting question which is not addressed in the paper, but where future research may provide results that are directly relevant to policy makers, is whether a more general vocational training (i.e. at the upper secondary level of schooling) provides a better insulation against the consequences of offshoring shocks than the more specific form of training typically provided in the Danish context. In the Swedish debate it is often claimed, but rarely with the support of empirical results, that the more general type of vocational education provided in Sweden is better at insulating workers against the consequences of structural change. Using the approach discussed in this paper to shed some light on the hypothesis

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2 In addition, estimates are likely to vary with the exact instrument used since the aggregate component may vary across instruments.
that it is more important to have enough *general* skills to be able to adapt when the economy is hit by restructuring shocks than it is to have the right *specific* skills would be an interesting avenue for future research.

The paper also provides an interesting discussion regarding the role of training programs for reattaching displaced workers to the labor market. Here, it is notable that the training programs discussed in the paper appear to be of a very different form than training programs offered with the system of active labor market programs (ALMPs) in most countries. In contrast to most ALMPs which focus on training for the unemployed, the programs studied appear to be targeted at employed workers (often with a focus on firm-specific skills). In addition, their duration is short, often just a few weeks in contrast to, e.g., 3-6 months for training programs within the Swedish system of ALMP.

Given that the offshoring shocks appear to have a structural component, it appears that providing training courses which allow these workers to acquire skills that are useful in other, presumably expanding, parts of the labor market is well in line with the traditional Nordic rationale for Active Labor Market Training Programs. Surprisingly, the results in this paper suggest that training programs are associated with a *higher* probability of staying in the original sector. However, it is important to reiterate the authors’ caveat; these estimates should not be interpreted as causal since trained offshorers may have better labor market prospects than untrained offshorers for other reasons than the effects of training. Given the short duration of the training programs, I would be inclined to favor this latter interpretation before an interpretation building on large positive causal effects. Perhaps the most important implication of this part of the analysis is that a next useful topic for the stream of randomized trials of active labor market programs in Denmark would be to provide evaluations of training programs. Probably longer than those discussed in the paper separately for displaced workers with and without an offshoring background.

**References**