
3rd FIW Special - International Economics



Offshoring and Labour Markets

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This report considers the impact of offshoring on labour markets. The report begins by surveying the empirical literature linking offshoring activities to changes in employment and the relative wage and employment of high- to low-skilled workers. The report moves on to consider recent developments in offshoring activities and in labour markets for a sample of 40 developing and developed countries. Based on these developments the report draws conclusions on the likely developments in offshoring and its impact on labour markets.

Offshoring and Labour Markets

1. Introduction

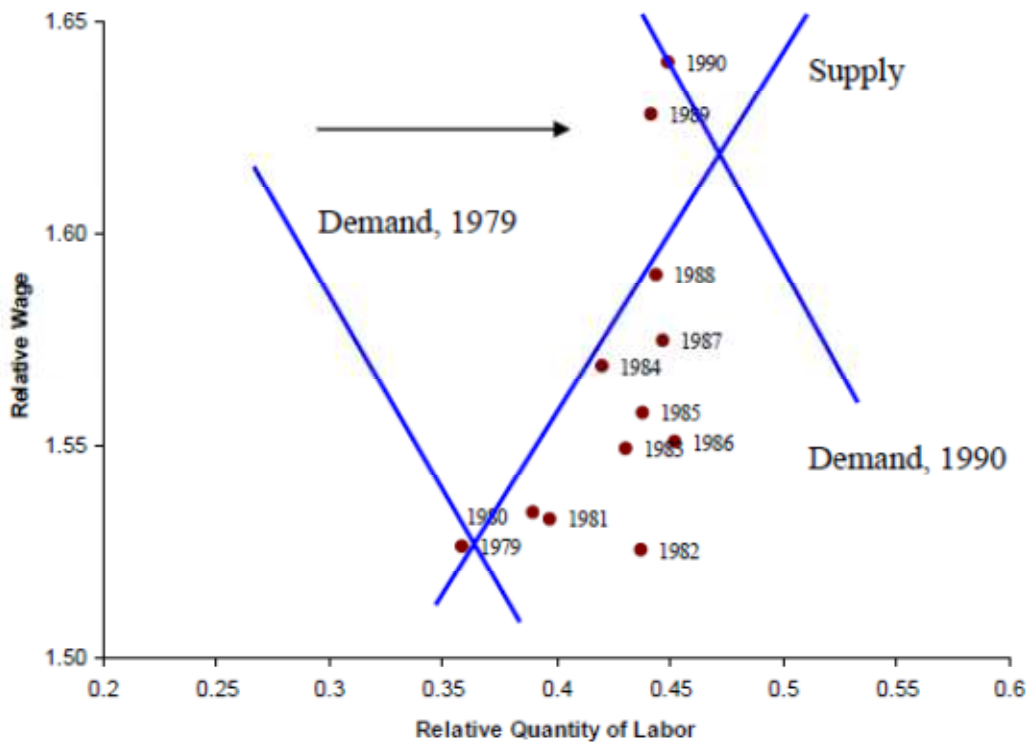
The ongoing process of globalisation has seen the increasing frequency and extent of international outsourcing – or offshoring – of production¹, involving the contracting out of activities that were previously performed within a production unit to foreign subcontractors. Such offshoring is expected to bring about gains for consumers and producers, through lower costs and prices, and through a more efficient allocation of resources. Productivity at the aggregate level may also improve if offshoring leads to the creation of new firms and the destruction of old ones, or if offshoring is associated with enhanced technology diffusion and knowledge spillovers. By creating linkages between economies we may also expect that offshoring can increase the extent of business cycle co-movement, as well as providing a means of smoothing business cycle volatility in countries in offshoring countries. Despite these benefits there are concerns that the costs of offshoring may fall disproportionately on workers and in the developed world at least on low-skilled workers in particular.

One of the most pervasive features of the labour market has been the rising demand for skilled workers relative to unskilled workers in Europe and the United States (Autor and Dorn, 2009). Despite a concomitant increase in the supply of skilled workers, relative wages of skilled workers have risen in almost all industries. These empirical regularities began to be noticed in the early 1990s, particularly in the USA, and led to a literature that developed throughout the 1990s considering the impact of offshoring on labour markets. Figure 1 for example, which is from Feenstra (2010), shows how relative wages (i.e. the ratio of high-skilled to low-skilled wages) and relative employment (i.e. the ratio of high-skilled to low-skilled employment) developed in the USA over the period 1979-1990.² What we observe is a tendency for the relative wage and relative employment of high-skilled workers to increase. This positive co-movement of relative employment and wages suggests that a shift of the demand curve for high-skilled labour has taken place resulting in a shift along the supply curve, as depicted in Figure 1. This pattern was subsequently found for other (developed and developing) countries and led to a great deal of effort expended in order to understand the causes of this relative decline.

¹) In what follows we consider offshoring to involve the importation of intermediate goods (including raw materials). This is a broader definition to that employed by the OECD which also includes FDI, but is narrower than that used in the business literature which concentrates on the contracting out of activities.

²) More precisely the figure reports the values for production and non-production workers.

Figure 1: Plot of Relative Wages against Relative Employment in the USA (1979-1990)



Source: Feenstra, (2010)

At the same time as these changes have been witnessed in the labour market, the ongoing globalisation process has seen the increasing frequency of offshoring. An important ongoing research question of direct policy relevance is the issue of whether increased offshoring is a cause of the rising demand for skilled workers in advanced countries or whether some unrelated factor can explain these changes. Two factors are usually considered as possible explanations for these changes in relative labour demand. The first explanation was that the shift in demand was caused by skill-biased technological change, due to the increase in the use of computers and other advanced technology (see Berman et al, 1994 and 1998; Lawrence and Slaughter, 1993). The second explanation put forward was that the change in relative labour demand occurred due to the forces of globalisation, and in particular to offshoring of low-skilled jobs to other countries.

The establishment of international production networks associated with offshoring generates trade in intermediates, as has been shown by Campa and Goldberg (1997), Hummels et al (2001) and Yeats (2001). While this would be expected to affect the composition of international trade it may also change the pattern of trade, as firms look to source intermediates from low cost suppliers. In the international trade literature one of the main driving forces behind production offshoring is the existence of differences in factor prices across national borders (e.g. Feenstra and Hanson, 1996; Kohler, 2004). Offshoring differs importantly from import penetration in final goods in the sense that it explicitly takes into account the extent to which firms move production (and service) activities abroad. Labour demand is therefore likely to be affected not only in import-competing industries, but also in all industries that use foreign inputs and services. The impact of offshoring on the labour market may not be limited to

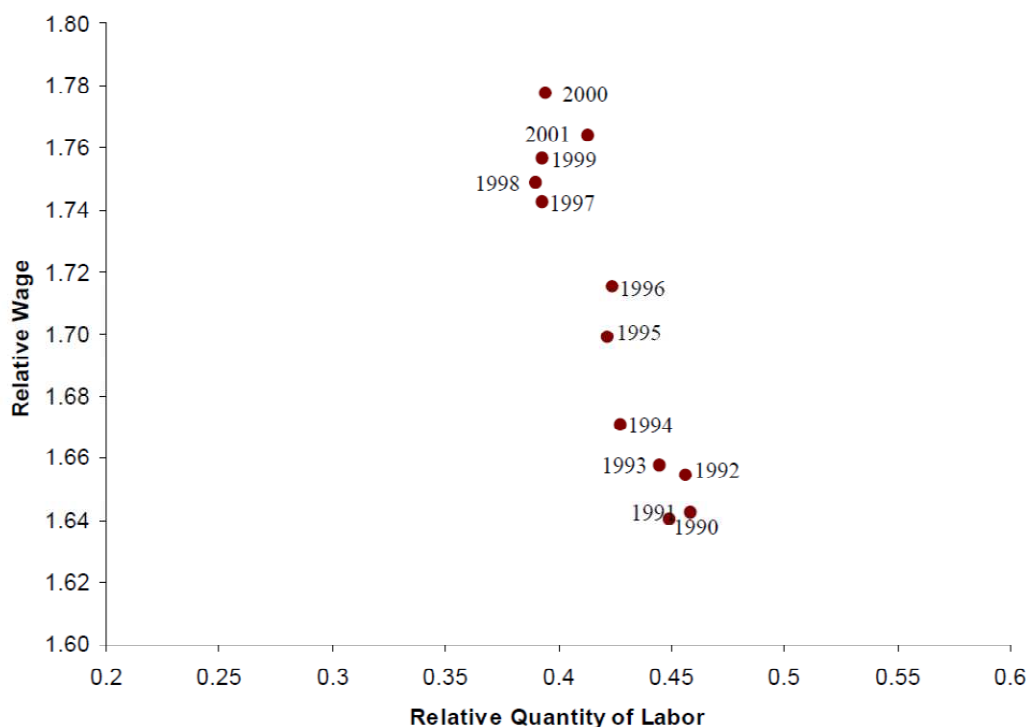
changing labour demands between industries therefore, but may also affect the relative demand for labour within industries.³ In particular, unskilled labour-intensive stages of production tend to be shifted to unskilled labour-abundant developing countries, while more technologically advanced stages remain in skilled labour-abundant developed countries. Production offshoring has led to the fear in developed countries especially that outsourcing will tend to reduce the demand for relatively unskilled workers therefore, resulting in either falling wages of unskilled labour and/or increased unemployment of unskilled labour. From a theoretical perspective however, it is by no means clear that this will be the case in a general equilibrium setting (e.g. Jones and Kierzkowski, 2001; Kohler, 2004). It remains an open and empirical question therefore as to whether offshoring is a large enough activity to have an adverse effect on labour market outcomes. As we will see below, the empirical literature has not been able to provide clear answers to whether offshoring impacts upon labour markets or on the relative importance of offshoring versus skill-biased technological change.

To an extent the debate and discussion of the causes of the rising employment and wage shares of high-skilled labour in the 1990s diminished somewhat in the early 2000s, though there remain concerns regarding the potential impact of offshoring on labour markets, with a number of recent empirical papers addressing various aspects of the offshoring and labour markets debate.⁴ The continued and renewed interest in this topic has arisen for a number of reasons. One reason is that since the early 1990s the clear pattern of rising relative wages and employment of high-skilled labour has tended to become blurred. Figure 2 (again from Feenstra, 2010) plots relative wages and employment for the USA from 1990 to 2001, with the data showing that while relative wages have tended to rise over this period there has been some decline in the share of high-skilled workers in total employment. A further reason for the renewed interest in this topic is that there is some evidence to suggest that the declining relative wages and employment of low-skilled workers in the developed world have also begun to become a feature of the relative wages and employment of medium-skilled workers.

³) With heterogeneous firms we may also observe such an effect through reallocation effects within industries towards more productive firms, which tend to have a larger skilled workforce.

⁴) Feenstra (2010) for example notes that "The impact of trade on wages after 2000 has received scant attention from trade economists, and this shortcoming deserves to be rectified" (p. 104).

Figure 2: Plot of Relative Wages against Relative Employment in the USA (1990-2001)



Source: Feenstra, (2010)

In this report we concentrate on the impact of offshoring on labour markets, surveying the existing empirical literature linking offshoring to wages and employment, and providing information on recent developments in labour markets and in offshoring for a large number of developed and developing countries. We begin in the next section (Section 2) by reviewing the empirical literature that looks to link international trade and offshoring in particular to developments in labour markets. We then move on to present data from the recently compiled World Input-Output Database describing recent developments in the extent of offshoring (Section 3) and in labour markets (Section 4) in a sample of 40 developed and developing countries. Finally, we look in Section 5 to link existing results on the relationship between offshoring and labour markets to the recent developments in offshoring activity and look to draw conclusions on the likely future developments in offshoring and its likely impact on labour markets.

2. Existing Evidence on the Impact of Offshoring on Labour Markets

This section reviews and surveys some of the literature linking offshoring to various aspects of the labour market.⁵ The discussion of the existing literature is split into two sub-sections. In the first sub-section we discuss studies examining the relationship between measures of offshoring

⁵) Some aspects, such as labour standards and working conditions, are not covered in this review. See Robertson et al (2009) for extensive coverage of these issues.

and employment levels, while the second section reviews studies considering the impact of offshoring on average and relative wages.

2.1 Offshoring and Employment

From a theoretical perspective there are two main effects of offshoring on employment in the offshoring country. The first is a 'technology effect' that reflects the destruction of jobs that occurs when firms relocate part of their production activities overseas. The second is a 'scale effect' that captures the creation of jobs following the expansion in industry output that may arise as a result of the productivity gains from offshoring. A third indirect 'substitution effect' may also be relevant, in which offshoring affects domestic sub-contracting relationships, thus leading to a negative impact on employment in other domestic sectors (Cappariello, 2010). Such an effect would imply that there would be negative employment effects on an industry of offshoring in other domestic industries. An alternative view (Arndt, 1997) would suggest that the positive scale effect of offshoring may lead to increased demand for intermediate goods from the domestic economy also, which may offset this indirect 'substitution effect'.

There is a fairly large empirical literature considering whether trade liberalisation and openness – broadly defined – impacts upon employment levels, and a smaller literature concentrating on the effects of offshoring more specifically. In terms of the former literature Wacziarg and Wallack (2004) for a number of developed and transition countries, Revenga (1997) for Mexico, Milner and Wright (1998) for Mauritius and Currie and Harrison (1997) for Morocco among others find either no effect or a small negative effect of trade liberalisation on employment.⁶ Biscourp and Kramarz (2007) concentrate on the impact of imports of mainly finished goods in France and find a strong relationship between imports and the destruction of jobs, with the effects being larger for final goods imports than for intermediates.

Recent studies on the impact of offshoring on the level of employment include Hijzen and Swaim (2007) who examine the relationship between offshoring and industry employment using data on 17 high-income OECD countries for 1995 and 2000. They distinguish between narrow- and broad offshoring⁷ and find that offshoring has no effect or a slight positive effect on sectoral employment. Narrow offshoring is found to reduce the labour-intensity of production, but not the overall level of employment, while broad offshoring does not affect labour-intensity but has a positive effect on overall sectoral employment. This contrasts with the results of OECD (2007) who find that offshoring lowers the conditional and unconditional demand for labour in OECD countries.

Some recent studies also consider the possibility of heterogeneity in the impact of offshoring on employment. Falk and Wolfmayr (2005) for example, examine the impact of offshoring to low-wage countries on employment for seven EU countries over the period 1995-2000. They find that importing intermediates from the same industry from low-wage countries has a negative and significant impact on total employment. When splitting their sample of industries into low- and high-skill intensity industries they find that while the employment effects of offshoring are negative and significant in low-skill intensity industries, they are not significant in high-skill intensive industries. Cadarso et al (2008), on the other hand, find in the case of Spain that a significant negative impact of offshoring on employment is found only in the case of

⁶) Much of this literature is surveyed by Winters et al (2004).

⁷) Narrow offshoring refers to offshoring that takes place within an industry, while broad offshoring refers to intermediate imports from all industries.

narrow offshoring in medium- and high-tech industries and only when inputs come from Central and Eastern European countries. Foster et al (2012) use the WIOD database to examine the impact of offshoring on employment levels for 40 countries over the period 1995-2008. Estimating a set of labour demand equations in a manner similar to Hijzen and Swaim (2007) they also allow for heterogeneity across industry-types (manufacturing and services, and low-, medium- and high-tech industries) and across geographical regions (EU15, EU12, China, USA, Other developed and other). Similar to Hijzen and Swaim (2007) they find that the overall impact of offshoring on employment levels is limited, though this general result hides many differences across regions and industry types, with some evidence existing to suggest that offshoring can have overall negative employment effects on different types of labour and for different types of – usually manufacturing – industries.

2.2 Offshoring and Wages

The majority of the literature considering the impact of trade, and offshoring specifically, on wages concentrates on the issue of relative wages, with the impact of trade on absolute wages addressed in only a small number of studies. One such study is Rama (2003) who employs data on a large number of countries and finds that there tends to be a negative and significant relationship between a variety of trade openness and policy variables and wages, while inward FDI is found to have a positive relationship with wages. Considering the possibility of a dynamic relationship however Rama finds that the negative impact of trade variables on wages only arises in the short-run, with the effect turning positive after a number of years.

Discussion of the effects of trade on relative wages is often couched in terms of the Stolper-Samuelson theorem. This states that a rise in the price of a good will increase the return to the factor used intensively in the production of that good. For a country well endowed with skilled labour therefore, an increase in openness would be expected to increase the returns to skilled labour, resulting in an increase in the wage gap. When considering general measures of openness and trade liberalisation a number of studies (e.g. Hanson and Harrison, 1999; Attanasio et al, 2004; Currie and Harrison, 1997; and Pavcnik et al, 2004) find that measures of trade protection disproportionately protected unskilled labour in their analyses of developing countries. Given this it is unsurprising that liberalisation in these countries was associated with declining relative wages for unskilled labour. Other studies argue that the impact of trade is likely to be limited. Goldberg and Pavcnik (2005) argue that for trade to play a role it must be that one observes a movement in employment from contracting to expanding sectors, yet few studies find such shifts in employment.

Much of the literature considering the relationship between offshoring and relative wages is summarised in Feenstra and Hanson (2001). Here we provide brief details on these studies along with results from more recent studies. There are a number of empirical studies examining the impact of production offshoring on the demand for skilled labour in developed countries, examples including Feenstra and Hanson (1996) for the US, Falk and Koebel (2002) for Germany, Strauss-Kahn (2003) for France and Hijzen et al (2005) for the UK. The results tend to indicate that offshoring has had a negative impact on the demand for unskilled labour, with one or two exceptions. Feenstra and Hanson (1996) for example consider the case of the USA, regressing the change in the non-production wage share on the change in the log capital-output ratio, the change in log output and the change in offshoring. They find that for the later period in their dataset (i.e. 1979-1990) offshoring contributed around 31 percent of the

increase in the nonproduction wage that occurred in the 1980s. Falk and Koebel (2002) use data for 26 German industries over the period 1978-1990. With their data they estimate a system of seven equations, one for each type of variable cost (different types of labour and materials). Their results provide little support for substitution effects between different types of labour and imported materials, with the increase in imported materials being driven by higher output growth rather than input substitution. Hijzen et al (2005) also estimate a system of regressions for three different types of labour and materials using data on UK manufacturing industries over the period 1982-1986. Their results indicate a large negative effect of outsourcing on the demand for unskilled labour. Similar results to those of Hijzen et al (2005) are presented by Strauss-Kahn (2003) for France.

Despite these results the consensus view of empirical economists is that while trade has played a role in observed changes in relative labour demand it was not the major reason for rising wage inequality in the 1980s and early 1990s. This view is based upon a number of factors. Firstly, the share of skilled workers increased within most industries (despite increased relative prices), which contrasts with the predictions of the basic Heckscher-Ohlin theory. Secondly, the demand for skilled workers was closely related to various measures of technology such as R&D, but not with measures of trade (Autor et al., 1998). Thirdly, the volume of trade was not large enough and not unskilled labour intensive enough to explain the large changes in relative wages. Fourthly, calibrated general equilibrium models found only a small quantitative role for trade (Borjas et al., 1997). Finally, recent research suggests that skill-biased technological change is still the main determinant of the demand for skilled workers (Michaels et al., 2010). Krugman (2008) however, argues that trade might have become much more important in driving the demand for skilled workers in recent years due to the fast growth in imports from low-skill abundant developing countries, notably China.

Box 1: On the Measurement of Offshoring

An initial issue in identifying the impact of offshoring is to decide upon the appropriate measure of offshoring. The majority of existing studies focus on some measure of trade in intermediates, though as Hijzen and Swaim (2007) note, this ignores the offshoring of assembly activities. Hijzen et al (2005) discuss some of the data sources used in the existing literature. One source of such data is data on outward processing trade, which is trade based on customs arrangements in which complete tariff exemptions or partial levy reductions are granted in accordance to the domestic input content of imported goods. A second source of data is the product classification of trade statistics, which through the use of the Classification by Broad Economic Categories (BEC) classification, can be used to infer the extent of trade in intermediate goods. A final source of data are input-output tables, which allow one to measure the intermediate input purchases by each industry from each industry, and which when combined across countries allows one to calculate the value of intermediate inputs imported by each industry.

A further issue relates to how one defines outsourcing. Feenstra and Hanson (1996) distinguish between narrow and broad outsourcing, where the former considers imported intermediates in a given industry from the same industry only, while the latter considers imported intermediates from all industries. Feenstra and Hanson (1996) prefer the narrow definition as it is thought to be closer to the essence of fragmentation, which necessarily takes place within the industry.¹ Following Hijzen and Swaim (2007) a measure of narrow offshoring (or intra-industry offshoring) for industry i , S_i^N , can be calculated as:

$$S_i^N = \frac{O_{j=i}}{V_i} \quad (1)$$

where O refers to imported intermediate purchases from industry $j = i$ by industry i , and V refers to value-added. Similarly, broad offshoring (or inter-industry offshoring) for industry i , S_i^B can be defined as:

$$S_i^B = \frac{\sum_{j=1}^J O_{j \neq i}}{V_i} \quad (2)$$

3. Recent Developments in Offshoring Activity

In this section we describe recent developments in the extent of narrow and broad offshoring. Using data from the recently compiled WIOD database⁸ we construct the two measures of offshoring described in Box 1 for 40 developed and developing countries and 35 industries for each year between 1995 and 2008.⁹

We begin the descriptive analysis by reporting in figures 3 and 4 the average values of narrow and broad offshoring by country in 1995, the change in the values of these variables between 1995 and 2008 and the average growth rate of these variables between 1995 and 2008.¹⁰ In these figures countries are ranked by the value of the offshoring measures in 1995. Figures 3 and 4 indicate that there is a great deal of heterogeneity in the extent of offshoring across countries, and that during the recent past the extent of offshoring has in most cases continued to increase. In terms of the level of narrow offshoring (Figure 3) we observe that the levels of offshoring in 1995 were relatively large for small developed economies such as Belgium, Luxembourg, Cyprus, Ireland and Malta, as one would expect, as well as for a number of transition economies, such as Slovenia, Slovakia, the Czech Republic and Estonia. For most other EU members the narrow measure of offshoring accounted for around 10 percent of industry value-added on average. Interestingly, the extent of narrow offshoring in the USA was relatively low, and lower than that for fellow NAFTA members Canada and Mexico. Figure 3 further indicates that during the recent past (1995-2008) narrow offshoring has grown in the majority of countries. Indeed, only in three cases do we observe a decline in narrow offshoring between 1995 and 2008. Average growth rates of narrow offshoring have also been relatively large in developing (e.g. China and Turkey) and transition (e.g. Bulgaria, Hungary, Poland) economies. Growth rates of narrow offshoring have been relatively low in NAFTA countries along with many other developed countries. Of the EU15 countries, Austria and Denmark have seen relatively large increases in narrow offshoring in the recent past.

The figures for broad offshoring (Table 4) in 1995 are fairly similar to those for narrow offshoring with small developed countries such as Belgium and Denmark and transition countries such as Estonia, Hungary and Lithuania having the highest values for the broad offshoring measures. The USA as well as Japan report relatively low values for the broad offshoring measure in 1995. When considering changes over time we do observe some differences when compared with developments in the narrow measure however. Firstly, the growth rate of broad offshoring tends to be positive and has tended to grow at a greater rate than that for narrow

⁸) www.wiod.org

⁹) While we have data up to 2009 we choose to limit our analysis to the period 1995-2008 in order to avoid the reported large trade effects of the financial crisis.

¹⁰) The narrow and broad measures are calculated for each industry, country and year. Average values of narrow and broad offshoring for each country are constructed as the simple unweighted averages of industry values for the offshoring measures. The growth rates of the offshoring measures are also calculated for each industry, country and year with the average growth rates reported in the figures being the unweighted averages of the growth rates across industries and years.

offshoring. Secondly, while a number of transition (Bulgaria, Poland) and developing (China, Turkey) countries again see large increases in broad offshoring we also observe relatively large increases in a number of developed countries, most notably Germany, Japan and Korea.

Figure 3: Level, Change and Growth of Narrow Offshoring by Country

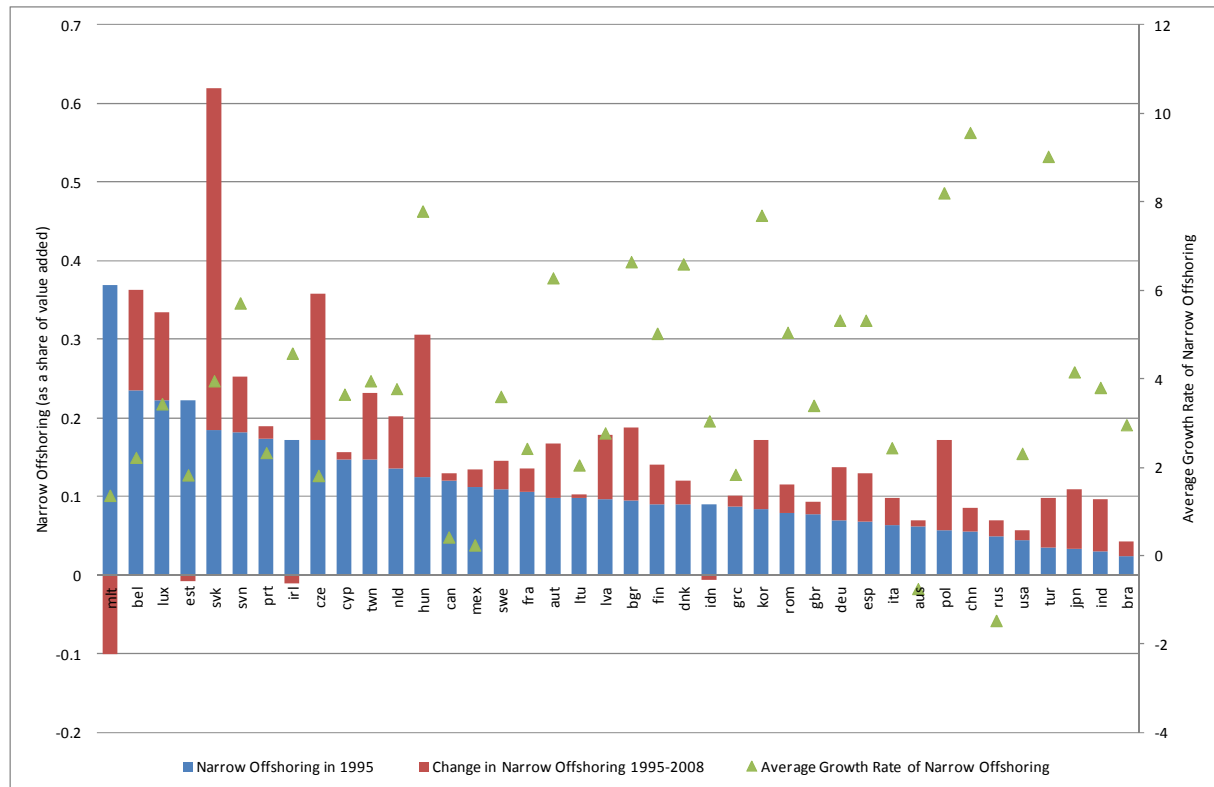
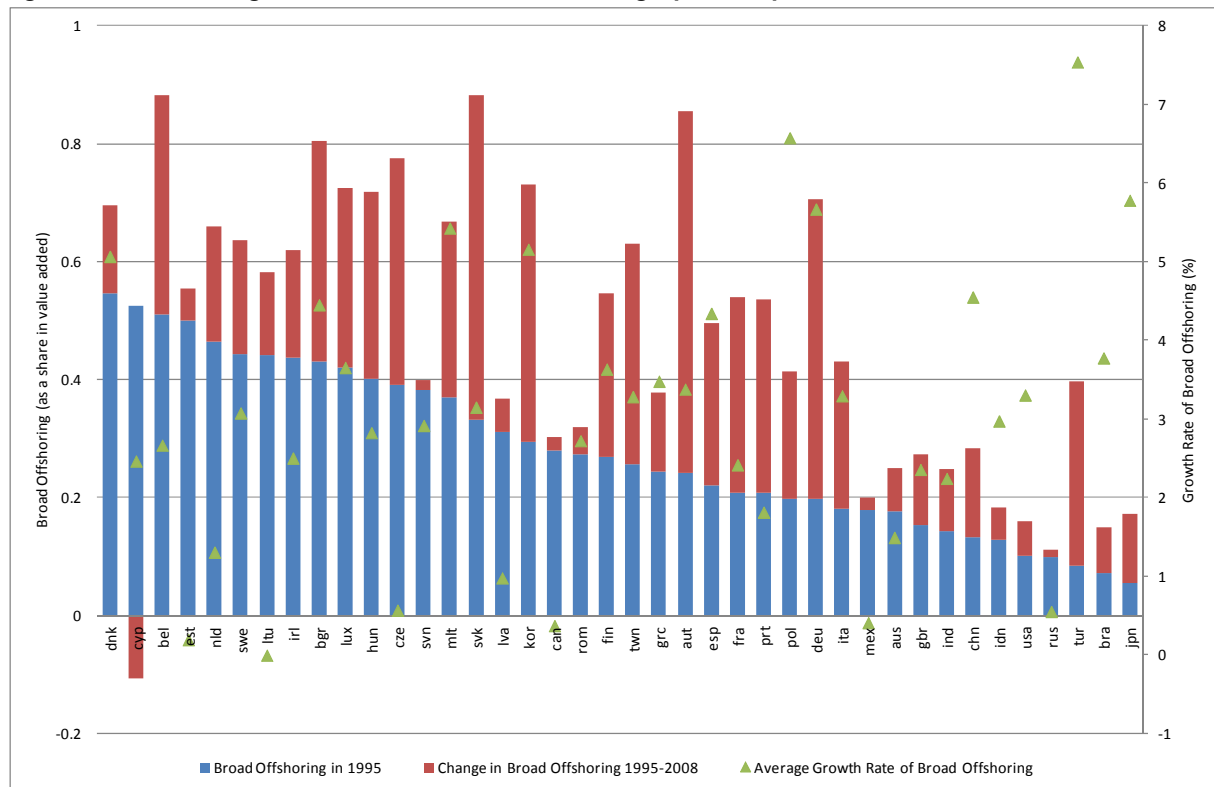


Figure 4: Level, Change and Growth of Broad Offshoring by Country

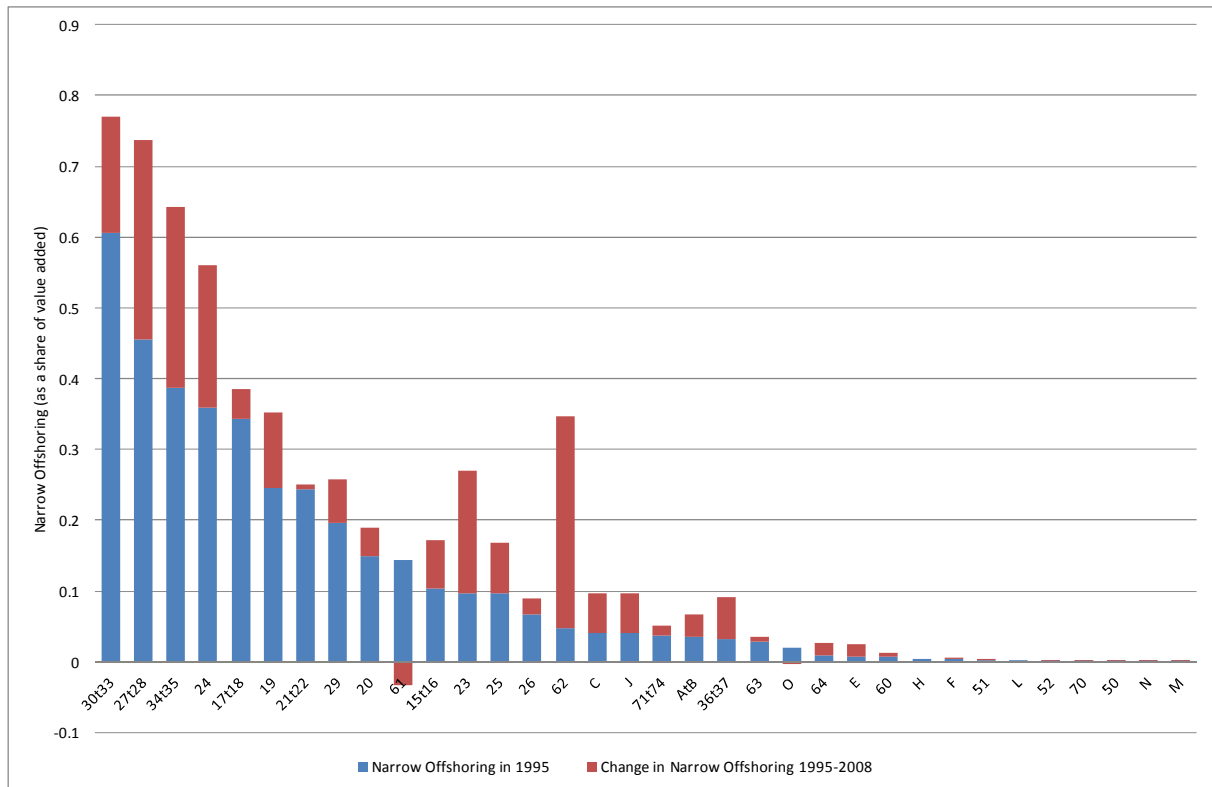


While it is interesting and informative to examine differences in offshoring across industries further information can be obtained by considering how offshoring differs across industries. In the following two figures (figures 5 and 6) therefore we report the average levels of narrow and broad offshoring in 1995, the change between 1995 and 2008 and the average growth rates over the period 1995-2008. The figures rank industries by the value of the offshoring measure in 1995. Figure 5 reports the values for narrow offshoring and what is immediately clear is that narrow offshoring is heavily concentrated within manufacturing industries and within a small subset of manufacturing industries in particular. Narrow offshoring in 1995 is concentrated in textiles (17+18), chemicals (24), basic metals (27+28), electrical equipment (30+33) and transport equipment (34+35). It is in these industries that parts and components trade and semi-finished products play an important, and so it is not wholly surprising that these industries tend to offshore relatively intensively. Of the service sectors only water transport (61) showed significant narrow offshoring in 1995. These manufacturing sectors also tended to see the largest increases in narrow offshoring between 1995 and 2008, with leather products (19), rubber products (25) and manufacturing (n.e.c.) and recycling (36+37) also seeing relatively large increases in narrow offshoring. Within the services sectors we observe a rapid increase in narrow offshoring for air transport (62).

When considering broad offshoring (Figure 6) we observe that this measure of offshoring is much less concentrated across industries, though the manufacturing sectors for which narrow offshoring was relatively large are again the sectors with the highest values of broad offshor-

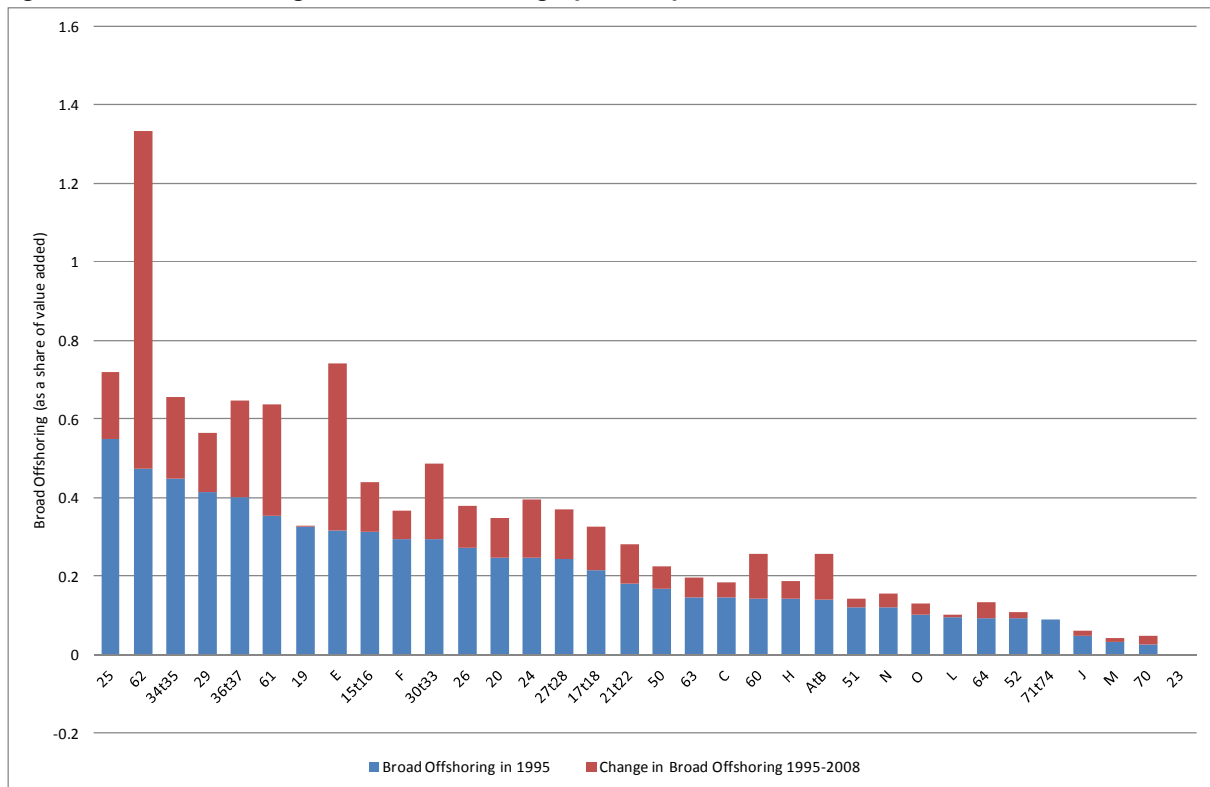
ing.¹¹ Values for the broad offshoring measure in services sectors tends to be lower than manufacturing sectors. Considering changes over time we observe that broad offshoring has increased in practically all industries, with the change in some services sectors (electricity, gas and water supply (E); air transport (62); water transport (61)) being particularly large.

Figure 5: Level and Change of Narrow Offshoring by Industry



¹¹) Data for industry 23 (coke, refined petroleum and nuclear fuel) are not reported as these are very much an outlier. High values of intermediates combined with low value-added in this sector for some countries results in very large values for the broad offshoring measure.

Figure 6: Level and Change of Broad Offshoring by Industry



Given the large number of countries and industries (as well as time periods) it is not a straightforward task to summarize developments in the extent of offshoring (or as we will see developments in labour markets). In much of the remainder of this report therefore we aggregate the data to concentrate on specific regions (EU15, EU12, China, USA, Other Developed, Other)¹² and specific sectors defined according to technology intensity.¹³

The following two figures (figures 7 and 8) report the average levels of narrow and broad offshoring by region and industry-type for the period 1995-2008 along with the average growth rates of the offshoring measures over the same period. When considering narrow offshoring we observe that across regions narrow offshoring is concentrated in manufacturing industries, and in particular high-tech manufacturing and to a lesser extent low-tech manufacturing. This is to be expected since the scope for offshoring is likely to be larger for complex manufactured products with a high technology content. Where narrow offshoring in services industries is present it tends to be concentrated in medium-tech services. Considering the growth rates we observe that in the recent past China has had the highest growth rates of narrow offshoring. This tends to be true for all industry types, but is particularly pronounced for medium- and high-tech services. The EU12 and EU15 have also witnessed relatively large growth rates in offshoring in the recent past, with growth rates again being highest in medium- and high-tech services sectors. The USA on the other hand has not seen much change in the extent of offshoring, with the growth – where present – being again in medium- and high-tech services

¹² Other developed countries are Australia, Canada, New Zealand, Korea and Taiwan, while the remaining 'Other' countries are Brazil, India, Indonesia, Mexico, Russia and Turkey.

¹³ The categories are low-tech manufacturing, medium-tech manufacturing, high-tech manufacturing, low-tech services, medium-tech services and high-tech services. The classification of industries into these categories is provided in Table A1 in the appendix.

and in medium-tech manufacturing. The Other group and the Other Developed country group have also seen relatively large increases in offshoring in medium-tech manufacturing industries, with the growth rate of offshoring in medium-tech services industries also being relatively large for the Other group.

For broad offshoring the figures provide a somewhat different picture. As with the figures above broad offshoring is more evenly spread across the different industry types, though it tends to be largest in medium- and high-tech manufacturing industries, with lower values found in the services sectors. Growth rates when considering the broad measure of offshoring again look somewhat different to those for the narrow measure. Growth rates again tend to be relatively high in China, but it is the manufacturing industries rather than the service industries that have the highest growth rates using this measure of offshoring. Growth rates are also relatively high in EU15 countries, with offshoring in services industries again having relatively high growth rates. Growth of broad offshoring in EU12 countries however is lower than that for most regions, while growth is also relatively low in the USA. Where growth rates are relatively high for these two regions they tend to be so in manufacturing industries and in medium- and high-tech services.

Figure 7: Narrow Offshoring in 1995 by Region and Industry-Type

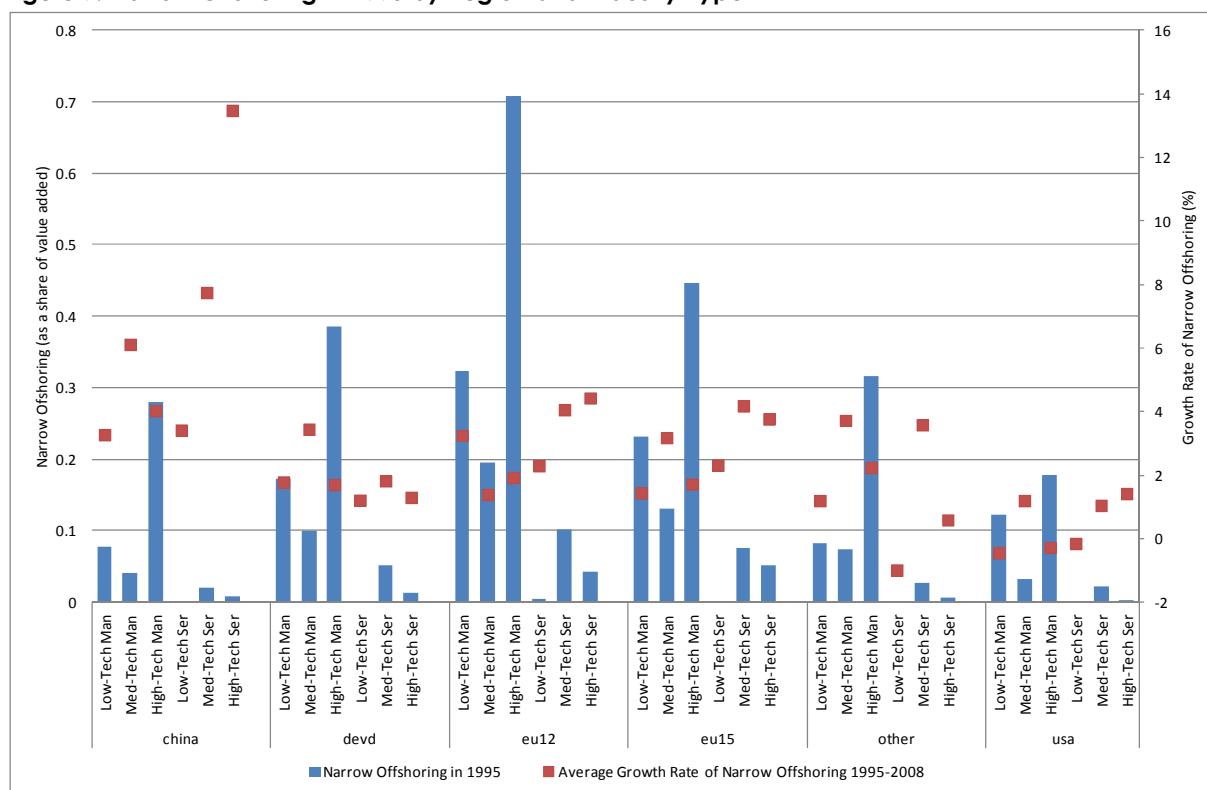
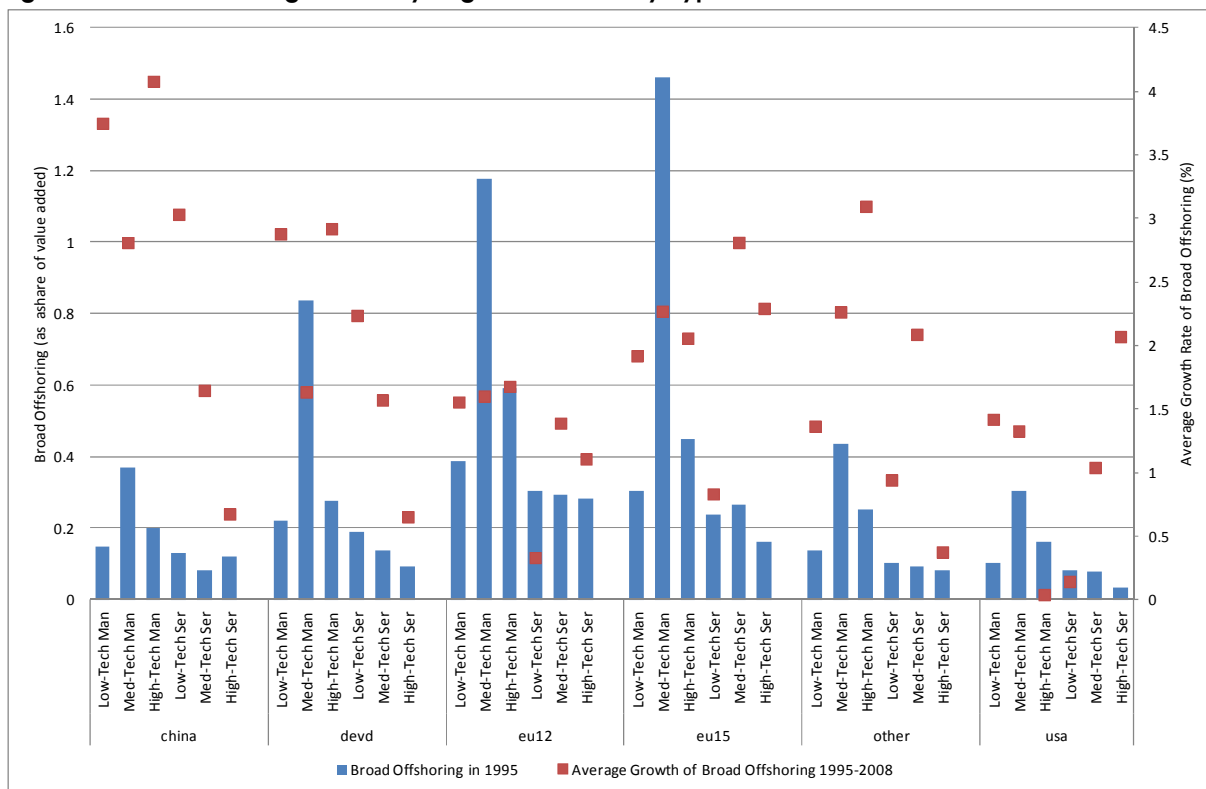


Figure 8: Broad Offshoring in 1995 by Region and Industry-Type



Box 2: Developments in Offshoring in Austria

In this box we briefly describe developments in the extent of narrow and broad offshoring in Austria over the period 1995-2008. Figure B1 reports the average annual values for both narrow and broad offshoring. The figure reveals that narrow offshoring has increased steadily since 1995, with the ratio rising from around 0.1 in 1995 to around 0.17 in 2008. Broad offshoring also increased relatively steadily until 2004, when we see a rapid rise in the extent of broad offshoring. Since 2004 the broad offshoring ratio has more than doubled in Austria. This increase maybe due to the accession of a number of central and eastern European countries in 2004, which may have lead to increased offshoring from Austria.

Figure B.1: Developments in Narrow and Broad Offshoring

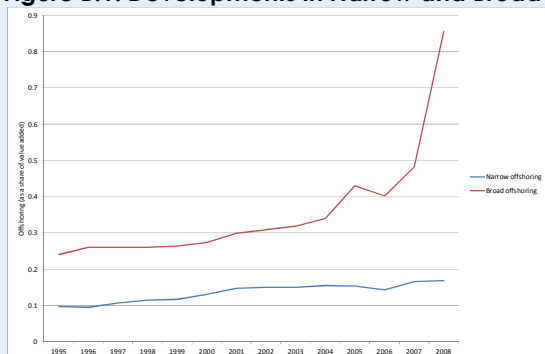
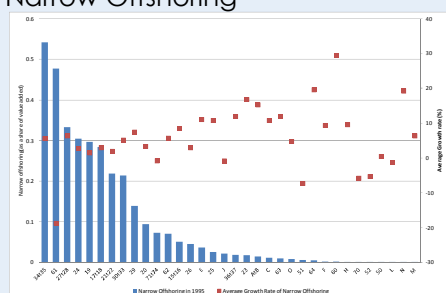


Figure B2 reports the values of narrow and broad offshoring by industry in 1995 and the average growth rates over the period 1995-2008. In the case of narrow offshoring we find that offshoring in 1995 was relatively intensive in transport equipment (34+35) and water transport (61), as well as basic metals (27+28), chemicals (24), leather (19) and textiles

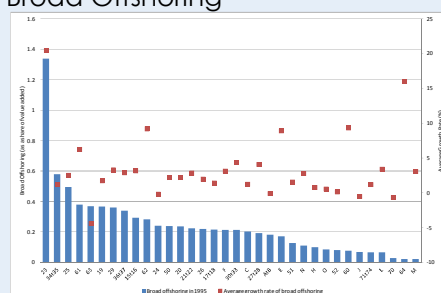
(17+18). Growth rates were particularly high in inland transport (60), post and telecommunications (64), and health and social care (N). When considering broad offshoring we obtain large values for offshoring of coke, refined petroleum and nuclear fuel (23) with significant offshoring also taking place in transport equipment, rubber and plastics (25), water transport (61) and auxiliary transport activities (63). Growth rates were high in the case of coke, refined petroleum and nuclear fuel, post and telecommunications, air transport (62) and electricity, gas and water supply (E).

Figure B.2: Narrow and Broad Offshoring by Industry for Austria

Narrow Offshoring



Broad Offshoring



4. Developments in Labour Markets

The empirical evidence described above provides at least partial support for the view that offshoring has some impact on labour markets, and on the wages (and employment) of low-skilled workers in some sectors at least. The previous section further indicates that offshoring has continued apace in the last 15 years or so. In this section we again use the WIOD dataset to examine developments in labour markets. In particular, we consider developments in average wages and employment across industries and regions, examining whether those sectors in which offshoring is more important have witnessed different developments in their labour markets. Using data from the WIOD dataset we are able to consider how relative wages and employment have developed over the period 1995-2007 for 40 developed and developing countries.¹⁴ The data further allow us to distinguish between three types of labour (low-, medium- and high-skilled), which thus allows us to isolate developments for workers in the middle of the wage distribution who – it is argued – have tended to lose ground to others in recent years.

4.1 Developments in Employment

In Figure 9 we report the shares of low-, medium- and high-skilled employment in total employment in 1995 for each of the six regions considered.¹⁵ The figures are largely as one would expect with nearly half of employment in China being made up of low-skilled employment and only a small percentage made up of high-skilled labour. The figures for other developing countries look fairly similar to that for China. In other regions however medium-skilled employment makes up the largest share of workers, with the shares being particularly large for the USA and to a lesser extent the EU12. In these developed regions high-skilled workers make

¹⁴ While the data is available up to 2009 we concentrate on the data for the period 1995-2007 as there were significant changes in the data in 2008 and 2009 due to the crisis, which may distort the general picture.

¹⁵ Employment is measured using hours worked rather than total number of employees.

up a larger share of employment than they do in developing regions, with the shares ranging from a low of 16 percent in the EU12 and EU15 to a high of 22 percent in the USA. In the USA we further observe a relatively small share of employment taken up by the low-skilled (just 13%).

Table 1 complements Figure 9 by reporting the growth rates of employment and the growth rate of employment by skill level for the six regions over the period 1995-2009. The table reveals that with the exception of other developed countries all regions have seen positive growth rates of total employment, with the growth rates being particularly high in China and in other developing countries. Despite rising offshoring therefore we continue to observe increases in employment, a result that is consistent with those arguing that in the long-run the demand for labour tends to adjust with labour supply. These positive growth rates for total employment do hide significant differences by skill-level however. The growth of high-skilled employment has been relatively large for all regions, and particularly so for China. The relatively high growth rates of high-skilled employment may have arisen for a number of reasons including changes in industry structure, skill-biased technological change and supply-side effects. That the growth of high-skilled workers has been particularly large in China and other developing countries may indicate a catching-up process in high-tech industries, and may suggest that increased offshoring from these countries should be expected. The growth of medium-skilled employment has also been relatively rapid in China and other developing countries, with much smaller growth rates observed in other regions. In the case of low-skilled employment however we have witnessed negative growth rates in all regions except China and other developing countries.

Table 1: Regional Growth Rates of Employment and Employment by Skill Type (1995-2009)

Region	Average Growth Rates (%)			
	Total Employment	High-Skilled Employment	Medium-Skilled Employment	Low-Skilled Employment
China	1.77	8.42	2.77	0.77
Other Developed	-0.27	2.58	-0.42	-4.11
EU12	0.17	3.92	0.07	-1.62
EU15	0.56	3.49	0.84	-1.96
Other	1.36	4.52	2.67	0.20
USA	0.47	1.96	-0.04	-1.18

Figure 9: Employment Shares by Skill-Level in 1995

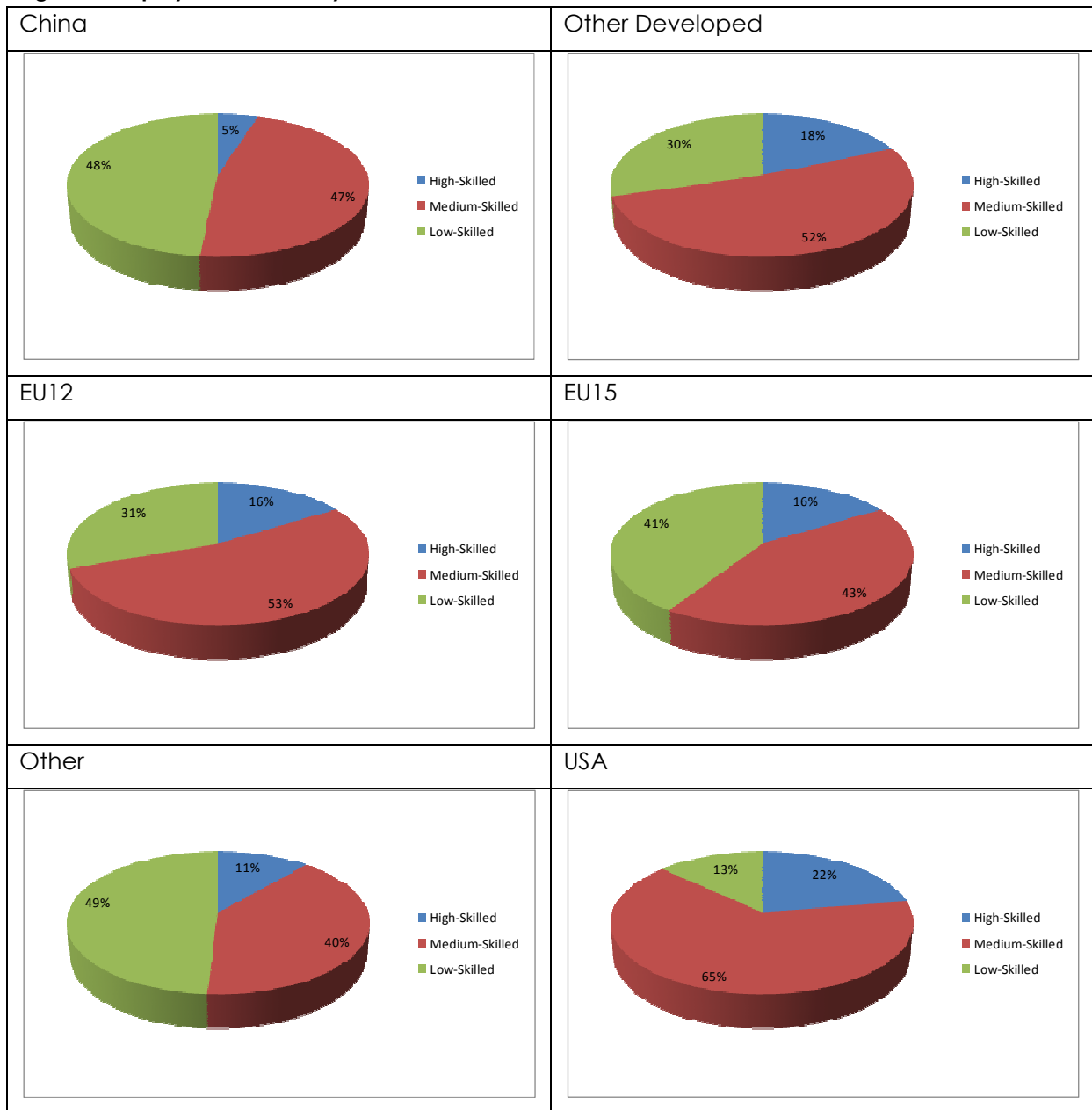


Table 2 extends the discussion of Figure 9 by reporting the shares in 1995 of employment by skill type (in total employment) for each region and industry type. In China and other developing countries low- and high-skilled workers make up by far the largest shares of employment across all industry types, with the high-skilled employment share only becoming significant in medium- and high-tech services. In the USA medium-skilled workers make up the highest shares of employment in all industry types, with the high-skilled share exceeding the low-skilled share in medium- and high-tech manufacturing and services industries. The figures for the other three regions follow those for the USA to a degree, with the medium-skilled shares usually being the largest. In these regions the low-skilled shares remain relatively large however, with the high-skilled share only exceeding the low-skilled share in high-tech services.

Table 2: Shares of Region and Industry Type Employment in 1995 by Skill Level

Region	Industry Type	High-Skilled Employment	Medium-Skilled Employment	Low-Skilled Employment
China	Low-Tech Manufacturing	0.76	24.14	75.10
	Medium-Tech Manufacturing	1.47	37.13	61.40
	High-Tech Manufacturing	3.19	45.16	51.64
	Low-Tech Services	1.31	42.10	56.58
	Medium-Tech Services	5.01	50.25	44.74
	High-Tech Services	12.20	67.00	20.81
Other Developed	Low-Tech Manufacturing	10.48	49.04	40.48
	Medium-Tech Manufacturing	14.73	51.80	33.48
	High-Tech Manufacturing	15.92	51.78	32.30
	Low-Tech Services	13.90	56.48	29.63
	Medium-Tech Services	16.03	54.91	29.06
	High-Tech Services	33.86	47.25	18.89
EU12	Low-Tech Manufacturing	8.08	52.68	39.24
	Medium-Tech Manufacturing	9.10	54.24	36.67
	High-Tech Manufacturing	8.97	54.79	36.24
	Low-Tech Services	12.04	55.63	32.33
	Medium-Tech Services	16.13	56.15	27.73
	High-Tech Services	32.58	47.88	19.54
EU15	Low-Tech Manufacturing	10.88	40.47	48.65
	Medium-Tech Manufacturing	12.80	41.27	45.93
	High-Tech Manufacturing	12.27	42.29	45.44
	Low-Tech Services	8.30	42.62	49.08
	Medium-Tech Services	14.30	45.62	40.08
	High-Tech Services	30.53	42.99	26.48
Other	Low-Tech Manufacturing	4.93	30.49	64.58
	Medium-Tech Manufacturing	8.59	37.52	53.88
	High-Tech Manufacturing	9.12	41.98	48.90
	Low-Tech Services	6.06	36.48	57.46
	Medium-Tech Services	9.21	40.91	49.87
	High-Tech Services	24.16	46.13	29.71
USA	Low-Tech Manufacturing	11.72	65.60	22.68
	Medium-Tech Manufacturing	21.49	64.02	14.49
	High-Tech Manufacturing	26.77	63.37	9.86
	Low-Tech Services	15.72	67.15	17.13
	Medium-Tech Services	19.03	68.87	12.10
	High-Tech Services	35.69	57.84	6.46

Finally, in Table 3 we report the average growth rates in employment and employment by skill type for each region and industry type over the period 1995-2009. This table reveals that total employment has tended to grow across industry types for China and other developing countries, while the results for other regions are mixed. For other developed countries we observe negative total employment growth in most cases, with the only exception being high-tech

services. In the other three regions we observe negative growth rates of total employment in all three manufacturing sectors, and in low-tech manufacturing in most cases in particular, and positive growth rates in the services sectors. In most cases the growth of high-tech services has outstripped that for low- and medium-tech services, with the exception of the EU12 where low-tech services have also grown relatively quickly. Considering results by skill-level we find that the growth in employment in China and other developing countries has been driven to a large extent by the growth in high-skilled employment, and to a lesser extent medium-skilled employment. For the other regions we find that the negative growth rates in total employment are being driven by relatively large negative growth rates for low-skilled employment, with medium-skilled employment also declining in the other developed group and in manufacturing industries across these regions. Results in Tables 2 and 3 would again support therefore a catching-up process, with a catching-up of skill structures by industry for developing countries.

Table 3: Growth Rates of Employment by Region and Industry Type (1995-2009)

Region	Industry Type	Average Growth Rates (%)			
		Total Employment	High-Skilled Employment	Medium-Skilled Employment	Low-Skilled Employment
China	Low-Tech Manufacturing	-0.21	5.76	2.56	-0.48
	Medium-Tech Manufacturing	2.51	9.65	3.35	1.79
	High-Tech Manufacturing	4.13	10.25	4.42	3.25
	Low-Tech Services	3.74	9.39	4.72	2.81
	Medium-Tech Services	2.60	9.49	2.91	1.29
	High-Tech Services	3.22	7.79	1.42	4.52
Other Developed	Low-Tech Manufacturing	-3.15	-0.45	-2.01	-6.80
	Medium-Tech Manufacturing	-1.23	0.75	-0.81	-4.08
	High-Tech Manufacturing	-1.27	1.29	-1.24	-4.16
	Low-Tech Services	-0.53	1.72	-0.34	-3.70
	Medium-Tech Services	-0.97	2.46	-1.33	-4.12
	High-Tech Services	1.83	3.71	1.25	-1.89
EU12	Low-Tech Manufacturing	-2.59	2.51	-2.29	-3.25
	Medium-Tech Manufacturing	-0.59	3.62	-0.47	-2.13
	High-Tech Manufacturing	-0.32	3.97	0.10	-2.32
	Low-Tech Services	2.07	3.72	2.08	1.54
	Medium-Tech Services	0.36	4.47	0.04	-0.88
	High-Tech Services	1.87	3.88	0.93	-0.07
EU15	Low-Tech Manufacturing	-1.91	2.20	-0.61	-3.76
	Medium-Tech Manufacturing	-1.79	1.73	-1.40	-3.89
	High-Tech Manufacturing	-1.22	2.07	-0.63	-3.73
	Low-Tech Services	1.03	3.98	1.84	-0.51
	Medium-Tech Services	0.06	3.55	0.57	-2.17
	High-Tech Services	1.74	3.68	1.41	-1.09
Other	Low-Tech Manufacturing	0.27	3.96	1.89	-0.29
	Medium-Tech Manufacturing	1.49	3.85	2.65	0.07

	High-Tech Manufacturing	0.15	3.43	-0.33	-0.52
	Low-Tech Services	4.14	5.23	5.38	3.31
	Medium-Tech Services	2.39	5.85	3.78	0.67
	High-Tech Services	1.77	4.18	1.67	-0.55
USA	Low-Tech Manufacturing	-1.42	-0.15	-1.32	-2.76
	Medium-Tech Manufacturing	-2.05	-0.69	-2.09	-4.38
	High-Tech Manufacturing	-2.52	0.22	-3.51	-6.05
	Low-Tech Services	0.63	2.14	0.43	0.04
	Medium-Tech Services	-0.02	1.05	-0.05	-1.76
	High-Tech Services	1.33	2.44	0.56	-0.01

4.2 Developments in Wages and Relative Wages

Table 4 reports the average growth rate of average wages for total employment and the growth rates for average wages by skill-type over the period 1995-2008.¹⁶ The data reveal that (nominal) wage growth has been growing in all six of our regions, with the growth rates being relatively high in other developing countries, the EU12 and China, and relatively low in three developed regions (EU15, USA and other developed). More interestingly however are developments in wages by skill-level. In many regions (i.e. China, other developed, USA) we observe that wages for high-skilled workers have grown faster than for the other two types of workers. While the differences are not pronounced for China and other developed countries, the difference in growth rates in the case of the USA is striking with the growth rate of high-skilled workers being more than twice as large as those for medium- and low-skilled workers. For the other three regions we observe a higher growth rate for low-skilled workers in the case of the EU12 and other developing countries and for medium-skilled workers in the case of the EU15. In all of these three cases the differences in growth rates are not pronounced.

Table 4: Regional Growth Rates of Wages and Wages by Skill Type (1995-2008)

Region	Average Growth Rates (%)			
	All	High-Skilled	Medium-Skilled	Low-Skilled
China	9.13	10.00	9.00	7.97
Other Developed	3.55	3.56	3.22	3.01
EU12	11.38	10.37	11.02	11.61
EU15	3.56	3.06	3.33	3.03
Other	15.57	14.80	14.76	15.23
USA	3.91	8.33	3.55	3.15

These differences in wage growth across skill-types imply that there would have been changes in relative wages. These changes can be seen more clearly in the following figures, which plot the relative employment and wages for each year and region. Figure 10 plots the relative wage of high- to low-skilled workers against relative employment of high to low skilled

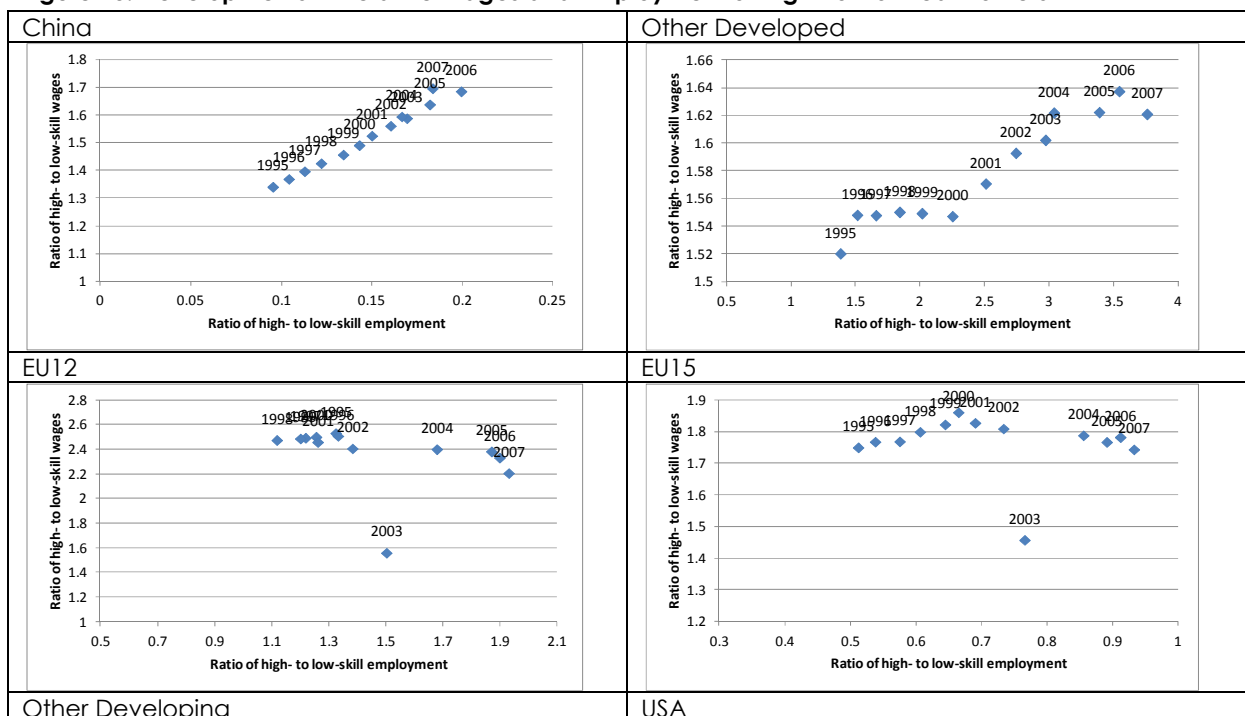
¹⁶) As with the offshoring measures these are simple unweighted averages across industries and time periods.

workers for each of the six regions, while Figure 11 does the same for the ratios of high- to medium-skilled workers.

Considering firstly developments in the ratios of high- to low-skilled workers we see that there have been differences across regions. For China we observe developments similar to those found for the USA in the 1980s, with a strong increase in the relative employment and relative wages of high-skilled workers. This is also the case for the USA, and since 2000, at least, this has also been the case for other developed countries. Prior to 2000 we observe an increase in the ratio of high- to low-skilled employment but no significant changes in relative wages for other developed countries. In the case of the EU12 there has been an increase in the ratio of high- to low-skilled employment and a slight decline in the relative wage of high-skilled workers. For the EU15 we find that both relative wages and relative employment tend to rise up to the year 2000, but after this year relative wages begin to fall (despite a continuing rise in relative employment). Finally, for other developing countries we obtain an interesting pattern with the ratio of high- to low-skill wages declining up to 2000 and then increasing (along with relative employment) after 2000.

When considering the relative wages and employment of high- to medium-skilled workers we find more consistent results for non-EU regions. In the case of China, other developed and developing countries and the USA we observe an increase in the relative wage and relative employment of high- to medium-skilled workers over the entire sample period. For the EU however, the patterns look different. In the case of the EU15 we see since 2000 at least a decline in the relative wage and an increase in the relative employment of high- to medium-skilled workers. For the EU12 we find that during the 1990s there was a decline in the relative wages and employment of high- to medium-skilled workers, while in the 2000s we see an increase in relative employment and a decline in relative wages of high- to medium-skilled workers.

Figure 10: Developments in Relative Wages and Employment of High-Low Skilled Workers



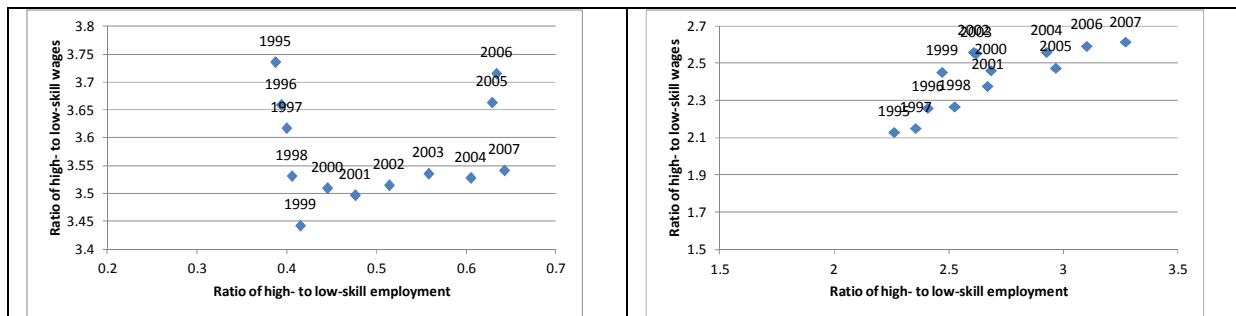
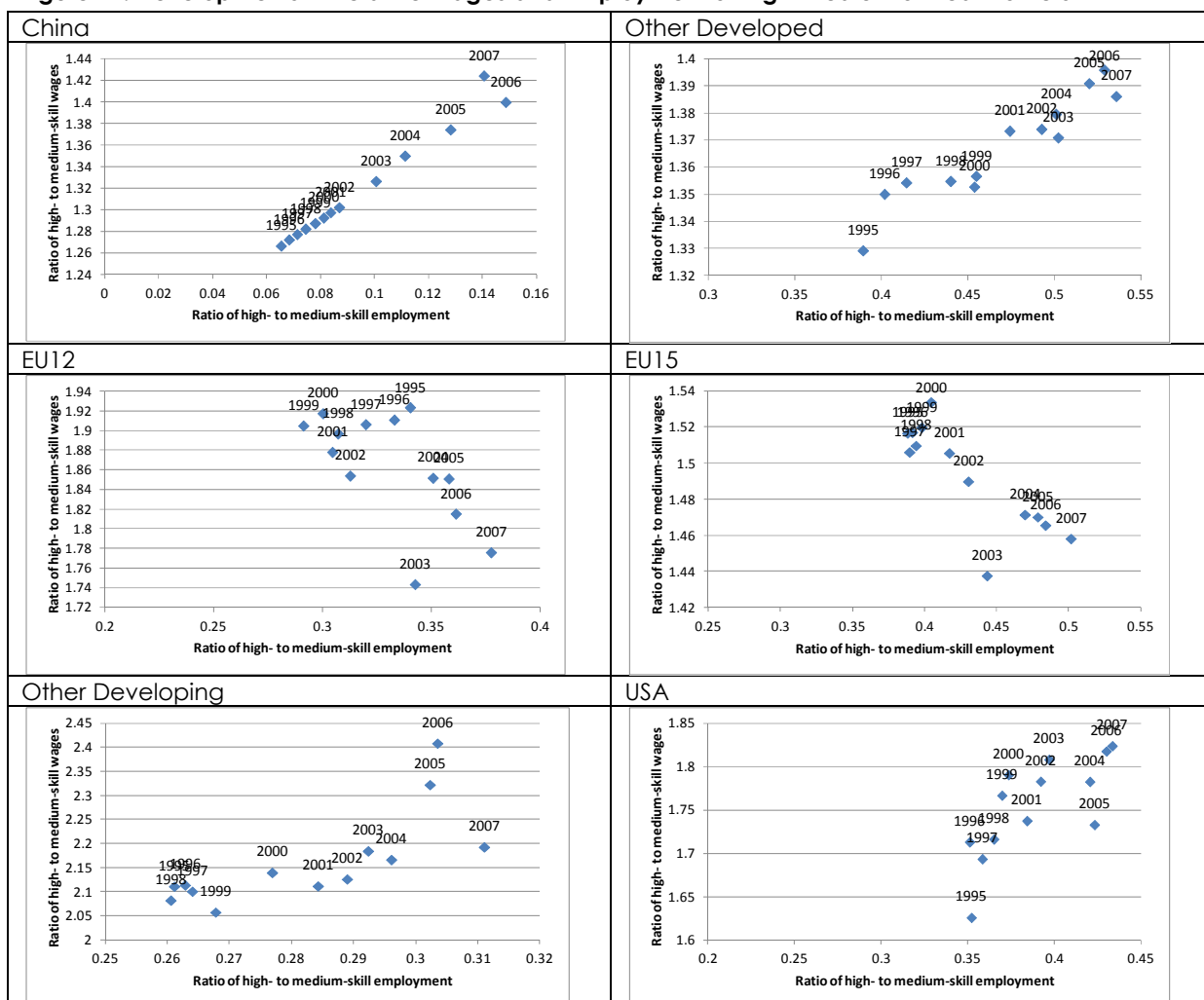


Figure 11: Developments in Relative Wages and Employment of High-Medium Skilled Workers



Box 3: Developments in Austrian Labour Markets

In this box we briefly describe developments in labour markets in Austria. In particular we plot in Figure B3 the ratio of high- to low- skilled employment against the ratio of high-to-low skilled wages and in Figure B4 the ratio of high-to-medium skilled employment against the ratio of high-to-medium skilled wages. The data indicate that while the ratio of high-to-low skilled workers increased consistently over the period 1995-2007, the relative wage rates of high-to-low skilled workers has tended to decline slightly over the period. Similar results are also found when considering the relative wages and employment of high-to-medium skilled workers, with a rise in the ratio of high-to-medium skilled employment and a

decline in the ratio of high-to-medium skilled wages observed. Overall therefore, despite the increased importance of high-skilled workers in total employment (which may be explained by skill-biased technological change, offshoring, or supply-side effects) wages of low- and medium-skilled workers have tended, if anything, to converge towards those of high-skilled workers.

Figure B.3: High-Low Skilled Workers

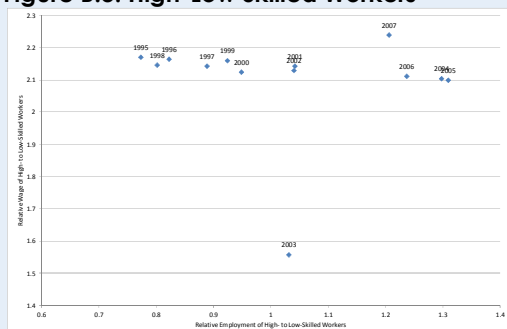
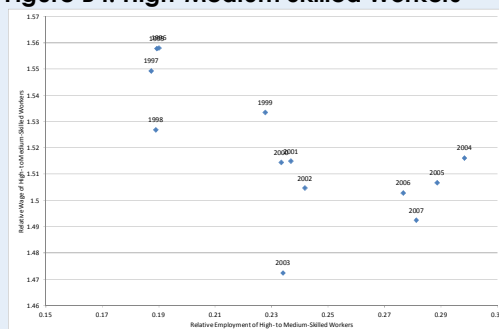


Figure B4: High-Medium Skilled Workers



5. Summary and Implications

In this final section we summarise the major points that come out of the discussion of the empirical literature and the descriptive statistics on offshoring and labour markets above, before drawing some implications and conclusions.

The empirical evidence surveyed in Section 2 is fairly mixed, but would tend to support the following:

- The impact of offshoring on total employment is likely to be limited. This result is likely to hide differences across industries and skill-types however, though the evidence as to which industries and skill-types affected is mixed.
- While there is little evidence on the impact of offshoring on total (average) wages that does exist would tend to suggest that offshoring would lower average wages.
- There also tends to be a negative impact of offshoring on the relative wage (defined as the ratio of high-skilled to low-skilled or of non-production to production workers), though this is not the major cause for the rising skill premium.

Our description of the narrow and broad offshoring measures indicates that:

- Regardless of the offshoring measure used we observe a tendency towards increasing offshoring, though this tendency differs a great deal across countries.
- It can be argued that offshoring has increased relatively quickly in developing and transition, as well as in smaller developed countries, but has increased more slowly in the larger developed countries. That developing and transition countries have witnessed large increases in offshoring suggests that these countries are themselves becoming assemblers and/or are becoming more engaged in the circular production process.

-
- Offshoring – however defined – is heavily concentrated in manufacturing industries (though particularly when measured by the narrow measure) and this remains so despite the growth in offshoring in services industries.
 - Results on the extent and growth of offshoring depend partly upon the measure of offshoring used, with the descriptive results often differing between the narrow and broad offshoring measure.

Considering the major developments in employment in the recent past we find that:

- Employment growth has been positive for all regions except for Other Developed countries.
- In the USA and in Europe this growth has been driven by growth in high-tech services, in particular. In China employment growth has been largest in high-tech manufacturing and services industries, with services also showing relatively high growth rates for other country groups.
- Across industries we observe relatively high growth rates of employment for high-skilled workers. The growth rate of low-skilled employment has been negative in all regions except for China and Other Developing countries.
- Medium- and high-skilled workers dominate employment in all regions except China and Other Developing countries.
- The relative shift of employment towards high-skilled workers is therefore something that we observe across all countries in the sample, though we don't observe absolute declines in low-skilled employment in the developing countries. This process has advanced furthest in the USA where only a small fraction of workers are considered to be low-skilled.

Finally, when considering changes in relative wages we find that:

- While growth rates of wages by skill-level are found to be fairly similar, the growth rates of wages are somewhat higher for medium-skilled workers in the EU15 and for low-skilled workers in the EU12 and Other Developing countries, but in the remaining cases we get the familiar pattern that wages for high-skilled workers have outstripped those for the other two skill types.
- The major exception to this is the USA, where a large gap between the growth rates of wages of high-skilled labour and the growth rates of wages for the other two skill types exist.
- While relative employment of high-skilled labour has risen for all regions over the sample period (both the high-low and high-medium ratios of employment), there have been differences in the development of relative wages across regions.
- In most cases we observe an increasing relative wage, but in EU countries the relative wage has declined somewhat (at least since 2000). This may be related to the European Growth Model where wage developments are more the result of existing regulation and institutionalised wage rather than free market mechanisms.

While it is very difficult to draw any firm conclusions on the (likely future) impact of offshoring on labour markets without more formal statistical analysis, the patterns described above would suggest the following:

- Offshoring continues to be an important activity and it is likely that it will become more so over time. Offshoring is likely to develop fairly rapidly in developing countries in particular, with their rates of offshoring expected to converge towards rates seen in the developed world.
- Offshoring will continue to be centred on specific industries, particularly medium- and high-tech manufacturing industries in which parts and components trade and semi-finished products are important. Despite this – and depending on the measure of offshoring we are concerned with – offshoring in other industries, and in service industries in particular, will continue to grow.
- The skill structure of employment in developing countries differs from that in the developed world. Developing countries tend to be increasing their levels of employment faster than the developed world however, and much of this growth in employment is taking place among high-skilled (and to a lesser extent medium-skilled) workers.
- In both the developed and developing world we have witnessed a shift in employment increasingly towards the service sector. This shift has been relatively strong for China and Other Developing countries, with the growth of employment in high-tech manufacturing also strong in the case of China.
- Over time therefore we would expect to see a convergence in the skill structure of employment across regions and industries.
- Given the descriptive statistics presented above (and the existing empirical evidence) it would be difficult to argue that offshoring impacts negatively upon total employment within a country. The growth rate of employment has been relatively large in both China and Other Developing countries where offshoring was either relatively intensive or where it has been growing relatively quickly in the recent past.
- This doesn't mean that offshoring doesn't impact upon employment however. Much of the growth in employment in China and Other Developing countries has taken place for high-skilled workers, with the average growth rates of high-skilled employment being 10.9 (22.6) times higher than the corresponding growth rates for low-skilled employment in China (Other Developing) countries. This is suggestive of offshoring shifting employment towards more highly-skilled labour, an outcome that would be consistent with some of the recent empirical literature on offshoring and employment.
- It is further difficult to argue that offshoring has been the primary force in increasing the relative wage of high-skilled workers in most regions. Two pieces of evidence presented above would support this stance
 - The USA which has seen the most rapid increase in the relative wage has one of the lowest ratios of (either narrow or broad) offshoring to value added, and also has a relatively low growth rate of offshoring according to these two measures. For the USA therefore, other factors (e.g. skill-biased technological change) must play a major role in influencing relative wages.
 - In both the EU12 and the EU15 we have witnessed declining relative wages despite relatively high rates and growth rates of offshoring in these countries.

Austria for example had one of the highest growth rates of narrow offshoring between 1995-2008, yet relative wages have declined somewhat since 1995. If there is an impact of offshoring on relative wages it would not seem to hold for the EU therefore, a result which may be explained by increased labour market regulation in European countries.

For other regions however, we can't rule out the possibility that offshoring has played a (major) role in increasing the skill premium. China, for example, has witnessed a relatively large increase in the relative wage of high-to-low skilled workers at the same time as offshoring has been growing rapidly. This is also true to an extent in Other Developed and Other Developing countries. In these cases therefore there may exist some evidence indicating that offshoring plays a role in impacting upon relative wages.

References

- Arndt, S., 1997. Globalization and the open economy. *North American Journal of Economics and Finance*, 8, 71-79.
- Attanasio, O., Goldberg, P., and N. Pavcnik, 2004. Trade reforms and wage inequality in Colombia. *Journal of Development Economics*, 74, 331-366.
- Autor, D. and D. Dorn, 2009. This job is "getting old": Measuring changes in job opportunities using occupational age structure. *American Economic Review*, 99, 45-51.
- Autor, D.H., Katz, L.F. and A.B. Krueger, 1998. Computing inequality: Have computers changed the labor market? *Quarterly Journal of Economics*, 113, 1169-1213.
- Berman, E., Bound, J. and Z. Griliches, 1994. Changes in the demand for skilled labor within U.S. manufacturing: Evidence from the Annual Survey of Manufactures. *Quarterly Journal of Economics*, 104, 367-398.
- Berman, E., Bound, J. and S. Machin, 1998. Implications of skill-biased technological change: International evidence. *Quarterly Journal of Economics*, 113, 1245-1280.
- Biscourp, P. and F. Kramarz, 2007. Employment, skill structure and international trade: Firm-level evidence for France. *Journal of International Economics*, 72, 22-51.
- Borjas, G.J., Freeman, R.B. and L.F. Katz, 1997. How much do immigration and trade affect labor market outcomes? *Brookings Papers on Economic Activity*, 1-90.
- Cadarso, M.A., Gomez, N., Lopez, L.A. and M.A. Tobarra, 2008. The EU enlargement and the impact of outsourcing on industrial employment in Spain, 1993-2003. *Structural Change and Economic Dynamics*, 19(1), 95-108.
- Campa, J. and L.S. Goldberg, 1997. The evolving external orientation of manufacturing: A profile of four countries. *Economic Policy Review*, Federal Reserve Bank of New York, 53-81.
- Cappariello, R., 2010. The implications of international outsourcing on employment: Estimates for the Italian manufacturing industry. Mimeo, Bank of Italy.
- Currie, J. and A.E. Harrison, 1997. Sharing the costs: The impact of trade reform on capital and labor in Morocco. *Journal of Labor Economics*, 15, S44-S71.
- Falk, M. and B.M. Koebel, 2002. Outsourcing, imports and labour demand. *Scandinavian Journal of Economics*, 104(4), 567-586.
- Falk, M. and B.M. Wolfmayr, 2005. Employment effects of outsourcing to low wage countries: Empirical evidence for EU countries. WIFO Working Paper no. 262, WIFO.
- Feenstra, R.C., 2010. *Offshoring in the Global Economy: Microeconomic Structure and Macroeconomic Implications*. Cambridge; MA, the MIT Press.
- Feenstra, R.C. and G. H. Hanson, 1996. Foreign investment, outsourcing and relative wages. In R.C. Feenstra, G.M. Grossman, and D.A. Irwin (eds.), *The Political Economy of Trade Policy: Papers in Honor of Jagdish Bhagwati*. Cambridge: MIT Press, pp. 89-127.
- Feenstra, R.C. and G. H. Hanson, 2001. Global production sharing and rising inequality: A survey of trade and wages. NBER Working Paper no. 8372, National Bureau of Economic Research.
- Foster, N., Poeschl, J. and R. Stehrer, 2012. Offshoring and employment levels. Mimeo, Vienna Institute for International Economic Studies.
- Goldberg, P.K. and N. Pavcnik, 2005. Trade, wages, and the political economy of trade protection: Evidence from the Colombian trade reforms. *Journal of International Economics*, 66, 75-105.
- Hijzen, A., Görg, H. and R.C. Hine, 2005. International outsourcing and the skill structure of labour demand in the United Kingdom. *Economic Journal*, 115, 860-878.
- Hijzen, A. and P. Swaim, 2007. Does offshoring reduce industry employment? GEP Research Paper no. 2007/24, The Leverhulme Centre for Research on Globalisation and Economic Policy, the University of Nottingham.
- Hummels, D., Ishii, J. and K-M Yi, 2001. The nature and growth of vertical specialization in world trade. *Journal of International Economics*, 54, 75-96.
- Jones, R. and H. Kierzkowski, 2001. Globalization and the consequences of international fragmentation. In R. Dornbusch (ed.), *Money, Capital Mobility and Trade: Essays in Honor of Robert A. Mundell*. Cambridge, MIT Press.
- Kohler, W., 2004. International outsourcing and factor prices with multistage production. *Economic Journal*, 114, 166-185.
- Krugman, P.R., 2008. Trade and wages, reconsidered. *Brookings Panel on Economic Activity*, Spring, 103-137.
- Lawrence, R.Z. and M.J. Slaughter, 1993. International trade and American wages in the 1980s: Giant sucking sound or small hiccup? *Brookings Paper on Economic Activity*, 161-210.
- Michaels, G., Natraj, A. and J. van Reenen, 2010. Has ICT polarized skill demand? Evidence from eleven countries over 25 years. Mimeo, London School of Economics.
- Milner, C. and P. Wright, 1998. Modelling labour market adjustment to trade liberalisation in an industrialising economy. *Economic Journal*, 108, 509-528.
- OECD, 2007. *Offshoring and employment: Trends and policy implications*. Paris, OECD.
- Pavcnik, N., Blom, A., Goldberg, P. and N. Schady, 2004. Trade liberalization and industry wage structure: Evidence from Brazil. *World Bank Economic Review*, 18, 319-344.
- Rama, M., 2003. Globalization and the labor market. *World Bank Research Observer*, 18, 159-186.
- Revenge, A., 1997. Employment and wage effects of trade liberalization: The case of Mexican manufacturing. *Journal of Labor Economics*, 15, S20-S43.
- Robertson, R., Brown, D., Pierre, G. and M.L. Sanchez-Puerta, 2009. *Globalization, Wages, and the Quality of Jobs*. The World Bank, Washington, DC.
- Strauss-Kahn, V., 2003. The role of globalization in the within-industry shift away from unskilled workers in France. NBER Working Paper no. 9716, National Bureau of Economic Research.

Wacziarg, R. and J.S. Wallack, 2004. Trade liberalization and intersectoral labor movements. *Journal of International Economics*, 64, 411-439.

Winters, L.A., McCulloch, N. and A. McKay, 2004. Trade liberalization and poverty: The evidence so far. *Journal of Economic Literature*, 42, 72-115.

Yeats, A.J., 2001. Just how big is global production sharing? In S.W. Arndt and H. Kiezowski (eds.), *Fragmentation: New Production Patterns in the World Economy*, Oxford, Oxford University Press.

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FIW Specials are published irregularly by the "Research Centre International Economics" (FIW) and discuss in detail relevant topics in International Economics. The FIW is sponsored by the Federal Ministry of Economy, Family and Youth (BMWFJ) in the framework of the Austrian Federal Government's "Internationalisation Drive" and is realised by the co-operation of three research institutions (WIFO, wiiw, WSR). FIW provides access to a series of databases and a research platform in the field of International Economics.

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Appendix

Appendix 1 – Countries Included in the WIOD Dataset

Country	Code	Region
Australia	aus	Other Developed
Austria	aut	EU15
Belgium	bel	EU15
Bulgaria	bgr	EU12
Brazil	bra	Other
Canada	can	Other Developed
China	chn	China
Cyprus	cyp	EU12
Czech Republic	cze	EU12
Germany	deu	EU15
Denmark	dnk	EU15
Spain	esp	EU15
Estonia	est	EU12
Finland	fin	EU15
France	fra	EU15
Great Britain	gbr	EU15
Greece	grc	EU15
Hungary	hun	EU12
Indonesia	idn	Other
India	ind	Other
Italy	ita	EU15
Japan	jpn	Other Developed
Korea	kor	Other Developed
Lithuania	ltu	EU12
Luxembourg	lux	EU15
Latvia	lva	EU12
Mexico	mex	Other
Malta	mlt	EU12
Netherlands	nld	EU15
Poland	pol	EU12
Portugal	prt	EU15
Romania	rom	EU12
Russia	rus	Other
Slovakia	svk	EU12
Slovenia	svn	EU12
Sweden	swe	EU15
Turkey	tur	Other
Taiwan	twn	Other Developed
United States of America	usa	USA

Appendix 2 – Industries and Industry Classification

Code	Industry	Type
A+B	Agriculture, Hunting, Forestry and Fishing	M/Low
C	Mining and Quarrying	M/Med
15+16	Food, Beverages and Tobacco	M/Low
17+18	Textiles and Textile Products	M/Low
19	Leather, Leather and Footwear	M/Low
20	Wood and Products of Wood and Cork	M/Low
21+22	Pulp, Paper, Paper, Printing and Publishing	M/Med
23	Coke, Refined Petroleum and Nuclear Fuel	M/Med
24	Chemicals and Chemical Products	M/High
25	Rubber and Plastics	M/Med
26	Other Non-Metallic Mineral	M/Low
27+28	Basic Metals and Fabricated Metal	M/Low
29	Machinery, Nec	M/High
30+33	Electrical and Optical Equipment	M/High
34+35	Transport Equipment	M/High
36+37	Manufacturing, Nec; Recycling	M/Med
E	Electricity, Gas and Water Supply	S/Med
F	Construction	S/Low
50	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel	S/Low
51	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles	S/Med
52	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods	S/Med
H	Hotels and Restaurants	S/Low
60	Inland Transport	S/Med
61	Water Transport	S/Med
62	Air Transport	S/High
63	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies	S/Med
64	Post and Telecommunications	S/Med
J	Financial Intermediation	S/High
70	Real Estate Activities	S/Med
71+74	Renting of M&Eq and Other Business Activities	S/High
L	Public Admin and Defence; Compulsory Social Security	S/High
M	Education	S/High
N	Health and Social Work	S/High
O	Other Community, Social and Personal Services	S/High
P	Private Households with Employed Persons	S/High

Notes: M/Low – Low-tech manufacturing; M/Med – Medium-tech manufacturing; M/High – High-tech manufacturing; S/Low – Low-tech services; S/Med – Medium-tech services; S/High – High-tech services