CESPRI

Centro di Ricerca sui Processi di Innovazione e Internazionalizzazione
Università Commerciale "Luigi Bocconi"
Via R. Sarfatti, 25 – 20136 Milano
Tel. 02 58363395/7 – fax 02 58363399
http://www.cespri.unibocconi.it

Rosario Crinò

Offshoring, Multinationals and Labor Market:

A Review of the Empirical Literature

WP n. 196 **January 2007**

Stampato in proprio da:
Università Commerciale Luigi Bocconi – CESPRI Via Sarfatti, 25 20136 Milano
Anno: 2007

Offshoring, Multinationals and Labor Market: A Review of the Empirical Literature

Rosario Crinò*

Università degli Studi di Milano - DEAS

CESPRI - Università Bocconi

Abstract

This paper reviews the existing empirical literature on the effects of offshoring and foreign activities of Multinational Enterprises (MNEs) on the labor markets of developed countries. Available results provide robust evidence in support of the fear that material offshoring worsens wage inequality between skilled and unskilled workers; on the contrary, results are still too ambiguous to support concerns that material offshoring raises the elasticity of unskilled labor demand and produces adverse short-run employment dynamics. Service offshoring does not reduce total labor demand significantly and does not pose serious threats to human capital accumulation. Finally, MNEs tend to substitute domestic labor with foreign labor, but the relationship is weak; moreover, substitutability is mainly driven by horizontal, market-seeking, Foreign Direct Investments.

Keywords: Offshoring, Multinational Enterprises, Labor Market

JEL codes: F16, F23, J31

*Contacts: CESPRI - Università Bocconi. Via Sarfatti 25, 20136 Milan (Italy). Email. rosario.crino@unibocconi.it

1. Introduction and motivation

During the last two decades, opponents to globalization have directed harsh protests against offshoring and foreign activities of domestic Multinational Enterprises (MNEs), arguing - among other things - that they may produce severe deterioration in the economic fortunes of employees in developed countries. Opposition exacerbated in the last few years, reaching its height at the onset of the 2004 U.S. presidential election (Amiti and Wei, 2005a; Mankiw and Swagel, 2006). The opposition, however, has been based on specific examples of firms that have fired domestic employees or exposed them to wage cuts, after the decision to expand operations abroad. Similar experiences are definitely harsh from the perspective of the workers involved. Nonetheless, from the viewpoint of an economist, they do not probably suffice to conclude that offshoring and MNEs are bad threats for the national economy and have to be impeded with the right policy interventions. Large evidence, in fact, suggests the existence of a positive link between offshoring and MNEs, on one hand, and productivity growth, on the other (Mann, 2003; Amiti and Wei, 2006; Olsen, 2006). By contrast, the labor market effects of offshoring and MNEs activities could end up being small for the national economy, once accounting for the complete adjustment in a general equilibrium perspective. If this were so, the most effective way of dealing with offshoring and foreign activities of MNEs would be to design appropriate wage insurance schemes and retraining programs for the affected workers, rather than trying to restrict the access of firms to these internationalization strategies. This would allow governments to spread more evenly the overall benefits of offshoring and MNEs activities across domestic workers. Based on this argument, this paper tries to draw some conclusions about the magnitude and nature of the labor market effects of offshoring and MNEs, by reviewing the existing *empirical* literature focusing on *developed* countries.

To clarify terminology, I will refer to offshoring as the practice through which firms fragment their production processes and relocate some stages abroad, with the main aim of exploiting cross-country cost differentials due to relative differences in resource endowments[1]. I will specialize the definition to *material offshoring* when referring to foreign relocation of purely productive stages (like assembly or production of specific intermediate components). I will instead specialize the definition to *service offshoring* when referring to foreign relocation of service tasks (like call center operations, back office activities, accounting, and the like). Turning to MNEs, I will often exploit the standard classification based on the horizontal or vertical nature of Foreign Direct Investments (FDI): vertical FDI are meant to transfer stages of production abroad to exploit cost differentials, whereas horizontal FDI are

meant to replicate abroad the same activities as those performed domestically, with the aim of serving local or neighboring markets. Clearly, the relationship between offshoring and foreign activities of MNEs is not exhaustive: neither offshoring takes place only through FDI, nor do MNEs exist only to arbitrage over cross-country cost differentials. Offshoring can take place also through arm's length contracts with foreign unaffiliated parties [in which case, it is usually referred to in the literature as *international outsourcing* (Helpman, 2006)]; moreover, when it does occur through FDI, offshoring leads to vertical FDI . This distinction is clear in theory[2]. In common discussions, however, offshoring and foreign activities of MNEs are often taken (erroneously) as alternative definitions of the same phenomenon: the common belief is that offshoring can take place only within the boundaries of MNEs (that is, between parents and affiliates) and that the only aim of MNEs is to fragment production internationally. Instead, most of today's offshoring occurs through arm's length contracts between unaffiliated parties and most of today's outward FDI from developed countries are horizontal. This means that the labor market effects of MNEs activities and offshoring are likely to be quite different from each other and a careful analysis should treat them separately. I will take this approach in the paper[3].

It is already well known that both offshoring and FDI have sharply risen in the last decades. Figure 1 shows the growth in world FDI outflows between 1975 and 2005, as well as the growth in FDI outflows from eight developed countries that accounted for 60% of the total in 2005. The figure shows striking evidence of dramatic FDI growth since the mid-1980s, especially compared with GDP growth; moreover, at least until 2000, the trend in worldwide outflows has almost entirely been driven by that in outflows from developed countries[4]. During the same period, offshoring has become a widespread practice in most developed countries, especially in the manufacturing sector. The solid line in Figure 2 shows the trend in material offshoring by U.S. manufacturing sectors between 1972 and 2002. Following Feenstra and Hanson (1996, 1999), I proxy material offshoring with the share of imported intermediate goods on total non-energy inputs purchases[5]. This share has increased from 5.1% in 1972 to 18.1% in 2002. Similar trends have occurred in almost all industrialized economies (Feenstra, 1998). For instance, Campa and Goldberg (1997) show that between 1974 and 1993 the above share has risen from 15.9 to 20.2 percent in the Canadian manufacturing sector, and from 13.4 to 21.6 percent in the U.K. industrial sector. The picture does not change if one uses an indicator of vertical specialization as an alternative proxy for material offshoring: vertical specialization - defined as the share of exports' value accounted for by imported inputs (Hummels *et al.*, 2001) - has soared in most developed countries between 1970 and 1990, passing from 3.9 to 7.4 percent in the U.S., from

14.3 to 19.1 percent in the U.K., from 17.5 to 23.2 percent in Canada, from 14.0 to 18.7 percent in France and from 14.2 to 16.3 percent in Germany (Hummels *et al.*, 1998). More recently, thanks to improvements in information and communication technologies that have eased the tradability of services (Freund and Weinhold, 2002; Lipsey, 2006), the practice of offshoring has been extended to service tasks. The dashed line in Figure 2 shows a proxy for service offshoring by U.S. manufacturing sectors between 1995 and 2002. The proxy is constructed along the same lines as that for material offshoring, that is, by computing the share of imported private services on total non-energy inputs purchases. While data are unavailable for the pre-1995 period, the figure shows that service offshoring was virtually close to zero in 1995. Since then, however, service offshoring rose exponentially, gaining roughly three percentage points in less than a decade. Similar patterns have occurred in the U.K. (Amiti and Wei, 2005a) and much anecdotal evidence suggests that service offshoring has been growing rapidly also in other developed countries.

The upsurge in offshoring and FDI outflows has raised strong concerns in developed countries about the potentially severe detrimental effects of both phenomena on the economic fortunes of domestic employees. In this paper, I discuss such concerns by reviewing the relevant literature about the effects exerted by material and service offshoring and by foreign activities of MNEs on the labor markets of developed countries.

I start from material offshoring in Section 2. During the 1980s and the first half of the 1990s, the strong increase in wage inequality and in relative skilled employment has been taken as evidence that material offshoring hurts unskilled workers employed in manufacturing, by easing the possibility of substituting them with imported intermediate inputs from less developed countries; moreover, material offshoring has been blamed to reduce the bargaining power of the unskilled, by making their labor demand more elastic, and to expose these workers to higher risk of job losses. Empirical studies have provided evidence in favor of a positive effect of material offshoring on wage inequality. This effect is qualitatively and quantitatively similar to that of skill-biased technical change. On the contrary, evidence is still inconclusive on the possibility that material offshoring makes unskilled labor demand more elastic, as well as on the hypothesis that it increases the risk of job losses.

I turn to service offshoring in Section 3. The weak labor market dynamics experienced by the U.S. and most other developed countries after the dot-com bust of the late 1990s has triggered oppositions to service offshoring: firms have been blamed to shift jobs abroad, thereby contributing to the labor market weakness. More recently, service offshoring has been blamed to pose a serious threat to *skilled* labor demand, and, through this channel, to the whole process of human capital accumulation.

Existing empirical evidence, however, do not support either of these concerns: service offshoring has insofar exerted no significant effect on total labor demand, and has actually fostered relative skilled labor demand.

I deal with the labor market effects of foreign activities of MNEs in Section 4. The main fear manifested by opponents of globalization is that national MNEs expand their foreign operations to take advantage of lower labor costs in developing countries, and, through this channel, substitute domestic labor with cheaper foreign labor. This concern, however, is at odds with empirical findings: although some evidence exists in favor of a substitutability relationship between domestic and foreign labor employed by MNEs, such a relationship seems too weak for the latter to pose serious threats to national workers; moreover, substitutability is mainly driven by horizontal and market seeking, rather than by vertical and cost-saving FDI.

In section 5, I finally draw a few conclusions from the existing empirical evidence and provide a few suggestions for future research.

The main contribution of this paper is to provide a comprehensive view of the labor market effects of offshoring and MNEs activities. By doing so, the paper improves upon previous surveys, that have instead taken a more partial perspective and analyzed just one of the two phenomena in isolation: either offshoring or MNEs. The most notable examples of such surveys are those by Feenstra (2004, chp. 4), Feenstra and Hanson (2003) and Hijzen (2005) on material offshoring and those by Barba Navaretti, Venables *et al.* (2004, chp. 9) on MNEs[6]. A second contribution of the paper is the specific attention devoted to service offshoring. Although still limited, the literature on this topic has been growing rapidly in recent years, and some satisfactory conclusions can already be drawn on some of the most relevant concerns for developed countries; moreover, given the importance and the novelty of the topic, as well as its expected diffusion in the near future, reviewing the state of the art in the literature may be useful as a basis for future research.

2. Material offshoring

Since material offshoring entails foreign relocation of unskill-intensive production stages, the fraction of the workforce that is potentially more at risk in developed countries is represented by the unskilled. The largest stream of empirical contributions has analyzed the role played by material offshoring in explaining the declining fortunes of unskilled workers in the last two decades, as symptomized by worsening wage inequality between them and the skilled. Fewer studies exist also on other two

related issues: the possibility for material offshoring to make unskilled labor demand more elastic, and to thereby lower the bargaining power of the unskilled; the short-run adjustment costs to material offshoring, in terms of job losses.

2.1. Effects on relative skilled labor demand and wage inequality

2.1.1. Setting the issue

During the 1980s and the first half of the 1990s, wage inequality between skilled and unskilled manufacturing workers has worsened in most industrialized countries. For instance, the wage ratio between skilled (non-production) and unskilled (production) workers increased by 7% in the U.S. between 1980 and 1995. During the same period, relative skilled employment increased as well: between 1980 and 1995, the employment ratio rose by 8% in the U.S. (Figure 3). As a consequence, the non-production workers shares of both wage bill and employment rose too: in the U.S., they increased by 9% and 6%, respectively[7]. Similar trends have taken place in almost all industrialized countries. In general, economies characterized by flexible labor markets have experienced sharp upsurges in both wage inequality and relative employment of the skilled: this is true, for example, for the U.K. (Machin, 1996) and for Hong Kong (Hsieh and Woo, 2005). Instead, economies characterized by relatively more rigid labor markets have seen wage inequality increasing at slower pace, but still experienced sharp increases in relative skilled employment (Freeman and Katz, 1995; Berman *et al.*, 1998; Katz and Autor, 1999; Krugman, 2000).

There is by now widespread agreement among scholars that the contemporaneous rise in relative wages and employment has been the result of an outward shift in relative skilled labor demand (Bound and Johnson, 1992; Katz and Murphy, 1992; Autor *et al.*, 2005). Fewer consensus exists instead on the determinants of such a shift. One point is extremely relevant in this respect: in all countries, the shift has occurred *within-industry*. This means that relative skilled labor demand has shifted outward because industries have raised their skill intensity of production, and not because high skill-intensive sectors have gained employment shares at the expense of low skill-intesive sectors (Berman *et al.*, 1994; Machin, 1996; Bernard and Jensen, 1997; Dunne *et al.*, 1997; Berman *et al.*, 1998; Osburn, 2001). Therefore, the explanations for the shift have to be searched for among those factors that could have acted within-industry. This has initially vindicated international trade: according to the neoclassical redistributional argument based on the Stolper-Samuelson theorem, in fact, trade works between-industry, by making developed countries specialize in high skill-intensive productions. There are at least other two pieces of evidence running against the neoclassical argument for trade: since

the early 1980s, 1) relative prices of skill-intensive goods have been declining and 2) skill-intensity of production has been increasing (Lawrence and Slaugther, 1993; Bhagwati and Deheja, 1994; Leamer, 1996; Anderton and Brenton, 1999a; Desjonqueres *et al.*, 1999; Krugman, 2000)[8].

Economists have initially identified in technological progress the main culprit for the outward shift in relative skilled labor demand. Since new technologies tend to complement skilled labor and substitute unskilled labor, their labor demand effects can be biased in favor of the skilled (*skill-biased technical change*, SBTC). For this reason, the fast technological progress occurred since the early 1980s could have explained part of the outward shift in relative skilled labor demand (Haskel and Slaughter, 2002; Acemoglu, 2002a). Some existing empirical studies have indeed confirmed this prediction and identified in SBTC the most important explanation in most developed countries (see, among others, Berman *et al.*, 1994; Autor *et al.*, 1998; Berman *et al.*, 1998; Machin and van Reenen, 1998; Haskel and Heden, 1999).

The interest in international trade has recently renewed. Three streams of theoretical literature have in fact identified new channels through which trade could cause an outward shift in relative labor demand within-industry. According to the first stream, international trade triggers SBTC (Neary, 2002; Acemoglu, 2002b, 2003; Thoenig and Verdier, 2003; Ekholm and Midelfart Knarvik, 2005). According to the second stream, based on the new trade theories, international trade triggers skilled-biased scale effects (Epifani and Gancia, 2004, 2006). Finally, according to the third stream, it is trade in intermediate goods and material offshoring to matter (Feenstra and Hanson, 1996, 1999, 2003). The latter channel will be the focus of this section.

How can material offshoring induce a within-industry shift in relative skilled labor demand? Briefly, suppose that firms have the opportunity to fragment their production processes internationally. Following standard factor-proportion considerations, they will tend to relocate unskill-intensive stages of production in less-developed economies, in order to exploit their relatively larger endowment of unskilled labor. This practice gives rise to *trade in intermediates*, because goods produced in different locations have to be collected in a single place to be assembled into the final good. The effects on relative labor demand are straightforward: since the stages of production moved abroad make intensive use of unskilled-labor, the skill intensity of home production rises and relative skilled labor demand shifts outward. This effect occurs within-industry, because domestic sectors increase their skill-intensity of production[9]. Hence, material offshoring may produce labor demand effects which are *observationally* equivalent to those of SBTC (Feenstra, 1998)[10]. A large stream of empirical studies has flourished since the mid-1990s with the aim of testing these theoretical predictions. The main

result is that material offshoring did, in fact, contribute to shift relative skilled labor demand outward, thereby worsening wage inequality and raising relative employment of the skilled; this is true not only for the U.S. and the U.K., but generally holds for most developed countries.

2.1.2. Empirical framework and measurement of offshoring

Assume that a representative firm in industry i ($i = 1, ..., N$) produces a given amount of output (Y) using skilled (S) and unskilled (U) labor; in the short-run, capital (K) is treated as a quasi-fixed input. Assuming that the short-run variable cost function of the firm has the translog form, Shepard's lemma yields an expression for the optimal demand of skilled labor in share-form:

$$SH_{S,i} = \alpha_S + \alpha_{SU} \ln \left(\frac{w_S}{w_U} \right)_i + \alpha_{SY} \ln Y_i + \alpha_{SK} \ln K_i + \sum_{z=1}^{Z} \alpha_{Sz} \ln z_i \tag{2.1}$$

where $SH_{S,i}$ is the share of skilled labor in total variable costs (wage bill), w stands for wage and $z = 1, ..., Z$ are shift-factors that can affect total costs and thus optimal demand for skilled labor[11]; among them, these studies include a proxy for the intensity of material offshoring ($moss$). Estimating equation (2.1) allows to identify the parameters α_{Sz}. If $\alpha_{S,moss} > 0$, material offshoring raises the share of skilled labor in total variable costs; this is tantamount to say that material offshoring shifts relative skilled labor demand outward.

How can material offshoring be measured? Feenstra and Hanson (1996) propose to use imports of intermediate inputs as a proxy. The argument is simple: part of the goods whose production is offshored have to be shipped back to the home country to be either assembled into a final product or sold under the brand name of domestic firms. Hence, material offshoring is positively correlated with imports of intermediate inputs, and the latter can be used as a proxy. Notice that this definition uses the term "intermediate inputs" loosely, because it includes both intermediate components of a broader production process that will be completed at home and final goods entirely produced abroad but sold under the brand name of national firms.

Imported intermediate inputs by industry i (III_i) can be estimated by combining input-output tables and final imports data as follows:

$$III_i = \sum_{k=1}^{K} [\text{input purchases of good } k \text{ by industry } i] * \left[\frac{\text{imports of good } k}{\text{apparent consumption of good } k} \right]$$

where "input purchases of good k by industry i" can be retrieved from input-output accounts, while "apparent consumption of good k" can be computed as production + imports - exports of good k. The second right-hand side term is the share of apparent consumption of good k accounted for by imports in the economy as a whole. Assuming that this share is constant across sectors, it can be applied to the overall amount of good k used as an intermediate input in each industry (i.e., the first right-hand side term) to obtain a proxy of imported intermediate inputs at the industry-level. Notice that, due to the use of final imports data in the second right hand side term, III_i consists both of parts and components to be assembled at home and of final goods to be sold under the brand name of national firms. With this measure at hand, $moss_i$ can finally be obtained by normalizing III_i with total purchases of non-energy inputs (NE) by industry i[12]:

$$moss_i = \frac{III_i}{NE_i} \tag{2.2}$$

A few comments on (2.2) are in order. First, notice that, because of the use of aggregate, economy-wide, imports data, (2.2) does not allow to disentangle offshoring through arm's length contracts from offshoring through production transfer within MNEs: both offshoring modes, in fact, raise III_i. In the next section, I will review a few studies that use measures of production transfer within MNEs to capture the second offshoring mode. Second, (2.2) can be specialized to proxy both a *narrow* and a *broad* concept of offshoring (Feenstra and Hanson, 1999): narrow offshoring accounts only for imports of intermediate inputs from the same industry, whereas broad offshoring accounts for imports of intermediate inputs from all industries.

Although (2.2) is probably the best proxy for material offshoring, data limitation has often prevented researchers from using it. In what follows, I will therefore take (2.2) as the ideal measure and describe alternative proxies when reviewing those studies that could not rely on (2.2).

2.1.3. Results

Countries with flexible labor markets: U.S., Canada, U.K. and Hong Kong As I mentioned, in countries with flexible labor markets, the outward shift in relative skilled labor demand has brought about sharp upsurges in both relative wages and relative employment of the skilled. Existing literature has focused on four cases: U.S., Canada, U.K. and Hong Kong.

Feenstra and Hanson (1996) compute *broad* material offshoring for 435 U.S. manufacturing industries over the period 1972-94; Feenstra and Hanson (1999) extend this computation to 447 industries

from 1972 to 1990 and calculate also *narrow* material offshoring. In both cases, skilled and unskilled workers are proxied by non-production and production workers respectively. Coefficient estimates from (2.1) suggest that the rise in broad material offshoring has explained from 32 to 53 percent of the observed increase in the non-production workers share of wage bill during the 1980s (Feenstra and Hanson, 1996); narrow material offshoring accounted instead for 13 to 23 percent of the increase (Feenstra and Hanson, 1999). These figures imply that, during the 1980s, broad offshoring has led to an annual increase in the non-production workers share of wage bill of 0.12-0.20 percent, whereas narrow offshoring has induced an annual rise of 0.05-0.09 percentage points. These results are confirmed by Anderton *et al.* (2002a) and Anderton and Oscarsson (2006).

Similar evidence is found for Canada by Yan (2006). Using data on 84 manufacturing industries between 1981 and 1996 and proxing broad material offshoring with the log of imported inputs in each industry - i.e., only the numerator of (2.2) - the author finds that broad material offshoring led to an annual increase of 0.12 percentage points in the non-production workers share of wage bill. The author also estimates equation (2.1) using the non-production workers share of total *employment* as the regressand, a practice often used by studies on European countries (see below). Results show that material offshoring led to a 0.10 annual percentage increase in this share.

An important role for material offshoring in explaining the outward shift in relative skilled labor demand has been detected also in the U.K.. Anderton and Brenton (1999b) analyze 11 textile and non-electrical machinery industries between 1970 and 1983. The lack of data on imported intermediate inputs for early years prevents the authors from using (2.2) as a proxy for material offshoring; as an alternative, they proxy material offshoring with import competition from low-wage countries, defined as the ratio between imports from these economies and total industry's consumption: this measure could be a good proxy in the case of the U.K., whose national firms have generally moved their low skill-intensive stages of production to low-wage countries, relatively better endowed with unskilled labor. Results show that the effects of material offshoring have been particularly important in the less skill-intensive textile sector: in this industry, material offshoring has in fact accounted for about 40% of the rise in the skilled labor share of wage bill[13]; when equation (2.1) is estimated using the skilled labor share of employment as the dependent variable, material offshoring is found to explain up to one third of the observed increase in this share.

Hsieh and Woo (2005) find comparable evidence also for Hong Kong, using a panel of 54 manufacturing industries over the period 1971-96. The authors focus just on offshoring to China, which has sharply increased since 1980, and proxy it by means of two alternative measures: the first is similar

to (2.2), but with only imported intermediates from China at the numerator; the second, instead, is the share of total imports from China on industry's consumption - i.e., import competition from China. Results show that material offshoring has been an important determinant of the outward shift in relative skilled labor demand occurred in Hong Kong, explaining as much as 40-50% of the increase in the non-production workers share of wage bill during the period.

Summing up, in countries characterized by flexible labor markets, rising material offshoring during the 1980s explained a large part of the outward shift in relative skilled labor demand and of the resulting increase in wage inequality and relative employment of the skilled.

Countries with less flexible labor markets: the case of Europe In Europe, due to lower wage flexibility, the outward shift in relative labor demand has caused less dramatic increases in wage inequality, accompanied however by significant upsurges in relative skilled employment and in unemployment for the unskilled. Several existing studies have taken into account the higher wage rigidity in these economies by slightly modifying the estimating equation in (2.1) through substitution of the skilled labor share of wage bill with either the skilled labor share of employment or the relative employment of the skilled. Due to data limitation, these studies have often been prevented from using (2.2) as a proxy for material offshoring, and thereby forced to found alternative measures. Notwithstanding these changes from the baseline framework, results for Europe are consistent with those for countries with more flexible labor markets: also in Europe has material offshoring played a large role in shifting relative skilled labor demand outward.

Two studies focus on Sweden (Anderton *et al.*, 2002b; Hansson, 2000). Both measure material offshoring as import competition from low-wage countries, defined as the ratio of imports from non-OECD Members and industry's consumption; however, while Hansson (2000) uses nominal variables to construct the offshoring proxy, Anderton *et al.* (2002b) use variables in real terms. This distinction turns out to be extremely relevant. In fact, when constructed in nominal terms, this offshoring proxy need not increase when import competition rises. For instance, if imports prices decreased due to tougher import competition, the proxy for offshoring could either rise or fall, depending on the import demand elasticity; moreover, increasing import competition could lead domestic producers to raise the quality, and thus the price, of their products, thereby boosting the denominator of the formula and eventually lowering the value of the offshoring proxy. Indeed, using a panel of 34 manufacturing industries over the period 1970-93, Hansson (2000) finds that the proxy for material offshoring measured in nominal terms explained only a limited fraction of the outward shift in relative skilled labor

demand: precisely, it explained at most 5% of the observed increase in the skilled labor share of total employment[14]. By contrast, using a panel of 41 manufacturing industries over the period 1975-93, Anderton *et al.* (2002b) find that the proxy for material offshoring measured in real terms had somewhat larger effects, explaining roughly 25% of the observed increase in the skilled (non-production) labor share of total wage bill and 15% of the observed increase in the share of total employment.

Similar evidence is found also for France by Strauss-Kahn (2003) and for Spain by Minondo and Rubert (2006). Strauss-Kahn (2003) uses a panel of 50 French industries (including manufacturing, agriculture and mining) over the period 1977-93 and computes narrow material offshoring as in (2.2). The estimating equation is a slight modification of (2.1), with the within-industry contribution to the change in the skilled labor share of wage bill as the regressand. Results show significant effects of material offshoring: the latter has accounted for 11% of the within-industry increase in the skilled-labor share of wage bill between 1977 and 1985, and for 25% over the period 1985-93. Results are robust to the distinction of material offshoring to non-OECD (low-wage) and OECD (high-wage) countries, though material offshoring to non-OECD countries has exerted somewhat larger effects. Minondo and Rubert (2006) reach similar conclusions by using a panel of 12 Spanish manufacturing industries over the period 1986-94 and estimating equation (2.1) with the skilled / unskilled employment ratio as the dependent variable. They find a positive contribution of narrow material offshoring to the observed increase in relative employment of the skilled[15]. Also in this case, offshoring to low-income countries has exerted somewhat stronger effects on relative skilled labor demand.

The effects of material offshoring on relative skilled labor demand have been analyzed also in a set of countries in Central Europe: Austria, Italy and Germany. The interest in this countries arose from the sharp increase in material offshoring to many formerly centrally planned economies in Eastern Europe (CEECs, henceforth) since 1990. Indeed, results from these studies attribute a substantial role to material offshoring to the CEECs. Starting from Austria, Egger and Egger (2005) focus on 20 manufacturing industries between 1990 and 1998 – the period right after the fall of the Communist regime - and compute narrow offshoring as in (2.2), but using only imported intermediates from the CEECs at the numerator. The estimating equation differs from (2.1) in two respects. First, in order to account for wage rigidities in the Austrian labor market, relative employment of the skilled is used as the regressand instead of the skilled labor share of wage bill[16]. Second, in order to account for indirect effects of offshoring through inter-industry spillovers, an additional variable is included among the regressors: the weighted skilled / unskilled employment ratio, with weights constructed using input-output coefficients, that gauge the degree of industrial interdependence. Results show that offshoring

to the CEECs did increase relative skilled labor demand; this effect has generally been magnified by inter-industry spillovers. A simulation exercise shows that an 87% increase in offshoring to the CEECs would have augmented the skilled / unskilled employment ratio by 17%[17]. These results have been questioned by a recent study by Lorentowicz *et al.* (2005): the authors find in fact that material offshoring alone would have *reduced* wage inequality and relative skilled employment in Austria. The analysis makes use of a panel of 15 industrial sectors between 1995 and 2002 and material offshoring is proxied as in (2.2); crucially, Lorentowicz *et al.* (2005) use total imports of intermediate inputs and not just imports from the CEECs, as Egger and Egger (2005) do instead. Estimation of equation (2.1) with relative employment of the skilled as the regressand shows that, despite the observed increase in this ratio, material offshoring alone would have *lowered* it by 24%; similar results arise when the skilled labor share of wage bill is used as the regressand: material offshoring would have lowered this share by 13.6%. The main explanation for the different results found by these two studies on Austria is probably the use of different proxies for material offshoring: since Austrian firms have mainly relocated their unskill-intensive stages of production to the CEECs, the proxy used by Egger and Egger (2005) is more likely to produce positive effects on relative skilled labor demand[18].

Turning to Italy, Helg and Tajoli (2005) use a panel of 20 manufacturing industries over the 1990s and construct a more conservative measure of material offshoring than the one in (2.2): the ratio between Outward Processing Trade (OPT) imports and industry's production; OPT imports occur when firms move abroad some intermediate goods for reasons of processing and then import back the processed goods. This measure has the advantage of describing more closely the main feature of material offshoring, that is, the choice by firms of the number of stages and of the amount of processing to perform abroad. The bulk of Italian OPT is done by traditional (low skill-intensive) sectors and takes place in the CEECs. The authors estimate equation (2.1) with the skilled labor share of employment as the dependent variable, in order to account for wage rigidities in the Italian labor market[19]. Results suggest that material offshoring has contributed to the increase in relative employment of the skilled in Italy. In the same study, Helg and Tajoli repeat the analysis for Germany. In this case, material offshoring is found to exert no significant effect on relative skilled labor demand. The authors justify the different results for Italy and Germany in the light of the characteristics of the industries that resort more heavily to OPT in the two countries: while, in Italy, these industries are mainly low skill-intensive, in Germany, their degree of skill-intensity is very close to the manufacturing average; as a consequence, increasing OPT is likely to have induced some shift in relative labor demand in Italy, but not in Germany. Another possible explanation is that the OPT proxy captures only a

specific facet of the whole offshoring phenomenon and is likely to underestimate its actual size: if only a small fraction of material offshoring by German firms takes place through OPT, this measure will not produce significant effects on relative skilled labor demand. Furthermore, as in the case of Austria, also in Germany most unskill-intensive stages of production have been relocated to the CEECs; thus using an aggregate measure of material offshoring may not be suited to capture this specific aspect of the phenomenon. And, in fact, Geishecker (2006) finds that, when measured as in (2.2) but with imported intermediate inputs only from the CEECs at the numerator, material offshoring does appear to exert significant effects of relative skilled labor demand in Germany. The author uses a panel of 23 manufacturing industries over the period 1991-2000 and finds that narrow (broad) offshoring to the CEECs has explained more than 47% (53%) of the observed increase in the skilled labor share of wage bill; as expected, the effect of offshoring to the rest of the EU and to the rest of the world is either insignificant (narrow) or significant but smaller (broad).

All above evidence suggests that material offshoring has been an important source of wage inequality in developed countries, and has thus penalized the economic fortunes of national unskilled workers relative to their skilled counterparts. Two questions, however, are left unanswered by this literature. First, what is the role of MNEs? As I mentioned before, due to the use of aggregate imports data, the above contributions are unable to disentangle offshoring through production transfer within MNEs from offshoring through arm's length contracts with foreign suppliers. Given the attention paid to MNEs in the ongoing debate about the effects of globalization, this issue deserves separate attention. Second, is a dichotomous classification of labor too restrictive? Classifying workers in just two categories may hide specific effects of material offshoring on subgroups of employees and sub-occupations; understanding these effects is important for policy reasons. Therefore, I will now move to review contributions that have tried to answer these two questions.

Material offshoring through production transfer within MNEs In practice, offshoring is a more complex phenomenon than described by (2.2). In fact, that measure captures all those cases in which goods are processed abroad and then reimported, regardless of whether the transfer of production occurs through arm's length contracts with foreign suppliers or through direct establishment of foreign plants by national firms. Therefore, in order to disentangle the specific contribution of MNEs to material offshoring, one has to construct a different proxy, measuring only production transfer within MNEs[20]. Moreover, MNEs involved in offshoring often carry out assembly activities in their foreign affiliates and then use these affiliates as a local presence to serve either the foreign market or other

neighboring economies [export-platform FDI (Ekholm *et al.*, 2003)]: in this case, production transfer within MNEs does not entail intra-firm trade in intermediates, but rather results in the expansion of foreign affiliates relative to the parent.

How important is production transfer within MNEs? The answer is that, although surely not negligible and rising, it is still a tiny fraction of total material offshoring. Slaughter (2000b) shows that, between 1977 and 1994, foreign affiliates of American MNEs have increased their share on MNE-wide employment, value added and capital stock and given rise to increasing trade flows with their parents in the U.S. and with other affiliates in foreign countries. Nevertheless, at the beginning of the 1990s, foreign affiliates accounted for less than 40% of all intermediate inputs imported by U.S. parents. Hence, the bulk of today's material offshoring occurs through arm's length contracts with foreign suppliers and also MNEs resort heavily to this offshoring mode. Nike is a case in point. Feenstra (1998) reports 1993 figures showing that:

> About 75,000 people are employed in Asia in the production of shoes and clothing [...], though only a few hundred of these are actually employees of the company. The rest are employed in factories that have some contractual arrangement with Nike, possibly run by third parties, such as South Korean entrepreneurs (Feenstra, 1998, pp. 36).

Given the limited importance of production transfer within MNEs, one may reasonably expect that it played only a minor role in explaining the outward shift in relative skilled labor demand in developed countries. This is what existing studies have found. More precisely, although production transfer has exerted significant effects on relative skilled labor demand *within MNEs*, these effects appear negligible when compared to the overall, *economy-wide*, outward shift.

In the general framework discussed before, these studies replace (2.2) with a measure of production transfer within MNEs. Equation (2.1) is estimated by using either MNE-level data or industry-level data, after having aggregated the proxy for production transfer at the industry level: in the former case, the focus of the analysis is the contribution of production transfer to the outward shift in relative skilled labor demand within the MNEs; in the second case, the focus is the contribution of production transfer to the economy-wide outward shift.

How is production transfer measured? In general, existing contributions use the share of foreign affiliates employment on total, MNE-wide, employment:

$$PRODTRANSF = \frac{\sum_i emp_i}{\sum_i emp_i + emp_p} \tag{2.3}$$

where $i = 1, ..., N$ indexes foreign affiliates and p stands for parent. Clearly, this indicator captures all those cases in which offshoring takes place within MNEs, regardless of whether goods produced abroad are reimported or sold in foreign markets. In both cases, in fact, affiliates gain employment shares at the expense of the parent.

Studies with MNE-level data have been carried out by Head and Ries (2002) for Japan and Hansson (2005) for Sweden. Head and Ries (2002) use data on 1052 Japanese manufacturing MNEs over the period 1971-90 and find a positive effect of production transfer on relative skilled (non-production) labor demand in Japanese parents[21]. This positive effect is stronger when production transfer occurs in affiliates located in low-income countries, which is consistent with the idea that Japanese MNEs offshore low skill-intensive stages of production to subsidiaries operating in countries with a relatively larger endowment of unskilled labor. Nonetheless, when compared to the *economy-wide*, overall, shift in relative skilled labor demand, the contribution of production transfer appears very small in magnitude: Head and Ries estimate in fact that it accounted for no more than 9% of the overall observed rise in the skilled labor share of wage bill between 1970 and 1989. This evidence is confirmed by Hansson (2005) for Sweden. The author computes (2.3) using data on affiliates employment in (low-wage) non-OECD countries. The analysis is carried out on both a balanced sample including 27 manufacturing MNEs in 1990, 1993 and 1997 and an unbalanced sample including also observations for 35 additional MNEs in 1990 and 1993 and for 11 additional MNEs in 1993 and 1997. Results show that production transfer to non-OECD countries has exerted positive effects on the skilled labor share of parents wage bill between 1993 and 1997, but not between 1990 and 1993; the reason is that production transfer to non-OECD countries took off only in 1993[22]. The magnitude of the effect amounts to roughly 15% of the observed increase in the skilled labor share of parents wage bill, and is therefore likely to have explained an even smaller fraction of the economy-wide increase. On the contrary, production transfer to OECD-based affiliates did not exert any significant effect on parents relative skilled labor demand.

The only two studies using industry-level data are Slaughter (2000b) for the U.S. and Falzoni and Grasseni (2003) for Italy. Slaughter (2000b) uses a panel of about 1500 U.S. parents and 8000 foreign affiliates, belonging to 32 manufacturing industries, over the period 1977-82. Equation (2.1) is estimated using the non-production workers share of wage bill in each of the 32 industries; in order to measure production transfer at the industry-level, the author replaces the denominator of (2.3) with total industry employment[23]. As anticipated, results show that production transfer played almost no role in explaining the economy-wide increase in the non-production workers share of wage bill: hence,

had U.S. MNEs made no use of production transfer, wage inequality would have increased by roughly the same amount. This result is strongly confirmed by Falzoni and Grasseni (2003) for Italy. The authors use a panel of Italian manufacturing MNEs observed in 1993, 1995 and 1997 and conduct their analysis on 89 NACE Rev. 3 industries. To this purpose, the proxy for production transfer in (2.3) is aggregated up at the industry-level and skilled and unskilled workers are proxied by white and blue collar employees. The data allow the authors to distinguish production transfer by region: in particular, Falzoni and Grasseni separately consider developed economies, less developed economies and CEECs. Results show no significant effect of production transfer to any of the three regions on the skilled labor share of wage bill at the industry level.

Studies with a more detailed disaggregation of labor I turn now to answer the second question: is the skilled / unskilled classification too restrictive? In principle, the answer is "yes". In particular, two drawbacks may affect studies using that classification. The first is due to the fact that the occupations falling in the two skill groups are generally characterized by significant differences in level of education, vocational qualification and working experience. Therefore, treating the groups as homogeneous may be misleading, because it implies aggregating occupations that differ significantly in exactly those characteristics that are most important to capture the skill level. Although the use of alternative classifications based on the level of educational attainment can somehow mitigate the problem, nonetheless, workers with the same level of education usually differ from each other in working experience and on-the-job qualification, and are typically employed in very heterogeneous occupations. Hence, treating workers with the same level of educational attainment as homogeneous may be misleading as well. Moreover, and this leads me to the second drawback, in order for aggregation of workers with different skills to be consistent, the underlying production technology has to satisfy very restrictive assumptions. In particular, either skilled and unskilled workers can be treated as perfect substitutes or the production function is separable in the labor services provided by skilled and unskilled workers. If these assumptions are violated, empirical results will be biased (Berndt and Christensen, 1974; Blackorby *et al.*, 1977; Denny and Fuss, 1977; Koebel, 2006). For these reasons, in recent years, a new interest has arisen in studies employing finer disaggregations of labor. This interest has been felt first by labor economists (Fitzenberger, 1999; Mellander, 1999)[24], but has recently been expressed also by trade economists interested in studying the effects of material offshoring on relative labor demand. Recent studies have therefore adopted classifications based on three or more levels of education of the workforce (Falk and Koebel, 2001, 2002; Morrison and Siegel, 2001; Ekholm and

Hakkala, 2005; Hijzen *et al.*, 2005).

The general approach used by this literature is similar to that presented in section 2.1.2. However, now the short-run translog cost function of the representative firm depends on $N > 2$ variable inputs. As a consequence, Shepard's lemma yields a *system* of N share equations with the same form as (2.1). Exploiting estimated parameters, labor demand elasticities to material offshoring can be derived as $\varepsilon_{i,moss} = \beta_{i,moss}/SH_i$, where $i = 1, ..., N$ indexes labor inputs and $\beta_{i,moss}$ is the coefficient of $moss$ in the i-th share equation. If $\varepsilon_{i,moss} < 0$, material offshoring shifts relative labor demand away from labor of type i[25].

The main result from these studies is that material offshoring has mostly affected workers with low or medium levels of education, but exerted almost no effect on the most skilled. These results are fully consistent with those emerging from the use of dichotomous classifications. Hence, although the latter may in principle be too restrictive, in practice they seem to perform quite well.

Hijzen *et al.* (2005) use a panel of 50 U.K. manufacturing industries over the period 1982-96 and distinguish labor in three categories: skilled, semi-skilled and unskilled[26]. Estimated elasticities show that material offshoring exerts negative effects only on the unskilled, thereby shifting relative labor demand away from them and towards the other two groups. Exploiting results reported in Table 6 of that study (pp. 871), a 10% increase in material offshoring leads to a 6.4% reduction in the wage bill share of unskilled workers and to an analogous increase in the wage bill share of the other two groups.

Similar results are found by Ekholm and Hakkala (2005) in their study on 89 Swedish industries between 1995 and 2000. Labor is disaggregated in three groups: workers with primary, secondary and tertiary education. Results show that material offshoring shifts demand away from workers with secondary education, but exerts no effect on those with tertiary education. Estimated elasticities imply that a 10% increase in narrow offshoring lowers demand for workers with secondary education by 4-6%[27]. The only relevant exception to this pattern is the effect of offshoring to low-income countries: the authors, in fact, find that it exerts some positive effect on relative demand for workers with tertiary education.

There are two additional studies that can be included in this section, although they depart somehow from the methodological framework previously discussed. The main departure stays in the use of alternative flexible functional forms for the short-run cost function of the firm. These studies, however, are also based on the derivation of labor demand elasticities from the full set of demand equations, and therefore can logically be included herein.

Morrison and Siegel (2001) use a Generalized Leontief short-run cost function instead of a translog

and disaggregate labor in four groups: workers with no high-school diploma, workers with high-school diploma, workers with some college but without college degree, workers with a college degree. The panel includes 450 U.S. manufacturing industries between 1959 and 1989; material offshoring is proxied with the ratio of imports to output. In line with previous studies, estimated elasticities show that increasing offshoring reduces the demand for workers without any college education (the two least skilled groups), but exerts almost no effect on those with at least some college degree.

Finally, Falk and Koebel (2002) use a Generalized Box-Cox cost function and a panel of 26 German manufacturing industries between 1978 and 1990. Labor is disaggregated in three skill groups: high-skilled workers (those with a university or polytechnical degree), medium-skilled workers (those with a vocational degree) and low-skilled workers (those without any formal qualification). Consistently with previous results, the authors find evidence of only weak negative effects of material offshoring on relative labor demand for the low-skilled; by contrast, also in this case, the high-skilled are not affected by material offshoring[28].

2.1.4. A few words about SBTC

Among the principal explanations for the outward shift in relative skilled labor demand occurred since the early 1980s in most developed countries, the literature has indicated SBTC, along with material offshoring. Indeed, many studies exist that have tested empirically the effect of SBTC in a framework similar to that described in section 2.1.2; these studies are recalled in section 2.1.1. While such contributions have focused almost exclusively on SBTC, the widely recognized importance of the diffusion of new technologies in explaining the outward shift in relative labor demand has made necessary also for the studies on material offshoring to at least control for SBTC in the empirical analysis. Hence, almost all previous contributions on material offshoring have included a proxy for SBTC in the estimating equation (2.1).

How is SBTC measured? As it was the case for material offshoring, also for SBTC it is possible to identify an ideal measure; also in this case, however, studies have often been prevented from using such a measure, and have thus been forced to rely on alternative proxies. Following Berndt and Morrison (1995) and Feenstra and Hanson (1999), the ideal measure of SBTC is represented by the share of high-tech capital services on total capital services. Computation of this share requires to measure the rate of return on high-tech capital, which can, in turn, be distinguished in *ex-post* and *ex-ante*: the difference between the two is that the ex-post rate of return includes also the capital gains on high-tech capital, whereas the ex-ante rate excludes them; as such, the ex-ante rate of return represents a safer

measure of the return on high-tech capital, because it does not consider gains due to price changes. Under a no-arbitrage condition, which states that individuals must be indifferent between investing in productive capital and in financial assets, the rate of return on productive capital must be equal to the prevailing interest rate. Hence, by multiplying the stock of high-tech capital with a measure of the interest rate (usually the rate on Baa bonds), one obtains a proxy for the rate of return on high-tech capital; since this proxy does not account for capital gains, it represents an ex-ante measure. Finally, by dividing this measure with the overall stock of capital, one obtains a proxy for the share of high-tech capital services on total capital services. A similar computation can be used to obtain the share expressed in ex-post terms; Hall and Jorgenson (1969) provide a useful formula to compute the ex-post price of capital, which accounts also for capital gains.

The ex-ante and ex-post measures of SBTC have generally been used in studies on the U.S. (Feenstra and Hanson, 1999); due to the lack of data on the stock of high-tech capital, studies on other countries have instead relied on different proxies for SBTC: the most widely adopted are expenditure in R&D (or the share of R&D in total sales) and the fraction of workers employed in either R&D or patenting activities.

How important are the effects of SBTC on relative skilled labor demand, as compared with those of material offshoring? Although I will not review all the results from previous studies - because this would take me away from the main focus of the paper - evidence suggests that SBTC has been as important as material offshoring. For example, Feenstra and Hanson (1999) show that SBTC has contributed to about 35% of the observed increase in the skilled labor share of wage bill in the U.S. between 1972 and 1994, versus a 32%-53% contribution of broad material offshoring and a 13%-23% contribution of narrow material offshoring. Similarly, in the case of Sweden, Anderton *et al.* (2002b) find that "technological change [...] was the dominant factor, accounting for well over half of the average increase in wage and employment inequality" (pp. 647). These results are generally confirmed by most of the studies surveyed before.

2.2. Effects on labor demand elasticities and short-run employment dynamics

Studies in previous section are based on the idea that, in the long-run, material offshoring pushes developed countries to a new labor market equilibrium, characterized by higher relative skilled wages and employment; this implies a deterioration in the economic fortunes of the unskilled relative to the skilled. Nevertheless, material offshoring may in principle hurt the unskilled through at least other two channels. First, even without shifting relative labor demand significantly, material offshoring

may make unskilled labor demand more elastic, by easing the possibility for domestic firms to replace national unskilled workers with cheaper foreign labor. A more elastic labor demand implies higher volatility of employment and wages, and lower bargaining power for the employees. What is crucial about this effect is that it may work even if the actual volume of offshoring is low, provided that the threat of future offshoring is high. This mechanism has first been described by Rodrik (1997); therefore, I will refer to it as Rodrik's hypothesis. Second, offshoring can significantly hurt the unskilled also in the short-run, by exposing them to the risk of being displaced and to become unemployed or to be reemployed in lower-wage jobs. From the workers' viewpoint, such a short-run effect is probably more relevant than the long-run impact on wage inequality. Empirical research on both topics is still very limited and additional contributions are surely needed to draw definite conclusions. Based on existing results, however, both effects appear weak.

I start from the Rodrik's hypothesis. Existing studies focus on the U.S. and reach conflicting conclusions about the validity of the hypothesis. The empirical framework is based on a two-step procedure. In the first step, the conditional (on output) labor demand elasticities are estimated from the following labor demand equation:

$$\ln L_{ijt}^{k} = \sum_{k=S,U} \beta_{1jt}^{k} \ln w_{ijt}^{k} + \beta_2 \ln Y_{ijt} + \varepsilon_{ijt} \tag{2.4}$$

where L is employment and Y output; t indexes time, j industries, i firms (or industries with a finer level of aggregation than those indexed by j), k skilled (S) and unskilled (U) workers; ε_{ijt} is an idiosyncratic error term. Own-wage conditional labor demand elasticities are given by $\eta_{jt}^{k} = \partial \ln L_{ijt}^{k} / \partial \ln w_{ijt}^{k} = \beta_{1jt}^{k}$; as evident, these elasticities can be left free to vary across industries j and over time. In the second step, estimated elasticities are regressed on material offshoring [measured as in (2.2)] and a vector of control variables $\mathbf{X}_{jt}$:

$$\eta_{jt}^{k} = \gamma \cdot moss_{jt} + \mathbf{X}_{jt}\boldsymbol{\delta}' + \omega_{jt}$$

where ω_{jt} is the idiosyncratic error term at the second stage and $\boldsymbol{\delta}$ is a vector of parameters to be estimated. Since $\eta_{jt}^{k} < 0$ for theoretical consistency (the labor demand function slopes downward), if $\gamma < 0$ material offshoring makes labor demand for input k more elastic.

Studies using industry-level data found little or no support for the Rodrik's hypothesis. Slaughter (2001) uses data on 450 4-digit U.S. manufacturing industries (i) observed between 1958 and 1991 to estimate labor demand elasticities for skilled (non-production) and unskilled (production) workers in

eight aggregated sectors (j). Over time, only unskilled labor demand has become more elastic, which is consistent with the idea that material offshoring poses stronger threats to the unskilled; this has happened in five out of eight industries. Nevertheless, results from the second estimation step show that offshoring (broad and narrow) played almost no role in explaining the rise in unskilled labor demand elasticities: when time controls are included in the second-stage regression, in fact, the offshoring coefficients lose significance[29]. The main explanation for the dominance of the time effects is probably statistical: the offshoring variables, like most of the remaining trade and technology controls used by the author, do not show significant cross-sectional variation, and therefore time dummies capture all the effect of these variables on labor demand elasticities[30]. This problem is addressed by Senses (2006) using firm-level data on roughly 25,000 U.S. manufacturing firms between 1977 and 1995[31]. Thanks to these data, the author is able to estimate labor demand elasticities for the whole set of 2-digit manufacturing industries, thereby allowing for sufficient cross-sectional variation. Results show that, on average, unskilled labor demand has become more elastic during the 1980s, and especially so between 1977 and 1992. This trend has been driven by those industries that resorted more heavily to offshoring; no significant pattern emerges instead for the remaining sectors. Consistently, second-step estimates show that material offshoring did play some role in making unskilled labor demand more elastic. The author shows that this result is robust to the use of broad and narrow measures of offshoring, as well as to the adoption of alternative proxies[32]. More importantly, the result is not affected by the inclusion of time controls; hence, when sufficient cross-sectional variation is allowed for, some effect of material offshoring on unskilled labor demand elasticity emerges, supporting the Rodrik's hypothesis.

I now turn to the short-run employment dynamics (adjustment costs) induced by material offshoring. Also in this case, the fear of negative effects on the unskilled has insofar found only partial support. The number of studies on the topic is limited: in fact, while several contributions have analyzed the short-run adjustment costs to trade in final goods and real exchange rate fluctuations (Grossman, 1987; Revenga, 1992; Burgess and Knetter, 1998; Goldberg *et al.*, 1999; Klein *et al.*, 2002, 2003a,b; Kletzer, 1998, 2001 and 2002), studies focusing specifically on material offshoring are very scant. Egger *et al.* (2006) use an employee-level panel dataset consisting of roughly 30,000 Austrian male individuals observed between 1988 and 2001. The possibility of tracking each individual over time allows the authors to compute a full transition probability matrix, with cells containing the fraction of workers moving each year among six different employment states: unemployed, out of labor force, employed in comparative advantage manufacturing industries, employed in comparative disadvantage

manufacturing industries; employed in the service sector and employed in the trade sector. Material offshoring is proxied by the imports share of intermediate goods. One main limitation of the analysis is that it is based on aggregate employment, while using data on unskilled workers would probably be more suited to the purpose. Estimation of the full transition probability matrix through a dynamic multinomial logit model with fixed effects shows a clear pattern of short-run employment dynamics induced by material offshoring: namely, the latter reduces the probability for workers to remain employed in comparative disadvantage industries; moreover, it reduces the probability for workers to move to such industries when unemployed or out of the labor force in the previous year. These results suggest that in the short-run, because of material offshoring, workers employed in sectors exposed to foreign competition may face higher risk of being displaced and either becoming unemployed or being reemployed in low-paid jobs. But, how big is the number of workers displaced by material offshoring? Do these workers really suffer from long-term unemployment and significant wage losses? Based on existing evidence, the concerns related to similar questions seem exaggerated: the number of jobs destroyed by material offshoring represents in fact only a small fraction of the total number of jobs lost in a given year; moreover, although material offshoring raises the risk of unemployment, the magnitude of this effect is limited. Munch (2005) uses a panel of Danish individual manufacturing employees between 1992 and 2001 and studies whether material offshoring - measured as in (2.2) - raises the probability for a given worker to have her job destroyed. By estimating a duration model with duration dependence and worker heterogeneity, the author finds that, although positive, the effects of material offshoring are small in magnitude. Precisely, in the worst scenario, a 1% increase in broad material offshoring raises the probability of job destruction by 0.48%; this implies that material offshoring accounts for 9% of the jobs destroyed in manufacturing in a given year and for 2% of the jobs destroyed in the economy as a whole. As to the risk of unemployment, material offshoring is found to increase it only for the unskilled and by a limited amount: a 1% increase in material offshoring raises the probability of being unemployed by 1.3% for workers with basic education.

3. Service Offshoring

I now turn to review the available literature on service offshoring. Research has mostly focused on the U.S. and the U.K., where service offshoring has been growing rapidly in recent years. Two issues have insofar received attention: the effects of service offshoring on aggregate labor demand and total employment and the effects of service offshoring on relative labor demand for skilled white-collar

workers.

3.1. Effects on aggregate labor demand and total employment

As I mentioned in the introduction, the first concern that emerged around service offshoring is that it will negatively affect total labor demand in developed countries, leading to substantial job losses. For instance, recent reports by Forrester Research (2002, 2004a,b) estimate that about 1 million U.S. jobs would have been offshored by the end of 2005 and that a total of 3.4 million jobs would be moved abroad by the end of 2015; another report by Goldman Sachs calculates that, between 2000 and 2004, 10,000 jobs per months have been moved overseas by U.S. firms, and that 15,000 to 30,000 jobs per month will be offshored in the near future (Mankiw and Swagel, 2006). These numbers are definitely large in absolute value. But, are they large enough to support the "fear of service offshoring"? (Amiti and Wei, 2005a). Existing studies suggest that the most correct answer to this question is "probably no". Some authors have in fact argued that, although sizeable in *absolute* terms, these numbers are small in *relative* terms. Specifically, they represent just a small fraction of the overall job turnover occurring each month in the U.S. labor market, which amounts to more than two million jobs (Baily and Farrell, 2004). Likewise, according to Mankiw and Swagel (2006), these numbers "seem modest compared to the more than 160 million jobs projected [...] to exist by 2015, and small even compared to the 35 million net new jobs gained over the past decade".

Not only are existing projections of future job losses due to service offshoring tiny relative to the usual job flows occurring in the U.S.; these projections are also probably overstated. On one hand, in fact, evidence based on Mass Layoffs Statistics for the U.S. suggests that the role of service offshoring in explaining recent layoff episodes is negligible: according to Rishi and Saxena (2004), the fraction of laid off workers due to offshoring in the first quarter of 2004 was less then 2.5% of the total. The bulk of these layoff episodes and, in general, of the recent labor market weakness in the U.S. has instead been caused by the dot-com bust and the macroeconomic downturn of the late 1990s (Baily and Lawrence, 2004; Schultze, 2004). On the other hand, econometric evidence has shown that the impact of service offshoring on labor demand in developed countries has up to now been negligible, and, in some cases, even positive. Amiti and Wei (2005b) study the relationship between service offshoring and labor demand in the U.S. manufacturing between 1992 and 2000; the analysis is carried out on two samples, consisting of 450 and 96 industries respectively. The authors measure service offshoring as in (2.2), but replacing imports of intermediate inputs with imports of private services[33]. Results from the estimation of a log-linear demand equation show only a weak negative effect of service

offshoring on labor demand in the sample of 450 sectors; this effect disappears, however, in the more aggregated sample of 96 industries. The authors therefore argue that "there is sufficient growth in demand in other industries within these broadly defined classifications to offset any negative effect [of service offshoring]" (Amiti and Wei, 2005b, pp. 29). Another study by Amiti and Wei (2005a) on the U.K. confirms these predictions: focusing on 69 manufacturing industries between 1992 and 2001 and employing the same methodology and the same measure of service offshoring[34], the authors find that service offshoring exerts no negative effect on labor demand; rather, in some specifications, the offshoring coefficient is positive and statistically significant. Finally, Gorg and Hanley (2005), using a panel of Irish electronics firms between 1990 and 1995, find that service offshoring exerts at most small negative effects on labor demand.

Why does service offshoring exert at most limited negative effects on labor demand? There are at least two explanations. First, although rapidly increasing, service offshoring is still too limited to affect labor demand significantly. Second, while possibly causing some jobs to be moved overseas, service offshoring also contributes to create new jobs at home. This happens through at least three channels. 1) Service offshoring allows for a more efficient allocation of activities across national borders; therefore, firms offshore the least productive activities and focus on those they can carry out more efficiently (Deardorff, 2005; Antras *et al.*, 2006a; Grossman and Rossi-Hansberg, 2006a,b). As a result, firms' productivity increases (Heshmati, 2003; Olsen, 2006; Amiti and Wei, 2006), average costs fall and firms become more competitive by reducing their average product prices; this, in turn, stimulates additional demand for the firms' products and, through a scale effect, raises domestic employment[35]. 2) Service jobs created abroad stimulate increasing demand for goods and services produced at home, either by the offshoring industry or by other sectors: hence, service offshoring creates new opportunities at home, and through this channel, boosts domestic employment (Amiti and Wei, 2005b). 3) Service offshoring may make financially viable projects that would otherwise be unfeasible for the domestic firms, due to their overall level of costs; starting the project, in turn, creates domestic jobs that would not exist otherwise (Bhagwati *et al.*, 2004).

Existing evidence has therefore shown that the first concern about service offshoring is exaggerated. Nevertheless, this is not enough to relieve all anxieties. Very recently, in fact, people started being concerned that service offshoring will exert downward pressures on *skilled* labor demand and threat the whole process of human capital accumulation in developed countries. Is this concern supported by theory and empirical evidence? This will be the topic of next section.

3.2. Are the white-collars at risk of service offshoring?

Service tasks are on average more skill-intensive than productive activities. Hence, unlike material offshoring, service offshoring leads to the relocation of *skilled* activities abroad. For this reason, service offshoring has recently been blamed to reduce the incentives to accumulate education and on-the-job qualification and eventually hinder the whole process of human capital accumulation in developed countries[36]. Existing results show, however, that also this second concern is likely to be exaggerated. For theoretical and empirical convenience, it is better to reformulate the issue in terms of the redistributional effects of service offshoring. Besides being on average more skilled than productive activities, service tasks are usually performed by white-collar workers. Some of these tasks are performed by *low-skilled* white-collars (e.g. call center operations), whereas others require *high-skilled* white-collars (e.g. engineering and managerial consulting). In order for service offshoring to threaten human capital accumulation in developed countries, it is the set of high-skilled service tasks that has to be jeopardized by service offshoring. Hence, the problem can be analyzed by studying whether service offshoring shifts relative labor demand away from high-skilled white-collar workers.

3.2.1. A bit of theory

Despite the empirical focus of this paper, the novelty of service offshoring makes some theory necessary to understand its effects on relative labor demand. Existing contributions can be divided in two streams: a traditional approach based on standard trade theory and a new approach exploiting the theory of firms organizations and hierarchies and emphasizing the nature of service offshoring as "trade in tasks". The two approaches yield similar predictions about the welfare and redistributional effects of service offshoring.

I will spend just a few words on the welfare effects. In brief, both approaches predict that, under fairly reasonable assumptions, service offshoring increases aggregate welfare at home. This happens because service offshoring allows for a more efficient allocation of activities across national borders and gives countries the possibility of specializing in the tasks they perform more efficiently, thereby raising overall domestic productivity [see Bhagwati *et al.* (2004), Deardorff (2005) and Markusen (2005) for contributions belonging to the first approach, and Antras *et al.* (2006a) and Grossman and Rossi-Hansberg (2006a,b) for contributions belonging to the second approach][37].

The discussion of the redistributional effects is slightly more complicated, because the two streams of literature approach the issue from very different starting points. Nonetheless, both streams converge to similar conclusions. What really matters to understand the redistributional effects of service

offshoring is which service tasks firms find more convenient to offshore; in particular, the final effect will depend on the skill intensity of such tasks. According to the first stream of literature, service offshoring will lead developed countries to specialize in high-skill intensive service tasks, in line with the standard law of comparative advantages (Trefler, 2005a,b). Hence, this approach predicts that service offshoring will shift relative labor demand in favor of the most skilled white-collar workers. The second stream of literature, instead, pays no attention at the skill-intensity of the tasks. What really matters according to this approach is that tasks show feature that make their services easily tradable; if this is so, tasks will be exposed to the risk of being offshored, regardless of their skill-intensity (Levy and Murname, 2004; Blinder, 2005; Grossman and Rossi-Hansberg, 2006a,b). As a consequence, following this approach might make less simple to predict the redistributional effects of service offshoring, because in principle there is no clear relationship between the tradability of a task and its skill intensity. Nevertheless, in practice, the tasks that show tradability features are generally highly routinized and low skill-intensive. For example, Garner (2004) suggests that service activities are more likely to be offshored if they are: 1) *labor intensive* - labor represents a high fraction of total costs; 2) *information based* - the output of the task can be delivered electronically across national borders; 3) *codifiable* - the task can be reduced to a set of simple rules and routinized instructions; 4) *high-transparency* - the information to be exchanged between the offshoring firm and the related party overseas is clear and easy to measure and to verify. Similar features have been suggested also by Autor *et al.* (2003), Bardhan ad Kroll (2003), Levy and Murname (2004), Blinder (2005), Jensen and Kletzer (2005), Kroll (2005), van Welsum and Reif (2005) and van Welsum and Vickery (2005). Evidently, tasks with these attributes are generally performed by low-skilled white-collar workers: think, for instance, of call center operations, accounting and bookkeeping procedures, bill processing, cost estimation and many back office activities[38]; but think also of more recent examples of service offshoring like X-ray screening and medical case history transcription. As a consequence, the conclusions that can be drawn from the second approach on the redistributional effects of service offshoring are similar to those emerging from the first approach: in developed countries, service offshoring will shift relative labor demand in favor of high-skilled white-collar workers (Antras *et al.*, 2006b).

Are theoretical predictions supported by the data? Although research is still limited, the answer is "probably yes".

3.2.2. What do the data tell us?

To the best of my knowledge, only two econometric studies have insofar analyzed the effects of service offshoring on the white-collars: Crinò (2006) and Liu and Trefler (2006); both focus on the U.S.. The main conclusions of these studies can be summarized as follows. The increasing exposure of the U.S. economy to service offshoring has caused neither significant wage losses nor sizeable increases in job insecurity for national high-skilled white-collar workers; rather, service offshoring has induced national firms to shift the composition of their labor demand exactly in favor of these workers. Hence, theoretical predictions seem supported by available empirical results: service offshoring is pushing the U.S. to shift abroad low skill-intensive service tasks, while specializing in more complex service activities, that are performed by high-skilled white-collar employees. Also empirical evidence, therefore, seems at odds with the fear that service offshoring will endanger human capital accumulation in developed countries in the near future.

Liu and Trefler (2006) study whether service offshoring increases the risk of wage losses and job insecurity for U.S. white-collar workers. Service offshoring is measured as imports of other private services from China and India[39]. The use of Current Population Survey data between 1996 and 2004 allows the authors to track individual workers over time and to identify three channels through which service offshoring may negatively affect U.S. white-collar employees: 1) by inducing losses of labor income; 2) by increasing the probability of industry switching; 3) by increasing the probability of occupation switching[40]. The last two channels represent ways in which service offshoring may raise job insecurity; moreover, since human capital typically is industry- or occupation-specific, they also represent ways in which service offshoring may threaten domestic human capital. Separate regressions are run for high-school graduates and college graduates, as well as for skilled and unskilled white-collars[41]. Fixed effects results show that for neither of the four groups has service offshoring to China and India caused significant losses of labor income. Turning to the probability of switching industry and occupations, probit results show only a very small rise in the likelihood of changing sector/job for U.S. white-collars as a result of service offshoring. In particular, a 10 percent increase in service imports from China and India raises the probability of switching industry by 0.25 percent for college graduates, by 0.32 percent for high-school graduates, by 0.27 percent for skilled white-collars and by 0.26 percent for unskilled white-collars (Liu and Trefler, 2006, Table 6, p.47). The same increase in service imports from China and India raises the probability of switching occupation by 0.22 percent for both college graduates and high-school graduates and by 0.24 percent for skilled white-collars, without producing any significant effect on unskilled white-collar workers (Liu and Trefler, 2006, Table 7, p.48). Hence,

service offshoring does not entail any loss of labor income for U.S. white-collars; moreover, although statistically significant, its effects on job insecurity are economically very modest[42].

Crinò (2006) studies how U.S. firms have changed the structure of labor demand in recent years, as a result of increasing service offshoring. The author uses a panel of 135 U.S. manufacturing industries covering the period 1997-2002 and proxies service offshoring with the share of imported services on total non-energy inputs purchases, as in Amiti and Wei (2005a,b, 2006)[43]. The use of the Occupational Employment Statistics of the BEA allows Crinò to distinguish each industry's employment into 111 minor occupations, out of which 58 are white-collar; these minor occupations are then aggregated up into 13 broader groups of workers, performing similar tasks: for example, minor managerial occupations are grouped into a broader category called "Managers". Thanks to a two-stage translog model, the author is able to estimate the effects of service offshoring on relative labor demand both for the minor occupations belonging to each major occupational group and for the major groups themselves. Results unambiguously show that service offshoring raises relative labor demand for high-skilled white-collar occupations within each group, as well as relative labor demand for each and every major group. Hence, service offshoring seems to stimulate, rather than threatening, the process of human capital accumulation in the U.S., by inducing firms to specialize in complex service activities requiring high-skilled white-collar workers.

The main conclusions emerging from the econometric studies are supported by a large body of stylized facts and projections about past and future trends in U.S. white-collar employment. This stream of literature shows, in fact, that the composition of white-collar employment has been - and will increasingly be - shifting in favor of high-skilled, high-paid, occupations. According to Forrester Research (2002, 2004a,b), 57 percent of the expected job losses in at-risk white-collar occupations by 2015 will occur in "Office and Administrative Support" and "Sales and Related Occupations". Workers in these jobs are the least skilled white-collars (Crinò, 2006) and receive wages significantly below the national average (Kirkegaard, 2004). Instead, with the only exceptions of the groups "Managers" and "Computer and Mathematical Occupations," the remaining white-collar groups have added jobs between 1999 and 2002 (Mann, 2003). Moreover, the overall decline in the number of employees in "Computer and Mathematical Occupations" has been driven by the contraction in the number of workers in low-wage occupations, while those in high-paid occupations have increased (Kirkegaard, 2004). Finally, Jensen and Kletzer (2005) show that the occupations at the lowest end of the skill distribution experienced negative employment growth rates between 1998 and 2002, a period in which the remaining occupations benefited instead from positive growth rates of employment. These trends

seem to be confirmed also at the level of the single Metropolitan Area: in particular, Kroll (2005) shows that the San Jose Metro Area (Silicon Valley) has been progressively specializing in high-end IT occupations, while loosing the low-end ones; moreover, the definition of high-end occupations has been shifting up, in the sense that jobs previously considered skilled have been progressively standardized and routinized and are now performed by low-skilled white-collars.

4. Multinational Enterprises (MNEs)

In Part 1 and 2, I reviewed the labor market effects of material and service offshoring. The literature surveyed therein pays little or no attention at the effects of outward FDI and MNEs activities in foreign markets, the only exception being the limited set of studies on production transfer within MNEs. The reason - as stated in the introduction - is that MNEs activities are not necessarily linked to offshoring. Indeed, MNEs very often enter foreign countries to serve local markets, rather than to exploit cross-country cost differentials. This notwithstanding, the effects of foreign activities of MNEs on the domestic labor market may be potentially strong and have actually been the object of harsh debates between advocates and opponents of globalization in recent years. Therefore, I will devote this section to a separate discussion of these effects.

The bulk of existing literature has focused on a specific issue: what are the consequences for domestic labor demand of the possibility for MNEs to adjust their employment choices at home (in the parent) in response to changes in foreign (affiliates) wages relative to domestic wages? The effect is not predictable *a priori*, but depends on the relationship between foreign and domestic employment: if the two types of labor are substitutes, domestic employment will decrease as foreign wages declines; by contrast, if domestic and foreign labor are complements, a decline in foreign wages relative to domestic wages will lead MNEs to raise domestic employment. The link between the nature of this relationship and that of FDI is not clear-cut. Without any ambition of being exhaustive, however, I can attempt to build the following classification. Under vertical FDI, both complementarity and substitutability may occur. If the activities transferred abroad require upstream or downstream tasks to be performed by the parent, domestic and foreign employment will be complement and domestic employment will expand as foreign employment increases. However, if foreign activities replace domestic operations, domestic and foreign employment will be substitutes; moreover, because vertical FDI are generally meant to exploit cost advantages abroad, substitutability will mainly work through the replacement of domestic labor with foreign *unskilled* labor. Under horizontal FDI, substitutability is more likely

to occur, because foreign production replaces domestic production and exports.

I should note that a limited number of studies have focused on a different, though related, topic: the effect of an expansion in the *volume* of foreign affiliates activities on parent employment. Briefly, MNEs may adjust domestic employment not only in response to changes in relative wages across countries, but also in response to changes in the volume of production and sales carried out by affiliates in foreign markets. Also in this case the effect is unpredictable *a priori* and existing empirical studies have insofar reached conflicting conclusions (Blomstrom *et al.*, 1997; Lipsey, 1997; Lipsey *et al.*, 2000; Desay *et al.*, 2005). Given the limited extent of this second stream of literature, I will focus only on the first set of studies; accurate surveys of contributions belonging to the second set can be found in Blomstrom and Kokko (2000) and in Barba Navaretti, Venables *et al.* (2004**,** chp. 9).

4.1. The framework

Suppose that MNEs are multiplant firms, with an overall cost function depending on total output (Y_{MNE}) and on the wages paid by the parent (w_p) and by the affiliates in N locations (w_i, with $i = 1, ..., N$):

$$C_{MNE} = f(w_p, w_1, ..., w_i, ..., w_N, Y_{MNE}) \tag{4.1}$$

Optimal labor demand by parent (conditional on Y_{MNE}) can then be derived through Shepard's lemma applied to (4.1):

$$\frac{\partial C_{MNE}(w_p, w_1, ..., w_i, ..., w_N, Y_{MNE})}{\partial w_p} = L_p(w_p, w_1, ..., w_i, ..., w_N, Y_{MNE}) \tag{4.2}$$

Finally, (4.2) can be used to derive cross-wage elasticities of parent labor demand to wages in the affiliates as:

$$\varepsilon_{L_p,w_i} = \frac{\partial \ln L_p(w_p, w_1, ..., w_i, ..., w_N, Y_{MNE})}{\partial \ln w_i} \tag{4.3}$$

Then, if $\varepsilon_{L_p,w_i} > 0$, parent and affiliate employment in location i are substitutes; instead, if $\varepsilon_{L_p,w_i} < 0$, the two labor inputs are complements.

Assuming a log-linear specification for (4.2), the estimating equation becomes:

$$\ln L_p = \alpha + \beta_p \ln w_p + \sum_{i=1}^{N} \beta_i \ln w_i + \beta_Y \ln Y_{MNE} \tag{4.4}$$

and $\varepsilon_{L_p,w_i} = \beta_i$.

Alternatively, assuming a translog specification for (4.1), Shepard's lemma yields a full set of wage-share equations of the form:

$$\begin{aligned} SH_p &= \gamma_p + \lambda_{pp} \ln w_p + \sum_{i=1}^{N} \lambda_{pi} \ln w_i + \vartheta_{pY} \ln Y_{MNE} \\ SH_1 &= \gamma_1 + \lambda_{1p} \ln w_p + \sum_{i=1}^{N} \lambda_{1i} \ln w_i + \vartheta_{1Y} \ln Y_{MNE} \\ &\cdot \\ &\cdot \\ SH_N &= \gamma_N + \lambda_{Np} \ln w_p + \sum_{i=1}^{N} \lambda_{Ni} \ln w_i + \vartheta_{NY} \ln Y_{MNE} \end{aligned} \tag{4.5}$$

where SH_p is the share of parent employment in total MNE's cost, while SH_i is the cost share of labor in affiliates located in i. Standard translog results yields the following formula for the cross-wage elasticities of parent labor demand:

$$\varepsilon_{L_p,w_i} = \frac{\lambda_{pi} + SH_p \cdot SH_i}{SH_i} \tag{4.6}$$

Notice that the translog approach allows also easy derivation of cross-wage elasticities of affiliates employment in the generic location i to a change in wages in location j. Indeed, studies using this approach have derived the full matrix of cross-wage elasticities, and not only those related to labor in the parent. However, since the focus of this paper is on the *domestic* labor market effects of offshoring and MNEs, I will mostly focus attention on ε_{L_p,w_i}[44].

4.2. Results

4.2.1. United States

The bulk of existing evidence is on the U.S.. The main result is that there is only weak evidence of substitutability between domestic and foreign labor. If any, substitutability is stronger with labor in affiliates located in other high-income countries in the Eastern hemisphere (e.g. Europe): this is consistent with FDI to these countries being mainly horizontal and aimed to serve local markets, by avoiding trade barriers and transportation costs (Brainard, 1997). Although existent, substitutability is instead weaker with respect to labor in low-income affiliates and decreasing in affiliates distance

from the parent. Moreover, in this case, substitutability seems to emerge because parent employment is substituted for with foreign *unskilled* labor; this is consistent with a vertical nature of FDI to low-income countries and with MNEs expansion in these economies being mainly aimed to exploit cost advantages in unskilled labor-intensive productions. Finally, the relationship is likely to switch into complementarity when moving from the short to the long run, due to adjustment costs in achieving the optimal level of employment in foreign locations. These adjustment costs mainly depend on the fact that MNEs have to search and train their foreign labor force: usually, the more different the foreign country is in terms of development, the slower the adjustment in foreign employment is towards the optimal level.

Slaughter (1995) applies the translog approach in (4.5) to data on U.S. parents and their affiliates in 32 industries between 1977 and 1989. The author does not disaggregate affiliates either according to the level of development or according to the geographic position of foreign countries; as a result, he estimates only the cross-wage elasticity between parent employment and *overall* affiliates employment. However, the author does make the distinction between short- and log-run adjustments of parent labor demand, by estimating two different versions of (4.5): the short-run version assumes that affiliates and parent capital be fixed at some pre-existing level, so that MNEs choose only the optimal labor demand at home and abroad; the long-run version, instead, treats both types of capital as variable, so that MNEs choose not only the optimal labor demand at home and abroad, but also the optimal demand for capital in both locations. Results from the short-run model show that labor at home and abroad are substitutes in the short-run: the estimated cross-wage elasticity is in fact significantly positive and ranges between 0.045 and 0.113, depending on whether all affiliates, or only majority-owned affiliates, are included in the regression. These figures imply that a 10% decline in affiliates wages reduces parent employment by only 0.45%-1.13% in the short-run; hence, substitutability is very weak. By contrast, labor at home and abroad become complements in the long-run: the estimated cross-wage elasticity is in fact significantly negative and ranges between -0.040 and -0.139, implying that a 10% reduction in affiliates wages increases parent employment by 0.4%-1.39%. Hence, substitutability is weak and mainly concentrated in the short-run.

Do these results change if affiliates are distinguished according to host countries characteristics? This question has been explicitly addressed by Brainard and Riker (1997), using the translog approach in (4.5) and firm-level data on U.S. manufacturing MNEs between 1983 and 1992. Affiliates are distinguished according to both their geographic location (Western and Eastern hemisphere) and the level of development of host countries (developed and developing); capital is treated as fixed, and

thus the analysis is limited to the short-run. Starting from the geographical classification of affiliates, estimated cross-wage elasticities suggest the existence of substitutability between parent employment and employment in both types of affiliates; the strength of this relationship, however, is small and mostly driven by affiliates in the Eastern hemisphere, consistently with a horizontal nature of FDI to those countries. Turning to the second classification, substitutability emerges again between parent employment and employment in both types of affiliates. The relationship, however, is weak also in this case. In order to further explore these results, the authors repeat the analysis by using a more detailed classification of affiliates, in which the latter are distinguished over both dimensions at the same time. Estimated cross-wage elasticities show that substitutability reaches the highest degree with respect to high-income countries located in the Eastern hemisphere, followed by low-income countries in the Western hemisphere. Hence, substitutability is mostly driven by affiliates in other high-wage locations; in the case of affiliates in low-wage countries, substitutability generally requires affiliates to be close to the parent, in order to minimize transportation costs, while exploiting foreign cost advantages. This finding is confirmed by Harrison and McMillan (2006), using a longer panel of U.S. manufacturing MNEs between 1971 and 1999. The authors employ both approaches in (4.4) and (4.5) and find some evidence of substitutability with respect to labor in low-income affiliates, in line with Brainard and Riker (1997). The strength of the relationship, however, is very weak also in this case: elasticities estimated from (4.4) show that a 10% decline in foreign affiliates wages in low-income countries leads only to a 0.5% decline in parent employment; similarly, elasticities estimated from (4.5) show that a 10% decline in foreign affiliates wages in low-income countries leads only to a 0.36% decline in parent employment. Substitutability is mostly driven by *production* employment in foreign affiliates, suggesting that U.S. parents do shift some of their labor intensive stages of production abroad to exploit cost advantages in low-wage foreign locations.

One could argue that these findings mask different effects on *domestic* workers, according to their level of skills. Hanson *et al.* (2003) focus on this issue, using a firm-level panel dataset for the period 1989-99 and the log-linear approach in (4.4). The authors carry out the analysis using both total parent employment and parent R&D employment, which represents a proxy for domestic skilled labor; moreover, they distinguish foreign employment into skilled and unskilled workers[45]. As a result, equation (4.4) is estimated twice, once with total parent employment and once with R&D employment as the dependent variable; each time, the specification includes the wage of skilled and unskilled foreign workers among the regressors. Both versions of the model reveal, also in this case, that substitutability between domestic and foreign employment is at most very weak. When estimated

on the sub-period 1989-94, elasticities from the first model show that only affiliates unskilled labor substitutes for parent employment; affiliates skilled labor, instead, complements parent employment. The size of both effects is small: a 10% fall in affiliate unskilled wages lowers domestic employment by 3%, while the same reduction in affiliate skilled wages raises it by 3%. Moreover, these results are not robust to the choice of alternative sub-periods: when estimated on the sub-sample 1994-99, in fact, all elasticities turn out to be insignificant. Turning to the second version of the model - i.e., that with R&D employment as the regressand - results show no relationship at all between affiliates and parent employment: estimated elasticities are always insignificant. This may suggest that demand for skilled labor in the parent is less sensitive to relative wage considerations, because skilled labor usually generates firm-wide competitive benefits.

Lastly, Bruno and Falzoni (2003) contribute to this literature by deepening the analysis of the short- and long-run relationship between parent and affiliates employment. As shown in Slaughter (1995), the relationship may switch from the short- to the long-run. Bruno and Falzoni confirm this finding by extending the adjustment cost model of Epstein and Denny (1983) to the MNEs and by testing its predictions on data for parents and affiliates in 32 industries between 1982 and 1994. Adjustment costs may be crucial in switching the sign of the relationship: in fact, MNEs usually encounter difficulties in searching and training their foreign labor force, so that the adjustment process towards the desired level of employment abroad may take time to be completed. After dividing affiliates in four regions (Canada, Europe, Latin America and Rest of the World), the authors find that adjustment costs do matter in fact, especially for the relationship between parent employment and affiliates employment in low-wage Latin American countries: while in the short-run substitutability prevails between the two labor inputs, in the long-run the relationship reverses into complementarity. Adjustment costs are instead a less severe problem in Europe: in this case, parent and affiliates employment are found to be substitutes both in the short- and in the long-run, a finding which is again consistent with a horizontal nature of U.S. FDI in Europe, as emphasized by previous studies.

4.2.2. Europe

Results on European MNEs are fairly consistent with those on the U.S.. The evidence reveals, also in this case, only weak substitutability between parent and affiliates employment. This relationship is mostly driven by affiliates in other European countries, in line with a horizontal nature of FDI towards these economies. Recent fears of a negative effect of FDI to the CEECs appear exaggerated: if any, substitutability between parent and affiliates employment in Central and Eastern Europe is

small; moreover, it seems to interest only those countries that are at the border with the CEECs.

Braconier and Ekholm (2000) apply the framework in (4.4) to a panel of 44 Swedish MNEs and their 594 affiliates over 6 non contiguous years[46], and find evidence of substitutability only between parent employment and affiliates employment in other high-income countries (EU, U.S., Canada, Japan and Australia); no significant relationship emerges instead with affiliates employment in low-income economies. Moreover, the strength of the relationship is low, a 10% fall in high-income affiliates wages leading only to a 8% reduction in parent employment. These findings are largely confirmed by Konings and Murphy (2006), for a panel of 1067 medium and large European MNEs over the period 1993-98. The authors find evidence of substitutability only between parent employment and employment in North European affiliates, but no significant relationship between parent employment and employment in low-income European countries and in the CEECs. The strength of substitutability is very low also in this case: estimated cross-wage elasticities suggest that a 10% reduction in affiliates wages in Northern Europe causes only a 0.32% decline in parent employment.

Although above evidence suggests that employment in European parents faces only limited substitution in favor of affiliates employment in other high-wage European economies, for specific countries, substitutability between parent employment and employment in low-wage CEECs may also arise: boundary countries like Germany have in fact seen their MNEs opening up several production plants in the CEECs, with the main aim of exploiting the larger endowment of unskilled labor in these economies, along with their close proximity to the parents. Hence, average results on the whole set of European MNEs may be misleading if applied to such boundary countries. This is what emerges from two recent studies by Becker *et al.* (2005) and Becker and Muendler (2006) on German MNEs. Both studies find that employment in German parents is linked by a substitutability relationship to employment in CEECs affiliates. Using the translog approach in (4.5) and a cross-section of 463 German MNEs in 2000, Becker *et al.* (2005) find that a 10% reduction in CEECs affiliates wages leads to a 0.9% reduction in parent employment. These results are confirmed by Becker and Muendler (2006) for a panel of 1259 German MNEs observed between 1996 and 2001: a 10% decline in CEECs affiliates wages lowers parent employment by 0.5%. Nonetheless, substitutability is much weaker with respect to labor in the CEECs than with respect to labor in other European countries: in this latter case, a 10% fall in foreign wages reduces parent employment by a factor ranging from 1.4% (Becker *et al.*, 2005) to 3.6% (Becker and Muendler, 2006). Becker *et al.* (2005) compare results for Germany with those for 98 Swedish MNEs observed in 1998. Findings are fairly similar: also in the case of Swedish MNEs, the main evidence is substitutability between parent employment and employment in other

European countries; some (much weaker) substitutability is found also with respect to labor in the CEECs. This latter result is inconsistent with Braconier and Ekholm (2000), who find no evidence of substitutability between parent employment and employment in affiliates located in low-wage countries. The inconsistency probably depends on the use of different data - only a cross-section of MNEs in 1998 - and different classifications of foreign affiliates by geographic region.

5. Conclusions and lines for further research

In this paper, I reviewed existing empirical evidence on the effects of offshoring and foreign expansion of MNEs on the labor markets of developed countries. The main conclusions of the paper can be summarized as follows:

- Material offshoring has been an important determinant of increasing wage inequality and relative skilled employment during the 1980s. It mainly worked by reducing relative labor demand for workers with the lowest level of skills. The role of production transfer within MNEs has been limited, due to the limited fraction of total material offshoring occurring within the boundaries of MNEs.

- The effects of material offshoring on the elasticity of unskilled labor demand and on the risk of job losses are small.

- Service offshoring produces at most very limited negative effects on total employment and tends to shift the composition of labor demand in favor of high-skilled white-collar occupations.

- MNEs tend to substitute domestic labor with foreign labor, but the relationship is weak; moreover, substitutability is mainly driven by horizontal, market-seeking, FDI directed to other high-wage economies.

Based on the existing empirical evidence, many of the concerns raised in recent years about the detrimental effects of offshoring and foreign expansion of MNEs seem exaggerated from an economist's viewpoint: while some workers in specific firms and industries may suffer from offshoring and outward FDI, at the economy level the effects are modest. On the basis of these findings, therefore, the most effective way for dealing with offshoring and outward FDI is not the imposition of obstacles and barriers to restrict the access of firms to these internationalization strategies. Rather, in the short-run, governments should develop appropriate wage insurance schemes directed to the affected workers and, in the long-run, promote effective retraining programs aiming to facilitate and accelerate the

transition of these workers towards domestic industries and jobs shielded from offshoring and FDI and retained domestically (Kletzer and Litan, 2001; Blinder, 2005; Brainard and Litan, 2004; Brainard *et al.*, 2005).

Despite its richness, the existing literature leaves open some promising avenues for future research. I would like to indicate three of them. First, within the broader topic of the short-run adjustment costs to offshoring, it would be interesting to expand the understanding of its potential consequences in terms of wage losses. Up to now, in fact, existing studies have shown that the costs of offshoring in terms of higher risk of unemployment and job destruction are limited; yet, offshoring may impose also different burdens to national employees, for instance, by forcing them to find new jobs in lower-wage occupations and industries after displacement. A clearer understanding of the existence and magnitude of these costs is crucial to tailor the right policy interventions in favor of workers hurt by offshoring. Second, some recent studies have suggested that offshoring may raise the volatility of labor demand, due to the fact that firms tend to change their offshoring decisions over time in response to changes in cost differentials across countries (Bergin *et al.*, 2006). Rising volatility of labor demand, in turn, means higher job and wage insecurity for national workers, and, if detected in the data, would require the appropriate policy measures to be dealt with. Third, turning to the MNE side of the paper, the above studies have analyzed only the effects produced by the expansion of *already existing* foreign plants: this has been defined as *intensive margin* effect of FDI (Becker and Muendler, 2006). However, employment at home may respond also at the *extensive margin*, that is, when MNEs decide to open up a new plant abroad. This is especially crucial nowadays, given the increasing importance of outward FDI to countries like China, where Western MNEs were virtually absent until a decade ago. Nonetheless, evidence on the extensive margin effects of MNEs on domestic employment is still scant: studies have in fact paid attention only at the extensive margin effect of MNEs expansion on employment in other affiliates, but not in the parents (Becker and Muendler, 2006).

ACKNOWLEDGEMENTS

The quality of this paper has sharply improved after long discussions with Paolo Epifani and Anna M. Falzoni. I am indebted to them for their precious comments and suggestions. The usual disclaimer applies .

Notes

[1]This practice has been given several alternative definitions in the literature. See Feenstra and Hanson (2003) for a survey. Moreover, while arbitraging over cost-differentials is probably the main reason behind offshoring, other forces may induce firms to resort to this practice: coeteris paribus, improvements in communication and transportation technologies and in political and economic institutions in foreign countries represent other important determinants (see Spencer, 2005).

[2]Antras (2003), Antras and Helpman (2004, 2006) and Grossman and Helpman (2003, 2004, 2005) develop models explaining the determinants of the choice between offshoring based on arm's lenght contracts and offshoring based on vertical FDI. Feenstra and Spencer (2005) clarify the role of geographic proximity in explaining the choice between specific-investment contracts and standard contracts based on market transactions. Helpman (2006) provides an updated survey of theoretical contributions about offshoring.

[3]Yet, when discussing offshoring, I will devote some time to review the limited number of studies that have analyzed the specific case in which offshoring occurs within the boundaries of MNEs.

[4]Recent years have seen developing countries affirming as origin of FDI (UNCTAD, 2006). I will not focus on this issue herein, but concentrate just on FDI outflows from, and foreign activities of MNEs based in, developed countries.

[5]See section 2.1.2 for a discussion of measurement issues.

[6]A more comprehensive approach has been taken by Greenaway and Nelson (2001) and Anderton *et al.* (2006), who focus however on the broader topic of globalization and labor market, without deepening the analysis of offshoring and MNEs.

[7]Author's calculations based on NBER Manufacturing Industry Productivity Database (Bartelsman and Gray, 1996). Although not fully precise, the non-production/production workers definition represents a good proxy for the skilled / unskilled classification (Berman *et al.*, 1994).

[8]Studies based on factor-content analysis attribute a somewhat larger role to international trade. Also in this case, however, the role of trade appears too limited as compared with the observed outward shift in relative skilled labor demand (Wood, 1994, 1995; Sachs and Shatz, 1994).

[9]Formal theoretical models explaining these effects can be found in Arndt (1997, 1999), Arndt and Kierzkowski (2001), Egger and Egger (2001), Feenstra and Hanson (2003) and Kohler (2001, 2004).

[10]Feenstra and Hanson (1997) show that material offshoring can shift relative labor demand outward also in the foreign country, through a similar effect on the skill intensity of production.

[11]Notice that equation (2.1) already imposes homogeneity and simmetry restrictions, as standard in the translog case.

[12]Alternatively, III_i can be normalized by using industry's output or value added.

[13]These results are supported by a recent study by Hijzen (2006), who uses mandated-wage regressions, instead of wage-share regressions, to study the effects of material offshoring. For a deep discussion of mandated-wage regressions, see Feenstra and Hanson (1999) and Slaughter (2000a).

[14]Hansson defines skilled and unskilled workers according to the educational attainment of employees: in particular, skilled workers are defined as those with post-secondary education, that is, with more than 12 years of schooling.

[15]Skilled workers are defined as those with tertiary education; unskilled workers are defined as those with either secondary or primary education. Results are robust to the use of the two different definitions of unskilled labor.

[16]The authors classify as skilled those workers whose job requires either high or special qualification level; the remaining workers are classified as unskilled.

[17]Other related studies on Austria find similar results, despite the use of a different methodological approach, based on mandate wage regressions (Egger *et al.*, 2001).

[18]Indeed, according to Lorentowicz *et al.* (2005), Austrian offshoring to countries like Germany and the U.S. involves skill-intensive activities, becuase Austria is relatively less endowed with skilled labor than such countries. As a consequence, the measure of overall offshoring used by Lorentowicz *et al.* (2005) is likely to be negatively correlated with relative skilled labor demand.

[19]The white / blue collar classification is used to identify skilled and unskilled workers.

[20]Among the determinants of production transfer, Hanson *et al.* (2005) find low unskilled labor costs and corporate taxes in the host country and close proximity between parents and affiliates.

[21]The authors also show that production transfer has increased the average wage paid by the parents, which suggests that production transfer has changed the employment skill mix in the parents towards the non-production workers.

[22]Skilled workers are defined as those with post-secondary education (more than 12 years of schooling).

[23]Actually, Slaughter constucts 5 different measures of production transfer: besides affiliates employment, the author uses wage bill, value added, capital stock and value of shipments back to the U.S.. In order to be consistent with the measurement in (2.3), in the text I refer only to the employment-based measure of production transfer; however, results are not affected by the use of different proxies.

[24]See also Hamermesh (1993) for a survey.

[25]$\varepsilon_{i,moss}$ has usually been defined as labor demand elasticity to material offshoring. I will use this definition too, altough it is imprecise. In fact, $\varepsilon_{i,moss}$ represents only one component of such an elasticity, whose full expression is given by $\eta_{i,moss} = \varepsilon_{i,moss} + \xi_{C,moss}$, where $\xi_{C,moss}$ is the cost elasticity to material offshoring. Nevertheless, since $\xi_{C,moss}$ is neutral across inputs, the only term capturing changes in factor intensity (and therefore changes in relative labor demand) is $\varepsilon_{i,moss}$. Therefore, $\varepsilon_{i,moss}$ can in fact be used to measure the compositional effects of material offshoring, but must be interpreted as measuring such effects *at given costs*.

[26]The authors classify as skilled the following occupations: managers and administrators; professional occupations. Semi-skilled include: associate professional and technical occupations; clerical and secretarial occupations; craft and related occupations; personal and protective service occupations; sales occupations. Finally, the unskilled group consists of: plant and machine occupations; other occupations.

[27]Similar figures result from the use of broad offshoring.

[28]Similar results are found by Geischecker and Gorg (2005), using a wage equation approach and data on 1612 German workers between 1991 and 2000. Labor is distinguished into four categories: skilled and unskilled workers employed in skill- and unskill-intensive industries. Results show that international offshoring only lowers the relative wage of unskilled workers in low skill-intensive sectors.

[29]The same result holds true for all other trade and technology controls used by Slaughter.

[30]A related study by Bruno *et al.* (2004) tests the effects of final trade (not offshoring) on labor demand elasticity on a sample of European countries plus U.S. and Japan. Evidence in favor of the Rodrik's hypothesis is at best mixed also in this case.

[31]Robustness checks are conducted using also a sample of 9905 firms over the same period. The main difference between the two samples is that the former is unbalanced, whereas the latter is balanced.

[32]Specifically, Senses proxies the *threat* of offshoring by using the share of an industry's imports value and number of imported products from low-wage countries, as well as a measure of transportation costs.

[33]Imports of private services used in this study belong to five categories: telecommunications, insurance, finance, business services, and computing and information services.

[34]Amiti and Wei (2005a) use nine categories of private services to construct their measure of service offshoring: 1) telecommunications; 2) banking and finance, insurance and pension funds, auxiliary financial services; 3) renting of machinery; 4) computer services; 5) research and development; 6)

legal activities, accounting services, market research, and management consultancy; 7) architectural activities and technical consultancy; 8) advertising; 9) other business services.

[35]Several studies have analyzed the productivity effects of *domestic outsourcing*, a practice similar to offshoring but involving other national firms as suppliers. See, among others, Griliches and Siegel (1992) and ten Raa and Wolff (2001).

[36]See Blinder (2005), Trefler (2005a,b), Mankiw and Swagel (2006) for a detailed discussion of this point.

[37]A less optimistic view is expressed by Samuelson (2004), who argues that service offshoring will lower aggregate welfare in developed countries, as less developed economies like China and India experience productivity improvements in their imports (service) sector. However, since such improvements have the effect of reducing the overall scope for trade in the new equilibrium, the eventual welfare reduction occurs just because of the overall decline in trade volumes and not as a direct consequence of service offshoring.

[38]Overall, the number of workers performing these tasks accounts for roughly 30% of total employment in the U.S. (Jensen and Kletzer, 2005; Liu and Trefler, 2006), 18.6% in Canada, 19.2% in the EU-15, 19.4% in Australia and 13% in South Korea (van Welsum and Vickery, 2005).

[39]The categories of other private services included in the analysis are: 1) education; 2) insurance; 3) financial services; 4) telecommunications; 5) advertising; 6) computer and information services; 7) construction, architectural and engineering; 8) industrial engineering; 9) legal services; 10) management, consulting and public relation services; 11) research, development and testing services; 12) other business, professional and technical services.

[40]A worker is defined as switching industry (occupation) either if she moves from a 4-digit sector (occupation) to another between time t and $t+1$, or if she exits/enters unemployment over the same time interval. Robustness checks are carried out, however, by excluding unemployed workers from the sample.

[41]Skilled white-collars include: management, business and financial occupations; professional and related occupations. Unskilled white-collars include: service occupations; sales and related occupations; office and administrative support occupations.

[42]In the same study, Liu and Trefler also find that service offshoring does not raise the risk of unemployment for U.S. white-collar workers. They do find, instead, that service *inshoring* to China and India, generally *reduces* job insecurity and *boosts* earning growth for national white-collars.

[43]To construct his proxy, Crinò uses import-matrix coefficients and unaffiliated imports of twelve

categories of other private services: 1) finance; 2) insurance; 3) computer and information services; 4) research, development and testing services; 5) business, professional and technical services; 6) advertising; 7) management, consulting and public relation services; 8) industrial engineering; 9) installation, maintenance and repair of equipment; 10) legal services; 11) operational leasing; 12) accounting, auditing and bookkeeping.

[44]See Riker and Brainard (1997) for a study analyzing exclusively the relationship between affiliates employment in different locations.

[45]Due to the lack of wage data for the two groups of workers at the affiliate level, the authors proxy skilled wage with the average wage paid in the three most skill-intensive industries in the countries where U.S. MNEs have affiliates (chemicals, transportation equipment and scientific equipment). Similarly, unskilled wage is contructed by using average wages in textile, footwear and apparel.

[46]The sample includes the years 1970, 1974, 1978, 1986, 1990, 1994.

References

[1] Acemoglu, Daron, 2002a, "Technical Change, Inequality, and the Labor Market," *Journal of Economic Literature*, 40(1), pp. 7-72

[2] Acemoglu, Daron, 2002b, "Directed Technical Change," *Review of Economic Studies*, 69(4), pp. 781-809

[3] Acemoglu, Daron, 2003, "Patterns of Skill Premia," *Review of Economic Studies*, 70(2), pp. 199-230

[4] Amiti, Mary and Shang-Jin Wei, 2005a, "Fear of Service Outsourcing: Is It Justified?," *Economic Policy*, 20(42), pp.308-347

[5] Amiti, Mary and Shang-Jin Wei, 2005b, "Service Offshoring, Productivity and Employment: Evidence from the United States," *CEPR working paper 5475.*

[6] Amiti, Mary and Shang-Jin Wei, 2006, "Service Offshoring and Productivity: Evidence from the United States," *NBER working paper 11926*

[7] Anderton, Robert and Paul Brenton, 1999a, "Trade with the NICs and Wage Inequality: Evidence from the U.K. and Germany," in Paul Brenton and Jacques Pelkman, eds., *Global Trade and European Workers*, McMillan: London

[8] Anderton, Robert and Paul Brenton, 1999b, "Outsourcing and Low-Skilled Workers in the UK," *Bulletin of Economic Research*, 51(4), pp. 267-285

[9] Anderton, Robert, Paul Brenton and Eva Oscarsson, 2002a, "Outsourcing and Inequality," *Centre for European Policy Studies Working Document no. 187*

[10] Anderton, Robert, Paul Brenton and Eva Oscarsson, 2002b, "What's Trade Got to Do with It? Relative Demand for Skills," *Weltwirtschaftliches Archiv/Review of World Economics*, 138(4), pp. 629-651

[11] Anderton, Robert, Paul Brenton and John Walley, 2006, *Globalization and the Labor Market: Trade, Technology and Less-Skilled Workers in Europe and the United States*, Routledged: London and New York

[12] Anderton, Robert and Eva Oscarsson, 2006, "Inequality, Trade and Defensive Innovation in the United States," in Robert Anderton, Paul Brenton and John Walley, eds., *Globalization and the*

Labor Market: Trade, Technology and Less-Skilled Workers in Europe and the United States, Routledged: London and New York

[13] Antras, Pol, 2003, "Firms, Contracts, and Trade Structure," *Quarterly Journal of Economics*, 118(4), pp. 1375-1418

[14] Antras, Pol, Luis Garicano and Esteban Rossi-Hansberg, 2006a, "Organizing Offshoring: Middle Managers and Communication Costs," *NBER Working Papers 12196*

[15] Antras, Pol, Luis Garicano and Esteban Rossi-Hansberg, 2006b, "Offshoring in a Knowledge Economy," *Quarterly Journal of Economics*, 121(1), pp. 31-77

[16] Antras, Pol and Elhanan Helpman, 2004, "Global Sourcing," *Journal of Political Economy*, 112(3), pp. 552-580

[17] Antras, Pol and Elhanan Helpman, 2006, "Contractual Frictions and Global Sourcing," *NBER Working Paper 12747*

[18] Arndt, Sven W., 1997, "Globalization and the Open Economy," *North American Journal of Economics and Finance*, 8(1), pp. 71–79.

[19] Arndt, Sven W., 1999, "Globalization and Economic Development," *Journal of International Trade and Economic Development*, 8 (3), pp. 309–318.

[20] Arndt, Sven W. and Henryk Kierzkowski, 2001, *Fragmentation: New Production Patterns in the World Economy*, Oxford University Press: Oxford

[21] Autor, David, Lawrence F. Katz and Melissa S. Kearney, 2005, "Trends in U.S. Wage Inequality: Re-Assessing the Revisionists," *NBER Working Paper 11627*

[22] Autor, David, Lawrence F. Katz and Alan B. Krueger, 1998, "Computing Inequality: Have Computers Changed the Labor Market?," *Quarterly Journal of Economics*, 113(4), pp. 1169-1213

[23] Autor, David, Frank Levy and Richard Murname, 2003, "The Skill Content of Recent Technological Change: An Empirical Exploration," *Quarterly Journal of Economics*, 118(4), pp. 1279-1333.

[24] Baily, Martin N. and Diana Farrell, 2004. "Exploding the Myths of Offshoring," *McKinsey Quarterly*, April 2004

[25] Baily, Martin N. and Robert Z. Lawrence, 2004, "What Happened to the Great U.S. Job Machine? The Role of Trade and Electronic Offshoring," *Brookings Papers on Economic Activity*, 2004(2), pp. 211-284

[26] Barba Navaretti, Giorgio, Anthony J. Venables, *et al.*, 2004, *Multinational Firms in the World Economy*, Princeton University Press: Princeton and Oxford

[27] Bardhan, Ashok D. and Cynthia Kroll, 2003, "The New Wave of Outsourcing," *Fisher Center for Real Estate and Urban Economics Working Paper 1103*

[28] Bartelsman, Eric J. and Wayne Gray, 1996, "The NBER Manufacturing Productivity Database," *NBER Technical Working Paper 205*

[29] Becker, Sasha O., Karolina Ekholm, Robert Jackle and Marc Muendler, 2005, "Location Choice and Employment Decisions: A Comparison of German and Swedish Multinationals," *Weltwirtschaftliches Archiv/Review of World Economics*, 141(4), pp. 693-731

[30] Becker, Sasha O. and Marc Muendler, 2006, "Margins of Multinational Labor Substitution," *UCSD Department of Economics Discussion Paper 2006-04*, University of California San Diego

[31] Bergin, Paul, Robert C. Feenstra and Gordon H. Hanson, 2006, "Outsourcing and Volatility," *mimeo*

[32] Berman, Eli, John Bound and Zvi Griliches, 1994, "Changes in the Demand for Skilled Labor within U.S. Manufacturing: Evidence from the Annual Survey of Manufactures," *Quarterly Journal of Economics*, 109(2), pp. 367-397.

[33] Berman, Eli, John Bound and Stephen Machin, 1998, "Implications of Skill-Biased Technological Change: International Evidence," *Quarterly Journal of Economics*, 113(4), pp. 1245-1279

[34] Bernard, Andrew B. and Bradford J. Jensen, 1997, "Exporters, Skill Upgrading, and the Wage Gap," *Journal of International Economics*, 42(1-2), pp. 3-31

[35] Berndt, Ernst R. and Laurits R. Christensen, 1974, "Testing for the Existence of a Consistent Aggregate Index of Labor Inputs," *American Economic Review*, 64(3), pp.391-404

[36] Berndt, Ernst R. and Chaterine Morrison, 1995, "High-Tech Capital Formation and Labor Composition in U.S. Manufacturing Industries," *Journal of Econometrics*, 65(1), pp. 9-43.

[37] Bhagwati, Jagdish and Vivek H. Dehejia, 1994, "Freer Trade and Wages of the Unskilled–Is Marx Striking Again?," in Jagdish Bhagwati and Marvin Kosters, eds., *Trade and Wages*, American Enterprise Institute, Washington, D.C.

[38] Bhagwati, Jagdish, Arvind Panagariya and T.N. Srinivasan, 2004, "The Muddles over Outsourcing," *Journal of Economic Perspectives*, 18(4), pp. 93-114

[39] Blackorby, Charles, Daniel Primont and Robert R. Russell, 1977, "On Testing Separability Restrictions with Flexible Functional Forms," *Journal of Econometrics*, 5, pp. 195-209

[40] Blinder, Alan S., 2005, "Fear of Offshoring," *CEPS Working Paper 119*

[41] Blomstrom, Magnus, Gunnar, Fors and Robert E., Lipsey, 1997, "Foreign Direct Investment and Employment: Home Country Experience in the United States and Sweden," *Economic Journal*, 107(445), pp. 1787-1797

[42] Blomstrom, Magnus and Ari Kokko, 2000, "Outward Investment, Employment, and Wages in Swedish Multinationals," *Oxford Review of Economic Policy*, 16(3), pp. 76-89

[43] Bound, John and George Johnson, 1992, "Changes in the Structure of Wages during the 1980s: An Evaluation of Alternative Explanations," *American Economic Review*, 82(3), pp. 371-392

[44] Braconier, Henrik and Karolina Ekholm, 2000, "Swedish Multinationals and Competition from High- and Low-Wage Locations," *Review of International Economics*, 8(3), pp. 448-461

[45] Brainard, Lael S., 1997, "An Empirical Assessment of the Proximity-Concentration Trade-Off between Multinational Sales and Trade," *American Economic Review*, 87(4), pp. 520-544

[46] Brainard, Lael S. and Robert E. Litan, 2004, "Offshoring Service Jobs: Bane or Boon and What to Do?," *The Brookings Institution Policy Brief 132*

[47] Brainard, Lael S., Robert E. Litan and Nicholas Warren, 2005, "Insuring America's Workers in a New Era of Offshoring," *The Brookings Institution Policy Brief 143*

[48] Brainard, Lael S. and David A. Riker, 1997, "Are U.S. Multinationals Exporting U.S. Jobs?," *NBER Working Paper 5958*

[49] Bruno, Giovanni S.F. and Anna M. Falzoni, 2003, "Multinational Corporations, Wages and Employment: Do Adjustment Costs Matter?," *Applied Economics*, 35, pp. 1277-1290

[50] Bruno, Giovanni S.F., Anna M. Falzoni and Rodolfo Helg, 2004, "Measuring the Effect of Globalization on Labour Demand Elasticity: An Empirical Application to OECD Countries," *Working Paper CESPRI 153*, Università Bocconi

[51] Burgess, Simon M. and Michael M. Knetter, 1998, "An International Comparison of Employment Adjustment to Exchange Rate Fluctuations," *Review of International Economics*, 6(1), pp. 151-163

[52] Campa, Jose and Linda S. Goldberg, 1997, "The Evolving External Orientation of Manufacturing Industries: Evidence from Four Countries," *NBER Working Papers 5919*

[53] Crinò, Rosario, 2006, "Are U.S. White-Collar Really At-Risk of Service Offshoring," *CESPRI Working Paper 183*, Università Bocconi

[54] Deardorff, Alan V., 2005, "A Trade Theorist's Take on Skilled-Labor Outsourcing," *International Review of Economics and Finance*, 14(3), pp.259-271

[55] Denny, Michael G.S. and Melvyn Fuss, 1977, "The Use of Approximation Analysis to Test for Separability and the Existence of Consistent Aggregates," *American Economic Review,* 67(3), pp. 404-418.

[56] Desay, Mihir R., Fritz, C. Foley and James R. Hines Jr., 2005, "Foreign Direct Investment and Domestic Economic Activity," *NBER Working Paper 11717*

[57] Desjonqueres, Thibaut, Stephen Machin and John Van Reenen, 1999, "Another Nail in the Coffin? Or Can the Trade Based Explanation of Changing Skill Structures Be Resurrected?," *Scandinavian Journal of Economics*, 101(4), pp. 533-554

[58] Dunne, Timothy, John Haltiwanger and Kenneth R. Troske, 1997, "Technology and Jobs: Secular Changes and Cyclical Dynamics," *Carnegie-Rochester Conference Series on Public Policy*, 46, pp. 107-178

[59] Egger, Harmut and Peter Hegger, 2001, "Cross-Border Sourcing and Outward Processing in EU Manufacturing," *North American Journal of Economics and Finance*, 12(3), pp. 243-256

[60] Egger, Harmut and Peter Egger, 2005, "Labor Market Effects of Outsourcing under Industrial Interdependence," *International Review of Economics and Finance*, 14(3), pp. 349-63

[61] Egger, Peter, Michael Pfaffermayr and Andrea Weber, 2006, "Sectoral Adjustment of Employment: The Impact of Outsourcing and Trade at the Micro-Level," *Journal of Applied Econometrics*, forthcoming

[62] Egger, Peter, Michael Pfaffermayr and Yvonne Wolfmayr-Schnitzer, 2001, "The International Fragmentation of Austrian Manufacturing: The Effects of Outsourcing on Productivity and Wages," *North American Journal of Economics and Finance*, 12(3), pp. 257-272

[63] Ekholm, Karolina, Rikard Forslid and James Markusen, 2003, "Export-Platform Foreign Direct Investment," *NBER Working Papers 9517*

[64] Ekholm, Karolina and Katarina Hakkala, 2005 "The Effect of Offshoring on Labor Demand: Evidence from Sweden," *CEPR Working Paper 5648*

[65] Ekholm, Karolina and Karen Helene Midelfart-Knarvik, 2005, "Relative Wages and Trade-Induced Changes in Technology," *European Economic Review*, 49(6), pp.1637-1663

[66] Epifani, Paolo and Gino Gancia, 2004, "The Skill Bias of World Trade," *Economics Working Papers 833*, Department of Economics and Business, Universitat Pompeu Fabra

[67] Epifani, Paolo and Gino Gancia, 2006, "Increasing Returns, Imperfect Competition and Factor Prices," *Review of Economics and Statistics*, 88(4), pp. 583-598

[68] Epstein, Larry G. and Michael G.S. Denny, 1983, "The Multivariate Flexible Accelerator Model: Its Empirical Restrictions and an Application to U.S. Manufacturing," *Econometrica*, 51(3), pp. 647-674

[69] Falk, Martin and Bertrand M. Koebel, 2001, "A Dynamic Heterogeneous Labour Demand Model for German Manufacturing," *Applied Economics*, 33(3), pp. 339-348

[70] Falk, Martin and Bertrand M. Koebel, 2002, "Outsourcing, Imports and Labour Demand," *Scandinavian Journal of Economics*, 104(4), pp. 567-586

[71] Falzoni, Anna M. and Mara Grasseni, 2003, "Outward FDI and Skill Upgrading in the Italian Labor Market," paper presented at AIEL, 23rd Convegno Nazionale di Economia del Lavoro, Messina, September 25-26, 2003

[72] Feenstra, Robert C., 1998, "Integration of Trade and Disintegration of Production in the Global Economy," *Journal of Economic Perspectives*, 12(4), pp. 31-50.

[73] Feenstra, Robert C., 2004, *Advanced International Trade: Theory and Evidence*, Princeton University Press: Princeton and Oxford

[74] Feenstra, Robert C. and Gordon H. Hanson, 1996, "Globalization, Outsourcing and Wage Inequality," *American Economic Review*, 86(2), pp. 240-245.

[75] Feenstra, Robert C. and Gordon H. Hanson, 1997, "Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladoras," *Journal of International Economics*, 42(3-4), pp. 371-393

[76] Feenstra, Robert C. and Gordon H. Hanson, 1999, "The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States, 1979-1990," *Quarterly Journal of Economics*, 114(3), pp. 907-940

[77] Feenstra, Robert C. and G. H. Hanson, 2003, "Global Production Sharing and Rising Inequality: A Survey of Trade and Wages," in, K. Choi and J. Harrigan, eds., *Handbook of International Trade*, Basil Blackwell

[78] Feenstra, Robert C. and Barbara Spencer, 2005, "Contractual Versus Generic Outsourcing: The Role of Proximity," *NBER Working Paper 11885*

[79] Fitzenberger, Bernd, 1999, "Wages and Employment Across Skill Groups: An Analysis for West Germany," ZEW Economic Studies, vol. 6. Heidelberg: Physica; Mannheim

[80] Forrester Research, 2002, "3.3 Million US Service Jobs To Go Offshore," Cambridge, MA: Forrester Research

[81] Forrester Research, 2004a, "Two-Speed Europe: Why 1 Million Jobs Will Move Offshore," Cambridge, MA: Forrester Research

[82] Forrester Research, 2004b, "Near-Term Growth of Offshoring Accelerating," Cambridge, MA: Forrester Research

[83] Freeman, Richard B. and Lawrence F. Katz, 1995, *Differences and Changes in Wage Structures*, NBER, Comparative Labor Markets Series

[84] Freund, Caroline and Diana Weinhold, 2002, "The Internet and International Trade in Services," *American Economic Review Papers and Proceedings*, 92(2), pp. 236-240

[85] Garner, Alan C., 2004, "Offshoring in the Service Sector: Economic Impact and Policy Issues," *Federal Reserve Bank of Kansas City - Economic Review*

[86] Geishecker, Ingo, 2006, "Does Outsourcing to Central and Eastern Europe Really Threaten Manual Workers' Jobs in Germany?," *World Economy*, 29(5), pp. 559-583

[87] Geishecker, Ingo and Holger Gorg, 2005, "Do Unskilled Workers Always Lose from Fragmentation?," *North American Journal of Economics and Finance*, 16(1), pp. 81-92

[88] Goldberg, Linda, Joseph Tracy and Stephanie Aaronson, 1999, "Exchange Rates and Employment Instability: Evidence from Matched CPS Data," *American Economic Review*, 89(2), pp. 204-210

[89] Gorg, Holger and Aoife Hanley, 2005, "Labour Demand Effects of International Outsourcing: Evidence from Plant-Level Data," *International Review of Economics and Finance*, 14(3), pp. 365-376

[90] Greenaway, David and Douglas Nelson, 2001, "Globalization and Labour Markets: A Review of the Literature," in David Greenaway and Douglas Nelson, eds., *Globalization and Labour Markets*, Vols. I and II, Edward Elgar

[91] Griliches, Zvi and Donald Siegel, 1992, "Purchased Services, Outsourcing, Computers, and Productivity in Manufacturing," in *Output measurement in the service sectors*, pp.429-458, National Bureau of Economic Research Studies in Income and Wealth, vol. 56., Chicago and London: University of Chicago Press

[92] Grossman, Gene, 1987, "The Employment and Wage Effects of Import Competition," *Journal of International Economics*, 2, pp. 1-23

[93] Grossman, Gene and Elhanan Helpman, 2003, "Outsourcing versus FDI in Industry Equilibrium," *Journal of the European Economic Association*, 1(2-3), pp. 317-327

[94] Grossman, Gene and Elhanan Helpman, 2004, "Managerial Incentives and the International Organization of Production," *Journal of International Economics*, 63(2), pp. 237-262

[95] Grossman, Gene and Elhanan Helpman, 2005, "Outsourcing in a Global Economy," *Review of Economic Studies*, 72(1), pp. 135-59

[96] Grossman, Gene M. and Esteban Rossi-Hansberg, 2006a, "The Rise of Offshoring: It's Not Wine for Cloth Anymore," paper presented at the Economic Symposium "The New economic Geography: Effects and Policy Implications," Federal Reserve Bank of Kasas City

[97] Grossman, Gene M. and Esteban Rossi-Hansberg, 2006b,"Trading Tasks: A Simple Theory of Offshoring," *NBER Working Paper 12721*

[98] Hall, Robert E. and Dale W. Jorgenson, 1969, "Tax Policy and Investment Behavior: Reply and Further Results," *American Economic Review*, 59(3), pp. 388-401

[99] Hamermesh, Daniel S., 1993, *Labor Demand*, Princeton University Press: Princeton and Chichester, U.K.

[100] Hanson, Gordon H., Raymond J. Mataloni Jr. and Matthew J. Slaughter, 2003, "Expansion Abroad and the Domestic Operations of U.S. Multinational Firms," *mimeo*

[101] Hanson, Gordon H., Raymond J. Mataloni Jr. and Matthew J. Slaughter, 2005, "Vertical Production Networks in Multinational Firms," *Review of Economics and Statistics*, 87(4), pp. 664-678

[102] Hansson, Par, 2000, "Relative Demand for Skills in Swedish Manufacturing: Technology or Trade?," *Review of International Economics*, 8(3), pp. 533-555

[103] Hansson, Par, 2005, "Skill Upgrading and Production Transfer within Swedish Multinationals," *Scandinavian Journal of Economics*, 107(4), pp. 673-692

[104] Harrison, Ann E. and Margaret S. McMillan, 2006, "Outsourcing Jobs? Multinationals and US Employment," *NBER Working Paper 12372*

[105] Haskel, Jonathan and Ylva Heden, 1999, "Computers and the Demand for Skilled Labour: Industry- and Establishment-Level Panel Evidence for the UK," *Economic Journal*, 109(454), pp. C68-C79

[106] Haskel, Jonathan and Matthew J. Slaughter, 2002, "Does the Sector Bias of Skill-Biased Technical Change Explain Changing Skill Premia?," *European Economic Review*, 46(10), pp. 1757-1783

[107] Head, Keith and John Ries, 2002, "Offshore Production and Skill Upgrading by Japanese Manufacturing Firms," *Journal of International Economics*, 58(1), pp. 81-105

[108] Helg, Rodolfo and Lucia Tajoli, 2005, "Patterns of International Fragmentation of Production and the Relative Demand for Labor," *North American Journal of Economics and Finance*, 16(2), pp. 233-254

[109] Helpman, Elhanan, 2006, "Trade, FDI, and the Organization of Firms," *Journal of Economic Literature*, 44(4), pp. 580-630

[110] Heshmati, Almas, 2003, "Productivity Growth, Efficiency and Outsourcing in Manufacturing and Service Industries," *Journal of Economic Surveys*, 17(1), pp. 79-112

[111] Hijzen, Alexander, 2005, "A Bird's Eye View of International Outsourcing: Data, Measurement and Labour Demand Effects," *Economie Internationale*, 104(4), pp. 45-63

[112] Hijzen, Alexander, 2006, "International Outsourcing, Technological Change, and Wage Inequality," *Review of International Economics*, forthcoming

[113] Hijzen, Alexander, Holger Gorg and Robert C. Hine, 2005, "International Outsourcing and the Skill Structure of Labour Demand in the United Kingdom," *Economic Journal*, 115(506), pp. 860-878

[114] Hsieh, Chang-Tai and Keong T. Woo, 2005, "The Impact of Outsourcing to China on Hong Kong's Labor Market," *American Economic Review*, 95(5), pp. 1673-1687

[115] Hummels, David, Jun Ishii and Kei-Mu Yi, 2001, "The Nature and Growth of Vertical Specialization in World Trade," *Journal of International Economics*, 54(1), pp. 75-96

[116] Hummels, David, Dana Rapoport and Kei-Mu Yi, 1998, "Vertical Specialization and the Changing Nature of World Trade," *Economic Policy Review*, Federal Reserve Bank of New York, June, pp. 79-99

[117] Jensen, Bradford J. and Lori Kletzer, 2005, "Tradable Services: Understanding the Scope and Impact of Services Offshoring," in Lael Brainard and Susan M. Collins, eds ., *Offshoring White-Collar Work - The Issues and the Implications,* Washington, D.C.: Brookings Trade Forum 2005

[118] Katz, Lawrence F. and David H. Autor, 1999 "Changes in the Wage Structure and Earnings Inequality," in Orley Ashenfelter and David Card, eds., *Handbook of Labor Economics*, edition 1, volume 3, chapter 26, pp. 1463-1555, Elsevier

[119] Katz, Lawrence F. and Kevin M. Murphy, 1992, "Changes in Relative Wages, 1963-1987: Supply and Demand Factors," *Quarterly Journal of Economics*, 107(1), pp. 35-78

[120] Kirkegaard, Jacob F., 2004, "Outsourcing - Stains on the White-Collar?," *mimeo*

[121] Klein, Michael W., Scott Schuh and Robert K. Triest, 2002, "Job Creation, Job Destruction and International Competition: A Literature Review," *Federal Reserve Bank of Boston Working Paper 02-7*

[122] Klein, Michael W., Scott Schuh and Robert K. Triest, 2003a, "Job creation, job destruction, and the real exchange rate," *Journal of International Economics*, 59(2), pp. 239-265

[123] Klein, Michael W., Scott Schuh and Robert K. Triest, 2003b, *Job Creation, Job Destruction and International Competition*, W.E. Upjohn Institute for Employment Research

[124] Kletzer, Lori G., 1998, "Trade and Job Loss in U.S. Manufacturing, 1979-94," in Robert C. Feenstra, eds., T*he Impact of International Trade on Wages*, University of Chicago Press: Chicago

[125] Kletzer, Lori G., 2001, *Job Loss from Imports: Measuring the Costs*, Institute for International Economics, Washington D.C.

[126] Kletzer, Lori G., 2002, *Imports, Exports, and Jobs: What does trade mean for employment and job loss?*, W.E. Upjohn Institute for Employment Research

[127] Kletzer, Lori G. and Robert E. Litan, 2001, "A Prescription to Relieve Worker Anxiety," *Institute for International Economics Policy Brief, PB01-2, March*

[128] Koebel, Bertrand M., 2006, "Exports and Labor Demand: Searching for Functional Structure in Multi-Output Multi-Skill Technologies," *Journal of Business and Economic Statistics*, Vol. 24(1), pp. 91-103.

[129] Kohler, Wilhelm, 2001, "A Specific-Factor View on Outsourcing," *North American Journal of Economics and Finance*, 12(1), pp. 31-53

[130] Kohler, Wilhelm, 2004, "International Outsourcing and Factor Prices with Multistage Production," *Economic Journal*, 114(494), pp. C166-C185

[131] Konings, Jozef and Alan P. Murphy, 2006, "Do Multinational Enterprises Relocate Employment to Low-Wage Regions? Evidence from European Multinationals," *Weltwirtschaftliches Archiv/Review of World Economics*, 142(2), pp. 267-286

[132] Kroll, Cynthia A., 2005, "State and Metropolitan Area Impacts of the Offshore Outsourcing of Business Services and IT," *Fisher Center for Real Estate and Urban Economics Working Paper 293*

[133] Krugman, Paul R., 2000, "Technology, Trade and Factor Prices," *Journal of International Economics*, 50(1), pp. 51-71

[134] Lawrence, Robert Z. and Matthew J. Slaughter, 1993, "International Trade and American Wages in the 1980s: Giant Sucking Sound or Small Hiccup?," *Brookings Papers on Economic Activity*, Microeconomics, pp. 161-210

[135] Leamer, Edward E., 1996, "In Search of Stolper-Samuelson Effects on U.S. Wages," *NBER Working Paper 5427*

[136] Levy, Frank and Richard Murname, 2004, *The New Division of Labor,* Princeton University Press, Princeton

[137] Lipsey, Robert E., 1997, "Foreign Production by U.S. Firms and Parent Firm Employment," *NBER Working Paper 7357*

[138] Lipsey, Robert E., 2006, "Measuring International Trade in Services," *NBER Working Paper 12271*

[139] Lipsey, Robert E., Eric D. Ramstetter and Magnus Blomstrom, 2000, "Outward FDI and Parent Exports and Employment: Japan, the United States, and Sweden," *NBER Working Paper 7623*

[140] Liu, Runjuan and Daniel Trefler, 2006, "The Impact of Service Offshoring and Inshoring on the U.S. Labor Market," *mimeo*

[141] Lorentowicz, Andzelika, Dalia Marin and Alexander Raubold, 2005, "Is Human Capital Losing from Outsourcing? Evidence for Austria and Poland," *CEPR Discussion Papers 5344*

[142] Machin, Stephen, 1996, "Changes in the Relative Demand for Skills in the U.K. Labor Market," in Alison Booth and Dennis Snower, eds., *Acquiring Skills: Market Failures, Their Symptoms and Policy Responses*, Cambridge University Press: Cambridge, MA

[143] Machin, Stephen and John Van Reenen, 1998, "Technology and Changes in Skill Structure: Evidence from Seven OECD Countries," *Quarterly Journal of Economics*, 113(4), pp. 1215-1244

[144] Mankiw, Gregory N. and Phillip Swagel, 2006, "The Politics and Economics of Offshore Outsourcing," *Journal of Monetary Economics*, 53(5), pp. 1027-1056

[145] Mann, Catherine L., 2003, "Globalization of IT Services and White-Collar Jobs: The Next Wave of Productivity Growth," *International economics, Policy Brief 03-11*

[146] Markusen, James, 2005, "Modeling the Offshoring of White-Collar Services: From Comparative Advantage to the New Theories of Trade and FDI," in Lael Brainard and Susan M. Collins, eds ., *Offshoring White-Collar Work - The Issues and the Implications,* Washington, D.C.: Brookings Trade Forum 2005

[147] Mellander, Erik, 1999, "The Multi-Dimensional Nature of Labour Demand and Skill Biased Technical Change," *IFAU Working Paper Series 1999:9*

[148] Minondo, Asier and Gloria Rubert, 2006, "The Effect of Outsourcing on the Demand for Skills in the Spanish Manufacturing Industry," *Applied Economics Letters*, 13(9), pp.599-604

[149] Morrison, Catherine and Donald Siegel, 2001, "The Impacts of Technology, Trade and Outsourcing on Employment and Labor Composition," *Scandinavian Journal of Economics*, 103(2), pp. 241-264

[150] Munch, Jakob R., 2005, "International Outsourcing and Individual Job Separations," *Department of Economics Working Paper 05-11*, University of Copenhagen

[151] Neary, Peter, 2002, "Foreign Competition and Wage Inequality," *Review of International Economics*, 10, pp. 680-693.

[152] Olsen, Karsten B., 2006, "Productivity Impacts of Offshoring and Outsourcing: A Review," *OECD Directorate for Science, Technology and Industry (STI), Working Paper 2006/1*

[153] Osburn, Jane, 2001, "Occupational Upgrading and Changes in Capital Usage in U.S.," *Review of Income and Wealth*, 47(4), pp. 451-472

[154] Revenga, Ana L., 1992, "Exporting Jobs? The Impact of Import Competition on Employment and Wages in U.S. Manufacturing," *Quarterly Journal of Economics*, 107(1), pp. 255-284

[155] Riker, David A. and Lael S. Brainard, 1997, "U.S. Multinationals and Competition from Low Wage Countries," *NBER Working Paper 5959*

[156] Rishi, Meenakshi and Sweta C. Saxena, 2004, "Is Outsourcing Really as Bad as It Is Made to Sound? A Re-Assessment and Some Perspective," *EconWPA Working Paper, Macroeconomics, 0508009*

[157] Rodrik, Dani, 1997, *Has globalization gone too far?*, Institute for International Economics: Washington, D.C.

[158] Sachs, Jeffrey D. and Howard J. Shatz, 1994, "Trade and Jobs in U.S. Manufacturing," *Brookings Papers on Economic Activity*, 1994(1), pp. 1-84

[159] Samuelson, Paul A., 2004, "Where Ricardo and Mill Rebut and Confirm Arguments of Mainstream Economists Supporting Globalization," *Journal of Economic Perspectives*, 18(3), pp. 135-146

[160] Schultze, Charles L., 2004, "Offshoring, Import Competition, and the Jobless Recovery," *The Brookings Institution, Policy Brief 136*

[161] Senses, Mine Zeynep, 2006, "The Effects of Outsourcing on the Elasticity of Labor Demand," *Center for Economic Studies Working Paper 06-07,* U.S. Census Bureau

[162] Slaughter, Matthew, 1995, "Multinational Corporations, Outsourcing, and American Wage Divergence," *NBER Working Paper 5253*

[163] Slaughter, Matthew, 2000a, "What Are the Results of Product-Price Studies and What Can We Learn from Their Differences?," in Robert C. Feenstra, eds., *The Impact of International Trade on Wages*, pp. 129-165, University of Chicago Press for the NBER: Chicago.

[164] Slaughter, Matthew, 2000b, "Production Transfer within Multinational Enterprises and American Wages," *Journal of International Economics*, 50(2), pp. 449-472

[165] Slaughter, Matthew, 2001, "International Trade and Labor-Demand Elasticities," *Journal of International Economics*, 54(1), pp. 27-56

[166] Spencer, Barbara, 2005, "International Outsourcing and Incomplete Contracts," *NBER Working Paper 11418*

[167] Strauss-Kahn, Vanessa, 2003, "The Role of Globalization in the Within-Industry Shift Away from Unskilled Workers in France," *NBER Working Paper 9716*

[168] Ten Raa, Thijs and Edward N. Wolff, 2001, "Outsourcing of Services and the Productivity Recovery in U.S. Manufacturing in the 1980s and 1990s," *Journal of Productivity Analysis*, 16(2), pp. 149-165

[169] Thoenig, Mathias and Thierry Verdier, 2003, "A Theory of Defensive Skill-Biased Innovation and International Trade," *American Economic Review*, 93(3), pp. 709-728.

[170] Trefler, Daniel, 2005a, "Offshoring: Threats and Opportunities," in Lael Brainard and Susan M. Collins, eds ., *Offshoring White-Collar Work - The Issues and the Implications,* Washington, D.C.: Brookings Trade Forum 2005

[171] Trefler, Daniel, 2005b, "Policy Responses to the New Offshoring: Think Globally, Invest Locally," paper prepared for Industry Canada's Roundtable on Offshoring, March 30, 2005

[172] UNCTAD, 2006, "World Investment Report: FDI from Developing and Transition Economies: Implications for Developments," United Nations, New York and Geneva

[173] Van Welsum, Desirée and Xavier Reif, 2005, "Potential Offshoring: Evidence from Selected OECD Countries," in Lael Brainard and Susan M. Collins, eds ., *Offshoring White-Collar Work - The Issues and the Implications*, Washington, D.C.: Brookings Trade Forum 2005

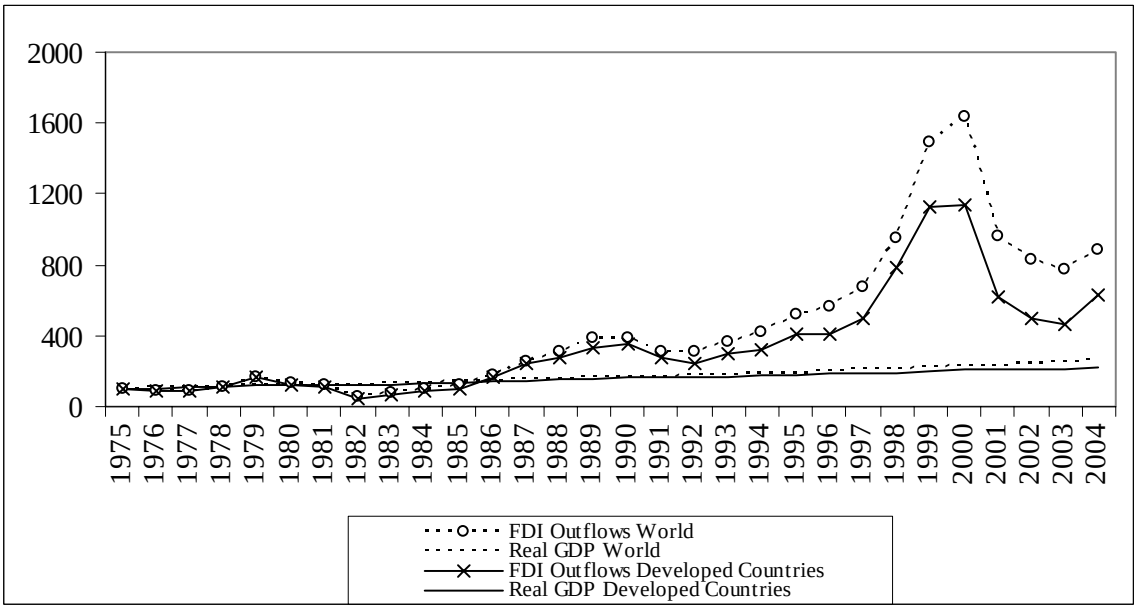
[174] Van Welsum, Desirée and Graham Vickery, 2005, "Potential Off-Shoring of ICT-Intensive Occupations," in *Enhancing the Performance of the Services Sector*, pp. 179-204, OECD, Paris and Washington, D.C.

[175] Wood, Adrian, 1994, *North-South Trade, Employment and Inequality: Changing Fortunes in a Skill-Driven World*, Oxford University Press: Oxford

[176] Wood, Adrian, 1995, "How Trade Hurt Unskilled Workers," *Journal of Economic Perspectives*, 9(3), pp. 57-80

[177] Yan, Beilling, 2006, "Demand for Skills in Canada: The Role of Foreign Outsourcing," *Canadian Journal of Economics*, 39(1), pp. 53-67

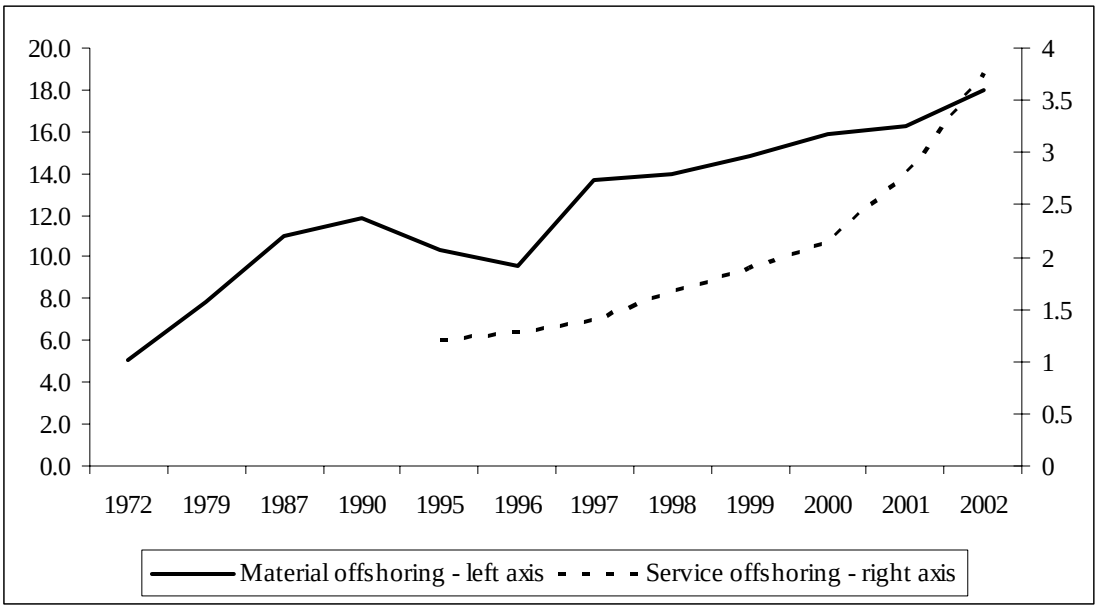
Figure 1 – Growth in FDI Outflows as Compared with GDP Growth: World and Developed Countries (Indexes, 1975 = 100)



Note: All variables are in constant 2000 U.S. dollars. Developed countries include: Canada, France, Germany, Italy, Japan, Sweden, United Kingdom, United States.
Source: UNCTAD, Foreign Direct Investment Database; World Bank, World Development Indicators

Figure 2 – Material and Service Offshoring in U.S. Manufacturing

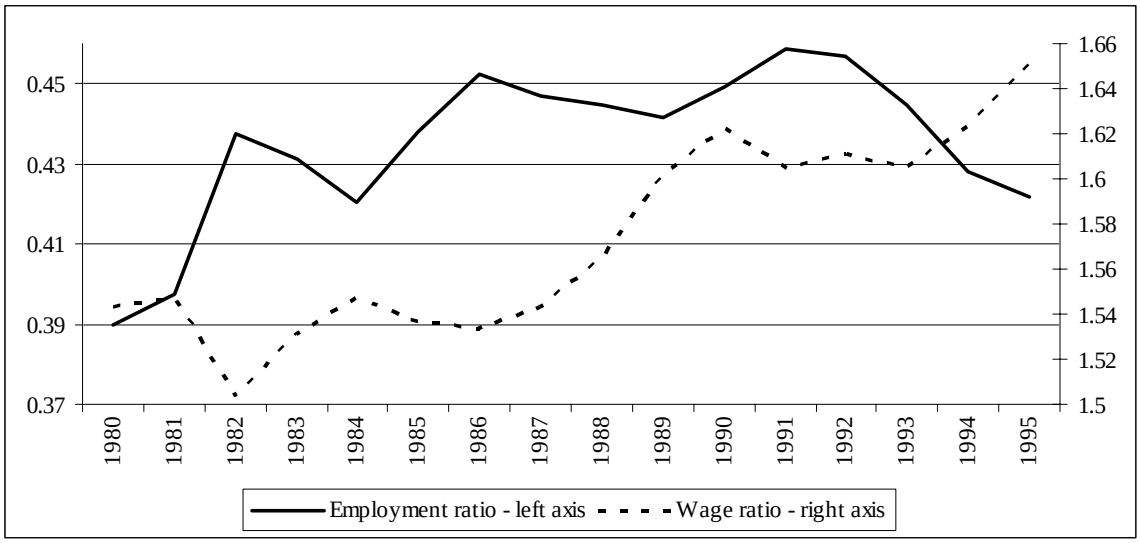
(Share of imported intermediate goods and services on total non-energy inputs purchases)



Note: Unweighed manufacturing averages, computed over 450 4-digit SIC industries (material offshoring) and 135 3-digit SIC industries (service offshoring). Service imports include the following twelve categories of "Other Private Services": financial services; insurance services; computer and information services; research, development and testing services; business, professional and technical services; advertising; management consulting and public relation services; industrial engineering; installation, maintenance and repair of equipment; legal services; operational leasing; accounting, auditing and bookkeeping.

Source: data on material offshoring between 1972 and 1990 comes from Feenstra and Hanson (1999); for the period 1995-2002, material offshoring has been constructed using input-output data from BEA ("1997 Benchmark Input-Output Data**"**), data on non-energy inputs purchases from Bureau of the Census ("Annual Survey of Manufactures") and trade data from NBER ("U.S. Trade by 1987-SIC category"). Service offshoring has been constructed using data on services imports from BEA ("U.S. International Services: Cross-Border Trade 1986-2004, and Sales Through Affiliates, 1986-2003", Table 5 and 7), import matrix from BEA ("1997 Benchmark Input-Output Data**"**) and data on non-energy inputs purchases from Bureau of the Census ("Annual Survey of Manufactures").

Figure 3 – Skilled / Unskilled Employment and Wage Ratios in U.S. Manufacturing



Note: Unweighed manufacturing averages. Skilled and unskilled workers are proxied by non-production and production workers.
Source: NBER Manufacturing Industry Productivity Database