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OUTSOURCING AND INEQUALITY

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Abstract

This paper brings together and analyses the results of empirical analyses which, in contrast to most other studies, find that trade has been a significant cause of labour market inequality in various industrialised countries. The approach is based upon the concept of outsourcing – whereby the low-skill parts of the production chain are ‘outsourced’ to low-wage countries. A distinguishing feature of the empirical work is the use of highly detailed trade data, which allow imports from high- and low-wage countries to be separately identified at the industry level. Using cost minimisation framework, we show that imports from low-wage countries have made a significant contribution to the decline in the wage-bill share and/or relative employment of less-skilled workers in the UK, the USA, Sweden and Italy. We also show how the country-specific characteristics of outsourcing can lead to quite different inequality outcomes in different countries. In line with other studies, we also find that technology has played an important role in causing the increase in inequality in many countries. However, there is also some evidence that some of the rapid increase in the application of new technologies in recent decades has been trade-induced through mechanisms such as ‘defensive innovation’.

Keywords: Outsourcing, skilled and unskilled workers, inequality, technology, defensive innovation.

JEL Classification Number: F, J31, O33.

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1. Introduction

The decline in the relative economic fortunes of unskilled workers in various industrialised countries over the past two decades has been extensively documented and analysed.¹ Empirical studies based upon the traditional neo-classical trade theory, which identifies trade and technology as the potential causes of inequality tend to conclude that the increase in imports from low-wage countries has played, at most, a minor role in this development. However, recent econometric research based on the notion of *outsourcing*, where firms reduce costs by moving low-skill-intensive production activities to low-wage countries, tends to find a significant impact of trade on the relative employment and wages of unskilled workers in industrialised countries. This paper brings together and collates our work on outsourcing which provides considerable empirical evidence that trade has had a significant impact on labour market inequality in the UK, the USA, Sweden and Italy.

Traditional trade theories primarily explain movements in relative wages *across* industries, whereas what needs to be explained is the actual dramatic fall in the relative wages and employment of unskilled workers that has occurred *within* sectors. Such a development is consistent with outsourcing and in this paper we begin by describing how the various mechanisms of outsourcing can explain rising inequality *within* industries. We then discuss how the particular way that outsourcing is measured empirically (through trade variables) may have an important, and potentially misleading, impact on the results of many other studies which investigate the impact of trade on inequality.

We argue that more accurate proxies for outsourcing are obtained by using highly disaggregated bilateral trade data (preferably expressed in volume terms). We then describe our empirical results – based on bilateral trade, industry and labour market data disaggregated to a detailed level – which show that imports from low-wage countries (our proxy for outsourcing) have made a significant contribution to the decline in the wage-bill share and relative employment of the less-skilled in various countries. Such disaggregated data also reveal how

¹ See, for example: the Summer 1995 and Spring 1997 issues of the *Journal of Economic Perspectives*; *Oxford Review of Economic Policy*, Vol. 16, No. 3 (Special Issue on ‘Globalisation and Labour Market Adjustment’ edited by David Greenaway and Douglas Nelson); *Journal of International Economics*, Vol. 50, No. 1 and Vol. 54, No. 1.

outsourcing can lead to quite different inequality outcomes in different countries. Nevertheless, in line with other studies, our work finds that technology has also played an important role in causing the increase in inequality in many countries, but we also suggest that much of the rapid increase in the application of new technologies in recent decades may have been partly trade-induced. Finally, our conclusion briefly addresses the policy implications of our conjecture that trade has played a substantial role in influencing the within-sector distribution of wages and employment in the manufacturing industry of many industrial countries. We argue that intervention to curtail trade is not an appropriate response.

2. Outsourcing

Two main explanations are frequently offered for the apparent shift in demand away from low-skilled workers in industrial countries over the past two decades, which, it is commonly perceived, has contributed to an increase in wage inequality in countries with relatively flexible labour markets (the USA and the UK) and a rise in unemployment for such workers in countries with more rigid labour markets (continental Europe). First, that skill-biased labour-saving technical progress has reduced the relative demand for unskilled workers. Second, that increased international trade with nations with an abundant supply of low-skill and low-wage labour has decreased the demand for low-skilled workers in the advanced industrialised countries. Standard trade theory suggests that both of these factors could be responsible for the decline in the fortunes of low-skilled workers in industrial countries and that empirical analysis is required to identify the relative importance of each.

Traditional trade theories primarily explain movements in relative wages *across* industries, whereas industrialised countries have experienced a dramatic fall in the relative wages and employment of unskilled workers *within* sectors.² Indeed, the observed shift away from the use of unskilled labour within all industries is in contradiction with trade being the principal cause of rising inequality in the traditional model. If trade with low-wage countries has reduced the relative wage of unskilled labour then firms within all sectors have an incentive to use relatively more of this now cheaper factor. Consequently, there should be an increase in the *relative* use of unskilled labour in *all* sectors. This has led a number of authors to conclude by deduction that factor-biased technological change must be the principal cause of the observed shift away from the use of unskilled labour. However, the impact of globalisation appears to be more complicated than is allowed for within the confines of standard factor proportions trade

² See Sachs and Shatz (1996) and Anderton and Brenton (1998a), which look at developments across industries in the context of traditional trade theories such as the Heckscher-Ohlin-Samuelson model incorporating the Stolper-Samuelson theorem.

theory. We need to look more carefully at how firms within sectors respond to the more intense competition provided by increased imports from low-wage countries.

One explanation of how trade with low-wage countries may push down the relative wages and employment of unskilled workers *within* industries is provided by the notion of ‘outsourcing’. Outsourcing occurs where firms take advantage of both the low-wage costs of relatively labour abundant countries and modern production techniques – whereby the process of manufacturing a product can be broken-down, or fragmented, into a number of discrete activities – and move the low-skill-intensive parts of production abroad, but continue to carry out the high-skill-intensive activities themselves.³ Once the low-skill activities have been performed, the goods are then imported back from the low-wage countries and either used as intermediate inputs or sold as finished goods. Hence, trade with low-wage countries via this route will shift demand away from less-skilled towards skilled workers in advanced industrialised countries, and put downward pressure on the relative wages and employment of low-skilled workers *within* industries.

Casual but direct evidence suggests that outsourcing plays a significant role in modern production. For example, Nike only employs 2,500 persons in the USA for marketing and other headquarters services, whereas about 75,000 persons are employed in Asia producing shoes that are sold to Nike. General Electric *imports* all of the microwaves marketed under their brand name from Samsung in Korea (Magaziner and Patinkin, 1989). Outsourcing is also a well-documented feature of industries such as footwear (Yoffie and Gomes-Casseres, 1994, and Brenton *et al*, 2000), textiles⁴ (Waldinger, 1986; Gereffi, 1993), and electronics (Alic and Harris, 1986). Many of the above examples – such as the General Electric case – also illustrate that outsourcing applies to *finished* goods as well as *intermediate* inputs.⁵

³ ‘Moving the low-skill-intensive parts of production abroad’ does not necessarily mean that the firm is involved in outward foreign direct investment, it can also mean that the low-skill parts of production are closed-down and replaced by imports – of either intermediate or finished goods – from low-wage countries.

⁴ *Textile World* (1994) provides an idea of the relative level of wages in various low-wage countries in the textiles sector in 1993. For example, medium-income countries such as South Korea and Mexico have hourly compensation levels of around one quarter to one-third of those in the USA, whereas low-income countries such as India, China and Bangladesh have average textile wage rates under 5% of US levels.

⁵ Slaughter (1995) finds that multinational outsourcing contributed very little to the increase in wage inequality in the USA. Moreover, differences in the definition of outsourcing partly explain why the results of Feenstra and Hanson (1995) differ to those of Slaughter.

In their case study analysis, Anderton and Schultz (1999) find that outsourcing of production to low-wage countries is quite common in the medical equipment industry in both Germany and the UK. Furthermore, the emergence of the new-democracies of Eastern Europe has created additional outsourcing opportunities for Germany because of the geographical proximity of these low-wage countries. With regard to more sophisticated medical equipment – such as diagnostic, monitoring and therapy equipment – it seems that the basic parts of production (such as metal casings) are sometimes outsourced to low-wage countries, while the more complex parts of the production process are performed domestically. By contrast, the domestic production by some firms of lower-tech medical equipment, such as simple surgical instruments, is frequently supplemented by importing similar *finished* products from low-wage countries and reselling them on the domestic market after carrying out simple tasks such as quality control procedures and packaging. Some of the price differentials in this sector are extremely large; for example, simple scalpels sold by one UK firm for 25 pounds can be purchased from Pakistani companies for one pound! Hence the price incentives to outsource can be substantial.

Jarvis and O'Mahony (2000), in their case study analysis of the ceramic tableware industry, report that many German companies outsource the manual 'decoration' of their tableware to the nearby Czech Republic and Poland and that this accounts for roughly 20 per cent of total output volume. The net saving in labour costs – that is, net of supervisory personnel, transport costs and breakages in transit – amounts to roughly 30 per cent in comparison to German ceramic tableware decorators. Glass and Saggi (2001) point out how workers in the USA feel a real threat from outsourcing and how this has become an important policy issue. For example, staff at a General Motors plant in Ohio went on strike to protest at increased outsourcing to low-wage countries, while Boeing employees (in Kansas, Washington and Oregon) went on strike to protest at Boeing's intention to outsource half of the value of the average jet aircraft (mostly to China).

3. Outsourcing: Measurement Issues and Possible Mechanisms

Measurement issues

So, theory and case study evidence support the notion that outsourcing may have played a substantial part in the wage and employment prospects of unskilled workers in industrial countries. Is this substantiated by statistical evidence across a range of industries in different countries? Our empirical work – based upon a representation of the cost function of the firm – econometrically estimates the wage bill and employment shares of low-skill workers at the industry level and includes a measure of imports as a proxy variable for outsourcing. Previous

studies based upon such an approach (see, for example, Feenstra and Hanson, 1996) proxy outsourcing by the share of imports in total consumption from *all* countries, which implicitly captures the outsourcing of production to advanced industrialised countries as well as to low-wage countries. However, there is no obvious reason why firms would outsource *low-skill-intensive* activities, which is a key mechanism by which outsourcing may affect the demand for the less-skilled, to advanced industrialised countries which are relatively abundant in skilled labour.

By contrast, an important feature of all of the applications reported in this paper is that we disaggregate imports according to individual supplier countries and construct an import term for different groups of countries – distinguishing between industrialised and low-wage countries – for each of the detailed industry sectors included in the analysis. Thus, we explicitly identify imports *solely from low-wage countries* and use this as a variable for explaining changes in the relative wages and employment of the low-skilled, and thereby more accurately proxy outsourcing to low-wage countries (particularly when compared to other studies).⁶

Some empirical studies of outsourcing have also utilised estimates of the value of imported intermediate inputs – usually derived from information on intermediate inputs from input-output tables – which is then multiplied by the ratio of imports to total purchases. In our studies we prefer to use the direct import measure for two main reasons. First, import penetration captures the outsourcing of what are measured as final products in the customs statistics, whereas the input-output approach does not. For example, footwear and clothing products sold under brand names in Europe which are actually produced in low-wage countries.⁷ Second, the variables generated by these two alternative approaches are likely to be very similar since input-output tables are compiled infrequently, typically every five years, so that virtually all of the variation in the imported intermediate term will be due to changes in import penetration.

Another potentially important measurement issue is whether the import term is specified in *nominal* or *real* terms. Most studies testing for the impact of trade on inequality specify the import penetration variable as the *value* of imports divided by the value of the sum of domestic sales and imports. However, the change in such a nominal term in response to, say, a decline in import prices

⁶ Virtually all other empirical studies on the ‘trade and inequality debate’ do not distinguish between imports from high and low-wage countries.

⁷ It might also be argued that, in addition to measuring the actual amount of intermediate inputs that are imported, the import penetration term captures the incentive for firms to outsource, in terms of pressure of competition in the market for the final product.

could be positive or negative and will depend on the magnitudes of the demand elasticities (in other words, it is not necessarily the case that increased external competition results in increased import penetration in *value* terms).⁸

In addition, if domestic producers respond to greater import competition by increasing the quality of their products – a process which, through various mechanisms, could also push down the relative wages and employment of the less-skilled – then it is feasible that greater import competition could be accompanied by a *fall* in import penetration in value terms. By contrast, import penetration measured in *volume* terms does not suffer from these problems: with normal demand curves, a fall in import prices, *ceteris paribus*, will lead to an increase in import penetration. In certain of the applications discussed below, we find that an index of import penetration in volume terms in our estimating equations can be a superior alternative to import penetration variables expressed in terms of values.

Outsourcing mechanisms

Ostensibly, one might think that outsourcing to low-wage countries – due to their abundance of low-skill labour – would be more prevalent in low-skill-intensive sectors in advanced industrialised countries, rather than high-skill-intensive industries. This expectation seems reasonable if firms can substitute low-skilled workers with outsourcing by simply importing the necessary semi- or finished products from low-wage countries. Firms can easily do this regardless of whether they are low-skill/low-profit or high-skill/high-profit. By contrast, if outsourcing requires foreign direct investment in low-wage countries – involving the manufacture of specific components or products possibly requiring supervision and technical expertise from the investing company – then this may only be possible for high-skill/high-profit firms. In other words, only high-skill/high-profit firms may have the ability to outsource – hence, under these circumstances, outsourcing could be more important for high-skill sectors in comparison to low-skill-intensive sectors.

In addition, the scope for outsourcing partly depends upon the degree to which production of the final product can be fragmented into discrete stages, which embody substantially different factor intensity ratios. This, in turn, will be determined by technological conditions in the industry in question. Hence, whether outsourcing is most appropriate in high or low-skill-intensive sectors is an empirical question. In summary, although the incentive to outsource will be

⁸ Given that we proxy outsourcing by import penetration of both finished and intermediate products, we are implicitly capturing trends in both outsourcing and direct import substitution. To the extent that the two mechanisms are positively correlated, our estimates should be interpreted as the ‘upper bounds’ of the impact of outsourcing.

greater in low-skill intensive sectors where low-skilled workers comprise a substantial portion of total production costs, the capacity and ability to outsource may be greater in either high or low technology/skill sectors, and will depend upon a variety of factors which may differ between countries. It follows that outsourcing and its impact may be quite different across countries. This is even more likely to be the case for our sample of four countries, given their fundamentally different labour markets. One would expect adjustment to increased competition from low-wage countries to occur mainly via changes in the relative wages of the less skilled in the flexible labour markets of the USA and UK, while relative employment is more likely to be affected in the more rigid labour markets of Sweden and Italy.

Another important feature possibly related to outsourcing mechanisms is the ‘lumpiness’ of changes in the economic circumstances of the less-skilled. For example, inequality increased dramatically in the early 1980s in both the USA and UK, while Sweden experience a burst in inequality in the early 1990s. If outsourcing is a significant cause of the rise in inequality, it may be the case that outsourcing is occurring at an uneven pace. One explanation may be that outsourcing is triggered by threshold levels related to switching costs. Orcutt (1950) argues that the *costs of switching* from domestic to foreign suppliers may cause the price elasticity of imports to be bigger for large price changes than for small changes and a similar argument might be made for disproportionately large increases in ‘outsourcing’. For example, when considering whether or not to ‘outsource’, producers have to take into account the costs incurred when switching from in-house, or other domestic, supplies to foreign suppliers. When switching to foreign suppliers, producers may have to modify production techniques to be compatible with the newly-imported products and spend time ensuring that the new supplier is both reliable and produces a product of the required specifications and quality. Consequently, small changes in the price of foreign goods will not be acted upon as the change in price differential will not cover switching costs. In contrast, a large appreciation of the domestic currency will result in a substantial differential between the costs of producing ‘in-house’ (or domestic) goods and imports – which may be at least sufficient to cover the costs of switching. So, *switching costs* may cause a *disproportionate* increase in ‘outsourcing’ during *large* exchange rate appreciations, which may partially explain the ‘lumpiness’ of changes in the economic circumstances of the less-skilled in some of the countries examined in this study. Similarly, high real exchange rates and recessions may put considerable competitive pressures on firms to reduce prices and outsourcing may be an effective way of reducing costs.

4. Methodology

In this section, we briefly outline the derivation of our basic empirical specifications and then discuss our econometric estimates regarding the impact of both trade with low-wage countries and changes in technology on the wage-bill and employment shares of non-production workers in the various countries. A key feature of our studies is that we use highly disaggregated wage, employment and production data. In common with the majority of previous studies, we treat non-production workers as skilled and production workers as less skilled.⁹

Our empirical equations explain the share of the wage bill and/or employment accounted for by the two categories of workers (skilled and unskilled) in terms of the traditional factors entering the variable cost function of the firm; the level of output, the amount of capital, technology, and factor prices. In our equations these variables are supplemented by an import penetration term designed to capture the incentives for the firm to outsource low-skill activities (the full derivation of the equations is presented in Anderton and Brenton, 1999, and Anderton, Brenton and Oscarsson, 2001). This import penetration term can be interpreted as representing a reduced-form relationship between outsourcing and a firm's unit input requirement for skilled labour (Feenstra and Hanson (1995, 1996)).

Specifically, following in the tradition of Berman, Bound and Griliches (1994) and starting from a translog representation of the cost function, we estimate equations that typically take the following form

$$dSW_{it} = \mathbf{a}d \ln K_{it} + \mathbf{b}d \ln Y_{it} + \mathbf{r}TECH_{it} + \mathbf{I}d \ln MS_{it} + \mathbf{g}D_{it} + U_{it} \quad (1)$$

$$dSE_{it} = \mathbf{a}d \ln K_{it} + \mathbf{b}d \ln Y_{it} + \mathbf{r}TECH_{it} + \mathbf{I}d \ln MS_{it} + \ell d \ln(W^{hs} / W^{ls})_{it} + \mathbf{g}D_{it} + U_{it} \quad (2)$$

Where: SW_{it} is the share of the wage bill of the high skilled $\left(\frac{WB_{it}^{hs}}{WB_{it}^{hs} + WB_{it}^{ls}} \right)$

⁹ However, in the study of Italy, which we discuss below, inequality is measured between white-collar and blue-collar workers. Where blue-collar workers are manual workers and white-collar workers are distinguished by the amount of their responsibilities. Thus, the Italian data are not open to the same criticisms as the use of production and non-production workers which have been criticised (see, Leamer, 1994) for the inclusion of certain manual workers - such as office cleaners - as non-production, and hence skilled, workers.

SE_{it} is the employment share of the high skilled (similarly derived as SW_{it}).

WB_{it}^{hs} is the wage bill of the high skilled (non-production workers).

WB_{it}^{ls} is the wage bill of the lower skilled (production workers).

W^{hs} / W^{ls} = relative wage rates of high and low-skilled workers.

K_{it} is the capital stock.

Y_{it} is real output.

$TECH_{it}$ proxy variable for technological change.

MS_{it} is a term measuring the importance of imports from low-wage countries¹⁰ relative to total domestic demand for the output of industry i .

D_t is a set of time dummies.

U_{it} is an error term.

d is the first difference.

Subscript represents industry i .¹¹

Note that in the wage share equation the relative wage term is dropped due to potential endogeneity and the problem of the definitional relationship between the dependent variable (the share of the wage bill) and relative wage rates. The time dummies capture changes in demand for non-production relative to production workers common across industries in each year. In the main, and in common with most studies, we use R&D expenditure as a share of total output as our proxy for technological change. However, in one exercise we also experiment with patenting activity as a suitable proxy for technological change. One advantage of using patents is that they are an *output* of the innovation process, whereas R&D expenditure is simply an expenditure *input*, which may never come to fruition in terms of practical application in the manufacturing process.

¹⁰ Low-wage countries are defined as non-OECD countries, with the OECD taken as those members prior to 1994 (i.e. excluding recent members such as the Czech Republic, Hungary, Poland, South Korea and Mexico).

¹¹ The bilateral import data are from the OECD on an SITC basis and converted to the ISIC REV2 industrial classification. Thus, we utilise trade, production, wage and employment data all disaggregated to the 4-digit ISIC level, which probably reflects the highest level of sectoral detail used in a comprehensive assessment of the impact of globalisation on labour market outcomes in industrialised countries. Data at this level of detail are only available since the 1970s or later and so in order to provide enough observations we pool the data across 4-digit ISIC sectors and apply a 'panel estimation' approach.

5. Summary of Empirical Results

This section describes our results using panel estimates of the above specification for the UK, USA, Sweden and Italy. An overview of our empirical results is shown in Table 1. The first rows of the table show the estimated parameter values for the standard variables which enter the cost function; output (Y), Capital (K), relative wages (RW), where employment equations are reported, and technology (R&D and Patents (PAT)). Subsequently, we report results for the trade variables: import penetration from low-wage countries in value terms (MPV), import penetration from low-wage countries in terms of quantities (MPQ), and the variance of import prices (NSDIP), which will be discussed below. We now briefly summarise the results from our studies country by country.

5.1 United Kingdom

An initial study of the UK utilised data for eleven 4-digit ISIC sectors within the textiles industry (usually defined as low-skill-intensive) and the non-electrical machinery industry (high-skill-intensive). The data are annual covering the period 1970 to 1986. The key finding of this research is that, while total import penetration from all countries (measured in value terms) was not important, imports specifically from low-wage countries were found to have a statistically significant positive influence on the wage bill share of high skill workers within the sectors analysed. In other words, increasing import penetration from low-wage countries has reduced the wage bill share of low-skill workers and thereby resulted in increased inequality. Table 1 (columns 1 and 2) provides a summary of these results (see Anderton and Brenton, 1999, for further details).¹² Although not reported here, similar results were found for the UK employment shares. Further tests using dummy variables showed that the parameter with regard to import penetration from low-wage countries was much smaller for the higher-skill non-electrical machinery sectors relative to the low-skill-intensive textiles sectors, suggesting that the higher-skill-intensive UK industry has been far less prone to outsourcing.

¹² As the capital stock and R&D terms seemed to be collinear in the UK econometric analysis, we show column (1) without the R&D term, and column (2) without the capital stock term.

Table 1: Estimated Wage Bill and Employment Share Equations

EQUATION	UK (wage bill share)		USA (wage bill share)			Sweden (employment share)		Italy (employment share)	
	(1)	(2)	(3) LSA	(4) LSB	(5) HS	(6)	(7)	(8) LSA	(9) HS
C	0.38*10 ⁻²	-0.13*10 ⁻²	0.013	0.32*10 ⁻³	0.23*10 ⁻³	0.006	0.006	-0.007	-0.009
	(0.94)	(0.29)	(2.27)	(0.66)	(0.81)	(3.24)	(3.35)	(1.75)	(1.29)
dlnY _{it}	-0.61	-0.82*10 ⁻²	-0.014	-0.043	-0.025	-0.009	-0.006	0.015	-0.021
	*10 ⁻²	(1.33)	(1.01)	(3.31)	(2.46)	(1.36)	(0.98)	(1.50)	(2.33)
	(1.01)								
dlnK _{it}	0.138	-	-0.026	-0.66*10 ⁻³	0.029	0.039	0.039	0.003	-0.018
	(1.60)		(0.59)	(0.10)	(0.740)	(2.42)	(2.45)	(0.30)	(2.00)
dlnRW _{it}	-	-	-	-	-	-0.076	-0.075	0.055	0.065
						(7.56)	(7.57)	(2.04)	(2.41)
(R&D/Y) _{it-1}	-	0.219	0.375	-0.014	0.052	0.053	0.055	0.039	-0.027
		(1.62)	(0.43)	(0.06)	(3.38)	(4.17)	(4.32)	(3.00)	(0.45)
PAT/Y	-	-	-	-	-	0.458	0.40	-	-
						(4.08)	(3.50)		
dlnMPV _{it}	0.016	0.019	0.29	0.58*10 ⁻³	-0.58	-	-	0.004	0.010
	(3.11)	(3.34)	(2.08)	(2.21)	*10 ⁻⁴			(0.125)	(2.01)
					(0.49)				
dlnMPQ	-	-	-	-	-	0.005	0.003	-	-
						(2.96)	(1.81)		
dlnMPQ*D _{HS}	-	-	-	-	-	-	0.013	-	-
							(3.05)		

	UK (wage bill share)		USA (wage bill share)			Sweden (employment share)		Italy (employment share)	
EQUATION	(1)	(2)	(3) LSA	(4) LSB	(5) HS	(6)	(7)	(8) LSA	(9) HS
NSDIP	-	-	-	-	-	-	-	0.00 (0.25)	0.01 (2.50)
N	176	143	360	200	440	721	721	128	139
R ²	0.3728	0.3744	0.2368	0.5592	0.3583	0.3994	0.4073	0.31	0.31
SEE	.01269	.01291	0.01088	0.00854	0.01325	0.0175	0.0174		

Notes: (i) OLS estimation for annual data. The precise time period, as well as the number of 4-digit ISIC industries pooled across, differs between countries (N equals the number of observations); (ii) ‘t’ statistics are in parentheses; (iii) The dependent variable is the wage bill or employment share of high-skill workers, Y is a measure of domestic output (sales in the case of Italy), K is a measure of the capital stock, RW is the wage of the skilled relative to the less-skilled, R&D is research and development expenditures, PAT is the number of industry patents, MPV is import penetration from low-wage countries in value terms, MPQ is an index of the volume imports from low-wage countries relative to the volume of domestic output (the former is measured in tonnes, the latter is derived as the value of domestic output divided by the producer price index for each sector), $\ln MPQ * D_{HS}$ is MPQ multiplied by a dummy variable with a value of 1 for high-skill sectors and zero otherwise, NSDIP is the normalised standard deviation of import prices (unit values) from 5 low-wage regions (Latin and Central America, Asia, Africa, NICS, and the rest of the world, with the latter corresponding mainly to central and eastern European countries); (iv) in the case of Italy, Y enters lagged one period in the LSA regression and lagged two periods in the HS regression, whilst MPV enters lagged one period in the HS regression; (v) LSA indicates low skill intensive sectors, LSB indicates low-skill intensive and capital intensive sectors, HS indicates skilled intensive sectors; (vi) The (R&D/Y) term for Sweden is only statistically significant for the period 1990-93 (ie, the Swedish R&D term is multiplied by a dummy variable with a value of 1 for 1990-93 and zero otherwise). **Priors:** Y is expected to be negatively signed as a short-run decline in output tends to hurt the wages and employment the less-skilled relative to the skilled; K is expected to be positively signed as there should be complementarities between capital and skilled-workers; RW should be negatively signed as an increase in the relative wage of skilled workers should decrease the relative demand for such workers; R&D and PAT are expected to be positively signed when technological progress is skill-biased; MPV and MPQ are expected to have positive signs if imports from low-wage countries have an adverse impact on the relative wages and employment of the less-skilled. NSDIP is expected to be positively signed as the scope for outsourcing increases as the range of low-wage countries trading on international markets increases. Full and detailed results for the UK are shown in Anderton and Brenton (1999); USA (Anderton and Brenton, 1998); Sweden (Anderton, Brenton and Oscarsson, 2002).

We also investigated the impact of relative import prices – the price of UK imports relative to the UK domestic price – again disaggregated to the 4-digit industry level and distinguishing between different import suppliers. Tests using dummy variables revealed that these relative price terms were again only statistically significant for low-wage country import suppliers for the low-skill-intensive textiles industry, particularly during the early 1980s when import price competition was further intensified by the high level of sterling. Moreover, the relative price terms were included along with the import penetration variables, hence their impact is in addition to the effects of any actual increase in import penetration. Accordingly, the relative price terms might be interpreted as capturing the ‘threat’ of increased competition from low-wage countries (and the associated ‘threat’ of increased opportunities for reducing labour costs via outsourcing).

In terms of the magnitude of its impact, these results suggest that outsourcing to low-wage countries in the 1970s and early 1980s may have accounted for as much as 40% of the increase in the wage bill share of skilled workers, and approximately one third of their employment share, in the UK textiles industry. Although we also found that technological change contributed significantly to the observed within sector increase in inequality, our import penetration results suggest a quantitatively much greater impact from trade than has been suggested in other studies of the UK (for example, Haskel, 1996).

5.2 United States

Our analysis of the USA (Anderton and Brenton, 1998b) uses a considerably broader set of data for 40 manufacturing sectors using annual data for the period 1970-1993 and distinguishes between high and low-skill sectors given the heterogeneous inequality outcomes for these different industries (see Table 2 below). The Table presents summary information for two groups of industries that can be classed as low-skill-intensive (abbreviated as LSA and LSB) and one group of high-skill-intensive sectors (HS). The LSA group contains sectors that are traditionally thought of as low-skill intensive such as textiles and clothing. The second group contains sectors where there is a high unskilled labour content (relative to skilled labour) but production techniques are more capital intensive than for the first group.

The upper part of Table 2 shows that the largest rise in US inequality occurred in all three groups of sectors between 1978-1986 (a period of substantial dollar appreciation), but that inequality continued to increase, albeit more gradually, through the rest of the 1980s and early 1990s.¹³ The bottom section of Table 2

¹³ The higher wage bill share for non-production workers in the HS sectors relative to the other sectors is consistent with our claim that the former sectors are relatively high-skill-intensive.

shows that R&D expenditure is extremely small in the two low-skill sectors, amounting to substantially less than one per cent of the value of output in both sectors. Given that the R&D ratios are extremely small in these low-skill sectors – indicating that these are low-technology-intensive industries – one obvious question to ask is: ‘how can movements in R&D expenditure/technology explain the change in the wage share of non-production workers in these low-skill-intensive sectors when technology plays only a minor role in these industries?’. On the other hand, the technology explanation seems to correspond with movements in R&D expenditure in the high-skill sectors, particularly the large rise in R&D between 1978-1986 during the period of the dollar appreciation in the early 1980s corresponding with the large rise in inequality in these sectors (Table 2).

Table 2 also shows US imports from low-wage countries as a proportion of total sectoral imports. Although the relationship between the import share of low-wage countries in the low-skill sectors and the wage share of non-production workers is unclear in the early 1970s, there is a large increase in the share of US imports from low-wage countries during the period when inequality rose more rapidly and the dollar appreciated. Conversely, imports from low-wage countries for the high-skill sector group remained static between 1978 to 1986 – perhaps indicating that the rise in R&D expenditure during that period may have acted as ‘defensive innovation’ and succeeded in reducing import competition from low-wage countries in this sector (however, the relatively high import share of low-wage countries in this high-skill sector suggests that the degree of low-wage country competition may be sufficient to be a plausible cause of defensive innovation).

The preliminary conclusions of the data-based analysis arising from Table 2 are broadly supported by our econometric analysis. The econometric results for the USA presented in the summary Table 1 show that increasing import penetration from low-wage countries resulted in a significant increase in inequality in the two low-skill-intensive groups of sectors. However, this is not the case in the high-skill-intensive intensive sectors where our econometric results show that technological change – proxied by R&D expenditure – explains the rise in inequality. A similar story holds for the employment shares (see Anderton and Oscarsson, 2001, for more detailed results regarding employment).

Table 2: USA wage bill and employment share of non-production workers, import share of low-wage countries (LWCs) and R&D in low and high-skill-intensive sectors¹

	Wage bill share			Employment share		
Year	LSA ²	LSB ²	HS ²	LSA ²	LSB ²	HS ²
1974	24.8	25.8	41.2	14.6	20.3	30.9
1978	25.1	26.3	42.2	14.9	20.3	32.3
1986	27.3	30.3	49.6	17.1	23.4	38.4
1993	28.6	31.7	51.1	17.5	23.7	37.6
	Import share of LWCs ³			R&D/Output ratio		
Year	LSA ²	LSB ²	HS ²	LSA ²	LSB ²	HS ²
1974	37.7	26.1	34.9	0.45	0.48	4.24
1978	46.1	26.0	36.6	0.46	0.49	3.85
1986	58.0	30.2	35.8	0.57	0.86	5.79
1993	61.2	33.7	42.8	0.80	0.62	5.42

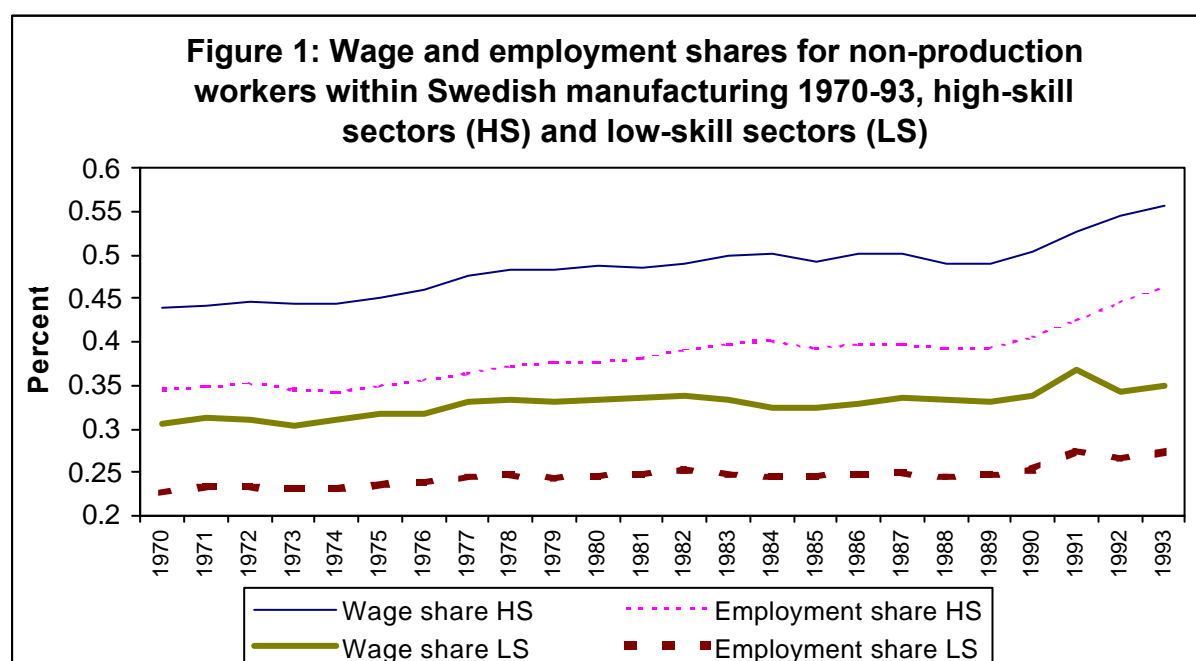
Notes: ¹All figures are in percentages. ²LSA= low-skill sector group ‘A’ comprising ISIC sectors 3200, 3300 and 3400 (ie, Textiles, Apparel and Leather; Wood Products and Furniture; Paper, Paper Products and Printing). LSB= low-skill sector group ‘B’ comprising ISIC sectors 3600, 3700 and 3810 (ie, Non-Metallic Mineral Products; Basic Metal Industries; Metal Products); HS= High-skill sectors comprising ISIC sectors 3500, 3820, 3830, 3850 (Chemical Products; Non-electrical Machinery; Electrical Machinery; Professional Goods). ³ Sectoral imports from LWCs expressed as a percentage of total sectoral imports.

However, one might also argue that the dramatic rise in R&D expenditures in the high-skill-intensive sectors in the USA between 1978-1986 may have been partly trade-induced. For example, it may be the case that the substantial rise in the dollar over this period, and the associated deterioration in the trade competitiveness of US industry, may explain some of the rapid rise in R&D expenditure intensities in the higher-tech sectors. First, less-competitive firms within these sectors – most likely offering low-quality products, perhaps associated with relatively lower R&D spending and a relatively high proportion of low-skilled workers in their labour force – would have been squeezed out of business (as the dollar appreciation made US imports much cheaper). These possible *compositional* effects imply that, after a considerable ‘shake-out’, industry would subsequently consist of a higher proportion of high-tech firms and the average R&D/output ratio would therefore rise (and be associated with a higher proportion of high-skilled workers if the technology is skill-biased). Moreover, the deterioration in competitiveness may have encouraged US

manufacturers to ‘*innovate defensively*’, that is, faced with strong competition from low-cost imports, firms may have attempted to escape fierce import price competition by upgrading the quality of their manufactures via ‘product innovation’ which, in turn, required spending more on R&D.¹⁴

5.3 Sweden

Sweden is an interesting and contrasting case since it is a much smaller and more open economy than the US and the UK and has fundamentally different labour market policies compared to these two countries (which are typically held up as paragons of flexible labour markets). Nevertheless, all of these countries have experienced a shift away from unskilled towards skilled workers within the manufacturing sector. However, two important features characterise the Swedish experience during our sample period 1970-1993. First, skill upgrading in Sweden has been particularly evident in the *high-skill* sectors such as Machinery and equipment (ISIC 382), Electrical machinery, apparatus appliances and supplies (ISIC 383) and Instruments and photo equipment (ISIC 385), while only a few lower-skill sectors – such as, textiles, wearing apparel and leather (ISIC 32) – display rises in labour market inequality. This is illustrated in Figure 1, which reveals that the wage and employment shares for skilled (non-production) workers increased by more within the high-skill industry group than in the low-skill industry group, particularly at the end of the period (i.e. 1990-1993).



Source: *Manufacturing, various issue, Statistics Sweden.*

Note: High-skill industries are ISIC 342, 35, 382, 383 and 385.

¹⁴ The experience of the UK during this period is very similar to that of the US. Between 1979-1981, sterling temporarily appreciated by around thirty per cent and was associated with a rise in the UK manufacturing R&D/output ratio from around 1.5 per cent to 2 per cent.

Second, the non-production worker share of employment in Swedish manufacturing increased from 27 to 35 percent between 1970 and 1993, with a sharp increase from around 1990 onwards, while the share of the total manufacturing wage-bill for non-production workers increased from 36 to 43 percent during the same period. The larger proportionate change in the employment share compared to the wage-bill share of skilled workers suggests that the increase in inequality between skilled and unskilled workers in Sweden owes more to increasing disparities in employment opportunities than to greater differentials in wages. This is confirmed by data which show that, in contrast to the US and the UK, the relative wage of non-production to production workers remained constant (with a premium of about 50 per cent) throughout the 1970s and 1980s in Sweden and actually *fell* during the recession of the early 1990s. On the other hand the ratio of manufacturing non-production to production workers employed increased steadily from around 38 per cent in the mid 1970s to 45 per cent at the end of the 1980s, followed by a large increase to 55 per cent in the early 1990s recession.

Structural labour market rigidities in Sweden may explain why most of the adjustment took place on the employment side, while relative wages remained stable. For example, the Swedish labour market is characterised by ‘strong’ trade unions (around 80 percent of employees were union members in 1991; see Edin and Holmlund, 1995). As is well known, wage bargaining in Sweden was highly centralised during a considerable part of our sample period. Such an institutional framework tends to compress wage-differentials between skill groups, with the result that a decrease in the relative demand for the less-skilled will be reflected in a fall in relative employment rather than relative wages – which is consistent with labour market outcomes in Sweden.

Accordingly, the econometric results shown for Sweden in Table 1 focus on the employment share of skilled workers (although similar results hold for the wage bill share equations which are not reported here – see Anderton, Brenton and Oscarsson, 2002, for full details of the Swedish results). One key point regarding the econometric results for Sweden is that import penetration measured in **value** terms was not statistically significant in any of our regressions. This is consistent with previous studies of the impact of globalisation in Sweden. Meanwhile, import penetration measured in **volume** terms, or the relative **price** of imports, tended to have a positively signed statistically significant impact on the employment share of skilled workers throughout our analysis of Sweden, but, again, only for imports from low-wage countries.

By contrast, the relative price of imports from *high-wage* OECD countries was not statistically significant when separately included, while import penetration in volume terms by OECD countries was estimated to have a negative effect on the share of skilled workers in employment and total remuneration. Hence, it appears

that skilled workers in Sweden are in direct competition with other skilled workers in OECD countries, whilst what threatens unskilled workers are imports from emerging economies. The data for Sweden suggest a very low correlation (-0.09) between the proportionate change in relative import prices for low-wage countries and the proportionate change in import penetration measured in value terms. On the other hand, the correlation between changes in relative import prices and changes in import penetration measured in volume terms is much higher (-0.54), thereby supporting our use of import volume measures in our study of Sweden.

The econometric results also suggest a much stronger impact of technology on Swedish inequality during the recession years of 1990-93.¹⁵ Given that this recession period was extremely unusual, in that after years of stable unemployment the number of people without jobs increased dramatically, it seems likely that this represented opportunities for a substantial restructuring of production, probably associated with an increase in the intensity of competition between firms as they attempted to sustain demand for their products in a shrinking domestic market. An alternative interpretation might be that this was simply a compositional effect within sectors whereby the severe recession and increased competition resulted in the survival of the 'better' firms, which in this case are high-tech/high R&D/high-skill-intensive firms, while the low-tech/low R&D/low-skill-intensive firms simply went out of business. Under such a scenario, the rise in R&D expenditure during 1990-1993 would also be associated with an increase in the wage-bill and employment shares of the higher skilled.

Another interesting result from the Swedish econometric analysis is that the impact of trade with low-wage countries on Swedish inequality appears to have been *larger* for high-skill sectors compared to low-skill sectors.¹⁶ From our earlier discussion, we postulate that this may reflect that when outsourcing requires foreign direct investment in low-wage countries – involving the production of specific components/products possibly requiring supervision and technical expertise from the investing company – then this may only be feasible for high-skill/high-profit firms. Also, the scope for outsourcing depends upon the degree to which production of the final product can be fragmented into discreet stages with substantially different factor intensity ratios. This will be determined by technological conditions in the industry, which may be more conducive to outsourcing in high-tech sectors. According to our econometric results, the latter may be the case in Sweden.

¹⁵ The R&D term is only statistically significant for the 1990-93 period.

¹⁶ The parameter on the import penetration variable multiplied by a dummy variable for high-skill sectors ($\text{dlnMPQ} * D_{\text{HS}}$ in Table 1) is quantitatively large and strongly significant.

Finally, although we find that trade with low-wage countries has been an important determinant of rising inequality in Swedish manufacturing sectors, our results also demonstrate that technological change, as proxied by patenting activity and expenditures on R&D in the 1990s, also played a major role. Our results suggest that between 1970-1993 outsourcing to low-wage countries accounted for around 25 per cent of the average sectoral increase in the wage share of skilled workers in Sweden and for around 15 per cent of the increase in the employment share. Technological change on the other hand was the dominant factor accounting for well over half of the average increase in wage and employment inequality in Sweden.

5.4 Italy

In Italy the share of blue-collar (low-skill) workers in total manufacturing employment decreased by 6 percentage points between 1973 and 1983 and by a further 6 percentage points between 1983 and 1995. The decline in the wage share of blue-collar workers was less pronounced, particularly in the first period up to 1983. All of the decrease in the wage share was concentrated in the period after 1983 and up to 1995 (from 66% to 59%). The relatively large change in the employment share compared to the change in the wage bill share shows that the increase in inequality between skilled and unskilled workers in Italy, as in Sweden, primarily reflects the adjustment of the quantity, rather than the price, of unskilled workers.

This feature is also reflected in the trend in wages per blue-collar employee relative to salaries per white-collar worker. Relative wages of blue-collar workers increased by 14 percentage points between 1973 and 1984, but fell by 5 points in the following period. These developments are consistent with previous evidence suggesting that labour market regulations and institutions compressed the gap between the relative returns to skilled and unskilled labour in Italy, at least until the mid-1980s. During the 1970s, trade unions in Italy primarily bargained over wages and managed to induce a strong compression of wage differentials. Indeed, the collective contracts of the early 1970s granted equal increases in pay to all workers. Furthermore, after 1975 high inflation rates in Italy were accompanied by wage agreements stipulating that all wages should increase by an equal absolute amount. These strict regulations were relaxed somewhat in the 1980s.¹⁷

Our econometric analysis of Italy (Brenton and Pinna (2001)) shows firstly that economic variables played little or no role in determining the relative demand for

¹⁷ See Anderton and Barrell (1995) for further details of changes in institutional structures relating to Italian wage formation. In particular, the 'Scala Mobile' imposed full backward indexation of all Italian wages in line with inflation until the system was reformed in the mid-1980s.

unskilled workers in the 1970s. This seems to confirm the dominant role played by Italian labour market institutions in this period.¹⁸ Subsequently, in the 1980s and 1990s, following some labour market reforms, international competition appears to have had a significant effect on the relative demand for unskilled workers in Italy, but, as in the case of Sweden, this effect is significant only in skilled-intensive sectors. According to the results of Brenton and Pinna (2001), increasing import penetration in high-skill sectors in Italy in the 1980s and early 1990s accounted for around one third of the increase in employment inequality between skilled and unskilled workers. Interestingly, technological change, proxied by expenditures on research and development, was not a significant determinant of the change in the employment skill-mix in Italian high-skilled sectors.

In unskilled intensive sectors, such as textiles and clothing, where the impact of imports from low-wage countries might be expected to be more pronounced, no significant effect from imports was found. In contrast, technological change seems to have played a significant role in skill upgrading in low-skill intensive sectors. The result is consistent with previous studies that indicate that Italian textile and clothing firms have remained internationally competitive by increasingly switching to higher quality segments of the industry (see, for example, Quintieri and Rosati, 1996).

A further feature of the Italian study is that a measure of the variance of trade prices from different low-wage countries is introduced in order to capture the idea that, over time, comparative advantages have become narrower (Bhagwati and Dehejia, 1995) and that production has become more and more internationally footloose and has undermined unskilled employment in countries such as Italy. In other words, the incentive to outsource increases since instability in the location of production and continual new entries into the international arena generate uncertainty for firms regarding the nature of competitive conditions. Such considerations are likely to be most pronounced regarding low-skill intensive activities and may further encourage the outsourcing of this part of the production process, whilst skill intensive elements, which are subject to less volatility and uncertainty in international competition, are retained in the domestic market. Interestingly, the measures of trade price variability for Italy are found to be strongly linked to the phenomena of skill upgrading in the high-skilled sectors, but not the low-skill industries. This suggests that uncertainty regarding trade as well as the amount of trade itself might encourage firms to adjust and upgrade production to more skilled labour intensive techniques and to outsource the less skilled activities. This is an issue that warrants further research.

¹⁸ For example, the real wage terms are wrongly signed for the Italian employment share results. This is not surprising given that relative wages in Italy were compressed, and employment decisions constrained, by labour market regulations and institutions.

6. Summary and Discussion of Policy Implications

This paper summarises the results of a selection of our empirical works which, in contrast to the majority of other studies, find that trade has had a significant impact on labour market inequality. This work uses the concept of outsourcing – whereby the low-skill parts of the production chain are transferred to low-wage countries – which is empirically proxied by import penetration by those countries. A key feature of the empirical work that distinguishes it from other studies is the use of highly disaggregated bilateral trade data which allow a separation between imports from high- and low-wage countries at a highly detailed industry level. Using these data, we have demonstrated that imports from low-wage countries are associated with a decline in the relative demand, and a fall in the wage-bill share, for less-skilled labour in the manufacturing sectors of various countries. In line with other studies, we also find that technology has played an important role in causing the increase in inequality in many countries. However, there is also limited evidence that some of the rapid increase in technology in recent decades has been trade induced through mechanisms such as ‘defensive innovation’.

What does our finding that trade with low-wage countries has had an adverse effect on the distribution of wages and employment within manufacturing sectors imply for economic policy? An impulsive reaction might aim at stopping those factors that are perceived as contributing to inequality and social exclusion by restricting imports. However, given the array of domestic policies available in modern industrial countries, it is clear that *intervention that constrains trade will be one of the least effective mechanisms*. In essence, trade brings benefits as well as difficulties and those benefits are expected to significantly exceed any costs that arise. Thus, more effective policies will be those which tackle the problems of inequality affecting unskilled workers without removing the gains from trade. In other words, policy should seek to address as directly as possible the problems of social exclusion without making matters worse elsewhere, as trade barriers would do (Deardorff (1998)). To date there has not been an extensive public discussion of how governments should respond to the widening wage and employment inequality in Europe in the face of globalisation and technological change, particularly regarding policies concerned with training and income redistribution. This debate is perhaps now due.

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