Fear of service outsourcing

Is it justified?

SUMMARY

The recent media and political attention on service outsourcing from developed to developing countries gives the impression that outsourcing is exploding. As a result, workers in industrial countries are anxious about job losses. This paper aims to establish what are the hypes and what are the facts. The results show that although service outsourcing has been steadily increasing it is still very low, and that in the United States and many other industrial countries 'insourcing' of services is greater than outsourcing. Using the United Kingdom as a case study, we find that job growth at a sectoral level is not negatively related to service outsourcing.

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Fear of service outsourcing: is it justified?

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1. INTRODUCTION

Outsourcing of services has received an enormous amount of attention in the media and political circles in recent times. In just five months, between January and May 2004, there were 2,634 reports in US newspapers on service outsourcing, mostly focusing on the fear of job losses.[1] In particular, there have been reports about jobs moving from industrial countries like the United States and the United Kingdom to developing countries such as India. These concerns are not limited to the United States. Similar reports appeared in newspapers in other industrial countries such as the United Kingdom, which had 380 reports on outsourcing in its newspapers during the same period. Newspapers in Australia have also published similar reports. Figure 1 plots a quarterly count of news stories and commentaries in major newspapers and

[1] During the two-week period, from 1 March to 5 March 2004, there were 270 such stories that simultaneously mentioned outsourcing and either job loss or unemployment in the same story.
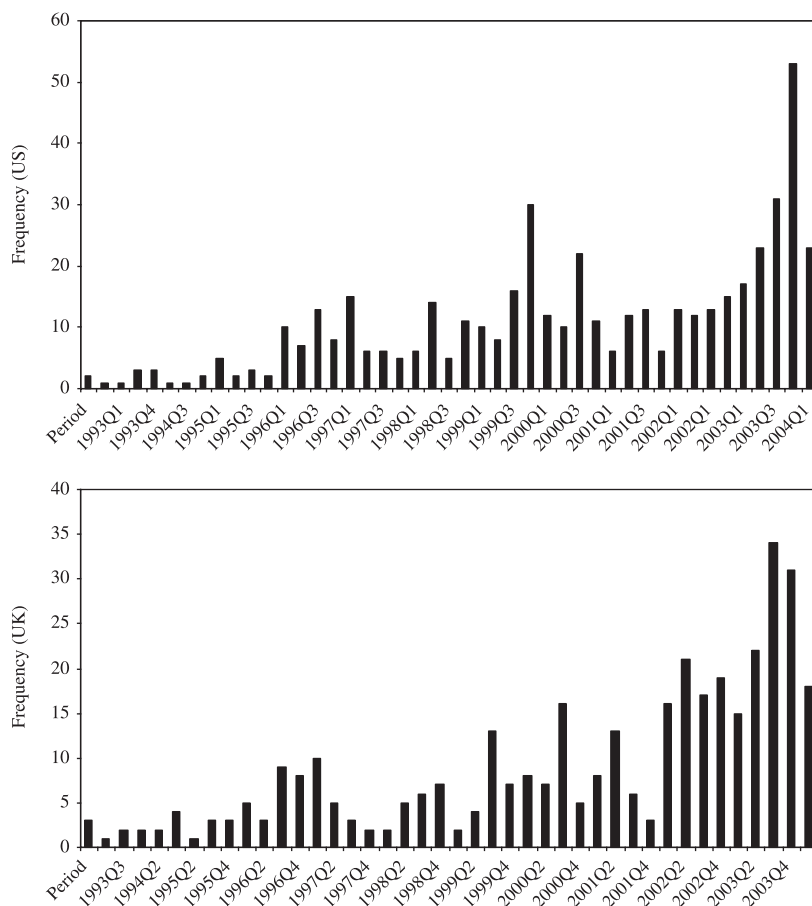
Figure 1. News count of outsourcing

Source: (1) US news sources: Dow Jones News Service, Financial Times, The New York Times (Abstracts), The Seattle Times, The Wall Street Journal, The Washington Post. (2) UK news sources: Daily Mail (UK), Financial Times, The Economist (UK), The Guardian (UK), The Observer (UK), The Sunday Times (London), The Times (London).

newswire service reports on international service outsourcing from the first quarter of 1991 to the first quarter of 2004 in the United States and the United Kingdom, which we have constructed using an electronic database on newspaper articles (FACTIVA). Both indices show a clear upward trend in media interest in international outsourcing of services.[2]

All this media hype would lead one to believe that service outsourcing is some new phenomenon that has exploded. What has stirred such an interest in outsourcing? Many people would argue that outsourcing is indeed just a normal part of international trade, whereas others see it as something different. To date, there is not even agreement on what the term outsourcing means. The American Heritage Dictionary

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[2] The index for the United States exhibits local peaks in 1996, 2000 and 2004, which are all presidential election years.

defines it as 'The procuring of services or products . . . from an outside supplier or manufacturer in order to cut costs.' Some people interpret 'outside' to mean outside the firm, and others outside the country. Both usages are common. But since the main concerns in industrial countries are with 'exporting jobs' to developing countries, we will restrict our attention to international outsourcing. We delve further into the meaning and origins of outsourcing in the next section.

What is new about outsourcing today is that it is increasingly in services. Although international outsourcing of material inputs is still far more quantitatively important than services for a typical industrialized economy, as we show below, the current wave of anxiety in advanced economies is mostly about international outsourcing of services. There is a sense in which services outsourcing is qualitatively different from material outsourcing in terms of the 'stress effect'. In the past, the service sector was largely considered impervious to international competition. Accountants did not fear that someone abroad would take their high-paying jobs, but they certainly benefited from the cheaper imported manufactured goods that open trade allowed. For this reason, service sector professionals were likely to have been staunch supporters of open trade. With the improvement in the communication technology such as the Internet, services can cross political borders via the airwaves.[3] Jobs in fields ranging from architecture to radiology seem much more at risk. While it was possible for firms to relocate abroad in the past, they had to give up something – their closeness to important markets, for example. With the new technologies they can retain these links while also obtaining access to cheap, but well-trained labour. The lack of control and the worry that outsourcing could spread contributes to the fears of job losses among white collar workers. A study conducted by the University of Maryland found that, in the United States, among those with incomes over $100,000, the percentage actively supporting free trade slid from 57% in 1999 to 28% in January 2004 (Rajan and Wei, 2004).

Whether there is any basis for this fear of job losses has not been carefully examined. Besides newspaper articles, which are largely based on management consultant reports, there is very little empirical research on service outsourcing. We present an overview of the literature in Section 3. The growth of service outsourcing and its effects on job losses deserve closer attention for a number of reasons. First, there does appear to be a backslide in support for free trade policies, particularly among white-collar workers. The fear of losing one's job is of concern in itself, as it could lead to lobbying for protectionist type policies. For example, in Australia there were news reports of lobbies by Australian software companies to restrict (other) Australian firms' ability to outsource software designs to India. In the United States, the Senate passed restrictions on foreign outsourcing for federal contracts in March 2004 (though they did not become law). Trade and Industry Secretary Patricia

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[3] Freund and Weinhold (2002) find that Internet penetration, measured by the number of Internet hosts in a country, has a positive and significant effect on services trade.

Hewitt stated that the United Kingdom would not pass protectionist legislation (see *Financial Times*, 5 March 2004, p. 6). If support for protectionist policies increases, this may not continue to be their stance. Second, even though we may expect service outsourcing to lead to long-run benefits, there may be adjustment costs in the form of job losses. Many theoretical trade models assume full employment and perfect factor mobility between sectors, but rigidities in the labour market can lead to short-term employment effects. It is important, therefore, to examine whether outsourcing does lead to job losses and if so, how large these effects are in order to inform the policy debate on possible relocation assistance programmes.

The main objective of this paper is to investigate and to establish what are the hypes and what are the facts about service outsourcing. We develop a set of stylized facts describing the trends in service outsourcing, which we present in Section 4. We focus on business services and computing and information service trade as these most closely reflect the service categories that are generally thought of as being outsourced. Some of our results correct some misleading impressions that one may derive from the news media, while others complement them. We examine the following questions: Has service outsourcing exploded in recent years? How does it compare with the level of material outsourcing? Who are the biggest outsourcers of services? Who are the biggest recipients of service outsourcing from the rest of the world (the 'insourcers')? And are there job losses arising from service outsourcing at a sectoral level? Our data serve to address on a factual basis some of the assertions made in the press coverage.[4]

A number of interesting results emerge. We show that service outsourcing has been steadily increasing but is still at very low levels. For example, in the United States, imports of computing and business services as a share of GDP were only 0.4% in 2003. This share has roughly doubled each decade – from 0.1% in 1983 to 0.2% in 1993, and to 0.4% in 2003, based on IMF's balance of payments trade data. A similar picture emerges from industry level outsourcing intensity ratios, which we constructed using input/output coefficients. These show that material outsourcing is at much higher levels than service outsourcing.

Interestingly, in the United States and in many other industrial countries, exports of these services are greater than imports. The United States has a net surplus in services and this surplus has been increasing in recent years. This highlights that trade in services, like trade in goods, is a two-way street. In value terms the United States is the largest importer and exporter of combined computing and business services. When scaled by GDP, however, the proportion of outsourcing-type trade in the United States is low compared with the rest of the world. Based on 2002 figures, its share of imports of business services as a proportion of its GDP ranks 117th in the world, with the United Kingdom ranking 85th. In comparison, China, which ranked 99th in the world, is ahead of the United States. The countries with the highest

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[4] Of course there may be other reasons why there is opposition to outsourcing, such as its potential effects on wages, income distribution and terms of trade. However, providing an overall welfare assessment is not possible with the available data.

ratio of imports of business services to GDP are Angola, the Republic of Congo, Mozambique and Ireland.

The second main contribution of the paper is provided in Section 5, where we analyze the effects of service and material outsourcing on employment, using the United Kingdom as a case study. We do not find any evidence to suggest that outsourcing has led to employment losses in those sectors that increased their outsourcing intensity in the United Kingdom, during the period 1995 to 2001, in either the manufacturing or the services sectors. In Section 6 we present our conclusions.

2. WHAT'S IN A NAME?

The use of the term outsourcing has not been standardized. Outsourcing generally refers to the procuring of material inputs or services by a firm from outside the firm. Outsourcing can be domestic or international. Examples of domestic outsourcing would include a Detroit-based automobile company that contracts out the production of some of its parts to a firm in Cleveland, Ohio; or its employee food service to a local restaurant which in turn provides the service on the site of the auto firm. Issues relating to domestic outsourcing have not featured prominently in the media. The main concern in the public debate is mostly about international outsourcing, particularly the outsourcing by firms in advanced economies to firms located in low-wage countries.

In this paper, we focus on international outsourcing, defined as the procuring of service or material inputs by a firm from a source in a foreign country. This term includes both intra-firm international outsourcing (by which the foreign provider of the input is still owned by the firm) and arm's-length international outsourcing (by which the foreign provider of the input is independent from the firm using the input). International outsourcing is part of a country's imports (of goods and services).

Interestingly, the earliest use of the word 'outsource' that we have traced appears to refer to international outsourcing of services. According to the *Oxford English Dictionary* (http://dictionary.oed.com), the earliest use was about the British auto industry contracting out engineering design work to Germany and appeared in an article in 1979 in the *Journal of Royal Society of Arts*, Vol. CXXVII, 141/1.[5,6] For whatever reason, many other early uses of the terms 'outsource' and 'outsourcing' also tend to be related to the automobile industry, though they could refer to material inputs as well as services. The earliest use of the terms in the United States that can be traced electronically, according to FACTIVA, appeared in the *Harvard Business Review* in 1980, and in a major US newspaper in 1981.

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[5] The original sentence stated: 'We are so short of professional engineers in the motor industry that we are having to outsource design work to Germany.'

[6] There are interesting historical examples of outsourcing much earlier than 1979, for example when the British military used German mercenaries to fight US revolutionaries. Our focus here is on outsourcing services related to the production process.

Another commonly used term for international outsourcing is offshoring. The word 'offshore' has a long history and can be traced at least to 1895, according to the online version of the *Oxford English Dictionary*. It means 'moving away from the shore' or 'foreign'. Using 'offshoring' to refer to international outsourcing in the way we have defined above has a much shorter history.

The word 'insourcing' was once used to refer to the production of something inside a company that it used to contract out.[7] In this paper, we define it as outsourcing in the opposite direction (from foreign-located firms to domestic firms). For example, the phrase US 'insourcing' refers to the outsourcing from the rest of the world to the United States.

3. RELATED LITERATURE

This section reviews the literature on outsourcing. It starts with a discussion of empirical studies on material and service outsourcing, and then moves on to the relevant theoretical models.

3.1. Empirical

In the empirical literature, while there is a large set of papers on material input outsourcing, there is very little on service outsourcing.

3.1.1. Material outsourcing.   A number of papers have studied the evolution of material outsourcing in the United States and other member countries of the Organization for Economic Cooperation and Development (OECD) – for example, see Feenstra and Hanson (1996), Campa and Goldberg (1997), Hummels *et al.* (2001), Yeats (2001), Hanson *et al.* (2004), and Borga and Zeile (2004). Generally, these studies found a steady increase in the extent of international outsourcing of material inputs (measured in different ways by different authors) over time. For example, Yeats (2001) estimates that 30% of OECD exports of machinery and transport equipment comprised parts and components in 1995, and 26% in 1978. This share is the highest for the United States and increased from 36% in 1978 to 40% in 1995; in Europe it increased from 26% to 28%; and in Japan from 15% to 26%. However, when looking at the share of components imported in apparent consumption of transport and machinery for 1995, the EU shows the highest share at 16% (these being components imported from outside the EU) compared to 11% for North America and 8% in Japan.

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[7] The earliest use that we have traced (using FACTIVA) appeared in an article by Dale Buss in the 20 July 1984 issue of the *Wall Street Journal*, 'Whether Ford, GM Keep Small-Car Output in U.S. May Hinge on Firms' Labour Talks'. The original sentence reads, '. . . Ford's Mr. Pestillo says that the company could eventually become efficient enough to "insource" production of such things as manual transmissions, which it currently purchases from the outside.' Note that, as in the case of early uses of 'outsourcing', this term was also used in association with the auto industry.

In addition to examining the magnitude and trends in material outsourcing, the literature has studied their effects on productivity and the wage skill premium. Egger and Egger (2001) find that there is a negative effect of international material outsourcing on the productivity of low-skilled workers in the short run, but a positive effect in the long run. They found that international outsourcing of materials contributed to 3.3% of real value added per low-skilled worker in the EU from 1993 to 1997. They attribute the negative short-run effect to imperfections in the EU labour and goods markets.

Several papers have studied the effect of international outsourcing of material inputs on the wage skill premium. By relocating the unskilled-intensive parts of the production process from relatively skill abundant countries to unskilled-abundant countries, outsourcing is expected to increase the relative demand for skilled labour in the skill-abundant country and hence increase the skill premium. Empirical evidence in the United States (Feenstra and Hanson, 1996, 1999) and the United Kingdom (Hijzen *et al.*, 2002) confirm this finding. Feenstra and Hanson (1999) show that outsourcing contributed between 17.5 to 40% of the increase in the non-production wage share over the period 1979 to 1990. Feenstra and Hanson (1997) also show that liberalized foreign investment and trade led to an increase in the skill premium in Mexico too. The foreign assembly plants located on the border were created by US firms outsourcing their less skill-intensive parts, which are more skill intensive relative to other industries in Mexico.

3.1.2. Service outsourcing. The literature becomes much thinner when it comes to international outsourcing of services. Focusing on the information technology (IT) sector in the United States, Mann (2004) argues that international outsourcing of IT hardware led to a fall of 10 to 30% in prices of IT hardware, which translated into higher productivities in all sectors that use IT hardware. Mann then argues that IT software – a form of international outsourcing of services – should be expected to benefit the economy in the same way as IT hardware. Furthermore, if one assumes that IT software is more price elastic than IT hardware, then the expected productivity gains could be even higher. Finally, Mann documented that IT industries had exhibited high job growth, so the international outsourcing did not appear to hurt job growth in that sector.

Amiti and Wei (2004), using data on all manufacturing industries in the United States, find that service outsourcing is positively correlated with labour productivity in the United States but material outsourcing is insignificant. Gorg and Hanley (2003) show that international outsourcing of services had a positive impact on productivity in the electronics industry in Ireland between 1990 and 1995. They also found that outsourcing of tangible inputs did not have a significant effect on productivity during this period. Girma and Gorg (2004) find positive evidence of service outsourcing on labour productivity and total factor productivity in the United Kingdom between 1980 and 1992, but they are unable to distinguish between domestic and foreign outsourcing.

Studies on service outsourcing and employment effects have mainly been conducted by management consultants. For example, McKinsey Global Institute's report (2003) is a widely quoted study on service outsourcing. It makes a prediction on the number of jobs likely to be lost due to outsourcing from 2003 to 2015 and computes the distribution of gains between the country that does the outsourcing and the one that receives the outsourcing. The underlying methodology used to make the calculations is not entirely transparent in the report, making it difficult to assign standard errors to the estimates. The McKinsey report also makes the point that the amount of job losses due to outsourcing is a relatively trivial share of overall job losses during the normal course of a business cycle. Brainard and Litan (2004) provide an overview of these studies, and focus on the distributional effects of outsourcing, pointing out that it is the low paid jobs that are being replaced with higher paid jobs. They also provide a number of policy prescriptions for the United States. Shultz (2004) provides some indirect evidence of job losses related to service outsourcing and concludes that the effect is very small.

A more rigorous study of the effects of service outsourcing on employment is provided in Amiti and Wei (2005) using US data. This study also concludes that there is a small negative effect of service outsourcing on employment when using highly disaggregated data. Some details of that study are provided in Section 5 of this paper.

3.2. Theoretical

Although there is a rich body of literature that models a firm's decision on where to locate different parts of the production stage, all these models assume perfect inter-sectoral labour mobility so they do not make predictions of net job losses at the economy level. For example, Jones and Kierzkowski (1990, 1991, and 2001), Dixit and Grossman (1984), Krugman and Venables (1995), Deardorff (1998a and b), Yi (2003) and Amiti (2005) develop models of where different parts of the production stage will be located. When trade costs or technological progress leads to international fragmentation of different parts of the production stage, firms engage in input trade, and this can be thought of as part of outsourcing. These are models of non-integrated firms, where different firms own different production stages, and hence the type of trade that takes place is referred to as arm's-length trade. Outsourcing can also take place between vertically integrated firms, such as in Helpman's (1984) model of vertical foreign direct investment, which is referred to as intra-firm trade.[8] Antras (2003) introduces incomplete contracts to study ownership decision (whether firms should own the plants producing intermediate inputs or not); and Antras and Helpman (2003) combine the ownership decision with the decision on whether intermediate

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[8] This slicing up of the production chain across different countries has also been referred to in the literature as international production sharing, globalized production, de-localization, fragmentation, intra-product specialization, intra-mediate trade, and offshoring. Intra-firm international outsourcing has also been related to vertical foreign direct investment, and vertical specialization.

input producing plants should be located abroad or not. In all of these models, the focus is on the outsourcing of material inputs but these could, in principle, be re-interpreted as service inputs.

Trade economists generally assume full employment and perfect factor mobility between sectors within a country, for example, as in the Heckscher–Ohlin (H–O) model, so then all the action is on factor prices, that is, the net economy-wide employment effects are essentially assumed away. And in this kind of model you do not need to have a large amount of trade to affect factor prices. All you need is for goods prices to change, which then affect factor prices (i.e. Samuelson–Stolper theorem). These international price changes can arise for many reasons. For example, the threat of foreign competition in itself can drive down goods prices even if the trade does not take place.

The H–O model is generally considered to be a long-run model, that is, with factors perfectly mobile. So in this model trade can lead to sectoral employment changes as one sector contracts and another expands but no net economy-wide job losses. In the short run, there may be rigidities that prevent perfect factor mobility and hence give rise to net employment effects. For example, Sachs and Shatz (1994) argue that any of the following factors could give rise to net employment losses in manufacturing: '(i) low-wage workers have a positively sloped supply elasticity, so that a decline in their wage leads to a decline in labour force participation; (2) low-wage workers are unionized, and unions maintain wages above full-employment levels; or (3) low-wage workers have alternative employment opportunities in non-manufacturing (such as services), so that they leave the manufacturing sector entirely when international competition puts downward pressure on wages.' Krugman (1995) presents an H–O model with rigid factor prices to show how trade can give rise to big employment effects. If one were to also introduce frictions in inter-sectoral labour mobility then these effects would be even larger.[9]

4. GLOBAL PATTERNS OF SERVICE OUTSOURCING: THE UNTOLD STORIES IN THE MEDIA

In this section, we document a set of features about patterns of global service trade that have been under-reported or misreported by news media. Specifically, we aim to address the following questions. Is there a discrete and abrupt rise in service outsourcing in industrialized economies in recent years? What is the relative importance of service outsourcing versus material outsourcing? Who are the biggest outsourcers of services in the world? Who are the biggest recipients of service outsourcing from the rest of the world?

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[9] The McKinsey report indicated that more than 69% of workers who lost jobs due to imports in the United States between 1979 and 1999 were re-employed (this is based on US Bureau of Labour Statistics data). Of course, this means that 31% were not re-employed, highlighting that there may be some rigidities in the labour market.

We first provide a description of the data used to measure outsourcing before moving on to the results.

4.1. Measurement of outsourcing

Outsourcing is generally difficult to measure because information on which parts of the production stage are contracted out is not readily available, so we need to rely on indirect measures. We construct two different types of measures of outsourcing. The first is an economy-wide measure based on imports of computing (which includes computer software designs) and other business services (which include accounting and other back-office operations), using data from the IMF's *Balance of Payments Statistics Yearbook*, which in turn is compiled from the reports to the IMF by the national authorities of member countries. This is the main data source we use to explore patterns of cross-border services trade.

We chose to focus on trade in computing and information and other business services because these are the categories that most likely encompass outsourcing activities. The other categories, such as travel and education, are less likely to include such activities so we excluded them from the study. We would expect that business services should predominantly comprise inputs used by firms, but the computing category is likely to include a higher component of final consumer purchases. However, it is impossible to specify exactly how much of the trade is in final consumer services. As a robustness check, at least for the US data, we compared the trends in the IMF statistics with those provided by the Bureau of Economic Analysis (BEA). The BEA splits services trade by affiliates and non-affiliates. The affiliate trade is undertaken by multinational corporations, between parents and affiliates, so more closely reflects outsourcing trade. We found that the trends for affiliate trade are similar to those indicated by the IMF data.

The second measure of service outsourcing is calculated on an industry basis for the United Kingdom, as Feenstra and Hanson (1996, 1999) do for material inputs for the United States. For a given industry i, its outsourced services as a share of total non-energy inputs, OSS_i, is calculated as follows:

$$OSS = \left[\frac{\text{Input purchase of service by industry}}{\text{Total nonenergy inputs used by industry}} \right] * \left[\frac{\text{Imports of service}}{\text{Production} + \text{Imports} - \text{Exports}} \right]$$

(1)

The first square bracketed term is calculated using input/output tables. The denominator includes all non-energy material inputs, listed in Table A2 of the Appendix, plus the following five service industries: communication, financial, insurance, other business services, and computing and information.[10]

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[10] These five service categories were chosen to match the IMF balance of payments trade in services data. The employment service data we use in the next section is more disaggregated. There we include nine service categories, which are also listed in Appendix 2.

Table 1. United Kingdom: Outsourcing of services

Services	Share of service				Import of service j
	Mean	Std Dev	Min	Max	
1992					
Communication	0.0153	0.0373	0.0012	0.2937	0.0587
Financial	0.0330	0.0247	0.0072	0.2000	0.0173
Insurance	0.0137	0.0103	0.0027	0.0758	0.0186
Other business service	0.1261	0.1615	0.0196	0.7226	0.0503
Computer and Information	0.0112	0.0185	0.0012	0.0916	0.0148
2001					
Communication	0.0158	0.0393	0.0022	0.3175	0.0547
Financial	0.0306	0.0198	0.0055	0.1440	0.0420
Insurance	0.0123	0.0060	0.0018	0.0322	0.0230
Other business service	0.1536	0.1872	0.0228	0.8012	0.0659
Computer and Information	0.0211	0.0302	0.0027	0.1543	0.0283

Source: Input-Output Tables-United Kingdom National Accounts and IMF, *Balance of Payments Statistics Yearbook.*

The second square bracketed term is calculated using international trade data from the IMF's *Balance of Payments Statistics Yearbooks*. Unfortunately, imports of each input by industry are unavailable. As a proxy, an economy-wide import share is applied to each industry. To illustrate, the UK economy imported 6.6% of business services in 2001. We then assume that each industry (in the manufacturing and service sectors) imports 6.6% of the business services used in that year. On average, a UK industry uses 15.4% of business services as a proportion of total non-energy material inputs. So the outsourcing intensity of business services for a typical industry would be 0.15*0.066 = 1%. We then aggregate across the five service inputs to get the average service outsourcing intensity for each industry. The breakdown of the two components of the outsourcing intensity ratio for each service category is provided for 1992 and 2001 in Table 1. The first column shows the average intensity of each service category (the first term in Equation 1) and the last column gives the average import intensity of each service category (the second term in Equation 1). We see from column 1 that business services is the largest service category used across manufacturing and service industries, and this has grown from an average of 12.6% in 1991 to 15.4% in 2001. There is also much variation between industries. For example, in 2001, in the 'basic precious and non-ferrous metals' industry business services only accounted for 2% of total inputs whereas in the tobacco industry it was 48%. From Table 1, we see that the average share of computing and information services also increased over the period whereas the other three categories remained roughly constant. From the last column, we see that the import share of each service category increased over the period except communications, which remained roughly unchanged. The largest import share was in business services, at 6.6%.

An analogous measure is constructed for material outsourcing for each industry i, denoted OSM_i. In total, our sample consists of 78 industries (69 manufacturing industries and 9 service industries).
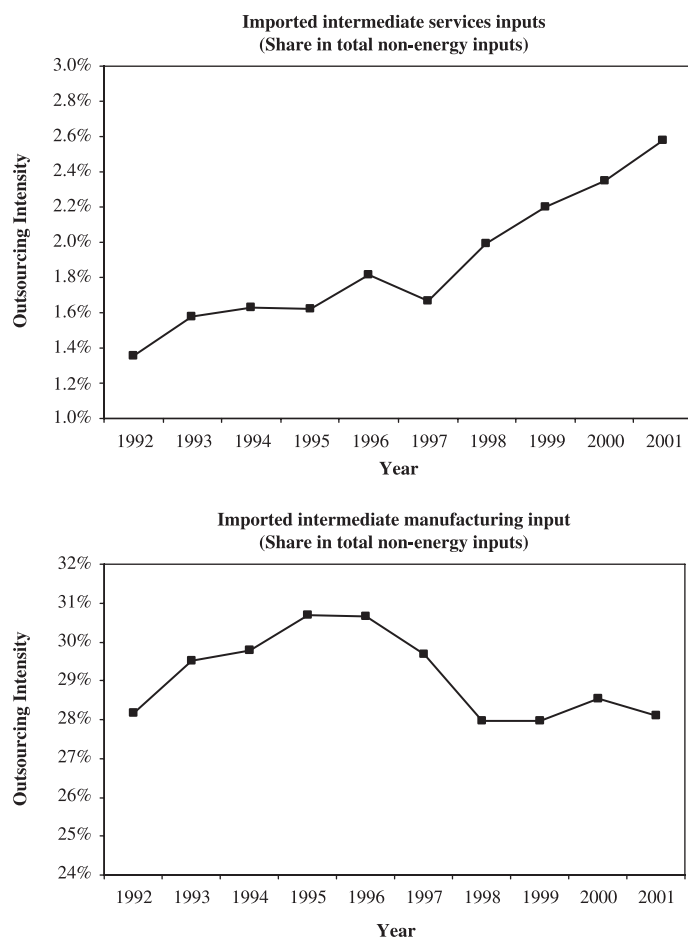
A number of potential problems with our outsourcing measures should be noted. First, they are likely to underestimate the value of outsourcing because the cost of importing services is likely to be lower than the cost of purchasing them domestically. So it would be preferable to have quantity data rather than current values but this is unavailable for the United Kingdom. Second, applying the same import share to all industries is not ideal, but given the unavailability of imports by industry this is our 'best guess'. The same strategy was used by Feenstra and Hanson (1996, 1999) to construct measures of material outsourcing. This approach apportions a higher value of imported inputs to the industries that are the biggest users of those inputs. Although this seems reasonable, without access to actual import data by industry it is impossible to say how accurate it is. Third, the total use of inputs by industry only includes those inputs purchased from a different industry so services produced within the industry are not included, hence the extent of outsourcing is unlikely to be precisely measured. Despite these limitations, we believe that combining the input use information with trade data provides a reasonable proxy of the proportion of services imported from abroad.

4.2. Outsourcing trends in developed countries

International outsourcing of services has increased in the United States but still remains low, based on our economy-wide measure using IMF international trade data. Imports of computer and information plus other business services as a share of GDP were only 0.4% in 2003. This share has roughly doubled in each decade – from 0.1% in 1983 to 0.2% in 1993, and to 0.4% in 2003. The United Kingdom has a higher outsourcing ratio than the United States – at 0.9% in 1983, 0.7% in 1993, and 1.2% in 2003.

A similar picture emerges from industry level outsourcing intensity ratios. Figure 2 presents the average outsourcing intensity ratios across manufacturing and service industries, weighted by output, from 1992 to 2001. These ratios indicate that on average the share of service imports in the United Kingdom increased from 1.4% in 1992 to 2.6% in 2001. These figures are higher than those for the United States, which increased from 0.6% to 0.9% over the same period (see Amiti and Wei, 2005). But in both cases there is clearly an upward trend.

Material outsourcing intensities are significantly higher than service outsourcing in both the United Kingdom and United States. Material outsourcing is around 27% in the United Kingdom and 11% in the United States. From Figure 2, we see that in the United Kingdom material outsourcing peaked in 1996 and has been on a downward trend since then. In the United States it has been steadily increasing but at a slower pace than service outsourcing.

Imported intermediate services inputs
(Share in total non-energy inputs)

Imported intermediate manufacturing input
(Share in total non-energy inputs)

Figure 2. United Kingdom: Outsourcing intensity of intermediate inputs (weighted average across all industries by outputs)

Source: Input-Output Tables-United Kingdom National Accounts and IMF, *Balance of Payments Statistics Yearbook.*

In sum, service outsourcing is much lower than material outsourcing, but it is increasing at a faster pace.

4.3. Which countries are the biggest outsourcers?

Media reports might give the impression that outsourcing is mostly about the United States and other industrialized countries contracting out services to India and a few other developing countries. This is not entirely correct.

To set the record straight, we look at the trade data in two categories of services that have been most intensely reported: computer and information services and other business services. In value terms, other business services (which we will refer to as just business services) are by far the larger of the two categories.

Table 2. Who are the biggest absolute outsourcers, 2002?[a]

Million US Dollars

Rank	Country	Business services	Rank	Country	Computer and information services
1	United States	40,929	1	Germany	6,124
2	Germany	39,113	2	United Kingdom	2,602
3	Japan	24,714	3	Japan	2,148
4	Netherlands	21,038	4	Netherlands	1,586
5	Italy	20,370	5	Spain	1,572
6	France	19,111	6	United States	1,547
9	United Kingdom	16,184	9	France	1,150
11	India	11,817	10	China, P.R.	1,133
18	China, P.R.	7,957	14	Russia	592
20	Russia	4,583			

Note: [a]For India, information on computer and information services is not given in the IMF *Balance of Payments Yearbook.*

Source: IMF, *Balance of Payments Statistics Yearbook.*

Using data for 2002, the latest year for which internationally comparable data were available, the top outsourcers of business services in dollar amounts are United States (US$41 billion), Germany (US$39 billion), followed by a group of countries with trade approximately of the same order of magnitude, Japan ($25 billion), the Netherlands (US$21 billion), Italy (US$20 billion), France (US$19 billion), and the United Kingdom (US$16 billion). Interestingly, India and China – two countries that have been portrayed as major recipients of outsourcing in the media – are themselves significant outsourcers of business services (with a value of US$11 billion for India and US$8 billion for China, and ranked 11th and 18th in the world, respectively). Table 2 lists the value of imports for these services for selected countries with their rankings in the world.[11]

In the categories of computer and information services (which is quantitatively an order of magnitude smaller than business services), the top five importers are Germany, United Kingdom, Japan, the Netherlands and Spain. The United States is a close 6th. China is ranked at 10th place. Unfortunately, there is no data from the IMF's *Balance of Payments Statistics Yearbook* for India on trade in computer and information services.

Of course, larger economies naturally trade more than smaller ones. Therefore, to get a sense of the importance of outsourcing for a local economy, it is important to scale the value of imports by the size of the economy. For example, if one scales imports of business services by local GDP, none of the countries mentioned above would appear in the top ten list. In fact, smaller economies like Angola, the Republic of Congo, Mozambique, Ireland and Vanuatu turn out to be much more outsourcing-intensive, with the ratio of imported business services to GDP exceeding 10%. In

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[11] An electronic Appendix with rankings of all countries is available on the *Economic Policy* website.

Table 3. Who are the biggest relative outsourcers (2002)?[a]

Rank	Country	Business services	Rank	Country	Computer and information services
A. Ratio to Local GDP (%)					
1	Angola	35.01	1	Cyprus	2.06
2	Congo, Republic of	22.33	2	Luxembourg	1.25
3	Mozambique	17.41	3	Moldova	0.71
4	Ireland	15.44	4	Belgium	0.57
5	Vanuatu	14.22	5	Guyana	0.48
44	India	2.40	13	Germany	0.31
57	Germany	1.96	29	Russia	0.17
74	France	1.33	30	United Kingdom	0.17
75	Russia	1.33	43	China, P.R.	0.09
85	United Kingdom	1.03	48	France	0.08
99	China, P.R.	0.63	57	Japan	0.05
103	Japan	0.62	73	United States	0.01
117	United States	0.39			
B. Ratio to Value-added of Local Service Sector (%)					
1	Angola	138.67	1	Luxembourg	1.60
2	Congo, Republic of	79.81	2	Moldova	1.43
3	Papua New Guinea	35.12	3	Guyana	1.19
4	Mozambique	33.33	4	Ireland	0.81
5	Ireland	28.28	5	Belgium	0.79
37	India	4.96	12	Germany	0.45
59	Germany	2.90	26	Russia	0.31
70	Russia	2.37	29	China, P.R.	0.27
78	China, P.R.	1.87	33	United Kingdom	0.23
80	France	1.86	53	France	0.11
90	United Kingdom	1.44	59	Japan	0.08
104	Japan	0.93	74	United States	0.02
115	United States	0.53			

Note: [a] There is no separate information on computer and information services in the balance of payments of India.
Source: IMF, *Balance of Payments Statistics Yearbook.*

contrast, the United States has an outsourcing ratio in business services less than half of a percent of its GDP (ranked 117th in the world), and the United Kingdom slightly over 1% of its GDP (ranked 85th). As a comparison, India imports a larger amount of business services as a share of GDP (2.4%) than the United States and the United Kingdom. Table 3A lists the share of imports of services as a proportion of local GDP and their ranks. The country rankings are almost the same if one scales the value of service imports by local total service value-added. See Table 3B.

In sum, the notion that large industrialized countries outsource more intensely than other economies is not supported by the trade data.

4.4. Who are the biggest 'insourcers'?

Like trade in goods, trade in services is a two-way street. Most countries receive outsourcing of services from other countries as well as outsource to other countries.

Table 4. Who are the biggest absolute insourcers (2002)?[a]

Million US Dollars

Rank	Country	Business services	Rank	Country	Computer and information services
1	United States	58,794	1	Ireland	10,426
2	United Kingdom	36,740	2	United Kingdom	5,675
3	Germany	27,907	3	United States	5,431
4	France	20,864	4	Germany	5,185
5	Netherlands	20,074	5	Spain	2,487
6	India	18,630	10	France	1,191
8	Japan	17,401	11	Japan	1,140
14	China, P.R.	10,419	12	China, P.R.	638
29	Russia	2,012	25	Russia	137

Note: [a] There is no separate information on computer and information services in the balance of payments of India.

Source: IMF, *Balance of Payments Statistics Yearbook.*

Given the high level of aggregation in the services data it is not clear whether countries are actually importing and exporting exactly the same service. These could in fact differ substantially in their factor intensities. For example, within the business services category you might have call centres that may only require high school training as well as accounting services that require tertiary training. But it is also quite likely that there is two-way trade in the same services due to the differentiated nature of the service, just as models of intra-industry trade in goods. For example, services traded could be in French and Indian translation.

In recent times, the word 'insourcing' has been used as a shorthand for the amount of outsourcing a country receives from the rest of the world. We use exports of business and computing services as a proxy for insourcing.

Who are the biggest insourcers or the recipients of global outsourcing? From Table 4, we see that the top five recipients in 2002 in dollar terms are the United States (US$59 billion), the United Kingdom (US$37 billion), Germany (US$28 billion), France (US$21 billion), and the Netherlands (US$20 billion). India, a country that has received the most media attention as a recipient of outsourcing, is ranked at 6th place (US$18.6 billion); and China is ranked at 14th place (US$10 billion). It is worth emphasizing that India is one of the biggest exporters of business services in the world but there are five industrialized countries ahead of it. The data show that the top recipients of global service outsourcing tend to be rich, industrialized countries, rather than poor developing countries.

However, if one scales the value of exports by the size of local GDP, smaller economies turn out to be more insourcing-intensive than the larger ones. For example, from Table 5 we see that the top three insource-intensive economies are Vanuatu, Singapore and Hong Kong SAR, each with exporting services as a share of local GDP exceeding 10%. By this metric, India is somewhat more insourcing-intensive

Table 5. Who are the biggest relative insourcers, 2002?[a]

Rank	Economy	Business services	Rank	Economy	Computer and information services
A. Ratio to Local GDP (%)					
1	Vanuatu	17.13	1	Ireland	8.54
2	Singapore	14.98	2	Cyprus	2.19
3	Hong Kong SAR	11.53	3	Luxembourg	1.09
4	Papua New Guinea	10.55	4	Costa Rica	0.91
5	Luxembourg	9.78	5	Belgium	0.76
21	India	3.79	17	United Kingdom	0.36
33	United Kingdom	2.35	24	Germany	0.26
50	France	1.45	42	France	0.08
54	Germany	1.40	49	United States	0.05
79	China, P.R.	0.82	51	China, P.R.	0.05
88	Russia	0.58	54	Russia	0.04
90	United States	0.56	59	Japan	0.03
95	Japan	0.44			
B. Ratio to Value-added of Local Service Sector (%)					
1	Papua New Guinea	32.95	1	Ireland	15.64
2	Vanuatu	23.85	2	Guyana	1.50
3	Singapore	21.93	3	Costa Rica	1.46
4	Swaziland	16.06	4	Luxembourg	1.40
5	Hong Kong SAR	13.46	5	Armenia	1.09
13	India	7.82	18	United Kingdom	0.51
44	United Kingdom	3.28	24	Germany	0.38
53	China, P.R.	2.45	38	China, P.R.	0.15
64	Germany	2.07	42	France	0.12
66	France	2.03	51	Russia	0.07
87	Russia	1.04	52	United States	0.07
91	United States	0.76	60	Japan	0.04
94	Japan	0.66			

Note: [a] There is no separate information on computer and information services in the balance of payments of India.
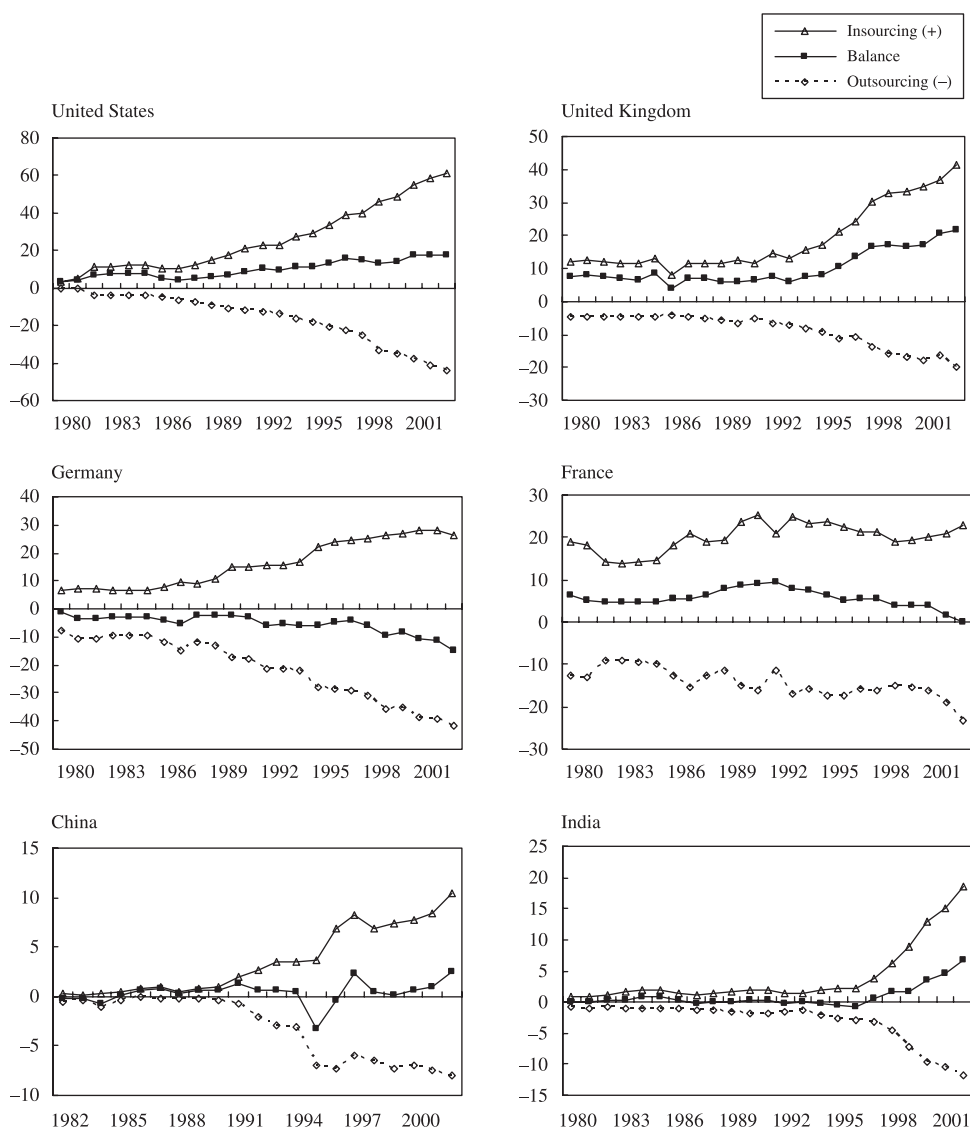
Source: IMF, *Balance of Payments Statistics Yearbook.*

than the United Kingdom (3.8% of GDP vs. 2.4%); and China is somewhat ahead of the United States (0.8% of GDP vs. 0.6%).

4.5. Who are the biggest surplus countries?

At this point, it is natural to consider the balance of payments implications of service outsourcing. Are industrialized economies more likely to run a deficit in services trade than developing countries? The answer is a resounding no. In fact, the largest surplus countries of combined computing and business services in the world are the United Kingdom and the United States.

Figure 3 plots the time series of the US imports, exports, and the net balance of business services. Table 6 ranks countries in terms of exports of business services and computing, and net balance, respectively. We note that the United States has been running a surplus in this service category every year since 1980, as does the United Kingdom. They are

Figure 3. Insourcing and outsourcing of business services (billion dollars)

Source: IMF, *Balance of Payments Statistics Yearbook* and *International Financial Statistics*.

in fact, the largest and the second largest surplus countries in the world, respectively. In other words, if every country reduced its overall service outsourcing, the United States and the United Kingdom would be the biggest two losers in terms of net dollars lost in service trade. The US current account deficit would become bigger, not smaller.

However, the patterns for other industrialized countries are more varied. For example, in business services, Germany has been running a small deficit every year throughout our sample, between 1980 and 2001. France had been consistently running a small surplus until the end of the sample when it switches to a mild deficit.

Table 6. Who are the biggest surplus and deficit countries, 2002?[a]

| Rank	Economy	Business services	Rank	Economy	Computer and information services	Rank	Economy	Total
Surplus countries			**Surplus countries**			**Surplus countries**		
1	United Kingdom	20,555.96	1	Ireland	9,882.71	1	United Kingdom	23,628.68
2	United States	17,864.30	2	United States	3,884.00	2	United States	21,748.30
3	Hong Kong SAR	15,424.54	3	United Kingdom	3,072.72	3	Hong Kong SAR	15,663.41
4	India	6,813.44	4	Canada	1,077.12	4	India	6,813.44
5	Singapore	3,826.12	5	Spain	914.65	5	Singapore	3,826.12
6	China, P.R.	2,462.05	15	France	41.39	9	China, P.R.	1,967.20
10	France	1,752.32				10	France	1,793.70
Deficit countries			**Deficit countries**			**Deficit countries**		
135	Russia	−2,570.90	95	Russia	−454.30	137	Russia	−3,025.20
139	Korea	−4,450.90	96	China, P.R.	−494.85	139	Italy	−4,001.71
140	Japan	−7,313.51	97	Italy	−674.85	140	Korea	−4,555.30
141	Indonesia	−7,985.71	98	Germany	−939.29	141	Indonesia	−7,985.71
142	Germany	−11,205.43	99	Japan	−1,007.74	142	Japan	−8,321.25
143	Ireland	−13,882.01	100	Brazil	−1,118.10	143	Germany	−12,144.72

Note: [a] Positive numbers in this table represent net insourcing of services (surplus), and negative numbers represent net outsourcing (deficit).

Source: IMF, *Balance of Payments Statistics Yearbook*.

There does not seem to be a consistent pattern of a country being in net surplus or deficit in business services solely based on the level of development. For example, in India, imports and exports of business services were fairly balanced in much of the early part of the sample. However, starting from 1996, exports have really taken off, surpassing imports by an ever widening margin, resulting in a reasonably large surplus position today. For China, the relative size of imports and exports of business services alternates between periods, though it ends the sample with a small surplus.

Figure 4 plots time series of imports, exports and the trade balance in computer and information services. The patterns are broadly similar to trade in business services, with both the United States and United Kingdom showing a net surplus, and China alternating between a surplus and deficit. The new feature in computing trends relative to business services is that Ireland is the largest surplus country in computing.

To sum up, the presumption that global service trade is dominated by lopsided one-way outsourcing from developed countries to developing countries is not supported by the data. If anything, several major industrialized countries, notably the United States and the United Kingdom, export more outsourcing type services than they import from the rest of the world. It is particularly important to note that the United States and United Kingdom are net exporters of services since the media seem to equate outsourcing with job losses (and insourcing with job gains). Of course,
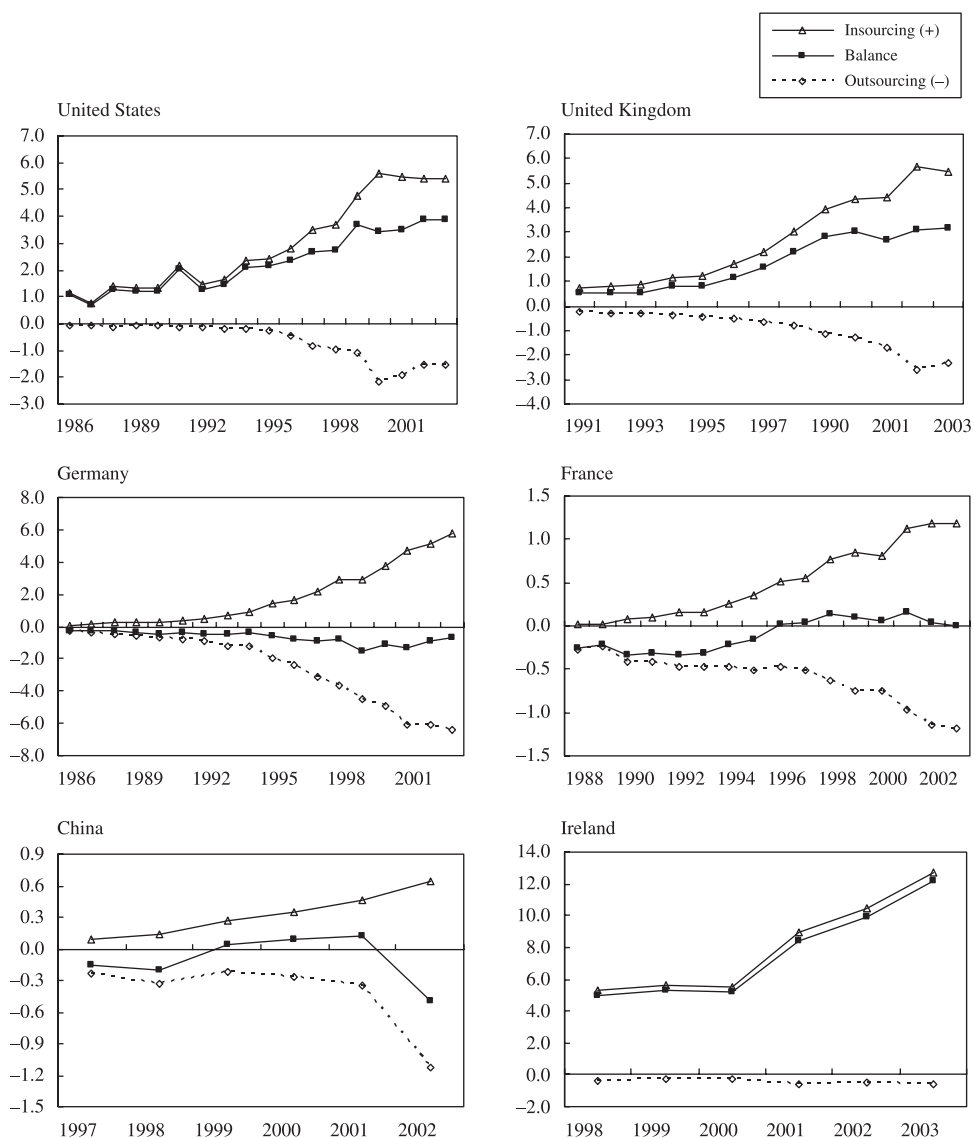
Figure 4. Insourcing and outsourcing of computer and information services (billion dollars)

Source: IMF, *Balance of Payments Statistics Yearbook* and *International Financial Statistics*.

to assess whether there are in fact any job losses arising from outsourcing we need a more rigorous analysis, which we turn to in the next section.

5. DOES SERVICE OUTSOURCING REDUCE JOBS?

A factor behind the recent anxiety in advanced economies over service outsourcing is the fear of losing jobs at home. If labour were perfectly mobile between sectors

then a job lost in one sector would be gained in another. However, if there are rigidities in the labour market then outsourcing could lead to net employment losses, at least in the short run. In this case, even a small amount of outsourcing could lead to large job losses. But outsourcing could also lead to job growth. On the one hand, every job lost is a job lost.[12] On the other hand, firms that have outsourced may become more efficient and expand production, and expand employment in other lines of work. If firms relocate their relatively inefficient parts of the production process to another country, where they can be produced more cheaply, they can expand their output in production stages for which they have comparative advantage. These productivity benefits can translate into lower prices generating further demand and hence create more jobs. This job creation effect could in principle offset the direct job losses due to outsourcing.

As the predictions from the theory are ambiguous, we turn to the data to see if there are higher job losses in the industries that have increased outsourcing. We estimate the effects of outsourcing on employment using a common empirical specification of labour demand (see Hamermesh, 1993) as follows:[13]

$$\ln L_{it} = \alpha_0 + \alpha_1 \ln w_{it} + \beta \ln \omega_{it} + \gamma \ln y_{it} \tag{2}$$

where w is the wage rate, ω is a vector of other input prices, and y is the level of output. The source of identification of employment in these types of industry labour demand studies is the assumption that the wage is exogenous to the industry. This would be the case if labour were mobile across industries. However, if labour were not perfectly mobile and there were industry specific rents then wages would not be exogenous. Provided these rents are unchanged over time then they would be absorbed in the industry fixed effects and the results would be unbiased.

In general, an increase in output would be expected to have a positive effect on employment demand and an increase in the wage a negative effect, whereas an increase in the price of other inputs would lead firms to substitute away from the more expensive inputs towards labour. The question arises as to which input prices to use for outsourcing. If the firm is a multinational firm deciding on how much labour to employ at home and abroad then it should be the foreign wage. But not all of outsourcing takes place within multinational firms and also with outsourcing from many countries it is unclear which foreign wage to include, if any. Firms that import inputs at arm's-length do not care about the foreign wage but instead are concerned about the price of the imported service. Since prices of imported services were unavailable we use the outsourcing intensity as an inverse proxy of the price of imported service inputs, that is, the lower the price of imported service inputs the

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[12] Note that this would also be true for domestic outsourcing. The main difference is that the job lost with domestic outsourcing is necessarily gained in another sector in the domestic economy. But with foreign outsourcing this job is lost to a foreign country, hence the focus on international outsourcing.

[13] This is derived from a cost function using Shepard's lemma.

higher the outsourcing intensity. An increase in outsourcing intensity can be inter-
preted as a fall in the price of outsourcing. For other input prices, such as the rental
rate on capital, we assume that all firms face the same price, which we assume is some
function of time, $r = f(t)$.

So outsourcing can affect labour demand through two channels. First, there is a
substitution effect through the input price of materials or services. For example, a fall
in the price of services would lead to a fall in the demand for labour if labour and
services are substitutes. Second, outsourcing can affect the demand for employment
through output effects. An increase in outsourcing can make the firm more efficient
and competitive, increasing demand for its output and hence labour – that is,
increases in efficiency could lead to lower prices for a firm's output that results in
increased demand for output, which in turn increases derived demand for labour. Of
course, if outsourcing leads to efficiency gains, this could also result in a reduction in
demand for labour since the firm could produce the same amount of output with less
inputs. The net effect depends on the size of the productivity gain and the increased
demand for the final good. We will estimate the equation with and without output in
order to allow for the possibility of scale effects.

We take first differences of Equation (2), denoted by Δ, giving the following
estimating equation,

$$\Delta \ln L_{it} = \alpha_0 + \alpha_1 \Delta \ln w_{it} + \beta_1 \Delta \ln OSS_{it} + \beta_2 \Delta \ln OSM_{it} + \gamma \Delta \ln y_{it} + \delta D_t + \varepsilon_{it} \qquad (3)$$

where $\Delta \ln OSS_{it}$ is the log difference in service outsourcing intensity, and $\Delta \ln OSM_{it}$
is the log difference of material outsourcing intensity. This first difference specification
controls for any time-invariant industry-specific effects such as industry technology
differences. We also include year fixed effects, D_t, to control for any unobserved effect
common across all industries, such as changes in the cost of capital, and in some
specifications we also include industry fixed effects. Some industries may be pioneer-
ing industries that are high growth industries and hence more likely to outsource; and
some industries might be subject to higher technical progress than others. Adding
industry fixed effects to a time differenced equation takes account of these factors,
provided the growth or technical progress is fairly constant over time.

In our companion paper (Amiti and Wei, 2005), we estimate this equation using US
data, where we found the effect on jobs depends crucially on the level of disaggrega-
tion. When the US economy was decomposed into 450 sectors, a faster growth in
outsourcing at a sector level was associated with a small negative growth in jobs in
that sector (i.e., $\beta_1 < 0$). However, when the US economy was decomposed into 96
sectors (still very disaggregated but less so than the 450-sector classification), there
was no correlation between job growth and outsourcing growth at the sector level.
These results seem sensible. At sufficiently disaggregated levels, every outsourced job
is a job lost. Hence, job growth and outsourcing may be negatively related. At the
other extreme, for the economy as a whole, outsourcing is likely to change only the
sectoral composition of the jobs, but not necessarily the aggregate level of employment.

The interesting finding is that one does not need to aggregate the sectors very much: even when the US economy is disaggregated into 96 sectors, one can already see enough creation of new jobs in the outsourcing-intensive sectors that can offset jobs lost due to outsourcing.

A nagging question is whether the results from the US case are applicable to European and other advanced economies. Therefore, it would be useful to re-examine this question for another economy. In this section of the paper, we turn to a case study of the United Kingdom, which makes an interesting comparison with the United States. First, as we have shown at the beginning of this paper, the anxiety over service outsourcing in the United Kingdom is likely to be as high as in the United States, as indicated by the intensity of news coverage if scaled by the size of the economy. Second, the United Kingdom actually engages in about three times as much service outsourcing as a share of its GDP (1.2% in 2001) as the United States (0.4% in 2001).

5.1. Statistical results

The data we use is for the United Kingdom from 1995 to 2001. It includes 69 manufacturing industries and 9 service industries. The employment data is for total employment. Ideally, we would distinguish between skilled and unskilled workers given that the concern over job losses appears to be predominantly among white-collar workers. Unfortunately, the ONS stopped collecting employment and wage data by skill in 1995, so all our results pertain to total employment by industry. The list of industries and details of the variables are provided in the Appendix.

To fix ideas, we first look at some examples of sectors with the fastest and the slowest employment growth and their associated growth in service outsourcing. The top five and bottom five industries ranked by total employment growth are presented in Table 7a; and the top five and bottom five industries ranked by service outsourcing growth are presented in Table 7b. From Tables 7a and 7b, we see that no uniform pattern emerges between service outsourcing and employment growth. For example, the 'other transport equipment' sector has the second highest growth in employment and one of the highest growth in service outsourcing, yet the 'preparation and spinning of textile fibres' sector experienced negative employment growth over the period and was ranked one of the biggest outsourcing sectors. In contrast, both the 'man made fibre' and the 'footwear' sectors experienced a large decline in employment growth, yet the 'man made fibre' sector experienced high service outsourcing growth and the 'footwear' sector experienced a rapid decline in service outsourcing. A scatter plot of service outsourcing growth and employment growth for all 78 industries is presented in Figure 5. Summary statistics are presented in Table 8.

In Tables 9 and 10 we present our results using statistical analysis to relate job growth at a sectoral level to the change in service outsourcing at the same disaggregated level. Tables 9a and 9b present the results for the manufacturing industries and Tables 10a and 10b present the results for the service industries. In the first column

Table 7a. United Kingdom: Top five and bottom five sectors of employment growth, 1995–2001[a]

Industry	Total employment growth (%)	Rank of total employment growth	Service outsourcing intensity growth (%)	Rank of service outsourcing growth
Top Five				
Computer and related activities	144.0	1	23.6	53
Other transport equipment	73.9	2	110.0	7
Renting of machinery and equipment	52.9	3	37.0	36
Advertising	52.0	4	31.9	45
Television and radio transmitters	46.5	5	18.5	60
Bottom Five				
Preparation and spinning of textile fibers	−47.0	74	144.5	4
Knitted and crocheted fabrics and articles	−48.2	75	19.9	57
Wearing apparel; dressing and dying of fur	−53.4	76	47.6	28
Finishing of textiles	−54.0	77	13.4	66
Footwear	−69.0	78	−34.7	78

Table 7b. United Kingdom: Top five and bottom five sectors of service outsourcing growth, 1995–2001[a]

Industry	Total employment growth (%)	Rank of total employment growth	Service outsourcing intensity growth (%)	Rank of service outsourcing growth
Top Five				
Man-made fibers	−38.9	73	233.2	1
Vegetable and animal oils and fats	3.8	30	181.7	2
Production and distribution of electricity	−8.4	48	149.9	3
Preparation and spinning of textile fibers	−47.0	74	144.5	4
Cement, lime and plaster	−31.3	71	117.5	5
Bottom Five				
Medical, precision and optical instruments, watches and clocks	5.2	29	1.6	74
Cutlery, tools and general hardware	−6.9	46	−5.4	75
Sports goods, games and toys	−23.7	61	−13.9	76
Machine tools	−28.2	67	−14.5	77
Footwear	−69.0	78	−34.7	78

Note: [a] Industries in this study are aggregated into 84 sectors, which are based on SIC (92) 3-digit codes.

Source: Employment data are from the Annual Employment Survey (AES, 1995–1997) and Annual Business Inquiry (ABI, 1998–2001). Service outsourcing ratios are calculated from input-output tables.
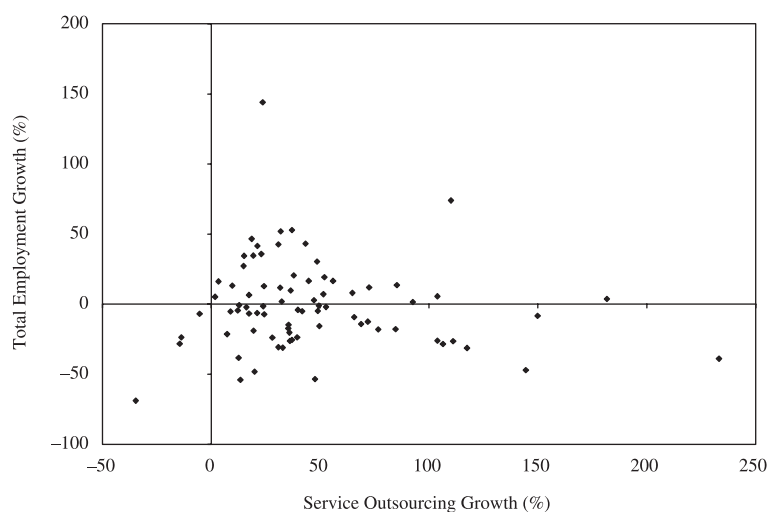
Figure 5. United Kingdom: Service outsourcing growth and employment growth, 1995–2001

Source: IMF, *Balance of Payments Statistics Yearbook* and *International Financial Statistics*.

Table 8. United Kingdom: Summary statistics (1995–2001)

Variable	Obs.	Mean	Std. Dev.	Min	Max
Manufacturing industries					
Total employment (thousand)	483	78	147	2	1,340
Nominal output (million pound)	483	7,178	13,366	534	12,6715
Outsourcing intensity of manufacture input	483	0.503	0.144	0.074	0.978
Outsourcing intensity of service input	483	0.007	0.005	0.002	0.042
Price index (2000=100)	448	101	12	75	237
Real output (million pound)	448	5,499	5,509	502	33,040
Total wage (million pound)	483	1,810	2,826	68	25,900
Service industries					
Total employment (thousand)	63	531	512	68	1,715
Nominal output (million pound)	63	34,412	27,048	4,772	120,248
Outsourcing intensity of manufacture input	63	0.115	0.092	0.043	0.423
Outsourcing intensity of service input	63	0.042	0.009	0.021	0.057
Total wage (million pound)	63	8,571	5,097	1,578	20,407

Source: Refer to the Appendix.

of Table 9a we present the results from estimating Equation (3) using employment for all manufacturing industries. We also add first period lags to allow for the fact that the effects may not be instantaneous. This is a conditional labour demand function, with output held constant. In this specification we see that service outsourcing appears to have a positive effect on employment. As hypothesized, the wage has a significant negative effect on employment, and output has a significant positive effect.

Table 9a. United Kingdom: Manufacturing employment and service outsourcing (1995–2001)

	Dependent variable Δln(employment)					
Variable	One period difference			Long time difference		
	(1)	(2)	(3)	(4)	(5)	(6)
Δln(OSS)$_t$	0.119**	0.113*	0.103*	0.148	0.094	0.083
	(0.057)	(0.062)	(0.059)	(0.182)	(0.271)	(0.249)
Δln(OSS)$_{t-1}$	0.045**	0.021	0.018			
	(0.022)	(0.025)	(0.024)			
Δln(OSM)$_t$	0.069	−0.048	−0.074	0.143	−0.192	−0.061
	(0.074)	(0.099)	(0.088)	(0.306)	(0.623)	(0.504)
Δln(OSM)$_{t-1}$	0.036	−0.028	−0.026			
	(0.068)	(0.088)	(0.076)			
Δln($wage$)$_t$	−0.704***	−0.739***	−0.733***	−0.466**	−0.683**	−0.654**
	(0.038)	(0.041)	(0.039)	(0.203)	(0.292)	(0.287)
Δln($wage$)$_{t-1}$	0.046	0.006	0.011			
	(0.032)	(0.036)	(0.033)			
Δln($real\ output$)$_t$	0.398***			0.622***		
	(0.062)			(0.177)		
Δln($real\ output$)$_{t-1}$	0.201***					
	(0.050)					
Δln($price$)$_t$		0.163			0.020	
		(0.221)			(0.134)	
Δln($price$)$_{t-1}$		−0.162				
		(0.210)				
Time fixed effects	Yes	Yes	Yes	No	No	No
Industry fixed effects	No	No	No	No	No	No
N	320	320	345	64	64	69
R^2	0.75	0.65	0.64	0.61	0.25	0.22

Notes: Standard errors in parentheses; In columns (4) to (6), all variables are differenced over the whole period i.e., $\Delta x(t) = x(T) - x(t)$
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
Source: Refer to the Appendix.

In the second column we substitute in the final goods price for output in order to allow outsourcing to affect employment through the scale affect. We see that the coefficient on service outsourcing is still positive but only significant at the 10% level. Excluding output and price, from the equation in column 3, to allow for scale effects, gives the same results as in column 2 with prices. All of these specifications indicate a positive correlation between employment and service outsourcing.

However, there is some concern that taking first time differences might induce measurement error, particularly when the variables are aggregated at the industry level. To address this concern, we re-estimate the equations using long time differences over the whole period, which we present in columns (4), (5) and (6) of Table 9a.[14] Now, we see that service outsourcing has an insignificant effect in all three specifications,

[14] See Griliches and Hausman (1986).

Table 9b. United Kingdom: Manufacturing employment and service outsourcing – sensitivity tests (1995–2001)

Variable	Dependent variable $\Delta\ln$(employment)			
	One period difference			
	Industry fixed effects		Lagged dependent variable	
	(1)	(2)	(3)	(4)
$\Delta\ln(OSS)_t$	0.090**	0.085**	0.118**	0.115**
	(0.036)	(0.041)	(0.056)	(0.058)
$\Delta\ln(OSS)_{t-1}$	0.047**	0.025	0.033	0.004
	(0.020)	(0.024)	(0.020)	(0.024)
$\Delta\ln(OSM)_t$	0.037	−0.057	0.078	−0.001
	(0.073)	(0.092)	(0.072)	(0.088)
$\Delta\ln(OSM)_{t-1}$	0.027	−0.030	0.008	−0.054
	(0.067)	(0.087)	(0.074)	(0.081)
$\Delta\ln(wage)_t$	−0.790***	−0.784***	−0.705***	−0.738***
	(0.050)	(0.055)	(0.043)	(0.047)
$\Delta\ln(wage)_{t-1}$	−0.020	−0.022	0.169*	0.269***
	(0.041)	(0.046)	(0.086)	(0.080)
$\Delta\ln(real\ output)_t$	0.382***		0.385***	
	(0.067)		(0.059)	
$\Delta\ln(real\ output)_{t-1}$	0.246***		0.131*	
	(0.076)		(0.072)	
$\Delta\ln(price)_t$		0.116		0.127
		(0.206)		(0.208)
$\Delta\ln(price)_{t-1}$		−0.215		−0.149
		(0.198)		(0.197)
$\Delta\ln(employment)_{t-1}$			0.178*	0.374***
			(0.102)	(0.091)
Time fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	No	No
N	320	320	320	320
R²	0.85	0.81	0.76	0.69

Note: Standard errors in parentheses.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
Source: Refer to the Appendix.

although the coefficient remains positive. The magnitudes of the coefficients on wages and output are a little different but their signs and significance are unchanged.

In Table 9b we conduct further sensitivity analysis to determine whether there is any effect from service outsourcing on manufacturing employment. There is some concern that there may be a third factor that could be affecting both labour demand and outsourcing, and hence causing an upward bias in the coefficient on outsourcing. Whether there is a potential problem depends on what is causing the change in outsourcing. If it is a fall in telephone prices then this would only affect employment through outsourcing so the estimates would be unbiased. However, if it is a technology shock in, say, computing that might affect labour demand directly, and the shock is

Table 10a. United Kingdom: Service sector employment and service outsourcing (1995–2001)

	Dependent variable $\Delta\ln$(employment)			
Variable	One period difference		Long time difference	
	(1)	(2)	(3)	(4)
$\Delta\ln(OSS)_t$	−0.027	−0.412**	1.633*	−0.864
	(0.161)	(0.192)	(0.591)	(1.719)
$\Delta\ln(OSS)_{t-1}$	−0.312*	−0.583**		
	(0.181)	(0.227)		
$\Delta\ln(OSM)_t$	−0.425***	−0.693***	−0.095	−0.836
	(0.129)	(0.166)	(0.131)	(0.653)
$\Delta\ln(OSM)_{t-1}$	−0.065	−0.101		
	(0.115)	(0.179)		
$\Delta\ln(wage)_t$	−0.947***	−0.823***	−0.683***	−0.779
	(0.057)	(0.065)	(0.070)	(0.540)
$\Delta\ln(wage)_{t-1}$	0.126	0.113		
	(0.075)	(0.114)		
$\Delta\ln(nominal\ output)_t$	0.807***		1.239***	
	(0.197)		(0.106)	
$\Delta\ln(nominal\ output)_{t-1}$	0.130			
	(0.155)			
Time fixed effects	Yes	Yes	No	No
Industry fixed effects	No	No	No	No
N	45	45	9	9
R²	0.89	0.75	0.97	0.47

Notes: Standard errors in parentheses; In columns (4) to (6), all variables are differenced over the whole period, i.e. $\Delta x(t) = x(T) - x(t)$
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Source: Refer to the Appendix.

correlated with telecommunications, which alters outsourcing as well, then the estimates might be upwardly biased. Unfortunately, the available data do not allow us to pinpoint the cause of the changes in outsourcing. So, in order to address this potential concern we add industry fixed effects to the first differenced specification in column (1) where we control for output, and in column (2) where we control for price. These industry fixed effects take account of the differences in unobserved industry characteristics such as differences in technology that could be driving employment growth. Again, the service outsourcing coefficients are significant and positive but we see that the size of the coefficient on service outsourcing is a bit lower. For example, in column (2), where we allow for scale effects, the coefficient on service outsourcing falls from 0.11 in Table 9a to 0.085 in Table 9b.[15] As a final check, we include a

[15] This implies that a 1% increase in service outsourcing increases employment by 0.08%. Re-estimating the equations in columns (1) and (2) in Table 9b with the difference in outsourcing (not logged) we find that a one percentage point increase in outsourcing leads to a 12% increase in employment. Given that service outsourcing only increased by one-third of a percentage point over the sample period on average in the manufacturing industries, from 0.6% to 0.9%, this implies an average employment increase of 0.6 of a percent per year. But note that the coefficient is not significant in the long difference estimations.

Table 10b. United Kingdom: Service sector employment and service outsourcing – sensitivity tests (1995–2001)

Variable	Dependent variable $\Delta\ln$(employment)			
	One period difference			
	Industry fixed effects		Lagged dependent variable	
	(1)	(2)	(3)	(4)
$\Delta\ln(OSS)_t$	−0.333***	−0.463***	−0.029	−0.264
	(0.119)	(0.121)	(0.133)	(0.170)
$\Delta\ln(OSS)_{t-1}$	−0.666***	−0.590***	−0.204	−0.142
	(0.164)	(0.187)	(0.168)	(0.188)
$\Delta\ln(OSM)_t$	−0.741***	−0.758***	−0.249	−0.271
	(0.156)	(0.168)	(0.153)	(0.188)
$\Delta\ln(OSM)_{t-1}$	−0.182	−0.111	0.068	0.184
	(0.135)	(0.147)	(0.105)	(0.122)
$\Delta\ln(wage)_t$	−0.878***	−0.849***	−0.892***	−0.804***
	(0.065)	(0.067)	(0.063)	(0.062)
$\Delta\ln(wage)_{t-1}$	0.222***	0.182**	0.489***	0.634***
	(0.060)	(0.070)	(0.148)	(0.128)
$\Delta\ln(nominal\ output)_t$	0.488***		0.716***	
	(0.150)		(0.187)	
$\Delta\ln(nominal\ output)_{t-1}$	−0.237		−0.160	
	(0.144)		(0.162)	
$\Delta\ln(employment)_{t-1}$			0.455***	0.698***
			(0.163)	(0.107)
Time fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	No	No
N	45	45	45	45
R²	0.95	0.93	0.91	0.85

Note: Standard errors in parentheses.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
Source: Refer to the Appendix.

lagged dependent variable to take account of persistence. A similar picture emerges in this specification, with a positive coefficient on service outsourcing. Also note that the coefficient on material outsourcing is insignificant in all of the specifications for the manufacturing sectors, although it is sometimes negative.

The main message from Tables 9a and 9b is that outsourcing does not have a negative effect on manufacturing employment at the sectoral level. There is a positive significant coefficient on all of the first differenced specifications, although some only at the 10% level, but this finding is not robust in the long differenced specifications. Moreover, in none of the specifications did we see a negative coefficient on service outsourcing. The insignificant effect on employment may be explained by the level of industry aggregation. For example, a worker may lose her job due to outsourcing but then find a job in another firm within the same industry classification. So if there is sufficient job creation within the broadly defined sectors to offset any job loss, then the job loss effect of outsourcing would not show up in aggregate data.

In Tables 10a and 10b, we present the results for the services industries. All of the specifications are the same as for the manufacturing industries except we include nominal output instead of real output because service price indices were unavailable. Using the one period differenced data in the first two columns of Table 10a, we find a negative coefficient on service outsourcing. With nominal output the coefficient on the lagged outsourcing variable is only significant at the 10% level. In the second column, where we exclude output in order to allow for a scale effect, the coefficient on service outsourcing is negative and significant at the 5% level. But this effect is not robust across specifications. For example, in the long differenced time data in columns (3) and (4) the coefficient is either positive and significant (at the 10% level) or negative and insignificant. In the sensitivity tests in Table 10b, the effect is negative and significant in columns (1) and (2) with industry fixed effects, but insignificant when we include a lagged dependent variable in columns (3) and (4). Similarly, we see that material outsourcing is negative and significant only in some of the specifications. So there does not appear to be any robust significant negative effect from service outsourcing or material outsourcing in service industries, although the effect is negative and significant in some of the specifications.[16]

In sum, the statistical results would appear to suggest that jobs displaced by service outsourcing are likely to be offset by new jobs created in the same sector.

6. CONCLUDING REMARKS

In developed countries, there is a tremendous amount of anxiety over international outsourcing of services. The anxiety comes in part from the perception one may obtain from the news media that global service trade is exploding and that it is dominated by lopsided, one-way outsourcing from developed countries to developing countries, and that this will lead to massive job losses in countries such as the United States and United Kingdom.

This paper presents a body of evidence that suggest neither aspect of the anxiety is well supported by the data. In particular, most developed countries are not generally more outsourcing-intensive (when adjusted for economic size) than many developing countries. In any case, many developed countries tend to run surpluses – i.e., the rest of the world outsources more to them than the reverse – in those categories most often featured in the news media, for example, business services and computer and information services. In fact, the United States and the United Kingdom have run the largest and second largest surpluses in services trade in the world in recent years.

Using data on 78 sectors in the United Kingdom, we found that job growth at the sectoral level is not negatively related to outsourcing. In our companion paper on the

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[16] Note that the service industry equations may be less reliable because we were unable to control for real output or prices and the sample size is much smaller, with only nine industries.

US economy (Amiti and Wei, 2005), we find that a negative effect on employment can be detected if the economy is decomposed into 450 sectors, but the negative effect disappears when one looks at slightly broadly defined sectors (96 sectors in the US economy). These studies show that jobs are not being exported, on net, from industrial countries to developing countries as a result of outsourcing. In fact, the evidence suggests that workers who lose jobs in one industry manage to find jobs in other growing industries.

To conclude, the risk of service outsourcing dramatically reducing job growth in the advanced economies has been greatly exaggerated.

DISCUSSION

Jonathan Haskel
Queen Mary, University of London and CEPR

The paper looks at international outsourcing, particularly of services, and tries to answer two questions: how much outsourcing is there and what are the effects on UK employment? The answer to the first question is that there is not too much outsourcing of services (in UK about 5% of non-energy inputs). Furthermore the UK and USA are net exporters of business services not importers, a fact that would surprise many people. As for the second question, the authors find small effects on employment that are not negative in any of their specifications.

As usual there are always problems and quibbles with methods. But we should not lose sight of the fact that the authors have written a timely and interesting paper that should be required reading for all those who only look at the extensive column inches of what journalists have to say on this matter.

Don Cook's book, *The Long Fuse: How England Lost the American Colonies, 1760–1785*

Before looking at the recent evidence the authors mention some of the historical antecedents of modern day outsourcing. These are, I think, of some interest. Don Cook's book *The Long Fuse*, about the US War of Independence, has some fascinating discussion of an early example of service sector outsourcing, namely the hiring of (mainly German) mercenaries by King George to fight rebels in the USA. Interestingly he argues that they won no battles, suggesting that the notion that outsourced labour may be of poor quality is not a new one.

The authors develop two measures of outsourcing. The first is country-specific and is taken from the IMF Balance of Payment Statistics on 'imports of computing (including computer software designs) and other business services (which includes accounting and other back-office operations' and is set out for many countries. The

second is an industry specific measure for the UK and is an aggregation, for each industry i, of nine j services outsourced

$$OSS_i = \sum_j \left[\frac{input\ purch\ of\ service\ j\ by\ ind\ i}{tot\ non-energy\ inputs\ used\ by\ ind\ j} \right] \left[\frac{M\ of\ service\ j}{Sales_j + M_j - X_j} \right]$$

The first measure has the problem, acknowledged by the authors, that it might include computer sales to consumers rather than firms and so might be biased. But both have a more over-riding problem, namely the original source of the data. To discover this involves penetrating the innards of the relevant statistics agency which is often hard to do. Fortunately the UK Office of National Statistics has a specific project on outsourcing and so we can get some idea of the data using Clayton (2004). The 'International Trade in Services Survey' is sent to around 20,000 firms who are asked about their exports and imports of business services, which such services split up into categories such as R&D, telecoms, accounting etc. These micro data, which are not available outside the ONS, are then used to calculate service-specific exports and imports, and this is the second bracket in the OSS formula used by the authors. Unfortunately, these data are not provided at an industry and service-specific level, whereas all services are so provided. This is why the authors are forced to use service-specific outsourcing ratios that are the same across all industries in the formula above. How much bias this imparts to the cross-industry variation in outsourcing awaits calculations using the micro data. At the moment, therefore, the economy-wide data are likely to be better in quality than the industry-wide data.

The economy-wide data are themselves very interesting. Two points are notable. First, the UK and USA are substantial receivers of outsourcing. Indeed they are so much so that they actually run a surplus in services trade. This would surprise many, I conjecture. Second, industries both outsource and insource at the same time. I would like to see some discussion of what this suggests for the trade theories that purport to explain trade in services.

The authors then use the industry specific data to run panel labour demand equations with employment regressed on wages, outsourcing ratios (a proxy for the price of outsourcing) and various other controls such as fixed effects, output and time dummies. Here the authors find that none of the effects of outsourcing are ever negative, as the prophets of doom might have us believe, and indeed that some are positive. This motivation for this part of the paper is set out neatly: one needs to assume that factor prices are exogenous and that there is no technological shock that both makes outsourcing more feasible and alters labour demand. Nonetheless I think it would be worth discussing at least two issues. First, what are the issues involved in trying to isolate a price effect of outsourcing when all that is available is the quantity of outsourcing (in fact the share of outsourced services in non-energy inputs)? Such a share is presumably a potentially endogenous variable, chosen by firms in a way that might reflect both the price of outsourcing but also other factor prices and technologies. Second, what are the issues involved in using industry data to try to

estimate a production function that presumably refers to a company? Since changes in an industry refer to changes both on the intensive and extensive margin then the question of just what the regression coefficient returns is worth considering I think. If changes are mostly on the intensive margin then the coefficient is more likely to reflect movement along the isoquant concerned. But if firm opening and closing is important then the coefficient reflects this instead. We know from micro studies that opening and closing is a non-negligible part of productivity growth. Whether it is an important part of the response to outsourcing awaits more detailed micro data.

Emmanuelle Auriol
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The paper studies service outsourcing. It is very useful because the subject attracts a lot of media and political attention. The paper is one of the first empirical studies dealing seriously with this issue. With the help of descriptive statistics, it first establishes that service outsourcing is at a very low level (e.g., less than half a percent of GDP in the USA in 2003) but it is growing. Moreover, until now it has mainly benefited the trade balance of developed economies. The paper studies next the impact of service outsourcing on employment in the UK. The authors conclude from their statistical analysis that service outsourcing has a weak *positive* effect on manufacturing employment in the UK. The reader is hence induced to believe that workers in rich economies have nothing to fear from service outsourcing.

If service outsourcing remains at the current level there is indeed nothing to fear. However, if service outsourcing grows substantially in the future, we need to consider the possibility that some workers in services are going to get hurt. The paper is interesting because it is essentially descriptive. This is also a weakness because it does not analyse the consequence of an increase in service outsourcing. Yet service outsourcing is a normal part of international trade. Based on standard international trade theory we can predict that the relative prices of outsourced service are going to decline, which is good, but also that the relative wages of those who used to work in outsourced service are going to decline, which for them at least is not so good. If there are downward rigidities on wages, as it is the case for instance in many European countries, this might also give rise to unemployment. The experience we have on material outsourcing supports this view. People without qualifications, who previously would have held blue collar jobs in now vanished industries, are either unemployed (e.g., in France and in Germany) or belong to the class of the 'working poor' (e.g., in the UK and in the USA). By focusing exclusively on employment the authors are presumably missing a crucial aspect of the impact of outsourcing in the UK, namely the impact on real wages. Moreover the authors choose to stress the positive effect that service outsourcing has on manufacturing employment (Tables 9a and b). However, they find the opposite result, that is a *negative* effect, on service sector employment (Tables 10a and b). The authors dismiss the result on the ground that it is not robust. It is true that in 1 regression over 8 the sign is positive, but this regression is based

on a sample of 9 observations. It is hard to trust such a result. In contrast the other regressions where the sign is negative and significant involve 45 observations.

Since we are at the early stage of the process it is hard to draw many conclusions on the future evolution of service outsourcing. The evidence presented in the paper is mixed. Service outsourcing seems to increase employment in manufacturing, and to decrease it in service sector. This result is worrisome because some 70% of jobs and of GDP value added in rich economies are in services. The emotion generated by service outsourcing, as negligible as it is right now, reflects the deep fear educated people have of falling from the middle-class to the working poor. The paper does not address this issue because it does not consider wages. I believe that it has to be addressed, along with the employment issue. Otherwise if service outsourcing rises substantially, protectionism among educated people will rise even more. In a democracy this would become a major political problem.

Panel discussion

Tullio Jappelli agreed with the discussants that outsourcing should not be dismissed merely because it is a small phenomenon. If the practice is in its infancy, then the levels seen in the data of the 1990s may not be indicative of the future impact of the practice. Hans-Werner Sinn agreed and argues that the analysis should look at wage stickiness, which if present will produce too much outsourcing. He cited data from Germany which indicated that 80% of the reduction in value added by German industry went to other countries, with only 20% going to other domestic sectors. Jaume Ventura was not surprised by the small amount because services are generally untraded. Georges de Ménil thought that the authors were using the wrong measure, and that with GDP as the denominator service imports will always seem tiny in any large economy. He suggested using service imports over total imports.

Jaume Ventura asked what was the shock that led to the growth of outsourcing, arguing that it was the fall in the cost of trade. He didn't see this as a new phenomenon, arguing that the British outsourced production of materials (cotton) during the industrial revolution, and thought that opening to trade would change comparative advantage symmetrically. Paul Seabright agreed that it was important to discuss the shock which leads to outsourcing as the fundamental event being evaluated. He proposed two possibilities: the fall in the cost of telecoms, which even though it might cost some jobs due to outsourcing greatly benefits the majority of people and thus could hardly be argued to have decreased welfare overall. The second possibility was the discovery on the part of countries such as India a new capacity to create services, thereby benefiting producers of complements and hurting producers of substitutes.

Philippe Martin objected that while the title suggested some welfare analysis, changes in labour are not directly related to welfare, and that terms of trade should

be considered, as well as the change in productivity of the service sector in developing countries. More generally, he wondered how the small numbers found for labour restructuring could be reconciled with the big gains from outsourcing. The authors responded that their objective was to try to inform the decisions of policy makers by analysing what is reported in the press; it was never to address welfare issues which would involve not just trade issues but also consumer and producer surplus, for which they did not have adequate data.

Andrew Filardo objected to the idea that the 'fear' of the title and the anxiety it might produce was necessarily a bad thing. He thinks that the anxiety would be productive, inducing workers to acquire more human capital. The authors argued that the political economy effects of anxiety might be a bad thing if they led to protectionism.

Andrea Prat wondered what role, if any, language barriers play in outsourcing of services. He was surprised to find that the high outsourcers included countries with languages that were not widely spoken elsewhere, such as Italy and Japan.

Georges de Ménil questioned the use of the same equation to describe service imports for both service and manufacturing sectors, arguing that these are fundamentally different in that for manufacturing service imports represent the cheaper supply of an input while they are a substitute, competition, for the service sector.

And finally, Michael Gasiorek wondered if there was anything to be learned by expanding the analysis to look at spillovers and linkages between countries and industries. He also recommended, for future research, that it would be interesting to look not at the effects but the determinants of outsourcing.

APPENDIX

Table A1. Data sources

Variable	Source	Description/Notes
Trade Data: imports and exports of computing and information services; and other business services	IMF Balance of Payments, International Financial Statistics	
Newscount	FACTIVA, Dow Jones & Reuters, www.factiva.com	
Input/output tables[a] Total compensation Output in current values	National Statistics online, United Kingdom, (www.statistics.gov.uk)	
Employment[b]	Annual Employment survey (AES)	Great Britain, SIC92 3 digit, 1995–98
	Annual Business Inquiry (ABI)	United Kingdom, SIC92 5 digit 1998–2001
	Census of Employment, Northern Ireland	Northern Ireland, 1995 and 1997
Price Indices[c]	National Statistics online, United Kingdom, (www.statistics.gov.uk)	Manufacturing industries only, SIC92.

Notes: [a] In order for the information from all sources to match, certain industries are aggregated together. The employment data from ABI are first aggregated into SIC92 3-digit level so as to match the categories of AES. A second stage of aggregation happens whenever there is a multiple-to-multiple correspondence between the I/O tables codes and the SIC92 3-digit codes. Finally, after dropping out industries which are either not of interest to this study, such as agriculture and mining sectors, or with incomplete information, we are left with 69 manufacturing industries, and 9 service industries, listed below.

[b] The regional coverage of the two sources of employment information are different. In order to make the two data comparable, the following steps were taken. First, the data for employment from Northern Ireland were added to employment data from Great Britain to get employment figures for United Kingdom for 1995–1997. Note, for 1996 the employment in north Ireland is taken as a simple average of 1995 and 1997 employment. There still remain some industries for which there is no corresponding data in Northern Ireland. For these industries, the information of the overlapping year (1998) serves as a bridge to merge the whole series, with the employment of Great Britain industries assumed to be constant ratios of those of United Kingdom.

[c] These price indices are available at different levels of disaggregation (SIC92 classification) and do not correspond to industries in our sample in a one-to-one fashion. Hence, we constructed a weighted average of these PPI (using average employment for the United Kingdom for the period 1998 to 2001 as weights – the only years available at the appropriate level of disaggregation) to get price indices at 3 digit SIC level.

Table A2. List of industries in the UK sample

Manufacturing industries

IO	Industry Name	IO	Industry Name
8	Meat processing	49	Glass and glass products
9	Fish and fruit processing	50	Ceramic goods
10	Oils and fats	51	Structural clay products
11	Dairy products	52	Cement, lime and plaster
12	Grain milling and starch	53	Articles of concrete, stone etc
13	Animal feed	54	Iron and steel
14	Bread, biscuits etc	55	Non-ferrous metals
15	Sugar	56	Metal castings
16	Confectionery	57	Structural metal products
17	Other food products	58	Metal boilers and radiators
18	Alcoholic beverages	59	Metal forging, pressing, etc
19	Soft drinks and mineral waters	60	Cutlery, tools etc
20	Tobacco products	61	Other metal products
21	Textile fibres	62	Mechanical power equipment
22	Textile weaving	63	General purpose machinery
23	Textile finishing	64	Agricultural machinery
24	Made-up textiles	65	Machine tools
25	Carpets and rugs	66	Special purpose machinery
26	Other textiles	67	Weapons and ammunition
27	Knitted goods	68	Domestic appliances nec
28	Wearing apparel and fur products	69	Office machinery & computers
29	Leather goods	70	Electric motors and generators etc
30	Footwear	71	Insulated wire and cable
31	Wood and wood products	72	Electrical equipment nec
32	Pulp, paper and paperboard	73	Electronic components
33	Paper and paperboard products	74	Transmitters for TV, radio and phone
34	Printing and publishing	75	Receivers for TV and radio
36	Industrial gases and dyes	76	Medical and precision instruments
37	Inorganic chemicals	77	Motor vehicles
38	Organic chemicals	78	Shipbuilding and repair
39	Fertilisers	79	Other transport equipment
40	Plastics & synthetic resins etc	80	Aircraft and spacecraft
41	Pesticides	81	Furniture
42	Paints, varnishes, printing ink etc	82	Jewellery and related products
43	Pharmaceuticals	83	Sports goods and toys
44	Soap and toilet preparations	84	Miscellaneous manufacturing nec & recycling
45	Other chemical products	85	Electricity production and distribution
46	Man-made fibres	88	Construction
47	Rubber products		
48	Plastic products		Total Manufacturing Industries = 69

Service industries

IO	Industry Name	IO	Industry Name
99	Telecommunications	108	Research and development
100	Banking and finance	109	Legal activities
101	Insurance and pension funds	110	Accountancy services
102	Auxiliary financial services	111	Market research, management consultancy
106	Renting of machinery etc	112	Architectural activities and technical consultancy
107	Computer services	113	Advertising
		114	Other business services

Total Service Industries = 9

Notes: Industries in the bold frames have been grouped together to match input/output classifications. Specifically, industries 14–17, 18–19, 25–26, 36–40, 100–102, and 109–111 are treated as 6 groups of industries.

WEB APPENDIX

Available at: http://www.economic-policy.org

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