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The impact of offshoring on employment in Belgium

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Abstract - The fear of massive job losses has prompted a fast-growing literature on offshoring and its impact on the labour markets of advanced economies. This paper contributes to this literature by examining the situation for Belgium during the period 1995-2003. It addresses both materials and business services offshoring to high-wage and low-wage countries. The offshoring intensities are measured by the share of imported intermediates in output that is computed using a series of constant price supply-and-use tables. The estimations of industry-level labour demand equations augmented by offshoring intensities do not reveal a significant impact of either materials or business services offshoring on total employment for Belgium between 1995 and 2003.

Jel Classification – F and J.

Keywords – Offshoring, imported intermediate inputs, supply and use tables, industry-level employment, labour demand equations, panel data.

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Contents

List of tables

1. Introduction

The world economy is becoming ever more integrated through various channels. Offshoring – the shift of economic activities abroad – is one of them[1]. It has recently received widespread attention in advanced economies where the shift of activities to low-wage countries is perceived as a major threat to jobs and a source of downward pressure on wages. Traditionally, offshoring used to be an issue only for manufacturing activities, for which such shifts abroad have since long occurred on a regular basis. But in recent years, the threat of offshoring has also come to be felt in service activities as the output of those activities has become increasingly tradable.

The perceived threat has prompted a fast-growing literature on offshoring and its impact on the labour markets of advanced economies. Most theoretical contributions to this literature draw on traditional trade models and generally confirm the widely-held intuition that although offshoring should prove beneficial for an economy in the long run both in terms of productivity and employment, there may be adjustment costs in the short run in the form of unemployment or a downward pressure on wages. The first problem to sort out for the empirical strand of the literature was that of measuring the extent of offshoring. The aim was to get a better idea of its extent than what is conveyed by anecdotal evidence presented in the press. By now, the share of imported intermediates in output has become the widely accepted standard measure for the offshoring intensity. It is usually based on input-output or supply-and-use tables, separated into materials and business services, and sometimes even split according to the origin of the imported intermediates so as to distinguish between high-wage and low-wage countries. Empirical papers have then estimated the employment impact of these offshoring intensities in a neoclassical labour demand framework augmented by an offshoring variable. Most of them use industry data. This partial equilibrium setting has mostly been used to determine the differential impact of offshoring on high-skilled and low-skilled employment, and some papers have found a negative impact of offshoring on low-skilled employment. Nonetheless, a few papers have focused on the impact of offshoring on total employment. However, the results presented in these papers do no lead to a clear-cut conclusion regarding the impact of offshoring on total employment: this impact is mostly small or not significant.

For Belgium, offshoring is an important issue because of the very high degree of openness of the economy, which favours the shift of activities abroad. Media attention has mainly focused on job losses through offshoring in manufacturing, especially in the textile industry, but also in automobile production. Indeed, Belgium hosts several big automobile assembly plants that have undergone restructuring recently. Service offshoring has drawn less attention, but this is bound to become an issue in the future.

[1] Other terms such as outsourcing or fragmentation have been used to describe this shift abroad of activities. We will come back the terminology in the next chapter.

In this context, we pursue two objectives: first of all, we want to take a closer look at recent trends in both materials and service offshoring for Belgium, most of all in terms of destination regions. For this purpose, we use a series of supply-and-use tables that are all consistent with the national accounts vintage of 2007 and that contain use tables of imports for the years 1995 to 2003 in prices of 2000. From these tables we compute the standard offshoring measures in constant prices. Thereby, we improve on measures that are generally presented in the literature, i.e. current price measures based on input-output or supply-and-use tables of different national accounts vintages. The split of the materials and business services offshoring intensities into high-wage and low-wage regions is operated using import data by country of origin. Second, the main objective of this paper is to throw some light on the question of whether in Belgium offshoring has had an impact on industry-level employment in recent years, i.e. total employment by industry without making a specific distinction between high-skilled and low-skilled workers. For the estimation of this impact, we follow the literature relatively closely and specify several types of labour demand equations: conditional and unconditional in a static or dynamic setting – always augmented by our offshoring measures. The econometric methods used for estimating these equations are adapted according to the type of labour demand. Finally, we have separated manufacturing and service industries for the estimations and we have always included both materials and business services offshoring in order to obtain complete results.

The rest of this paper is organised as follows: chapter 2 provides an overview of the theory, chapter 3 contains the measures of offshoring intensity for Belgium, and the labour demand equations to be estimated are derived in chapter 4. The relevant empirical literature is reviewed in chapter 5, while the data and the estimation results are presented in chapters 6 and 7. Finally, chapter 8 concludes.

2. Theory

Offshoring has been described under many different names: international fragmentation, vertical specialisation or foreign outsourcing to name just the most widely used. All these terms stand for a common phenomenon: the splitting up of the production process into many separate activities and the shift of some of these activities abroad. Following the terminology of several international organisations[2], we will call this offshoring.

The motivation of firms to shift parts of their production process to another country is relatively straightforward: they make cost arbitrages and try to locate each stage of the production process where factor prices make this most profitable. The classical scenario is that they take advantage of lower labour costs in developing economies if these cost gains outweigh the extra coordination costs of the more complex production process and the extra transport costs for the intermediate goods or services to be provided to the other stages of the production process. Put briefly, offshoring is a "new vehicle of internationalisation where international arbitrage cuts value-added processes into ever smaller slices produced in different locations".[3] Thus, offshoring enhances the international division of labour and, naturally, raises fears of massive job losses or downward pressure on wages in high-wage countries. The theoretical literature on this subject lends from the one on the welfare effects of trade. According to Deardorff (2006, p.1057), offshoring "is just a particular, to some extent modern, manifestation of trade and […] therefore its welfare effects are already well understood". This sums up the view of most authors, hence it is not surprising that most theoretical analyses have been conducted using traditional trade models adapted to take the specificities of offshoring into account.

Although the impact of offshoring on the labour market in advanced economies is a complex problem with an uncertain outcome, a basic line of argument is put forward in many contributions to the literature. On the one hand, shifting a stage of the production process abroad will cause lay-offs of workers that used to perform this activity giving rise to unemployment and downward pressure on wages. On the other hand, there will be gains from offshoring in the form of enhanced efficiency. The productivity of workers in downstream parts of the production process will be raised through cheaper inputs or a higher quality of inputs at the same price. This concerns inputs that before were produced by the laid-off workers and are now imported. Whether those gains accrue to the workers in the downstream activity, to workers in other activities or to capital depends on how the rent is shared. In terms of overall welfare, the productivity gains are generally believed to outweigh the losses suffered by the laid-off workers. The redistributive character of this short-term impact of offshoring is pointed out by Brainard and Litan (2004, p.1): "Economic theory and past performance suggest that although offshoring provides overall economic gains, it is also redistributive with affected workers facing

[2] See OECD (2007a), UNCTAD (2004) and WTO (2005).

[3] Kohler (2004), p.793.

possible job loss and wage pressures." Special attention has been paid in the literature to the question whether low-skilled workers are systematically the losers from offshoring and high-skilled workers the winners.

The focus here is employment, which is the main channel of adjustment in a relatively rigid labour market like in Belgium. As said above, offshoring will lead to lay-offs and unemployment in the short-term in such a labour market, replacing demand for workers with skills that are useful in the offshored production stage. It is generally assumed that in the long run these workers can acquire other skills needed to find a job in a different activity. The employment effect of the productivity gains may also turn out to be negative as emphasized by Amiti and Wei (2005). Enhanced productivity of workers in downstream activities may depress the demand for those workers. Nonetheless, in the long-run one would rather expect to observe an expansion of production and in turn higher employment as offshoring improves the efficiency of the production process and competitiveness. Thus, the standard prediction of the theory is a negative short-term employment impact of offshoring and a positive long-run impact in advanced economies.

This is the dominant pattern, but there are, of course, caveats regarding the welfare and employment effects of offshoring. For the short-run adjustment that leaves some winners and some losers the outcome in terms of welfare and employment for different groups of workers depends on the initial relative factor demands – or rather the demand for the type of skills they can offer. Regarding employment, the negative effect for a group of workers may be mitigated in a less rigid labour market, but this comes at the price of downward pressure on wages for that group. For a country's welfare its terms of trade play a crucial role as usual in trade models. They may be altered through the impact of offshoring on world prices and cancel the overall gain that stems from enhanced productivity. In the long run, various scenarios of welfare losses become possible. Samuelson (2004) shows what may happen when there is innovation in an activity that has been offshored from a high-wage to a low-wage country. In his Ricardian framework, this innovation will induce a welfare loss for the high-wage country. Deardorff (2006) completes the argument by adding that it may precisely be offshoring that fosters innovation and productivity gains in the low-wage country. Another example comes from Kohler (2004) who shows that in a specific factors model offshoring may lead to welfare losses for the high-wage country when it is treated as a discrete event, i.e. the activity is performed either entirely at home or entirely abroad. Long-run employment effects are generally absent from trade-based models given the assumption of labour mobility between industries.

3. Measuring offshoring

In trying to see what impact offshoring has on employment, the first issue for empirical studies was how to measure offshoring. Due to a lack of appropriate data on shifted activities, most measures that have been put forward are based on trade flows, i.e. a consequence of offshoring, rather than on the shift of activity itself. The share of imported intermediate inputs in total intermediate inputs or output has by now become the standard measure for the intensity of offshoring.[4] It is almost always based on data from input-output tables (IOT) or supply and use tables (SUT).[5] Although it is the best one among the trade measures, it still remains a rough proxy. Just like any trade measure it ignores cases of offshoring that do not give rise to imports, and includes some imports that are not due to offshoring. Moreover, focusing on intermediate inputs implies leaving out cases where the final stage of the production process is offshored.[6] Finally, since the classical offshoring scenario consists in the shift of a production stage from a high-wage to a low-wage country, the relevance of the analysis can be improved by splitting the imports of intermediates by country of origin and identifying those coming from low-wage countries.

For the purpose of our analysis for Belgium, data on imports of intermediate inputs are taken from a series of constant price SUT for the period 1995-2003, which are compatible with the 2007 vintage of the Belgian national accounts. They contain a breakdown into 120 industries and 320 product categories. The methodology of compilation of these SUT is described in Avonds et al. (2007). According to Michel (2008, p.25), "SUT are more appropriate than IOT for constructing an imported intermediate input measure for offshoring. Product-by-product IOT are characterised by homogeneous industries, whereas SUT refer to heterogeneous industries. The latter may be preferable when linking imported intermediate inputs to employment data by industry from the national accounts, for which industries are always heterogeneous."[7]

In most of the literature, imported intermediate inputs have been computed in a proportional way combining data on intermediate inputs from IOT or SUT with trade data. Intermediate inputs of a product are multiplied for every industry by the share of imports in total supply for that product. Summing over the products for every industry allows to obtain imported intermediate inputs by industry. The data on imported intermediate inputs contained in the series of

4 Hijzen et al. (2005) and Hijzen (2005) use value-added as denominator for this share, but then it suffers from the high volatility of industry-level value-added over time.

5 SUT are industry-by-product tables that enable the analysis of output, intermediate consumption and final demand. They are the basis for the derivation of symmetric product-by-product IOT.

6 Nevertheless, through a shift-and-share analysis with Belgian data, Michel (2008) shows that the offshoring intensity is a relatively good indicator for the shift abroad of intermediate stages of the production process since shifts towards activities that are more intensive in imported intermediate inputs have very little impact on this measure.

7 Michel (2008, p.25) adds that the difference between heterogeneous and homogeneous industries tends to become small when there is a great industry and product detail available". Note that this is generally not the case in industry-level studies of the employment impact of offshoring where the number of industries is mostly less than 100. Feenstra and Hanson (1996) and Amiti and Wei (2006) are notable exceptions to this rule.

SUT for Belgium represent a substantial improvement in this respect. Here, they can be found in the use tables of imports. For the reference years 1995 and 2000, these tables have been computed according to a special method based on detailed information on imports by firm and product that is described in Van den Cruyce (2003).[8] Then, as explained in Avonds et al. (2007), the structure of the tables for these reference years has been used for the calculation of use tables of imports for the SUT of the remaining years.[9]

Another important improvement compared to other studies is that the series on SUT for Belgium contain constant price data on imported intermediate inputs through the deflation with separate price indices for domestic output and imports.[10] The main problem with a measure based on imported intermediate inputs in current prices is that it tends to understate the magnitude of offshoring due to an endogenous price effect. As said before, activities are offshored for reasons of cost arbitrage, i.e. because imported intermediate inputs are cheaper than domestically produced intermediate inputs. Therefore, when computed in value terms, the offshoring intensity will be biased downwards.

For the presentation of the data below and for the econometric analysis, we have chosen the offshoring intensity measure that divides imported intermediate inputs by output rather than by total intermediate inputs. Data on output by industry are also taken from the SUT. Denoting industries and products by subscripts i and j, total offshoring by ot, imported intermediate inputs by III and output by Y, we can write for the industry-level offshoring intensity:

$$ot_i = \frac{\sum_j III_{ij}}{Y_i}; i = 1,...,I; j = 1,...,J$$

Furthermore, different types of activities may be offshored and this is reflected in the different kinds of products that are imported as intermediate inputs. Traditionally, offshoring was confined to manufacturing activities because their output is easily tradable. But things have changed. Progress in information and communication technologies has made it possible to transfer the output of certain service activities over long distances. This tradability revolution for services has prompted the offshoring of service activities and this has occurred not only between high-wage countries, but also between high-wage and low-wage countries. Stories abound of call centres of American companies being moved to India or the Philippines or of accounting departments of Western European multinationals being transferred to Eastern Europe. Hence, the aim of distinguishing between trends in the offshoring of manufacturing and services activities warrants a split of the offshoring measure. The share of imported inter-

8 Van den Cruyce (2003) describes the method for manufactured goods, the one for services can be found in Hambÿe (2001).

9 Some authors, e.g. Hijzen et al. (2005) or Falk and Wolfmayr (2005, 2008), also rely on use tables of imports that are available from the source they take their data from. But no information is provided on how these tables have been calculated.

10 The methodology of deflation is explained in Avonds et al. (2007).

mediate manufacturing goods in output is referred to as materials offshoring (*om*) and covers 185 product categories from the SUT between CPA15 and CPA37[11]. The share of imported intermediate services is called service offshoring (*os*), and we will even restrict the latter to business services, which covers 15 product categories from the SUT between CPA72 and CPA74, since they contain the service categories such as accounting or call centres that have become tradable and that have been most frequently offshored. Business services offshoring has received growing attention in the literature in recent years, e.g. in UNCTAD (2004), Amiti and Wei (2005, 2006) and Falk and Wolfmayr (2008). All other product categories have been excluded either because they cannot be traded – this is the case for many service categories – or because imports of these product categories cannot be interpreted as offshoring, e.g. imported agricultural or energy products or imported transport services. Then, considering that the total number of products *J* is made up of *J'* manufacturing goods and *J-J'* services:

$$om_i = \frac{\sum_{j=1}^{J'} III_{ij}}{Y_i}$$

and

$$os_i = \frac{\sum_{j=J'+1}^{J} IIS_{ij}}{Y_i}$$

Some authors have opted for a more restrictive measure called 'narrow offshoring', which has initially been defined by Feenstra and Hanson (1999).[12] To compute this narrow measure, only imported intermediate inputs from the 'same' industry are taken into account, i.e. imported intermediate inputs that are part of the product category that constitutes the main output of the industry. However, we prefer the 'broad offshoring' that we have defined above over 'narrow offshoring' since we believe that the shift of activities abroad is not necessarily limited to only core activities.

In order to better identify offshoring to developing countries, it proves interesting to compute offshoring intensities for different regions. To the best of our knowledge, Egger and Egger (2003) were the first to suggest such a split-up of the offshoring measure. But, in the SUT no information is available on the country of origin of imported intermediate inputs. Therefore, we must rely on a proportional method combining the data on materials and business services offshoring from the SUT with data on Belgian imports broken down by country of origin. For manufactured goods, the data on imports by country of origin at the 5-digit CPA-level come from merchandise trade statistics, while for business services imports, we use balance of payments data by country of origin for the categories 'computer and information services' (7) and

11 CPA stands for the 'Statistical Classification of Products by Activity in the European Economic Community'.

12 The measure is of course used in Feenstra and Hanson (1999), but also among others in Ekholm and Hakkala (2005), Falk and Wolfmayr (2005), Hijzen et al. (2005) or OECD (2007b).

'miscellaneous business, professional and technical services' (9.3).[13] We distinguish three groups of countries: OECD-22 with variable suffix _i is made up of 22 OECD countries (Austria, Australia, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States); CEEC with variable suffix _e corresponds to the ten Central and Eastern European member states that have joined the EU recently (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia); ASIA with variable suffix _a groups together China, India and eight economies from South-East Asia (Hong Kong, Indonesia, Malaysia, the Philippines, Singapore, South Korea, Thailand and Taiwan). Together, those three groups account for more than 90% of Belgian imports of manufactured goods and services and most of these imports come from the region OECD-22. Both CEEC and ASIA contain emerging economies that are typical offshoring destinations.

The proportional method works as follows: first, use the trade data to calculate the share of each region in total Belgian imports for all the products in the SUT that are relevant for materials or business services offshoring. Then, for each product separately, multiply the imported intermediate inputs by these regional import shares. As a result, this provides imported intermediate inputs by region of origin for each industry-product combination. Finally, for each industry, sum those regional imported intermediate inputs over the products - manufacturing goods or business services –and divide this sum by the industry's output and thereby obtain offshoring intensities by region *om_i*, *om_e*, *om_a*, *os_i*, *os_e* and *os_a* for all industries. Write this as:

$$om\_k_i = \frac{1}{Y_i}\sum_{j=1}^{J'} III_{ij}\frac{M\_k_j}{M_j}, k = i, e, a$$

and

$$os\_k_i = \frac{1}{Y_i}\sum_{j=J'+1}^{J} III_{ij}\frac{M\_k_j}{M_j}, k = i, e, a$$

where *M_k* stands for Belgian imports from region *k* and *M* for total Belgian imports.

The results for Belgium over the period 1995-2003 are shown in Table 1 for three industry groups: all private sector industries, all manufacturing industries and all market services industries.[14] Several salient features emerge. For the private sector as a whole, the intensity of materials offshoring is much higher than that of business services offshoring, but the average growth rate of the latter is much higher. Both these features are true for the total as well as for the regional offshoring intensities. This is not really surprising given that services offshoring is a rather recent phenomenon. The offshoring intensities for the regions CEEC and ASIA are very low

13 Both these types of import data for Belgium are produced by the National Bank of Belgium (NBB).

14 The offshoring measures for the reported industry groups are output weighted averages. There are 58 manufacturing industries and 35 service industries.

over the whole period and the bulk of offshored activities are located in the OECD-22 countries. Nonetheless, the growth rates of materials and business services offshoring are highest for the CEEC region.

Table 1 Materials and business services offshoring for Belgium split by region of origin

	Materials offshoring (om)			Business services offshoring (os)		
	1995	2003	avg gr	1995	2003	avg gr
Private sector						
Total	13.21%	12.96%	-0.2%	1.00%	2.02%	9.2%
OECD-22 (_i)	12.01%	11.33%	-0.7%	0.96%	1.92%	9.0%
CEEC (_e)	0.22%	0.50%	10.8%	0.01%	0.03%	19.3%
ASIA (_a)	0.34%	0.50%	4.8%	0.01%	0.02%	8.1%
Manufacturing						
Total	29.76%	28.69%	-0.5%	0.45%	1.15%	12.4%
OECD-22 (_i)	27.03%	25.08%	-0.9%	0.43%	1.09%	12.2%
CEEC (_e)	0.53%	1.21%	10.9%	0.00%	0.02%	23.3%
ASIA (_a)	0.75%	1.02%	3.8%	0.01%	0.01%	10.6%
Market services						
Total	3.50%	4.32%	2.7%	1.52%	2.77%	7.8%
OECD-22 (_i)	3.18%	3.81%	2.3%	1.46%	2.63%	7.6%
CEEC (_e)	0.04%	0.09%	10.3%	0.01%	0.04%	17.6%
ASIA (_a)	0.11%	0.21%	7.8%	0.02%	0.03%	6.8%

Source: own calculations

For the manufacturing industries, similar features stand out from Table 1. The contrast between materials and business services offshoring is even stronger in both levels and growth rates. Things are different for market services industries. Total materials offshoring is much lower but still on the rise, while total business services offshoring has reached substantially higher levels. Regarding the regional offshoring intensities, the pattern is similar for manufacturing and market services industries. Most of the offshoring goes to OECD-22 countries, but the fastest growth rates of the offshoring intensities are recorded for the CEEC region.

4. Labour demand equation

Evaluating the employment impact of offshoring empirically is best done in a neoclassical framework where conditional factor demands are derived either through profit maximisation or through cost minimisation for a given output. The latter very easily allows to write a conditional labour demand equation that may be adapted to take offshoring into account. Following Hamermesh (1993), define a two-factor linear homogeneous production function for a firm as $f(L,K)$ with f_L, f_K >0, f_{LL}, f_{KK} <0, f_{LK} >0, and where L and K respectively stand for labour and capital services. Note their prices as w and r. Cost minimisation implies for the firm that its cost function is $C = wL^* + rK^*$, where L^* and K^* are the optimal factor quantities given the production of output Y. As L^* and K^* are themselves functions of w, r and Y, write the cost function as $C = C(w,r,Y)$ with C_w, C_r >0 and C_{wr} >0. Shephard's lemma then implies that:

$$L^* = C_w(w,r,Y) \quad (1)$$

The optimal conditional demand for labour is a function of its own price, w, the price of capital, r, and output Y. Given the assumption of constant returns to scale, this may also be taken as conditional labour demand at the industry level. Moreover, it can easily be extended to a multiple factor setting by simply including the prices of the new factors as extra arguments. Various forms may be chosen for the cost function, e.g. translog or generalised Leontief[15], and the conditional labour demand may be derived from this cost function. However, many authors simply skip this step and specify a log-linear labour demand equation, which is convenient for estimation since its parameters can be interpreted as elasticities. At the industry-level such an equation takes the following form:

$$\ln L_i = \alpha + \beta_1 \ln w_i + \beta_2 \ln r_i + \gamma \ln Y_i \quad (2)$$

Theory predicts β_1, the own-price elasticity of labour, to be negative, whereas β_2, the cross-price elasticity with respect to the other factor (K), should be positive. The income elasticity of labour demand, γ, is also expected to be positive.

To the extent that offshoring is measured through imported intermediate inputs, it may be treated as an extra factor of production whose price will have an impact on labour demand. This reflects the idea that offshoring represents foreign labour services that are a substitute for domestic labour services. Hence, let the price of imported intermediate inputs op enter the conditional labour demand equation in its log-linear form:

$$\ln L_i = \alpha + \beta_1 \ln w_i + \beta_2 \ln r_i + \beta_3 \ln op_i + \gamma \ln Y_i \quad (3)$$

15 Dumont (2006) compares different types of cost functions when estimating the impact of offshoring on labour demand.

In this context, *op* is a proxy for the price of foreign labour. The parameter β_3 represents the cross-price elasticity of labour demand with respect to imported intermediate inputs and is expected to be positive. When import prices for intermediate inputs fall, i.e. when offshoring becomes relatively cheaper, then this should depress labour demand.

But data on the price of imported intermediate inputs are difficult to come by. Therefore, Amiti and Wei (2005, p.329) suggest to use the offshoring intensity as an "inverse proxy" of the price of imported intermediate inputs. Implicitly, this rests on the assumption of a negative own-price elasticity of the volume of imported intermediate inputs. Then, for a given level of output, there exists an inverse relationship between the volume measure of the offshoring intensity and *op*. However, for the value measure of the offshoring intensity, which is used in the literature, this inverse relationship is less clear-cut because of the price effect, thereby casting some doubts on whether it is a good inverse proxy for *op*. In the end, replacing *op* by this inverse proxy comes down to the same as what most authors do to measure the impact of offshoring on labour demand: they simply augment the labour demand equation (2) by one or more variables that measure offshoring. Let us illustrate this with total offshoring:

$$\ln L_i = \alpha + \beta_1 \ln w_i + \beta_2 \ln r_i + \theta \ln ot_i + \gamma \ln Y_i \tag{4}$$

This equation may also be augmented by other variables to be controlled for, e.g. R&D investment or high-tech capital. Sometimes a measure of the capital stock is added.[16]

Controlling for output *Y* implies that the scale of the production may not change in response to offshoring. Hence, the feedback from offshoring to labour demand through increased production is eliminated from this conditional labour demand. As discussed in Chapter 2, we would then predict a negative employment impact of offshoring, i.e. $\theta < 0$. Amiti and Wei (2005, 2006) as well as OECD (2007a, 2007b) also specify an unconditional labour demand equation by controlling for output price *P* instead of output volume *Y*. In such a setting output may be increased in response to productivity gains through offshoring and lead to enhanced labour demand. The log-linear equation then becomes:

$$\ln L_i = \alpha + \beta_1 \ln w_i + \beta_2 \ln r_i + \theta \ln ot_i + \mu \ln P_i \tag{5}$$

Here the parameter θ is not expected to be negative anymore. Its sign is rather undetermined given the opposing effects that come into play. Nevertheless, we will treat the conditional labour demand equation as the reference equation.[17]

Equations (4) and (5) define static labour demand. They can easily be transformed to become testable by introducing a time index t, which we have left out so far for ease of presentation, and by adding time and industry dummies α_t and ε_i as well as a disturbance term u_{it}. To capture lagged effects, it is useful to also include first order lags of the explanatory variables. Moreover,

16 See, for example, Hijzen (2005) or Kratena (2008).

17 In both the static and the dynamic cases, see below.

the price of capital – the rental rate – r_{it} is dropped by making the assumption that for capital "all firms face the same price, which […] is some function of time".[18] In other words, r_{it} is taken to be part of the time dummies α_t. In view of the measures of offshoring presented in the previous chapter, we believe that it is important to take all split-ups of the offshoring intensity into account. The extended testable form of equation (4) then becomes:

$$\begin{aligned} \ln L_i &= \alpha_t + \beta_1 \ln w_{it} + \beta_2 \ln w_{it-1} + \gamma_1 \ln Y_{it} + \gamma_2 \ln Y_{it-1} \\ &+ \sum_{k=i,e,a} \left(\theta_{1k} \ln om\_k_{it} + \theta_{2k} \ln om\_k_{it-1} + \theta_{3k} \ln os\_k_{it} + \theta_{4k} \ln os\_k_{it-1} \right) \\ &+ \varepsilon_i + u_{it} \end{aligned} \tag{6}$$

The analogous form of (5) is obtained by simply replacing in (6) output Y by its price P:

$$\begin{aligned} \ln L_i &= \alpha_t + \beta_1 \ln w_{it} + \beta_2 \ln w_{it-1} + \mu_1 \ln P_{it} + \mu_2 \ln P_{it-1} \\ &+ \sum_{k=i,e,a} \left(\theta_{1k} \ln om\_k_{it} + \theta_{2k} \ln om\_k_{it-1} + \theta_{3k} \ln os\_k_{it} + \theta_{4k} \ln os\_k_{it-1} \right) \\ &+ \varepsilon_i + u_{it} \end{aligned} \tag{7}$$

Finally, we also want to extend this static labour demand framework: given that we have annual data, let labour demand in year *t* depend on labour demand in the previous year *t-1* through the inclusion of the lagged dependent variable, L_{it-1}, among the explanatory variables. Thus, we introduce an autoregressive element and thereby turn the equation into a dynamic labour demand.[19] Then, the dynamic versions of (6) and (7) are:

$$\begin{aligned} \ln L_i &= \alpha_t + \lambda \ln L_{it-1} + \beta_1 \ln w_{it} + \beta_2 \ln w_{it-1} + \gamma_1 \ln Y_{it} + \gamma_2 \ln Y_{it-1} \\ &+ \sum_{k=i,e,a} \left(\theta_{1k} \ln om\_k_{it} + \theta_{2k} \ln om\_k_{it-1} + \theta_{3k} \ln os\_k_{it} + \theta_{4k} \ln os\_k_{it-1} \right) \\ &+ \varepsilon_i + u_{it} \end{aligned} \tag{8}$$

and

$$\begin{aligned} \ln L_i &= \alpha_t + \lambda \ln L_{it-1} + \beta_1 \ln w_{it} + \beta_2 \ln w_{it-1} + \mu_1 \ln P_{it} + \mu_2 \ln P_{it-1} \\ &+ \sum_{k=i,e,a} \left(\theta_{1k} \ln om\_k_{it} + \theta_{2k} \ln om\_k_{it-1} + \theta_{3k} \ln os\_k_{it} + \theta_{4k} \ln os\_k_{it-1} \right) \\ &+ \varepsilon_i + u_{it} \end{aligned} \tag{9}$$

The aim is to bring those equations to the data at the industry-level to estimate the sign and magnitude of the θ parameters, which reflect the impact of offshoring. But before discussing the data and econometric methodology for estimating (6)-(9), let us first take a look at the assumptions and findings of the related empirical literature.

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18 Amiti and Wei (2005, p.330).

19 This could have been derived by explicitly modelling adjustment costs – mainly hiring and firing costs – for firms that want to adapt their level of employment, see Hamermesh (1993).

5. Relevant empirical literature

To start with, it must be noted that the bulk of the empirical literature has focused on the differential impact of the offshoring intensity on skill categories of workers. The aim has been to determine whether on average low-skilled workers are hit more severely by offshoring than high-skilled workers in the form of either unemployment or wage reductions. The papers are mostly based on industry-level data of those heterogeneous employment categories. The early contributions to this strand of the literature have been surveyed in Hijzen (2005)[20], and this type of analysis has continued to be popular among researchers.[21] Although the conclusions are not clear-cut, some of the more recent papers, e.g. Hijzen et al. (2005), OECD (2007b) or Kratena (2008), suggest that offshoring does indeed have a small negative impact on employment and wages of low-skilled workers.

The focus of our analysis is the impact of the offshoring intensity on total industry-level employment without a distinction by skill-levels.[22] We are aware of seven papers that have estimated the sign and magnitude of the total employment impact of offshoring with industry-level data. Four of them – Falk and Wolfmayr (2005, 2008) and OECD (2007a, 2007b)[23] – examine a panel of respectively EU and OECD countries, while the three remaining ones – Amiti and Wei (2005, 2006) and Cadarso et al. (2008) – concentrate on one single country – respectively the UK, the US, and Spain. No such analysis has yet been conducted for Belgium. Although quite a few further differences exist between these papers, most notably with respect to the econometric methodology and the type of offshoring variable that is used, their main common point is that all of them rely on a labour demand framework similar to the one derived in the previous chapter.

The data, the econometric methodology, the features of the offshoring variable and the econometric results of these seven papers are summarised in Tables 2a, 2b and 3. Apart from the aspect of the country focus – panel or single country – there are major differences in the datasets regarding the industry detail (column 3 of Table 2a). Most striking is that in the cross-country studies the industry-level data are pooled over the countries in the sample and that only three papers present data on service industries. Another important difference is the way of measuring the dependent variable, i.e. industry-level employment. Here, a measure in hours should be preferred if it is available. Although several authors do not indicate the unit of measurement of their employment variable, it seems that only Cadarso et al. (2008) use industry-level employment data in hours (column 5 of Table 2a). Moreover, Table 2b shows quite some variation in

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20 The pioneering papers are Feenstra and Hanson (1996, 1999), followed by Egger and Egger (2003) and Strauss-Kahn (2003).

21 Hijzen et al. (2005), Ekholm and Hakkala (2005), Dumont (2006), OECD (2007b), and Kratena (2008) are examples of recent contributions to this literature.

22 This is oftent referred to as homogeneous employment as opposed to heterogeneous employment where different skill-levels are taken into account. We lacked the wage data needed for examining the latter.

23 Note that OECD (2007b) also contains estimations for industry-level employment by skill-level.

the offshoring intensity measure used in those papers. This is very likely to affect the estimated employment impact of offshoring. From our point of view, a 'broad' constant price measure of imported intermediate inputs by industry is to be preferred. This should then be divided by total industry-level output and be split into materials and business services offshoring as well as by the region of origin of the imported intermediate inputs.

Table 2a Summary of the data and econometric methodology used in studies on the total employment impact of offshoring

	Period	Country/ region	Industry detail	Labour demand	Depend. variable[d]	Controls	Econometric methodology
Falk and Wolfmayr (2005)	1995-2000[a]	EU7	144 manuf. (pooled)	Cond., static	FT+PT	Wage, output	LD
Falk and Wolfmayr (2008)	1995-2000[a]	EU5	105 manuf. 100 serv. (pooled)	Cond., static	FT+PT	Wage, output	LD
OECD (2007a)	1995-2000[a]	OECD12	266 manuf. (pooled)	Cond. & uncond., static	FTE and FT+PT	Wage, output, output price, invest. deflator	LD
OECD (2007b)	1995-2000[a]	OECD17	182 manuf. 58 serv. (pooled)	Cond. & uncond., static	na[e]	Wage, output, output price, capital stock, R&D intensity	LD
Amiti and Wei (2005)	1995-2001	UK	69 manuf. 9 serv.	Cond. & uncond., static & dynamic	na[e]	Wage, output[f], output price, output price	LD, FD and FE[g]
Amiti and Wei (2006)	1992-2000	US	96 manuf.[b]	Cond. & uncond., static & dynamic	na[e]	Wage, output, output price, import share, hi-tech capital	LD, FD, FE, IV and GMM
Cadarso et al. (2008)	1993-2002	Spain	93 manuf.[c]	Cond., dynamic	hours	Wage, output	FD, FE and DPD

Legend: EU7 = Austria, Denmark, Finland, Germany, Italy, the Netherlands and Sweden; EU5 = Austria, Finland, Germany, Italy and the Netherlands; OECD12 = Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Norway, South Korea, Sweden and the United States; OECD17 = Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, the United Kingdom and the United States; FT+PT: total number of full-time and part-time employed; FTE: full-time equivalents; LD: long differences; FD: first differences; FE: fixed effects; IV: instrumental variables; GMM: generalised method of moments; DPD: dynamic panel data methods (both difference and systems GMM).

Remarks: a: no data FOR intermediate years; b: 450 industries for some estimations; c: separate data on the offshoring intensity is available for only 26 more aggregated industries; d: total industry employment; e: no information is provided on how total industry employment is measured; f: nominal output for service industries; g: also includes a specification with a lagged dependent variable among the explanatory variables, but no information is provided on whether this is estimated using a GMM-technique.

Despite a common theoretical framework, the exact labour demand equations and the estimation methods also differ substantially. A static conditional labour demand including a wage and an output measure – mostly value-added – as controls is the rule. But other types of equations are estimated as well in some of the papers: unconditional labour demand where the output volume is replaced by its price, or dynamic labour demand including a lagged dependent variable among the explanatory variables. To some extent, this is linked to the available data. While the cross-country studies pool over industries and countries and estimate cross-sections in five-year differences by ordinary least squares due to a lack of data for intermediate years, the single country studies are based on various more robust panel data methods. Amiti and Wei (2005) alternatively use first differences and fixed effects, Amiti and Wei (2006) introduce IV- and GMM-estimation, and Cadarso et al. (2008) rely on more recent dynamic panel data methods.

Table 2b Summary of the offshoring measures used in studies on the total employment impact of offshoring

	Source - Calculation	Denominator	Value/ Volume	Narrow/ Broad	Materials offshoring	Services offshoring	Regional data
Falk and Wolfmayr (2005)	Imported use tables	Output	Current prices	narrow	yes	no	yes[g]
Falk and Wolfmayr (2008)	Imported use tables	Output	Current prices	both[c]	yes	yes[e]	yes[h]
OECD (2007a)	Imputed	Total intermediate inputs[a]	Current prices	broad	yes	yes[f]	no
OECD (2007b)	Imputed	Value-added	Current prices	both[d]	yes	yes[f]	no
Amiti and Wei (2005)	Imputed	Total intermediate inputs[a]	Current prices	broad	yes	yes[f]	no
Amiti and Wei (2006)	Imputed	Total intermediate inputs[a]	Current prices	broad	yes	yes[f]	no
Cadarso et al. (2008)	Imported use tables	Output	Deflated[b]	narrow	yes	no	yes[i]

Remarks: a: excluding energy inputs; b: no information is provided on how this measure has been deflated; c: broad offshoring only for services; d: includes 'narrow offshoring' and 'difference offshoring', which sum to 'broad offshoring'; e: total services offshoring and business services offshoring; f: business services offshoring only; g: distinction between low-wage countries (CEEC and Asian countries) and high-wage countries; h: for materials offshoring, distinction between high-wage countries, CEEC, and China and East Asian countries, and for services offshoring, distinction between high-wage and low-wage countries; i: for enlarged region of CEEC only.

The findings on the correlation between offshoring and total industry employment are mixed. Table 3 shows that they depend on the type of offshored activity – materials or business services offshoring – and on whether manufacturing or service industries are considered. For the manufacturing industries, the cross-country studies all find either a non-significant or a negative impact of both materials and business services offshoring. This is even the case in the unconditional labour demand specifications. Moreover, when the offshoring intensity is split by region, the estimations tend to show that it is rather offshoring to low-wage countries that has a negative impact and that offshoring to high-wage countries is not significant. This is also true for the estimations by Cadarso et al. (2008) for Spain. The results of the other single country studies – Amiti and Wei (2005, 2006) – show that a positive impact from materials or business services offshoring may even occur in conditional labour demand specifications. It turns out that the results depend to a large extent on whether a lagged dependent variable is included among the explanatory variables to capture the dynamics of labour demand, something that is not possible in the long difference specifications of the cross-country studies. Furthermore, the results are also influenced by the estimation method as illustrated in Cadarso et al. (2008) with dynamic panel data methods.

Regarding service industries, Table 3 (columns 4 and 5) shows that the empirical evidence on the employment impact of offshoring is really very scarce. While the impact of materials offshoring on service industries is not of great interest, that of services offshoring on service industries deserves greater attention. But, hindered by the lack of reliable data on service industries, this is examined explicitly in only two papers that find a negative or non-significant coefficient on their services offshoring variable.

Table 3 Summary of the estimated coefficients for the offshoring variables in studies on the total employment impact of offshoring

	Manufacturing industries		Service industries	
	Materials offshoring	Services offshoring	Materials offshoring	Services offshoring
Falk and Wolfmayr (2005)	ns/-[b]	x	x	x
Falk and Wolfmayr (2008)	ns	ns	x	ns/-[i]
OECD (2007a)	-	-	x	x
OECD (2007b)[a]	-/ns[c]	-/ns[f]	x	x
Amiti and Wei (2005)	ns	+	-[h]	-[h]
Amiti and Wei (2006)	ns/+[d]	ns/-[g]	x	x
Cadarso et al. (2008)	ns/-[e]	x	x	x

Legend: ns: not significant; +: positive; -: negative; x: not estimated.

Remarks: a: labour demand equations augmented by 'narrow offshoring' and 'difference offshoring' are also estimated for all industries, i.e. without a distinction between manufacturing and service industries, where 'narrow offshoring' is negative significant and 'difference offshoring' not significant in conditional labour demand and 'difference offshoring' is positive significant and 'narrow offshoring' not significant in unconditional labour demand; b: negative only for offshoring to low-wage countries for less skill-intensive industries; c: not significant for broad offshoring and in the unconditional labour demand specification; d: positive, but very small in some specifications; e: negative only for offshoring to CEEC for medium high-tech industries; f: not significant in the unconditional labour demand specification; g: negative only in a few specifications; h: small sample size for service industries; i: only total services offshoring considered, negative coefficient only for offshoring to low-wage countries.

Finally, even when the coefficients of the offshoring variables are found to be significant – mostly negative, sometimes positive – they are generally very small. In other words, none of these industry-level estimations reveals evidence of massive job losses due to offshoring. Some are more or less in line with the predictions of the theory regarding the short-term effect, i.e. some find negative coefficients in conditional labour demand specifications. For the longer term, the theory does not make clear-cut predictions. All in all, this review of the empirical literature provides limited guidance as to what kind of results we should expect from our Belgian data. At best, there is a presumption of a small negative employment impact of offshoring in the short-term.

6. Data

The data used to compute the offshoring intensities have already been described previously. Industry-level data on imported intermediate inputs and total output come from the SUT for Belgium. The trade data by country of origin for the regional split-ups can be found in foreign trade and balance of payments statistics of the NBB.

The database underlying the national accounts (NA) is the source for the dependent variable, i.e. employment by industry. We restrict the analysis to employees for which we have data on the number of hours.[24] They have been corrected for calendar effects and cover the same period as the SUT tables, i.e. 1995-2003. The available industry breakdown is also the same as for the SUT. In line with the offshoring intensity presented in Table 1, we focus on 58 manufacturing and 35 market services industries.[25] Total average employment growth in hours for all industries amounts to 1.3% for the period 1995-2003. This is driven by market services for which the average growth rate is 2.4%. Employment has fallen in manufacturing industries by 1.2% on average per year over the same period. The average growth rates for the total number of employees are very similar (1.4%, 2.4%, -1.1%) implying that the number of hours worked per year is stable in both manufacturing and market services. However, the level is higher in the former: 1555 hours worked on average in 2003 in manufacturing against 1420 in market services.

The data for the control variables are all drawn from the SUT. For Y_i, we use industry-level value-added in prices of the year 2000, and for P_i we use the deflator of output. The wage rate per hour, w_i, is computed using data on industry-level compensation of employees, which reflects labour costs for firms. This is deflated for each industry with the output deflator and then divided by industry employment in hours to obtain w_i. The average wage rate for all industries in 2003 is 26.9 euros/hour. It is higher in manufacturing (30.9) than in market services (25.4). The average growth rate over 1995-2003 is 1.2% for all industries (2.4% for manufacturing and 0.7% for market services). Summary descriptive statistics for these variables are provided in Table A2 in the Appendix.

24 There are no data on worked hours for self-employed. Data on the total number of employees by industry are also available in the NA, but we prefer to use hours.

25 They are listed in Table A1 in the appendix.

7. Results

7.1. Static labour demand

To start with, Tables 4 and 5 present the results for the static conditional labour demand equation – equation (6) – respectively for the manufacturing sector (58 industries) and the service sector (35 industries). We estimate this equation by fixed effects for our balanced panels for the period 1995-2003.[26] In terms of methodology, this is comparable to what has been applied in Amiti and Wei (2005, 2006) for US and UK data. But we have pushed things one step further by splitting up the offshoring intensity variables by region. In both tables, column (1) shows the estimated labour demand equation with total materials and business services offshoring intensity, i.e. without any regional split-up. The columns (2)-(4) provide the results when the split-up offshoring intensity variables are included. As opposed to the ideal case of equation (6), they are introduced separately for the three regions (OECD-22, CEEC, ASIA) in the labour demand equations to avoid problems of multicollinearity.

Regarding the control variables w and Y, their coefficients are significant – at least for w_t and Y_t – and of the expected sign. For the manufacturing sector, the wage elasticity of labour demand of about 0.25 is within the reference confidence interval [0.15; 0.75] defined by Hamermesh (1993, p.92) for this type of labour demand equation. Results for this elasticity tend to be lower in estimations based on aggregated or industry-level data than in estimations using firm-level data. The fact that our results are at the lower end of the interval is consistent with this general trend. Our results are also in line with previous results for Belgium that are summarised in Dhyne (2001).[27] The story is somewhat different for the service sector, where the coefficients on both w_t and w_{t-1} are significant and negative. The coefficient on w_t amounts to more or less 0.7, which is rather high but still within the above-mentioned confidence interval. However, it is surprising to find a wage-elasticity of labour demand that is higher in the service sector than in manufacturing. Finally, the elasticities of labour demand with respect to value-added are respectively 0.2 and 0.5 for the manufacturing sector and the service sector. This is broadly in line with earlier findings.

The main variables of interest here are the offshoring intensity variables. For the manufacturing sector, our results for these variables show that offshoring intensity measured in terms of imported intermediate inputs as a share of output has little impact on employment. Regarding materials and business services offshoring without a regional split, only the lagged materials

[26] Using fixed effects estimation with a panel where the number of industries, i.e. individuals N, largely exceeds the number of time periods T implies that the coefficients of our equation should be interpreted as structural elasticities rather than short-run or long-run elasticities given that the estimation essentially relies on the variation between industries for the variables.

[27] See Dhyne (2001, p.161). Again, the wage-elasticity of labour demand is found to be substantially higher in estimations using firm-level data. This is confirmed by more recent estimations in Mahy (2005).

offshoring intensity om_{t-1} has a significant but positive coefficient, which runs counter to our theoretical predictions for conditional labour demand made in Chapters 2 and 4. But even this significant elasticity of 0.05 is rather small. None of the regional offshoring intensity variables for OECD-22 and CEEC is significant and for ASIA only contemporaneous materials offshoring intensity om_a_t has a significant positive but rather small impact on employment.

Table 4 Static conditional labour demand equations for the manufacturing sector, 1995-2003

	Fixed effects estimation for 1995-2003, equation (6), dependent variable L_t			
	(1)	(2)	(3)	(4)
w_t	-0.288 (0.127)**	-0.296 (0.132)**	-0.268 (0.120)**	-0.227 (0.099)**
w_{t-1}	0.040 (0.151)	0.046 (0.148)	0.032 (0.132)	0.020 (0.138)
Y_t	0.219 (0.079)***	0.222 (0.080)***	0.217 (0.072)***	0.200 (0.071)***
Y_{t-1}	0.064 (0.076)	0.061 (0.076)	0.066 (0.076)	0.068 (0.073)
om_t	0.035 (0.027)			
om_{t-1}	0.046 (0.023)**			
os_t	0.013 (0.009)			
os_{t-1}	-0.004 (0.010)			
om_i_t		0.012 (0.043)		
om_i_{t-1}		0.025 (0.026)		
os_i_t		0.013 (0.009)		
os_i_{t-1}		-0.004 (0.010)		
om_e_t			-0.004 (0.022)	
om_e_{t-1}			-0.011 (0.018)	
os_e_t			0.012 (0.009)	
os_e_{t-1}			-0.004 (0.009)	
om_a_t				0.034 (0.010)***
om_a_{t-1}				0.019 (0.013)
os_a_t				0.013 (0.009)
os_a_{t-1}				-0.004 (0.010)
cons	1.697 (0.699)**	1.638 (0.689)**	1.479 (0.799)*	1.835 (0.710)**
N	464	464	464	464
AIC	-984.46	-976.65	-976.09	-1000.68
BIC	-922.36	-914.55	-913.99	-938.59
Joint significance F(15,57)-test for all parameters				
p-value	[0.000]	[0.000]	[0.000]	[0.000]
Joint significance tests (F(2,34)-test, p-value)				
w_t and w_{t-1}	[0.073]	[0.076]	[0.052]	[0.024]
Y_t and Y_{t-1}	[0.019]	[0.017]	[0.005]	[0.005]
om_k_t and om_k_{t-1}	[0.086]	[0.651]	[0.815]	[0.004]
os_k_t and os_k_{t-1}	[0.306]	[0.314]	[0.373]	[0.294]

Source: own calculations, all estimations done with STATA.

Remarks: 58 manufacturing industries covered (see appendix for industry detail); all equations include year dummies; heteroskedasticity-robust standard errors in parentheses; in the last two lines, k is either void (for materials or service offshoring without a geographical split), or equal to i, e or a for the three regions defined above.

Legend: * p-value<0.1, ** p-value<0.05, *** p-value<0.01.

The results for the service sector shown in Table 5 are similar. The only significant – and positive – coefficient for any of the offshoring intensity variables is for lagged materials offshoring to CEEC (om_e_{t-1}). However, as said before, materials offshoring is not of great interest for service industries. Overall, the business services offshoring intensity does not have a significant impact even for employment in the service sector.

Table 5 Static conditional labour demand equations for the market service sector, 1995-2003

	Fixed effects estimation for 1995-2003, equation (6), dependent variable L_t			
	(1)	(2)	(3)	(4)
w_t	-0.720 (0.171)***	-0.717 (0.168)***	-0.638 (0.164)***	-0.716 (0.194)***
w_{t-1}	-0.394 (0.115)***	-0.396 (0.114)***	-0.367 (0.101)***	-0.304 (0.091)***
Y_t	0.509 (0.099)***	0.509 (0.099)***	0.447 (0.099)***	0.510 (0.113)***
Y_{t-1}	0.157 (0.100)	0.157 (0.103)	0.112 (0.096)	0.115 (0.120)
om_t	-0.037 (0.042)			
om_{t-1}	-0.004 (0.025)			
os_t	-0.017 (0.027)			
os_{t-1}	0.001 (0.028)			
om_i_t		-0.018 (0.037)		
om_i_{t-1}		-0.009 (0.023)		
os_i_t		-0.016 (0.027)		
os_i_{t-1}		-0.000 (0.029)		
om_e_t			0.028 (0.021)	
om_e_{t-1}			0.041 (0.018)**	
os_e_t			0.009 (0.024)	
os_e_{t-1}			0.005 (0.025)	
om_a_t				-0.045 (0.027)
om_a_{t-1}				0.018 (0.027)
os_a_t				-0.004 (0.025)
os_a_{t-1}				0.007 (0.024)
cons	1.840 (0.958)*	1.892 (0.955)*	3.187 (1.010)***	1.879 (1.074)*
N	280	280	280	280
AIC	-422.13	-420.04	-435.65	-427.87
BIC	-367.61	-365.52	-381.13	-373.35
Joint significance F(15,34)-test for all parameters				
p-value	[0.000]	[0.000]	[0.000]	[0.000]
Joint significance tests (F(2,34)-test, p-value)				
w_t and w_{t-1}	[0.001]	[0.001]	[0.000]	[0.001]
Y_t and Y_{t-1}	[0.000]	[0.000]	[0.000]	[0.000]
om_k_t and om_k_{t-1}	[0.612]	[0.735]	[0.038]	[0.263]
os_k_t and os_k_{t-1}	[0.783]	[0.822]	[0.924]	[0.912]

Source: own calculations, all estimations done with STATA.

Remarks: 35 service industries covered (see appendix for industry detail); all equations include year dummies; heteroskedasticity-robust standard errors in parentheses; in the last two lines, k is either void (for materials or service offshoring without a geographical split), or equal to i, e or a for the three regions defined above.

Legend: * p-value<0.1, ** p-value<0.05, *** p-value<0.01.

Tables 6 and 7 contain results for the static unconditional labour demand equation for the manufacturing and the service sector. This corresponds to equation (7), which is estimated by fixed effects. Regarding the control variables, the wage elasticities turn out to be much smaller than in the estimations of the conditional labour demand equations. For the service sector, this elasticity remains significant, whereas for the manufacturing sector it becomes non-significant and even positive in the specification shown in column 4 of Table 6.

Table 6 Static unconditional labour demand equations for the manufacturing sector, 1995-2003

	Fixed effects estimation for 1995-2003, equation (7), dependent variable L_t			
	(1)	(2)	(3)	(4)
w_t	-0.055 (0.140)	-0.052 (0.137)	-0.041 (0.131)	0.004 (0.112)
w_{t-1}	0.209 (0.151)	0.211 (0.147)	0.202 (0.143)	0.187 (0.148)
P_t	-0.044 (0.046)	-0.045 (0.046)	-0.045 (0.048)	-0.031 (0.042)
P_{t-1}	0.008 (0.058)	0.012 (0.058)	0.014 (0.056)	0.003 (0.059)
om_t	0.028 (0.029)			
om_{t-1}	0.038 (0.023)*			
os_t	0.015 (0.012)			
os_{t-1}	-0.008 (0.012)			
om_i_t		-0.003 (0.042)		
om_i_{t-1}		0.002 (0.032)		
os_i_t		0.015 (0.012)		
os_i_{t-1}		-0.008 (0.012)		
om_e_t			0.014 (0.028)	
om_e_{t-1}			-0.010 (0.018)	
os_e_t			0.017 (0.012)	
os_e_{t-1}			-0.009 (0.011)	
om_a_t				0.035 (0.013)***
om_a_{t-1}				0.033 (0.017)
os_a_t				0.015 (0.012)
os_a_{t-1}				-0.008 (0.012)
cons	2.083 (0.768)***	1.964 (0.758)**	2.017 (0.772)**	2.234 (0.742)***
N	464	464	464	464
AIC	-839.81	-834.95	-835.90	-866.66
BIC	-777.71	-772.85	-773.81	-804.56
Joint significance F(15,57)-test for all parameters				
p-value	[0.000]	[0.000]	[0.000]	[0.000]
Joint significance tests (F(2,34)-test, p-value)				
w_t and w_{t-1}	[0.285]	[0.255]	[0.250]	[0.347]
P_t and P_{t-1}	[0.557]	[0.577]	[0.644]	[0.667]
om_k_t and om_k_{t-1}	[0.242]	[0.985]	[0.517]	[0.016]
os_k_t and os_k_{t-1}	[0.430]	[0.436]	[0.377]	[0.445]

Source: own calculations, all estimations done with STATA.

Remarks: 58 manufacturing industries covered (see appendix for industry detail); all equations include year dummies; heteroskedasticity-robust standard errors in parentheses; in the last two lines, k is either void (for materials or service offshoring without a geographical split), or equal to i, e or a for the three regions defined above.

Legend: * p-value<0.1, ** p-value<0.05, *** p-value<0.01.

The results for the offshoring intensity variables do not change very much compared to the estimations presented for the conditional labour demand equations in the first two tables. For the manufacturing sector, it is the same coefficients – those on the variables om_{t-1} and om_a_t – that have a positive significant employment impact of an almost identical magnitude as in the conditional labour demand estimations. For the service sector, ignoring the results for the less relevant materials offshoring, the only significant result in the unconditional labour demand estimations in Table 7 is the positive coefficient of the offshoring intensity of business service activities to the CEEC. Overall, there is not much more evidence of an employment impact of the offshoring intensities in the unconditional labour demand estimations than in the conditional ones.

Table 7 Static unconditional labour demand equations for the market service sector, 1995-2003

	Fixed effects estimation for 1995-2003, equation (7), dependent variable L_t			
	(1)	(2)	(3)	(4)
w_t	-0.252 (0.111)**	-0.246 (0.111)**	-0.215 (0.113)*	-0.249 (0.107)**
w_{t-1}	-0.203 (0.149)	-0.205 (0.148)	-0.217 (0.129)	-0.132 (0.165)
P_t	0.053 (0.063)	0.055 (0.063)	0.059 (0.047)	0.057 (0.044)
P_{t-1}	0.236 (0.118)*	0.236 (0.119)*	0.205 (0.126)	0.230 (0.102)**
om_t	-0.017 (0.052)			
om_{t-1}	0.001 (0.023)			
os_t	0.044 (0.041)			
os_{t-1}	0.003 (0.026)			
om_i_t		-0.001 (0.047)		
om_i_{t-1}		0.000 (0.022)		
os_i_t		0.044 (0.039)		
os_i_{t-1}		0.003 (0.026)		
om_e_t			0.036 (0.026)	
om_e_{t-1}			0.068 (0.023)***	
os_e_t			0.064 (0.029)**	
os_e_{t-1}			0.004 (0.024)	
om_a_t				-0.052 (0.026)*
om_a_{t-1}				0.014 (0.022)
os_a_t				0.051 (0.041)
os_a_{t-1}				0.011 (0.021)
cons	4.962 (0.941)***	5.011 (0.925)***	6.238 (0.938)***	4.810 (1.252)***
N	280	280	280	280
AIC	-354.37	-353.55	-397.01	-370.95
BIC	-299.85	-299.03	-342.49	-316.42
Joint significance F(15,34)-test for all parameters				
p-value	[0.000]	[0.000]	[0.000]	[0.001]
Joint significance tests (F(2,34)-test, p-value)				
w_t and w_{t-1}	[0.089]	[0.097]	[0.130]	[0.075]
P_t and P_{t-1}	[0.018]	[0.018]	[0.029]	[0.009]
om_k_t and om_k_{t-1}	[0.951]	[0.999]	[0.010]	[0.118]
os_k_t and os_k_{t-1}	[0.566]	[0.529]	[0.083]	[0.442]

Source: own calculations, all estimations done with STATA.

Remarks: 35 service industries covered (see appendix for industry detail); all equations include year dummies; heteroskedasticity-robust standard errors in parentheses; in the last two lines, k is either void (for materials or service offshoring without a geographical split), or equal to i, e or a for the three regions defined above.

Legend: * p-value<0.1, ** p-value<0.05, *** p-value<0.01.

All in all, these results do not come as a big surprise. Based on our theoretical discussion and the overview of previous empirical analyses of the same kind, we did not expect a strong impact of offshoring on total employment. The finding that the magnitude of this impact is mostly insignificant is consistent with the growth rates of the offshoring intensity variables shown in Table 1.[28] Offshoring is indeed on the rise – except for materials offshoring to the OECD-22 region – but the growth rates do not seem to be strong enough to have a substantial impact on the labour market. This does not mean that there are no jobs lost due to offshoring, but rather that the amount of jobs lost because of offshoring is simply not very big compared to the total number of jobs in the economy. Hence, our findings are in line with what has been argued by several authors, e.g. Bhagwati et al. (2004) or OECD (2007a): job losses due to offshoring are small compared to annual turnover in the labour market.

Furthermore, several other arguments can be put forward to explain our results. First of all, as described in Chapter 3 our measure of the offshoring intensity is not perfect. It has been argued in OECD (2007a) that this measure probably underestimates the extent and growth of offshoring. Therefore, we may not be capturing the entire impact of offshoring on employment.

Second, it is clear that business services offshoring had not taken off yet for Belgium in the period 1995-2003. As a consequence, we do not find a significant impact of the offshoring intensity of business service activities on employment. This is consistent with the fact that the debate about offshoring in Belgium during these years was still largely focused on manufacturing[29]. Worries about service offshoring have surfaced only recently.

Third, the industry breakdown of our data may not be sufficient to capture the employment impact of offshoring. This argument rests upon a finding presented in Amiti and Wei (2006). They estimate the employment impact of offshoring for two different levels of detail in terms of the industry breakdown. At the more detailed level (450 industries), they obtain a significant negative impact, while this impact turns out to be non-significant at the more aggregated level (96 industries). Their explanation for this finding is that workers laid off because of offshoring tend to find a new job relatively easily within the broader, more aggregated industry. More generally, flows in and out of employment are netted out at the more aggregate level and therefore the impact of offshoring may not be captured at this level.

Fourth, the focus on total industry-level employment may hide a differential impact of offshoring on different types of workers within those industries. Indeed, as mentioned above, a large part of the literature on offshoring looks at its differential impact on various skill categories of workers and finds that high and medium skilled employment tends to be favoured by offshoring, while the low-skilled face job losses. These opposing effects may cancel out so that the measured impact on total industry-level employment is found to be non-significant.

Finally, although the growth rates of offshoring to the low-wage regions CEEC and ASIA are indeed found to be generally higher than those of offshoring to the high-wage region OECD -22,

[28] We have tested the robustness of our results with respect to the offshoring measure by using the offshoring intensity computed with total intermediate inputs instead of output in the denominator. But this gives rise to only marginal changes in the results.

[29] See Bernard et al. (1994, 1998) and Hertveldt et al. (2005).

this does not seem to have a significant impact on employment. One explanation for this is that the difference in growth rates is probably not big enough. However, we also believe that to some extent activities that had initially been offshored to high-wage countries are increasingly shifted to low-wage countries. Such a 'relocation of offshoring' is then neutral with respect to employment for Belgium.

7.2. Dynamic labour demand

In addition to the static labour demand equations, we have also specified dynamic ones – both conditional and unconditional –, which include an autoregressive element. These are equations (8) and (9) in Chapter 4. They are similar to the specification put forward in Cadarso et al. (2008). Note that Amiti and Wei (2005, 2006) also produce some results from estimations of dynamic labour demand.

Regarding the econometric methodology, we follow Bond (2002). This paper illustrates why adopting a dynamic specification is sometimes useful "for identifying the parameters of interest, even when the dynamics themselves are not the principal focus of attention"[30]. In terms of our data set, we are in the classical case where the number of cross-section units (N) – here the number of industries in the manufacturing or the service sector – is large compared to the number of time periods (T) so that for the asymptotic distributions of the estimators we assume N to become large, while treating T as fixed. Then, estimating a dynamic equation by ordinary least squares (OLS) will structurally overestimate the autoregressive coefficient, whereas fixed effects (FE) estimation tends to underestimate this coefficient. The generalised method of moments (GMM) estimator offers a solution to the inconsistency of the OLS and FE estimators. The method is generally referred to as GMM-DIF because the first differenced equation is estimated using lagged levels of the dependent variable as instruments. Nonetheless, the GMM-DIF estimate of the autoregressive coefficient is often found to be downward biased in finite samples, in particular when the dependent variable has near unit root properties. In that case, instruments in the first differenced equation are weak as shown by Blundell and Bond (1998). This can be improved upon by applying an extended GMM estimation method referred to as GMM-SYS, which combines the equation in first differences with the equation in levels and uses lagged differences of the dependent variable as instruments for the latter in addition to the levels that again serve as instruments for the first-differenced equation. Two types of tests are used to assess the model and the validity of the two types of GMM -estimates: the Arellano-Bond first and second order autocorrelation tests (m1 and m2) for the first-differenced residuals, which should ideally provide an indication of first order autocorrelation, and the Sargan test for the validity of the over-identifying restrictions of the GMM.[31]

Bond (2002, p.155) recommends "investigating the time series properties of the individual series […] when using these GMM estimators for dynamic panel data methods." We follow this rec-

30 See Bond (2002), p.156.
31 For a more detailed description of these estimation methods and tests, see Bond (2002).

ommendation and estimate AR(1)-specifications for L_t, w_t and Y_t. The results are reported in Table A3 in the appendix using all four methods described above (OLS in levels, FE, GMM-DIF and GMM-SYS)[32]. They show that our dependent variable L_t has near unit root properties. Things are less clear for the other two variables w_t and Y_t. The very strong downward bias in some of the GMM-DIF estimators of the autoregressive coefficient is striking. However, the results for the autocorrelation and Sargan tests leads us to discard the GMM-DIF estimates in most cases and to prefer the GMM-SYS estimates for which the autocorrelation test result correspond to what should be expected. Nonetheless, the results are weak regarding the validity of the over-identifying restrictions.

Table 8 Dynamic conditional labour demand estimations, equation (8), manufacturing and market service sector, total materials and service offshoring intensities, 1995-2003

	Manufacturing sector				Service sector			
	OLS-lev	FE	GMM-DIF	GMM-SYS	OLS-lev	FE	GMM-DIF	GMM-SYS
L_{t-1}	0.960***	0.715***	0.290***	0.885***	0.979***	0.949***	0.837***	0.894***
se(L_{t-1})	(0.028)	(0.047)	(0.102)	(0.131)	(0.008)	(0.065)	(0.095)	(0.040)
w_t	-0.086	-0.048	-0.406**	-0.169	-0.407***	-0.322***	-0.346*	-0.403**
se(w_t)	(0.114)	(0.127)	(0.162)	(0.367)	(0.096)	(0.092)	(0.208)	(0.181)
w_{t-1}	0.079	0.122	-0.186*	0.444**	0.350***	0.258**	0.329*	0.288
se(w_{t-1})	(0.102)	(0.084)	(0.102)	(0.188)	(0.098)	(0.103)	(0.190)	(0.197)
Y_t	0.218**	0.162*	0.208*	0.188	0.307***	0.261***	0.272***	0.345***
se(Y_t)	(0.092)	(0.088)	(0.121)	(0.166)	(0.060)	(0.048)	(0.084)	(0.071)
Y_{t-1}	-0.178**	-0.123***	0.069*	-0.176**	-0.276***	-0.270***	-0.228**	-0.197***
se(Y_{t-1})	(0.073)	(0.040)	(0.040)	(0.073)	(0.057)	(0.083)	(0.092)	(0.060)
om_t	0.012	0.009	0.042**	0.019	0.010	0.013	0.020	0.020
se(om_t)	(0.013)	(0.013)	(0.019)	(0.024)	(0.013)	(0.009)	(0.015)	(0.012)
om_{t-1}	-0.009	0.001	0.048***	0.015	-0.015	-0.011	0.010	-0.012
se(om_{t-1})	(0.013)	(0.018)	(0.014)	(0.025)	(0.012)	(0.015)	(0.018)	(0.024)
os_t	0.011	0.009	0.004	0.003	0.024*	0.012	0.021*	0.028**
se(os_t)	(0.007)	(0.006)	(0.009)	(0.011)	(0.012)	(0.010)	(0.012)	(0.013)
os_{t-1}	-0.010*	-0.012	-0.007	-0.011	-0.009	-0.017	-0.018	-0.020
se(os_{t-1})	(0.006)	(0.009)	(0.009)	(0.010)	(0.012)	(0.014)	(0.015)	(0.023)
m1			[0.566]	[0.012]			[0.015]	[0.012]
m2			[0.625]	[0.940]			[0.790]	[0.946]
Sargan			[0.000]	[0.000]			[0.011]	[0.000]

Source: own calculations, all estimations done with STATA.

Remarks: 58 manufacturing and 35 service industries covered (see appendix for industry detail); all equations include year dummies; wage variables taken as predetermined in GMM-estimations; OLS-lev: ordinary least squares estimation for levels;FE: fixed effects estimation; GMM-DIF: difference generalised method of moments estimator (one step) using L_{t-2}, L_{t-3}, w_{t-2} and w_{t-3} as instruments for the differenced equation; GMM-SYS: systems generalised method of moments estimator (one step) using L_{t-2}, L_{t-3}, w_{t-2} and w_{t-3} as instruments for the differenced equation, as well as ΔL_{t-1} and Δw_{t-1} as instruments for the levels equation; all reported standard errors are heteroskedasticity-robust; m1 and m2: Arellano-Bond tests for first-order and second-order autocorrelation of the first-differenced residuals – p-values reported (H_0: no autocorrelation); Sargan: test of validity of over-identifying restrictions for GMM-estimators – p-values reported (H_0: overidentifying restrictions valid).

Our estimation results for the dynamic conditional and unconditional labour demand equations for both the manufacturing and the service sector are presented in Tables 8 and 9 below where total materials and business services offshoring intensities are included in the equations, and in

32 Note that we use one-step GMM-estimators for all the estimations, i.e. for the dynamic labour demand below, too.

Tables A4-A9 in the Appendix where the regional offshoring intensities are included in the equations. Again, we have used all four methods described above, i.e. OLS in levels, FE, GMM-DIF and GMM-SYS. We will mainly focus on the results for GMM-SYS as the other three methods produce biased estimators for the autoregressive coefficient. The GMM-estimations allow to treat explanatory variables as predetermined or endogenous. We have chosen to treat the wage rate *w* as predetermined.

For both conditional and unconditional labour demand equations estimated by GMM-SYS, the autocorrelation tests reject the null of no first order autocorrelation and do not reject the null of no second order autocorrelation. However, the validity of the over-identifying restrictions is always rejected by the Sargan test. Things get better in this respect, i.e. the validity of the over-identifying restrictions is not rejected anymore, when computing two-step estimators instead of the one-step estimators that we have reported here. But the correction for heteroskedasticity to obtain robust results inflates the standard errors of the estimators so much that merely the autoregressive coefficient remains significant. This sheds some doubt on the dynamic results.

Table 9 Dynamic unconditional labour demand estimations, equation (9), manufacturing and market service sector, total materials and service offshoring intensities, 1995-2003

	Manufacturing sector				Service sector			
	OLS-lev	FE	GMM-DIF	GMM-SYS	OLS-lev	FE	GMM-DIF	GMM-SYS
L_{t-1}	0.998***	0.724***	0.391***	0.912***	1.004***	0.883***	0.790***	1.036***
se(L_{t-1})	(0.007)	(0.052)	(0.107)	(0.033)	(0.004)	(0.022)	(0.057)	(0.011)
w_t	0.101	0.106	-0.221	0.155	-0.223**	-0.150*	-0.110	-0.193
se(w_t)	(0.179)	(0.167)	(0.165)	(0.280)	(0.092)	(0.082)	(0.255)	(0.255)
w_{t-1}	-0.043	0.071	-0.157	0.271	0.207**	0.120*	0.198	0.229
se(w_{t-1})	(0.164)	(0.094)	(0.115)	(0.207)	(0.095)	(0.063)	(0.146)	(0.237)
P_t	0.001	-0.002	-0.065	0.028	-0.005	-0.025	0.009	-0.054
se(P_t)	(0.047)	(0.024)	(0.047)	(0.060)	(0.040)	(0.033)	(0.040)	(0.037)
P_{t-1}	0.066	0.049*	-0.053	0.094	0.042	0.116**	0.082**	0.104**
se(P_{t-1})	(0.045)	(0.027)	(0.053)	(0.057)	(0.041)	(0.049)	(0.035)	(0.042)
om_t	0.009	0.010	0.054***	0.026	0.007	0.012	0.023	0.008
se(om_t)	(0.014)	(0.011)	(0.020)	(0.023)	(0.021)	(0.018)	(0.026)	(0.021)
om_{t-1}	-0.015	0.001	0.040***	-0.010	-0.013	-0.007	0.023	-0.012
se(om_{t-1})	(0.013)	(0.017)	(0.014)	(0.022)	(0.020)	(0.024)	(0.029)	(0.038)
os_t	0.006	0.006	0.009	0.005	0.034*	0.021	0.030*	0.048**
se(os_t)	(0.007)	(0.007)	(0.007)	(0.013)	(0.020)	(0.013)	(0.017)	(0.023)
os_{t-1}	-0.008	-0.011	-0.014	-0.010	-0.014	-0.024	-0.023	-0.013
se(os_{t-1})	(0.006)	(0.009)	(0.012)	(0.010)	(0.018)	(0.022)	(0.019)	(0.026)
m1			[0.945]	[0.003]			[0.037]	[0.027]
m2			[0.547]	[0.511]			[0.881]	[0.559]
Sargan			[0.000]	[0.000]			[0.000]	[0.000]

Source: own calculations, all estimations done with STATA.

Remarks: 58 manufacturing and 35 service industries covered (see appendix for industry detail); all equations include year dummies; wage variables taken as predetermined in GMM-estimations; OLS-lev: ordinary least squares estimation for levels; FE: fixed effects estimation; GMM-DIF: difference generalised method of moments estimator (one step) using L_{t-2}, L_{t-3}, w_{t-2} and w_{t-3} as instruments for the differenced equation; GMM-SYS: systems generalised method of moments estimator (one step) using L_{t-2}, L_{t-3}, w_{t-2} and w_{t-3} as instruments for the differenced equation, as well as ΔL_{t-1} and Δw_{t-1} as instruments for the levels equation; all reported standard errors are heteroskedasticity-robust; m1 and m2: Arellano-Bond tests for first-order and second-order autocorrelation of the first-differenced residuals – p-values reported (H_0: no autocorrelation); Sargan: test of validity of over-identifying restrictions for GMM-estimators – p-values reported (H_0: overidentifying restrictions valid).

Moreover, in the conditional labour demand estimations for the manufacturing sector reported in Table 8, the coefficients of the control variables w_t and Y_t are of the expected sign, but turn out to be non-significant in the GMM-SYS estimation. This is due to relatively bigger robust standard errors. The results for the control variables come closer to what we expect in the conditional labour demand estimations for the service sector. Regarding the unconditional labour demand estimations shown in Table 9, the coefficient of w_t is non-significant for both the manufacturing and the service sector. Overall, the same observations can also be made for all the specifications that contain the regional offshoring intensities and that are reported in the Appendix.

The results for the offshoring intensity variables do not change very much compared to the estimations of the static labour demand equations since there is again little evidence of an employment impact of offshoring. For the manufacturing sector, things are straightforward: none of the total or regional offshoring intensity variables is significant in the GMM-SYS estimations in either the conditional or the unconditional labour demand equations except for the lagged business services offshoring intensity to CEEC (os_e_{t-1}), which turns out to be marginally significant with a negative but very small coefficient. For the service sector, it is the contemporaneous business services offshoring intensities (os_t, os_i_t, os_e_t and os_a_t,) that have a significant positive impact on labour demand. Although it is small, this impact proves to be stronger in the unconditional labour demand estimations than in the conditional ones.

All in all, for the employment impact of offshoring, the dynamic labour demand estimations confirm the results obtained from the static ones: the impact is at best very small. Moreover it is more often positive than negative, which runs to some extent counter to the theory. The arguments put forward in the previous section to explain the lack of an employment impact of our offshoring intensity measures are also valid in the dynamic labour demand context. Nonetheless, given that the results for the control variables are much closer to what we would expect intuitively in the static equations than in the dynamic ones, we prefer the former.

8. Conclusion

The fears raised by offshoring are mostly related to the consequences for the labour market and especially employment in the advanced economies. They used to be focused on manufacturing, but by now they also extend to certain kinds of services, mainly business services that have become increasingly tradable and thereby subject to offshoring. In this paper, we have taken a look at the situation for Belgium: we have presented evidence on both materials and service offshoring through measures based on imported intermediate inputs, and we have estimated their employment impact at the industry-level within a partial equilibrium framework for the period 1995-2003.

Regarding the extent of offshoring for Belgium, it does not come as a surprise that the levels of the offshoring intensities are very different for materials and business services: the intensity proves to be high for the former and still relatively low for the latter even in 2003. In terms of the growth rates, the intensity of materials offshoring stagnates, whereas the intensity of business services offshoring is on the rise. A split of the intensities by region shows that for materials it is offshoring to high-wage countries that drags the growth rate down, and that the highest growth rates over the period 1995-2003 can be observed for offshoring to Central and Eastern European countries.

The estimations of labour demand equations for 58 manufacturing industries and 35 service industries fail to reveal a substantial impact of the offshoring intensities on total employment in these industries. In all specifications, the employment impact is found to be either non-significant or very small when it is actually significant. This is true for both materials and service offshoring. Moreover, these results are in line with previous findings in the literature. The main conclusion to be drawn from these results is that they show that, at the industry-level, offshoring has not massively depressed employment during the years 1995 to 2003. We believe that this is consistent with the view that materials offshoring is mature and not rising strongly anymore, while service offshoring still remained at low levels in Belgium during this period despite substantial growth rates. Moreover, our estimation results for the employment impact of offshoring are in line with the argument put forward by many observers that job losses because of offshoring remain small compared to total job turnover in an economy. Nonetheless, these are results at the industry-level and they do not mean that there are no jobs lost due to offshoring. These results may indeed hide disparities in demand for different skill categories, which is influenced by offshoring, as well as differences in trends at the level of the firms. Both these issues deserve to be carefully examined in future research for Belgium.

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Appendix

Table A1 List of industries, SUT-code and description

14A1	Mining and quarrying of stone, sand, clay and chemical and fertilizer materials, production of salt, and other mining and quarrying n.e.c.
15A1	Production, processing and preserving of meat and meat products
15B1	Processing and preserving of fish and fish products
15C1	Processing and preserving of fruit and vegetables
15D1	Manufacture of vegetable and animal oils and fats
15E1	Manufacture of dairy products
15F1	Manufacture of grain mill products, starches and starch products
15G1	Manufacture of prepared animal feeds
15H1	Manufacture of bread, fresh pastry goods, rusks and biscuits
15I1	Manufacture of sugar, chocolate and sugar confectionery
15J1	Manufacture of noodles and similar farinaceous products, processing of tea, coffee and food products n.e.c.
15K1	Manufacture of beverages except mineral waters and soft drinks
15L1	Production of mineral waters and soft drinks
16A1	Manufacture of tobacco products
17A1	Preparation and spinning of textile fibres, weaving and finishing of textiles
17B1	Manufacture of made-up textile articles, except apparel, other textiles, and knitted and crocheted fabrics
18A1	Manufacture of wearing apparel; dressing and dyeing of fur
19A1	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20A1	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw
21A1	Manufacture of pulp, paper and paper products
22A1	Publishing
22B1	Printing and service activities related to printing, reproduction of recorded media
23A1	Manufacture of coke, refined petroleum products and nuclear fuel
24A1	Manufacture of basic chemicals
24B1	Manufacture of pesticides and other agro-chemical products
24C1	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
24D1	Manufacture of pharmaceuticals, medicinal chemicals and botanical products
24E1	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
24F1	Manufacture of other chemical products
24G1	Manufacture of man-made fibres
25A1	Manufacture of rubber products
25B1	Manufacture of plastic products
26A1	Manufacture of glass and glass products
26B1	Manufacture of ceramic products
26C1	Manufacture of cement, lime and plaster
26D1	Manufacture of articles of concrete, plaster and cement; cutting, shaping and finishing of stone; manufacture of other non-metallic mineral products
27A1	Manufacture of basic iron and steel and of ferro-alloys and tubes
27B1	Other first processing of iron and steel; manufacture of non-ferrous metals; casting of metals
28A1	Manufacture of structural metal products, tanks, reservoirs, containers of metal, central heating radiators, boilers and steam generators; forging, pressing, stamping and roll forming of metal
28B1	Treatment and coating of metals; general mechanical engineering
28C1	Manufacture of cutlery, tools, general hardware and other fabricated metal products
29A1	Manufacture of machinery for the production and use of mechanical power, except aircraft and vehicle engines
29B1	Manufacture of other general purpose machinery

29C1	Manufacture of agricultural and forestry machinery and of machine tools
29D1	Manufacture of domestic appliances
30A1	Manufacture of office machinery and computers
31A1	Manufacture of electric motors, generators and transformers, of electricity distribution and control apparatus, and of insulated wire and cable
31B1	Manufacture of accumulators, batteries, lamps, lighting equipment and electrical equipment
32A1	Manufacture of radio, television and communication equipment and apparatus
33A1	Manufacture of medical, precision and optical instruments, watches and clocks
34A1	Manufacture of motor vehicles
34B1	Manufacture of bodies (coachwork) for motor vehicles, of trailers and parts and accessories for motor vehicles
35A1	Building and repairing of ships and boats; manufacture of locomotives and rolling stock, and of aircraft
35B1	Manufacture of motorcycles and bicycles and other transport equipment n.e.c.
36A1	Manufacture of furniture
36B1	Manufacture of jewellery and related articles
36C1	Manufacture of musical instruments, sports goods, games and toys; miscellaneous manufacturing
37A1	Recycling
50A1	Sale, maintenance and repair of motor vehicles and motorcycles, parts and accessories
50B1	Retail sale of automotive fuel
51A1	Wholesale trade and commission trade, except of motor vehicles and motorcycles
52A1	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods
55A1	Hotels and other provision of short-stay accommodation
55B1	Restaurants, bars, canteens and catering
60A1	Transport via railways
60B1	Other scheduled passenger land transport; taxi operation; other land passenger transport
60C1	Freight transport by road; transport via pipelines
61A1	Sea and coastal water transport
61B1	Inland water transport
62A1	Air transport
63A1	Activities of travel agencies and tour operators; tourist assistance activities n.e.c.
63B1	Cargo handling and storage, other supporting transport activities; activities of other transport agencies
64A1	Post and courier activities
64B1	Telecommunications
65A2	Financial intermediation, except insurance and pension funding
66A2	Insurance and pension funding, except compulsory social security
67A1	Activities auxiliary to financial intermediation
70A1-	Real estate activities
71A1	Renting of automobiles and other transport equipment
71B1	Renting of machinery and equipment and personal and household goods
72A1	Computer and related activities
73A1	Research and development
74A1	Legal activities, accounting activities; market research and public opinion polling
74B1	Business and management consultancy activities; management activities of holding companies
74C1	Architectural and engineering activities and related technical consultancy
74D1	Advertising
74E1	Labour recruitment and provision of personnel
74F1	Investigation and security activities; industrial cleaning; miscellaneous business activities n.e.c.
85A1	Human health activities
85B1	Veterinary activities
85C1	Social work activities
92A1	Motion picture and video activities; radio and television activities
92B1	Other entertainment activities

Remark: line separates manufacturing from service industries.

Table A2 Descriptive statistics for the dependent variable (employment, L_t) and the control variables (wage, w_t, and value added, Y_t), manufacturing sector, market service sector and all industries, 1995-2003

	Manufacturing sector			
	1995	2003	Δ	avg g rate
Employment (millions of hours)	1026	930	-96	-1,2%
Employment (thousands of employees)	653	598	-55	-1,1%
Worked hours (hours per employee year)	1571	1555	-16	-0,1%
Real wage rate (euros per hour)	25,5	30,9	5,4	2,4%
Value-added (millions of euros)	38337	42874	4537	1,4%
Value added price (deflator =100 in 2000)	99,5	100,4	1,0	0,1%

	Market service sector			
	1995	2003	Δ	avg g rate
Employment (millions of hours)	2042	2471	429	2,4%
Employment (thousands of employees)	1445	1740	295	2,3%
Worked hours (hours per employee year)	1413	1420	7	0,1%
Real wage rate (euros per hour)	24,0	25,4	1,4	0,7%
Value-added (millions of euros)	94517	115884	21367	2,6%
Value added price (deflator =100 in 2000)	92,3	106,5	14,2	1,8%

	All industries			
	1995	2003	Δ	avg g rate
Employment (millions of hours)	3068	3402	333	1,3%
Employment (thousands of employees)	2098	2338	240	1,4%
Worked hours (hours per employee year)	1462	1455	-7	-0,1%
Real wage rate (euros per hour)	24,5	26,9	2,4	1,2%
Value-added (millions of euros)	132854	158758	25904	2,3%
Value added price (deflator =100 in 2000)	94,3	104,8	10,5	1,3%

Sources: Belgian Institute of National Accounts (INA), own calculations.

Remarks: Δ: absolute change; avg g rate: average growth over the period 1995-2003; employment (millions of hours) corresponds to L_t; wage rate (euros per hour) corresponds to w_t; value-added (millions of euros) corresponds to Y_t; value-added price (deflator =100 in 2000) corresponds to P_t.

Table A3 Autoregressive characteristics of employment (L_t), wage (w_t) and value added (Y_t), manufacturing and market service sector, 1995-2003

Alternative estimation methods for the AR(1) for L_t, 1995-2003

	Manufacturing sector				Service sector			
	OLS-lev	FE	GMM-DIF	GMM-SYS	OLS-lev	FE	GMM-DIF	GMM-SYS
L_{t-1}	0.998***	0.718***	0.395***	0.873***	1.008***	0.928***	0.865***	1.082***
se(L_{t-1})	(0.006)	(0.054)	(0.082)	(0.070)	(0.004)	(0.051)	(0.068)	(0.046)
m1			[0.689]	[0.000]			[0.063]	[0.036]
m2			[0.536]	[0.311]			[0.831]	[0.901]
Sargan			[0.000]	[0.000]			[0.011]	[0.000]

Alternative estimation methods for the AR(1) for w_t, 1995-2003

	Manufacturing sector				Service sector			
	OLS-lev	FE	GMM-DIF	GMM-SYS	OLS-lev	FE	GMM-DIF	GMM-SYS
w_{t-1}	0.958***	0.503***	0.670***	0.765***	0.986***	0.646***	0.050	0.639***
se(w_{t-1})	(0.018)	(0.065)	(0.121)	(0.090)	(0.015)	(0.093)	(0.259)	(0.194)
m1			[0.000]	[0.001]			[0.355]	[0.015]
m2			[0.446]	[0.461]			[0.215]	[0.140]
Sargan			[0.001]	[0.000]			[0.029]	[0.004]

Alternative estimation methods for the AR(1) for Y_t, 1995-2003

	Manufacturing sector				Service sector			
	OLS-lev	FE	GMM-DIF	GMM-SYS	OLS-lev	FE	GMM-DIF	GMM-SYS
Y_{t-1}	0.987***	0.644***	0.362	0.705***	1.005***	0.631***	0.344	1.023***
se(Y_{t-1})	(0.015)	(0.043)	(0.236)	(0.071)	(0.009)	(0.076)	(0.489)	(0.068)
m1			[0.103]	[0.032]			[0.444]	[0.007]
m2			[0.244]	[0.296]			[0.263]	[0.273]
Sargan			[0.000]	[0.000]			[0.000]	[0.001]

Source: own calculations, all estimations done with STATA.

Remarks: 58 manufacturing and 35 service industries covered (see appendix for industry detail); all equations include year dummies; OLS-lev: ordinary least squares estimation for levels; FE: fixed effects estimation; GMM-DIF: difference generalised method of moments estimator (one step) using respectively L_{t-2} and L_{t-3}, w_{t-2} and w_{t-3} or Y_{t-2} and Y_{t-3} as instruments for the differenced equation; GMM-SYS: systems generalised method of moments estimator (one step) using respectively L_{t-2} and L_{t-3}, w_{t-2} and w_{t-3} or Y_{t-2} and Y_{t-3} as instruments for the differenced equation, and ΔL_{t-1}, Δw_{t-1} or ΔY_{t-1} as instruments for the levels equation; heteroskedasticity-robust standard errors for se(L_{t-1}), se(w_{t-1}) and se(Y_{t-1}); m1 and m2: Arellano-Bond tests for first-order and second-order autocorrelation of the first-differenced residuals – p-values reported (H_0: no autocorrelation); Sargan: test of validity of over-identifying restrictions for GMM-estimators – p-values reported (H_0: overidentifying restrictions valid).

Table A4 Dynamic conditional labour demand estimations, equation (8), manufacturing and market service sector, materials and service offshoring intensities for OECD-22, 1995-2003

	Manufacturing sector				Service sector			
	OLS-lev	FE	GMM-DIF	GMM-SYS	OLS-lev	FE	GMM-DIF	GMM-SYS
L_{t-1}	0.957***	0.721***	0.279***	0.881***	0.979***	0.950***	0.840***	0.896***
se(L_{t-1})	(0.029)	(0.048)	(0.105)	(0.137)	(0.008)	(0.066)	(0.084)	(0.038)
w_t	-0.090	-0.041	-0.405**	-0.152	-0.407***	-0.320***	-0.340	-0.400**
se(w_t)	(0.115)	(0.125)	(0.175)	(0.384)	(0.096)	(0.092)	(0.209)	(0.188)
w_{t-1}	0.078	0.122	-0.185*	0.412**	0.350***	0.259**	0.320*	0.287
se(w_{t-1})	(0.101)	(0.082)	(0.099)	(0.184)	(0.097)	(0.103)	(0.193)	(0.202)
Y_t	0.219**	0.161*	0.210*	0.185	0.308***	0.260***	0.270***	0.343***
se(Y_t)	(0.092)	(0.088)	(0.120)	(0.165)	(0.059)	(0.047)	(0.083)	(0.072)
Y_{t-1}	-0.177**	-0.126***	0.075*	-0.169**	-0.276***	-0.270***	-0.224**	-0.198***
se(Y_{t-1})	(0.073)	(0.041)	(0.041)	(0.072)	(0.056)	(0.083)	(0.092)	(0.061)
om_i_t	0.018	0.006	0.040**	0.029	0.018	0.021**	0.021	0.025*
se(om_i_t)	(0.015)	(0.018)	(0.025)	(0.026)	(0.012)	(0.010)	(0.015)	(0.013)
om_i_{t-1}	-0.013	-0.015	0.048**	0.010	-0.022*	-0.017	0.008	-0.020
se(om_i_{t-1})	(0.015)	(0.019)	(0.019)	(0.029)	(0.012)	(0.014)	(0.016)	(0.019)
os_i_t	0.011*	0.009	0.005	0.003	0.024*	0.012	0.021**	0.028**
se(os_i_t)	(0.007)	(0.006)	(0.009)	(0.011)	(0.012)	(0.010)	(0.010)	(0.014)
os_i_{t-1}	-0.011*	-0.012	-0.008	-0.012	-0.008	-0.017	-0.019	-0.020
se(os_i_{t-1})	(0.006)	(0.009)	(0.010)	(0.010)	(0.012)	(0.014)	(0.015)	(0.023)
m1			[0.696]	[0.011]			[0.016]	[0.012]
m2			[0.640]	[0.943]			[0.784]	[0.947]
Sargan			[0.000]	[0.000]			[0.003]	[0.000]

Table A5 Dynamic conditional labour demand estimations, equation (8), manufacturing and market service sector, materials and service offshoring intensities for CEEC, 1995-2003

	Manufacturing sector				Service sector			
	OLS-lev	FE	GMM-DIF	GMM-SYS	OLS-lev	FE	GMM-DIF	GMM-SYS
L_{t-1}	0.971***	0.728***	0.270**	0.934***	0.978***	0.940***	0.750***	0.891***
se(L_{t-1})	(0.030)	(0.049)	(0.107)	(0.119)	(0.008)	(0.069)	(0.087)	(0.038)
w_t	-0.055	-0.012	-0.474***	-0.109	-0.399***	-0.317***	-0.295	-0.372**
se(w_t)	(0.114)	(0.119)	(0.147)	(0.391)	(0.096)	(0.090)	(0.215)	(0.187)
w_{t-1}	0.066	0.102	-0.242**	0.481**	0.342***	0.255**	0.280	0.260
se(w_{t-1})	(0.100)	(0.077)	(0.118)	(0.203)	(0.098)	(0.104)	(0.189)	(0.195)
Y_t	0.216**	0.160*	0.218*	0.171	0.304***	0.256***	0.249***	0.333***
se(Y_t)	(0.093)	(0.085)	(0.125)	(0.161)	(0.058)	(0.048)	(0.085)	(0.074)
Y_{t-1}	-0.186**	-0.123***	0.069	-0.197***	-0.272***	-0.272***	-0.208**	-0.184***
se(Y_{t-1})	(0.074)	(0.044)	(0.046)	(0.076)	(0.055)	(0.084)	(0.084)	(0.059)
om_e_t	0.023**	0.014	0.021*	0.010	0.007	0.004	0.013	0.002
se(om_e_t)	(0.012)	(0.011)	(0.012)	(0.019)	(0.009)	(0.011)	(0.010)	(0.010)
om_e_{t-1}	-0.028**	-0.033**	-0.004	-0.030	-0.010	0.003	-0.000	-0.006
se(om_e_{t-1})	(0.011)	(0.014)	(0.011)	(0.025)	(0.009)	(0.012)	(0.011)	(0.016)
os_e_t	0.013**	0.009*	0.006	0.000	0.024**	0.016	0.024**	0.025*
se(os_e_t)	(0.006)	(0.005)	(0.009)	(0.011)	(0.011)	(0.009)	(0.010)	(0.013)
os_e_{t-1}	-0.013**	-0.013*	-0.005	-0.016*	-0.009	-0.018	-0.012	-0.018
se(os_e_{t-1})	(0.006)	(0.007)	(0.006)	(0.009)	(0.011)	(0.015)	(0.014)	(0.021)
m1			[0.960]	[0.012]			[0.020]	[0.012]
m2			[0.335]	[0.962]			[0.903]	[0.783]
Sargan			[0.001]	[0.000]			[0.002]	[0.000]

Table A6 Dynamic conditional labour demand estimations, equation (8), manufacturing and market service sector, materials and service offshoring intensities for ASIA, 1995-2003

	Manufacturing sector				Service sector			
	OLS-lev	FE	GMM-DIF	GMM-SYS	OLS-lev	FE	GMM-DIF	GMM-SYS
L_{t-1}	0.968***	0.705***	0.315***	0.907***	0.978***	0.947***	0.810***	0.899***
se(L_{t-1})	(0.025)	(0.045)	(0.096)	(0.119)	(0.008)	(0.066)	(0.097)	(0.036)
w_t	-0.077	-0.041	-0.482***	-0.205	-0.393***	-0.317***	-0.307	-0.349**
se(w_t)	(0.114)	(0.122)	(0.134)	(0.360)	(0.095)	(0.093)	(0.255)	(0.217)
w_{t-1}	0.076	0.116	-0.163*	0.521***	0.345***	0.258**	0.250	0.235
se(w_{t-1})	(0.104)	(0.079)	(0.107)	(0.180)	(0.095)	(0.107)	(0.237)	(0.234)
Y_t	0.213**	0.159*	0.211*	0.187	0.306***	0.259***	0.256***	0.313***
se(Y_t)	(0.091)	(0.088)	(0.128)	(0.163)	(0.057)	(0.049)	(0.106)	(0.089)
Y_{t-1}	-0.183**	-0.119***	0.057	-0.191**	-0.274***	-0.268***	-0.203**	-0.178**
se(Y_{t-1})	(0.074)	(0.040)	(0.039)	(0.075)	(0.054)	(0.085)	(0.093)	(0.070)
om_a_t	0.004	0.010*	0.016*	-0.006	0.000	0.000	0.012	0.018
se(om_a_t)	(0.006)	(0.006)	(0.009)	(0.013)	(0.009)	(0.007)	(0.012)	(0.011)
om_a_{t-1}	-0.011*	0.002	0.018***	0.003	0.007	-0.005	-0.002	0.003
se(om_a_{t-1})	(0.006)	(0.010)	(0.006)	(0.012)	(0.009)	(0.007)	(0.007)	(0.012)
os_a_t	0.011*	0.008	-0.002	-0.000	0.022**	0.013	0.003	0.021*
se(os_a_t)	(0.007)	(0.006)	(0.008)	(0.011)	(0.011)	(0.009)	(0.010)	(0.012)
os_a_{t-1}	-0.011*	-0.011	-0.003	-0.012	-0.010	-0.018	-0.005	-0.021
se(os_a_{t-1})	(0.006)	(0.009)	(0.005)	(0.011)	(0.011)	(0.013)	(0.015)	(0.021)
m1			[0.463]	[0.013]			[0.015]	[0.008]
m2			[0.473]	[0.942]			[0.737]	[0.718]
Sargan			[0.001]	[0.000]			[0.001]	[0.002]

Source for Tables A4-A6: own calculations, all estimations done with STATA.

Remarks for Tables A4-A6: 58 manufacturing and 35 service industries covered (see appendix for industry detail); all equations include year dummies; wage variables taken as predetermined in GMM-estimations; OLS-lev: ordinary least squares estimation for levels; FE: fixed effects estimation; GMM-DIF: difference generalised method of moments estimator (one step) using L_{t-2}, L_{t-3}, w_{t-2} and w_{t-3} as instruments for the differenced equation; GMM-SYS: systems generalised method of moments estimator (one step) using L_{t-2}, L_{t-3}, w_{t-2} and w_{t-3} as instruments for the differenced equation, as well as ΔL_{t-1} and Δw_{t-1} as instruments for the levels equation; all reported standard errors are heteroskedasticity-robust; m1 and m2: Arellano-Bond tests for first-order and second-order autocorrelation of the first-differenced residuals – p-values reported (H_0: no autocorrelation); Sargan: test of validity of over-identifying restrictions for GMM-estimators – p-values reported (H_0: overidentifying restrictions valid).

Table A7 Dynamic unconditional labour demand estimations, equation (9), manufacturing and market service sector, materials and service offshoring intensities for OECD-22, 1995-2003

	Manufacturing sector				Service sector			
	OLS-lev	FE	GMM-DIF	GMM-SYS	OLS-lev	FE	GMM-DIF	GMM-SYS
L_{t-1}	0.997***	0.727***	0.387***	0.912***	1.004***	0.884***	0.797***	1.036***
se(L_{t-1})	(0.007)	(0.053)	(0.109)	(0.036)	(0.004)	(0.023)	(0.054)	(0.011)
w_t	0.099	0.114	-0.210	0.194	-0.222**	-0.148*	-0.094	-0.193
se(w_t)	(0.179)	(0.164)	(0.182)	(0.282)	(0.092)	(0.084)	(0.261)	(0.262)
w_{t-1}	-0.041	0.070	-0.160	0.226	0.207**	0.120*	0.188	0.225
se(w_{t-1})	(0.164)	(0.093)	(0.116)	(0.199)	(0.095)	(0.063)	(0.145)	(0.240)
P_t	0.001	-0.001	-0.063	0.033	-0.004	-0.024	0.012	-0.052
se(P_t)	(0.047)	(0.024)	(0.046)	(0.057)	(0.040)	(0.034)	(0.043)	(0.038)
P_{t-1}	0.065	0.051*	-0.054	0.086	0.042	0.115**	0.082**	0.102**
se(P_{t-1})	(0.045)	(0.028)	(0.055)	(0.055)	(0.041)	(0.047)	(0.034)	(0.042)
om_i_t	0.011	-0.002	0.045*	0.036	0.016	0.021	0.024	0.016
se(om_i_t)	(0.017)	(0.019)	(0.023)	(0.027)	(0.018)	(0.015)	(0.022)	(0.015)
om_i_{t-1}	-0.014	-0.018	0.030	-0.016	-0.022	-0.012	0.022	-0.021
se(om_i_{t-1})	(0.016)	(0.022)	(0.021)	(0.028)	(0.019)	(0.021)	(0.027)	(0.033)
os_i_t	0.006	0.005	0.010	0.006	0.034*	0.021	0.031*	0.048**
se(os_i_t)	(0.007)	(0.007)	(0.007)	(0.013)	(0.019)	(0.013)	(0.016)	(0.022)
os_i_{t-1}	-0.008	-0.011	-0.015	-0.011	-0.014	-0.023	-0.023	-0.013
se(os_i_{t-1})	(0.006)	(0.009)	(0.012)	(0.010)	(0.017)	(0.022)	(0.018)	(0.026)
m1			[0.981]	[0.003]			[0.040]	[0.026]
m2			[0.531]	[0.531]			[0.884]	[0.539]
Sargan			[0.000]	[0.000]			[0.000]	[0.000]

Table A8 Dynamic unconditional labour demand estimations, equation (9), manufacturing and market service sector, materials and service offshoring intensities for CEEC, 1995-2003

	Manufacturing sector				Service sector			
	OLS-lev	FE	GMM-DIF	GMM-SYS	OLS-lev	FE	GMM-DIF	GMM-SYS
L_{t-1}	1.000***	0.736***	0.346***	0.925***	1.004***	0.870***	0.687***	1.039***
se(L_{t-1})	(0.007)	(0.052)	(0.123)	(0.034)	(0.003)	(0.025)	(0.046)	(0.010)
w_t	0.124	0.137	-0.323**	0.108	-0.210**	-0.144*	-0.103	-0.173
se(w_t)	(0.178)	(0.162)	(0.135)	(0.304)	(0.092)	(0.079)	(0.288)	(0.259)
w_{t-1}	-0.062	0.048	-0.227*	0.351	0.197**	0.110	0.122	0.216
se(w_{t-1})	(0.163)	(0.090)	(0.133)	(0.226)	(0.096)	(0.067)	(0.152)	(0.232)
P_t	0.001	-0.004	-0.084	0.021	-0.008	-0.025	0.006	-0.060
se(P_t)	(0.045)	(0.024)	(0.058)	(0.066)	(0.041)	(0.033)	(0.045)	(0.043)
P_{t-1}	0.069	0.045	-0.059	0.102*	0.040	0.116**	0.071**	0.105**
se(P_{t-1})	(0.045)	(0.028)	(0.049)	(0.060)	(0.040)	(0.050)	(0.035)	(0.043)
om_e_t	0.016	0.008	0.030**	0.002	0.015	0.009	0.021	0.005
se(om_e_t)	(0.012)	(0.014)	(0.013)	(0.025)	(0.013)	(0.015)	(0.015)	(0.012)
om_e_{t-1}	-0.025**	-0.032**	-0.012	-0.031	-0.017	-0.001	-0.002	-0.014
se(om_e_{t-1})	(0.012)	(0.014)	(0.012)	(0.022)	(0.013)	(0.017)	(0.012)	(0.025)
os_e_t	0.008	0.005	0.011	0.000	0.032*	0.023*	0.033***	0.042**
se(os_e_t)	(0.007)	(0.007)	(0.007)	(0.014)	(0.018)	(0.013)	(0.013)	(0.021)
os_e_{t-1}	-0.011*	-0.013	-0.007	-0.014*	-0.014	-0.024	-0.016	-0.013
se(os_e_{t-1})	(0.006)	(0.008)	(0.008)	(0.008)	(0.017)	(0.023)	(0.021)	(0.026)
m1			[0.439]	[0.004]			[0.049]	[0.028]
m2			[0.367]	[0.440]			[0.943]	[0.585]
Sargan			[0.000]	[0.000]			[0.000]	[0.000]

Table A9 Dynamic unconditional labour demand estimations, equation (9), manufacturing and market service sector, materials and service offshoring intensities for ASIA, 1995-2003

	Manufacturing sector				Service sector			
	OLS-lev	FE	GMM-DIF	GMM-SYS	OLS-lev	FE	GMM-DIF	GMM-SYS
L_{t-1}	0.997***	0.709***	0.389***	0.913***	1.004***	0.888***	0.771***	1.027***
se(L_{t-1})	(0.006)	(0.049)	(0.097)	(0.032)	(0.003)	(0.024)	(0.061)	(0.011)
w_t	0.096	0.117	-0.360***	0.045	-0.208**	-0.141*	-0.092	-0.160
se(w_t)	(0.181)	(0.160)	(0.086)	(0.293)	(0.092)	(0.082)	(0.281)	(0.268)
w_{t-1}	-0.048	0.070	-0.120	0.381*	0.203**	0.115	0.077	0.178
se(w_{t-1})	(0.166)	(0.091)	(0.140)	(0.199)	(0.095)	(0.070)	(0.171)	(0.256)
P_t	0.001	0.001	-0.083	0.014	-0.015	-0.029	0.009	-0.058
se(P_t)	(0.048)	(0.024)	(0.058)	(0.068)	(0.041)	(0.032)	(0.042)	(0.046)
P_{t-1}	0.069	0.046*	-0.047	0.109*	0.045	0.121**	0.066**	0.109**
se(P_{t-1})	(0.045)	(0.026)	(0.047)	(0.058)	(0.041)	(0.049)	(0.033)	(0.046)
om_a_t	-0.000	0.011	0.024***	-0.005	0.008	0.009	0.026*	0.037***
se(om_a_t)	(0.007)	(0.008)	(0.008)	(0.015)	(0.013)	(0.010)	(0.014)	(0.010)
om_a_{t-1}	-0.010	0.009	0.023***	0.001	0.001	-0.016	-0.007	0.003
se(om_a_{t-1})	(0.007)	(0.011)	(0.006)	(0.012)	(0.012)	(0.011)	(0.011)	(0.020)
os_a_t	0.007	0.005	-0.003	0.002	0.031*	0.021	0.009	0.034**
se(os_a_t)	(0.007)	(0.007)	(0.009)	(0.012)	(0.018)	(0.012)	(0.010)	(0.016)
os_a_{t-1}	-0.010	-0.010	-0.004	-0.009	-0.015	-0.024	-0.008	-0.019
se(os_a_{t-1})	(0.006)	(0.009)	(0.006)	(0.010)	(0.017)	(0.021)	(0.015)	(0.025)
m1			[0.967]	[0.004]			[0.053]	[0.031]
m2			[0.467]	[0.441]			[0.657]	[0.512]
Sargan			[0.000]	[0.000]			[0.000]	[0.000]

Source for Tables A7-A9: own calculations, all estimations done with STATA.

Remarks for Tables A7-A9: 58 manufacturing and 35 service industries covered (see appendix for industry detail); all equations include year dummies; wage variables taken as predetermined in GMM-estimations; OLS-lev: ordinary least squares estimation for levels; FE: fixed effects estimation; GMM-DIF: difference generalised method of moments estimator (one step) using L_{t-2}, L_{t-3}, w_{t-2} and w_{t-3} as instruments for the differenced equation; GMM-SYS: systems generalised method of moments estimator (one step) using L_{t-2}, L_{t-3}, w_{t-2} and w_{t-3} as instruments for the differenced equation, as well as ΔL_{t-1} and Δw_{t-1} as instruments for the levels equation; all reported standard errors are heteroskedasticity-robust; m1 and m2: Arellano-Bond tests for first-order and second-order autocorrelation of the first-differenced residuals – p-values reported (H_0: no autocorrelation); Sargan: test of validity of over-identifying restrictions for GMM-estimators – p-values reported (H_0: overidentifying restrictions valid).