

Economic Integration and the Elasticities of Labour Demand: Econometric Evidence from Finland*

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Abstract

By using theoretical model and empirical analysis, we investigate the effects of the economic integration on the elasticity of labour demand with own price. In a general theoretical model of intra-industry trade, we analyze how economic integration changes the labour-demand elasticity. We show that intensified trade competition increases the labour-demand elasticity, whereas better advantage of economies of scale decreases the elasticity of labour demand by decreasing elasticity of substitution between differentiated products. If integration gives rise to an increase in input-substitutability and/or outsourcing activities, labour demand will become more elastic. We test the idea whether European integration has changed the labour-demand elasticities in Finland using data from the manufacturing sector from 1975 to 2002. Overall, the results provide support for the hypothesis that economic integration has contributed to increased elasticities of total labour demand.

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1 INTRODUCTION

Economic integration is a process in which markets for goods and factors of production tend to become perfectly integrated. The competition on the location of capital and production is getting more and more tightened with globalization. As Rodrik (1998, 1999) argues, open economies, which are free to trade with each other, differ from closed economies in the respect that in particular capital and employers are internationally mobile.¹ Liberalising financial markets and the programme of the European community for liberalising goods markets throughout Europe have already made considerable progress towards globalization. Liberalization of capital movements in the mid-1980s has effectively created one common market for financial capital. However, the local demand for capital is less than perfectly elastic, so capital is neither perfectly mobile nor perfectly immobile. As de M enil (1999) has emphasized, there do appear to be significant differences in rates of return to capital within EU countries. Liberalising the capital market has been promoting the opportunities for multinational corporations to invest and establish production plants in countries where they are able to obtain labour more cheaply.² The completion of the Single European Market, which was scheduled to have occurred by the 1992, was intended to complete the process of removing tariff and non-tariff barriers to trade among the countries of the European Union. The mobility of production has been increasing as a consequence of product market integration. The progress of integration with the wider trade and capital flows has been strengthening the competition between EU countries, which has reflected in the labour market. On the other hand, the firms with access to the wider market were expected to be able to expand sales and production to take better advantage of economies of scale while continuing to cover production costs despite lower price-cost margins.

¹ On the other hand, as Osmundsen (1999) discusses, barriers to labour mobility have been lowered by the creation of the EU international market, and education and language skills have improved, implying enhanced international mobility of the workforce.

² Wildasin (2000) explains that labour mobility contributing to either lower real wages or higher unemployment worsens especially the welfare of low skilled workers, which are easier to substitute with foreign workers.

The establishment of the European Monetary Union is asserted to strengthen this process of integration further via the increasing competition in the international product and capital markets. As Calmfors (1998, 2001) argues, in the process of integration a common currency reduces the trade barriers (as both transaction costs and exchange-rate risks with international payments), and therefore leads to not only more trade, but also more foreign direct investment.³ The primary objective of European Monetary Union will be price stability, which forces countries to adjust to low inflation and to pay attention to firms' competitiveness. Due to EMU, member-states lose the opportunity to make use of the exchange rate as an instrument to correct macroeconomic disequilibria.⁴ In particular, they cannot devalue their own currency so as to restore international price competitiveness. The loss of national adjustment variables, such as the exchange rate or the interest rate, will result in an increased need for alternative flexible mechanisms to correct possible asymmetric shocks between EMU-countries.⁵ Product demand will become more sensitive to price differentials between different countries and firms' location decisions more responsive to relative labour costs. Burda (1999) speculates that if nominal price rigidity (correlation of nominal wage movements) in Europe is likely to increase, then real rigidities (correlation of real wage growth) are likely to decrease, as a consequence of EMU, which calls for labour market flexibility. This adjustment would help the region to improve its competitive position. Therefore, competitiveness pressure on the labour market towards greater flexibility is expected to increase under EMU as diminishing trade barriers.

Within the past few years, the effects of the European economic integration on the labour market have attracted wide interest. While there has been some increase in trade with countries outside the European area, it is a fact that the region remains fairly closed with a consolidated trade share of about ten percent of total GDP, whereas trade within the region has been rapidly increasing (see OECD 1999). The purpose of this study is to

³ EMU will eliminate the transaction costs incurred in exchanging currencies, make information less costly, and reduce political risk as the monetary policy is transferred on to the European Central Bank (see, e.g., de M n l 1999, p. 185).

⁴ Currency devaluation can be used to reduce domestic costs in foreign-currency terms, thereby offsetting the loss in competitiveness (see, e.g., Rodrik 1998, p. 4).

⁵ In addition, as Andersen et al. (2000) explain, European countries may be affected differently by changes in inter-industry trade, which are more relevant for southern European countries, and intra-industry trade, which are more relevant for northern Europe.

examine by using theoretical model and empirical analysis the impact of the economic integration on the elasticity of labour demand with own price. The empirical aim is to determine whether European integration has increased or decreased the own price elasticities in Finland. The economic integration associating with market power can in theory increase or decrease labour-demand elasticity. With increased integration and competition firms with access to the wider market were expected to be able to expand sales and production to take better advantage of economies of scale. Thus, market power may arise from specialization in production and differentiation of products to establish segmented markets. This might in turn decrease the elasticity of labour demand. In contrast, for instance, Rodrik (1997) and Slaughter (2001) have emphasized the possibility, particularly in imperfectly competitive contexts, for the elasticity of demand for labour to be higher with greater openness. As Slaughter (2001) has pointed out, the link between factor demand elasticities and product market elasticities is directly established through Hicks-Marshall's fundamental law of factor demand, which implies that "the demand for anything is likely to be more elastic, the more elastic is the demand for any further thing which it contributes to produce". Since product market elasticities are likely to rise with integration, this implies that, with greater trade openness, we should see an increase in labour-demand elasticities as well. From a theoretical point of view, Panagariya (1999) shows that the Rodrik's conjecture of a positive effect of globalisation on labour-demand elasticity is not a general result. As a consequence, the validity of the relationship has to be determined empirically.

First, the purpose is to examine the main channels through which the elasticity of labour demand is affected by international integration. We focus on how product market integration can change in theory the elasticity of labour demand. This general model of intra-industry trade specifies a theoretical framework of estimation for the elasticities of labour demand and determining the effects of economic integration on the elasticities. Intra-industry trade may be defined as the two-way exchange of goods in which neither country seems to have a comparative cost advantage. As Helpman and Krugman (1989) have pointed out, it is a phenomenon that first drew attention during the rapid expansion of trade in manufactured goods that followed the creation of the European Common Market. There are two major channels through which integration might affect labour markets, product markets and factor substitution. In regard to the demand for labour and

capital we derive the own-price elasticity of labour demand, and derive substitution and scale effects for the elasticity of labour demand.

Second, we focus on the empirical work with the aim of determining the effect of European integration on the elasticities of labour demand. This has been tested using data from the Finnish manufacturing sector from 1975 to 2002. Our empirical work is closely related to tests of the Factor Price Equalization (FPE) theorem, although the theorem does not depend on substitution between inputs and market power with differentiation of products. The theorem according to which free trade and accordingly equalization of relative product prices across countries would imply that relative factor prices also have to be the same across countries, even in the absence of perfect factor mobility. Even when labour mobility is low, product market integration will force product price and factor price convergence for production factors of similar quality. When the mobility of capital is increasing as consequence of integration, domestic workers can be substituted by other factors, either through trade or through investing. The barriers to trade make the movements of labour and capital more costly and more risky, and prevent the complete equalization of factor prices.

The study is organized as follows. Section 2 focuses on identifying the main channels through which economic integration affects the labour-demand elasticities. It specifies a theoretical framework for empirical analysis. Section 3 set up the econometric model. The data is described in Section 4. Section 5 presents the estimation strategy, and reports on the empirical results. A few concluding remarks and suggestions for future analysis are given in the last section.

2 THEORETICAL BACKGROUNDS

2.1 Theorems of international trade

The labour market effects of integration running via changes in relative factor supplies are captured by the Heckscher-Ohlin (HO) theorem. The Heckscher-Ohlin theorem of traditional trade models connects trade with factor supplies. The HO model identifies a mapping from exogenously given factor supplies and exogenously given external prod-

uct prices determined in the international market place into internal factor prices, output levels and consumption levels, the difference between these last two items being international trade. (See, e.g., Leamer and Levinsohn 1995, p. 1345.) Thus, pressure on factor prices comes from trade with countries with dissimilar relative endowments. The empirical prediction of the HO model is that a country should be observed exporting the goods in which it has a comparative advantage and importing the goods in which it does not. However, Leontief (1953) observed that the US, which was at that time by far the most capital-intensive country in the world, was exporting relatively labour-intensive products. Another approach to testing the implications HO theorem is to see if the pattern of net exports within an individual country conforms to what would be expected on the basis of the relative factor endowment of that country. For example, using US data, Baldwin and Cain (1997) report estimates of relative comparative advantage as a function of factor shares across industries producing tradable goods. Their results suggest that the US tends to be a net exporter of goods and services that are relatively education-intensive.

The Stolper-Samuelson theorem⁶, one of the HO models, connects factor prices with product prices. The theorem describes a mapping from prices determined externally in international markets to prices determined internally in local markets. The result applies if the external markets determine prices of commodities and the internal markets determine prices of factors. An increase in the relative price of good yields an increase in the real return to the factor used intensively in that good and a decrease in the real return to the other factor. The empirical prediction of the theorem is that under certain conditions⁷ the prices of individual factors across different countries would - in the absence of tariffs or other impediments to free trade - tend to equalize. Andersen (2001) has emphasized, according to the Stolper-Samuelson proposition, the relative wage of unskilled in European countries should decline if the integration process is associated with a de-

⁶ See, e.g., Leamer and Levinsohn 1995, pp. 1345-1348.

⁷ One of these assumptions is that the technology of the production of each good is identical in each country. Several papers (e.g., Trefler, 1993 and 1995; Davis et al., 1997; Harrigan, 1997) have revisited the HO prediction with specifications that allow for estimation of inter-country differences in technology to be an additional source of comparative advantage. The results of these studies, when technology differences are taken into account, are at least qualitatively consistent with the predictions of the HO model; countries tend to be net exporters of the services of the factors in which they are relatively abundant. An interesting aspect of Trefler (1995) is his conclusion that observed trade flows reflects also inter-country technology differences.

cline in relative prices of commodities intensive in low skilled labour. The deteriorated situation for low skilled workers may more generally show up in the form of lower relative wages or a higher incidence of unemployment for low skilled workers in European countries. Wage dispersion may be going up, as is the difference in employment across both skill and geographical dimensions.⁸

If an economy's relative endowment equals that of the rest of the world then when economies are more integrated they experience via the HO theorem no change in product prices and thus via the Stolper-Samuelson theorem no change in wages. But integration can make foreign factors more substitutable with the domestic ones. The Rybczynski theorem⁹ depends on substitution between inputs within sectors. The theorem connects output levels with factor supplies. It relates changes in endowments to changes in the pattern of production. Holding product prices fixed, an increase in the quantity of one factor will give rise to a more than proportional increase in the output of the good which uses that factor intensively and a reduction of the output of the other good. Then, pressure on the elasticities of labour demand comes from dissimilar relative endowments regardless of international trade. For example, using a panel data of two industries Harrigan (1995) explains production levels as functions of national factor endowments. The results suggest that capital is a source of comparative advantage in both industries; while skilled labour is a source of comparative advantage in one industry, and unskilled labour is a source of comparative disadvantage in both.

The Factor Price Insensitivity (FPI) theorem¹⁰ connects factor prices with factor supplies. Within a country, factor prices are altogether insensitive to changes in factor supplies, holding product prices fixed. Johnson and Stafford (1999) explain, according to the FPI-model, that changes in relative factor supplies have no effect on relative factor prices. The empirical study of Slaughter (1997) is close to a direct test of the FPI-theorem. The theorem according to which free trade and accordingly equalization of relative product prices across countries would imply that relative factor prices also have to be the same across countries, even in the absence of perfect factor mobility. The idea of Slaughter behind the test is that, as the U.S. economy became more open, the abso-

⁸ This depends on a trend towards more decentralized wage formation giving a larger role for wage setting at the firm level.

⁹ See, e.g., Leamer and Levinsohn 1995, pp. 1345-1346.

lute elasticity of labour demand should have become larger. Although, as Andersen and Sørensen (2000) summarize, the theorem relies on a number of crucial assumptions of which one is that there is perfect competition in product markets. This assumption is counterfactual for a number of products and factor price equalization does not necessarily follow from free trade. Market power arises among other things from specialization in production and differentiation of products to establish segmented markets. Another assumption is that the demand for labour in integration is infinitely elastic. This requires that factor supply variation is too small to take the country into a different range of specialization. In addition, the FPI-theorem with the HO theorem and the Stolper-Samuelson theorem do not depend at all on substitution between inputs within sectors.

2.2 A Model of the Elasticity of Labour Demand and Product Market Integration

We will structure a general theoretical model of intra-industry trade to capture the effects of product market integration¹¹ on the elasticities of labour demand. The focus is on how the process of integration may reflect via the removal of barriers with international trade, substitution, and outsourcing in the labour-demand elasticities. We consider an open economy where there are many firms at industry level producing differentiated good Y_j with capital K_j , skilled labour L_{js} and unskilled labour L_{ju} as inputs. Capital and skilled labour are mobile across countries, while unskilled labour is immobile. Supposing that product markets are imperfectly competitive, there is monopolistic competition in good markets adapting the model of Dixit and Stiglitz (1977) where there is assumed to be no strategic (Bertrand or Cournot) interaction between firms.¹² The structure of this general model is such that consumers demand a variety of differentiated products.

¹⁰ See, e.g., Leamer and Levinsohn 1995, p. 1354.

¹¹ An integration process is implying more integration across product markets.

¹² This approximates a situation in which there are a large number of varieties and each firm has some power over the pricing of its product.

We suppose for simplicity that all industries produce only differentiated products.¹³ Representative consumer's tastes are assumed represented by the utility function

$$(2.1) \quad V = \sum_j b_j \frac{1}{\theta_j} D_j^{\theta_j}$$

where $D_j = \sum_{i=1}^n D_{ji}$ is an index of consumption of the differentiated products at industry j , and b_j is the positive constant. By imposing the symmetry assumption a consumer maximizing¹⁴ will set

$$(2.2) \quad D_j = \left(\frac{P_j^*}{b_j} \right)^{\frac{-1}{1-\theta_j}}$$

where $\varepsilon_j = \frac{1}{1-\theta_j} > 1$ is the product-demand elasticity, and P_j^* represents an index of the price level in terms of international integration. The product-demand elasticity can be thought as an increasing function of the number of products $\varepsilon_j = \varepsilon_j(n_j)$, where $\varepsilon'_j(n_j) > 0$, and n_j is the number of products/firms at industry j . An increase in the number of firms leads to an increase in the degree of competition. The demand of products type i is given as

$$(2.3) \quad \begin{aligned} D_{ji} &= D_j \left(\frac{p_{ji}}{P_j^*} \right)^{-\phi_j} \\ &= a_j p_{ji}^{-\phi_j} P_j^{*\phi_j - \varepsilon_j} \end{aligned}$$

¹³ It is possible to suppose that there is a sector producing the outside good only for domestic market.

¹⁴ Each consumer maximises their utility function (2.1) subject to the budget constraint. The budget constraint simply requires that the value of expenditure is not more than value of the income.

where p_{ji} represents the price of variety i with $\phi_j > 1$ denoting the elasticity of substitution between any two products types (see Helpman and Krugman 1989). The industry's elasticity of substitution among differentiated goods can be thought as a decreasing function of the advantage of economies of scale $\phi_j = \phi_j(a_j)$, where $\phi'_j(a_j) < 0$, and $a_j \equiv \frac{A_j}{A_j^*}$ is an exogenous comparative productivity for domestic industry relative to foreign. A growth in the advantage of economies of scale in industry leads to a decrease in the degree of substitution among differentiated goods within industry.¹⁵

Consider now the impact of a reduction in marginal trade costs on product markets. Let τ_j denotes a trade cost due to transactions costs and other trade barriers related to foreign trade¹⁶ at industry j . The effects on imperfectly competitive product markets of increased integration via declining trade costs are basically of two counteracting sorts. Hence, it turns out to vary competition by varying both advantage of economies of scale holding ε_j constant, and number of firms holding ϕ_j constant. First, individual producers with access to the wider market were expected to be able to expand production to take better advantage of economies of scale (a_j). This has associated to reduced market imperfection and to increased incentive of product-differentiating. Hence, we assume that

$$(2.4) \quad \frac{\partial \phi_j}{\partial a_j} \frac{\partial a_j}{\partial \tau_j} > 0.$$

Second, market entry becomes easier and/or less costly implying that more goods become traded goods (n_j). With increased integration and competition, an industry's mar-

¹⁵ Together with interaction between number of products/firms and degree of price competition, intra-industry trade and economic integration can be seen as the result of the interaction between product differentiation and economies of scale. Each industry contains a large, but limited because of economies of scale, number of potential differentiated products that consumers regard as imperfect substitutes. Given the opportunity to trade, industries will specialize in the production of different ranges, while the degree of price competition will increase.

¹⁶ For simplicity, we assume that the trade costs of import and export outputs are equal.

ket share becomes increasingly sensitive to price changes raising the elasticity of the consumption price. Thus, we have

$$(2.5) \quad \frac{\partial \varepsilon_j}{\partial n_j} \frac{\partial n_j}{\partial \tau_j} < 0.$$

The higher the degree of price competition is, i.e., the closer substitutes the good sale on the world market is, the more elastic with respect to own price output demand becomes. On the other hand, if the initial competitiveness of domestic industry is much better than the competitiveness of foreign industry, an increase in the degree of competition tends to give rise to a higher supply taking better advantage of economies of scale.

In the imperfect competition, we have then the condition of pricing rule for products types at industry j

$$(2.6) \quad P_j^* \geq \left[\sum_{i=1}^n \frac{(1 + \tau_j)}{a_j} p_{ji}^{1-\phi_j} \right]^{\frac{1}{1-\phi_j}}.$$

In optimum, the price equals to the marginal revenue from exporting, where we must have that relative trade cost equals to mark-up factor i.e. $\frac{1 + \tau_j}{a_j} = \frac{\phi_j + \varepsilon_j}{\phi_j + \varepsilon_j - 1}$ (see, e.g.,

Helpman and Krugman 1989, p. 18). We summarize the characterization of the optimal pricing rule in

Proposition 1 *Lower trade costs with increased integration, higher number of firms and in consequence of its higher elasticity of product demand will reduce the mark-up price, whereas better advantage of economies of scale and in consequence of its lower elasticity of substitution between differentiated products will raise it, ceteris paribus.*

Furthermore, international integration gives access to foreign factors of production as well as domestic ones, either directly in foreign affiliates or indirectly through intermediate inputs. As Burda and Dluhosch (2000) discuss, the removal of barriers to trade and

mobility between countries will increase incentives for firms to economize on variable costs by outsourcing or fragmenting the production process. In this sense, an enlarged market associated with trade can drive an endogenous evolution of technology, which in turn have been affected the factor markets by imported intermediate inputs. A change in capital costs affects together with labour costs on the firms' price setting. The firm considers the gross interest rate of industry \tilde{r}_j as given. It is given by the net-of-tax interest rate plus a capital tax, i.e. $\tilde{r}_j = (1+t_r)r_j$ with t_r denoting the capital tax rate.¹⁷ The gross wage of industry \tilde{w}_j consists of the net-of-tax wage¹⁸ plus the social security contributions t_w , so that $\tilde{w}_j = (1+t_w)w_j$. Let the unit costs of international outsourcing for industry j be denoted λ_j , and assume that these costs have a cumulative distribution function given by ψ_j . There are monitoring, switching and friction costs involved in letting an activity be outsourced.¹⁹ Then it is profitable for the firm to outsource activities if

$$(2.7) \quad \frac{\tilde{w}_j}{\tilde{r}_j} > \lambda_j$$

which applies for a fraction

$$(2.8) \quad \psi_j(\lambda_j, \tau_j) = \Pr\left(\frac{\tilde{w}_j}{\tilde{r}_j} < \lambda_j\right)$$

The cumulative distribution function $\psi_j(\lambda_j, \tau_j)$ is also parameterized on trade costs (τ_j) reflecting the effect of increased integration on the switching costs of outsourcing.

¹⁷ Other capital costs are mainly the depreciation of capital.

¹⁸ A rise in income tax increases the labour costs when a rise of income tax is compensated by an increase in the negotiated wages.

¹⁹ As Wildasin (2000) argues, capital and labour are not actually homogeneous factors of production, but rather aggregates of many specific types of inputs. Firms cannot without costs alter the stocks of capital and labour. The adjustment of production in response to shocks in the product market incurs costs because it is costly to replace plant and equipment, and to hire new workers.

Integration may lower the switching costs involved in outsourcing activities. Hence, we have

$$(2.9) \quad \frac{\partial \psi_j}{\partial \lambda_j} > 0,$$

$$(2.10) \quad \frac{\partial \psi_j}{\partial \tau_j} > 0.$$

The first inequality is implying that input-share become more sensitive to the relative input-price, when the switching costs of outsourcing are decreased. The second inequality is saying that more integration (lower trade costs) for a given relative input-price (switching costs) increases the share of firms choosing an outsourcing.

Assuming that linear-homogenous technology can be represented by CES (constant elasticity of substitution)²⁰ cost function form and strong separable between unskilled and skilled labour²¹, the total cost function

$$(2.11) \quad C_j = \sum_g C_{jg}$$

can be specified as sum of sub-CES cost functions of the form

$$(2.12) \quad C_{jg} = Y_j \left[\psi_{jg} \tilde{w}_{jg}^{1-\sigma_{jg}} + (1 - \psi_{jg}) \tilde{r}_{jg}^{1-\sigma_{jg}} \right]^{\frac{1}{1-\sigma_{jg}}}$$

²⁰ The CES function exhibits constant returns to scale. However, intra-industry trade may give rise to take advantage of economies of scale in production.

²¹ Empirical studies usually point to a lower degree of substitution between skilled labour and capital than between unskilled labour and capital. The integration forces changing labour substitutability by making labour less/more easily substituted for foreign factors of production depending on complementarity between human capital and physical capital (see, e.g., Skaksen and Sørensen 2002, or Feenstra and Hanson 2001). However, as Hamermesh (1993) discuss, the difficulty with the production function $Y = F(H(L_u, L_s), K)$ is that the aggregation of labour inputs by the function H is an arbitrary description of technology. If the labour sub-aggregates are not separable from capital, one will underestimate own-price demand elasticities, and infer that the types of labour are greater price-substitutes than in fact they are. Because of this problem of the separable of inputs I estimate also the elasticities of total labour demand.

where j and g refer to industry and input group, respectively; the industry j 's elasticities of substitution between capital and unskilled or skilled labour are denoted σ_{jg} . The elasticity of substitution is defined as the effect of a change in relative factor prices on relative inputs of these two factors, holding output constant (see Allen 1938, or Hamermesh 1993). The distribution parameter ψ_{jg} can be defined an index of augmenting technological change which is related to international outsourcing. In particular, increased imported intermediate inputs should mainly have affected unskilled labour who finds it more difficult to adjust this imported technological change. The CES function allows values $\sigma_{jg} \geq 0$ which can be thought as parameterized on trade costs (τ_j) to reflect that integration expands the set of factors by increasing mobility of capital. Thus, firms can substitute other factors of production for immobile workers more easily by investing. If the elasticity of substitution is great, as labour costs rises relative to capital costs, labour will be substituted for capital.²²

We assume imperfect competition in the product market i.e., each single firm at industry j 's level faces a downward sloping demand curve

$$(2.13) \quad Y_j = D_j(p_j) = p_j^{-(\phi_j + \varepsilon_j)}.$$

The closer substitutes for output Y_j on the international market are, the more elastic output demand becomes.²³ Profit maximization implies that the firms will set a price,

which exceeds the marginal cost by a constant mark-up factor, i.e. $\frac{\phi_j + \varepsilon_j}{\phi_j + \varepsilon_j - 1} > 1$. In a

process of integration, there are pressures for the mark-ups to decline with increasing

²² When there is a rise in the labour costs, the relative price of capital in terms of labour in this industry will decline i.e. capital here will be relatively cheap. As a result competitive forces will lead to the adoption of more capital-intensive techniques of production than elsewhere. In case of a unitary elasticity of substitution, the capital/labour ratio will also change by equal percentages as the factor-price ratio. If the elasticity of substitution is less than one, an increase in the price of labour must induce firms to use more capital, but the increase in the use of capital is not equal relative to an increase in the labour-price.

²³ Applying one of the four Hicks-Marshall laws of derived demand, the demand for anything is likely to be more elastic, the more elastic is the demand for any further thing, which it contributes to produce (Hicks 1966, p. 242).

elasticity of product demand.²⁴ On the other hand, a decrease in the product-substitution elasticity may compensate this effect. The firm maximizes profits, which are given by

$$(2.14) \quad \Pi_j = p_j(Y_j)Y_j - \tilde{w}_j L_j - \tilde{r}_j K_j.$$

Profit maximization with respect to labour yields the conditional labour demand function

$$(2.15) \quad L_{jg} = \psi_{jg} Y_j \left[\psi_{jg} \tilde{w}_{jg}^{1-\sigma_{jg}} + (1-\psi_{jg}) \tilde{r}_{jg}^{1-\sigma_{jg}} \right]^{\frac{\sigma_{jg}}{1-\sigma_{jg}}} \tilde{w}_{jg}^{-\sigma_{jg}}$$

The group g 's cost function can be written as $C_{jg}(\tilde{w}_{jg}, \tilde{r}_{jg}, Y_j) = c_{jg}(\tilde{w}_{jg}, \tilde{r}_{jg})Y_j$ at industry

j . The shares of labour and capital cost in total costs are defined for group g $s_{jg} \equiv \frac{\tilde{w}_{jg} L_{jg}}{c_{jg} Y_j}$

and $(1-s_{jg}) \equiv \frac{\tilde{r}_{jg} K_{jg}}{c_{jg} Y_j}$, respectively, with $c_{jg} = c_{jg}(\tilde{w}_{jg}, \tilde{r}_{jg})$ denoting group g 's unit and

marginal cost of production at industry j . Marginal cost depends on the gross factor prices only. Labour demand is affected by the share of labour in total costs. If this share is low, then a percentage increase in labour costs will have a smaller impact on total costs than, if the share of labour is large (see, e.g., Booth 1995, p. 58). The own-price elasticity of labour demand can be derived (see Allen 1938, or Hamermesh 1993) as

$$(2.16) \quad \eta_{LL_{jg}} = \frac{-(1-s_{jg})}{(1-\psi_{jg})} \sigma_{LL_{jg}} - \frac{s_{jg}}{\psi_{jg}} (\phi_j + \varepsilon_j) - \eta_{\psi \tilde{w}_{jg}}$$

²⁴ Whenever an economy faces a larger number of firms in an integrated world market, trade itself leads to a decline in the mark-ups. Hence, the degree of competition tends to increase when more goods become traded. By increasing competition facing individual firms in product markets, it is intended that firms should lower their mark-ups of prices over marginal costs. For instance, Hoon (2001) has affirmed that as domestic and foreign firms compete in the markets for traded goods, there are pressures for the mark-ups to decline.

where $\eta_{\psi\tilde{w}_{jg}} \equiv -\left(\frac{\partial\psi_{jg}}{\partial\tilde{w}_{jg}}\frac{\tilde{w}_{jg}}{\psi_{jg}}\right)$ is industry j 's elasticity of outsourcing with the price of labour type g . In equation (2.16), $\eta_{LL_{jg}}$ is industry j 's elasticity of labour demand with own price for group g ; $\sigma_{LL_{jg}}$ is group g 's elasticity of substitution between labour and capital at industry j ; ϕ_j is the elasticity of product substitution, and ε_j the elasticity of product demand for industry j 's output market. Equation (2.16) consists of three parts. The first part tells, for a given level of output, how much firms substitutes away from labour type towards capital when labour costs rise. For example, an increase in social security contributions shifts the labour demand curve inward by increasing the cost of labour (see, e.g., Pissarides 1997, p. 5). As Holmlund et al. (1989) explain if there is complete nominal wage rigidity, employment takes the whole burden of adjustment.²⁵ The second part of equation (2.16) tells how much industry's labour demand changes after a labour cost change in response to the change in the industry's output. For example, higher (lower) wages imply higher (lower) costs and thus, moving along the product-market demand schedule, lower (higher) industry output. The third part tells how much an increase in the wage costs gives rise to a switch towards more outsourcing. In summary, when labour costs have arisen, the industry substitutes away from labour towards capital or switch towards more outsourcing, and with higher costs the industry produces less output such that it demands less all factors.²⁶

In theory, economic integration can change the elasticities of labour demand without changing labour prices. Differentiating of equation (2.16) with respect to trade costs it gives the effect of increased product market integration on the labour-demand elasticity

$$(2.17) \quad \frac{\partial\eta_{LL_{jg}}}{\partial\tau_j} = \frac{-(1-s_{jg})}{(1-\psi_{jg})} \frac{\partial\sigma_{jg}}{\partial\tau_j} - \frac{s_{jg}}{\psi_{jg}} \left(\frac{\partial\phi_j}{\partial a_j} \frac{\partial a_j}{\partial\tau_j} + \frac{\partial\varepsilon_j}{\partial n_j} \frac{\partial n_j}{\partial\tau_j} \right) - \frac{\partial\eta_{\psi\tilde{w}_{jg}}}{\partial\tau_j} + \left[\frac{s_{jg}((\phi_j + \varepsilon_j)(1-\psi_{jg})^2 + \sigma_{jg}\psi_{jg}^2) - \sigma_{jg}\psi_{jg}^2}{\psi_{jg}^2(1-\psi_{jg})^2} \right] \frac{\partial\psi_{jg}}{\partial\tau_j}.$$

²⁵ If there is correspondingly complete nominal wage flexibility, the increase in social security contributions is completely shifted back on wages.

²⁶ Similarly, a cut in social security contributions shifts the labour demand curve to the right. Both real wages and employment rise but how much is the impact on wages and employment depends on the own-price elasticity of labour demand.

In the process of integration international trade can increase the elasticity of labour demand through the elasticity of substitution between labour and capital which is captured by the first term on the right hand side of equation (2.17). In consequence of decreased trade costs (τ_j) as industry j 's substitutability increases (i.e., $\sigma_{LL_{jg}}$ rises), labour demand becomes more elastic (i.e., $\eta_{LL_{jg}}$ falls). The smaller is labour's share in the firm's costs (s_{jg}), the stronger is the pass-through from the elasticity of substitution to the elasticity of labour demand. In other words, higher wages trigger the larger (smaller) changes in the quantity of labour demanded the less (more) important labour is in total costs. As Rodrik (1997) argues, the increasing mobility of capital means that the demand for labour will generally be more responsive to changes in the factor prices. Firms can substitute other factors of production for immobile workers more easily by investing.²⁷ However, if the industry is specialized in the skill-intensive sector, the own-price elasticity of labour demand should be lower in that industry as in the industry that specializes in the unskilled labour intensive good.²⁸ Then, the shifts in the production technology or an increase in the use of physical capital has also required that workers acquire new skills which increase the demand for human capital (i.e. $\frac{\partial \sigma_{LL_{jg}}}{\partial \tau_j} > 0$) and thus decrease the elasticity of skilled labour demand.

Another substitution effect is the incentive to outsource which is captured by the third and last terms on the right hand side of equation (2.17). By using equation (2.10), in consequence of decreased trade costs (τ_j) it follows that as industry j 's outsourcing

²⁷ Generally, the demand for any factor of production becomes more elastic when the others can respond to changes in the economic environment with greater ease (Rodrik 1997, p. 17). As the costs of capital mobility fall via the removal both of exchange rate risks and the costs of transaction, capital owners are more sensitive to move their capital to a country where it earns higher return. As Rodrik and van Ypersele (2001) explain, in the process of integration real and financial capital are more sensitive to respond to shocks such as changes in productivity or the terms of trade. A negative shock at home may induce a capital outflow abroad. A capital outflow is also liable to affect the marginal productivity of labour, in turn leading to effects on the wages (see, e.g., Keen and Marchand, 1997). An increase in capital productivity tends to increase relative labour costs, which may encourage shifting production determining by higher productivity. Particularly in production with low-skill workers employers can react sensitively to changes in prevailing wages by investing.

²⁸ In the case of labour demand with several inputs, adopting more capital-intensive production will decrease the demand for low-skilled workers and increase the demand for educated workers. Then, a rise in the cost to employers of using the physical capital will decrease the demand of educated workers used at

becomes more elastic (i.e., $\eta_{\psi_{jg}}$ rises) and the probability of outsourcing increase (i.e., ψ_{jg} falls) labour demand becomes more elastic (i.e., η_{LL_j} falls). The smaller is the share of labour-input costs the stronger is the pass-through from the outsourcing-probability to the elasticity of labour demand. Integration thus expands the set of factors industries can substitute indirectly towards in response to higher domestic wages beyond just domestic non-labour factors to include foreign factors as well.²⁹ Whereas, in the skill-intensive industry, when the elasticity of substitution between skilled labour and capital is small ($\sigma_{LL_{jg}} < 1$) with high share of labour-input costs (s_{jg}) and initially low outsourcing-probability (ψ_{jg}) the effect of increased outsourcing-elasticity on the labour-demand elasticity can be compensated partly by the effect of increased outsourcing-probability because of its sign is then negative. The intuition of this counteracting effect of outsourcing is that labour costs become a relatively more important cost-component when a larger fraction of activities are outsourced. We summarize the substitution effects of integration in

Proposition 2 *Lower trade costs with increased integration, higher elasticity of substitution between labour and capital and/or higher elasticity of outsourcing with higher probability of outsourcing will increase the elasticity of labour demand.*

So an integration process should increase the substitution, directly or indirectly, and economic integration should tend to further increase the elasticity of labour demand, especially unskilled.

If product markets are imperfectly competitive, integration can also make product markets more competitive via international trade. Several models of imperfect competition predict that trade liberalization makes demand more elastic, but not infinitely so.³⁰

each level of production. In case of complements, the elasticity of substitution is low so that a rise in the price of capital also leads to a decrease in employment.

²⁹ Slaughter (2001) emphasizes that industries need not actually access foreign factors, the ability to do so is sufficient to increase the elasticity of labour demand.

³⁰ In a perfectly competitive international market the output price decreases as the demand decreases, and firms take the market price of output as given. Supposing decreasing returns to scale, each firm decreases labour demand to the level where price equal marginal cost (see, e.g., Varian 1992, pp. 215-216). The

The market shares of a domestic supplier and a foreign supplier become more sensitive to the relative price, when economies are more integrated. International integration reducing trade frictions and therefore making it easier to shift supplier can have potentially large effects on product-elasticities. Rodrik (1997) argues that, since the demand for labour is a derived demand, which varies proportionately with the elasticity of demand for goods, the integration of goods markets alone makes the demand for domestic labour more elastic because of declining mark-ups.³¹ Trade flattens the demand curve for labour and increases the elasticity of demand for labour.³² However, by using (2.4) and (2.5), differentiation (2.17) shows that in consequence of decreased trade costs (τ_j) as number of products/firms raise (n_j) industry j 's product demand becomes more elastic (i.e., ε_j rises), so does labour demand (i.e., η_{LL_jg} falls), while as advantage of economies of scale raise (a_j) product substitution becomes less elastic (i.e., ϕ_j falls), so does also labour demand (i.e., η_{LL_jg} rises). The larger is labour's share in costs, the stronger is the pass-through from the elasticities of product to the elasticities of labour demand. The number of firms (both domestic and foreign) competing in this industry can arise as a result of integration process, which shifts the foreign output mix towards this industry. An integration process can force domestic firms to face heightened foreign competition. An increase in the elasticity of product demand triggered by more firms increases the elasticities of labour demand.³³ Product demand becomes more price elastic when product markets are more integrated, but is the effect of product market integration on the price sensitivity of the market share larger than its direct effect on the

models of international trade (e.g., Heckscher-Ohlin model) with perfectly-competitive product markets have the extreme result of infinitely-elastic product demand and thus infinitely-elastic labour demand.

³¹ Also, increased information allows firms to respond more effectively to costs differences. Increased comparability means that the labour market impact of changes in profits increase and thus the elasticity of labour demand increases. (See Rauch and Trindade 2000, p. 7.)

³² Rodrik (1997, 1998) explains when the shock of product market is a negative one; there is a larger decrease in employment in the more open economy than there is in the more closed economy. A consequence of integration is greater instability in labour-market outcomes when openness magnifies the effects of shocks on labour demand. An inward shift and a flattening of the demand curve for labour reduce average earnings. Increased trade and investment opportunities for employers make it more costly for workers to achieve a high level of labour standards and benefits. The larger the elasticity of demand for labour, the higher the share of any such costs that must be borne by the workers themselves.

³³ Teffler (1995) discussed that when consumers regard home and foreign product varieties as imperfect substitutes, the overall industry product-demand elasticity depends on the elasticity of substitution be-

market share. For example, individual industry with access to the wider market might be able to expand sales and production taking better advantage of economies scale which can be associated to decreased market imperfection and thus decreased labour demand elasticities. Because of these counteracting effects we cannot conclude that the scale effects of integration tends to increase the labour-demand elasticities. We summarize the scale effects of integration in

Proposition 3 *Lower trade costs with increased integration, higher number of firms and in consequence of its higher elasticity of product demand will increase the elasticity of labour demand, whereas better advantage of economies of scale and in consequence of its lower elasticity of substitution between differentiated products will decrease it.*

Finally (2.17) reveals the following result

Corollary 1 *If $\frac{\partial \phi_j}{\partial a_j} \frac{\partial a_j}{\partial \tau_j} < \frac{\partial \varepsilon_j}{\partial n_j} \frac{\partial n_j}{\partial \tau_j}$ and $\frac{\partial \sigma_{LLjg}}{\partial \tau_j} < 0$, then $\frac{\partial \eta_{LLjg}}{\partial \tau_j} > 0$.*

In summary, the labour-demand elasticity involves two different – substitution and scale - effects of an increase in the degree of integration. In the present set-up, economic integration can change the own-price elasticity of labour demand by increasing/decreasing either both of the product elasticities, demand and substitution, or the elasticity of direct substitution between factors of production and outsourcing activities. The process of integration reduces the trade barriers, and therefore leads to not only more trade, but also more foreign investment. Increased trade, outsourcing, and investment opportunities make firms more sensitive to changes in such costs. When unskilled labour is immobile, and the mobility of other factors is increasing as consequence of integration, workers can be substituted by other workers across national borders, either through trade or through outsourcing. Then, integration can make labour demand more elastic either by making output markets more competitive or by making domestic labour

tween home and foreign varieties. An integration process, which eases substitution, increases the overall industry elasticity of demand and thus the derived elasticity of demand for labour.

more substitutable with foreign factors. However, the effect of integration on the price sensitivity of the market share may be compensated by its direct effect on the market share, i.e. industry's market power can arise from specialization in production and differentiation of products being able to take better advantage of economies scale with segmented markets. In addition, if the industry is specialized in the skill-intensive sector, the shifts in the production technology or an increase in the use of physical capital has also required that workers acquire new skills which increase the demand for human capital making labour demand less elastic. Thus, the effect on labour-demand elasticities of increased integration is more empirical question.

3 ECONOMETRIC MODEL

The elasticities of labour demand are estimated, as Hamermesh proposes, using a log-linear specification where the quantity of factor employment is regressed on real factor prices and real production. In response to the logarithmic form of the conditional labour demand equation (2.15), the parameters correspond to the own-price elasticities of labour demand enabling the described integration effects to be determined on the elasticities. Supposing that the scale returns are constant we estimate constant-output elasticities of labour demand using restricted least squares procedure.³⁴ For each year, this suggests the following regression equation for estimating constant-output elasticities:³⁵

$$(3.1) \quad \Delta \ln(L_{it}) = \alpha_t \Delta \ln(\omega_{it}) + \mu_t \Delta \ln(\Psi_{it}) + \beta_t \Delta \ln(Y_{it}) + e_{it}$$

where L is quantity of labour employed (either both workers types or total workers), ω real labour costs, Ψ real capital costs, Y real output, and $\beta = 1$ with constant output. i indexes plants, and t the year. The individual parameter α is the estimate of the elasticity of labour demand with respect to own price when the production is constant. Hamermesh (1983) argues that the measurement error introduced by average wage

³⁴ In the short run, a change in the price of labour will induce a change in output, i.e. elasticities include the scale effect. The long run elasticities would be estimated without production or with production as constant. (Hamermesh 1986, p. 449.)

measures biases elasticity estimates up towards zero; but with measurement error in other factor prices as well the net bias is unclear. However, if the measurement-error bias is relative constant over time, the true pattern in elasticity time trends is relative unaffected. Thus, as Slaughter (2001) argues, the primary concern should be trends over time in elasticities rather than their levels. It is assumed that there are no significant time lags between the changes of factor price and the plant's labour demand responses. Hamermesh (1983) reports that typical adjustment lags are six months to one year, so in the annual data lags should not be too important at the plant level.

If both scale and constant-output elasticities are consistently estimated, then the difference between these two is the estimate of the scale effect, and it would provide indirect evidence about the competitiveness of product market; and thus it can be determined the impact of integration's scale effects on the labour-demand elasticities. To estimate scale effect elasticities of labour demand for each year, this suggests the following regression equation:

$$(3.2) \quad \Delta \ln(L_{it}) = \Phi_t \Delta \ln(\omega_{it}) + \mu_t \Delta \ln(\Psi_{it}) + \beta_t \Delta \ln(Y_{it}) + u_{it}$$

The individual parameter Φ is the estimate of scale effect labour-demand elasticity when scale returns are not constant. The scale effect β measures the impact of international demand shock on labour demand. This estimate of the instruments of scale effect measures the impact of change in product demand on labour demand. If demand for the product of industry were to increase, more of outputs could be sold at the same price, and thus production level would rise as firms in the industry maximize profits, and this effect would increase the labour demand. We use two different instrument variables: the share of Finland's exports to the EU-countries in production and the share of the output of European Union in production which are deflated by a real competitiveness indicator where euro-country weights are based on Finland's bilateral exports. Both two instruments vary by industry and year. The first attempts to measure foreign demand for Finland's products, and the second attempts to measure the overall demand of European

³⁵ Taking logarithms in conditional labour demand, equation (2.15) yields to the form which is very useful for estimation.

Union. Furthermore, a real competitiveness indicator measures the international product market competition. If these regressors do not adequately control for shifts in the demand of product market then estimates of Φ are likely to be biased upwards. In that case, positive shocks to product-market demand and thus labour demand raise plants' wages for example, because of rent sharing.

Similarly, for each year equation (3.3) can be used to estimate constant-substitution elasticities of labour demand:³⁶

$$(3.3) \quad \Delta \ln(L_{it}) = \rho_t \Delta \ln(\omega_{it}) + \chi_t \Delta \ln(K_{it}) + e_{it}$$

where K is capital stock, and $\chi = 1$ with constant investment. The individual parameter ρ is the estimate of the elasticity of labour demand with respect to own price when the capital stock is constant. If both substitution and constant-substitution elasticities are consistently estimated, then the difference between these two is an estimate of the substitution effect, and it would provide indirect evidence about the international outsourcing activities; and thus it can be determined the impact of integration's substitution effects on the labour-demand elasticities. To estimate substitution effect elasticities of labour demand for each year, this suggests the following regression equation:

$$(3.4) \quad \Delta \ln(L_{it}) = \Gamma_t \Delta \ln(\omega_{it}) + \chi_t \Delta \ln(K_{it}) + u_{it}$$

The individual parameter Γ is the estimate of substitution effect elasticity of labour demand when capital stock is not constant. The substitution effect χ measures the impact of international outsourcing shock on labour demand. This estimate of the instruments of substitution effect measures the impact of change in non-labour inputs demand on labour demand. If demand for the non-labour inputs were to increase induced by increased demand of outputs and thus production level, this effect would increase the labour demand. We use two different instruments: the share of intermediate inputs that are

³⁶ Profit maximization with respect to capital yields the conditional capital demand function, substituting this conditional capital demand into equation (2.15), and taking logarithms yields to the form which is very useful for estimation.

imported from EU-countries in production and the share of the investment of EU countries in domestic investment which are deflated by a real competitiveness indicator. Both two instruments vary by industry and year. The first attempts to measure foreign intermediate input outsourcing, and the second attempts to measure overall substitution between labour and investment.

4 DATA

The elasticities of labour demand are estimated using assembled panel data from the manufacturing sector³⁷ based on a diversity of sources: the Longitudinal Database on Plants in Finnish Manufacturing (LDPM) of Statistics Finland, the Financial Market Statistics of Bank of Finland, the Foreign Trade Statistics of National Board of Customs, and the Industrial Structure Statistics of OECD STAN Database.³⁸ The panel data covers period from 1975 to 2002. Table 4.1 reports summary statistics of the observations. The ideal data here, as Slaughter (1997) argues, would be firm-level data because firms are the relevant units that actually demand factors. However, plant-level data sets do not contain firm-level trade-prices and measurements of foreign demand (supply) for firm-level products (non-labour inputs), so the next best alternative for these integration measurements is using industry-level (2-digit ISIC manufacturing industries) data. Demand estimation requires measures of employment, real factor prices, real investment and real output for all plant-year observations. The deflating variable is a producer price index for (3-digit ISIC) manufacturing industry maintained by Statistics Finland. National Accounts Statistics includes annual data from 1975 through 2002 for manufacturing plants covering variables as production, investment, price of investment, employment (production and non-production workers), and nominal wages and employer social security payments for production and non-production workers. The labour demand is supposed to depend on the labour costs negatively. The higher are labour costs, the slighter is the labour demand. Employment comes directly from the data set as the number of production and non-production workers. For each worker type and total employ-

³⁷ Unfortunately, there are no comparable data for the service sector.

ment I construct real labour costs as nominal annual wages and social security payments deflated by the producer price index and divided by the number of workers. For investment the price index comes directly from the LDPM panel. In case of the substitution, when capital costs rise, the industry substitutes away from capital towards labour.³⁹ Then, the labour demand is supposed to depend on the capital costs positively.⁴⁰

Table 4.1 Variable summary statistics.

Variable (logarithm)	Obs	Mean	Std. Dev.	Min	Max
Production (real)	158181	7.611	1.652	-2.669	15.49
Capital stock (real)	141142	6.116	2.265	-5.433	13.69
Price index of investment	153406	-0.491	0.373	-1.320	0.233
Number of total workers	160203	3.373	1.290	0.000	8.715
Number of production workers	152698	3.123	1.269	0.000	8.402
Number of non-production workers	141412	2.034	1.392	0.000	8.557
Real labour price (total)	160194	2.997	0.484	-1.670	7.150
Real labour price (production)	152688	2.885	0.472	-3.031	6.920
Real labour price (non-production)	141384	3.259	0.515	-1.612	7.587
Exports share (real)	155166	11.13	1.759	-2.364	22.97
EU-output share (real)	155166	17.88	1.738	9.405	28.40
Intermediate inputs share (real)	155166	10.88	2.034	-0.399	23.01
EU-investment share (real)	138432	16.64	2.307	8.981	28.93

For the equations (3.2) and (3.4), I construct a real competitiveness indicator as nominal competitiveness indicator multiplied by terms of trade ratio of export and import prices. The constructed nominal competitiveness indicator for the period 1975 - 2002 is based on Financial Market Statistics maintained by Bank of Finland. The industrial prices of exports and imports are based on Producer Price Indices of Statistics Finland. An increase in the real competitiveness indicator means that an industry's price competitive ability decrease is supposed to decrease the product demand and thus the labour demand. Thus, declining competitiveness indicator should make international product markets more competitive; this should make all factor demands more elastic via the scale effect.

³⁸ The manufacturing industries are included by the standard ISIC classification, excluding petroleum, energy, and quarrying.

³⁹ Empirical studies reviewed by Hamermesh (1993), usually point to a lower degree of substitution between skilled labour and capital than between unskilled labour and capital (see, e.g., Griliches 1969, Bergström and Panas 1992, Biscourp and Gianella 2001).

⁴⁰ Conversely, in case of the complementarity, the labour demand depends on the capital costs negatively.

For the equation (3.2), we use two different instrument variables: the share of Finland's exports to the EU-countries in production and the share of the output of European Union in production. Industrial exports to the EU-countries are based on Foreign Trade Statistics maintained by National Board of Customs. Another instrument variable, the production of European Union for each industry is based on OECD Industrial Structure Statistics. Finally, I construct real output, another of endogenous variables, as nominal production divided by the producer price index. A rise in exports increases the production of industry, which is supposed to increase the labour demand. In theory, the labour demand is supposed to depend on the production positively. If product demand rises and thus production increases, the firms' demand for factors rises. The assumption is that higher export signals better scale economies (or less foreign competition).⁴¹ This makes all factor demands less elastic via the scale effect. On the other hand, the more the rest of the EU accounts for the output of industry, the more competitive that industry is for Finnish firms and thus the more elastic all factor demands will be via the scale effect.

For the equation (3.4), we use two different instruments: the share of intermediate inputs that are imported from EU-countries in production and the share of the investment of EU countries in domestic investment. Imported intermediate inputs from the EU-countries for each industry are based on Foreign Trade Statistics maintained by National Board of Customs. Another instrument variable, industrial investment of European Union is based on OECD Industrial Structure Statistics. Finally, I construct real investment, another of endogenous variables, as nominal investment divided by the producer price index. If demand for the non-labour inputs were to increase induced by increased demand of outputs and thus production level, this effect would increase the labour demand. While, foreign outsourcing and/or international investment provides an alternative to many production-intensive plants and thus decreases dependence on production labour, but also increases reliance on human capital and thus non-production labour. Thus, increased foreign outsourcing and/or international investment is assumed to make demand more elastic, especially for production labour, via the substitution effects.

⁴¹ Péridy (2004) finds using data of four EU countries over the period 1975 - 2000 that exports unambi-

5 EMPIRICAL ANALYSIS

Concerning studies on Finland, Tuomiario (2001) focuses on labour demand adjustment by studying what kind of impact the internationalization of firms in retail and wholesale trade and foreign ownership have had on the structure of the employed labour force and labour demand in Finland over the period 1989 - 1996. The dynamic analysis reveals that exports intensity correlates positively with labour demand in all the age groups and in the lower level educational groups. Furthermore, changes in output or wages have a greater influence on employment in domestically owned companies than in foreign-owned companies.⁴² The study does not focus on the effects of the economic integration on the elasticities of labour demand, but it addresses how the internationalization of firms affects the structure of employed labour force adjustment during the recession. In addition, it considers only the retail and wholesale sector. Also, the period over deep depression is problematic. The study of Ali-Yrkkö and Ylä-Anttila (1997) looks at the effects of foreign direct investment of Finnish industrial firms on exports, production, and employment. The data used in empirical analysis consist of 30 largest industrial firms over the period 1985 - 1995. The results show that in the 1980s foreign direct investment rather complemented than replaced domestic investment. While, in the 1990s foreign production has started to replace domestic production. However, their study does not link directly these international developments to labour markets. In addition, the data consists of only the largest industrial firms, while the labour demand is more flexible in the small and medium-sized firms than in the large firms. In contrast to these work, this study is the first to estimate the labour-demand elasticities using data from the Finnish manufacturing sector and to determine the impact of economic integration on the labour-demand elasticities.

guously rise with the degree of scale economies.

⁴² This result can be explained in part by the fact that foreign-owned companies belong normally in Finland to the largest firms where the elasticity of labour demand is smaller than in the small and medium-sized firms. Piekkola (1998) explains labour demand by the firm's financial position and the corporate profitability using firm-level data. The results show that there is no increase in the wage elasticity of labour demand in the large firms over the period 1986-1995 and in the small and medium-sized firms over the period 1990-1996, aside from that explained by financial distress. The study confirms evidence on that labour demand is more sensitive to the economic cycle in the large firms than in the small and medium-size firms. On the other hand, the labour demand is more flexible in the small and medium-sized firms than in the large firms.

5.1 Estimation strategy

There are some issues to mention regarding the estimation strategy. One is the exogeneity of the regressors in the equation (3.1) - (3.4). As Hamermesh (1986) discusses, some of them might actually be endogenous variables because firms make their output and factor demand decisions jointly. Quandt and Roser (1989) estimated an equilibrium model of the labour market, and used it to test the assumption of production exogeneity. They did not reject the assumption that production is exogenous. Furthermore, for the possibility of endogeneity of investment the presence of capital market imperfections suggests that firms will find it difficult to adjust investment quickly in response to exogenous shocks that may influence employment decisions. If some regressors are endogenous, then least-squares parameter estimates will suffer endogeneity bias, the net direction of which is not clear.⁴³ On the other hand, not only because of this potential problem, we estimate both of constant-output (constant-substitution) elasticities by using least squares, and scale effect (substitution effect) elasticities by using controls as instruments and by supposing that production (investment) is endogenous.

A second issue is that both labour demand and labour supply probably depend on wages which raises the identification problem in estimating equations (3.1) - (3.4). It is therefore not clear what combination of labour-demand and labour-supply elasticities is obtained from regressing labour quantities on labour prices.⁴⁴ Hamermesh (1993) argues that individual firms usually face perfectly-elastic labour supplies. On the other words, firms take exogenous wages as given, and choose employment. In contrast, an entire economy faces perfectly-inelastic labour supply. In the economy level wages are

⁴³ Because the endogenous variable is correlated with the disturbance, the least squares estimators of the parameters of equations with endogenous variables on the right-hand side are inconsistent (see, e.g., Greene, 2000).

⁴⁴ Slaughter (2001) argues that industry elasticity and a national elasticity of labour demand are two conceptually distinct ideas. Both elasticities arise from the profit-maximizing input choices of firms. But industry elasticity describes how the quantity of labour demanded by a single industry responds to a labour cost change, which is exogenous to that industry. Leamer (2000) has emphasized that a national elasticity describes how endogenously determined national wages respond to an exogenous change in labour supply. A sufficiently diversified small open economy may have a national labour demand that is infinitely elastic. For this economy a change in the national labour supply does not change national wages. Conversely, a large country producing a single product under a very flexible technology could have nearly infinite elasticities of labour demand at the industry level but a rather inelastic national elasticity of labour demand.

endogenously determined, and it takes exogenous quantities as given.⁴⁵ In addition, Nickell and Symons (1990) have explained that the identification problem does not really exist anyway since labour supply and labour demand really depend upon two quite different real/nominal wages, one deflated labour costs by the producer price and one deflated net wages by the consumer price index. Although people's decisions take time to respond to industry wages while firms' labour-demand decisions do not, corresponding to the labour supply of national level, the labour supply of industry is supposed to be closer to perfectly elastic than perfectly inelastic. If the identifying assumption of perfectly-elastic labour supply is violated then the estimated labour-demand elasticities will be biased upwards because of the positive correlation between wages and labour supply.⁴⁶ To sum up, we suppose that at plant level the supply of labour is perfectly elastic.

A third issue is that the constructed unit value of average product wage is not a true marginal labour price. Because non-wage labour costs (e.g., training) are not incorporated in labour costs, the data contain measurement error. Different firms employ different skill mixes within each labour group. Thus, different unit values might reflect different skill mixes rather than true differences in labour prices. Time differencing might mitigate the measurement error due to missing non-wage labour costs.

Taking time differences also controls for unobserved time-invariant industry fixed effects influencing the labour-demand level. However, time-differencing can also aggravate regressor measurement error and result in inconsistent estimates.⁴⁷ To minimize

⁴⁵ The converse of asking, as we have, what happens to the choice of inputs in response to an exogenous shift in a factor price is to ask what happens to factor prices in response to an exogenous change in factor supply. The elasticity of complementarity measures the percentage responsiveness of relative factor prices to a one percent change in factor supplies in the long run. (See Hamermesh 1986, p. 434.)

⁴⁶ If more than one theory is consistent with the some data, we have no way of determining which of equilibrium of demand and supply the right one is. Then, it is obvious that there will not be a solution i.e., reduced form cannot be transformed back into a structure. Thus, the structure underlying the data is under-identified. Because of this identification problem least squares will be biased. One of technique is to use instrumental variables to overcome this problem, if there exists a valid instrumental variable which is correlated with the exogenous variables, but not with the error term. The data do not contain a valid instrumental variable that is plausibly included in the equation of labour supply but excluded from the equation of labour demand that can be used to shift labour supply along labour demand. The model is not estimable without restrictions i.e., supposing that labour-supply elasticities shift with labour-demand elasticities. (See Greene, 2000, pp. 654-666.)

⁴⁷ Hsiao (1986) argues that if variables are indeed subject to measurement errors, exploiting panel data to control for the effects of unobserved individual characteristics using standard differenced estimators may result in even more biased estimates than simple OLS estimators using cross-sectional data alone.

this inconsistency, as Griliches and Hausman (1986) suggest, we estimate equations (3.1) - (3.4) using long differences, three-year and five-year differences. When the concern focuses on trends over time in elasticities rather than their levels, then the bias of measurement might not influence decisively. Another advantage of longer differences is that over longer time horizons the maintained identifying assumption of perfectly-elastic labour supplies is more likely to hold.⁴⁸

Slaughter (2001), adopting a two-stage approach, regresses estimated elasticities on several plausible measures of international trade in second stage. However, the theoretical model on which we base our empirical analysis has the feature of producing labour-demand elasticities and determining the integration effects on the elasticities in one stage, so avoiding the econometric difficulties of two-stage procedures. One issue is the fact that the dependent variable in stage-two regression equation is estimated, not observed which means that the error term is heteroskedastic. Supposing that economic integration has influenced own-price labour-demand elasticities, it is necessary to determine elasticities for during process of integration, i.e., supporting the hypothesis of inter-time heterogeneous coefficients. To allow time-variation within elasticities over integration process, we estimate manufacturing-wide elasticities for each year from as far as 1975 through 2002 using common intercepts over pooled plants. For the equations (3.1) and (3.3), to estimate constant-output elasticities and constant-substitution elasticities we use generalized least squares estimation (GLS); and for the equations (3.2) and (3.4), to estimate scale effect elasticities and substitution effect elasticities we apply instrumental variables estimation (G2SLS).⁴⁹ In fact, we adopt GLS estimation procedure which allows for heteroscedasticity with cross section correlation.⁵⁰

⁴⁸ As Slaughter (2001) discusses, industry-specific skills obtained on the job might tend to make industry labour supply more inelastic. Longer time horizons should make this supply more elastic by allowing people more opportunity to break these industry attachments.

⁴⁹ By adopting a dynamic approach we also estimated elasticities specifying dynamics in terms of lags of the dependent variable and a distributed lag structure for the independent variables. However, it shown that the estimators of this dynamic approach perform worse than differenced estimators. The difficulty is that the lagged dependent variable is correlated with the disturbance, even if it is assumed that error term is not itself autocorrelated.

⁵⁰ The heteroskedasticity means that the variances of the error terms are not constant across observations, but may arise with the value of observation. Thus, the estimators are not efficient. (See, e.g., Greene, 2000.) Anderson (1993) explains controlling for heteroskedasticity would require weighting observations which estimated elasticities are relatively imprecise. The logic of weighted least squares (WLS) is that observations with smaller variances receive a larger weight and therefore have greater influence in the

5.2 Literature survey

An interesting attempt to test for the labour market implications of changes in the degree of openness is Slaughter (1997).⁵¹ Slaughter's (1997) study is the first to estimate the time patterns for U.S. elasticities of labour demand and then correlate these estimates with measures of international trade. The paper comes close to a direct test of the FPI-theorem. The idea behind the test is that, as the U.S. economy became more open from 1960 to 1991, the absolute elasticity of labour demand in individual industries should have become larger. Richardson and Khripounova (1998) also estimate the time pattern of U.S. labour demand elasticities, but their approach is patterned after the regressions of Slaughter. Slaughter's empirical work yields three main results. First, demand for production labour became more elastic in manufacturing overall and in five of eight industries within manufacturing. Second, the demand of non-production labour did not become more elastic in manufacturing overall or in any of the eight industries within manufacturing. Third, the hypothesis that trade contributed to increased elasticities has mixed support, at best. The time series of elasticities of labour demand are explained largely by a residual, time itself. Richardson and Khripounova (1998) search for linkages between the growing integration of U.S. markets with the global economy (determined by different trade conceptions) and the apparent decline in the market power of the American workers (determined by elasticity of labour demand). Their regressions are specified as closely as possible to the regressions of Slaughter. They considered not only production and non-production workers, but also workers of different education. Conclusion of their research is that from 1984 through 1991 growing global integration weakened the market power of less-skilled workers relative to more-skilled, and probably relative to employers. But they did not find that globalization weakens the market power of more skilled workers. A similar methodology has been applied by Faini et al. (1998) for Italy with labour-demand elasticities estimated on the period 1985-1995 distinguishing 14 manufacturing industries. They find weak support to the hypothesis that greater globalisation is associated with larger elasticities. Greenaway et al. (1999)

estimates; similarly, observations with greater variances receive a smaller weight and therefore have smaller influence in the estimates (Greene 2000, p. 512).

⁵¹ A later version of this paper has been published (2001) in the *Journal of International Economics*.

evaluate the impact of trade volumes on employment through induced productivity changes, and the impact of trade changes on the slope of the derived labour demand introducing a term corresponding to interactions between the wage rate and import and export volumes. Adapting a dynamic labour demand framework for the UK, they find not significant and weak positive impact of import and export volumes on the labour-demand elasticity in manufacturing industries over the period 1979 to 1991. Adopting a different methodology and focusing on the intersectoral dimension of the scale effect of trade, Jean (2000) finds for France that openness can indeed have a significant effect on the labour-demand elasticities.

Bruno et al. (2001) test the impact of globalisation on the elasticities of labour demand using an industry-year panel for a number of industrialized countries including major European countries, Japan and the U.S. over the period 1970-1996. They focus to evaluate the substitution effect of trade by estimating a dynamic specification. Overall they did not find any significant effect of trade on labour demand elasticity. The only exception is France which seems to confirm the findings of Jean (2000). Andersen et al. (2001) estimate time varying employment relations in the manufacturing sector for EU countries over the period 1970 to 1999. Their empirical analysis of employment takes explicitly into account that international integration changes the elasticity of labour demand. The empirical model is non-structural in the sense that the sources that potentially cause elasticities over time cannot be identified. They suppose that the various channels of integration have qualitatively different effects on the elasticity of employment, i.e. the effects running via product markets and via possibilities for outsourcing may run in opposite direction in respect to the level of employment. Their preliminary results support the approach of not treating the parameters of labour demand as constant.

The experience of dramatic changes in trade regimes in a number of developing countries might be thought as the appropriate context to investigate the link between openness and the elasticity of labour demand. This approach has been followed by Krishna et al. (2001), Fajnzylber and Maloney (2000), Hasan et al. (2003), and Haouas and Yagoubi (2004). Krishna et al. (2001) test the impact of trade liberalization on the elasticities of labour demand using Turkish manufacturing plant-level data from years 1983-1986. The 1984 import liberalization program significantly reduced both tariff and

non-tariff barriers in Turkey. They use the volume of import, estimates of protection (tariff and non-tariff) change, and Levinsohn's (1993)⁵² estimates of mark-up changes as basic measures of trade liberalization. The results suggest that the linkage between greater trade openness and labour demand elasticities may be empirically quite weak. Also, only very mixed support and no consistent patterns for the idea that trade liberalization has an impact on own wage elasticities emerges in the study by Fajnzylber and Maloney (2000). They use dynamic panel techniques to estimate labour demand functions for manufacturing establishments in Chile, Columbia and Mexico. Hasan et al. (2003) use various specifications, constant-output, constant-capital, and partial-adjustment labour-demand models, and their various meaningful combinations using industry-level data disaggregated by states from 1980 to 1997. They find a positive impact of trade liberalization on labour-demand elasticities in the Indian manufacturing sector. Furthermore, they find that these elasticities are not only higher for states with more flexible labour regulations but also larger impacted by trade reforms. Haouas and Yagoubi (2004) investigate the effects of trade liberalization on the elasticities of labour demand using data from 1971 to 1996 for manufacturing industries in Tunisia. Their results show a weak support for the idea that openness will lead to an increase in elasticities. However, results are robust to the type of labour, contract and permanent labour, which supports the conclusion that in liberalization the labour markets of Tunisia have become more flexible.

Revenge (1992), Abowd and Lemieux (1993), Borjas and Ramey (1995), Driffill et al. (1998), Burda (1999), Boeri et al. (2000), and Haffner et al. (2000) do not focus on the elasticities of labour demand, but they do address how the competitiveness of product market affects wages and/or employment. Revenge (1992) investigates the effect of increased import competition on U.S. manufacturing employment and wages, using data on a panel of manufacturing industries over the period 1977-1987. The empirical analysis uses industry import price data and an instrumental variables estimation strategy.

⁵² Levinsohn (1993) and Harrison (1994) use firm-level data to study how trade liberalization affects the competitiveness of product market in manufacturing. Levinsohn (1993) finds using Turkish data from 1983 to 1986 that after trade liberalization, the demand of product market became more elastic. Using a panel of manufacturing firms in the Ivory Coast, Harrison (1994) presents evidence on that the impact of liberalization on competition leads to biased estimates of the relationship between trade reform and productivity growth. Neither study links these developments of product market to labour markets.

The estimates suggest that changes in import prices have a significant effect on both employment and wages. Abowd and Lemieux (1993) study how international price competition affects the negotiated wage settlements and employment. Their data include a sample of Canadian collective bargaining agreements from 1965 to 1983. They conclude that standard estimates of rent-sharing based on contract data seriously understate the impact of product market competition on negotiated wage settlements. Borjas and Ramey (1995) study how foreign competition reduces firms' power in the product market and thus labour rents. They suppose that the impact of foreign competition on the relative wages of less skilled workers depends on the market structure of the industry penetrated. The empirical evidence indicates that employment changes in a small group of trade-impacted concentrated industries can explain not only part of the aggregate rise in wage inequality in the United States, but also some of the differences in the trends in wage inequality in overall. Driffill et al. (1998) investigate how a reduction in non-tariff barriers effects on wages using a cross-section of UK manufacturing data set from the 1990s. They suppose that when economies become more integrated through the removal of tariff and other barriers to trade, resulting in an increase in competition in product markets, there should be effects on wage and employment outcomes in labour markets, particularly those in which unions are active. Their results show that a reduction in non-tariff barriers from high to medium level appears to have a negative effect on wages, both for union and non-union establishments, but particularly for unskilled workers. Burda (1999) surveys the effects of EMU on the functioning of labour and product markets and the relative importance of real and nominal rigidities. He finds empirical evidence of increasing nominal rigidities and decreasing real rigidities within EMU countries using 1961-1996 data. The results support that the real rigidities in labour markets will come under increasing pressure from integration. Boeri et al. (2000) identify the impacts of changing profile of product and labour market regulations on employment across OECD countries. They construct regulation indicators, such as employment protection and barriers to trade and investment, for period 1982-1995. They find that countries with restrictive product market regulation and tight employment protection legislation tend to have lower employment rates. In particular, the stronger integration in the EU area does not seem to have been associated so far with convergence in a number of labour market institutional features, such as employment protection, collective bargain-

ing, as well as the size and structure of social benefits. Haffner et al. (2000) investigate whether European market integration, competition policies and the EMU provide sufficient incentives to countries for increasing competitive pressures needed to make labour markets more flexible. They use indicators, such as convergence of price structures, trends of profit margins, and degree of product and labour market regulations, over the past two decades. They find evidence that both product market competition and labour market flexibility have been fostered by integration. However, there is still considerable scope for increasing competitive pressures within the EU.

5.3 Estimation results

Our estimated elasticities of labour demand for total labour and each labour type (production and non-production) are presented in figures 5.1, 5.2, 5.4 and 5.5. Figures plot manufacturing-wide elasticities each year for the each specification using three-year and five-year differencing. To represent better the underlying trends, as Slaughter (2001) argues, the figures plot three-year moving averages of the estimated elasticities. The estimates seem very plausible and well estimated. For all specifications their estimates lie within the range of $[-0.09, -0.80]$ that Hamermesh (1993) proposes as plausible based on his literature survey. Furthermore, all point estimates are negative, and all are statistically significant. Overall, unskilled labour is found, as expected, to have somewhat higher wage elasticities in absolute terms than skilled labour. In addition, these patterns are very consistent across both the three-year and five-year differenced specifications.

In figures 5.1a, 5.1b and 5.1c is presented estimated constant-scale-return labour-demand elasticities for total, production and non-production labour, and in figures 5.2a, 5.2b and 5.2c estimated scale effect labour-demand elasticities. The basic result is that labour demand became more elastic over integration. Constant-output elasticities of total labour demand declined steadily, except during deep depression early 1990 in Finland,⁵³ to around -0.75. Also, by using instruments we see that total labour demand became more elastic during 1980s and 1990s. Unexpected, there is more relative growth

⁵³ Labour demand is more sensitive to the economic cycle than integration process during deep depression.

in elasticities for non-production labour than production labour. Furthermore, we see that own-price demand elasticities of both labour types are underestimated. The difficulty is that the aggregation of labour inputs by the production function is an arbitrary description of technology. If the labour sub-aggregates are not separable from non-labour inputs, one will underestimate own-price demand elasticities, and infer that the types of labour are greater price-substitutes than in fact they are. Because of this problem of the separability of inputs and thus underestimated elasticities for both labour types I assess the effects of integration on the elasticities only for total labour demand. The scale-effect labour-demand elasticity estimates express changes in product-market competitiveness working through the scale effect. In comparison to the constant-output elasticity estimates the scale-effect elasticity estimates seem more plausible and well estimated. According to the correlation squares (R^2), GLS-estimator performs better overall, within and between by using instruments than supposing constant scale return.⁵⁴

If both constant-output and scale-effect elasticities of labour demand are consistently estimated then the difference between these two is an estimate of the scale effect. In figure 5.3 is presented how much estimates of the instruments provide indirect evidence – i.e. decreasing unexplained difference - about the scale effects of integration on the elasticities. Although, our instruments may not adequately control for shifts in product-market demand, we note that the difference between constant-output and scale-effect elasticities of labour demand became nearer an estimate of the scale effect⁵⁵ over integration (except during deep depression). This result provides support for the hypothesis that economic integration has contributed to increased elasticities of labour demand via scale effects.

⁵⁴ For example, the R -sq (within) of last year (5-year differencing) for total labour demand is 0.3086 by using instrument and 0.1036 by supposing constant scale effect. For brevity, all R -sq (overall, within and between) and CHI -sq statistics for each year, each specification, total labour and both labour types, and both differencing are not reported. In summary, some statistics for the few years, each specification, total labour, and 3-year differencing are provided in the Appendix 1.

⁵⁵ For total labour demand the scale-effect estimates lie within the range of [0.26, 0.55], and they all are statistically significant. The positive sign of this coefficient shows that in the short run an increase in demand of outputs is associated with an increase in demand of all inputs.

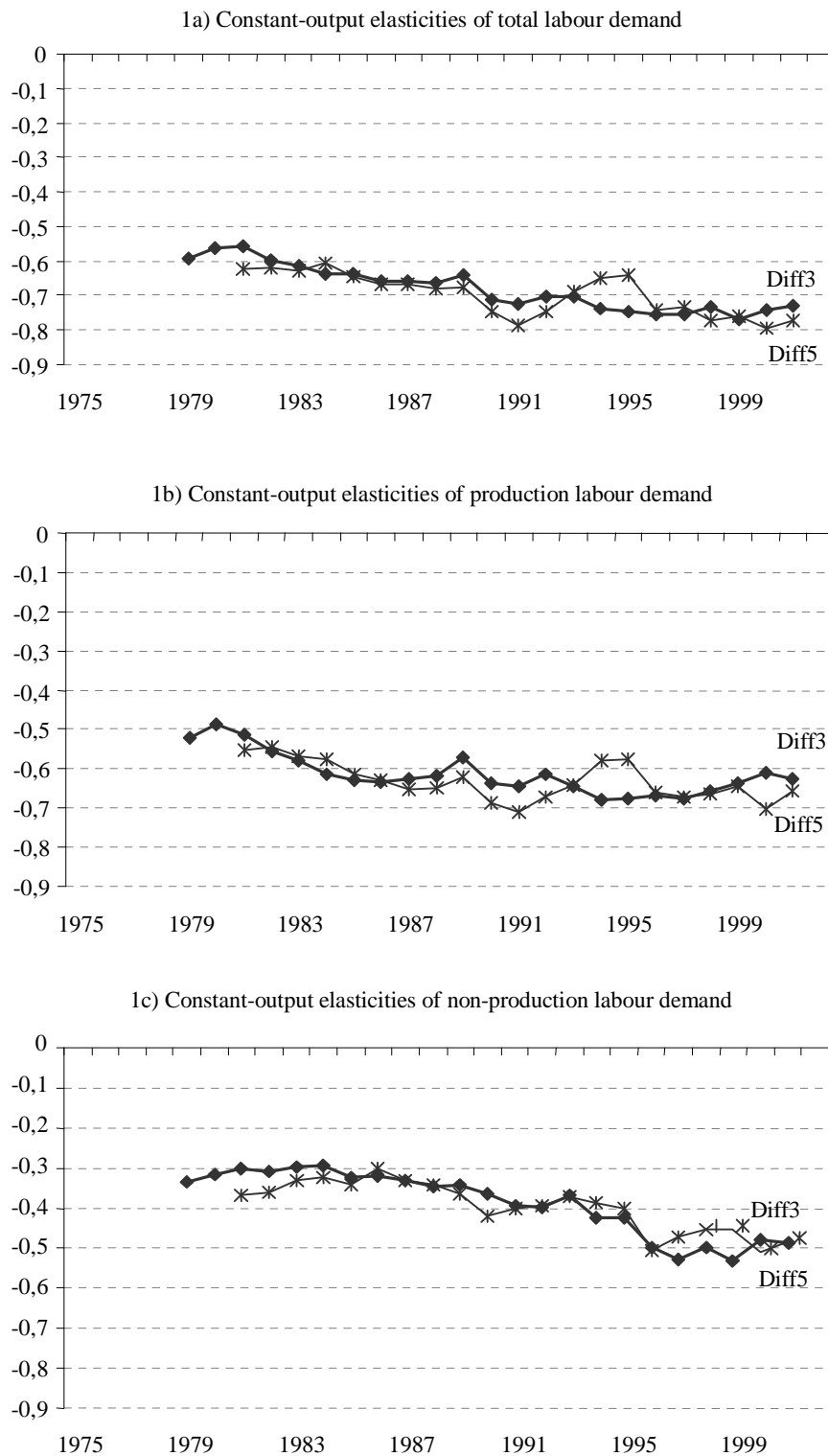


Figure 5.1 Estimated constant-output labour-demand elasticity (3-year moving averages of 3-year and 5-year differencing) estimates for total labour (a), production labour (b), and non-production labour (c). The specification is (3.1) $\Delta \ln(L_{it}) = \alpha_i \Delta \ln(\omega_{it}) + \mu_i \Delta \ln(\Psi_{it}) + \beta_i \Delta \ln(Y_{it}) + e_{it}$.

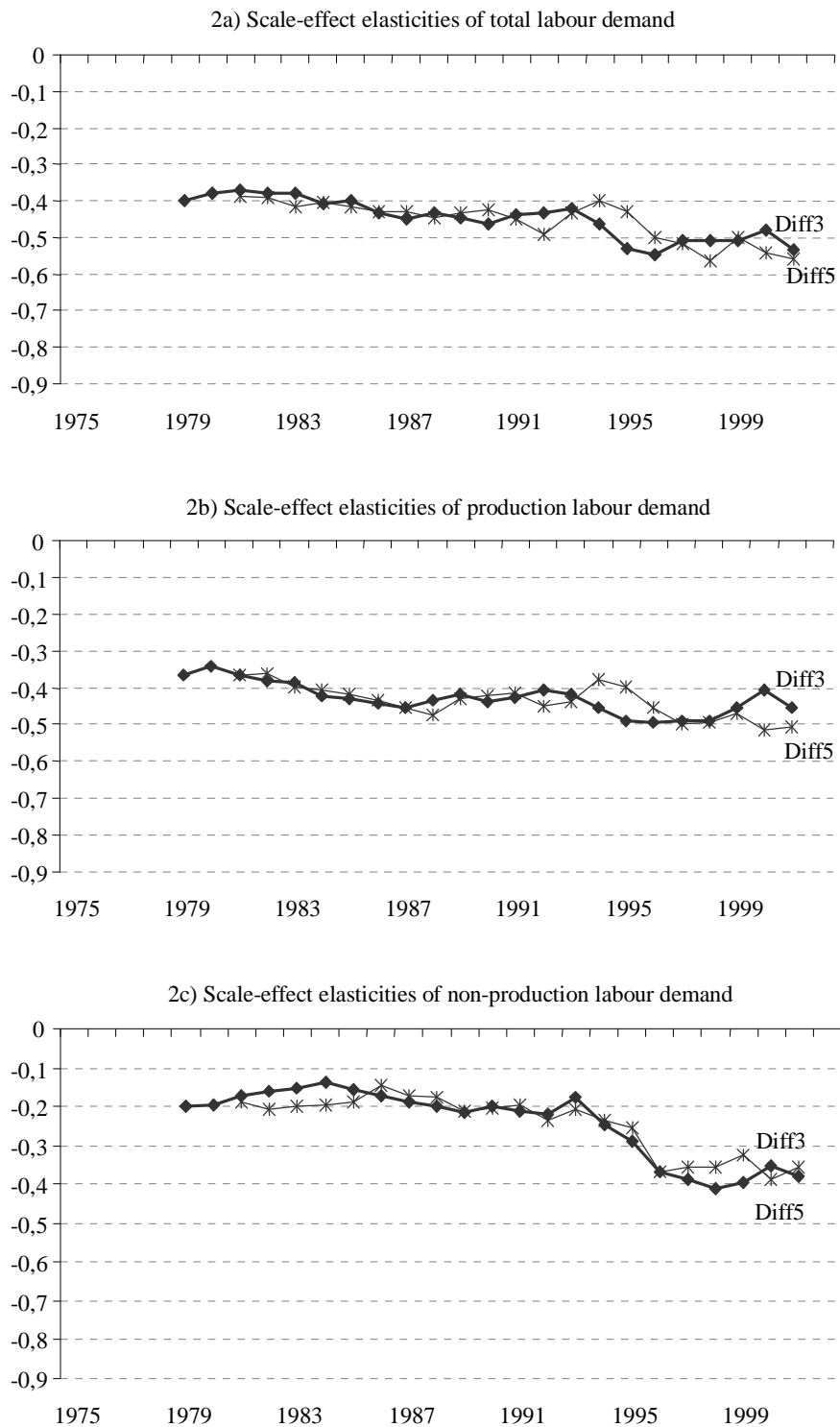


Figure 5.2 Estimated scale-effect labour-demand elasticity (3-year MA of 3-year and 5-year differencing) estimates for total labour (a), production labour (b), and non-production labour (c). The specification is (3.2).

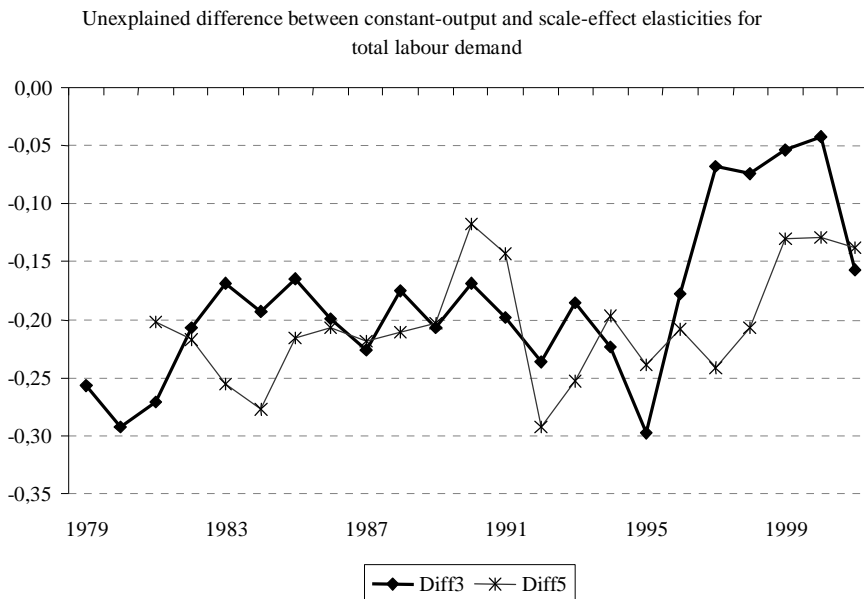


Figure 5.3 How much scale-effect estimates do not explain difference between constant-output and scale-effect labour-demand elasticity estimates for total labour.

In figures 5.4a, 5.4b and 5.4c is presented estimated constant-substitution labour-demand elasticities for total, production and non-production labour, and in figures 5.5a, 5.5b and 5.5c estimated substitution-effect labour-demand elasticities. We see that there is growth in capital-constrained elasticities for all labour types over integration, although labour demand became less elastic during deep depression. Constant-substitution and substitution effect elasticities of total labour demand declined to around -0.4. Unskilled labour is found, as expected, to have somewhat higher wage elasticities in absolute terms than skilled labour. Empirical studies usually point to a lower degree of substitution between skilled labour and capital than between unskilled labour and capital. The integration forces changing labour substitutability by making labour less/more easily substituted for foreign factors of production depending on complementarity between human capital and physical investment. Surprisingly and counter-intuitively, there is more relative growth in elasticities for skilled labour than unskilled labour. Because of problem of the separable of inputs, as discussed above, I assess the substitution effects of integration on the elasticities only for total labour demand in case of the gross substi-

tution. Under gross substitution between labour and capital the labour demand is supposed to depend on the capital costs positively.⁵⁶ For example, in specifications (3.1) and (3.2) the coefficient of gross elasticity has mostly positive and statistically significant sign for total labour demand. The substitution-effect labour-demand elasticity estimates express changes in international outsourcing working through the substitution effect. In comparison to the constant-substitution elasticity estimates the substitution-effect elasticity estimates seem more plausible. According to the R^2 s, GLS-estimator performs better overall, within and between by using instruments than supposing constant capital stock.⁵⁷

If both constant-substitution and substitution-effect elasticities of labour demand are consistently estimated then the difference between these two is an estimate of the substitution effect. In figure 5.6 is presented how much estimates of the instruments provide indirect evidence about the substitution effects of integration on the elasticities. Although, our instruments may not adequately control for shifts in international outsourcing, we note that the difference between constant-substitution and substitution-effect elasticities of labour demand became nearer an estimate of the substitution effect⁵⁸ over integration (except late1980). This result provides support for the hypothesis that economic integration has contributed to increased elasticities of labour demand via substitution effects.

⁵⁶ Conversely, in case of the complementarity, the labour demand depends on the capital costs negatively.

⁵⁷ For example, the R-sq (within) of last year (5-year differencing) for total labour demand is 0.1078 by using instrument and 0.0255 by supposing constant capital stock.

⁵⁸ For total labour demand the substitution-effect estimates lie within the range of [0.045, 0.226], and they all are statistically significant. The positive sign of this coefficient shows that in the short run higher demand of non-labour inputs induced by increased demand of outputs is associated with higher employment.

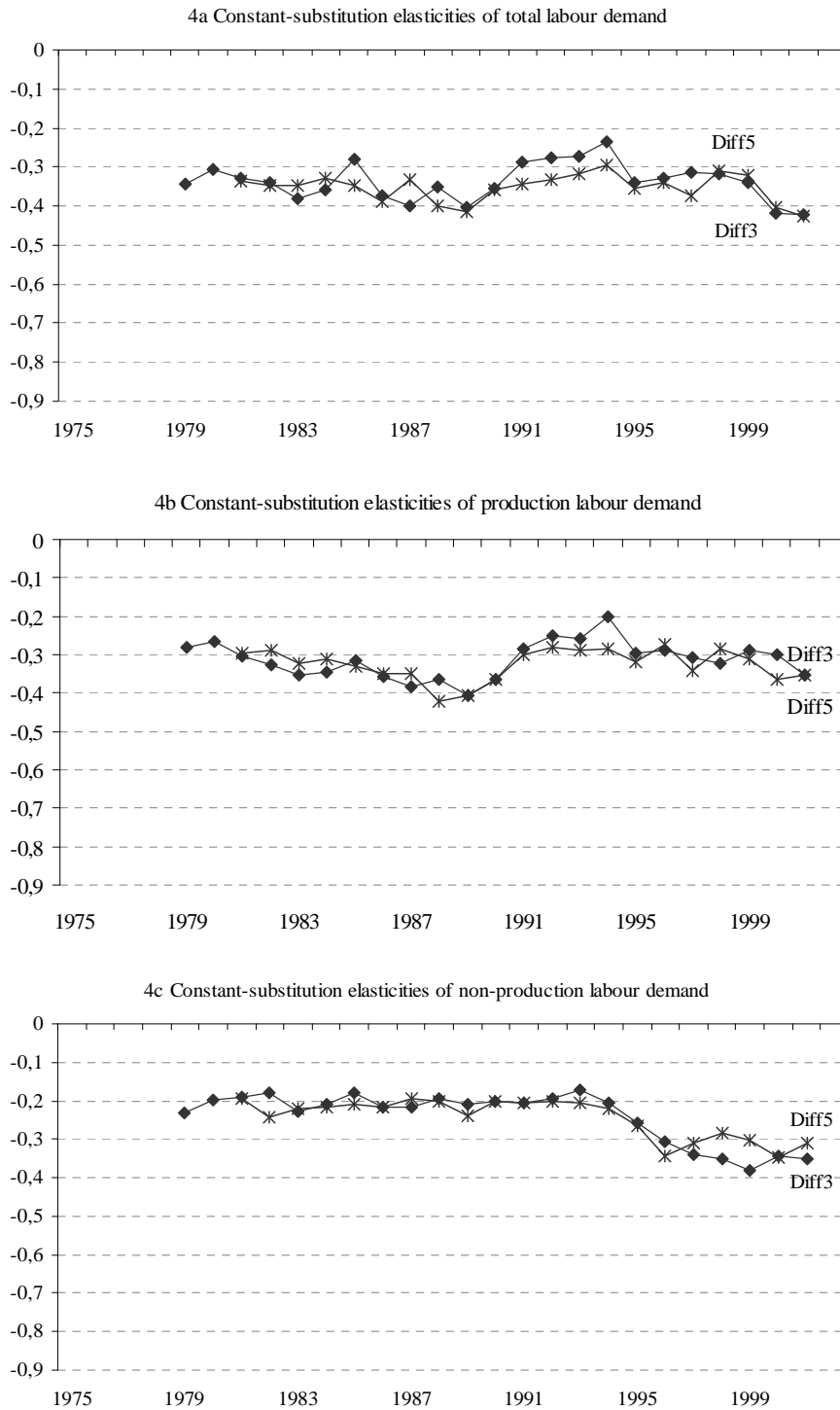


Figure 5.4 Estimated constant-substitution labour-demand elasticity (3-year MA of 3-year and 5-year differencing) estimates for total labour (a), production labour (b), and non-production labour (c). The specification is (3.3) $\Delta \ln(L_{it}) = \rho_i \Delta \ln(\omega_{it}) + \chi_i \Delta \ln(K_{it}) + e_{it}$.

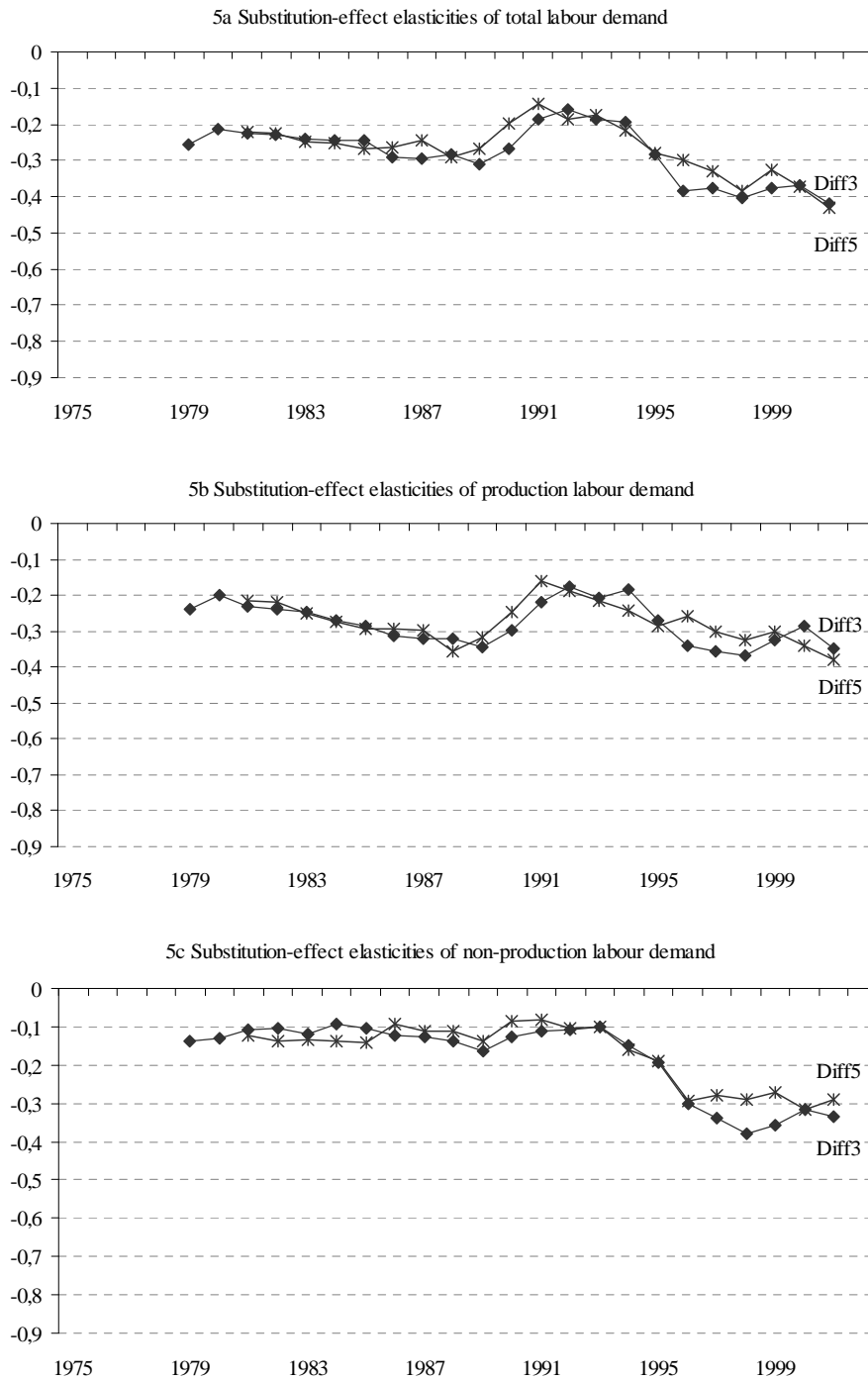


Figure 5.5 Estimated substitution-effect labour-demand elasticity (3-year MA of 3-year and 5-year differencing) estimates for total labour (a), production labour (b), and non-production labour (c). The specification is (3.4).

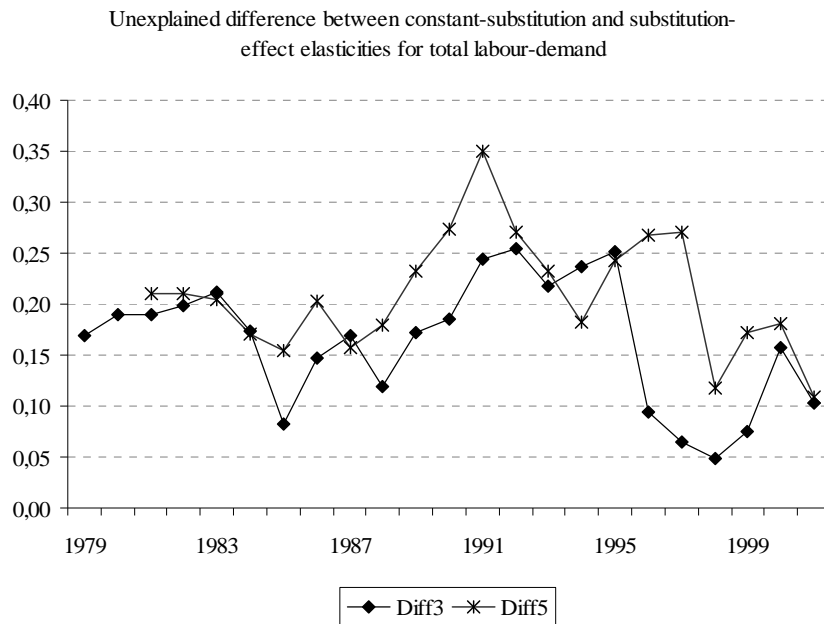


Figure 5.6 How much substitution-effect estimates do not explain difference between constant-substitution and substitution-effect labour-demand elasticity estimates for total labour.

6 CONCLUSIONS

The purpose of this study has been twofold to investigate the effects of the economic integration on the elasticity of labour demand with own price by using theoretical model and empirical analysis. We build the theoretical framework for estimating the elasticities of labour demand and determining the effects of economic integration on the elasticities. In a general theoretical model of intra-industry trade, we analyzed how economic integration changes the labour-demand elasticity. A model captures both effects running from product markets, the scale effects, as well as factor substitutions possibilities, the substitution effects, to the elasticity of labour demand. We show that intensified trade competition increases the labour-demand elasticity, whereas better advantage of economies of scale decreases the labour-demand elasticity by decreasing elasticity of substitution between differentiated products. If integration gives rise to an increase in input-substitutability and/or outsourcing activities, labour demand will become more elastic.

We structured the econometric model in which the aim is to determine whether European integration has changed the own-price elasticities of labour demand in Finland using data from the manufacturing sector from 1975 to 2002. We find that over time demand for total, production and non-production labour has become more elastic in manufacturing overall. However, it is shown that there is unexpected more relative growth in elasticities for non-production labour than production labour. Furthermore, we noted that own-price demand elasticities of both labour types are underestimated. Because of problem of the separable of inputs and thus underestimated elasticities for both labour types we assessed the effects of integration on the elasticities only for total labour demand. If both constant-output (constant-substitution) and scale-effect (substitution-effect) elasticities of labour demand were consistently estimated then the difference between these two is an estimate of the scale effect (substitution effect). We noted that the difference between constant-output (constant-substitution) and scale-effect (substitution-effect) elasticities of labour demand became nearer an estimate of the scale effect (substitution effect) over integration. These results provide support for the hypothesis that economic integration has contributed to increased elasticities of labour demand.

Finally, the study points up potentially interesting area for future research. One area for further research would be to extend the integration model to capture the effect of increasing labour-demand elasticities on wage formation and thus on the structural unemployment. Our findings have important challenges for policy-making with economic integration implicating the role of profit-sharing and labour productivity.

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APPENDIX 1. Some regression results for total labour demand

Method (3-year differencing)	Equation (3.1) GLS		Equation (3.2) G2SLS		Equation (3.3) GLS		Equation (3.4) G2SLS	
3-year average: 1979 - 1981								
Constant	-0,111	(-8,69)	-0,057	(-5,76)	-0,268	(-27,9)	0,038	(7,67)
Production			0,476	(72,9)				
Capital stock							0,096	(18,2)
Capital costs	0,104	(2,37)	0,211	(6,26)				
Labour costs	-0,561	(-42,7)	-0,378	(-37,4)	-0,308	(-13,2)	-0,214	(-18,1)
R ² (within)	0,100		0,261		0,011		0,029	
CHI ²	1834,32	[2]	5848,89	[3]	176,06	[2]	637,07	[3]
3-year average: 1989 - 1991								
Constant	0,003	(0,45)	0,008	(1,60)	-0,253	(-25,2)	-0,040	(-8,53)
Production			0,417	(78,3)				
Capital stock							0,098	(20,8)
Capital costs	0,149	(4,82)	0,058	(2,51)				
Labour costs	-0,712	(-47,5)	-0,464	(-42,9)	-0,356	(-14,3)	-0,269	(-20,5)
R ² (within)	0,159		0,377		0,018		0,065	
CHI ²	2309,71	[2]	6898,37	[3]	205,48	[2]	820,54	[3]
3-year average: 2000 - 2002								
Constant	-0,045	(-3,46)	0,012	(1,40)	-0,047	(-3,76)	0,021	(2,89)
Production			0,351	(43,4)				
Capital stock							0,100	(10,6)
Capital costs	0,272	(1,73)	0,027	(0,33)				
Labour costs	-0,728	(-25,0)	-0,534	(-26,4)	-0,422	(-11,2)	-0,418	(-17,9)
R ² (within)	0,088		0,281		0,025		0,089	
CHI ²	632,21	[2]	2325,41	[3]	127,47	[2]	433,97	[3]

Notes: (1) Values of t-ratios are reported in parentheses. (2) Degrees of freedom are presented in square brackets.