Employment in Domestic Plants and Foreign Affiliates: A Note on the Elasticity of Substitution

Michael Pfaffermayr

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Abstract:
For high wage countries, such as Austria, it is commonly expected that the growing employment in foreign affiliates abroad substitutes jobs at home. This note uses bilateral data on foreign and domestic activities of Austrian manufacturing over the period 1989-1990 covering the 10 most important host countries and 7 industrial sectors. The level equations of relative labour demand in the small three-way panel indicate a low and insignificant elasticity of substitution between employment at home and employment in foreign affiliates Allowing the substitution elasticity to vary across industries reveals significant, but likewise inelastic substitution in some industries. In contrast, in a dynamic framework formulated in first differences an elasticity of substitution greater than one has been found. The size of total demand as well as plant specific relative labour productivity, however, seem to be the more important determinants of relative labour demand.

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Austrian Institute of Economic Research
P.O. Box 91
A-1103 Vienna
Austria
Email: pfafferm@wsr.ac.at

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Michael Pfaffermayr[*)]

I Introduction

The massive increase in direct investment during recent years has led to controversial discussions over the role of multinational firms (MNEs). The removal of trade and investment barriers, the liberalisation of market access in most economies - especially the opening up of Eastern European and Asian markets - and the advances in telecommunications technology have made it much easier for firms to produce abroad. From the home country's point of view, there is growing concern about the substitution of exports and domestic investment resulting in diminished demand in domestic labour markets and/or decreasing wage rates. On the other hand, outward direct investment is an important strategy for corporate restructuring, firm growth and for gaining competitiveness in the world markets. With production facilities in foreign countries domestic based MNEs achieve enhanced possibilities to adjust labour and capital inputs and to exploit factor price differentials across countries. From a high wage country's point view, such as Austria, negative labour market consequences are commonly expected to be most harmful in labour intensive industries and in the low-skill, low-wage segment of the labour market. Whether and to which extent this assertion holds true depends to great deal on the nature of foreign investment. Horizontal investments abroad may reduce domestic labour demand. Market orientated investments in downstream activities like services and distribution or in upstream-production stage on the other hand may well increase labour demand at home by inducing further intrafirm-exports. The responsiveness of domestic labour to foreign direct investment abroad, especially to horizontal direct investments induced by changes in relative wages, is thus an empirical matter.

This note contributes to the discussion by estimating the elasticity of substitution between employment in foreign affiliates and domestic employment for Austrian manufacturing at the industry bilateral-country level for the 10 most important host countries. Data cover the period 1989-1994 and include the neighbour transition countries, Czech and Slovak Republic[1], and Hungary that received a relatively large share of Austrian outward direct investment in recent years. This allows the estimation of the responsiveness of relative labour demand over a wide range of relative wage levels. Although it cannot be claimed that the current pattern of adjustment during the transition period will prevail in the future, the estimates may nevertheless give some indication of the degree of substitution between employment at home and in foreign affiliates.

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1 Since their separation both are treated as one country. Only labour unit costs refer to the Czech Republic.

II Labour demand of home plants and foreign affiliates: a simple specification for estimating their elasticity of substitution

Consider a multinational enterprise (MNE) which is horizontally and vertically integrated across borders. Conceptually, a MNE allocates labour in foreign affiliates to two activities: (1) production of endproducts[2], q_F, (horizontal integration), and (2) additional downstream activities like services and distribution, z_F. As in traditional models horizontal activities are based on a trade-off between plant economies and scale and transportation costs (Horst, 1971, Brainard, 1993, Pfaffermayr, 1997) which are captured by the elasticity of substitution between exports, *x*, and foreign production, q_F. To keep the analysis tractable, assume the plants at each location operate under a linear cost structure: $c_i(q_i) = a_i w_i q_i \;, i = H,F$ with q_i denoting the output, w_i the wage rate[3] at home and abroad. Additionally, firms have the option to export. In contrast to previous models (Brainard, 1993, Markusen, Venables, 1995) where either export or setting-up plants abroad as exclusive options are considered, in the present setting MNEs may do both. The motivation is that significant diseconomies of scale at the plant level or rising marginal transportation costs may induce firms to operate more than one plant as usually they do not give up exporting completely. In the present setting this implies that exports and foreign production are imperfect substitutes. So the higher transportation costs are, the more MNEs rely on local production even if marginal costs are higher abroad. On the other hand with low transportation costs and a high elasticity of substitution between locally produced goods and traded goods it pays more to concentrate production in the lower cost plant the larger economies of scale. This relationship can be captured by imposing $y_F = \left(q_F^{-t} + (Tx)^{-t}\right)^{-\frac{r}{t}}$ with $t > -1$ and $T \geq 1$ as additional iceberg-transportation cost parameter. Corner solutions are ruled out for the moment and considered below. The MNE chooses $x \leq s_F$ to minimise total costs given by

$$(1) \quad \min_{x,q_F} c_H(x) + c_F(q_F) \quad s.t: \left(q_F^{-t} + (Tx)^{-t}\right)^{-\frac{d}{t}} = y_F$$

Denoting the Lagrange multiplier by l, differentiating and using $c_i' = a_i w_i \;, i = H,F$ gives relative labour demand for the horizontal activities[4]:

$$(2.1) \quad c_H' - l\left(-\frac{r}{t}\right)\left(q_F^{-t} - (xT)^{-t}\right)^{\frac{r}{t}-1}(-t)(Tx)^{-t-1} = 0$$

$$(2.2) \quad c_F' - l\left(-\frac{r}{t}\right)\left(q_F^{-t} - (xT)^{-t}\right)^{\frac{r}{t}-1}(-t){q_F}^{-t-1} = 0$$

[2] As the analysis is based on a bilateral framework production for the home market or other markets in the home country is not considered. Only the number of workers to produce exports to the host countries is taken into account.

[3] See Brainard Riker (1997B) for a similar approach.

4 Sufficient for the second order condition to hold is $t > -1$, see Chiang (1984).

or

(2.3) $\frac{q_F}{x} = T^{\frac{t}{1+t}}\left[\frac{c'_H}{c'_F}\right]^{\frac{1}{1+t}}$

Due to the simple linear technology with fixed labour coefficients, for $x > 0$ (2.3) can be stated in terms of labour ($L_i^q, i = H, F$):

(2.4) $\frac{L_F^q}{L_H x_q} = \frac{q_F}{x} * \frac{a_H}{a_F} = \left[\frac{a_H}{a_F}\right]^{\frac{t}{1+t}}\left[\frac{w_H}{w_F}\right]^{\frac{1}{1+t}} T^{\frac{t}{1+t}}$

The amount of domestic labour in the production of exports can easily be calculated from the total industry employment using the export share $x_q = x / q_H$. The second component of labour demand at home and abroad comprises vertical downstream activities like service- and distribution activities that cannot be traded and (in the extreme case) solely depend on the size of the market they service. The simplest assumption on labour demand for these activities is:

(3) $L_F^z = ds_F^f$

(2) and (3) are combined to derive the total labour demand of the foreign plants using a linear approximation around $f_o = \frac{\ln L_F^q - \ln d}{\ln s_F}$ which implies $L_F^q = ds_F^f$ i.e. labour is allocated to horizontal and vertical activities in the same proportion.

(4) $ln\left[L_F^q + L_F^z\right] = ln\left[L_F^q + ds_F^f\right] \approx ln\left[L_F^q + ds_F^{f_o}\right] + \frac{ds_F^{f_o} \ln s_F}{L_F^q + ds_F^{f_o}}\left(f - f_o\right) = \ln L_F^q + \frac{f}{2}\ln s_F^f - \frac{1}{2}\ln d + \ln 2$

Using (2) this gives the basic econometric specification of the bilateral relative labour demand equation:

(5) $ln\left[\frac{L_F^q + L_F^z}{x_q L_H}\right] \approx \frac{t}{1+t} ln\left(\frac{a_H}{a_F}\right) + \frac{1}{(1+t)} ln\left(\frac{w_H}{w_F}\right) + \frac{t}{1+t} \ln T + f \ln s_F - \frac{1}{2}\ln d + \ln 2$

Equation (5) relates relative labour demand to relative wage rates, relative productivity and the size of the foreign market. Thus this simple - and therefore to a certain extent restrictive specification - is able to disentangle the horizontal and vertical component of the activities in foreign affiliates. Especially, it gives a direct estimate of the elasticity of substitution between worker employed in home and in foreign plants. The specification can be generalised to multiple host countries in an obvious way and it will estimated below at the bilateral country-industry level (ignoring the problem of aggregation over firms). It only holds for industry-host country pairs with foreign production. The decision to serve a foreign market by exports only (and relying on a foreign owned firm to provide upstream-services) can easily included if fixed set-up costs for foreign plants are added. There will be production abroad if total costs of home and foreign production including fixed plant-set up costs are lower than with exports only. Empirically, the proper method of estimating (3) in a bilateral country-industry framework for those industries with investment abroad is a sample selection model (Heckman, 1974, Maddala, 1983, p.231f). Representing differences in total costs in a reduced form, the empirical model with fixed time, industry and country effects reads (the index *i* refers to the host country; *j* the industry *i* and t time):

(5) $$ln\left(\frac{L_{ijt}}{\tilde{L}_{Hjt}}\right) = b_0 + ß_1 ln\left(\frac{pr_{ijt}}{pr_{Hjt}}\right) + ß_2 ln\left(\frac{w_{Hjt}}{w_{ijt}}\right) + b_3 ln s_{ijt} + b_4 TR_{ijt} + b_5 INTRAF_{ijt} + b_l \hat{l}_{ijt} + k_i + m_j + l_t + e_{ijt}$$

if

$$ln\left(\frac{C_{Hj}(w_{Hjt}, s_{ijt})}{C_{Hj}(w_{Hjt}, x^*_{ijt}) + C_{Fi}(w_{ijt}, s_{ijt}, x^*_{ijt}) + F_{ijt}}\right) = g_0 + g_1 ln(s_{ijt}) + g_2 ln\left(\frac{a_{Hit} w_{Hjt}}{a_{iit} w_{ijt}}\right) + g_3 ln\left(\frac{k_{Hjt}}{l_{Hjt}}\right) + g_4 ln T_i + J_i + n_j + h_t + v_{ijt} > 0$$

and $L_{ijt} = 0$ and the relative labour demand equation is not defined otherwise.

with $\tilde{L}_{Hjt} = L_{Hjt} * \left(\frac{x_{Hjt}}{q_{Hjt}}\right)^{-1}$ for $x_{Hjt} > 0$, $e_{ijt} \sim N(0, s_e)$, $v_{ijt} \sim N(0, s_v)$, $Cov(e_{ijt}, v_{ijt}) = r$. k_i, m_j, l_t, (J_i, n_j, h_t, respectively) denote fixed country (country group), industry and time effects, respectively. Note further, that relative efficiency, $\frac{a_H}{a_F}$ is approximated by relative plant specific labour productivity, $\frac{pr_{ijt}}{pr_{Hjt}}$. The transportation cost parameter, T_i, is subsumed in the country fixed effects, whereas it is measured as distance in the investment equation as here country-group dummies have to be used. As mentioned above, $ß_2$ ($ß_1$) gives a direct estimate of the elasticity of substitution between employment abroad and at home with respect to wages (productivity). Additionally, the labour demand equation is augmented by *TR* defined as the share of wholesale and retail trade in affiliate sales to account for the fact many firms invest in sales affiliates. *INTRAF* is defined share of intraindustry trade volume in total trade volume and it controls for the production of intermediate inputs in foreign plants which are used by the parent firm in the production for third markets.

III Data and estimation results

Table 1 provides an overview about the data in an aggregate of 5 regions and additionally averaged over industries and over time. Sources and definitions are reported in the Appendix. The most striking feature of Austrian foreign direct investment during the period 1989-1994 lies in the fast reorientation of foreign production to the neighbouring transition economies Hungary, the Czech Republic and the Slovak Republic after the opening up of their markets in 1989. In the Eastern European countries along with EU-south (Italy, Portugal) relative employment as well as relative demand has grown fastest, too. Affiliates in the Northern part of the EU (FRG, UK, Netherlands, Belgium) in contrast are less dynamic, but hold the larger share total affiliate sales. Wages and productivity are particularly low in Eastern European Countries with an average 11.7 % and 36.6% of the corresponding Austrian figure[5].

5 Wages for the Eastern European Countries are calculated form average monthly labour costs per employee*14 (Source: WIIW), whereas wages for all other countries are from STAN (Source: OECD) and calculated as total labour compensation/number of employees. As data sources are not fully compatible, there may be some degree of underestimation.

Table 1: Descriptive Statistics on multinational activities in Austrian manufacturing

	1989-1994 (unweighted)			ϕ1989-1994 (weighted by employment in foreign affiliates)					
	$L_{ijt} = 0$ share in %	employment in foreign plants share in %	sales of foreign plants share in %	l_j / l_H *100	s_j / s_H *100	rel. wages *100	rel. productivity *100	growth of l_j / l_H *100	growth of s_j / s_H *100
Eastern Europe [a)]	24.6	47.5	16.8	12.7	13.5	11.7	36.6	31.7	48.5
EU-North [a)]	34.3	38.6	66.9	3.5	43.9	122.5	151.9	7.6	8.4
EU-South [c)]	15.3	9.0	8.6	2.9	8.5	76.3	83.4	27.9	21.7
US	13.8	3.6	5.2	0.4	4.9	148.2	159.7	0.8	20.8
Switzerland	11.9	1.3	2.5	0.4	5.2	187.2	174.7	3.6	-0.5
Total	100.0	100.0	100.0	8.7	21.1	55.7	79.7	23.0	33.1

Note: industries with no Austrian FDI and 2 outliers with growth rates above 300% excluded.
a) Hungary, Czech Republic + Slovak Republic
b) Germany (West), UK, Netherlands, Belgium
c) Italy, Portugal

Since the model is also estimated in a dynamic formulation the dependent variable in the Probit-model is valued one if the respective industry operates affiliates for at least 3 consecutive years in a host country. Thus, the estimated equation cannot be interpreted as an FDI-equation in a strict sense, but as an estimation of the probability of longer lasting activities abroad. The Probit-equation uses real demand (defined as exports and affiliate sales), relative labour-unit costs (since at the industry level wages and productivity are highly correlated) as well as the domestic capital labour ratio as dependent variables. Transport costs are approximated by distance and by the trade openness measured as ratio of exports and imports to domestic production. The distance variable does not allow for country dummies, so only time, industry dummies and country group dummies (as defined in Table 1) are included in the Probit-equation.

Table 2: Probit-equation

	ln demand	ln domestic capital/labour ratio	ln distance	ln rel. labour unit cost* industry dummies	time dummies	industry dummies	country group dummies
estimated ß	1.24	-0.82	-0.10	0.59 [a)]	-	-	-
t, c^2 [b)]	5.97[**)]	-6.50[**)]	-0.22	19.61[**)] (7)	4.08 (4)	31.23 (7)[**)]	46.03 (4)[**)]
marginal effects	0.27	-0.19	0.11	0.17			
t, c^2 b)	7.17[**)]	7.35[**)]	2.98[**)]				
NT 418							
Logl -92.26							
R^2 [c)]: 0.89							

a) Average of industry-specific estimates
b) Degrees of freedom in parentheses
c) Zavoina, McKelvey (1975)
**) significant at 5%
*) significant at 10%

Consistent with theory the estimated Probit-equation reveals that the firms in an industry operate more likely affiliates in one of the countries, the higher real demand (defined as exports plus affiliate sales) and the more labour intensive production in Austria is. The distance to the respective host country is insignificant. Industry specific relative unit labour costs[6] are found significantly negative in 2 out of 7 industries, in one significantly. Together with the importance of the demand variable this finding indicates that low unit labour costs abroad did not form an important motive for investment abroad in all industries. Furthermore, the propensity to invest abroad differs significantly across industries as shown by the significant industry dummies .

Data on employment and sales of the foreign affiliates are very volatile and heavily affected by outliers originating from the small number and the lumpiness of foreign direct investment projects (and maybe partly also from some mismeasurement of the sales figures). The relative labour demand equation thus includes outlier dummies (13 in the levels equation and 2 in the dynamic equations, respectively) for those observations which revealed a standardised residual above 3.0 in the basic specification I. The relative labour demand equation is corrected for a possible sample selection bias by including the inverse Mill's ratio. Generally, the equations seem to be well specified, although the REST test in the levels equation indicates that the functional form may be overly restrictive.

The estimation results point to an overwhelming importance of real foreign demand as determinant of relative labour demand. A 1% growth leads to an increase in relative labour demand between 1.2% and 1.4% illustrating that that firms more and more rely on foreign production and supply market related services in the foreign market even if a wage differential does not exist. Furthermore, a significant and robust impact of labour productivity in foreign plants relative to domestic plants can be found. Consistently with theory a 1% increase in relative labour productivity c.p. decreases relative labour demand by approximately 0.5 to 0.6%. The findings on the direct impact of relative wages are not as robust and ambiguous, however. In specification I the elasticity of substitution is small and insignificant. According to specification II the elasticity of substitution varies significantly across industries. Substitution is significant (at least at a level of 10%), but inelastic in the chemical industry, the paper and wood industry and in the stone, clay and glass industries. We have to bear in mind, however, that the estimates are pure static within estimates. Given the large differences in relative wage rates, firms may well gain from investing in low wage countries even if wages are rising there. The fact that Hungary, Czech Republic and Slovak Republic and Portugal have high country fixed effect confirms this view.

[6] Pooling this variable over industries proved as too restrictive. The Wald-test indicates significant differences of this parameters across industries.

Table 3: Relative labour demand in manufacturing at the bilateral country-industry level : foreign affiliates/Austria

	I OLS		II OLS		III GMM[b)]		IV GMM[b)]	
	ß	t[a)]	ß	t[a)]	ß	t[a)]	ß	t[a)]
log rel employment$_{-1}$					0.15	2.80[**)]	0.12	1.91[+)]
log rel. productivity	-0.63	7.19[**)]	-0.61	7.31[**)]	-0.52	-3.82[**)]	-0.52	-4.05[**)]
log rel. wage rate (Austria vs. Host country; base: metals, machinery)	-0.24	-0.67	0.41	1.03	1.74	1.77[+)]	1.00	0.87
log rel. wage rate, difference to the base:								
Electronics	-	-	-0.33	-2.25[**)]	-	-	1.02	0.63
Chemicals, oil	-	-	0.35	2.46[**)]	-	-	0.53	0.35
Paper, wood products	-	-	0.56	4.89[**)]	-	-	2.63	2.39[**)]
Textiles, leather, clothing	-	-	-0.13	-0.82	-	-	0.39	0.10
food, beverages, tobacco	-	-	0.40	1.52	-	-	2.61	1.31
stone, clay, glass	-	-	0.30	1.86[+)]	-	-	2.20	1.31
log demand	1.37	13.04[**)]	1.50	12.62[**)]	1.20	5.26[**)]	1.16	4.82[**)]
Share of wholesale and retail trade in affiliate sales	-0.51	-2.37[**)]	-0.54	-2.61[**)]	-0.47	-1.18	-0.57	-1.57
Share of intraindustry trade volume in total trade volume	-0.27	-1.34	-0.68	-3.44[**)]	-1.45	-4.34[**)]	-1.41	-3.77[**)]
Inverse Mill's ratio	0.47	2.65[**)]	0.20	0.91	-0.17	-0.64	-0.16	-0.58
Constant	-9.16	-8.35[**)]	-11.47	-9.25[**)]	0.14	0.80	0.21	1.35
NT	244		244		156		156	
R^2	0.92		0.93		0.52 [c)]		0.56 [c)]	
s	0.67		0.62		0.54 [d)]		0.52 [d)]	
Normal residuals (Jarque-Bera): $c^2(2)$	0.27		2.90		-		-	
Heteroscedasticity (Breusch-Pagan): [e)], c^2	70.02[**)]	(39)	87.56[**)]	(45)	-		-	
RESET: t	-3.1		-2.89[**)]		-		-	
Time dummies: c^2 [b)]	14.91[**)]	(5)	17.82[**)]		39.06[**)]	(4)	39.33[**)]	
Country dummies: $c(9)$	367.04[**)]		399.10[**)]		59.69[**)]	(9)	58.12[**)]	
Industry dummies $c(6)$	409.36[**)]		509.72[**)]		-		-	
log rel. labour unit costs*industry dummies: $c(6)$	-		41.36[**)]		-		14.61[*)]	
Overidentifying restrictions, Sargan-c^2	-		-		7.22	(6)	8.97	(6)
2nd order autocorrelation of the error term (asym. normal)	-		-		-0.50		-0.80	

Note: outlier dummies as well as fixed time, industry and country effects not reported.
a) Heteroscedasticity consistent using the White-procedure.
b) Two-step estimates with heteroscedasticity robust errors using the levels of the endogenous variable with lag 2 and 3 used as instruments, Arrelano, Bond (1988, 1991).
c) Calculated as $1-\frac{RSS}{TSS}$ from one step estimates.
d) Calculated as $\sqrt{\frac{1}{NT}RSS}$ from one step estimates.
e) Degrees of freedom in parentheses
**) significant at 1%
*) significant at 5%
+) significant at 10%

The dynamic specifications II and IV are based on a model of adjustment costs (Hamermesh, Pfann, 1996) and account for the fact that substitution of labour is not instantaneous, but follows a transition path with partial adjustment. Since country dummies proved to be important determinants of growth in relative factor demands,

the dynamic specifications with country specific growth in labour demand are not exactly comparable to the static ones. With this country-specific growth rates in relative labour demand, the estimated speed of adjustment is rather high (0.85 and 0.88, respectively). The findings on the impact of real demand and relative productivity, however, are robust and approximately replicated in the dynamic setting. The estimated elasticity of substitution with respect to wages now is greater than one, however only at l0% level of significance. As in specification II some industries reveal higher elasticities of substitution, but only in the paper and wood industries significantly so. Summing up, a significant role of relative wages and therefore substitution between employment in domestic and foreign plants can be detected in several industries in both specifications, but so far the results do not seem robust enough to draw firm conclusions. Furthermore, we have to bear in mind that the estimates are conditioned on given foreign demand. In a richer model, which also accounts for competition in the product market, we may well find that firms with investments abroad gain market shares which generates growth in labour demand both at home and abroad. Therefore, the degree of substitution may well be overestimated with the present cost based approach.

IV Conclusions

For high wage countries, like Austria, it is commonly expected that the growing employment in foreign affiliates substitutes jobs at home. This paper provides a framework for estimating the determinants of relative labour demand (abroad in relation to that at home) on a bilateral basis. It is based on the relationship of (dis)economies and transportation costs under the hypothesis that goods trade is an imperfect substitute for foreign production in the case of horizontal investments whereas it is solely dependent on relative market size for vertical investments. Using bilateral data on foreign affiliates and domestic activities of Austrian manuf-acturing covering the period 1989-1990, the 10 most important host countries and 7 industrial sectors, the estimates reveal real demand market size and relative plant-specific productivity as most important determinants.

The estimates of the elasticity of substitution between employment at home and employment in foreign affiliates indicate that relative labour demand is responsive to relative labour costs, but that it varies across industries. In the static stetting the overall estimates indicates inelastic substitution between employment at home and employment in foreign affiliates, in some industries significantly. In the dynamic estimations the elasticity of substitution is generally higher. The findings on the elasticity of substitution do not seem to capture the whole effect, however. First, industries may reveal high relative labour demand in low-wage countries and can they be expected to do so, even if the low foreign wages rise faster than the domestic ones, especially during the transition phase. Secondly, the empirical analysis lacks information on the skill composition of employment, another important determinant of relative labour demand.

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Appendix: Variable definitions and data sources at industry-country level :

All nominal variables are converted into $, the real variables are converted into 1989 $. The data source of each variable mentioned in parenthesis:

Variable definitions:

Rel. Labour demand: employment in foreign affiliate (OENB)/total employment in the respective Austrian industry (OECD-STAN).

Foreign demand: affiliate sales (OENB) + exports (WIFO) + net-intrafirm exports (OENB) deflated by foreign value added deflator (OECD-STAN and WIIW).

Rel. productivity: Real affiliate sales/employment in foreign affiliates (OENB, deflator: foreign value added deflator (OECD-STAN) divided into real Output/Employment in Austria (STAN).

capital labour ratio: Austrian stock of capital estimated by the perpetually inventory method using Gross fixed capital formation and a depreciation rate of 10% divided into labour cost (OECD-STAN).

Rel. wages: Eastern European Countries: 14*mountly wage rate (WIIW).
other Countries including Austria: labour compensation/per employee (STAN-OECD).

Rel. Labour unit cost: Eastern European Countries: 14*mountly wage rate (WIIW)/ real Output divided into Austrian Labour unit costs. Other Countries: Total Labour compensation/real production divided into Austrian total labour compensation (all OECD-STAN Database).

Distance: Distance between capital cities in km.

H: Share of wholesale and retail trade in total affiliate sales(OENB).

Intraim: Share of intraindustry trade volume in total trade volume(OENB).

Abbreviations:

OECD-STAN: The OECD Stan Database for industrial Analysis, OECD 1995

OENB: Austrian National Bank (personal communication)

WIFO: Austrian Institute of Economic Research

WIIW: Austrian Institute of Comparative Studies

Industry definition ISIC Rev.2:

Metals, machinery: 37+38-383

Electrical machinery: 383

Chemical Products: 35

Paper, wood products: 34,35

Textiles, apparel, leather: 32

Food, beverages, tabacco: 31

Stone, clay, glass: 36

Note data form OENB and WIFO are classified according to „Fachverbände“ i.e. according to the membership in the chamber of commerce and are converted to ISIC. Data from WIIW are classified in 2 digits NACE and likewise have been aggregated to the ISIC- definitiond above.