OFFSHORING SERVICES, MANUFACTURING LINKAGES, AND THE STRUCTURE OF TRADE AND INDUSTRY

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Abstract: Working with a mix of panel data on goods and services trade for the OECD for 1994-2004, combined with social accounts data (i.e. data on intermediate linkages) for 78 countries benchmarked to the panel midpoint, we examine the role of services as inputs in manufacturing, with a particular focus on indirect service intensity of merchandise exports, and also on the related interaction between service sector openness and the overall pattern of manufacturing output and exports. We find significant and strong positive effects from increased business service openness (i.e. greater levels of imports) on industries like machinery, motor vehicles, chemicals and electric equipment, supporting the notion that off-shoring of business services may promote the competitiveness of the most skill and technology intensive industries in the OECD. Conversely, we find evidence of negative general equilibrium effects for sectors that are less service intensive.

JEL: F14, L8, O11

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1. INTRODUCTION

Merchandise trade dominates international trade, with about 70-80% of all cross-border transactions involving goods trade. Yet services dominate the domestic economic landscape in most middle- and high-income economies. At the same time, there is a growing realization that official trade data may actually underplay the role of services in trade, as they reflect neither the use of services as inputs for manufactured goods destined for export markets, nor the importance of services sold through local affiliates of multinationals. (See Hoekman, 2006; Hoekman and Prima Braga, 1997.)

In this paper we examine the role of services as inputs in manufactured exports, with a particular focus on indirect exports of services, and also on the related interaction between service sector openness and the relative impact of offshoring in different service sectors in the overall pattern of manufacturing performance.[1] We provide cross-country and panel-based evidence to complement the case-study approach of the recent literature, while working with data that reflects the sweep of the information technology revolution across the service industries in the 1990s.

The paper is organized as follows. In Section 2 we develop a duality-based multi-sector generalization of the recent 2x2 theoretical literature. This gives us a structured set of estimating equations for linking intermediate service sector inputs to manufacturing performance. The next two sections, 3 and 4, are devoted to general levels of direct and indirect service intensity (i.e. services embodied in manufacturing exports) and, give these direct and indirect linkages, quantifying the impact of service imports on manufacturing performance. Our data include a mix of panel data on goods and services trade for the 30 OECD Members for 1994-2004, combined with social

[1] A related strand of the literature focuses not so much on production patterns linked to intermediate services trade and FDI, but on the corresponding shift in employment patterns and productivity that follows from trends in FDI and offshoring. (Feenstra and Hanson 1999, 2003; Bloningen 2005.)

accounts data (i.e. data on intermediate linkages) for 78 countries inclusive of our OECD sample and benchmarked to the year 2001. Finally, we summarize and conclude in Section 5.

2. General Equilibrium Impacts in a Multi-Sector Framework

Analytically, the recent literature on offshoring and outsourcing addresses issues related to those found in the earlier literature on middle products. (Sanyal and Jones 1982, Sanyal 1980, Jones and Neary 1986). Grossman and Rossi-Hansberg (2006), for example, offer an analytical framework for analysis of offshoring grounded in the 2x2 model. As in the middle-products literature, changes in the price of intermediate goods or tasks work like price changes for final goods in a small country, with Hecksher-Ohlin mechanisms driving relative factor income changes. The emphasis in the recent literature has been on wage impacts. Our goal in this section is to focus attention on the output and trade impacts of offshoring, and to generalize beyond the 2x2 framework in a maner sufficiently parsimonious to guide regression analysis at the level of multiple industries. We do this by developing a dual model of trade with intermediate products, and treating offshoring as a case of falling trade costs and consequent rising imports of intermediate services.

We will first define a dual general equilibrium system for an economy that includes both traded and domestic intermediate products (goods and services), as well as imported and domestic final products. Within the resulting system of equations, outsourcing and offshoring in response to changes in trade costs for intermediates both then emerge as a shift from domestic to imported intermediates in production.

We adopt a number of assumptions:

- World prices: We assume that we have a small country, facing the set p of world prices for its products (consumed domestically and exported). In addition, it

faces a set of P prices for foreign products that compete with its domestic products in intermediate and/or final consumption.

- Composite prices: Intermediate and final demand is sufficiently separable to allow us to classify products by type, such that we can also define a set of composite prices ϕ indexed by product type, that are a function of the set of corresponding domestic and foreign prices p and P. This would follow, for example, from the CES aggregators common in Ethier/Krugman/Melitz models and Armington models, and more generally from models where products are similar but not identical in intermediate or final consumption. The aggregation technology for composite products meets the necessary conditions for a well-behaved price index (convexity, monotonicity, regularity).
- Technology: We assume that technology is sufficiently separable in each sector and across inputs, between a value added activity and composite inputs, to allow us to specify the cost of production as a function of the price of value added P_{VA} and the price of inputs ϕ. Technology for value added and total production meets necessary conditions for a set of well-behaved cost indexes.
- Preferences: Consumers have identical homothetic preferences, that meet sufficient conditions for the existence of a well-behaved expenditure function.

Following out assumption about composite prices, we can specify ϕ as follows:

(1) $$\phi = \phi(p, P)$$

At the same time, our assumptions about technology also mean that for a given vector of primary factors v we can also specify an economy-wide revenue function as a function of the set of value-added prices across sectors.

(2) $$r = r(P_{VA}, v)$$

(3) $$\omega = r_v$$

(4) $r_{P_{VA}} = VA$

The term ω is the set of factor prices, and its relationship to the revenue function $r_v = \omega$ follows from the envelope theorem. Similarly, VA is the set of value added quantities, and its relationship to the revenue function $r_{P_{VA}} = VA$ also follows from the envelope theorem.

In general equilibrium, where expenditures equal receipts, the economy-wide budget constraint can be written in terms of the expenditure function *e* and the revenue function.

(5) $e(\phi, u) - r(P_{VA}, v) = \bar{B}$

In equation (5), the term $\bar{B}$ represents net transfers from the rest of the world. The term *u* represents welfare. The cost of living index or consumer price index (the price of welfare or utility) is then $CPI = e_{\phi}(\phi, u)$. We will also normalize world prices to one, and introduce a set of trade cost coefficients γ_1 for imports and γ_2 for exports.

(6) $P = \gamma_1$

(7) $p = \gamma_2$

Given our technology set, and assuming cost minimizing firms, we can also specify unit input coefficients for value-added and composite products as a function of prices.

(8) $a = a(P_{VA}, \phi), \quad a_{P_{VA}} > 0, a_{\phi} < 0$

(9) $b = b(P_{VA}, \phi), b_{P_{VA}} > 0, b_{\phi} < 0$

In equation (8), *a* is the set of inverse value added input coefficients, or in other words the ratio of output to value added in each sector. In equation (9), *b* is the set of intermediate input coefficients. Given our definition of *a* we can recover the set of domestic production levels Q from (4) and (8).

(10) $Q = a \cdot r_{P_{VA}}$

Assuming firms minimize cost, and that we have competitive firms, then from the first order conditions for profit maximization we can also map the price of value added from the price of intermediate and final products, or alternatively to the set of prices form domestic and imported goods.

$$(11) \qquad P_{VA} = f(p,P) = f(p,\phi), f_p > 0, f_\phi < 0$$

Finally, employing the envelope theorem and our definition of input coefficients *a* and *b*, we can define imports as the difference between domestic intermediate and final consumption, and domestic production.

$$(12) \qquad M = \underbrace{e_\phi\left(\phi_p + \phi_P\right)}_{\text{final consumption}} + \underbrace{\left[\phi_P \cdot b \cdot a \cdot r_{P_{VA}}\right]}_{\text{imported intermediates}} - \underbrace{\left(\underbrace{a \cdot r_{P_{VA}}}_{\text{gross output}} - \underbrace{\left[\phi_p \cdot b \cdot a \cdot r_{P_{VA}}\right]}_{\text{domestic intermediates}} \right)}_{\text{net output}}$$

In the system as outlined, we have 12 sets of equations, and 12 sets of unknowns: ϕ, r, ω, *u,VA, p, P, a, b, Q,* P_{VA}, *M.*

We are interested in the impact of increased imports of intermediate service imports on the pattern of output, employment, and exports across industries. This will follow from changes in the price of imported intermediates, realized through changes in γ_1. To arrive at an analytical set of equations linking changes in γ_1 to patterns of production, trade, and employment, we will first employ a number of normalizations. We normalize internal prices, worl prices, and trade cost coefficients at unity, and will evaluate the impact of changes in trade costs around such equilibrium. Through total differentiation of the system defined by equations (1)-(12) (see the technical annex) we can arrive at the following general expressions linking $d\gamma_1$ to *dQ* and $dX = -dM$.

$$(13) \qquad dQ = \left(a_{P_{VA}} \cdot r_{P_{VA}} \cdot P_{VA\phi} \cdot \phi_P + a_\phi \cdot r_{P_{VA}} \cdot \phi_P + a \cdot r_{P_{VA}, P_{VA}} P_{VA\phi} \cdot \phi_P\right) d\gamma_1$$

$$
\begin{aligned}
dX \quad &= \left(a_{P_{VA}} \cdot r_{P_{VA}} \cdot P_{VA\phi} \cdot \phi_P + a_\phi \cdot r_{P_{VA}} \cdot \phi_P + a \cdot r_{P_{VA}.P_{VA}} P_{VA\phi} \cdot \phi_P\right) d\gamma_1 \\
(14) \qquad &-e_{\phi u}\left(\phi_p + \phi_P\right)\left(e_u^{-1} r_{P_{VA}} P_{VA\phi}\phi_P - e_\phi \phi_P\right) d\gamma_1 - \left(e_{\phi\phi}\left(\phi_p + \phi_P\right)\phi_P + e_\phi \phi_{PP}\right) d\gamma_1 \\
&-\begin{pmatrix} \phi_{pP} \cdot b \cdot a \cdot r_{P_{VA}} + b_\phi \cdot \phi_p \cdot a \cdot r_{P_{VA}} \cdot \phi_P + b_{P_{VA}} \cdot \phi_p \cdot a \cdot r_{P_{VA}} \cdot P_{VA\phi} \cdot \phi_P \\ +a_{P_{VA}} \cdot \phi_p \cdot b \cdot r_{P_{VA}} \cdot P_{VA\phi} \cdot \phi_P + a_\phi \cdot \phi_p \cdot b \cdot r_{P_{VA}} \cdot \phi_P + \phi_p \cdot b \cdot a \cdot r_{P_{VA}.P_{VA}} P_{VA\phi} \cdot \phi_P \end{pmatrix} d\gamma_1
\end{aligned}
$$

Changes in the allocation of value added (and hence employment) across sectors follow from combining equations (8) and (13).

In equation (13), the general equilibrium impact of changes in the cost of offshoring on output hinges on a mix of substitution effects between inputs and value added (the first sets of terms) and general equilibrium effects linked to output elasticities with respect to value added price changes (the last set of terms on the right). Note that, for a small prices where the set of prices p is given by world markets, changes in input prices P will lead to changes in value added prices, and the sectors that use a given input more intensively will realize a greater change in value added – the term $P_{VA\phi}$ -- so that changes in input import prices are analogous to changes in final goods prices p in terms of impact on value added.

The impact on trade is more complex. For exports, where we have focused on the set of domestic products in (14) as a subset of the trade matrix M in equation (12), the impact of changes in $d\gamma_1$ on exports depend on three sets of factors. The first row of right hand side terms, which follows from equation (13), is change in output. The second relates to changes in consumer demand. If the imported products in question are intermediates, then this second row simplifies to pure income effects for a small country. The last row relates to domestic intermediate demand for domestic products. Starting from changes in output, income effects will reduce export expansion relative to output growth. At the same time, the mix of intermediate input demand changes will depend on the mix of substitution and output responses to price changes.

To simplify the general form of (13), we adopt the following additional assumptions. First, we assume that we value added and intermediates are combined in fixed proportions (Leontief technology) so that the *a* and *b* coefficients are fixed. We also assume we are working with intermediate inputs (no final consumption of activities subject to reductions in offshoring costs). We also reiterate the normalization of prices and γ_1 at unity. Under these assumptions, we can rewrite equation (13) in the following forms:

$$(15) \qquad d\ln Q = \frac{dQ}{Q} = a\eta_{VA}\left(b\theta_M\right)d\ln\gamma_1$$

$$(16) \qquad d\ln Q = \frac{dQ}{Q} = a\eta_{VA}\sigma^{-1}\left(b\theta_M\right)d\ln M_1$$

Equations (15) and (16) reflect the fact that zero profits imply that $p = a^{-1}P_{VA} + b\phi$, which in turn implies that $P_{VA,\phi} = dP_{VA}/d\phi = ab$. In equations (15) and (16), the term $\left(b\theta_M\right)$ measures the cost share of imported intermediates, while η_{VA} is a set of general equilibrium output or value added elasticities and $a\eta_{VA}\sigma^{-1}$ and $a\eta_{VA}$ are coefficients that can in theory be estimated, if we have data on changes in import volumes and/or prices and cost shares (i.e. import data and input-output data on cost shares). In equation (16), σ represents the set of import demand elasticities for imports.

Turning to exports, the basic impact from price changes for imported intermediate inputs will be:

$$\begin{aligned} dX \quad & = \left(a\cdot r_{P_{VA},P_{VA}}P_{VA\phi}\cdot\phi_P\right)d\gamma_1 \\ (17) \quad & -e_{\phi u}\left(\phi_p+\phi_P\right)\left(e_u^{-1}r_{P_{VA}}P_{VA\phi}\phi_P\right)d\gamma_1 \\ & -\left(\phi_{pP}\cdot b\cdot a\cdot r_{P_{VA}}+\phi_p\cdot b\cdot a\cdot r_{P_{VA},P_{VA}}P_{VA\phi}\cdot\phi_P\right)d\gamma_1 \end{aligned}$$

Adopting a reformulation similar to that in equations (15) and (16) we have:

$$(18)\quad d\ln X = \frac{dX}{X} \qquad = \theta_X^{-1}\left(\left[\underbrace{a\eta_{VA}\left(1-b\theta_M\right)\left(b\theta_M\right)}_{\substack{\text{output reponse net of imcreased}\\ \text{intermediate input use related to}\\ \text{output changes}}}\right]-\left[\underbrace{e_{\phi u}\left(e_u^{-1}b\theta_M\right)}_{\substack{\text{income effects}\\ \text{on demand for}\\ \text{domestic goods}}}+\left(\underbrace{\phi_{pP}\cdot b}_{\substack{\text{substitution}\\ \text{effects in}\\ \text{intermediate use}}}\right)\right]\right) d\ln\gamma_1$$

$$(19)\quad d\ln X = \sigma^{-1}\theta_X^{-1}\left(\left[\underbrace{a\eta_{VA}\left(1-b\theta_M\right)\left(b\theta_M\right)}_{\substack{\text{output reponse net of imcreased}\\ \text{intermediate input use related to}\\ \text{output changes}}}\right]-\left[\underbrace{e_{\phi u}\left(e_u^{-1}b\theta_M\right)}_{\substack{\text{income effects}\\ \text{on demand for}\\ \text{domestic goods}}}+\left(\underbrace{\phi_{pP}\cdot b}_{\substack{\text{substitution}\\ \text{effects in}\\ \text{intermediate use}}}\right)\right]\right) d\ln M$$

In equations (18) and (19), the first term in square brackets maps net output changes, and can be estimated in a similar manner to the output equations (15) and (16). The second term is then for changes in prices (or imports) without the interaction with cost shares, and captures a general equilibrium mix of final demand income effects and intermediate demand substitution effects. Finally, from equation (10), we can estimated the impact of value added and employment with a version of equations (13) and (14).

3. EMPIRICS 1: INDIRECT AND DIRECT SERVICE INTENSITY

3.1 Data

We work here with data covering trade in goods and services, and also data on intermediate linkages between goods sectors and services sectors from national accounts data for 78 countries. This requires combining data from a number of different sources. Our sectoring scheme is ultimately a compromise, limited by the structure of our national accounts data, and also by the constraints imposed by the breakdown of available service trade data. We employ a concordance so that services and goods trade data are defined at the same level of aggregation for which we also have corresponding data on intermediate use by manufacturing and service industries (upstream and

downstream linkages). We define our basic data sources here, as well as some indexes derived from these data that are used in the sections that follow.[2]

We have a panel of trade data spanning from 1994-2004 for the 30 OECD Members, and a broader cross-section of social accounting data for 78 countries for the mid-point of the panel, year 2001. Data on services trade come from the OECD supplemented with published IMF balance of payments statistics. These data are based on balance of payment statistics and correspond mainly to what is known as GATS mode 1 – cross border trade - and mode 2 – movement of consumers. Data are usually reported for total services trade flows on a bilateral basis or for trade flows to the world broken down by sectors. EUROSTAT provides data on services trade flows on a dual breakdown, by partners and sectors at the same time for a limited number of countries.[3] For our purposes, the sector breakdown is sufficient. In these data, information on detailed services trade by sector is limited to OECD Members. This gives us a range of national per-capita incomes spanning from Mexico to Switzerland, but leaves out the lower income countries. As such, while we will be working with national accounts data for countries covering the full range of low-, middle-, and high-income countries (basically from Malawi to Switzerland) in discussion of the 2001 cross-section, our panel analysis of trade data will by necessity be limited to the Mexico-to-Switzerland sub-sample of countries. Goods trade comes from the United Nations' COMTRADE database on commodity trade, aggregated to the sectors in our national accounts data (see below). Data on the national structure of production come from a set of input-output tables, organized in the form of social accounting matrices, for 78 countries for the year 2001. Of the 29 sectors, 15 are manufacturing sectors and 10 are service sectors

[2] The data, including the direct and indirect linkage indexes, are available on request.

[3] Eurostat covers 31 reporting countries – the EU25 plus Bulgaria, Japan, Norway, Romania, Turkey and the USA – and 64 partner countries over a total period of 10 to at most 20 years (1985-2004). Bilateral services trade flows are classified into 11 economic activities according to the BOP Manual 5 classification.

(see Table A1 in the appendix). We focus in particular on producer services, which are defined as the following: communication services, financial services, insurance services, business services and transportation services.[4]

We have organized our data as social accounting matrices (SAMs), meaning that we have a single entry bookkeeping representation of national income and receipts by sector and final consumers. Indexing the column by *i* and the row by *j*, element S_{ij} represents the expenditures from sector *j* on inputs from sector *i* (in the case of intermediate demand), or else it represents final consumption or external trade (imports and exports). (Reinert and Roland-Holst 1997; Bloningen et al 1997). We also make use of a number of indexes derived from our SAMs. To examine production linkages, we begin by denoting a country's n x n social accounting matrix by **S** and a column unit n-vector by **e** (where *n* is the number of elements in the column and row indexes.). Then $\mathbf{c} = \mathbf{e}'\mathbf{S}$ is the column-sum vectors of **S**. If a ^ over a vector is used to denote the corresponding n-dimensional diagonal matrix, then

$$\mathbf{A} = \mathbf{S}\hat{\mathbf{c}}^{-1} \tag{20}$$

Where A represents the column-sum normalized SAM. Hence, while S_{ij} is the actual expenditure received by sector *i* from sector *j*, an element A_{ij} is the proportion of sector j's expenditure received by sector i. Working with the column-normalized **A** matrix, we examine correlations between cross-country per capita income levels and the basic density of the intermediate use matrix. Formally, we define the linkage index D as:

$$D = \frac{\sum_{j\in\lambda}\sum_{i\in\lambda} A_{ij}}{\sum_{j\in\lambda}\sum_{i\in\omega} A_{ij}} \tag{21}$$

where λ is the set of industry accounts and ω is the set of industry plus value-added accounts. The index D measures the relative density of the column-normalized

[4] For a discussion of source data see Dimaranan (forthcoming).

intermediate use matrix. It reflects the importance of backward linkages between sectors, relative to the total level of production activity in the economy.

While the elements of the **A** matrix can be interpreted as direct input coefficients, we will also be interested in the complete set of linkages, involving both direct input demand (like services bought by the transport equipment sector), and also indirect linkages (such as the services bought by the steel sector which then is sold downstream to the transport equipment sector). (See Reinert and Roland-Holst 1994.) To do this, we divide the *n* accounts of a country's SAM into two groups: *m* endogenous accounts and *k* exogenous accounts. Following convention, we define the *k* exogenous accounts as the government, capital, and rest-of-world accounts (see Robinson, 1989). All remaining accounts, including the consumption account, are endogenous. Define the submatrix of **A** consisting of the m endogenous accounts as $\mathbf{A_{mm}}$. The multiplier matrix is given by

(22) $$\mathbf{M} = \left(\mathbf{I_m} - \mathbf{A_{mm}}\right)^{-1}$$

A representative element of the **M** matrix, M_{ij} , gives the direct and indirect marginal effects on sector *i* income (demand) caused by an exogenous unit increase in sector *j* income (demand). Following Reinert and Roland-Holst, we take one final step and use the multiplier matrix to break down total exports into implied total direct and indirect demand. Define f_i as the export final demand for commodity *i,* and **f** as the column vector of these elements. The coefficient ϕ

(23) $$\phi_i = f_i / \mathbf{f'e}$$

gives the share of commodity i in total export demand, and the column vector $\mathbf{\Phi}$ contains the full set of these coefficients. This vector represents direct export shares. To account for intermediate linkages, we also define the column vector

(24) $$\mathbf{\Omega} = \mathbf{M\Phi}$$

Elements ω_i of $\mathbf{\Omega}$ give the weighted average direct and indirect effect on the value of activity in sector *i* that follows from increasing export demand by one dollar, holding the sector composition of total exports constant.

3.2 Direct and indirect exports

From our development above of stylized facts linked to production, we expect greater service intensity to be linked to level of development. At the same time, from basic trade theory (Feenstra and Hanson 1996, 1999) we can also structure our expectations about how openness to intermediate services trade will impact on manufacturing. Indeed this is the guiding paradigm in the empirical offshoring literature. We should expect those manufacturing sectors that are more producer service intensive (i.e. the higher technology sectors) to systematically benefit from increased openness, not only directly, but also indirectly in the competition with other sectors in the economy for resources. Indeed, in general equilibrium, we can expect more service intensive sectors to expand, and less service intensive sectors to contract.

We start here with the service intensity of total exports as measured by the direct and indirect effects generated by an additional dollar of exports in various other sectors of the economy. This involves the terms $\mathbf{\Phi}$ and $\mathbf{\Omega}$ as defined in equations (4) and (5). Figure 1 plots the combined direct and indirect multipliers $\boldsymbol{\omega}$ for export effects for all sectors of the economy (except personal, cultural and recreational services, public services and housing, in which we are not interested here). In effect, this gives a fuller picture of the activity content of exports than simple export composition. Especially for the lowest income group, the most important contributor to exports is the agricultural sector. With rising per-capita income, the sector focus of exports is oriented increasingly toward industries such as chemicals, electrical equipment, machinery and especially

business services. Within the services sector, again the relative importance of activities like trade and repair and transportation services declines with a rising income level.

[Figure 1 here]

Estimated OLS coefficients based on the data in Figure 1 are reported in Table 1, based on equation (25).

(25) $$\omega_{ik} = \alpha_i + \beta 1_i pcGDP_k + \beta 2_i pcGDP_k^2 + \varepsilon_{ik}$$

where ω_{ij} is the additional activity (direct and indirect) in service sector *i* in country *k* as a result of one unit of additional merchandise exports of the economy. Here we run a regression for each service activity over all 78 countries in the sample. If we relate the indirect and direct activity composition of exports to per-capita income for our selected producer related service categories, we find again the strongest positive relationship in business services and further a weak (but not statistically significant) relationship in finance and insurance. Communication services show a weakly negative relationship and transportation services are characterized by less economic activity generated through additional exports in higher income countries. Thus again, it is the business services in which economic activity is rising significantly as a result of increased openness of the economy – proxied through exports. However, at very high levels of development, this trend is reversed and additional goods exports do not generate more activity in business services.

[Table 1 here]

4. EMPIRICS 2: EFFECTS OF OFFSHORING ON MANUFACTURING

In Section 2, we stressed that the impact on firms should not be uniform, but should vary systematically by sector, so that in the macroeconomic data downstream impacts depend on the relative depth of intermediate linkages. We look for evidence of this here. We are interested in the impact of service sector imports on manufacturing performance,

as summarized in equations (14) and (18) above. We look for evidence across the OECD and linked to services imports. In particular, from our analysis of social accounting-based indexes, we have a measure of the direct and indirect linkages between manufacturing activities and upstream service activities.

Tables 2-4 offers an assessment of linkage-driven effects (See equations 14 and 18) above, based on panel regression of OECD export data at the sector level for the industries defined in Appendix Table A1 for the time period 1994-2004. In evaluating the role played by service imports (i.e. off-shoring of services) we distinguish between different types of services, core business services, communication, financial and insurance services. Data for economy-wide service imports in each category (taken from the IMF) is interacted with the share of the respective service category used in each manufacturing industry. The latter is obtained from the SAMS (i.e. the M_{ij} coefficient from Section 3). In this way we proxy for the total role of business service imports in the cost structure of various manufacturing industries.[5] We further include total FDI inflows into the service sector as an alternative route for service inputs from abroad. All these variables are in logs. In addition, we control for implicit trade barriers as represented by domestic barriers to competition. For this we include indices of product market regulation from the OECD (Conway et al. 2005) for three broad dimensions: barriers to entrepreneurship, state control and barriers to foreign trade and investment. From Section 2, our estimating equations take the following form:

$$(26) \quad DepVar_{ikt} = \alpha_i + \beta 1_i Mbusiness_{ikt} + \beta 2_i Mcomm_{ikt} + \beta 3_i Mfinance_{ikt} + \beta 4 Minsurance_{ikt} + \\ + \beta 5_i FDI_{ikt} + \beta 6_i Bentrepreneur + \beta 7_i Bstate_{ikt} + \beta 8_i Btrade_{ikt} + \mu_k + \varepsilon_{ikt}$$

where $DepVar_{ikt}$ refers to either exports or value added or employment of manufacturing industry i in year t and country k in logs. We are looking at the effect of trade in services

[5] Our results are however robust to using economy wide imports of producer related services. Still, the interaction term gives a better approximation to the imports of services used by the respective manufacturing industry and thus a better fit.

on both, the domestic performance as well as exports of manufacturing industries. This should give a comprehensive picture of the full effects of economic integration within service sectors on the manufacturing sector. The importance is here to distinguish between individual manufacturing industries. Based on general equilibrium considerations, we clearly expect to see different, even contradictory effects in qualitatively different industries, which may be hidden if we only look at the aggregate. Most of our control variables are highly correlated among themselves. In addition, there may also be a serious problem of endogeneity, especially between openness on the export side of the manufacturing sectors and their openness to service imports. Therefore we employ a 2SLS estimator. Because we work with share data, our dependent variable is put through a logistic transformation.

(28) $$DepVar_{ikt} = \log\left(\frac{\theta_{ikt}}{1-\theta_{ikt}}\right) \qquad where \quad \theta_{ikt} = X_{ikt} / \sum_{i} X_{ikt}$$

where X_{ikt} is one of the following: exports, value added or employment of industry *i* in country *k* in year *t*.

We cluster our 15 industries into the three groups of technology intensive, labor intensive and resource intensive. Regressions are run separately for the average over each group of industries and the results are reported in Tables 2-4. Tables A2-A4 in the appendix contain further regression results for individual industries. What emerges from the regressions is that imports of business services are an important determinant of the pattern of manufacturing exports in the most advanced industries. While no significant effects from service imports on total manufacturing exports on average can be detected, there are clear positive effects in the most technology intensive industries (here defined as chemicals, electric equipment, machinery and motor vehicles). Again, as was to be expected, it is the imports of core business services that play a role here, while the coefficients on communication, insurance and financial services do not turn out to be

significant for the group as such. The results differ somewhat for each individual industry (see Appendix Table 2.1). On the other hand, a negative effect from increased business service imports emerges when we are restricting our attention to labor intensive industries only. This holds true in particular for the textiles, clothing and leather industries. Finally, no effects are found for resource intensive industries. This points to the more advanced industries being vertically integrated, not only nationally but also internationally through the off-shoring of business services. Indeed, the results in Table 2 support the notion that off-shoring of business services does actually promote the competitiveness of the most skill and technology intensive industries.

We find similar effects for domestic value added and employment in manufacturing. We report these results in Tables 3 and 4. Value added is again enhanced through greater openness to imports of business services for technology intensive industries, while labor intensive industries mostly experience a contraction when the economy opens up to business services from abroad. The negative coefficient on total FDI inflows may be explained by the fact that economies with higher inward FDI are potentially more service based (since the majority of FDI is often in service sectors) and derive less value added from manufacturing production in general. The negative sign of the coefficient on insurance service imports for technology is puzzling. Finally, we look at the effects of service sector openness on employment. We would expect to see fewer and weaker effects on employment than on value added, since most countries in the sample are characterized by rather rigid labor markets and thus not immediately responsive to changes in the economic environment. Indeed we find fewer significant coefficients when regressing service sector openness on manufacturing employment. The positive effect from imported business services in high tech industries remains, while no negative effects are seen for labor intensive industries. For individual industries we do see however negative employment effects for textiles, clothing and leather.

Hence, we observe not only positive output effects, but also positive employment effects from offshoring of services in the most skill and technology intensive industries. These results are fully consistent with general equilibrium linkages across sectors through intermediates as well as factor markets. Because of general equilibrium effects, positive effects in service intensive sectors are off-set by negative output and employment effects in labor intensive production activities, especially so in the textile and clothing sector. Thus, it is important to take a holistic look at the issue of service sector openness for an economy. The effects of opening up to trade in business services differ greatly between individual manufacturing activities with an ambiguous effect on the whole economy.

[Tables 2 - 4 here]

5. CONCLUSIONS AND SUMMARY

A marked aspect of the globalization process has been increased international integration not only of goods sectors, but also of service sectors. This is reflected not only in trade agreements and negotiations, but also in trade flows and FDI. Yet, compared to goods, our understanding of the possible impact of services trade is limited. (See Hoekman 2006 and Mattoo 2000.)

In this paper we have combined panel regressions on trade in goods and services with cross-country evidence on the structure of production, including intermediate linkages, to both quantify the importance of services as embodied in goods exports, and also the possible impact of service sector liberalization on the performance of goods sectors. We find that while goods dominate direct trade data, services are often the most important activities contributing to final exports. The incongruity between official trade data and our result follows from the importance of non-traded service inputs in the production of traded manufactures. In addition we find that, again because of their role

as inputs, increased import penetration by producer services has a positive effect on the skill and technology mix of exports, with greater openness in producer service sectors implying better export performance by skill and technology intensive industries. Protecting intermediate service sectors places manufacturing sectors (especially high wage manufacturing sectors) at a competitive disadvantage. Overall, our results point to service sector openness as a potentially positive factor in the evolution of efficiency in the most technology intensive manufacturing industries. This result, which is based on our work with panel data on trade and a cross-section of social accounts data, complements (and also supports) the results coming from the current literature based on individual country/case studies and firm level data.

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Figure 1: Indirect and Direct Effects of Exports on Economic Activity by Sectors

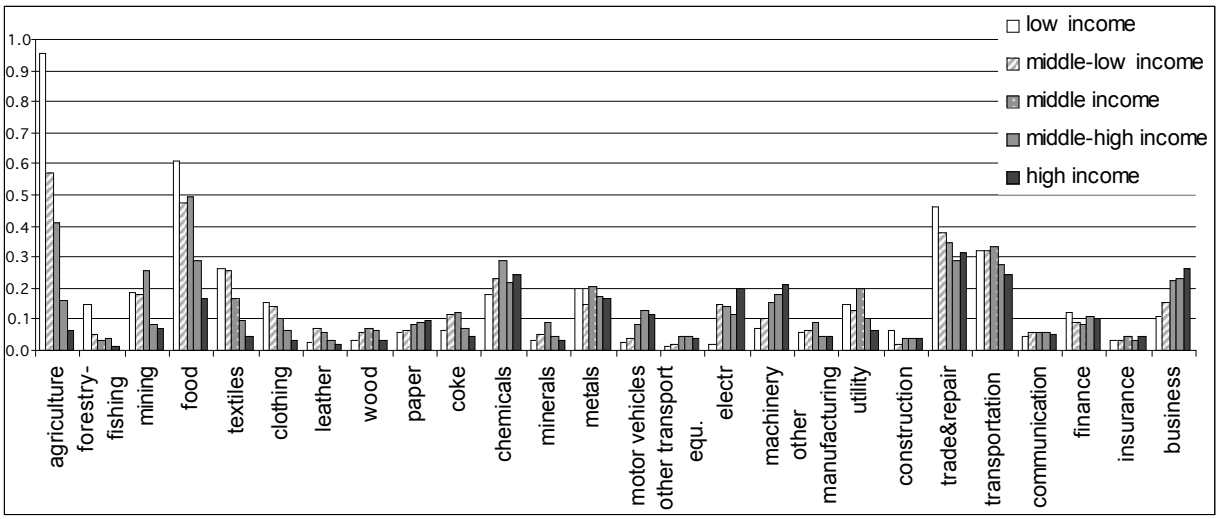

Table 1: Output Effects of Goods Exports on Service Sector Activity

service activity	GDP	t-stat	GDP²	t-stat	R²
business	9.12E-06	4.39	-1.52E-10	-4.87	0.095
communication	9.10E-09	0.01	-6.99E-12	-0.64	0.008
Finance	-2.56E-07	-0.12	2.01E-11	0.48	0.007
insurance	2.31E-07	0.39	3.68E-12	0.33	0.017
transportation	-3.06E-06	-2.13			0.045

Note: Dep. Var. is the total output effect of merchandise exports; robust std. errors.

Table 2: Effects of off-shoring on manufacturing exports

	Industry Group		
	tech intensive	**labour intensive**	**resource intensive**
	0.2199*	-0.2319**	-0.1637
imports of business services	*1.68*	*-1.96*	*-1.26*
imports of communication	-0.0819	0.2183	0.1875
services	*-0.36*	*0.91*	*0.99*
	0.1618	0.0986	-0.0365
imports of financial services	*1.10*	*0.67*	*-0.3*
	-0.1716	-0.0266	-0.1270
imports of insurance services	*-1.01*	*-0.13*	*-0.86*
total FDI inflows	-0.0016	0.0289	0.0095
	-0.04	*0.54*	*0.22*
	0.0093	0.4122	-0.0319
barriers to entrepreneurship	*0.02*	*1.45*	*-0.08*
state control	-0.0806	0.2361	0.0244
	-0.35	*1.05*	*0.13*
	-0.1129	0.0643	0.1762
barriers to trade and investment	*-0.43*	*0.27*	*0.78*
constant	-3.1994**	-4.6532**	-3.3768**
	-4.29	*-5.08*	*-4.67*
observations	182	182	182
groups	23	23	23
within R2	28.45	19.56	2.19
between R2	37.40	41.29	36.60
overall R2	30.73	38.09	30.94

Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.

Table 3: Effects of off-shoring on manufacturing value added

	Industry Group		
	tech intensive	**labour intensive**	**resource intensive**
imports of business services	0.1580**	-0.2328**	-0.0047
	(3.43)	(-3.22)	(-0.11)
imports of communication services	0.1227	0.3692**	0.0191
	(1.55)	(3.1)	(0.29)
imports of financial services	0.0713	0.1152	-0.0820*
	(1.32)	(1.33)	(-1.95)
imports of insurance services	-0.1815**	-0.1924*	0.0568
	(-2.66)	(-1.86)	(1.15)
total FDI inflows	-0.0204*	-0.0703**	-0.0107
	(-1.72)	(-3.36)	(-0.94)
barriers to entrepreneurship	0.0313	0.1343*	0.1140**
	(0.62)	(1.68)	(2.59)
state control	-0.0746*	0.1311*	-0.0454
	(-1.67)	(1.78)	(-1.15)
barriers to trade and investment	0.0588	-0.0002	0.0549
	(1.34)	(0)	(1.61)
constant	-3.2654**	-3.0549**	-2.9601**
	(-13.89)	(-8.45)	(-15.63)
Chi-squared	55.34	66.17	37.04
within R^2	0.0847	0.2081	0.1594
between R^2	0.4580	0.2133	0.0341
overall R^2	0.3588	0.2021	0.0228
observations	182	182	182

Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.

Table 4: Effects of off-shoring on manufacturing employment

	Industry Group		
	tech intensive	**labour intensive**	**resource intensive**
	0.1484**	-0.1705	0.0226
imports of business services	(2.51)	(-1.52)	(0.6)
imports of communication	0.0030	0.2229	-0.0024
services	(0.04)	(1.39)	(-0.04)
	0.0166	0.1373	-0.0479
imports of financial services	(0.24)	(0.97)	(-1.32)
	-0.0732	-0.2321	0.0270
imports of insurance services	(-0.89)	(-1.5)	(0.62)
total FDI inflows	-0.0041	-0.0335	0.0002
	(-0.63)	(-1.46)	(0.04)
	0.0368	0.0094	0.0035
barriers to entrepreneurship	(0.89)	(0.11)	(0.15)
state control	-0.0607**	0.1220*	0.0186
	(-2.16)	(1.86)	(0.89)
barriers to trade and	0.0303	0.0383	-0.0047
investment	(0.65)	(0.43)	(-0.22)
constant	-3.2772**	-2.8969**	-3.2611**
	(-12.63)	(-5.46)	(-21.8)
Chi-squared	79.95	48.33	9.49
within R^2	0.2403	0.1843	0.0675
between R^2	0.4571	0.3002	0.0001
overall R^2	0.3547	0.2695	0.0001
observations	182	182	182

Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.

Appendix Tables

Table A1: Sector and Country Aggregations

Manufacturing Sectors:	
technology intensive	chemicals, machinery, electrical equ., motor vehicles
labor intensive	food, textiles, clothing, leather, other transport equ.
resource intensive	wood, paper, coke, minerals, metals
other	other manufacturing
Service Sectors:	
producer services	transportation, financial, insurance, communication, business,
other	construction, trade, housing, public, personal-cultural and recreational services, utilities
Countries:	
low income	BGD, KHM, MDG, MOZ, MWI, NGA, TZA, UGA, ZMB
middle-low income	ALB, BOL, CHN, ECU, IDN, IND, LKA, MAR, PAK, PER, PHL, VNM, ZWE
middle income	BGR, BRA, BWA, COL, IRN, LTU, LVA, MEX, MKD, MYS, ROM, RUS, THA, TUN, TUR, URY, VEN
middle-high income	ARG, CHL, CYP, CZE, ESP, EST, GRC, HRV, HUN, KOR, MLT, MUS, NZL, POL, PRT, SVK, SVN, ZAF
high income	AUS, AUT, BEL, CAN, CHE, DEU, DNK, FIN, FRA, GBR, HKG, IRL, ITA, JPN, LUX, NLD, NOR, SGP, SWE, TWN, USA

Table A2.1: Effects of off-shoring on technology intensive industries' exports

	chemicals	electric equipment	machinery	motor vehicles
	0.1800*	0.2192**	0.2064**	0.2006
imports of business services	(1.86)	(3.30)	(2.18)	(1.45)
imports of communication	-0.1170	-0.1260	0.1012	-0.0179
services	(-0.82)	(-0.95)	(0.98)	(-0.08)
	-0.0952	0.1900**	0.1646	0.2712**
imports of financial services	(-0.87)	(2.16)	(1.36)	(2.02)
	0.2080**	-0.2096**	-0.2843**	-0.4077**
imports of insurance services	(2.20)	(-1.96)	(-2.32)	(-2.84)
total FDI inflows	0.0228	0.0206	-0.0279	0.0097
	(1.28)	(0.69)	(-1.61)	(0.32)
	-0.0990	0.1982*	0.0396	0.0811
barriers to entrepreneurship	(-1.35)	(1.71)	(0.45)	(0.60)
state control	-0.0188	-0.2041**	0.0281	-0.2101*
	(-0.33)	(-2.06)	(0.40)	(-1.84)
barriers to trade and	0.0453	-0.1437	0.0327	0.0278
investment	(0.62)	(-1.59)	(0.36)	(0.24)
constant	-2.8780**	-3.6377**	-3.2548**	-3.4938**
	(-5.97)	(-8.94)	(-6.45)	(-5.35)
observations	182	182	182	182
groups	23	23	23	23
within R2	36.02	27.48	1.31	14.77
between R2	20.87	19.95	32.1	18.19
overall R2	27.28	28.69	32.65	7.77

Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.

Table A2.2: Effects of off-shoring on technology intensive industries' value added

	chemicals	electric equipment	machinery	motor vehicles
	0.1767**	0.1678**	0.2033**	-0.0609
imports of business services	(3.59)	(4.74)	(3.82)	(-0.88)
imports of communication	-0.1491**	-0.0714	0.1583**	0.4245**
services	(-2.05)	(-0.95)	(2.2)	(3.46)
	-0.0761	0.1181**	-0.0665	0.1675**
imports of financial services	(-1.46)	(2.76)	(-0.99)	(2.55)
	0.2713**	-0.1596**	-0.1562**	-0.4002**
imports of insurance services	(4.73)	(-2.7)	(-2)	(-5.1)
total FDI inflows	0.0093	-0.0285	-0.0555**	0.0547
	(0.58)	(-0.82)	(-3.7)	(1.56)
	-0.0317	-0.0426	0.1126*	0.2065
barriers to entrepreneurship	(-0.52)	(-0.37)	(1.73)	(1.5)
state control	-0.0329	-0.0523	0.0014	-0.3718**
	(-0.58)	(-0.77)	(0.02)	(-3.7)
barriers to trade and	0.1145**	0.0012	0.0200	0.2038**
investment	(2.34)	(0.02)	(0.34)	(2.15)
constant	-2.8050**	-2.6475**	-3.5617**	-3.3405**
	(-10.33)	(-8.68)	(-11.68)	(-7.95)
Chi-squared	77.12	38.03	43.34	63.24
within R^2	0.1957	0.0310	0.0564	0.0416
between R^2	0.3237	0.2410	0.2413	0.4256
overall R^2	0.3927	0.1710	0.2578	0.2648
observations	182	182	182	182

Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.

Table A2.3: Effects of off-shoring on technology intensive industries' employment

	chemicals	electric equipment	machinery	motor vehicles
	0.0823**	0.1808**	0.1995*	0.0230
imports of business services	(2.11)	(4.62)	(1.78)	(0.24)
imports of communication	0.0264	-0.1317	-0.0975	0.4294**
services	(0.46)	(-1.79) *	(-1.03)	(2.61)
	-0.0167	0.0150	-0.1268	0.1718*
imports of financial services	(-0.38)	(0.29)	(-0.88)	(1.83)
	0.0191	-0.0358	0.0400	-0.3490**
imports of insurance services	(0.49)	(-0.57)	(0.31)	(-3.42)
total FDI inflows	-0.0079	0.0091	0.0039	-0.0310
	(-1.06)	(0.87)	(0.29)	(-1.34)
	0.0074	0.0265	-0.0104	0.1996**
barriers to entrepreneurship	(0.24)	(0.57)	(-0.12)	(1.97)
state control	0.0192	-0.1409**	0.0209	-0.1426*
	(0.79)	(-3.56)	(0.39)	(-1.65)
barriers to trade and	-0.0512*	0.0633	0.0379	0.0351
investment	(-1.72)	(1.49)	(0.38)	(0.42)
constant	-2.7410**	-2.8931**	-3.2591**	-3.6769**
	(-14.01)	(-13.96)	(-5.75)	(-7.96)
Chi-squared	68.44	57.28	14.34	34.53
within R^2	0.1531	0.1255	0.0019	0.1488
between R^2	0.3964	0.2934	0.4275	0.3994
overall R^2	0.4093	0.2444	0.3994	0.2691
observations	182	182	182	182

Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.

Table A3.1: Effects of off-shoring on labor intensive industries' exports

	textiles	clothing	leather	food	other transport equ.
	-0.2398**	-0.3545**	-0.3157*	-0.2210	0.1617**
imports of business services	*-2.07*	*-2.71*	*-1.80*	*-0.91*	*2.44*
imports of communication	0.4755**	0.3532*	0.5171**	0.1822	0.1391
services	*2.82*	*1.69*	*1.99*	*0.42*	*1.08*
	0.1067	-0.1861	-0.0449	-0.0568	0.0312
imports of financial services	*0.61*	*-1.29*	*-0.25*	*-0.22*	*0.54*
	-0.2449	0.0137	-0.3889*	0.2246	-0.0188
imports of insurance services	*-1.19*	*0.07*	*-1.81*	*0.67*	*-0.23*
	-0.0556*	0.0050	-0.0381	-0.0492	0.0011
total FDI inflows	*-1.83*	*0.16*	*-1.04*	*-1.11*	*0.04*
	0.0381	-0.0616	-0.0338	-0.0004	0.1175
barriers to entrepreneurship	*0.34*	*-0.51*	*-0.24*	*0.00*	*1.08*
	0.4283**	0.6461**	0.4038**	0.1697	-0.2075**
state control	*4.30*	*5.82*	*3.09*	*1.44*	*-2.36*
barriers to trade and	-0.1713	-0.2486**	0.0002	-0.0373	0.3073**
investment	*-1.55*	*-2.24*	*0.00*	*-0.20*	*3.81*
constant	-3.4368**	-3.6929**	-4.1782**	-1.8342	-4.8493**
	-6.06	*-5.84*	*-5.54*	*-1.62*	*-12.83*
observations	182	182	182	182	182
groups	23	23	23	23	23
within R2	12.34	26.53	23.81	9.35	0.26
between R2	16.88	29.76	10.36	20.5	38.4
overall R2	19.65	31.31	13.7	12.26	36.65

Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.

Table A3.2: Effects of off-shoring on labor intensive industries' value added

	textiles	clothing	leather	food	other transport equ.
	-0.2721**	-0.2682**	-0.2182**	-0.0625	-0.2247**
imports of business services	(-4.11)	(-3.81)	(-2.15)	(-1.49)	(-4.48)
imports of communication	0.4711**	0.2184*	0.1493	-0.0066	0.2267**
services	(4.38)	(1.95)	(1.01)	(-0.08)	(2.45)
	0.0298	-0.0132	0.1785*	-0.0305	0.0226
imports of financial services	(0.31)	(-0.16)	(1.72)	(-0.69)	(0.57)
	-0.1521	0.1255	-0.2767**	0.1861**	-0.0096
imports of insurance services	(-1.34)	(1.22)	(-2.3)	(3.19)	(-0.16)
total FDI inflows	-0.0676**	-0.0646**	-0.0409	-0.0469**	0.0465
	(-2.81)	(-2.6)	(-1.33)	(-2.76)	(1.42)
	0.2621**	0.2162**	0.0430	-0.0404	0.0942
barriers to entrepreneurship	(2.83)	(2.19)	(0.35)	(-0.65)	(0.76)
state control	0.1649*	0.1513	0.2327**	0.1061**	-0.0212
	(1.94)	(1.63)	(2.15)	(1.88)	(-0.29)
barriers to trade and	-0.0392	-0.0440	0.1731*	-0.0007	-0.0021
investment	(-0.5)	(-0.53)	(1.79)	(-0.01)	(-0.02)
constant	-3.1309**	-3.1935**	-5.0142**	-1.4992**	-3.1769**
	(-8.88)	(-8.33)	(-10.36)	(-6.15)	(-9.77)
Chi-squared	78.11	75.41	87.82	51.63	29.04
within R^2	0.2643	0.3302	0.3744	0.0578	0.0260
between R^2	0.1474	0.1667	0.2297	0.3600	0.2098
overall R^2	0.1609	0.1125	0.2567	0.1915	0.1469
observations	182	182	182	182	182

Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.

Table A3.3: Effects of off-shoring on labor intensive industries' employment

	textiles	clothing	leather	food	other transport equ.
	-0.2013**	-0.3105**	-0.3040**	-0.0633	-0.0739
	(-2.23)	(-3.54)	(-1.65)	(-0.96)	(-1.01)
imports of business services	0.3651**	0.2266	0.2561	-0.0237	0.2764**
imports of communication	(2.79)	(1.61)	(0.93)	(-0.19)	(1.96)
services	0.1058	-0.0373	0.0662	-0.0271	-0.0044
	(0.77)	(-0.37)	(0.35)	(-0.39)	(-0.07)
imports of financial services	-0.2144	0.0493	-0.3995*	0.0927	-0.1118
	(-1.33)	(0.37)	(-1.75)	(1.03)	(-1.31)
imports of insurance services	-0.0572**	-0.0317	-0.0138	-0.0012	-0.0258
total FDI inflows	(-2.45)	(-1.36)	(-0.41)	(-0.1)	(-1.51)
	0.1048	0.2659**	-0.0075	-0.0503	0.0092
	(1.23)	(2.91)	(-0.06)	(-1.08)	(0.12)
barriers to entrepreneurship	0.1017	0.1551*	0.2846**	0.0194	0.0765
state control	(1.35)	(1.79)	(2.58)	(0.53)	(1.18)
	0.0390	-0.1351	-0.0065	-0.0287	0.0251
barriers to trade and	(0.46)	(-1.62)	(-0.05)	(-0.55)	(0.41)
investment	-2.7238**	-2.2888**	-3.7129**	-1.3968**	-3.4886**
constant	(-6.19)	(-5.23)	(-4.86)	(-4.53)	(-9.55)
Chi-squared	51.22	74.69	61.20	10.07	12.86
within R^2	0.1471	0.3306	0.2445	0.0341	0.0132
between R^2	0.1201	0.1073	0.1952	0.2644	0.0445
overall R^2	0.1046	0.0730	0.1966	0.1704	0.0284
observations	182	182	182	182	182

Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.

Table A4.1: Effects of off-shoring on resource intensive industries' exports

	coke	minerals	metals	paper	wood
	-0.2281	-0.0745	-0.0120	0.0699	-0.2775
imports of business services	-1.15	-0.5	-0.12	0.29	-0.75
imports of communication	0.5615**	-0.1871	-0.1518	-0.1949	0.3910
services	2.33	-0.81	-1.13	-0.54	0.73
	-0.2643*	0.1826	-0.1305	-0.2768	0.1491
imports of financial services	-1.7	0.97	-1.03	-1.26	0.42
imports of insurance	-0.2544*	-0.0794	0.0331	0.2269	-0.3994
services	-1.72	-0.36	0.22	1.1	-0.88
	-0.0795	0.0013	0.0109	0.0401	-0.0178
total FDI inflows	-0.92	0.05	0.69	1.07	-0.31
	-0.6948**	-0.1749	0.0112	0.1668	0.0201
barriers to entrepreneurship	-2.05	-1.61	0.14	1.33	0.12
	-0.3932	0.1441*	-0.0312	0.0428	0.1402
state control	-1.36	1.82	-0.51	0.42	0.93
barriers to trade and	0.2810	0.0624	0.0809	-0.2450	-0.0217
investment	1.16	0.55	0.99	-2.0	-0.11
constant	-1.6813	-3.9813**	-2.0436**	-3.4588**	-3.2008**
	-1.41	-6.04	-4.69	-3.51	-2.05
observations	182	182	182	182	182
groups	23	23	23	23	23
within R2	4.86	11.83	18.05	7.52	0.26
between R2	40.96	22.96	23.73	2.56	24.9
overall R2	20.52	25.06	23.49	1.76	32.21

Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.

Table A4.2: Effects of off-shoring on resource intensive industries' value added

	coke	minerals	metals	paper	wood
	-0.0770	-0.0771**	0.1842**	0.0362	-0.1884**
imports of business services	(-1.44)	(-2.06)	(2.74)	(0.49)	(-2.4)
imports of communication	0.0838	0.0840	0.0608	-0.0664	0.2570**
services	(1.33)	(1.32)	(0.63)	(-0.62)	(2.11)
	-0.0485	0.0047	-0.0427	-0.1384*	-0.1528*
imports of financial services	(-1.15)	(0.11)	(-0.49)	(-1.9)	(-1.87)
	0.1391**	-0.1025*	-0.1813*	0.2253**	0.0923
imports of insurance services	(3.6)	(-1.87)	(-1.74)	(2.88)	(0.93)
total FDI inflows	0.0208	-0.0007	-0.0418**	0.0047	-0.0279
	(0.56)	(-0.04)	(-3.1)	(0.29)	(-1.42)
	0.4257**	0.0892	0.0510	0.1962**	0.2869**
barriers to entrepreneurship	(2.81)	(1.45)	(0.79)	(3.14)	(3.68)
state control	-0.1552*	0.0433	-0.0161	-0.0172	-0.0625
	(-1.75)	(0.84)	(-0.31)	(-0.3)	(-0.88)
barriers to trade and	0.2565**	-0.0689	0.1200**	-0.1553**	-0.1016
investment	(2.85)	(-1.55)	(2.02)	(-3.04)	(-1.51)
constant	-4.4701**	-2.8506**	-2.7602**	-2.2913**	-2.7460**
	(-11.55)	(-13.5)	(-8.7)	(-7.26)	(-7.58)
Chi-squared	39.72	17.30	47.30	27.77	26.25
within R^2	0.1224	0.0627	0.1499	0.0889	0.0832
between R^2	0.2234	0.1290	0.1471	0.0046	0.0062
overall R^2	0.1777	0.1664	0.1807	0.0128	0.0294
observations	182	182	182	182	182

Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.

Table A4.3: Effects of off-shoring on resource intensive industries' employment

	coke	minerals	metals	paper	wood
imports of business services	-0.0154	-0.0412	0.1372**	0.0401	-0.1353
	(-0.3)	(-0.57)	(2.41)	(0.49)	(-1.44)
imports of communication services	0.1898**	0.1006	0.0711	0.0790	0.0787
	(3.04)	(0.88)	(0.91)	(0.66)	(0.57)
imports of financial services	-0.0616	0.0287	0.0109	-0.0660	-0.0782
	(-1.54)	(0.32)	(0.15)	(-0.87)	(-0.86)
imports of insurance services	-0.0832**	-0.1123	-0.1419	0.0940	0.0721
	(-2.16)	(-1.07)	(-1.62)	(1.26)	(0.62)
total FDI inflows	-0.0279	-0.0100	-0.0033	-0.0102	0.0063
	(-1.52)	(-0.74)	(-0.37)	(-0.75)	(0.41)
barriers to entrepreneurship	0.0321	-0.0167	-0.0305	0.0975**	0.0997**
	(0.43)	(-0.29)	(-0.64)	(2.02)	(1.97)
state control	-0.1245*	0.0482	0.0372	0.0540	0.0258
	(-1.83)	(1.09)	(1.07)	(1.29)	(0.58)
barriers to trade and investment	0.2264**	-0.0198	0.0458	-0.1247**	-0.1387**
	(4.15)	(-0.35)	(0.96)	(-2.81)	(-2.47)
constant	-4.8050**	-2.9705**	-2.7968**	-2.7772**	-2.6498**
	(-16.62)	(-9.19)	(-11.03)	(-8.32)	(-6.61)
Chi-squared	42.95	3.00	33.94	32.90	13.54
within R^2	0.0871	0.0446	0.0732	0.0287	0.0328
between R^2	0.3311	0.0524	0.2418	0.2338	0.0443
overall R^2	0.2812	0.0863	0.2788	0.2333	0.0687
observations	182	182	182	182	182

Note: 2SLS regression results, instruments used: initial values, country dummies, value added of resp. industry group; ** (*) indicates significance at 1% (5%) level.