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Producer Services, Manufacturing, and Trade

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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 2001, we examine the role of services as inputs in manufacturing, with a particular focus on indirect exports of services through merchandise exports, and also on the related interaction between service sector openness and the overall pattern of manufacturing 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.

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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, 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, nor the importance of services sold through local affiliates of multinationals.

In this paper we examine the role of services as inputs in manufacturing, with a particular focus on indirect exports of services through merchandise exports, and also on the related interaction between service sector openness and the relative performance of different sectors in the overall pattern of manufacturing exports. We work with a mix of panel data on goods and services trade for the 30 OECD Members for 1994-2004, combined with social accounts data (i.e. data on intermediate linkages) for 78 countries inclusive of our OECD sample and benchmarked to the year 2001. With increasing per capita income, we find an increasing demand for producer services as inputs in manufacturing production at higher income levels, especially so for the narrowly defined category of business services. We also find strong direct and indirect multiplier effects for producer services, again positively related to income levels. Having quantified the importance of services as upstream inputs in manufacturing production, we next turn to the role of trade in both goods and services on the economy. On the one hand we observe strong indirect exports of producer services embodied as inputs in manufacturing. This is true across our sample of 78 low-, middle- and high-income countries. The relative importance of services in the total activity content of exports is also significantly correlated with income levels. With increasing per capita income the service intensity of exports increases –

especially so for business services. On the other hand, from panel regressions, we also 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. Finally, we find evidence that the importance of services as inputs in the post-industrial (high income OECD) economies has increased over the 1990s, such that we find that depth of intermediate linkages in modern service-based economies is greater than at the start of the 1990s. Our results on services and goods trade linkages also support the notion that off-shoring of business services does actually promote the competitiveness of the most skill and technology intensive industries in the OECD countries.

Explanations for the now dominant role of services in modern economies, relative both to low-income countries and to historic patterns within OECD countries themselves, have generally emphasized demand-side factors. Clark (1940) was the first to note a rising share of services associated with economic growth and attributed this to demand side factors, while later Baumol et al. (1985) related the pattern of rising final service prices to relative productivity differentials and to a predicted stagnation of overall productivity growth. In general, this literature stressed final demand services and non-homothetic demand as the driving force in service sector growth. Yet there have also been important post-War changes linked to intermediate or producer services. Working with national accounts data that largely pre-date the information technology revolution of the 1990s, Park (1989), Park and Chan (1989), and Uno (1989) have all confirmed the post-War rise in the importance of producer service inputs into manufacturing along the lines stressed by Katouzian (1970) and Francois (1990). More recently, emphasis has been placed on the implications of linkages between services and manufacturing for trade and FDI in the service sector.

This includes Javorcik, Arnold and Mattoo (2006) and Markusen Rutherford and Tarr (2005). In this paper we provide cross-country 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 proceeds as follows: We start in Section 2 with an overview of our data on production and trade. In Section 3 we then explore the role of service inputs in manufacturing. We turn to trade-based linkages in Section 4. We offer a brief summary and concluding remarks in Section 5.

2. 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 77 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 available breakdown of service trade data, so that a concordance is employed such 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 subsequent sections.¹

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 77 countries for the year

¹ The data, including the direct and indirect linkage indexes, are available on request.

2001. Data on services trade come from published IMF balance of payments statistics, supplemented with EUROSTAT data where possible.² 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 our purposes, the sector breakdown is sufficient. In these data, information on detailed services trade by sector is limited to OECD Members. This does give 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), our panel analysis of trade data will by necessity be limited to the OECD 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 the Global Trade Analysis Project (GTAP) database version 6.2. This version of the GTAP database represents 2001 values for production, expenditures and trade for 87 regions (or countries) from which we use 77 countries and 57 sectors which we aggregated for our purposes into 29 sectors. Of these 15 are manufacturing sectors and 10 are service sectors (see Table 1). We focus in particular on producer services, which are defined as the

² Eurostat covers 31 reporting countries – the EU25 plus Bulgaria, Japan, Norway, Romania, Turkey and the USA – and 64 partner countries (see below) 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. Complete coverage involves only the OECD sub-sample however.

following: communication services, financial services, insurance services, business services and transportation services. We have organized the 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 then 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).

[Table 1 here]

We also make use of a number of indexes derived from our social accounting data. To examine production linkages, we begin by denoting a country's $n \times n$ social accounting matrix by \mathbf{S} and a column unit n -vector by \mathbf{e} (where n is the number of number of elements in the column and row indexes.). Then $\mathbf{c} = \mathbf{e}'\mathbf{S}$ is the column-sum vectors of \mathbf{S} . If a $\hat{\cdot}$ over a vector is used to denote the corresponding n -dimensional diagonal matrix, then $\hat{\mathbf{A}} = \hat{\mathbf{S}}\mathbf{c}^{-1}$ 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 $\hat{\mathbf{A}}$ 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:

$$(1) \quad D = \frac{\prod_{j \in \lambda} \prod_{i \in \lambda} A_{ij}}{\prod_{j \in \lambda} \prod_{i \in \omega} A_{ij}}$$

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 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 \mathbf{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 the standard 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 \mathbf{A} consisting of the m endogenous accounts as \mathbf{A}_{mm} . The multiplier matrix is given by

$$(2) \quad \mathbf{M} = (\mathbf{I}_m - \mathbf{A}_{mm})^{-1}$$

A representative element of the \mathbf{M} matrix, M_{ij} , gives the direct and indirect 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 \mathbf{f} as the column vector of these elements. The coefficient ϕ

$$(3) \quad \phi_i = f_i / \mathbf{f}'\mathbf{e}$$

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

$$(4) \quad \Omega = \mathbf{M}\Phi$$

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. Services in Production

We start with a focus on linkages between services and manufacturing. Building on patterns identified in this section, we turn our attention to the implications for the interaction between trade in goods and trade in services in Section 4. From the earlier literature on the structure of production and demand across countries (Park 1989, Francois and Reinert 1996), we expect to see a rising demand for producer services for countries at higher levels of economic development. At the same time, from the corresponding literature on final demand (Hunter and Markusen 1988, Bhagwati 1984, Panagariya 1988) we also expect a shift toward final service production driven by final demand factors. In employment and output terms, what results is a U-pattern, where the service sector in general shows an initial decline when a country shifts toward a more industrialized structure of production, and then starts to increase its share in the economy again as the country moves further towards a more modern, service based economy. This overall pattern is driven by the interaction of final and intermediate demand factors. Our interest in this section is the intermediate demand factors driving demand for producer services. The role of services as inputs has important implications for the shift in the overall complexity of intermediate linkages between sectors linked to level of development. At the same time, when we compare this pattern to the literature for earlier periods, it appears that the complexity of intermediate linkages (the overall “roundaboutness of production”) has grown deeper over the 1990s for the higher-income service-based economies, a pattern consistent with a generally rising importance for services as inputs.

3.1. Direct demand and the intensity of inter-industry linkages

Figure 1 plots the demand for business services (measured as the share of intermediate demands) against per-capita GDP at purchasing power parities in 2001. In the figure we show the share of services used in individual manufacturing sectors (from our use coefficients A_{ij}). While no significant relationship (positive nor negative) between per-capita income and the demand for total services can be identified, we do find a positive relationship for most industries when looking at producer services only. However, the patterns point toward significant differences across individual manufacturing industries. When restricting our attention to business services only (these are activities such as accounting, book-keeping, management consultancy services, operational leasing, legal services, advertising, etc.) as in Figure 1 we find a strong positive correlation for all manufacturing sectors.

We test for the strength of this correlation for different service categories with the simple cross-section OLS model, given in equation 5:

$$(5) \quad A_{ijk} = \alpha_{ij} + \beta 1_{ij} pcGDP_k + \beta 2_{ij} pcGDP_k^2 + \varepsilon_{ijk}$$

In equation (5), A_{ijk} are the intermediate use shares from the use matrix \mathbf{A} for each country k for use of intermediates of each manufacturing industry in 2001, while $pcGDP_k$ is per-capita income level, measured at purchasing parities for each of the 78 countries in our sample (all variables are in logs). In every individual case we decide between a linear and a quadratic specification, depending on which one gives a better fit to the data. The results of this regression are reported in Table 2. Table 2.1 reports the OLS regression results separately for each manufacturing industry using producer services as the dependent variable. We identify a significant correlation between income levels and service intensity – U-shaped and statistically significant at the 1%-confidence level - for the following industries: food, textiles, clothing, leather, paper,

coke, chemicals, and metals. These industries are mostly labour and resource intensive. With increasing per capita income, the use of such more labour intensive services as inputs in industrial production first declines and at a more developed stage rises again. Thus, a significant relationship between rising per-capita income and the use of services in manufacturing production emerges clearly at the industrial sector level.

[Figure 1 here]

Table 2.2. reports the results for business services. Here, a highly significant linear relationship emerges for all industries, indicating a strong shift toward business services inputs in more developed countries. This underlines the increasing outsourcing of such activities to service firms. Whether these are sourced locally or imported from abroad cannot be assessed from this data, though Francois (1990) and Francois and Reinert (1996) offer evidence that this involves both off-shoring and a real qualitative shift toward greater service intensity in the manufacturing sector.

Tables 2.3 – 2.6 give further the results for other producer services, such as communication services, financial services, insurance services and transportation services. The latter activity is usually not accounted as a producer service, however, the increasing fragmentation of production also brings about a delocalisation of production units. As a consequence, also transportation services should play an increasing role in modern service based economies. We often find a U-shaped relationship between the use of services in production and stage of development, especially so for financial and insurance services in the more labour and resource intensive industries.

[Table 2 here]

We next turn to the overall density of the intermediate use matrix, or what is also known as the increasing roundaboutness of production. Services play an important role here (Francois 1990, Javorcik, Arnold and Mattoo 2006), while from earlier cross-country comparisons of input-output structures (Park and Chan 1989, Francois and Reinert 1996) we know that services exhibit fewer inter-industry linkages overall than manufacturing. What this implies is an overall shift in the density of the intermediate use matrix, with an initial rise from low to middle income economies (or from primary to manufacturing) and a subsequent drop with the move to higher income economies (or from manufacturing to service based).

Figure 2 plots the density index D as defined in equation (1) against per-capita income levels. The non-linear relationship between stage of development and the density of the intermediate use matrix becomes apparent, even after removing two outliers, namely Bulgaria (with an apparent very high density at low per-capita income) and Luxembourg (again with a high density at an extremely high level of per-capita income). However, compared to the evidence for 1992 with a broadly comparable set of data presented in Francois and Reinert, the peak point with the highest density has shifted from approximately 12,000 USD per-capita income to 20,000 USD per-capita income by 2001 measured at current prices. This corresponds to a shift from 16,860 USD in 1992 USD and thus means a real increase in the turning point. It is broadly consistent with the perception that the 1990s have seen a growth in the importance of services as inputs, driven in part by information technology. Such a shift offsets the drop in the intensity of linkages in the high income, service-based economies.

[Figure 2 here]

3.2. Combined direct and indirect linkages

We next look at the combination of direct and indirect effects for services generated by additional output demand in manufacturing sectors. In a first step, we simply group the multipliers ω from equation (4) by manufacturing sectors, as shown in Figure 3, and report them for five income groups (see Table 1 for the grouping of countries according to per-capita income). There are apparent differences between the effects generated by more skill and technology intensive industries as opposed to more labour and resource intensive industries. The labour intensive industries (like food, textiles, clothing, etc.) involve lower multiplier effects in higher income countries. In contrast, in industries like paper, chemicals, machinery, electrical equipment and automobiles, the effects are clearly stronger for the more advanced countries. This underlines the increasing importance of intermediate linkages through a higher degree of outsourcing of service inputs and more use of overall service inputs in the high-income countries.

The ranking of service activities with the greatest total linkage multipliers ω from manufacturing demand differ between low-skill, labor-intensive and high-skill, technology intensive industries. While trade and repair is the sector receiving the strongest effects from increased production in all industries, the magnitude of the multiplier effect is highest in industries like food, textiles, clothing etc. The multiplier effects for this service activity decline in the skill and technology intensity of the manufacturing sector causing the additional output effects. We further observe a decline in the effects for transportation services with increasing skill and technology intensity in manufacturing. On the other hand, business services receive stronger effects the more sophisticated the manufacturing industry. All this suggests an

increasing importance of business activities along with economic development and the according structural shift towards more skill and technology intensive production.

[Figure 3 here]

As a next step we do OLS again to see whether the stylized facts highlighted in Figure 3 amount to a statistically significant relationship. The regression equation is defined by equation (6):

$$(6) \quad M_{ijk} = \alpha_{ij} + \beta 1_{ij} pcGDP_k + \beta 2_{ij} pcGDP_k^2 + \varepsilon_{ijk}$$

Where M_{ijk} are the direct and indirect effects – as defined in equation (2) -- generated in the respective service category i as a result of an additional unit of output in each manufacturing industry j (i.e. the multiplier effect of manufacturing in the service sector). Again, regressions are run separately for each industry in a cross-section over all 78 countries using a quadratic specification only when appropriate. The coefficients reported in Tables 3.1 – 3.5 are elasticities of the multiplier M with respect to per-capita income levels. Here we look at the effects generated in individual service categories separately. For business services, we find a significant positive correlation of the direct and indirect effects generated by additional output in manufacturing and the stage of development. This holds true for all industries (see Table 3.1 and also Figure 4). In contrast to this clear result for business services, there are fewer effects relating to stage of economic development for other producer relevant service categories. The negative effect in Table 3.2 for leather and clothing reveals that these two industries account for lower indirect and direct output effects in communication services in more advanced countries. On the other hand, the production of machinery, electrical equipment and motor vehicles generates increasingly strong multiplier effects in communication services in higher income

countries. A similar finding arises for financial services, while here we often find the U-shaped relationship in the less technology intensive industries (Table 3.3). In insurance services, again the same industries account for higher multipliers in the higher income economies (Table 3.4). Consistent with the figures, we also have a negative income correlation for multipliers in transportation (Table 3.5). Almost all manufacturing industries generate lower multipliers for transport in the higher income economies. Only in the production of electrical equipment and motor vehicles and in the petroleum industry we see first an increasing demand for transportation services in value terms, which declines again at high stages of development. In our view this is likely to reflect greater overall efficiency in the transport systems of high income countries, rather than a structural shift in input demand.

[Table 3 here]

[Figure 4 here]

4. Services in Trade

From our discussion of intermediate linkages between services and manufacturing industries, we should expect trade in services, and the general openness of the producer service sectors, to play a role in the relative efficiency of manufacturing industries. Indeed, this is a basic point to be taken from the theoretical literature on trade in services. (Markusen 1989; Francois 1990b; van Marrewijk et al 1997; Markusen Rutherford and Tarr 2005). In this section, we examine the interaction between the evolution of producer service imports, on the one hand, and the relative success of various industries in overall manufacturing exports on the other. Because our data on services trade by sector are limited to the OECD, we work with a panel

dataset of OECD exports, combined with the indirect service intensity coefficients \mathbf{M} derived from our broader sample of social accounting data.

4.1. Direct and Indirect Exports

We start 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 Φ and Ω as defined in equations (3) and (4).

Figure 5 plots the combined direct and indirect multipliers ω 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 decline with a rising income level.

[Figure 5 here]

Figure 6 relates the indirect and direct activity composition of exports to per-capita income for our selected 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. These results are confirmed by the OLS coefficients reported in Table 4, based on equation (7).

$$(7) \quad \omega_{ik} = \alpha_i + \beta 1_i pcGDP_k + \beta 2_i pcGDP_k^2 + \varepsilon_{ik}$$

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. As mentioned previously, 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. Figure 6 further reveals that the magnitude of effects is much higher in business services as compared to communication and insurance services.

[Table 4 here]

[Figure 6 here]

4.2. Services Imports and Goods Export Composition

Finally, we are interested in the impact of service sector imports on manufacturing export performance. From Javorcik, Arnold and Mattoo (2006) we have case-study evidence (based on the experience of the Czech Republic) that service sector inward FDI can contribute to firm efficiency. Here we look for similar 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. Table 5 offers an assessment, based on panel regression of OECD export data with time-varying country fixed effects, at the sector level for sectors defined in Table 1 for 1994-2004. Given our previous findings, we concentrate here on business services. The following simple regression model is applied to our panel data set.

$$(8) \quad X_{ikt} = \alpha_{it} + \beta 1_{it} ServM_{ikt} + \beta 2_{it} TOTX_{kt} + \varepsilon_{kt}$$

where X_{ikt} refers to the exports of manufacturing industry i in year t of country k .

$ServM_{ikt}$ are imports of business services into industry i in economy k in year t ,

which we obtain by interacting our coefficients M_{ij} with business service imports. In this way we proxy for the total role of business service imports in the cost structure of various manufacturing industries. Finally, $TOTX_{ikt}$ are total goods exports of country k . We again use a fixed effects model, since we are in effect working with the full sample of OECD countries. Again we run the regressions separately for each industry and base our inference on robust standard errors. Results are presented in Table 5 and are robust to using different and additional control variables – for instance value added or employment of individual industries.

What emerges from the results is that imports of business services are an important determinant of the pattern of manufacturing exports in the most advanced industries. The coefficients on business service imports are all highly significant, with one exception in the leather industry. The effect is particularly high in the most skill and technology intensive industries, such as the manufacture of machinery, electrical equipment and chemicals. This points to the more advanced industries being vertically integrated, not only nationally but also internationally through the offshoring of business services. Indeed, the results in Table 5 support the notion that offshoring of business services does actually promote the competitiveness of the most skill and technology intensive industries.

5. 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 2000 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 manufacturing industries. This result, which is based on our work with panel data on trade and a cross-section of social accounts data (SAMs), complements (and supports) the results coming from the current literature based on individual country/case studies.

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Figures and Tables

Table 1: Sector and Country Aggregations

Manufacturing Sectors:	
food, textiles, clothing, leather, wood, paper, coke, chemicals, minerals, metals, machinery, electrical equ., motor vehicles, other transport equ., other manufacturing	
Service Sectors:	
construction, trade, transportation, financial, insurance, communication, business, 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 2.1: Manufacturing Demand for Producer Services

	GDP	t-stat	GDP²	t-stat	R²
food	-3.14	-5.18**	0.19	5.45**	0.39
textiles	-2.93	-2.20**	0.17	2.30**	0.07
clothing	-2.98	-2.38**	0.18	3.02**	0.19
leather	-3.91	-2.40**	0.23	2.49**	0.07
wood	-1.21	-1.20	0.07	1.29	0.03
paper	-3.02	-3.23**	0.18	3.39**	0.16
coke	-3.69	-2.11**	0.20	2.04**	0.10
chemicals	-4.47	-4.86**	0.27	5.02**	0.21
minerals	-0.64	-0.54	0.04	0.68	0.07
metals	-3.32	-3.39**	0.19	3.38**	0.10
machinery	0.27	0.18	0.00	-0.01	0.13
electrical equ.	0.52	0.42	-0.02	-0.29	0.08
motor vehicles	-0.88	-0.93	0.05	1.00	0.03
other transport equ.	-1.01	-0.87	0.07	1.08	0.10
other manufacturing	-1.99	-1.42	0.13	1.65*	0.10

Note: Dep. Var. is share of producer services in resp. industry; robust std. errors; ** (*) indicates significance at 1% (5%) level.

Table 2.2: Manufacturing Demand for Business Services

	GDP	t-stat	R²
food	0.63	5.13**	0.34
textiles	0.50	3.92**	0.17
clothing	0.58	3.93**	0.20
leather	0.40	2.88**	0.12
wood	0.39	2.79**	0.12
paper	0.59	3.14**	0.21
coke	0.64	3.17**	0.17
chemicals	0.47	3.39**	0.18
minerals	0.52	4.87**	0.30
metals	0.37	2.29**	0.10
machinery	0.57	4.21**	0.30
electrical equ.	0.40	4.16**	0.17
motor vehicles	0.42	3.73**	0.29
other transport equ.	0.46	4.07**	0.32
other manufacturing	0.34	2.56**	0.12

Note: Dep. Var. is share of business services in resp. industry; robust std. errors; ** (*) indicates significance at 1% (5%) level.

Table 2.3: Manufacturing Demand for Communication Services

	GDP	t-stat	GDP²	t-stat	R²
food	0.23	2.07**			0.07
textiles	0.21	2.16**			0.05
clothing	0.29	2.41**			0.09
leather	0.11	0.91			0.01
wood	0.24	1.83*			0.09
paper	-2.98	-2.25**	0.19	2.46**	0.16
coke	0.25	1.18			0.02
chemicals	0.17	1.47			0.04
minerals	0.11	0.91			0.02
metals	-2.79	-2.14**	0.16	2.19**	0.06
machinery	0.18	1.75*			0.05
electrical equ.	-0.11	-1.20			0.02
motor vehicles	-0.02	-0.20			0.00
other transport equ.	0.13	1.08			0.03
other manufacturing	0.05	0.64			0.00

Note: Dep. Var. is share of communication services in resp. industry; robust std. errors; ** (*) indicates significance at 1% (5%) level.

Table 2.4: Manufacturing Demand for Financial Services

	GDP	t-stat	GDP²	t-stat	R²
food	-6.77	-3.58**	0.39	3.55**	0.11
textiles	-4.67	-2.79**	0.27	2.76**	0.08
clothing	-6.79	-3.87**	0.39	3.88**	0.14
leather	-4.05	-2.73**	0.23	2.67**	0.07
wood	-3.09	-1.89*	0.18	1.90*	0.04
paper	-6.74	-3.81**	0.38	3.70**	0.14
coke	-7.57	-2.31**	0.43	2.30**	0.09
chemicals	-6.49	-3.34**	0.38	3.34**	0.11
minerals	-3.94	-2.17**	0.23	2.16**	0.05
metals	-5.59	-3.06**	0.32	2.99**	0.09
machinery	-2.35	-1.25	0.14	1.33	0.03
electrical equ.	-1.68	-1.25	0.10	1.27	0.02
motor vehicles	0.59	0.36	-0.04	-0.40	0.01
other transport equ.	-1.27	-0.82	0.07	0.82	0.01
other manufacturing	-6.76	-4.03**	0.39	4.00**	0.12

Note: Dep. Var. is share of financial services in resp. industry; robust std. errors; ** (*) indicates significance at 1% (5%) level.

Table 2.5: Manufacturing Demand for Insurance Services

	GDP	t-stat	GDP²	t-stat	R²
food	-4.54	-3.7**	0.27	3.76**	0.13
textiles	-2.67	-1.7*	0.15	1.71*	0.04
clothing	-3.71	-2.24**	0.22	2.29**	0.06
leather	-3.25	-2.16**	0.18	2.07**	0.05
wood	-2.24	-1.31	0.14	1.40	0.04
paper	-4.76	-3.37**	0.27	3.32**	0.13
coke	0.11	0.04	-0.01	-0.07	0.00
chemicals	-4.99	-3.27**	0.29	3.28**	0.13
minerals	-1.76	-1.12	0.11	1.20	0.03
metals	-3.53	-2.39**	0.21	2.44**	0.06
machinery	-2.31	-1.49	0.14	1.54	0.03
electrical equ.	-0.54	-0.33	0.03	0.33	0.00
motor vehicles	-1.34	-0.77	0.08	0.81	0.01
other transport equ.	-2.92	-1.83*	0.18	1.96**	0.09
other manufacturing	-4.18	-3.21**	0.24	3.25**	0.11

Note: Dep. Var. is share of insurance services in resp. industry; robust std. errors; ** (*) indicates significance at 1% (5%) level.

Table 2.6: Manufacturing Demand for Transportation Services

	GDP	t-stat	GDP²	t-stat	R²
food	-2.63	-3.13**	0.16	3.14**	0.10
textiles	-0.84	-0.56	0.05	0.61	0.01
clothing	-0.39	-0.32	0.02	0.35	0.00
leather	-1.82	-1.06	0.10	1.06	0.02
wood	1.23	0.97	-0.07	-0.92	0.03
paper	0.17	1.79*			0.07
coke	-0.29	-2.22**			0.06
chemicals	-4.21	-4.09**	0.24	4.08**	0.13
minerals	-0.67	-0.53	0.04	0.59	0.01
metals	-2.04	-1.45	0.11	1.44	0.03
machinery	1.17	0.77	-0.07	-0.79	0.01
electrical equ.	-0.16	-1.87*			0.06
motor vehicles	-0.83	-0.65	0.04	0.59	0.02
other transport equ.	-0.98	-0.79	0.06	0.78	0.01
other manufacturing	-0.93	-0.58	0.05	0.61	0.00

Note: Dep. Var. is share of transportation services in resp. industry; robust std. errors; ** (*) indicates significance at 1% (5%) level.

Table 3.1: Direct and Indirect Multiplier Effects in Business Services

	GDP	t-stat	GDP²	t-stat	R²
food	0.0396	4.02 **			0.13
textiles	0.0256	3.43**			0.12
clothing	0.0161	1.93*			0.04
leather	0.2142	1.98**	-0.0117	-1.82 *	0.06
wood	0.0218	2.38**			0.05
paper	0.0452	4.56**			0.20
coke	0.0151	2.15**			0.04
chemicals	0.0384	4.48**			0.20
minerals	0.0369	4.10**			0.15
metals	0.0318	3.47**			0.12
machinery	0.0411	5.21**			0.26
electrical equ.	0.0353	4.91**			0.20
motor vehicles	0.0347	4.71**			0.19
other transport equ.	0.0298	3.65**			0.11
other manufacturing	0.0294	3.60**			0.11

Note: Dep. Var. is the multiplier coefficient in business services in resp. industry; robust std. errors; ** (*) indicates significance at 1% (5%) level.

Table 3.2: Direct and Indirect Multiplier Effects in Communication Services

	GDP	t-stat	GDP²	t-stat	R²
food	-1.2E-04	-0.03			0.00
textiles	5.0E-06	0.00			0.00
clothing	-5.3E-03	-1.71 *			0.05
leather	-4.6E-03	-1.68 *			0.05
wood	-3.0E-03	-0.93			0.01
paper	4.9E-03	1.83*			0.05
coke	7.9E-02	2.40**	-4.5E-03	-2.32 **	0.05
chemicals	3.5E-03	1.34			0.03
minerals	9.2E-04	0.32			0.00
metals	4.4E-04	0.16			0.00
machinery	7.0E-03	4.58**			0.19
electrical equ.	4.6E-03	3.08**			0.09
motor vehicles	4.3E-03	2.50**			0.05
other transport equ.	1.8E-03	0.74			0.01
other manufacturing	-3.5E-04	-0.14			0.00

Note: Dep. Var. is the multiplier coefficient in communication services in resp. industry; robust std. errors; ** (*) indicates significance at 1% (5%) level.

Table 3.3: Direct and Indirect Multiplier Effects in Financial Services

	GDP	t-stat	GDP²	t-stat	R²
food	-2.8E-01	-2.44**	1.6E-02	2.50**	0.04
textiles	-1.1E-01	-1.40	6.4E-03	1.36	0.01
clothing	-2.1E-01	-1.87*	1.1E-02	1.76*	0.07
leather	-8.3E-02	-0.72	4.1E-03	0.64	0.03
wood	-1.7E-01	-1.42	9.3E-03	1.37	0.04
paper	-2.9E-01	-2.56**	1.7E-02	2.63**	0.07
coke	9.4E-03	0.13	-3.9E-04	-0.09	0.00
chemicals	-2.5E-01	-2.20**	1.4E-02	2.30**	0.08
minerals	-1.4E-01	-1.56	8.3E-03	1.61	0.02
metals	-2.1E-01	-2.19**	1.2E-02	2.21**	0.05
machinery	1.4E-02	2.75**			0.08
electrical equ.	1.0E-02	2.12**			0.05
motor vehicles	7.9E-03	0.13	-4.9E-05	-0.01	0.02
other transport equ.	-1.2E-01	-1.21	6.9E-03	1.24	0.04
other manufacturing	-2.0E-01	-1.97**	1.1E-02	2.03**	0.03

Note: Dep. Var. is the multiplier coefficient in financial services in resp. industry; robust std. errors; ** (*) indicates significance at 1% (5%) level.

Table 3.4: Direct and Indirect Multiplier Effects in Insurance Services

	GDP	t-stat	R²
food	3.8E-03	1.15	0.02
textiles	2.5E-03	1.23	0.01
clothing	-1.7E-03	-0.68	0.01
leather	-1.6E-03	-0.52	0.01
wood	3.0E-04	0.10	0.00
paper	3.2E-03	0.99	0.02
coke	2.6E-03	1.54	0.02
chemicals	4.0E-03	1.31	0.04
minerals	5.4E-03	2.79**	0.06
metals	3.1E-03	1.24	0.02
machinery	5.9E-03	3.69**	0.12
electrical equ.	4.1E-03	3.11**	0.07
motor vehicles	5.1E-03	3.42**	0.09
other transport equ.	3.5E-03	2.06**	0.04
other manufacturing	2.0E-03	0.64	0.01

Note: Dep. Var. is the multiplier coefficient in insurance services in resp. industry; robust std. errors; ** (*) indicates significance at 1% (5%) level.

Table 3.5: Direct and Indirect Multiplier Effects in Transportation Services

	GDP	t-stat	GDP²	t-stat	R²
food	-0.043	-3.10**			0.16
textiles	-0.032	-2.17**			0.11
clothing	-0.055	-4.05**			0.26
leather	-0.053	-3.93**			0.26
wood	-0.051	-3.65**			0.21
paper	-0.016	-1.37			0.03
coke	0.365	2.71**	-0.022	-2.78**	0.11
chemicals	-0.017	-1.64			0.05
minerals	-0.029	-2.14**			0.08
metals	-0.030	-2.91**			0.12
machinery	0.002	0.29			0.00
electrical equ.	0.159	2.07**	-0.010	2.12**	0.05
motor vehicles	0.277	2.78**	-0.016	-2.80**	0.08
other transport equ.	-0.020	-2.01**			0.07
other manufacturing	-0.039	-3.26**			0.20

Note: Dep. Var. is the multiplier coefficient in transportation services in resp. industry; robust std. errors; ** (*) indicates significance at 1% (5%) level.

Table 4: 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 5: Impact of Service Imports on Manufacturing Export Performance
 Fixed-effects panel regression results, dep. var. is resp. industry's exports.

industry	service imports	t-stat.	total exports	t-stat.	within R²	overall R²
food	0.246	8.83	0.491	2.84	0.268	0.3945
textiles	0.121	3.31	0.399	2.08	0.068	0.2109
clothing	0.119	2.75	0.233	0.93	0.027	0.0398
leather	0.060	1.68	0.476	3.07	0.052	0.2288
wood	0.229	6.15	0.683	2.77	0.143	0.2726
paper	0.348	8.92	0.875	4.47	0.317	0.4371
coke	1.243	6.88	3.485	5.24	0.266	0.1631
chemicals	0.560	13.87	0.697	3.88	0.560	0.618
minerals	0.243	8.63	0.447	2.87	0.234	0.3332
metals	0.335	11.54	0.697	3.88	0.405	0.5783
machinery	0.455	10.65	0.697	2.89	0.311	0.6447
electrical equ.	0.563	10.62	0.725	1.92	0.237	0.5066
motor vehicles	0.535	9.34	0.853	2.53	0.255	0.4357
other transport equ.	0.430	8.04	0.349	1.36	0.210	0.604
other manufacturing	0.175	3.7	0.545	2.35	0.068	0.485
Obs.	337					
Groups	28					

Figure 1: Manufacturing Demand for Business Services, continued on next page

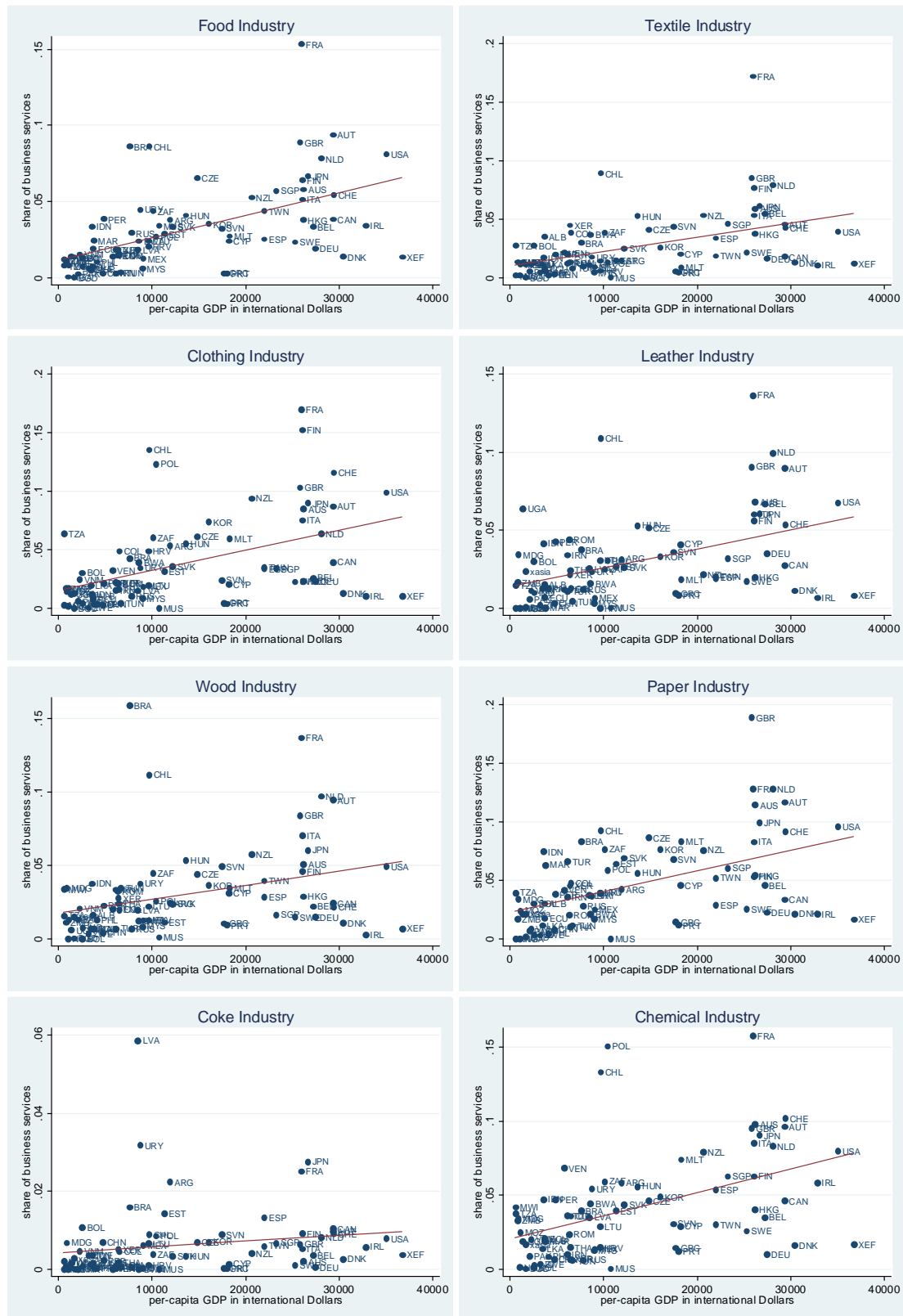


Figure 2: Interindustry Linkages

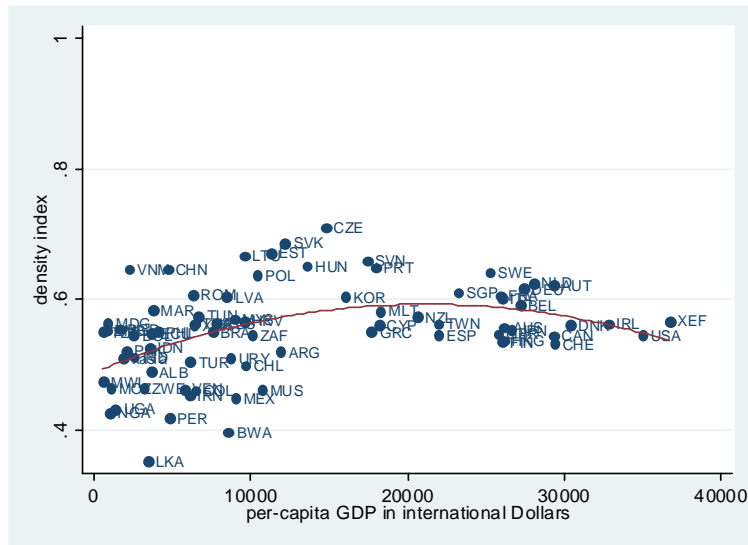


Figure 3: Multiplier effects in different service activities by stage of development, continued

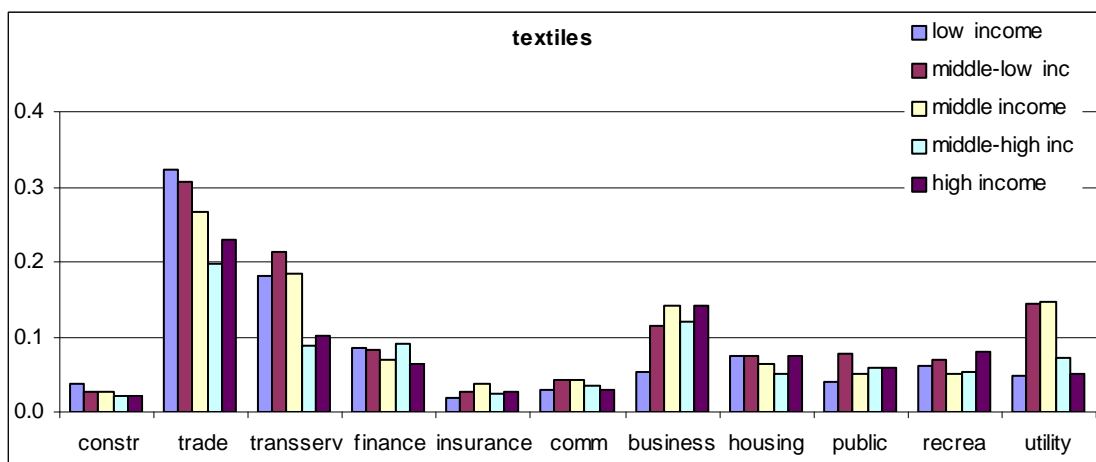
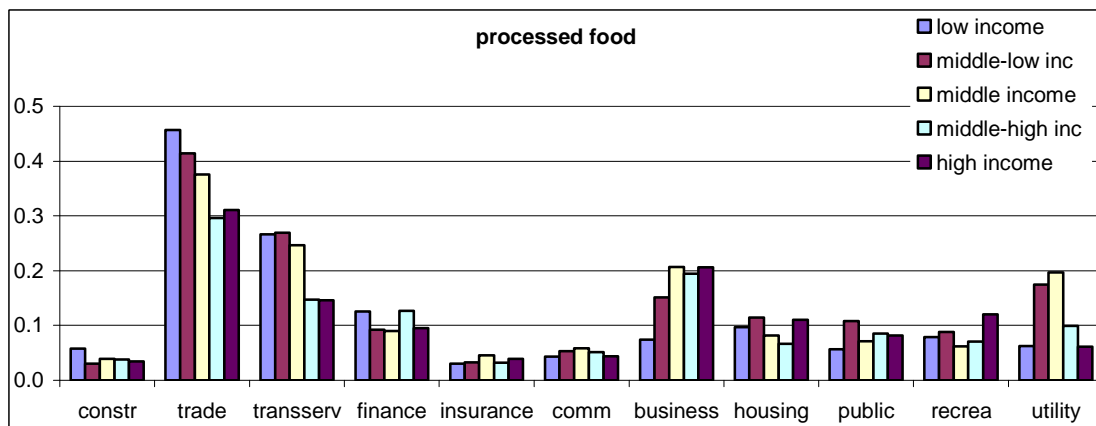


Figure 3, ctd.: Multiplier effects in different service activities by stage of development, continued

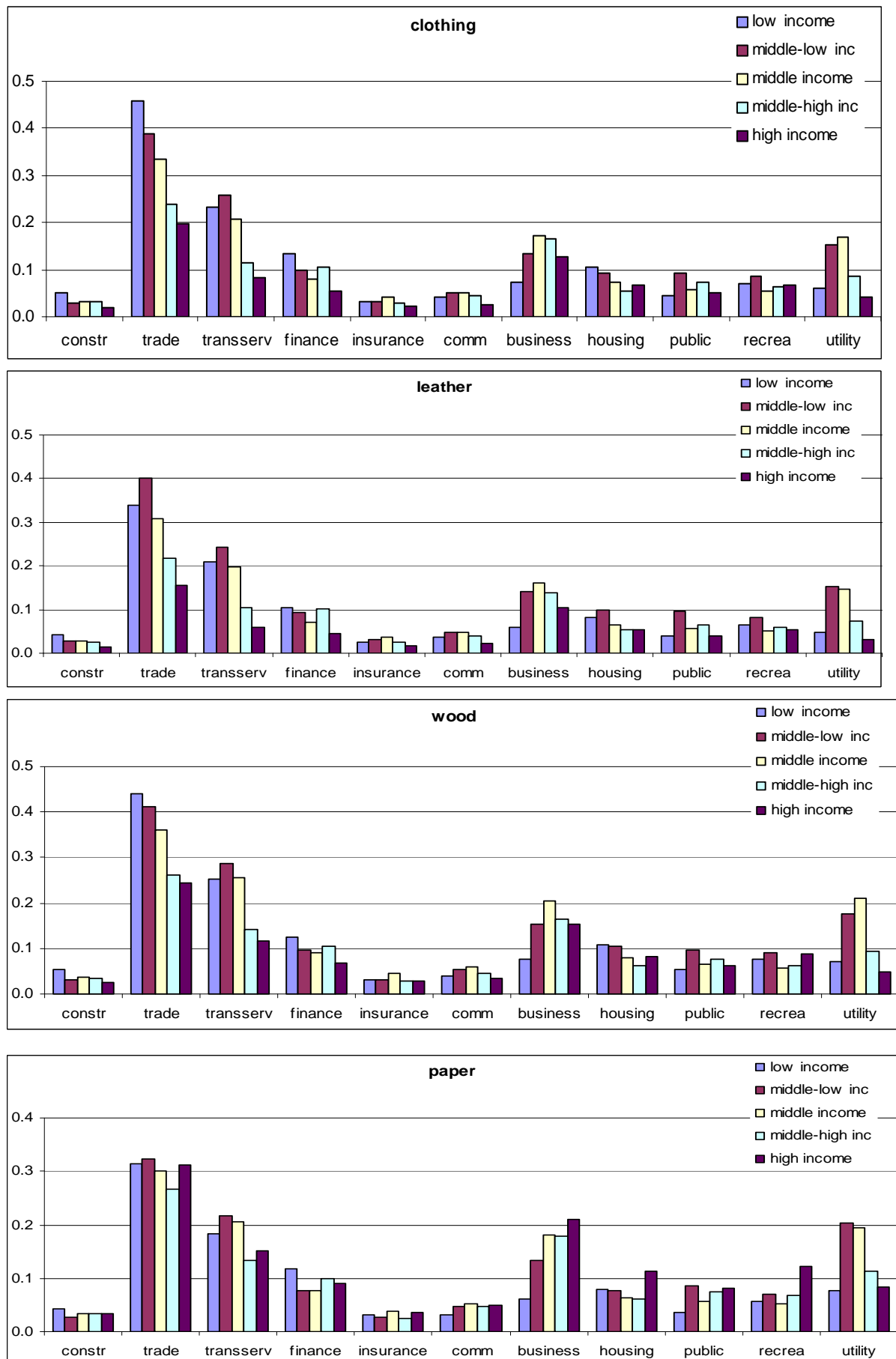


Figure 3, ctd.: Multiplier effects in different service activities by stage of development, continued

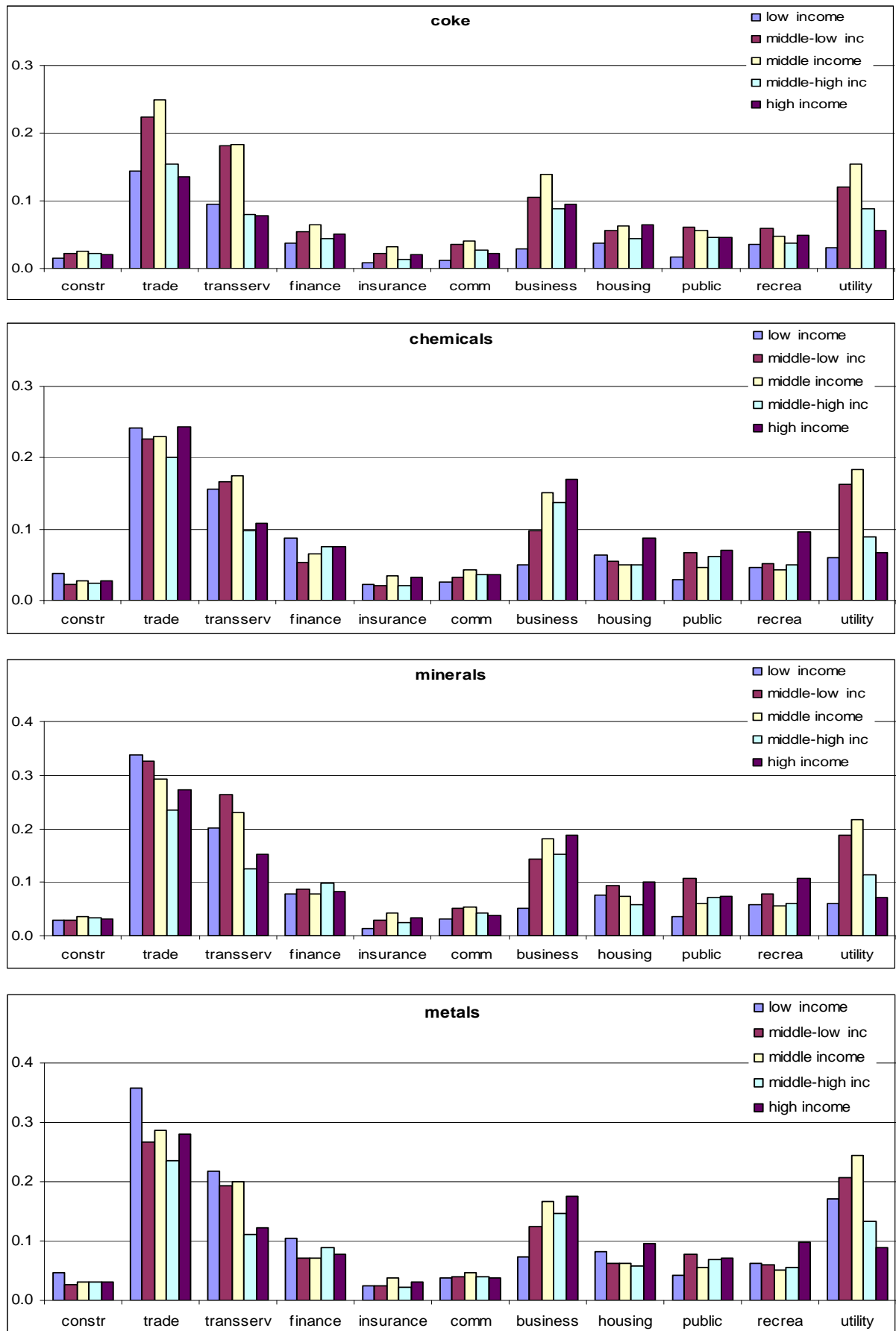


Figure 3, ctd.: Multiplier effects in different service activities by stage of development, continued

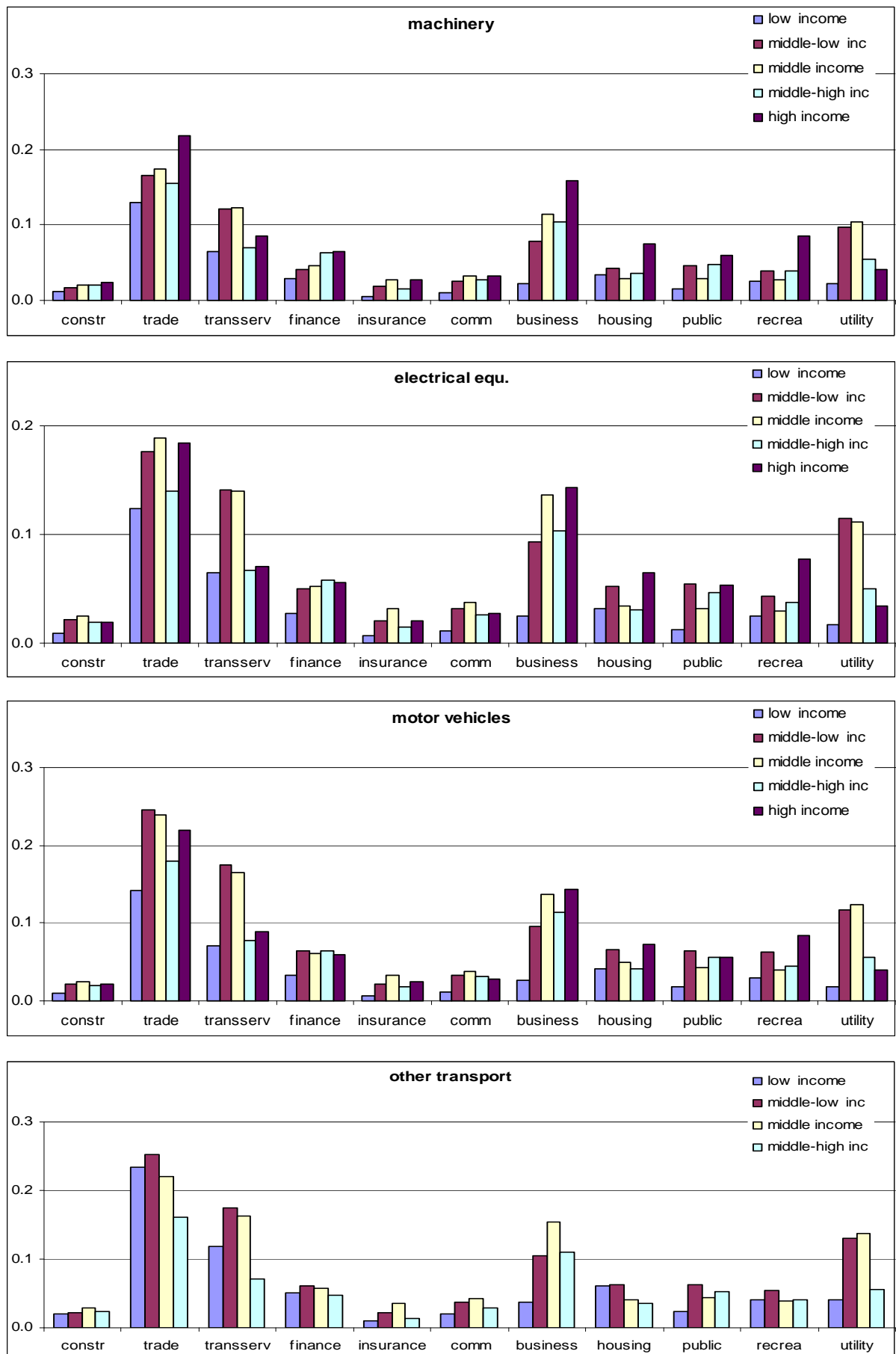


Figure 4: Multiplier Effects in Business Services by per-capita income, ctd. on next page



Figure 4, ctd.: Multiplier Effects in Business Services by per-capita income.



Figure 5: Indirect and Direct Effects of Exports on Economic Activity by Sectors

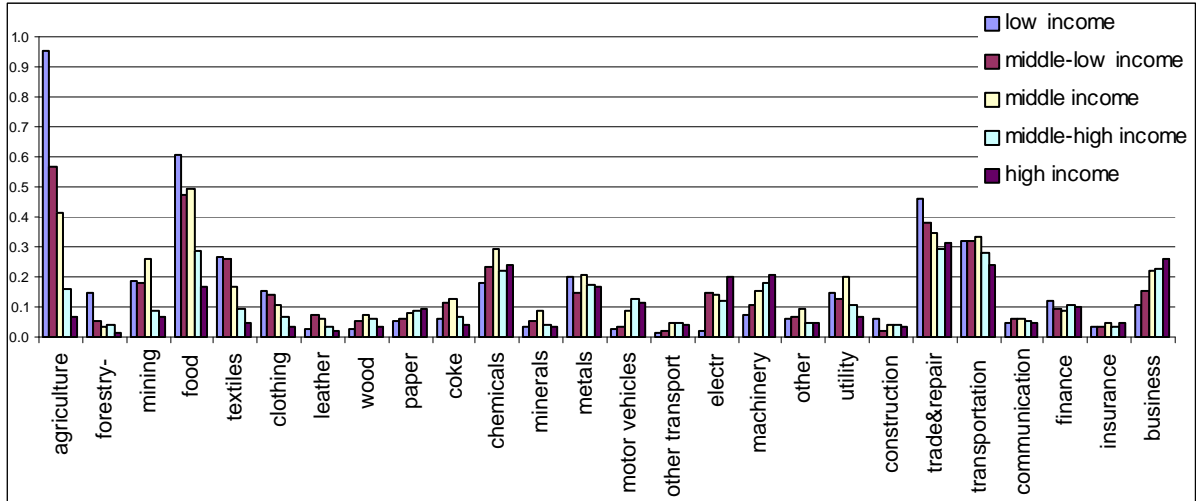


Figure 6: Additional Activity in Producer Services through Goods Exports

