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Doris Hanzl-Weiss and Robert Stehrer

The Role of Services in the New Member States: A Comparative Analysis Based on Input-Output Tables

*Doris Hanzl-Weiss and
Robert Stehrer*

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Abstract

Using input-output analysis, this research project investigates the role of services in the Central European new EU member states (NMS) – the Czech Republic, Hungary, Poland, the Slovak Republic and Slovenia – and compares it to that in Austria. The role of services includes not only their position in the production structure per se but also their increasing importance as an intermediate input for manufacturing and other services. As services were underdeveloped under the former system in the new EU member states, it is interesting to look at their features and changes over time. The analysis is based on Eurostat supply and use tables and done at the 2-digit level (NACE rev. 1/CPA) for the years 1995, 2000 and 2005 (in nominal values only). For certain parts of the project symmetric industry-by-industry input-output tables were constructed. The main findings are the following: a strong focus on manufacturing output, value added and intermediates still prevails on average in the NMS, while services are underrepresented. Between 1995 and 2005, structural change towards services took place in the NMS both on the production and use side. However, major structural differences still exist in comparison to Austria, which shows higher dynamics than the NMS and turns out to be a moving target. In a key sector analysis, service industries were classified as 'key' industries, depicting strong forward and backward linkages. Over time, especially backward linkages have grown. The expected 'gap' of knowledge-intensive business services vis-à-vis Austria at the beginning of the period was not revealed by the data for the Czech Republic, Hungary and Slovenia. Until 2005, Austria showed a pronounced shift towards 'other business services' and overtook the NMS in some respects.

Executive summary

Using input-output analysis, this study investigates the role of services in the Central European new EU member states (NMS) – the Czech Republic, Hungary, Poland, the Slovak Republic and Slovenia – and compares it to that in Austria. The role of services includes not only their position in the production structure per se but also their increasing importance as an intermediate input for manufacturing and other services. As services were underdeveloped under the former system in the new EU member states, it is interesting to look at their features and changes over time. Input-output data provide an appropriate tool for this analysis.

The study is structured into three main parts: First, it provides an overview of structural features of broad service categories, then it observes the linkages of the service industries with the rest of the economy and, finally, it looks in more detail at 'knowledge-intensive business services' (KIBS, including computer & related activities – NACE 72, research and development – NACE 73, and other business activities – NACE 74). The main questions investigated are: (i) Has there been a structural convergence process concerning the role of services between the new member states and Austria with respect to their relative importance in total output, as intermediate inputs and in trade? Are there differences among the new member states? (ii) How are services intertwined in the NMS with the total economy in comparison to Austria? How have service linkages developed? (iii) What is the role of knowledge-intensive business services in these economies?

The analysis is based on Eurostat supply and use tables and done at the 2-digit level (NACE rev. 1/CPA) for the years 1995, 2000 and 2005. Calculations are performed for the whole economy, which allows for an aggregation to a higher level on the one hand and focusing on particular service industries on the other. Overall, 25 service industries are included in the tables (NACE 50-95). For certain parts of the study, symmetric input-output tables were required and hence industry-by-industry tables, which are not supplied by Eurostat, were constructed for this purpose. The research project encompasses a wide range of descriptive statistics and some correlation analyses in all parts of the study. In addition, a shift-share-analysis is made in the first part in order to depict service intensities in the individual countries. In the second part, different linkage measures are calculated, providing a mechanism for identifying 'key' service sectors.

The main findings are the following:
Overall, services play a major role in the economies of the countries under investigation: In Austria, services accounted for 60% of total output and 70% of total value added in 2005, while in the Central European new EU member states (NMS) – the Czech Republic, Hungary, Poland, Slovakia and Slovenia – shares ranged from 40% to 50% in output and from 60% to 64% in value added respectively. Between 1995 and 2005, structural change towards services took place in the NMS both on the production and use side. However, there

are still major structural differences in comparison to Austria, which shows higher dynamics than the NMS and turns out to be a moving target.

***Looking at the structural features of broad service categories**, a strong focus on manufacturing output and value added (including mining & manufacturing) prevails on average in the NMS, while services are still underrepresented, particularly business services (JK) but also trade & hotels (GH) and community services (L-P). However, between 1995 and 2005, the data suggest that convergence processes are taking place though at a slow rate.*

Not surprisingly, trade is heavily focused on manufacturing as well: nearly 90% of total imports are industrial products, compared to 7-10% of service imports, which is due to the immanent characteristics of service products. Import quotas in business services (JK) are still larger in the NMS than in Austria, pointing to a greater need of these services in the NMS. However, between 1995 and 2005 these rates declined in most countries. When looking at exports, again almost 90% of total exports are industrial products. Service products with high export ratios include trade & hotels (GH) and transport (I). Export ratios for business services (JK) are comparably lower in the NMS than in Austria and have also been decreasing in some of them.

With respect to the use of services as intermediates there is evidence that, in the NMS, less service inputs are used in general and particularly so in manufacturing industries as compared to Austria. In particular, business service products (JK) are used less in the NMS than in Austria. However, there is a small tendency towards an increased use of services between 1995 and 2005, also for business services.

In 1995, service intensities for market services (CPA 50-74) were close to the Austrian level in the Czech Republic, Hungary and Slovenia, but below the Austrian level in Slovakia and Poland. Service intensities increased over time, the most pronounced changes taking place in the Czech Republic and Austria. Thus Austria turned out to be a moving target, which the NMS except the Czech Republic could not follow.

***Turning to backward and forward linkages**, service industries are generally performing better at forward linkages than at backward linkages as services are important suppliers of inputs to other industries along the value chain. However, combined in a key sector analysis, it turns out that service industries are not so much basic industries only (with strong forward and weak backward linkages) but rather key industries with strong forward and backward linkages. The main key industries are wholesale trade (NACE 51), land transport (NACE 60), other transport (NACE 63) and other business services (NACE 74), of which the latter has the most prominent position. Post & telecom (NACE 64) and financial intermediation (NACE 65) are either classified as key or basic under a range of countries.*

Over time, especially backward linkages have grown (particularly between 1995 and 2000), meaning that services have become more important as users of inputs from the economy. In addition, also forward linkages have increased. This is especially true for Austria, the Czech Republic and Slovakia, while there has been not much change in Hungary; in Slovenia, only forward linkages increased whereas backward linkages decreased slightly.

***Knowledge-intensive business services (KIBS) in the NMS** (defined as computer & related activities – NACE 72, research and development – NACE 73, and other business activities – NACE 74), and here 'other business services' (NACE 74) in particular, have an important role in the economies of the NMS and Austria – both in terms of output shares and as being the major intermediate product in these countries. In the period between 1995 and 2005, their importance even increased, especially in Austria. The other two sectors, i.e. computer services and R&D, play a minor role only as their output size is rather small (computer services is a medium-sized industry while R&D is very small). Output and intermediate shares grew for computer services, those of R&D remained mostly stable.*

Comparing KIBS in the NMS with those in Austria, we would have expected the NMS to lag behind Austria at the beginning of the investigated period and to catch up thereafter. However, this expected 'gap' vis-à-vis Austria was not confirmed by data for the Czech Republic, Hungary and Slovenia in 1995. One interesting finding is that Austria showed a pronounced shift towards 'other business services' until 2005 and overtook the NMS in some respects.

Overall, one has to keep in mind that input-output data are available in nominal values only, hence differences across countries and time may be due to differences in quantities or in relative prices. More research in this field needs to be done.

Doris Hanzl-Weiss and Robert Stehrer

The role of services in the new member states:
a comparative analysis based on input-output tables

1 Introduction

The service sector is the largest and most important sector in advanced industrialized economies, accounting for about 70% of value added and employment in OECD countries today. In Austria those shares also range at about 70% (see Wölfl, 2005; Peneder, 2001b). In the new EU member states, however, the service sector is still somewhat smaller and shows shares of around 60% in GDP, while employment shares may even range below this level in some countries. For instance, in the Czech Republic the service sector accounted for about 58% of total value added and 56% of total employment in 2006. In Hungary the respective shares were 65% and 63%, in Poland 64% and 54%.

The process of tertiarization, i.e. the over-proportionate growth of the service sector in developed economies, has characterized structural change throughout the 20th century. In a sample of 25 OECD countries (see Peneder, 2001b citing Feinstein, 1999) agricultural employment was cut by half in the first half of the century, while new jobs were created both in manufacturing and services during that period. Until the 1970s, the ongoing employment decline in agriculture was absorbed by growth in services. The share of manufacturing peaked between 1964 and 1975. Thereafter, the process of tertiarization accelerated on the one hand, while deindustrialization in terms of employment took place on the other: the services sector became the major employer in OECD economies.

In contrast to this development pattern, the economic systems in the now new EU member states were characterized by socialism first and the transition to a market economy thereafter. During the communist past, services were considered an unproductive part of the economy, rapid industrialization was promoted, and employment was highly concentrated in heavy industry (see Vidovic, 2002). As a result some services were either rarely provided on the market or simply non-existent. Certain services such as financial, real estate, and business services were simply not needed under socialism. Others, such as wholesale and retail trade, transport and telecommunications, were centrally organized and under strict control. Many of the services, particularly business services and certain community services (e.g. child care, some health care activities) were provided within large industrial conglomerates (see Vidovic, 2002). Since the start of the transformation, however, the new member states have undergone a reverse process: rapid deindustrialization and, in most countries, also a de-agrarization process occurred. Consequently the share of services in value added and employment expanded. Have the new member states been able to catch up with the structural features of the advanced OECD countries during the past ten years?

Are there still structural differences between the new EU member states and selected old member states, such as Austria? The analysis of and research on services in the NMS is still scarce (see Stare, 2005). The present study will help to fill this gap and try to provide answers to these questions.

Generally, the service sector is composed of a variety of activities ranging from financial transactions, legal consulting and communications to entirely different activities such as medical care, transport, security, or cleaning services. In more detail, especially so-called business-related services (in particular finance, insurance and business services) play an important role in services, being the most dynamic component and driver of structural change (see Wölfl, 2005; Peneder et al., 2001a). These business-related services are also increasingly important as intermediate inputs for manufacturing and other service activities (OECD, 2007; Pilat and Wölfl, 2005; Wölfl, 2005; European Commission, 2004). Hence, services are not only important for final consumption, they also play a significant role as intermediate inputs. Growth of demand for such 'producer services' (defined as services for intermediate consumption) as opposed to 'consumer services' (defined as services for final consumption, see Momigliano and Siniscalco, 1982) arises from the outsourcing of service activities from manufacturing (e.g. computer services, accounting, call centres, etc.) and from structural changes within the services sector (see Francois and Reinert, 1996). Over- all, growing demand for intermediates results in an increasing interaction between services and the rest of the economy, specifically manufacturing. This interrelationship between industries will be investigated in this study.

It is commonly acknowledged that 'knowledge-based services' and 'knowledge-intensive business services' (KIBS, including e.g. IT-consulting, R&D services, legal activities, ac- counting, etc.; see OECD, 2007; Kox and Rubalcaba, 2007; European Commission, 2004) are of growing significance as suppliers of intermediate inputs to the rest of the economy. 'Knowledge-based services have become increasingly important sources of innovation, product differentiation and productivity growth. These services not only contribute directly to economic development through their own growth in employment and income, they addi- tionally have the potential to improve performance in the economic system via knowledge transfer and increasing specialization.' (See Peneder et al., 2001a, p. 12.) However, ac- cording to Stare (2005), the new member states still lag behind in knowledge-intensive services – though there have been some examples of catching up recently (see e.g. Eng- man, 2007). The role of knowledge-intensive business services in the NMS is analysed in detail in this study.

Using input-output analysis, this report investigates the role of services in the Central European new EU member states (NMS) – the Czech Republic, Hungary, Poland, the Slovak Republic and Slovenia – and compares it to that in Austria. The study is structured into three main parts: In the first part, we explore differences across the Central European

NMS on the one hand and potential convergence to the Austrian benchmarks on the other. Austria is used as a benchmark country for comparison as it is a small open economy as are the new member states (with the only exception of Poland) and therefore sharing similar characteristics in this sense. The second part of the study presents different linkage measures. Backward and forward linkage indices then provide a mechanism for identifying key, leading, basic or independent industries. Calculations for these first two parts are done at the NACE rev. 1 2-digit level for the whole economy for the years 1995, 2000 and 2005. The focus of interest, however, is on the features of individual service industries (NACE 50-95). The third part of the study then analyses the role of knowledge-intensive business services in particular.

2   The structure of services in the new member states

Service industries play an increasingly important role in advanced economies both in terms of output and employment. However, the role of services includes not only their position in the production structure *per se* but also their growing significance as an intermediate input for manufacturing and other services. This part of the study looks into the structure of services in detail and investigates the following questions: Has there been a structural convergence process concerning the role of services between the new member states and Austria with respect to their relative importance in total output, as intermediate inputs and in trade? Are there differences among the new member states? The aim is mainly to document the most important differences without discussing potential causes in detail which would require a much more in-depth analysis for each country separately.

We start with a description of the database used for the project, i.e. supply and use tables, together with a discussion of potential data problems encountered during the investigation. In the second section, supply tables are analysed; the third section is devoted to a detailed discussion of the use tables. The fourth section discusses different measures of service intensities.

2.1 Methodological approach

This study makes use of input-output statistics, which consist of supply and use tables and symmetric input-output tables. Supply and use tables provide a detailed picture with respect to the supply of goods and services products by domestic industries and imports and the use of goods and service products for intermediate consumption by industry and final use (consumption, gross capital formation, exports). The use tables also include the components of value added (compensation of employees, other net taxes on production, consumption of fixed capital, net operating surplus) generated by industries in the domestic economy. Thus, supply and use tables provide detailed information on the production

processes, the interdependencies in production, the use of goods and services and generation of income generated in production.[1]

For this research we rely on supply and use tables provided by EUROSTAT. The EU member states are obliged to send annual supply- and use-tables, five-yearly symmetric input-output tables, symmetric input-output tables of domestic production and symmetric input-output tables of imports, all according to the 'European System of Accounts 1995' (ESA 95; see also Eurostat (2008) for details with respect to the system of supply, use and input-output tables and national accounts). This compulsory transmission started as of end 2002 and covers the period from 1995 onwards. The new member states covered in this report, i.e. the Czech Republic, Hungary, Poland, the Slovak Republic and Slovenia, acceded the European Union on 1 May 2004 and hence are obliged to provide the requested data, also those dating back if possible until 1995. The aim of this study is to compare structures evident from supply and use tables for these countries and Austria for the years 1995, 2000 and 2005. However, data for 1995 are not available for all NMS: Although these countries have a long tradition in the compilation of input-output tables, the collapse of the socialist system resulted in a break due to changes in concepts in methodology and in the classification system. Only since the end of the 1990s, compilation of I-O tables was resumed. Backward revision to 1995 was however not always made: For Slovenia supply and use tables are available for 1996 only, for Hungary for 1998. In the case of Poland we decided to analyse 1996 tables instead of those reported for 1995, due to better quality of data (as in 1995, there was a strong aggregation of industries). For a detailed description of data used, see Table 1.

Supply and use tables as provided by Eurostat are organized product by industry.[2] The corresponding classification schemes are CPA[3] for products and NACE rev. 1[4] for industries, distinguishing between 60 products and industries (however, in all tables CPA product 99 'Extra-territorial organizations and bodies' is not stated any more). Products and industries are listed in the Annex Table A.1. In the analysed supply and use tables, missing values or inclusion in higher aggregates often occur for products/industries in mining and quarrying (CPA 10-14), also for private households with employed persons (CPA 95) and certain sections of transport (CPA 61, 62 in Poland). For classification details in the individual country tables see Table 1. Certain special problems emerging during preparation of data are described in more detail in Annex B.

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[1]   A detailed description is provided in Eurostat (2008), p. 17.

[2]   More precisely, the make matrix is organized industry by product; the transposed make table which are named supply tables are as provided by Eurostat.

[3]   CPA – Classification of Products by Activity.

[4]   NACE – Nomenclature générale des activités économiques dans les communautés européennes, Classification of Economic Activities in the European Community.

Table 1

Overview on data and data quality

	Years	Classification	Notes on FISIM adjustment
Austria	95, 00, 05	CPA 01 including 02, 05 in 1995-tables CPA 11 including CPA 13 No entry for CPA 12	FISIM: 95,00
Czech Republic	95, 00, 05	All products/industries covered properly!!	FISIM: adjusted
Hungary	98, 00, 05	No entry for CPA 12 and CPA 95	FISIM: 98,00
Poland	96, 00, 04	CPA 11-13 added up and shown in CPA 13 CPA 61, 62 added up and shown in CPA 62	FISIM: adjusted
Slovak Republic	95, 00, 04	No entry for CPA 12 No entry for CPA 95 in 2004-tables	FISIM: 96
Slovenia	96, 00, 05	No entry for CPA 11 in 1996 and 2000-tables No entry for CPA 95 in 1996-tables	FISIM: 96, 00

Source: EUROSTAT Supply and Use Tables available at:
 http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/workbooks.

Calculations are performed at the 2-digit level, covering the whole economy. This allows for aggregation to a higher level later on (e.g. at the level of NACE 1-digit individual sectors, see Annex Table A.2; or at an aggregation of these sections into even broader groups[5]). The focus will be first on these broad groups and then on particular service industries (NACE and/or CPA 50-95) in more detail.[6]

2.2 Descriptive analysis of the supply tables

Supply tables are organized product by industry and show the supply of goods and service products supplying industry; further a distinction is made for supply of products by domestic industries and imports from those of other countries. Consequently, the table also shows total domestic output by industry, total imports and total supply by product, while in the columns total supply by product, consisting of domestic and imported products (CIF). These values are given in basic prices. Two further columns report trade & transport margins as well as net taxes (taxes less subsidies) by product. These two columns together with total supply at basic prices yield total supply at purchasers' prices by product.

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[5] AB (agriculture and fishing), CDE (mining, manufacturing and energy), F (construction), GH (wholesale and retail trade, hotels and restaurants), I (transport), JK (financial intermediation and real estate), L-P (public administration, education, health and social work, other social services and private households).

[6] Although input-output analysis is mainly devoted to the analysis of inter-industrial linkages at a rather detailed level for descriptive purposes in this paper it is more convenient to focus on the broader aggregates.

2.2.1 Output structure and convergence

Looking at the total domestic supply one can derive production structures by product or by industry for each country. For the sake of this report we analyse production structures by product in order to compare domestic production to total supply (including imports) later on. Emphasis is also given to the characteristic production of each industry explained below in more detail. When comparing production structures based on output values across countries and over time, one as to note that this reflects differences in quantities as well as differences in relative prices which can not be disentangled given the information available.[7] We thus have to focus on convergence in nominal terms.

When looking at output structures by broad aggregates as detailed in Table 2, there are still major differences existing between the new member states (NMS) and Austria in 2005: Austria is dominated by services (G-P) accounting for nearly 60% of total domestic output, while manufacturing output (CDE) reaches 32%. The rest is taken by agriculture and construction. In the new member states it is the other way around: manufacturing still takes a much larger share compared to Austria with 40-50% while total services make up only 40-50% and hence lag behind Austria by 10-20 percentage points: 10 percentage points in Hungary, Poland and Slovenia, 20 percentage points in the Czech and Slovak Republics (the most specialized in manufacturing). This is largely due to smaller shares in business services (JK) and to a lesser extent to smaller shares in trade & hotels (GH) as well as in community services (L-P). Transport services (I) show a slightly larger share of total output in the NMS than in Austria. However, also certain differences exist within the group of NMS: Besides showing large shares for business services (JK), there is also a focus on trade & hotels (GH) in Poland, and community services (L-P) in Hungary. Interestingly, in all other countries, these latter two groups show the same share size.

Despite these still existing striking differences one can see ongoing changes of these specialization patterns towards service industries since 1995. In Figure 1 we present the shares of these respective broad categories for 1995, 2000 and 2005 and the respective changes. In Figure 2 we provide the same numbers now allowing for easier cross country comparisons.

Between 1995 and 2005, structural change towards the services sectors is clearly visible in the NMS but also in Austria (see Figure 2): Shares of business services (JK) increased most during that time period, but also those of the transport sector (I) and community services (L-P) grew. Only shares of trade & hotels (GH) decreased somewhat in most countries. Direction of change in manufacturing shares (CDE) differed considerably among countries and time period. Overall, manufacturing shares decreased in Poland and Slove-

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nia, remained constant in the Czech Republic, Hungary and increased in the Slovak Republic. This is further partly due to specialization on transport equipment in the latter three countries along with a specialization on communication equipment in Hungary and on electricity in the Slovak Republic also reflecting specialization in trade patterns. Structural change was more pronounced between 1995 and 2000 and slowed down in the second period between 2000 and 2005, with the only exception of Hungary.

Table 2

Output shares by broad industry aggregates, by product, 2005

		Austria	Czech Rep.	Hungary	Poland	Slovak Rep.	Slovenia
AB	Agriculture & Fishing	2	2	4	5	4	2
CDE	Mining & Manuf. & Energy	32	45	41	38	49	38
F	Construction	7	9	6	7	7	10
GH	Wholesale & retail trade; Hotels & restaurants	15	10	11	15	10	13
I	Transport	7	9	6	8	9	8
JK	Financial intermediation; Real Estate	22	14	17	15	12	16
L-P	Community, Social & Personal Services	15	10	15	12	10	13

Notes: For Poland and the Slovak Republic 2004.

Source: Eurostat supply tables; authors' calculations.

Figure 1

AUSTRIA: Output shares by broad industry aggregates and pp. change, by product
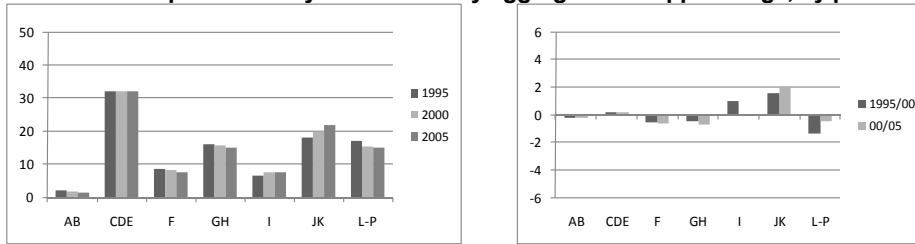
CZECH REPUBLIC: Output shares by sectors and pp. change, by product
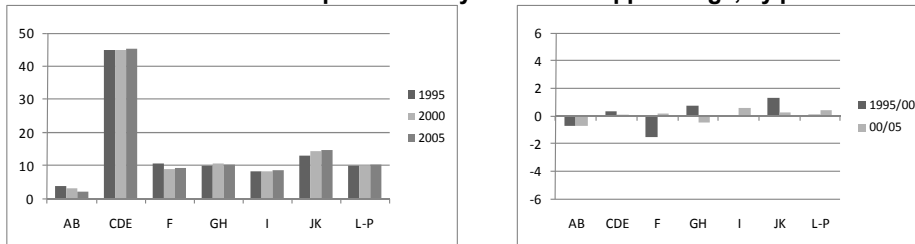
HUNGARY: Output shares by sectors and pp. change, by product
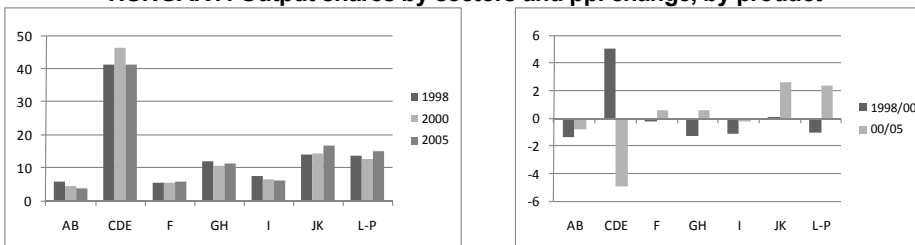
POLAND: Output shares by sectors and pp. change, by product

SLOVAK REPUBLIC: Output shares by sectors and pp. change, by product

SLOVENIA: Output shares by sectors and pp. change, by product
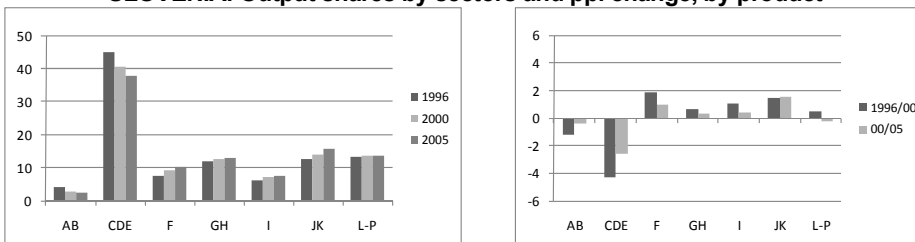
Source: Eurostat supply tables; authors' calculations.

Figure 2

P.P. Change of output shares by product, first period 1995-2000
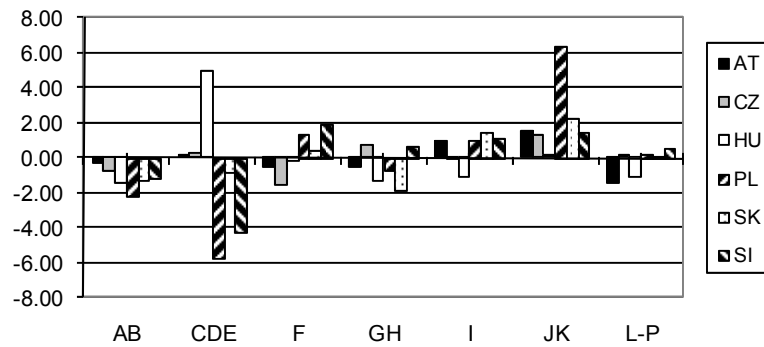
P.P. Change of output shares by product, second period 2000-2005
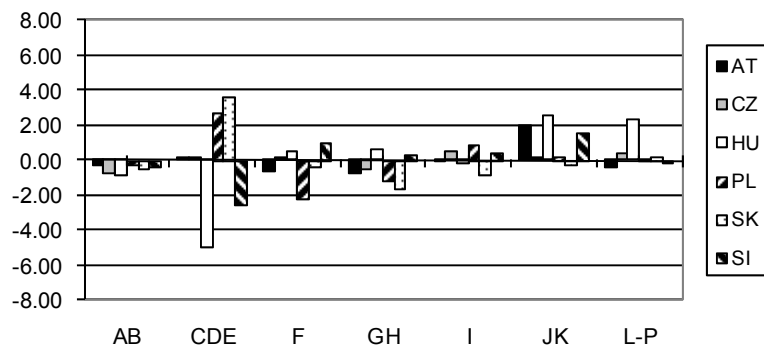
P.P. Change of output shares by product, whole period 1995-2000

Source: Eurostat supply tables; authors' calculations.

As a broad measure of similarity between output structures we use the coefficients of correlation. For services, the coefficient between Austria and the NMS is very high: it ranges between 0.85 for the Slovak Republic and 0.88 for Poland on the one side and 0.92 for the Czech Republic, 0.94 for Hungary and 0.95 for Slovenia on the other in 2005 (see Table 3). In addition, this coefficient of correlation increased constantly between 1995 and 2005 in all countries, pointing towards a convergence process of the NMS towards the Austrian output structure in services.

Table 3

Correlation of output structures

Correlation in the structure of domestic service output, by product

AT	1995	2000	2005
AT	1.00	1.00	1.00
CZ	0.87	0.91	0.92
HU	0.92	0.94	0.94
PL	0.76	0.90	0.88
SK	0.83	0.84	0.85
SI	0.90	0.94	0.95

Correlation in the structure of domestic output, by product

AT	1995	2000	2005
AT	1.00	1.00	1.00
CZ	0.84	0.86	0.86
HU	0.80	0.75	0.82
PL	0.76	0.87	0.85
SK	0.78	0.78	0.77
SI	0.86	0.92	0.91

Correlation in the structure of total supply at basic prices, by product

AT	1995	2000	2005
AT	1.00	1.00	1.00
CZ	0.84	0.88	0.87
HU	0.79	0.71	0.76
PL	0.76	0.86	0.85
SK	0.78	0.79	0.79
SI	0.84	0.91	0.90

Source: Eurostat supply tables; authors' calculations.

For total domestic output, the coefficient of correlation between Austria and the NMS is somewhat lower, pointing towards more specialization in manufacturing driven by the international division of labour and hence trade specialization. In addition, the direction of change varied over time: while correlation with Austria increased between 1995-2000 in most countries (except for Hungary), it fell again thereafter. However, it still remains higher than the coefficient observed in 1995.

Looking at total domestic supply (including imports), the coefficient of correlation between Austria and the NMS is almost the same as for domestic supply, maybe with the exception of Hungary.

2.2.2 Characteristic production

The supply tables for each country provide information on output of products by industries, consisting of products characteristic for an industry which is called primary output (also 'characteristic production') and production of other products not characteristic for this in-

Figure 3

AUSTRIA: Main product ratio and p.p. change

CZECH REPUBLIC: Main product ratio and p.p. change

HUNGARY: Main product ratio and p.p. change

POLAND: Main product ratio and p.p. change

SLOVAK REPUBLIC: Main product ratio and p.p. change

SLOVENIA: Main product ratio and p.p. change
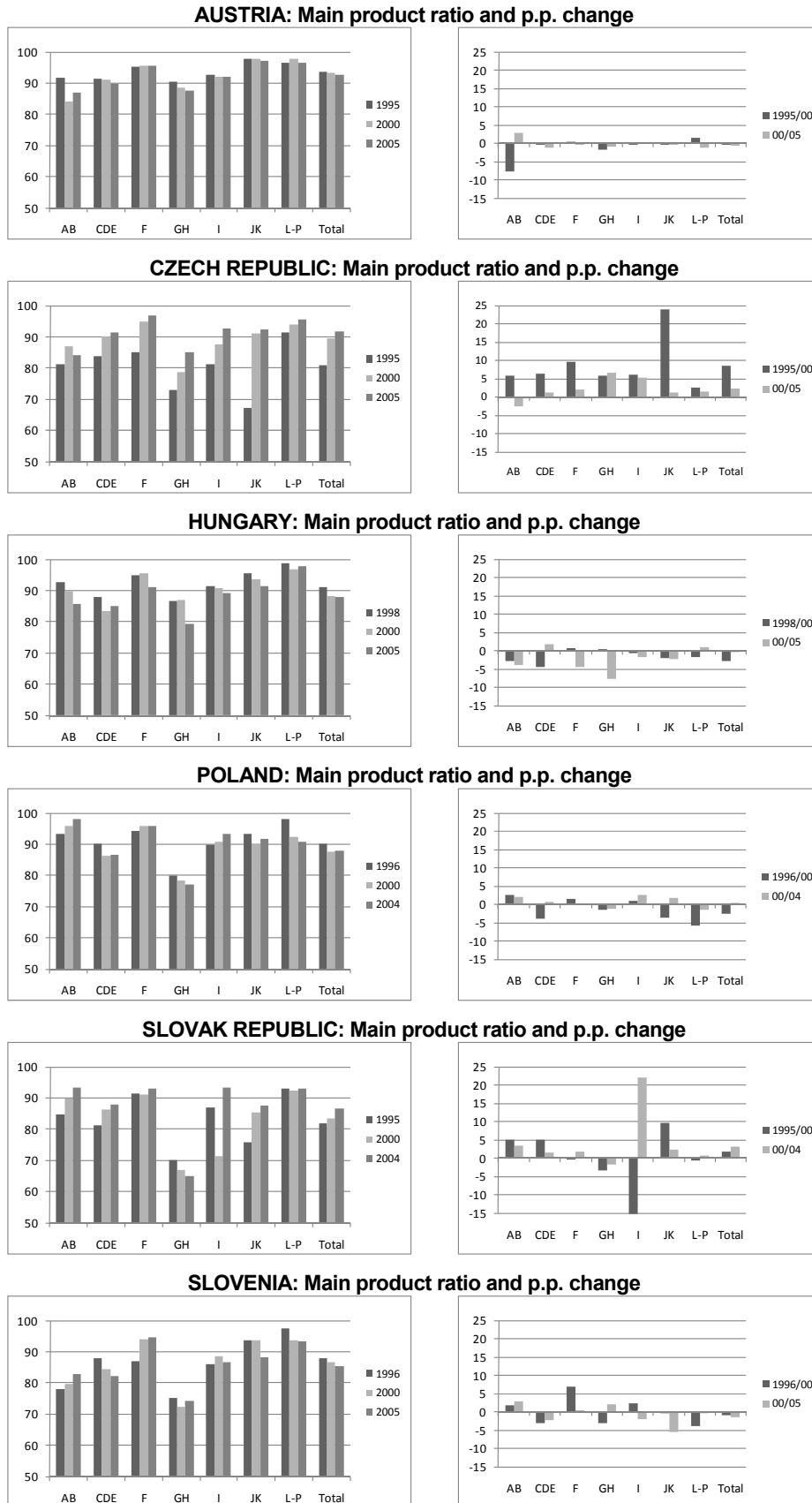
Source: Eurostat supply tables; authors' calculations.

dustry, called secondary output. Characteristic production is reported at the diagonal of the supply table while secondary activities of industries are reported off the diagonal.[8] In general, the share of characteristic production depends on the level of disaggregation of product data. It provides information to which degree one may relate the product classification (CPA) to the industry classification (NACE).

In general, the share of the characteristic product is relatively high in the NMS but still below the Austrian level (and also below other EU countries as shown in Eurostat, 2008, p. 308): the main-product ratio by country ranges between 85% in Slovenia, 87% in Slovakia, 88% in Poland and Hungary and 92% in the Czech Republic compared to 93% in Austria (see Figure 3).

Typically, service industries show a higher characteristic production than manufacturing. However, usually trade & hotels (GH) have lower characteristic production shares than other service industries, due to the production of manufacturing products as secondary products in trade industries (see Figure 3).

Looking at the main-product ratio by country for the years 1995, 2000 and 2005, it steadily increased in the Czech and Slovak Republic on the one hand, but slightly fell in Hungary, Slovenia and Poland on the other. The same holds true for the development of main production shares in manufacturing (CDE). Even in Austria, main production for the total economy and for manufacturing slightly decreased between 1995 and 2005 (see Figure 3).

Looking at broad service groups, different trends emerge in the individual countries: In the Czech Republic, the main-product ratio increased for all broad service groups, while in Austria, Hungary and Slovenia it mostly decreased. Varying trends across service groups are observed for Poland and Slovakia.

2.3.3 Imports

The supply tables are complemented by columns reporting imports by product. Hence it is possible to calculate the structure of imports (share of individual imports in total imports) as well as the import penetration (defined as the share of individual imports in total supply of a product).

Looking at the import structure, manufacturing imports (CDE) add up to almost 90% of total imports in all NMS in 2005, compared to 7-10% of services imports. In Austria, the relative shares stand at 82% and 15% respectively (see Figure 4). This is due to foreign trade playing a smaller role in services than in manufacturing, as services are more location-based

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[8]   Eurostat provides square supply and use tables; see Eurostat (2008), p. 18.

Figure 4

AUSTRIA: Import shares by sectors and pp. change, by product

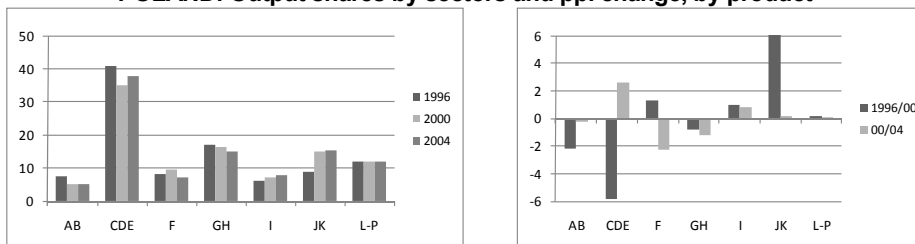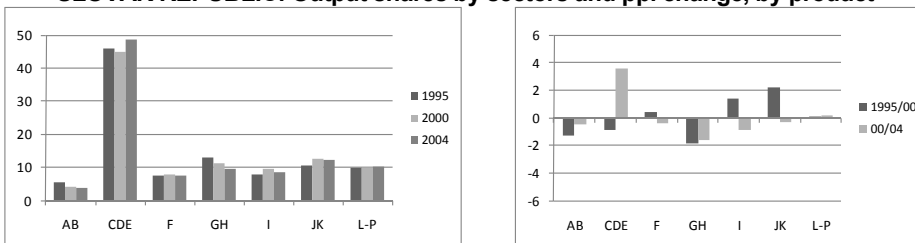## CZECH REPUBLIC: Import shares by sectors and pp. change, by product

## HUNGARY: Import shares by sectors and pp. change, by product

POLAND: Import shares by sectors and pp. change, by product

## SLOVAK REPUBLIC: Import shares by sectors and pp. change, by product

## SLOVENIA: Import shares by sectors and pp. change, by product

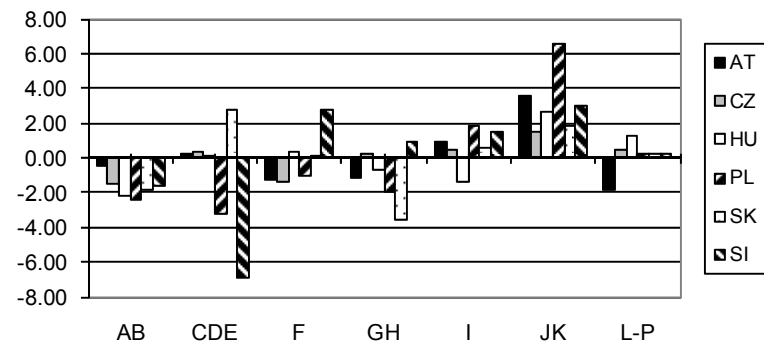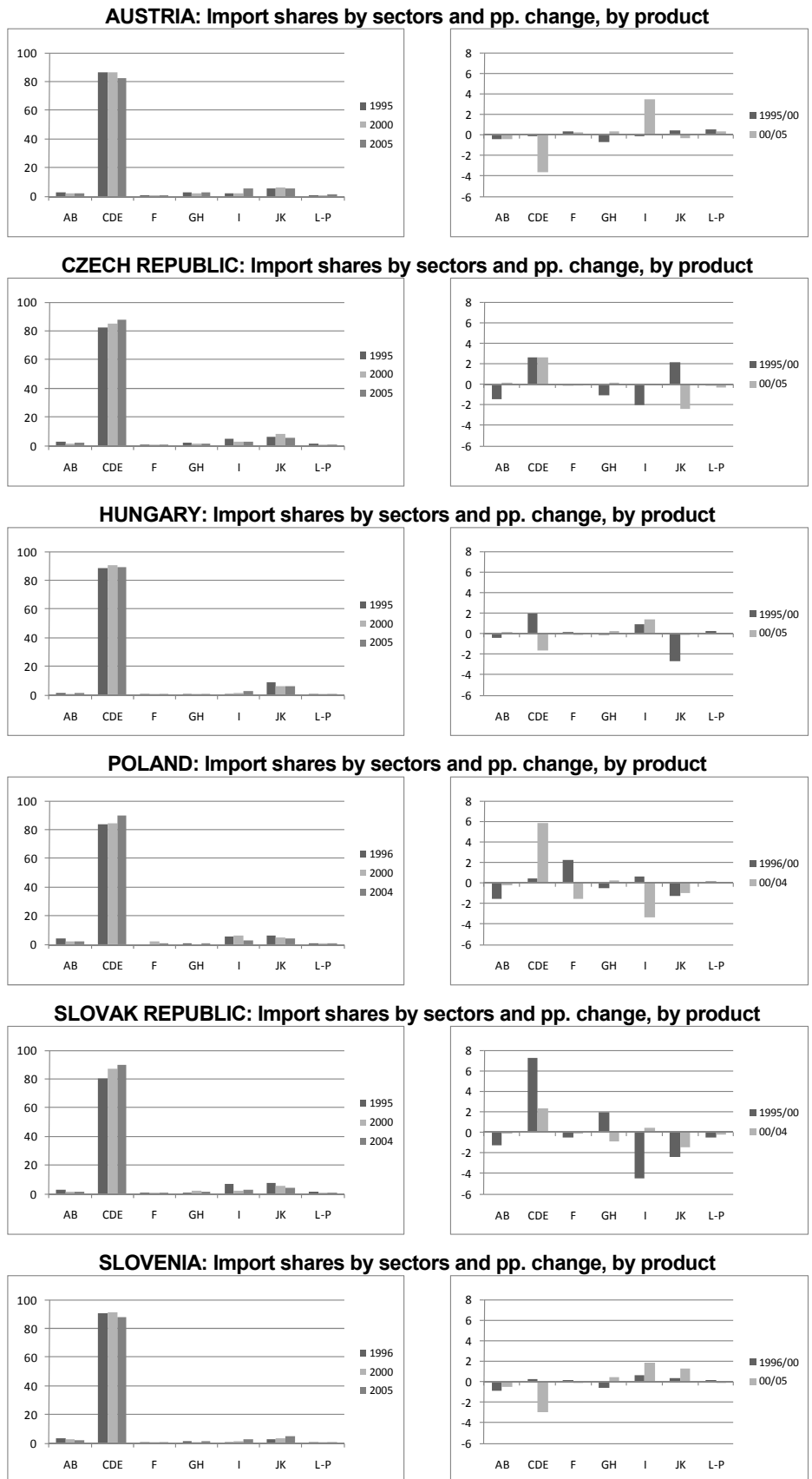*Source:* Eurostat supply tables; authors' calculations.

and production and consumption are closely linked. The only exceptions are business services, tourism and transport. Indeed when looking at services in more detail, import shares of business services (JK) take the largest portion (4-6% in the NMS, 6% in Austria). Transport import shares are somewhat smaller (3% in the NMS and 5% in Austria), while trade & hotels (GH) as well as community services' (L-P) import shares are very small (0-1% in the NMS, compared to 3% and 1% in Austria).

Between 1995 and 2005, manufacturing (CDE) import shares increased in the NMS, while services shares mostly declined, especially those in business services (JK). The only exception was Slovenia where CDE shares fell and services import shares – along with business services shares – were growing (see Figure 4).

Import penetration rates show the share of imports in total supply. Import penetration rates of manufacturing products are typically higher than that of other products as well as services, reflecting the greater openness of the sector and together with exports also the important role of trade (see Figure 5). Import penetration rates for the whole economy range between 22% in the Czech Republic, 24% in Hungary and Slovenia and 26% in Slovakia in 2004/05 and hence are slightly larger than that of Austria with 21%. Only in Poland, import penetration is lower typically for a large country and reaches 16% there. Generally, imports play a main role in manufacturing (accounting for 30-40% of total supply), but also in agriculture in Austria (24%). Looking at services, imports are important in transport services (I) and business services (JK). In transport services import penetration rates reach 6-12% in the NMS and 16% in Austria. In business services (JK) rates are more pronounced in the NMS than in Austria (5-11% in the NMS, 6% in Austria), which might point to a greater need for these services in the NMS and a relative pent-up demand there.

Overall, import penetration rates increased between 1995 and 2005, the least in the Czech Republic with +3 percentage point change and the most in Slovakia with +6 percentage point change. While manufacturing import quotas increased in all countries of the region, no uniform pattern can be discerned for services import quotas on this aggregated level. However, import quotas for business services (JK) declined in three countries (Hungary, Poland, Slovakia) and increased in Slovenia (see Figure 5).

For the structure of imports, the coefficient of correlation between the Czech Republic, Slovakia and Slovenia on the one hand and Austria on the other is very high as depicted in Table 4. It is somewhat lower between Poland and Austria (0.87) as expected, but also between Hungary and Austria (0.83). It seems that in the latter country, specialization takes place via imports (due to specialization on communication equipment imports). Here the coefficient of correlation markedly declined between 1995 and 2005, while it increased in all other countries.

Figure 5

AUSTRIA: Import quotas by sectors and pp. change, by product

CZECH REPUBLIC: Import quotas by sectors and pp. change, by product

HUNGARY: Import quotas by sectors and pp. change, by product

POLAND: Import quotas by sectors and pp. change, by product

SLOVAK REPUBLIC: Import quotas by sectors and pp. change, by product

SLOVENIA: Import quotas by sectors and pp. change, by product
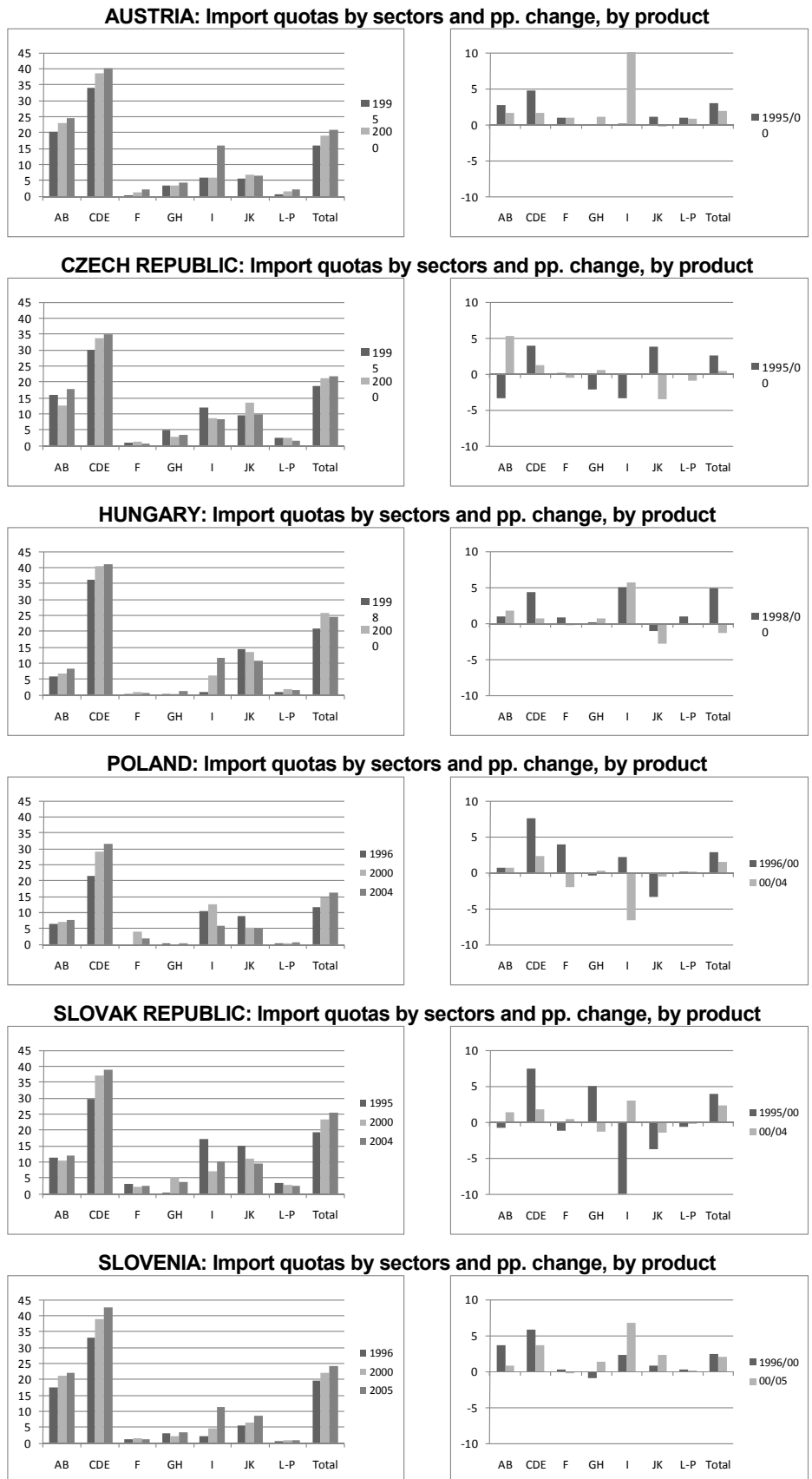
Source: Eurostat supply tables; authors' calculations.

Table 4

Import correlation

AT	1995	2000	2005
AT	1.00	1.00	1.00
CZ	0.90	0.92	0.93
HU	0.91	0.87	0.83
PL	0.78	0.83	0.87
SK	0.82	0.84	0.93
SI	0.94	0.92	0.92

Source: Eurostat supply tables; authors' calculations.

Detailed information on the use of imports can be found in the use table of imports as well as in the input-output table for imports. While the first ones are not publicly available in most cases, the last ones are published every five years together with the symmetric input-output tables of domestic production and provide information on the intermediate use of imports in a product by product format together with information on the final use categories. Symmetric input-output tables of imports provided by Eurostat for our countries are listed in Table 5. One has to note that import tables are however missing for many years. Direct comparisons between the use tables analysed above and the symmetric input-output table have further to take into account the different price base (purchasers' prices in comparison to basic prices).

Table 5

Availability of symmetric input-output tables of imports
(product by product, at basic prices)

Country/Year			
Austria	1995	2000	2005
Czech Republic	n.a.	n.a.	2005
Hungary	1998 (no export data)	2000	2005
Poland	n.a.	2000	n.a.
Slovak Republic	1995	2000 (no export data)	n.a.
Slovenia (few export data)	1996	2000, 2001	2005

Source: EUROSTAT Input-Output Tables available at:
http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/workbooks.

Overall, the share of intermediate inputs in total imports ranges between 60% in Austria, Poland and Slovenia and 80% in the Czech Republic, Hungary and Slovakia (see Figure 6). This share is very high for services but lower for manufacturing, most obviously so in the case of Austria and Hungary, while for the other countries this pattern it is less distinct.

Figure 6

AUSTRIA: Share of intermediate inputs in imports

CZECH REPUBLIC: Share of intermediate inputs in imports

HUNGARY: Share of intermediate inputs in imports

POLAND: Share of intermediate inputs in imports

SLOVAK REPUBLIC: Share of intermediate inputs in imports

SLOVENIA: Share of intermediate inputs in imports
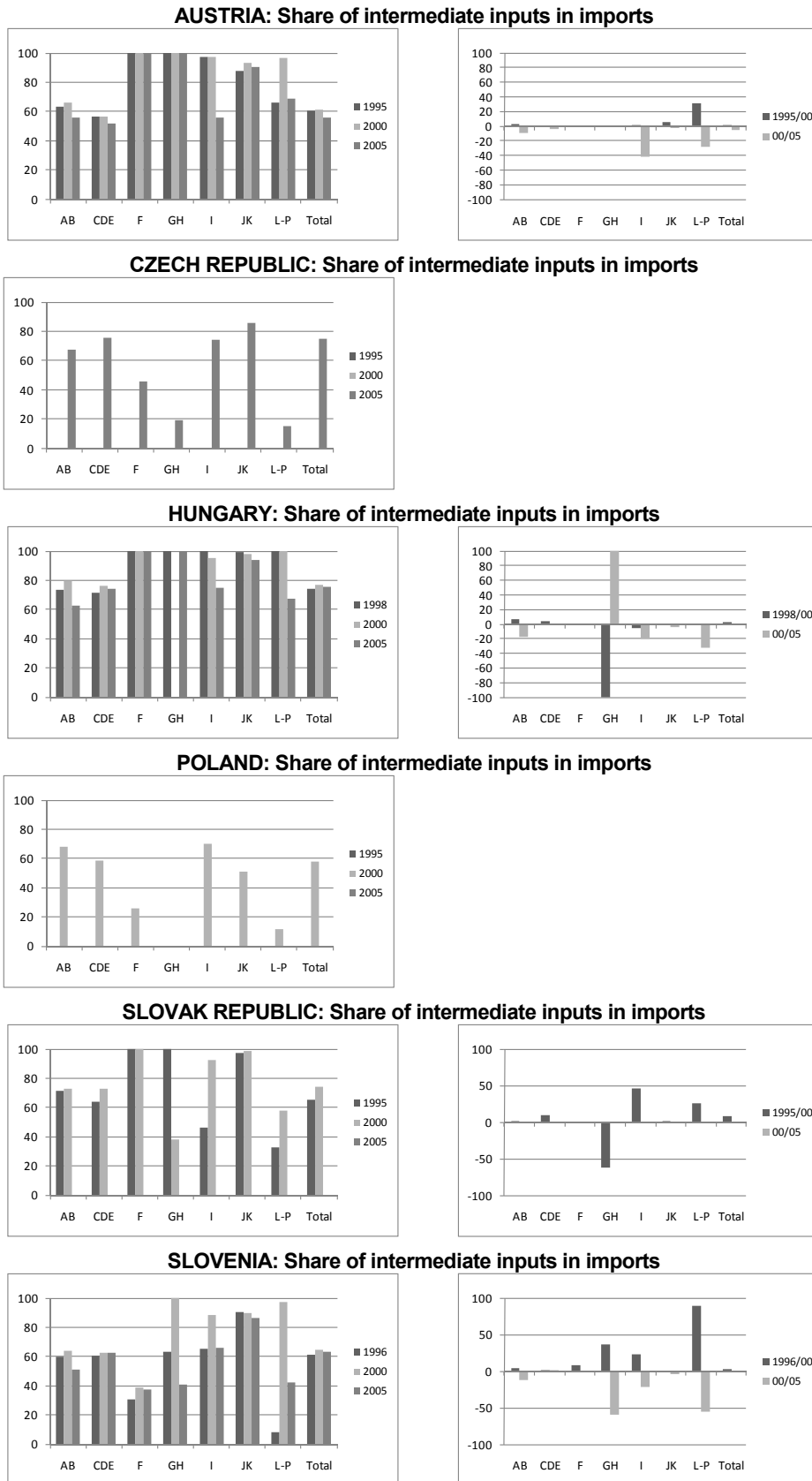
Note: In Poland, no imports were recorded in trade & hotels (GH).

Source: Eurostat symmetric input-output tables of imports; authors' calculations.

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Figure 7

AUSTRIA: Share of final consumption in imports
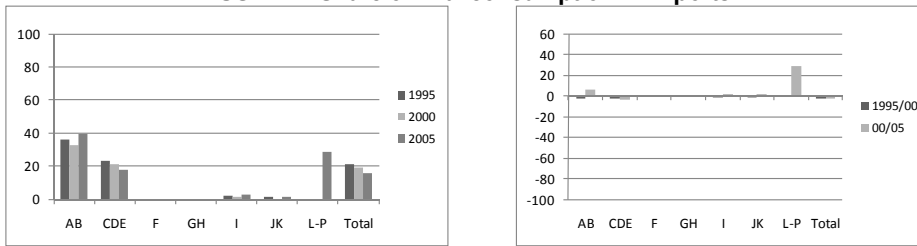
CZECH REPUBLIC: Share of final consumption in imports
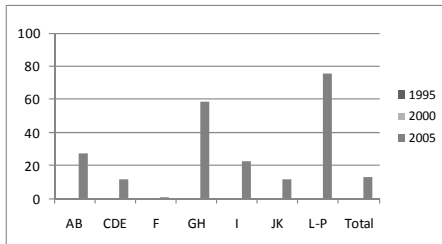
HUNGARY: Share of final consumption in imports
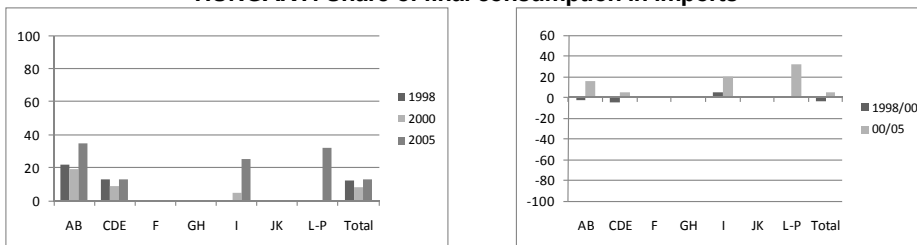
POLAND: Share of final consumption in imports
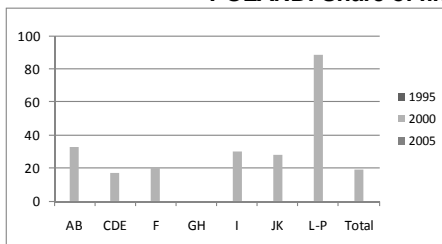
SLOVAK REPUBLIC: Share of final consumption in imports
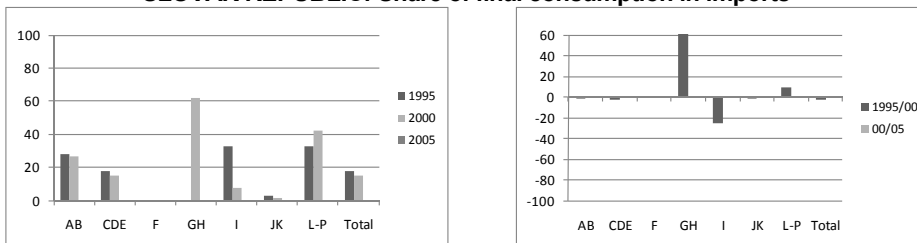
SLOVENIA: Share of final consumption in imports
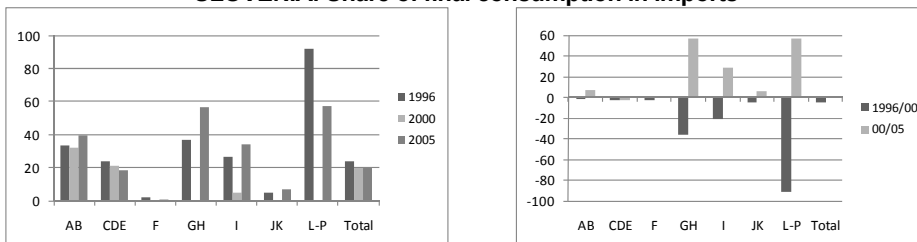
Source: Eurostat symmetric input-output tables of imports; authors' calculations.

Figure 8
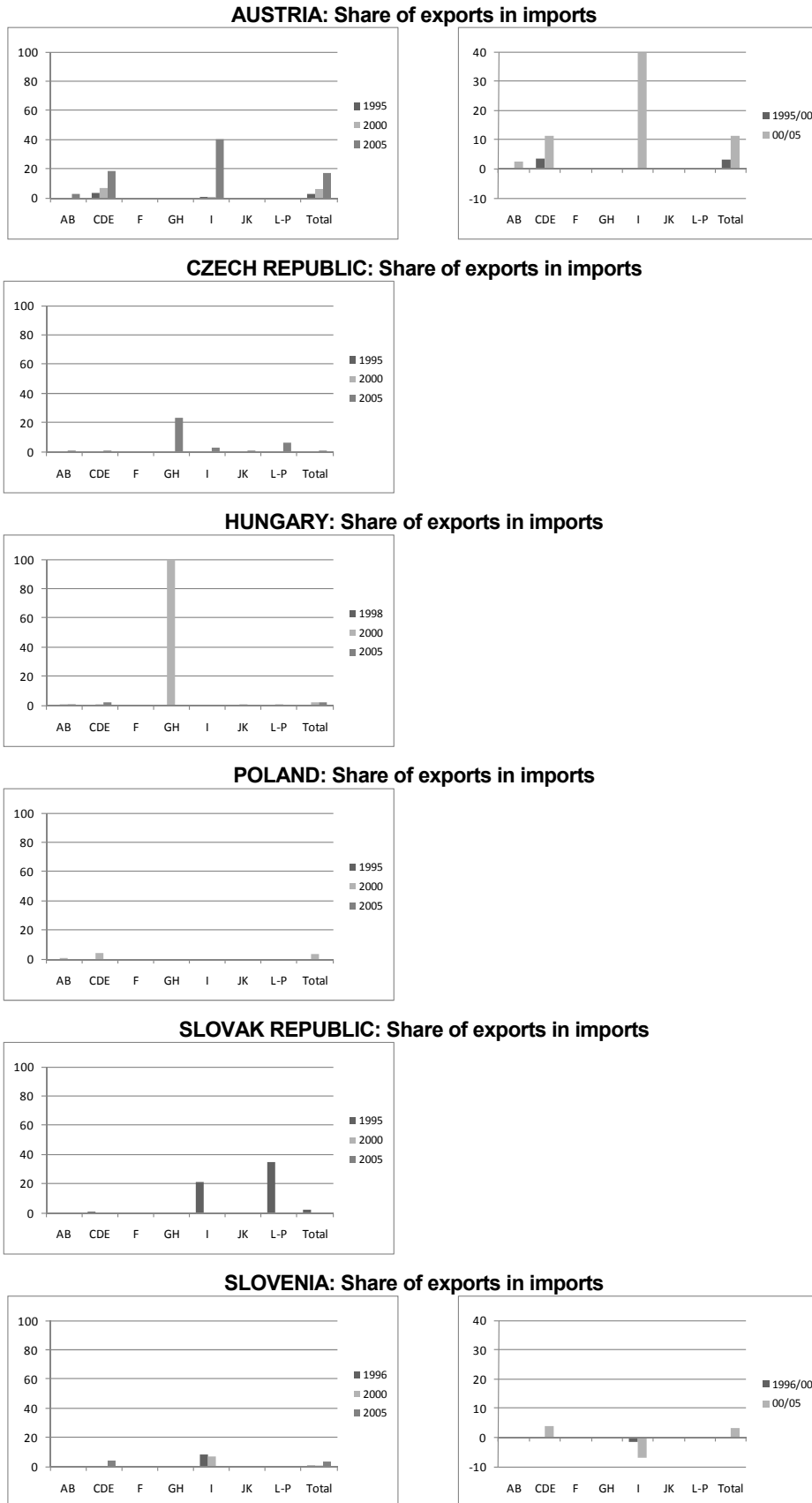
AUSTRIA: Share of exports in imports

CZECH REPUBLIC: Share of exports in imports

HUNGARY: Share of exports in imports

POLAND: Share of exports in imports

SLOVAK REPUBLIC: Share of exports in imports

SLOVENIA: Share of exports in imports

Source: Eurostat symmetric input-output tables of imports; authors' calculations.

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Figure 7 shows the share of final consumption in imports, which is 20% or below for the total economy (see Figure 7). Final consumption does play some role in agriculture and manufacturing. Among services, it has a dominant position in community services (L-P), but is also important in trade & hotels (GH) and transport services (I) in some countries.

Figure 8 exhibits the share of exports in imports. Overall, the share of export is very low for the NMS, where it ranges between 0.7% in the Czech Republic and 3.3% in Slovenia. The comparable figure for Austria is 17%, due to the high share of exports in manufacturing there.

2.3 Descriptive analysis of the use tables

2.3.1 Structure of intermediate demand and exports

Let us now come to a differentiated analysis of the information provided in the use tables. Here we mainly focus on the structure of intermediate inputs in the broad industry aggregates already mentioned above. Figure 9 provides an overview over the input structures of products by industry and the total in the six countries considered.

With respect to service inputs one can see that business services (JK) are the most important intermediate input within services in all countries. However, there are quite substantial differences across countries. Whereas in Austria this accounts for about 26% in total for the NMS this accounts for only about 13% in the Slovak Republic, 15% in Poland, 18% in the Czech Republic, 19% in Slovenia, up to about 21% in Hungary. This is partly driven by a lower share of input in the manufacturing sector in most NMS but also due to the lower share of inputs in other service sectors (and JK itself).

Figure 10 documents the use of intermediate inputs in total intermediate inputs by aggregate products and the respective changes over time. One can see that the share of business services is higher in Austria and somewhat lower in the manufacturing industries (CDE) as compared to the NMS.

With respect to the industries capturing most intermediate inputs one finds that the manufacturing sector makes up the largest part with about 50%; these shares are in general higher for the NMS compared to Austria. On the other hand, service industries and particularly business services use less intermediates in total in the NMS compared to Austria.

Figure 9

AUSTRIA: Input structure by industry, 1995
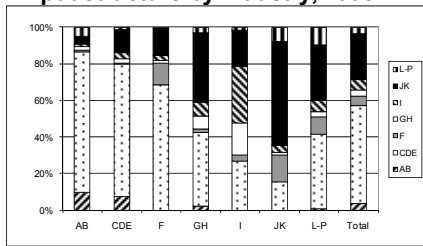
Input structure by industry, 2005
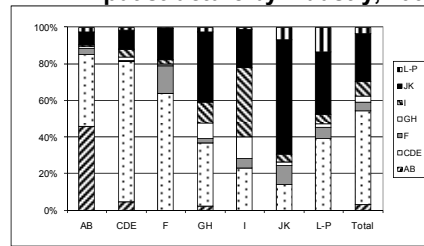
CZECH REPUBLIC: Input structure by industry, 1995
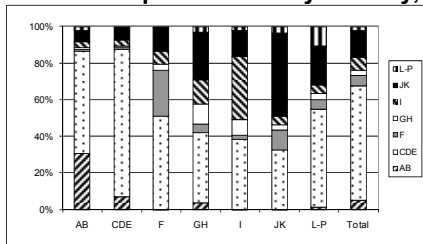
Input structure by industry, 2005
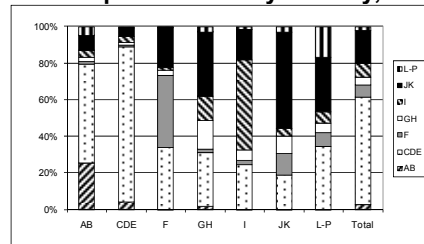
HUNGARY: Input structure by industry, 1998
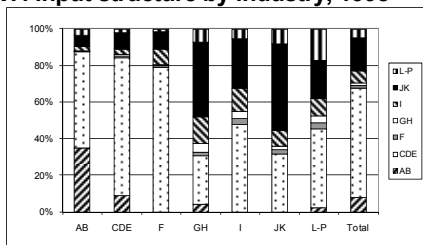
Input structure by industry, 2005
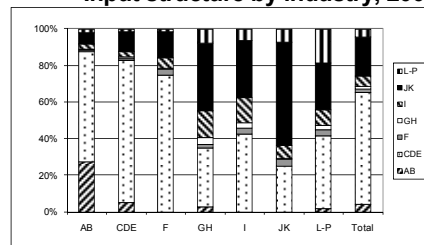
POLAND: Input structure by industry, 1996
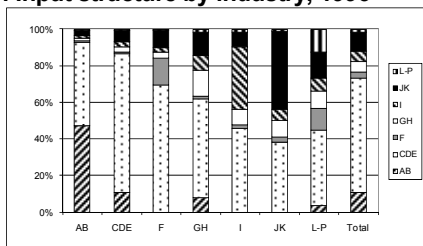
Input structure by industry, 2004
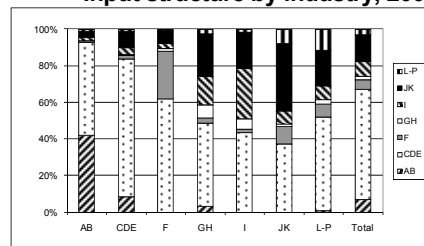
SLOVAK REPUBLIC: Input structure by industry, 1995
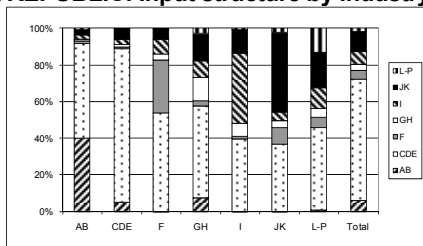
Input structure by industry, 2004
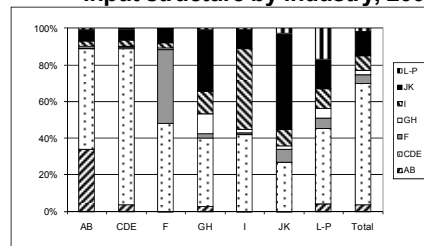
SLOVENIA: Input structure by industry, 1996
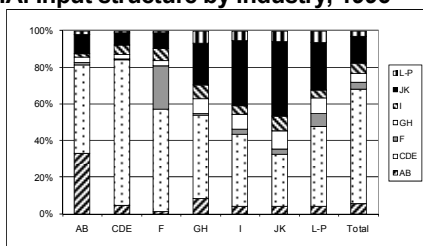
Input structure by industry, 2005
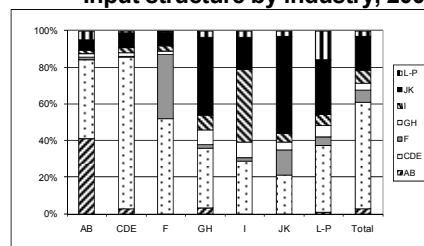
Source: Eurostat use tables; authors' calculations.

Figure 10

AUSTRIA: Structure of use of intermediate inputs by product and p.p. change
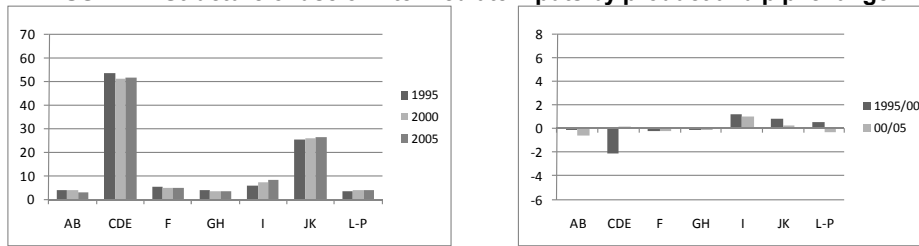
CZECH REPUBLIC: Structure of use of intermediate inputs by product and p.p. change
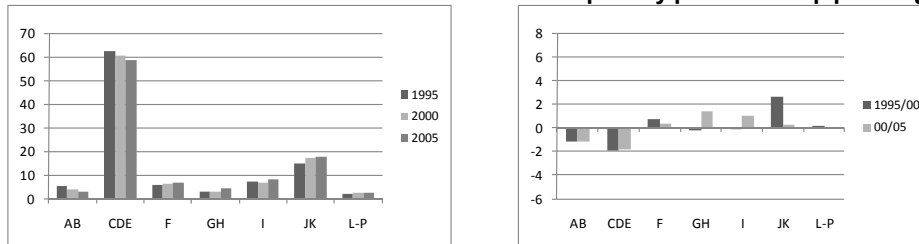
HUNGARY: Structure of use of intermediate inputs by product and p.p. change
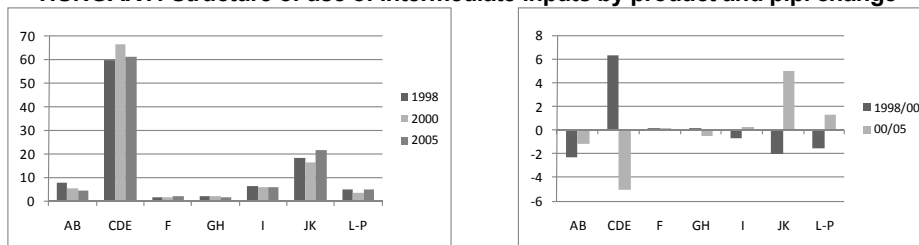
POLAND: Structure of use of intermediate inputs by product and p.p. change
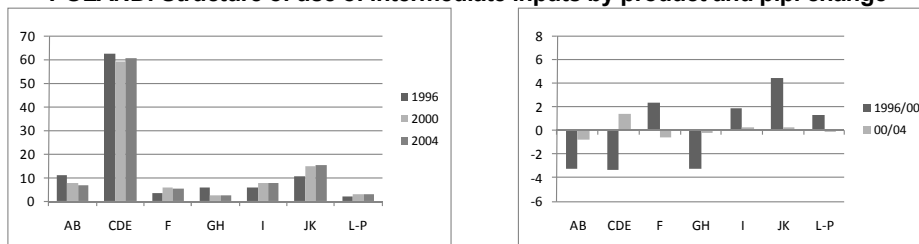
SLOVAK REPUBLIC: Structure of use of intermediate inputs by product and p.p. change
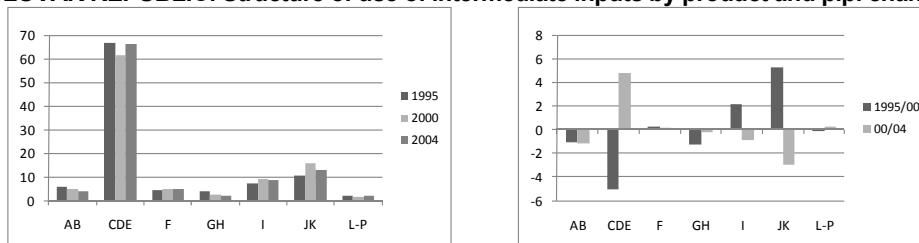
SLOVENIA: Structure of use of intermediate inputs by product and p.p. change
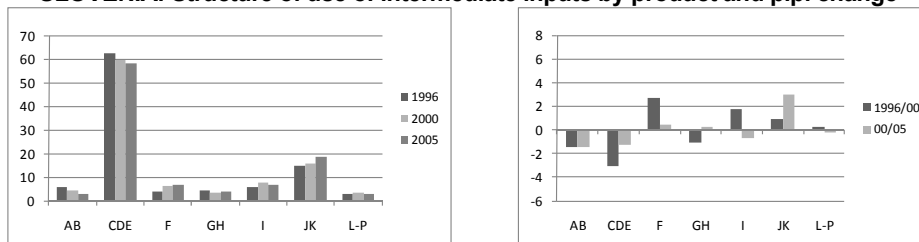
Source: Eurostat use tables; authors' calculations.

The next figure (Figure 11) presents the relative importance of the intermediates in total use by product. Somewhat different to above the share of intermediates in total supply of business services (JK) is more or less in line with the level in Austria of about 60% though a little bit higher in the Czech Republic, lower in Poland and fluctuating in the Slovak Republic. In contrast, the share of intermediates in manufacturing tends to be higher in the NMS compared to Austria. The counterpart, i.e. the share of final use in total use is documented in Figure 12.

Figure 11

AUSTRIA: Share of total intermediate inputs in total use at purchasers' prices by product and p.p. change
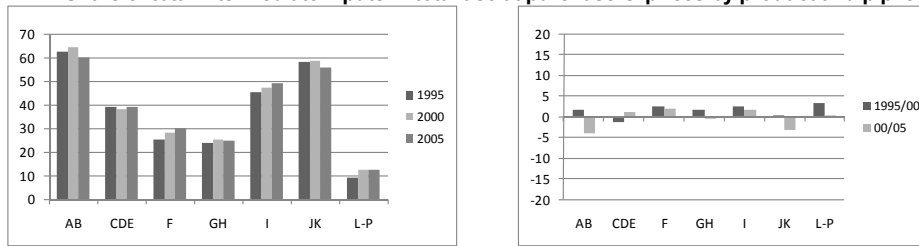
CZECH REPUBLIC: Share of total intermediate inputs in total use at purchasers' prices by product and p.p. change
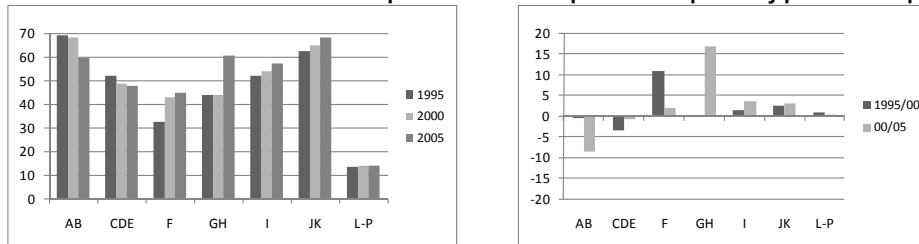
HUNGARY: Share of total intermediate inputs in total use at purchasers' prices by product and p.p. change
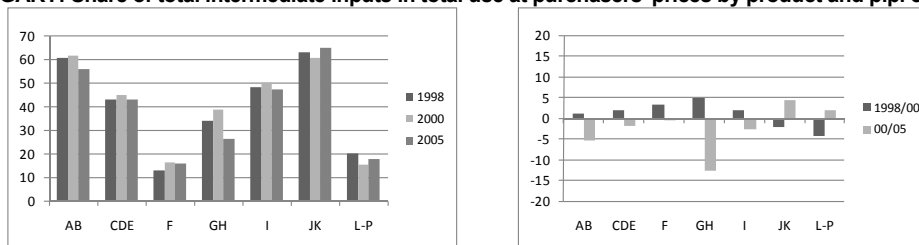
POLAND: Share of total intermediate inputs in total use at purchasers' prices by product and p.p. change
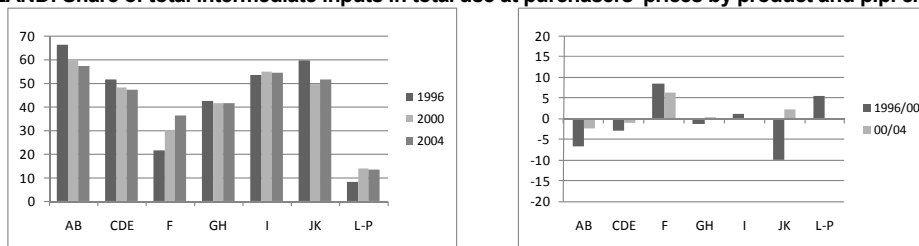
SLOVAK REPUBLIC: Share of total intermediate inputs in total use at purchasers' prices by product and p.p. change
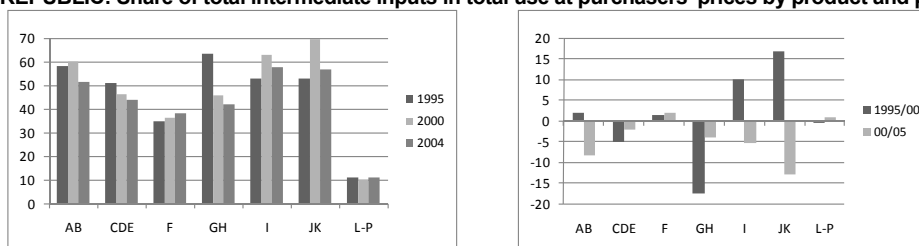
SLOVENIA: Share of total intermediate inputs in total use at purchasers' prices by product and p.p. change
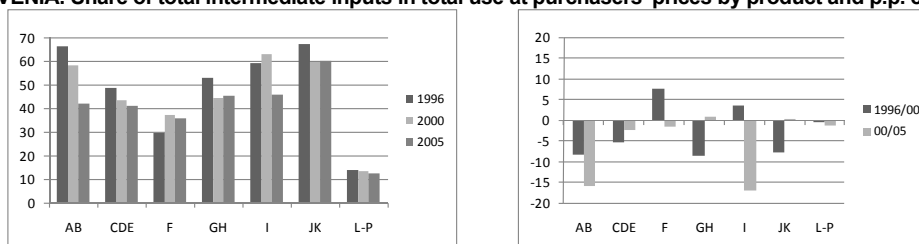
Source: Eurostat use tables; authors' calculations.

Figure 12

AUSTRIA: Share of final use in total use at purchasers' prices by product and p.p. change
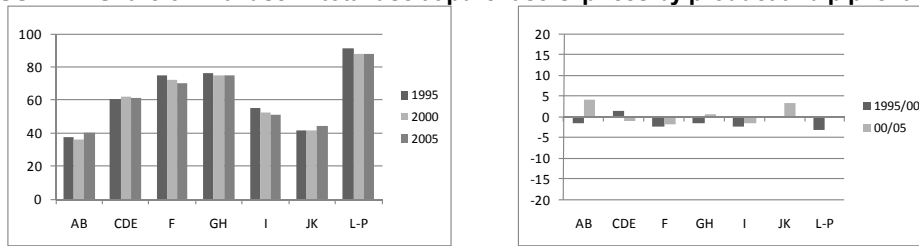
CZECH REPBULIC: Share of final use in total use at purchasers' prices by product and p.p. change
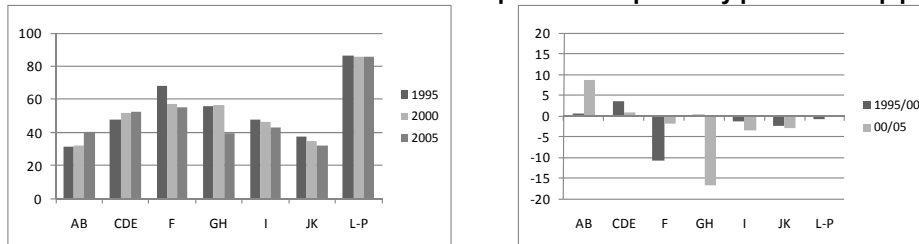
HUNGARY: Share of final use in total use at purchasers' prices by product and p.p. change
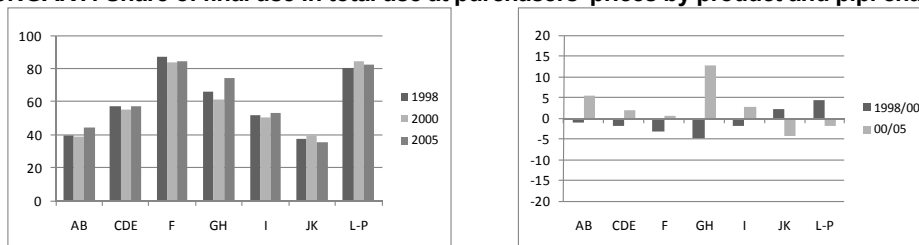
POLAND: Share of final use in total use at purchasers' prices by product and p.p. change
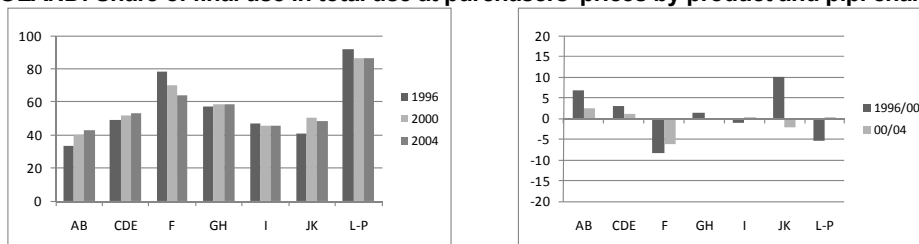
SLOVAK REPUBLIC: Share of final use in total use at purchasers' prices by product and p.p. change
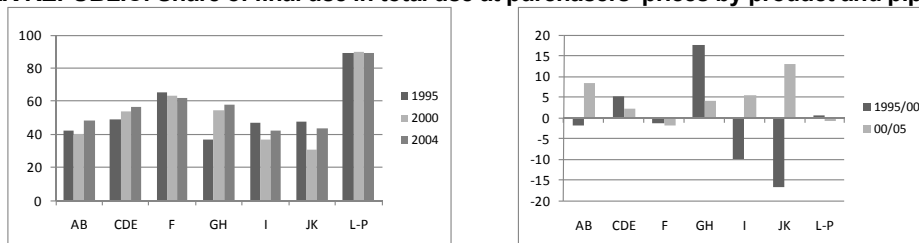
SLOVENIA: Share of final use in total use at purchasers' prices by product and p.p. change
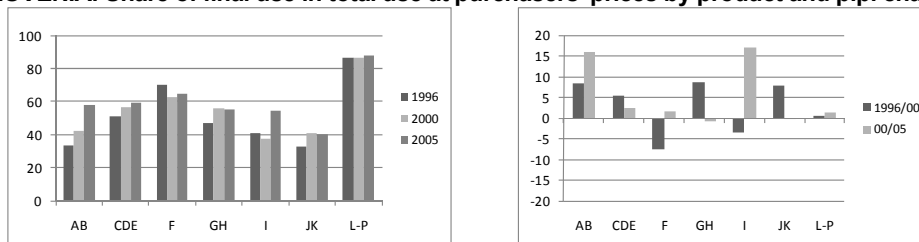
Source: Eurostat use tables; authors' calculations.

This could even be further split up by the share and structure of final consumption in total consumption by product category and similarly for the share and structure of gross fixed capital formation. We do show however the shares and structures of exports in Figures 13 and 14.

As expected the most export intensive sectors is manufacturing in most countries with ratios of above 30% in all countries with the exception of Poland. These shares have been rising in almost all countries rapidly with increases of up to 10 percentage points. However, there are also other products comprising a high export ratio, namely service products trade & hotels (GH) and transport (I). Business services (JK) show ratios of about 10% in Austria in 2005, but lower ones for the other countries. Notably these ratios have been decreasing in some of them (Czech Republic, Poland, Slovak Republic) especially in the period 1995-2000. The dominant role of the manufacturing (CDE) as exporting sector can however be seen in Figure 14. This sector makes up to 90% of exports in most countries and shows large increases over time for some countries (like Poland). Again exports of business services (JK) are much lower: In Austria these comprise for about 10% of total exports; shares are even lower for the NMS and even decreasing there over time.

Figure 13

AUSTRIA: Share of exports in total use at purchasers' prices by product

CZECH REPUBLIC: Share of exports in total use at purchasers' prices by product

HUNGARY: Share of exports in total use at purchasers' prices by product

POLAND: Share of exports in total use at purchasers' prices by product

SLOVAK REPUBLIC: Share of exports in total use at purchasers' prices by product

SLOVENIA: Share of exports in total use at purchasers' prices by product

Source: Eurostat use tables; authors' calculations.

Figure 14

AUSTRIA: Structure of exports and p.p. change

CZECH REPUBLIC: Structure of exports and p.p. change

HUNGARY: Structure of exports and p.p. change

POLAND: Structure of exports and p.p. change

SLOVAK REPUBLIC: Structure of exports and p.p. change

SLOVENIA: Structure of exports and p.p. change

Source: Eurostat use tables; authors' calculations.

2.3.2 Structure of value added

More often than output data value added data are used to describe the size of different sectors in the economy. This information can be distracted from the use tables as well. Services (G-P) account for about 70% of total value added in Austria in 2005, while in the NMS this share is still smaller. It reaches about 60% in the Czech Republic, 66% in Hungary, 64% in Poland, 60% in Slovakia and 64% in Slovenia. This is largely due to smaller shares in business services (JK) and to a lesser extent to smaller shares in trade & hotels (GH) as well as in community services (L-P). Transport services (I) show larger shares of value added in all NMS than in Austria. However, also certain differences exist within the group of NMS (GH in Poland; L-P in Hungary). Between 1995 and 2005 a clear decline in the value added share of manufacturing and an increase in business Services (JK) tool place (see Figure 15).

Figure 15

AUSTRIA: Structure of value added by industry

CZECH REPUBLIC: Structure of value added by industry

HUNGARY: Structure of value added by industry

POLAND: Structure of value added by industry

SLOVAK REPUBLIC: Structure of value added by industry

SLOVENIA: Structure of value added by industry
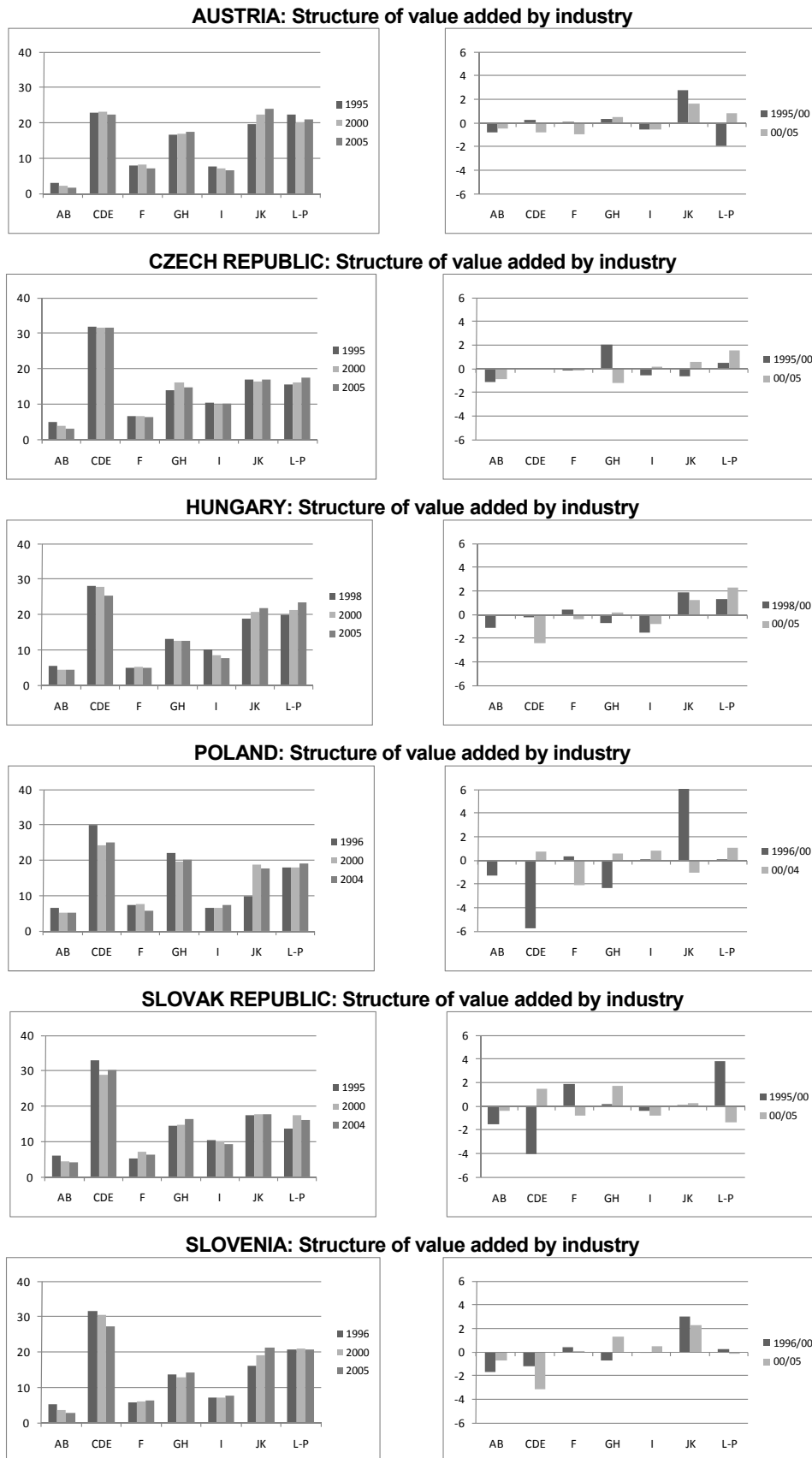
Source: Eurostat use tables; authors' calculations.

2.4 Service intensities, comparison to Austria and changes over time

In this chapter we will first calculate various service intensities for the total economy and then use a simple shift-share analysis outlined in Box 1 in order to compare them. Christie (2006) used this approach to compare energy intensities in selected old (Netherlands, Germany) and new EU member states (Hungary, Slovakia, Slovenia). We will make comparisons between Austria and the five new Member states as well as comparisons for the years 1995, 2000 and 2005 over time for all countries.

Calculation is based on the use tables for 1995, 2000 and 2005. As an approximating measure of service use intermediate consumption of products from CPA categories 50 to 74 (comprising 17 service industries, ranging from sale of motor vehicles to other business services, see Annex) will be taken first. Thus we only focus on so called 'market services' in this section and neglect the community services here. As this definition is still rather broad we also opted for a more detailed analysis, looking also at service use for CPA 50-75 without hotels (CPA 55), as well as at the following sub-categories: trade (CPA 50-52), hotels (55), transport & communication (CPA 60-64), financial intermediation (CPA 65-67) and real estate (70-74).

It is then possible to calculate several measures of service intensity by measuring the share of service use in total intermediate consumption, in total gross value added or in total output for each industry. In this chapter we decided to calculate the share of service use divided by output.

Box 1

Comparing service intensities between countries

An economy is made up of N industries: j = 1,....,N

o_j is the output of industry j and e_j is the service use of industry j in that economy (both measured at current prices), we then define:

The output share of industry j (s_j) and the service intensity of industry j (i_j):

$$s_j = \frac{o_j}{\sum_j o_j} \qquad \text{and} \qquad i_j = \frac{e_j}{o_j}$$

And the economy's total service intensity (in terms of intermediate uses with respect to output):

$$I = \frac{\sum_j e_j}{\sum_j o_j}$$

Therefore:

$$I = \frac{\sum_j e_j}{\sum_j o_j} = \frac{\sum_j i_j o_j}{\sum_j o_j} = \sum_j \left[i_j \cdot \frac{o_j}{\sum_j o_j} \right] = \sum_j i_j s_j$$

In other words: an economy's overall service intensity is the sum of the service intensities of the individual industries weighted by the output shares of the individual industries.

We then wish to analyse the difference in service intensity between a country, B, and a selected reference country A.

We thus have to compare the service intensities of the two countries:

$$I_A = \sum_j i_{jA} s_{jA} \quad \text{and} \quad I_B = \sum_j i_{jB} s_{jB}$$

We may look at the difference in service intensities:

$$I_B - I_A = \sum_j i_{jB} s_{jB} - \sum_j i_{jA} s_{jA}$$

Regrouping terms, we get the following decomposition:

$$I_B - I_A = \sum_j i_{jB}(s_{jB} - s_{jA}) + \sum_j s_{jA}(i_{jB} - i_{jA})$$

In effect the first term expresses the structural difference between the two countries (if the structures are identical this term will equal zero), while the second term expresses the difference in the service intensities in individual industries between the countries (likewise, if the service intensities are identical this second term will equal zero).

See Christie (2006), p. 8.

To calculate changes over time we can use the same approach by interpreting the two countries as different points in time (e.g. 1995 and 2004). Given time t=T (2004) and t=0 (1995) we can compare the service intensities of two years:

$$I_0 = \sum_j i_{j0} s_{j0} \text{ and } I_T = \sum_j i_{jT} s_{jT}$$

We then look at the difference in service intensities again:

$$I_0 - I_T = \sum_j i_{j0} s_{j0} - \sum_j i_{jT} s_{jT}$$

Regrouping terms, we get the following decomposition:

$$I_0 - I_T = \sum_j i_{j0}(s_{j0} - s_{jT}) + \sum_j s_{jT}(i_{j0} - i_{jT})$$

The first term expresses the structural difference between the two years (if the structures are identical this term will equal zero), while the second term expresses the difference in the service intensities in individual industries between the two years (likewise, if the service intensities are identical this second term will equal zero).

When looking at the service intensity for market services (CPA 50-74), it is evident that Austria as well as the Czech Republic showed the highest service intensities in 2005, followed by Hungary and Slovenia, while it was lowest in Slovakia and Poland. In the Czech Republic the service intensity was already nearly as large as that in Austria. Service intensities were higher in 2005 than in 1995 in all NMS, but paces thereto differ: in the Czech Republic and Poland service intensities increased steadily, in Hungary and Slovenia they declined slightly first and grew thereafter, while in Slovakia the service intensity peaked in 2000 and then fell again according to the data available to us. Interestingly, in 1995, when compared to Austria service intensities were only somewhat smaller in the Czech Republic, Hungary and Slovenia. Service intensities for the individual broad service categories trade, hotels, transport and finance are by definition smaller, the most important service intensity is found for real estate (70-74) (see Table 6).

Table 6

Service intensities

	AT1995	AT2000	AT2005	CZ1995	CZ2000	CZ2005	HU1998	HU2000	HU2005
Services 50-74	15.92	17.94	19.10	15.41	17.12	19.05	15.02	14.63	16.65
Services 50-74 (-55)	15.12	17.19	18.28	14.56	16.71	18.45	14.65	14.23	16.45
Trade 50-52	0.87	0.99	0.89	1.06	1.41	2.14	0.66	0.82	0.66
Hotels 55	0.80	0.75	0.82	0.85	0.41	0.60	0.37	0.40	0.20
Trans & comm 60-64	2.67	3.46	4.08	4.37	4.35	5.04	3.56	3.38	3.34
Finance 65-67	4.28	4.41	2.95	2.58	2.37	2.37	2.56	2.44	2.84
Real estate 70-74	7.30	8.33	10.36	6.54	8.58	8.89	7.87	7.59	9.61
KIBS (72-74)	4.30	5.14	6.73	4.64	6.42	6.92	6.58	5.98	7.36
	PL1996	**PL2000**	**PL2004**	**SK1995**	**SK2000**	**SK2004**	**SI1996**	**SI2000**	**SI2005**
Services 50-74	12.04	13.47	13.90	13.13	17.29	14.05	15.60	15.52	16.32
Services 50-74 (-55)	11.65	13.15	13.59	12.55	16.69	13.66	14.74	14.58	15.41
Trade 50-52	2.73	0.99	0.90	1.66	0.86	0.85	1.93	1.04	1.13
Hotels 55	0.39	0.33	0.31	0.58	0.60	0.40	0.86	0.94	0.90
Trans & comm 60-64	3.13	4.08	4.29	4.36	5.81	5.03	3.57	4.38	3.80
Finance 65-67	0.83	1.66	1.56	2.74	1.90	1.36	2.30	2.71	1.97
Real estate 70-74	4.96	6.42	6.84	3.79	8.12	6.41	6.94	6.45	8.51
KIBS (72-74)	2.85	4.61	5.08	2.18	4.97	4.48	6.06	5.51	6.82

Source: Eurostat use tables; authors' calculations.

We now take Austria in 2005 as a reference economy and look at the absolute differences in service intensities between the NMS and Austria, as well as at corresponding breakdowns into structural and service intensity terms (see Table 7). In all countries, market service intensity (CPA 50-74) is lower in the NMS than in Austria and this was due to both terms being negative (except in the Czech Republic). In Hungary and Slovenia both terms were roughly about the same size, with the structural term being more pronounced in Hungary in 2000 and 2005 and the intensity term in Slovenia for the same years. In the Polish case, pronounced lower service intensities by industry as compared to Austria resulted in

overall lower service intensities. No clear pattern is visible for Slovakia. In the Czech Republic, smaller overall service intensities were due to differences in the output structure only (2000 and 2005), meaning that the Czech structure was less service intensive than Austria in all years observed. Interestingly, the intensity term turned positive for 2000 and especially 2005, meaning that the service intensity by industry was larger than that in Austria.

Table 7

Differences in services intensities with respect to Austria 2005, market services (50-74)

Country/Year	CZ1995	CZ2000	CZ2005	HU1998	HU2000	HU2005	PL1996	PL2000	PL2004
Structural Term	-1.98	-2.15	-2.75	-1.78	-2.41	-1.77	-3.74	-0.69	-0.77
Intensity Term	-1.71	0.17	2.71	-2.30	-2.06	-0.68	-3.31	-4.93	-4.42
Total	**-3.69**	**-1.98**	**-0.05**	**-4.08**	**-4.47**	**-2.45**	**-7.06**	**-5.62**	**-5.20**

Country/Year	SK1995	SK2000	SK2004	SI1996	SI2000	SI2005
Structural Term	-1.90	-3.03	-2.62	-1.87	-1.39	-1.02
Intensity Term	-4.07	1.21	-2.43	-1.63	-2.19	-1.76
Total	**-5.97**	**-1.81**	**-5.05**	**-3.50**	**-3.58**	**-2.78**

Source: Eurostat use tables; authors' calculations.

Table 8

Differences in service intensities between years, market services (50-74)

Country/Year	AT 1995/00	AT 2000/05	AT 1995/05	CZ 1995/00	CZ 2000/05	CZ 1995/2005	HU 1998/00	HU 2000/05	HU 1995/05
Structural Term	-0.41	0.01	-0.52	-0.47	-0.23	-0.72	0.41	-0.64	-0.28
Intensity Term	-1.61	-1.17	-2.66	-1.24	-1.71	-2.92	-0.02	-1.37	-1.35
Total	**-2.02**	**-1.16**	**-3.18**	**-1.71**	**-1.94**	**-3.64**	**0.38**	**-2.02**	**-1.63**

Country/Year	PL 1996/00	PL 2000/04	PL 1996/04	SK 1995/00	SK 2000/04	SK 1995/04	SI 1996/00	SI 2000/05	SI 1996/05
Structural Term	-2.03	-0.10	-1.75	-0.92	0.73	-0.35	-0.38	-0.59	-0.89
Intensity Term	0.60	-0.33	-0.11	-3.23	2.50	-0.57	0.47	-0.22	0.17
Total	**-1.43**	**-0.43**	**-1.86**	**-4.15**	**3.23**	**-0.92**	**0.08**	**-0.80**	**-0.72**

Source: Eurostat use tables; authors' calculations.

Looking now at changes over time in more detail, all countries became more service intensive (CPA 50-74) between 1995 and 2005. The most pronounced changes took in fact place in the Czech Republic and Austria, the change being somewhat smaller in Poland and Hungary and even smaller in Slovakia and Slovenia (see Table 8). In most countries this was over-proportionately due to the service intensity of individual industries getting larger (i.e. the intensity term being more negative), with the only exceptions of Poland and

Slovenia. In Poland, the structural term was more pronounced, i.e. a change towards a more service intensive output structure took place. In Slovenia too, the output structure became more service intensive, while the service intensity of individual industries slightly fell (i.e. the intensity term became positive). The shift towards a larger service intensity varied between countries and periods of time: In Hungary and Slovenia, the shift took place between 2000 and 2005. In Poland, changes in the output structure mostly happened between 1996 and 2000. In Austria and the Czech Republic, service intensities increased in both periods, with the pace of change slowing down in Austria in the second period, while speeding up in the Czech Republic.

3 Backward and forward linkages of service industries

Linkages, i.e. the interconnectedness of sectors among each other, have increased during the last decades. This is often illustrated by the example of manufacturing industry and services, between which interaction and linkages between have grown over time (Pilat and Wölfl, 2005, p. 6). In this part of the study, the importance of linkages from the viewpoint of service industries will be highlighted and the following questions will be investigated: How are services in the new EU member states intertwined with the total economy in comparison to Austria? Are services still less intertwined with the rest of the economy in the NMS? How have service linkages developed?

This second part of the study will present different linkage measures which are based on symmetric industry-by-industry input-output tables. The first section discusses methodological issues, the second focuses on backward linkages and the third on forward linkages. Section 4 then summarizes the results with respect to the classification of industries into key, leading, basic and independent industries with a focus on service industries.

3.1 Methodological approach

Industry-by-industry symmetric input-output tables

Symmetric input-output tables (SIOT) are organized either product-by-product or industry-by-industry. Both types have their advantages and drawbacks and both are suited for various forms of analysis. Which type to use depends in the end on the purpose of analysis (see Eurostat, 2008, p. 301 or Ruada-Cantuche and Beutel, 2010). In this part of our analysis we rely on industry-by-industry tables rather than product-by-product tables in order to calculate linkage indictors for industries. However, Eurostat does provide only

product-by-product symmetric input-output tables. Hence we had to calculate industry-by-industry SIOT from the existing supply and use tables.[9]

Usually symmetric input-output tables are derived under a mix of assumptions (industry-based and commodity-based technology assumption).[10] The methods and underlying assumptions (on technology, etc.) for doing these calculations as well as potential problems (e.g. arising negative input coefficients) and suggested solutions are explained in detail in Miller and Blair (1985) (see chapter 5; Tables 5-10 on page 171 and 5-1-1 on page 191). Guo et al. (2002) provide an extensive overview of existing studies (in particular with respect to negative entries when applying the commodity technology assumption). Seemingly there is no commonly accepted approach in the literature (see the overview in Guo et al., 2002). For example, Guo et al. (2002) find for the US that the choice of method does not greatly affect the total multipliers. However there might be large differences for particular industries or commodities. Recently, basic transformation models refer to the categories of technology and market shares (for details see Eurostat, 2008, p. 309). Within this distinction, product-by-product tables are derived under the technology assumption (product technology-A or industry technology-B), industry-by-industry tables under the market share assumption (fixed industry sales structure-C or fixed product sales structure-D). Hence, four models (A-D) are available to calculate symmetric tables. The problems mentioned above remained the same. However, in the meantime Models A and D are widely used by statistical offices due to theoretical and practical reasons (no negative entries). We followed this approach and used Model D (assumption of fixed sales structure) to calculate our industry-by-industry tables.

Practically, calculation of symmetric input-output tables is based on the supply and use tables. However, while the supply tables are provided at basic prices, use tables are normally provided at purchasers' prices (as is done so by Eurostat). Hence, we first had to obtain the use tables at basic prices from the National Statistical Offices[11] for the years 1995, 2000 and 2005 (often they were supplied together with consistent supply tables, if not we took supply tables from Eurostat). Use tables then had to be harmonized across countries, negatives-adjustment and FISIM-adjustment had to be made again. Finally we arrived at symmetric industry-by-industry input output tables for the total economy. We did not make a distinction between total and domestic economy (excluding imports), as additional data sources would be needed for this distinction.

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[9] We did not choose to take the OECD input-output database, which provides industry-by-industry harmonized symmetric input-output tables (Yamano, Ahmad, 2006), as it does not publish supply and use tables which have been used in Part 1 of the project and data for Slovenia were missing at the beginning of the project.

[10] This will lead to different Leontief-inverse matrices; see Miller-Blair, 1985, p. 171.

[11] The Polish Statistical Office does not provide Use tables at basic prices, as symmetric input-output tables are calculated at purchaser's prices first and then transformed into basic prices. Hence, we excluded Poland from our analysis.

Methodology on linkage indices

Generally, two kinds of linkages occur in the framework of the input-output analysis: On the one hand, a sector needs inputs from other sectors. The interconnection of a particular sector with those 'upstream' sectors from which it purchases inputs is termed 'backward linkages'. The economic effect on other sectors is to be found on the demand side: 'If sector j increased its output, this means there will be increased demands from sector j (as a purchaser) on the sectors whose goods are used as inputs to production in j' (see Miller and Blair, 2009, p. 555). On the other hand, a sector sells its output to other sectors. This kind of interconnection of a particular sector with those 'upstream' sectors to which it sells its output is called 'forward linkages'. The economic effect is to be found on the supply side: 'If sector j increased its output, this means there will be increased supplies from sector j (as a seller) for the sectors that use good j in their production' (see Miller and Blair, 2009, p. 555).

Various measures have been proposed to calculate backward and forward linkages: An early and today still commonly used linkage index was suggested by Rasmussen in 1957 (see Box 2). A number of contributions later refine this traditional concept and suggest different measures of industries linkages. Rasmussen himself, for example, proposed an amended measure taking account of extreme values and calculated the coefficient of variation indices (see Soofi, 1992, p. 352). Jones (1976, as cited in Drejer, 2002) questions the use of Rasmussen's index of sensitivity of dispersion measure of forward linkages and instead proposes to utilize the output inverse matrix in the calculation of the index. Cuello et al. (1992) again use information from outside the Leontief-inverse in order to refine the Rasmussen-linkage indices (see Box 3). Drejer (2002) reviews these refinements (also including the one proposed by Cuello et al., 1992) and provides an empirical comparison for the Danish economy. She concludes that applied to highly developed economies the linkage analysis might only provide little information, however that it could be useful for developing economies. To our knowledge no such study was undertaken for the transition economies in a comparative manner and in particular with respect to analyse the changes over time which thus is an interesting part in this project.

For this chapter as a first step, we calculated the Leontief-inverse from the symmetric input-output table, i.e. $(I-A)^{-1}$ where I denotes the identity matrix and A is the coefficient matrix, i.e. the matrix of direct input coefficients. The Leontief-inverse gives the direct and indirect linkages between industries. Taking the column sums of the Leontief inverse gives the backward multipliers which are measuring the direct and indirect effects of an autonomous change of demand for a specific product on the total economy. Taking the row sums of the Leontief inverse gives the so called forward multipliers. These multipliers provide information on the increase of output of specific industries if total final demand increases by one unit.

In a further calculation we use these multipliers and derive the Rasmussen linkage indexes, i.e. the 'power of dispersion' (backward linkages) and the 'sensitivity of dispersion' (forward linkage) (compare Box 2). We then computed the revised backward and forward linkages as proposed by Cuello et al. (1992, see Box 3). Hence, we derived three measures for backward and forward linkages (Rasmussen linkages BL and FL; final demand weighted linkage index BL2 and FL2; output-weighted linkage index BL3 and FL3).

Box 2

Measurements of backward and forward linkages

The Rasmussen linkage index **'power of dispersion'** describes the relative extent to which an increase in final demand for the products of a given industry is dispersed throughout the total system of industries and is defined as:

$$U_j = \frac{\frac{1}{n}\sum_i B_{ij}}{\frac{1}{n^2}\sum_{ij} B_{ij}}$$

where n is the number of industries and $\sum_i B_{ij}$ is the sum of the column elements in the Leontief inverse matrix $\mathbf{B} = (\mathbf{I}\text{-}\mathbf{A})^{-1}$. It can be interpreted as the total increase in output from the entire system of industries needed to cope with an increase in final demand for the products of industry j by one unit. This index describes the 'backward linkage effects'.

Rasmussen also presented a supplementary index describing the extent to which the system of industries draws upon a given industry – an index of the **'sensitivity of dispersion'**. The sensitivity of dispersion index measures the increase in the production of industry i, driven by a unit increase in the final demand for all industries in the system. The index is defined as:

$$U_i = \frac{\frac{1}{n}\sum_j B_{ij}}{\frac{1}{n^2}\sum_{ij} B_{ij}}$$

where $\sum_j B_{ij}$ is the sum of the row elements in the Leontief inverse matrix, which is interpreted as the increase in output in industry i needed in order to cope with a unit increase in the final demand for the product of each industry. This index may be labelled as 'forward linkage effects'.

See Drejer (2002), p. 5.

Box 3

Refined measurements of backward and forward linkages

Cuello et al. (1992) incorporate information from outside the Leontief inverse matrix in order to obtain a more accurate measure of the economy-wide importance of key industries. Starting with the original Rasmussen definition (also in the case of the forward linkage measure the Leontief inverse matrix is based on input coefficients used), Cuello et al. reformulate the traditional measures by includ-

ing a vector of parameters which is used in weighting the coefficients in the Leontief inverse matrix. Two different vectors are used in the analysis: first the relative importance of final demand:

$$\alpha_i = \frac{y_i}{\sum y_i}$$

And second the relative importance of total sectoral output:

$$\beta_i = \frac{\sum_j \left(x_{ij} + y_{ij} \right)}{\sum_{ij} \left(x_{ij} + y_{ij} \right)}$$

The backward (U_{wj}) and forward linkages (U_{wi}) are now calculated as:

$$U_{wj} = \frac{\frac{1}{n} \sum_i w_i b_{ij}}{\frac{1}{n^2} \sum_{ij} w_i b_{ij}}$$

$$U_{wi} = \frac{\frac{1}{n} \sum_j w_j b_{ij}}{\frac{1}{n^2} \sum_{ij} w_j b_{ij}}$$

with w being the chosen weight (either α or β) and b_{ij} being the elements of the Leontief inverse (**B**). See Drejer (2002), p. 11.

In order to identify 'key' sectors in the economy, i.e. those sectors that are most connected and therefore most important in an economy, one can use these backward and forward linkage measures and select those industries with the highest measures. In the normalized form (as proposed by Rasmussen) these are industries with linkages measures greater than one. Miller and Blair (2009) suggest the following four way classification:

1) Generally independent of (not strongly connected to) other sectors (backward and forward linkages measures less than one)

2) Generally dependent on (connected to) other sectors (both linkage measures greater than one)

3) Dependent on interindustry supply (only backward linkage greater than 1)

4) Dependent on interindustry demand (only forward linkage greater than 1)

We will apply the following amended classification as used widely in the literature (see e.g Fernández-Fernández and Fernández-Grela, 2000).

• Key industries: strong forward and backward linkages

• Leading industries: weak forward and strong backward linkages

• Basic industries: strong forward and weak backward linkages

• Independent industries: weak forward and weak backward linkages

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3.2 Main results on backward linkages

Main backward linkages: importance in total economy and main service industries

Looking at industries with the highest backward linkages in the total economy in 2005, it turns out that one finds only one service industry amongst the top five industries in most cases. However, the particular service industry found in each case differs according to the linkage measure used and also according to the country observed (see Table 9). Looking at the Rasmussen-Linkage Index (BL) it is mainly other transport (NACE 63) which has large backward linkages. Regarding the final demand weighted Linkage index (BL2), real estate activities (NACE 70) and public administration (NACE 75) rank among the top industries and looking at the output-weighted index other business services (NACE 74) shows large backward linkages. Only in a few cases more than one service industries ranks under the top 5 (these exceptions are the Czech Republic using the Rasmussen-linkage index and in Austria using the weighted indices). Table 10 lists the main five service industries for all three linkage indices.

Looking at the individual indices in more detail one can observe the following interesting findings (compare Table 9 and 10):

- Rasmussen Linkage Index: In the Czech Republic, three service industries rank among the top five industries in the whole economy (Insurance (NACE 66), Other transport (NACE 63, Sewage, disposal (NACE 90). Hotels & restaurants (NACE 55) show major backward linkages in Hungary and Slovenia (see Table 9). In all countries, except Hungary, other transport (NACE 63) is among the main 5 service industries; sale of vehicles (NACE 50) is also among main service industries in three NMS (see Table 10).

- Final-demand weighted Index: Besides real estate activities (NACE 70) and public administration (NACE 75), health & social work (NACE 85) as well as retail trade (NACE 52) are among the five service industries with the highest backward linkages in all countries.

- Output-weighted Linkage Index: Other business services (NACE 74) ranks first in all countries observed (except in the Slovak Republic). Wholesale trade (NACE 51) is among the main three service industries in all five countries. Other industries with large linkages are real estate activities (NACE 70) and retail trade (NACE 52).

Results of the above analysis show the differences among the linkage indices, each of which has its advantages and drawbacks. The Rasmussen-Index shows interrelations regardless of the size of a sector, which may favour small industries with a lot of interrelations e.g. recycling. Weighted linkages again might be overshadowed by the weights and underestimate the linkage element. As results turned out to be interesting and different for the various indicators, we decided to present results derived from both the Rasmussen linkage indicators and the output-weighted linkage index in more detail in the text.

Table 9

Industries with highest backward linkages in the total economy, 2005

	Rasmussen Linkage Index (BL)				Final demand-weighted Linkage Index (BL2)				Output-weighted Linkage Index (BL3)		

AUSTRIA

Rank	CPA	Description	BL	Rank	CPA	Description	BL2	Rank	CPA	Description	BL3
1	40	Electricity	1.52	1	45	Construction	3.24	1	45	Construction	2.80
2	13	Metal ores	1.34	2	34	Motor vehicles	3.02	2	74	Other business services	2.50
3	20	Wood products	1.30	3	70	Real estate activities	2.73	3	70	Real estate activities	2.44
4	37	Recycling	1.27	4	85	Health and social work	2.55	4	40	Electricity	2.43
5	62	Air transport	1.25	5	29	Machinery (non-electr.)	2.52	5	34	Motor vehicles	2.36

CZECH REPUBLIC

Rank	CPA	Description	BL	Rank	CPA	Description	BL2	Rank	CPA	Description	BL3
1	45	Construction	1.40	1	34	Motor vehicles	4.25	1	45	Construction	3.50
2	66	Insurance	1.32	2	45	Construction	3.68	2	34	Motor vehicles	3.10
3	63	Other transport	1.25	3	29	Machinery (non-electr.)	2.79	3	74	Other business services	2.30
4	15	Food & beverages	1.23	4	15	Food & beverages	2.54	4	15	Food & beverages	2.16
5	90	Sewage, disposal etc.	1.23	5	70	Real estate activities	2.18	5	29	Machinery (non-electr.)	2.02

HUNGARY

Rank	CPA	Description	BL	Rank	CPA	Description	BL2	Rank	CPA	Description	BL3
1	15	Food & beverages	1.35	1	32	Communication equipm.	4.66	1	32	Communication equipm.	3.86
2	55	Hotels & restaurants	1.26	2	34	Motor vehicles	4.24	2	34	Motor vehicles	3.06
3	40	Electricity	1.24	3	15	Food & beverages	2.87	3	15	Food & beverages	2.41
4	45	Construction	1.23	4	45	Construction	2.69	4	45	Construction	2.02
5	05	Fishing	1.22	5	75	Public administration etc.	2.26	5	74	Other business services	2.00

SLOVAK REPUBLIC

Rank	CPA	Description	BL	Rank	CPA	Description	BL2	Rank	CPA	Description	BL3
1	40	Electricity	1.45	1	34	Motor vehicles	4.62	1	34	Motor vehicles	3.89
2	45	Construction	1.39	2	45	Construction	3.70	2	45	Construction	3.24
3	63	Other transport	1.35	3	15	Food & beverages	2.47	3	40	Electricity	2.88
4	15	Food & beverages	1.20	4	51	Wholesale trade	2.42	4	51	Wholesale trade	2.21
5	21	Paper	1.18	5	29	Machinery (non-electr.)	2.41	5	15	Food & beverages	1.89

SLOVENIA

Rank	CPA	Description	BL	Rank	CPA	Description	BL2	Rank	CPA	Description	BL3
1	26	Non-met. Min. prod.	1.55	1	45	Construction	4.16	1	45	Construction	3.94
2	45	Construction	1.52	2	34	Motor vehicles	3.21	2	24	Chemicals	2.84
3	24	Chemicals	1.45	3	24	Chemicals	3.03	3	74	Other business services	2.56
4	55	Hotels & restaurants	1.27	4	29	Machinery (non-electr.)	2.87	4	34	Motor vehicles	2.45
5	15	Food & beverages	1.25	5	75	Public administration etc.	2.19	5	29	Machinery (non-electr.)	2.29

Source: Authors' calculations.

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Table 10

Service industries with highest backward linkages, 2005

Rasmussen Linkage Index (BL)				Final demand-weighted Linkage Index (BL2)				Output-weighted Linkage Index (BL3)			

Rank	CPA	Description	BL	Rank	CPA	Description	BL2	Rank	CPA	Description	BL3
		AUSTRIA				**AUSTRIA**				**AUSTRIA**	
1	62	Air transport	1.25	1	70	Real estate activities	2.73	1	74	Other business services	2.50
2	67	Aux. Financial services	1.24	2	85	Health and social work	2.55	2	70	Real estate activities	2.44
3	63	Other transport	1.22	3	75	Public administration etc.	2.44	3	51	Wholesale trade	2.25
4	64	Post & telecomm.	1.18	4	55	Hotels & restaurants	2.17	4	85	Health and social work	1.68
5	90	Sewage, disposal etc.	1.16	5	52	Retail trade	2.16	5	55	Hotels & restaurants	1.67
		CZECH REPUBLIC				**CZECH REPUBLIC**				**CZECH REPUBLIC**	
1	66	Insurance	1.32	1	70	Real estate activities	2.18	1	74	Other business services	2.30
2	63	Other transport	1.25	2	75	Public administration etc.	1.96	2	70	Real estate activities	2.01
3	90	Sewage, disposal etc.	1.23	3	85	Health and social work	1.52	3	51	Wholesale trade	1.82
4	91	Organizations	1.19	4	63	Other transport	1.44	4	63	Other transport	1.55
5	50	Sale of vehicles	1.19	5	52	Retail trade	1.41	5	60	Land transport	1.51
		HUNGARY				**HUNGARY**				**HUNGARY**	
1	55	Hotels & restaurants	1.26	1	75	Public administration etc.	2.26	1	74	Other business services	2.00
2	50	Sale of vehicles	1.17	2	52	Retail trade	1.93	2	51	Wholesale trade	1.91
3	92	Culture	1.15	3	51	Wholesale trade	1.86	3	70	Real estate activities	1.55
4	66	Insurance	1.15	4	70	Real estate activities	1.85	4	52	Retail trade	1.50
5	51	Wholesale trade	1.15	5	85	Health and social work	1.82	5	55	Hotels & restaurants	1.41
		SLOVAK REPUBLIC				**SLOVAK REPUBLIC**				**SLOVAK REPUBLIC**	
1	63	Other transport	1.35	1	51	Wholesale trade	2.42	1	51	Wholesale trade	2.21
2	50	Sale of vehicles	1.15	2	75	Public administration etc.	2.24	2	60	Land transport	1.64
3	92	Culture	1.14	3	52	Retail trade	1.96	3	52	Retail trade	1.64
4	71	Renting of mach. & equ.	1.12	4	60	Land transport	1.70	4	74	Other business services	1.58
5	62	Air transport	1.11	5	70	Real estate activities	1.50	5	75	Public administration etc.	1.38
		SLOVENIA				**SLOVENIA**				**SLOVENIA**	
1	55	Hotels & restaurants	1.27	1	75	Public administration etc.	2.19	1	74	Other business services	2.56
2	63	Other transport	1.21	2	85	Health and social work	1.94	2	51	Wholesale trade	2.09
3	51	Wholesale trade	1.18	3	51	Wholesale trade	1.75	3	75	Public administration etc.	1.56
4	91	Organizations	1.17	4	70	Real estate activities	1.63	4	60	Land transport	1.56
5	60	Land transport	1.12	5	52	Retail trade	1.59	5	52	Retail trade	1.45

Source: Authors' calculations.

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Figure 16

Backward linkages of services (Rasmussen linkage indicator), 2005
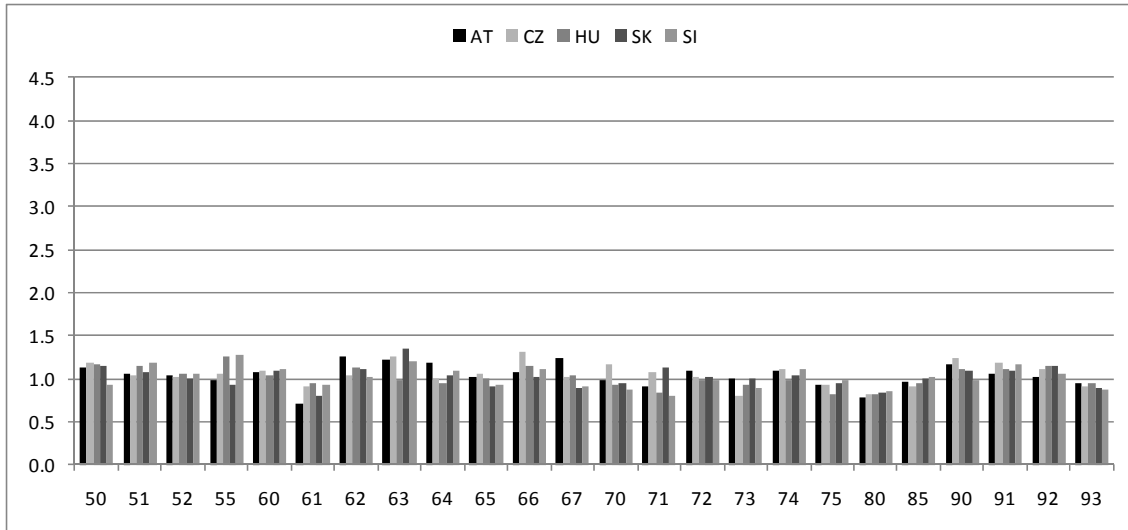
Source: Authors' calculations.

Figure 17

Backward linkages of services (Output-weighted linkage indicator), 2005
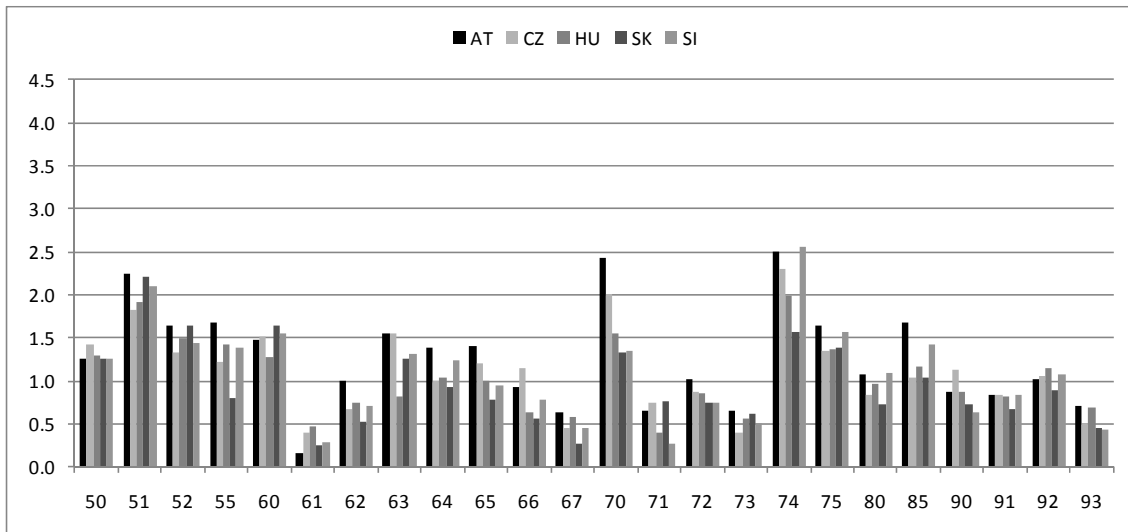
Source: Authors' calculations.

Comparison over time and with Austria

Backward linkages of service industries (measured by the Rasmussen linkage indicator) have changed considerably as indicated by correlation coefficients between 1995 and 2005 for all countries (see Table 11). The only exception seems to be Hungary where the correlations coefficient is very high (0.94). Changes were moderate for Slovenia and Austria (correlation coefficient of 0.86) but very pronounced for the Czech Republic and Slovakia (correlation coefficient of about 0.7).

Looking at backward linkages using the output-weighted linkage indicator, changes were somewhat smaller (see Table 12). On the one hand, there is Hungary again, where backward linkages for service industries have remained almost the same in the period 1995 and 2005. On the other hand, some change took place in the Czech Republic, mostly in the period between 1995 and 2000. In the other countries, changes were small (correlation coefficient of 0.9 for the period 1995 and 2005).

Table 11

Correlation of backward linkages (Rasmussen linkage index)

BL services	AT 1995	AT 2000	AT 2005
AT 1995	1.00		
AT 2000	0.92	1.00	
AT 2005	0.87	0.92	1.00
BL services	CZ 1995	CZ 2000	CZ 2005
CZ 1995	1.00		
CZ 2000	0.74	1.00	
CZ 2005	0.71	0.96	1.00
BL services	HU 1998	HU 2000	HU 2005
HU 1998	1.00		
HU 2000	0.95	1.00	
HU 2005	0.94	0.95	1.00
BL services	SK 1995	SK 2000	SK 2005
SK 1995	1.00		
SK 2000	0.62	1.00	
SK 2005	0.68	0.82	1.00
BL services	SI 1996	SI 2000	SI 2005
SI 1996	1.00		
SI 2000	0.91	1.00	
SI 2005	0.86	0.90	1.00
BL services	AT 1995	AT 2000	AT 2005
CZ 1995	0.79	0.79	0.74
CZ 2000	0.81	0.80	0.86
CZ 2005	0.85	0.81	0.87
HU 1998	0.82	0.76	0.80
HU 2000	0.85	0.82	0.83
HU 2005	0.85	0.82	0.86
SK 1995	0.63	0.55	0.61
SK 2000	0.89	0.88	0.84
SK 2005	0.82	0.77	0.90
SI 1996	0.78	0.71	0.73
SI 2000	0.82	0.80	0.79
SI 2005	0.80	0.79	0.83

Source: Authors' calculations.

When comparing the new member states with Austria (2005; based on the Rasmussen linkage indicator), backward linkages seem to be similar across countries as the correlation coefficient is rather high between the new member states and Austria for the service indus-

tries in 2005: it ranges between 0.83 in Slovenia and 0.9 in the Slovak Republic. Linkages have become more similar between Austria and the new member states between 1995 and 2005, with most convergence taking place in Slovakia.

Table 12

Correlation of backward linkages (Output-weighted linkage index)

BL services	AT 1995	AT 2000	AT 2005
AT 1995	1.00		
AT 2000	0.94	1.00	
AT 2005	0.89	0.92	1.00
BL services	*CZ 1995*	*CZ 2000*	*CZ 2005*
CZ 1995	1.00		
CZ 2000	0.80	1.00	
CZ 2005	0.80	0.96	1.00
BL services	*HU 1998*	*HU 2000*	*HU 2005*
HU 1998	1.00		
HU 2000	0.97	1.00	
HU 2005	0.96	0.97	1.00
BL services	*SK 1995*	*SK 2000*	*SK 2005*
SK 1995	1.00		
SK 2000	0.85	1.00	
SK 2005	0.89	0.90	1.00
BL services	*SI 1996*	*SI 2000*	*SI 2005*
SI 1996	1.00		
SI 2000	0.93	1.00	
SI 2005	0.90	0.95	1.00
BL services	*AT 1995*	*AT 2000*	*AT 2005*
CZ 1995	0.79	0.83	0.80
CZ 2000	0.81	0.85	0.93
CZ 2005	0.79	0.82	0.93
HU 1998	0.80	0.83	0.87
HU 2000	0.81	0.86	0.89
HU 2005	0.85	0.87	0.93
SK 1995	0.75	0.73	0.76
SK 2000	0.72	0.74	0.74
SK 2005	0.76	0.78	0.85
SI 1996	0.79	0.76	0.82
SI 2000	0.78	0.80	0.87
SI 2005	0.79	0.83	0.92

Source: Authors' calculations.

When looking at the output-weighted linkage indicator, backward linkages in the new member states do resemble those in Austria even more: the correlation coefficient reached 0.93 for the Czech Republic, Hungary and Slovenia in 2005. Only the Slovak Republic has a smaller correlation coefficient of 0.85, representing some differences to Austria. Linkages have again become more similar between Austria and the new member states between 1995 and 2005.

3.3 Main results on forward linkages

Main forward linkages: importance in total economy and main service industries

When looking at forward linkage indices calculated with input coefficients, service industries are more prominent among the main industries with the largest linkages, as would have been expected. Services are important suppliers of inputs to other industries along the value chain as concluded in OECD (2007). When calculating the Rasmussen-linkage index, four service industries show up among the top 5 industries with the largest forward linkages in the total economy in Austria and three in each of the new member states except Slovenia (only 2). Other business services (NACE 74) is the one with the highest forward linkage index in all countries except the Slovak Republic (ranking second behind electricity (NACE 40)). Wholesale trade (NACE 51) also belongs to those industries with the largest forward linkages in the total economy. Looking at the final demand and output-weighted linkage indices, again other business services (NACE 74) as well as wholesale trade (NACE 51) rank among the top 5 industries (see Table 13).

Looking at the individual indices in more detail the following interesting findings are observed (see Table 14):

- Rasmussen Linkage Index: Besides other business services (NACE 74) and wholesale trade (NACE 51), financial intermediation (NACE 65) and real estate activities (NACE 70) are among the main service industries with the largest forward linkages in most countries. Land transport (NACE 60) is prominent in the new member states only (see Table 14).

- Final-demand weighted Index: Besides business services (NACE 74) and wholesale trade (NACE 51), public administration (NACE 75) belongs to the 5 main service industries in all countries, health and social work (NACE 85) only in Austria.

- Output-weighted Linkage Index: Looking at this indicator, again business services (NACE 74) and wholesale trade (NACE 51) rank top. In addition, real estate activities (NACE 70) as well as land transport (NACE 60) are important industries in this respect in all countries. Financial intermediation (NACE 65) is placed among the top 5 service industries only in Austria, while other transport (NACE 63) is important in the Czech Republic, retail trade (NACE 52) in the Slovak Republic.

Table 13

Industries with highest forward linkages in the total economy, 2005

Rasmussen Linkage Index (BL) | Final demand-weighted Linkage Index (BL2) | Output-weighted Linkage Index (BL3)

AUSTRIA

Rank	CPA	Description	BL	Rank	CPA	Description	BL2	Rank	CPA	Description	BL3
1	74	Other business services	2.862	1	45	Construction	3.183	1	74	Other business services	4.020
2	40	Electricity	2.213	2	70	Real estate activities	2.939	2	40	Electricity	2.920
3	51	Wholesale trade	1.911	3	74	Other business services	2.794	3	45	Construction	2.896
4	70	Real estate activities	1.582	4	51	Wholesale trade	2.620	4	51	Wholesale trade	2.824
5	65	Financial intermediation	1.576	5	34	Motor vehicles	2.558	5	70	Real estate activities	2.781

CZECH REPUBLIC

Rank	CPA	Description	BL	Rank	CPA	Description	BL2	Rank	CPA	Description	BL3
1	74	Other business services	3.024	1	34	Motor vehicles	3.669	1	74	Other business services	3.773
2	51	Wholesale trade	2.116	2	45	Construction	3.621	2	45	Construction	3.469
3	45	Construction	1.792	3	74	Other business services	2.615	3	34	Motor vehicles	2.751
4	60	Land transport	1.576	4	29	Machinery (non-electr.)	2.482	4	51	Wholesale trade	2.676
5	40	Electricity	1.538	5	15	Food & beverages	2.211	5	27	Basic metals	2.406

HUNGARY

Rank	CPA	Description	BL	Rank	CPA	Description	BL2	Rank	CPA	Description	BL3
1	74	Other business services	3.135	1	32	Communication equipm.	4.380	1	32	Communication equipm.	4.068
2	23	Coke & refineries	2.369	2	34	Motor vehicles	3.473	2	74	Other business services	3.516
3	51	Wholesale trade	1.898	3	74	Other business services	2.511	3	23	Coke & refineries	2.835
4	40	Electricity	1.700	4	31	Electrical machinery	2.192	4	34	Motor vehicles	2.769
5	70	Real estate activities	1.562	5	15	Food & beverages	2.145	5	31	Electrical machinery	2.223

SLOVAK REPUBLIC

Rank	CPA	Description	BL	Rank	CPA	Description	BL2	Rank	CPA	Description	BL3
1	40	Electricity	2.656	1	34	Motor vehicles	4.047	1	34	Motor vehicles	3.917
2	74	Other business services	2.005	2	45	Construction	3.201	2	40	Electricity	3.600
3	51	Wholesale trade	1.929	3	51	Wholesale trade	2.733	3	45	Construction	3.147
4	45	Construction	1.704	4	40	Electricity	2.483	4	51	Wholesale trade	2.770
5	60	Land transport	1.686	5	27	Basic metals	2.104	5	27	Basic metals	2.212

SLOVENIA

Rank	CPA	Description	BL	Rank	CPA	Description	BL2	Rank	CPA	Description	BL3
1	74	Other business services	2.953	1	45	Construction	3.944	1	74	Other business services	4.048
2	28	Fabricated metal prod.	1.698	2	24	Chemicals	3.001	2	45	Construction	3.856
3	45	Construction	1.698	3	74	Other business services	2.908	3	28	Fabricated metal prod.	2.892
4	51	Wholesale trade	1.674	4	34	Motor vehicles	2.844	4	24	Chemicals	2.858
5	27	Basic metals	1.539	5	29	Machinery (non-electr.)	2.591	5	51	Wholesale trade	2.348

Source: Authors' calculations.

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Table 14

Service industries with highest forward linkages, 2005

Rasmussen Linkage Index (BL)				Final demand-weighted Linkage Index (BL2)				Output-weighted Linkage Index (BL3)			

Rank	CPA	Description	BL	Rank	CPA	Description	BL2	Rank	CPA	Description	BL3
AUSTRIA				**AUSTRIA**				**AUSTRIA**			
1	74	Other business services	2.862	1	70	Real estate activities	2.939	1	74	Other business services	4.020
2	51	Wholesale trade	1.911	2	74	Other business services	2.794	2	51	Wholesale trade	2.824
3	70	Real estate activities	1.582	3	51	Wholesale trade	2.620	3	70	Real estate activities	2.781
4	65	Financial intermediation	1.576	4	85	Health and social work	1.916	4	65	Financial intermediation	1.769
5	64	Post & telecomm.	1.357	5	75	Public administration etc.	1.836	5	60	Land transport	1.487
CZECH REPUBLIC				**CZECH REPUBLIC**				**CZECH REPUBLIC**			
1	74	Other business services	3.024	1	74	Other business services	2.615	1	74	Other business services	3.773
2	51	Wholesale trade	2.116	2	51	Wholesale trade	2.141	2	51	Wholesale trade	2.676
3	60	Land transport	1.576	3	70	Real estate activities	1.866	3	70	Real estate activities	1.702
4	65	Financial intermediation	1.470	4	60	Land transport	1.499	4	60	Land transport	1.700
5	63	Other transport	1.421	5	75	Public administration etc.	1.406	5	63	Other transport	1.360
HUNGARY				**HUNGARY**				**HUNGARY**			
1	74	Other business services	3.135	1	74	Other business services	2.511	1	74	Other business services	3.516
2	51	Wholesale trade	1.898	2	51	Wholesale trade	2.006	2	51	Wholesale trade	2.148
3	70	Real estate activities	1.562	3	70	Real estate activities	1.950	3	70	Real estate activities	1.816
4	65	Financial intermediation	1.373	4	75	Public administration etc.	1.889	4	75	Public administration etc.	1.254
5	60	Land transport	1.346	5	52	Retail trade	1.510	5	60	Land transport	1.205
SLOVAK REPUBLIC				**SLOVAK REPUBLIC**				**SLOVAK REPUBLIC**			
1	74	Other business services	2.005	1	51	Wholesale trade	2.733	1	51	Wholesale trade	2.770
2	51	Wholesale trade	1.929	2	52	Retail trade	1.865	2	74	Other business services	2.111
3	60	Land transport	1.686	3	60	Land transport	1.755	3	60	Land transport	1.866
4	52	Retail trade	1.395	4	74	Other business services	1.651	4	52	Retail trade	1.718
5	70	Real estate activities	1.371	5	75	Public administration etc.	1.579	5	70	Real estate activities	1.403
SLOVENIA				**SLOVENIA**				**SLOVENIA**			
1	74	Other business services	2.953	1	74	Other business services	2.908	1	74	Other business services	4.048
2	51	Wholesale trade	1.674	2	51	Wholesale trade	2.104	2	51	Wholesale trade	2.348
3	60	Land transport	1.374	3	75	Public administration etc.	1.815	3	60	Land transport	1.691
4	64	Post & telecomm.	1.332	4	70	Real estate activities	1.682	4	70	Real estate activities	1.457
5	65	Financial intermediation	1.317	5	60	Land transport	1.550	5	50	Sale of vehicles	1.439

Source: Authors' calculations.

Figure 18

Forward linkages of services (Rasmussen linkage indicator), 2005
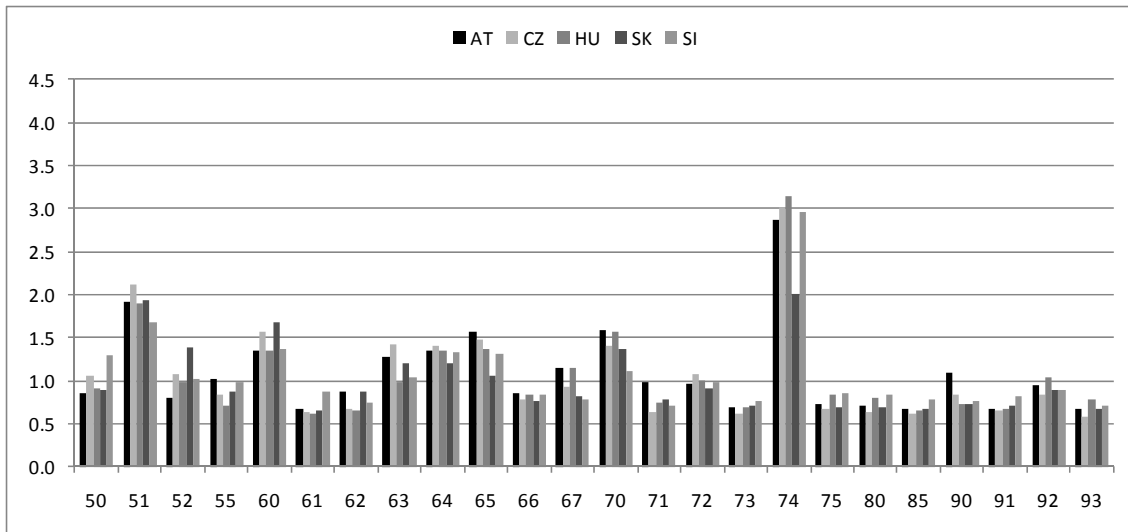
Figure 19

Forward linkages of services (Output-weighted linkage indicator), 2005
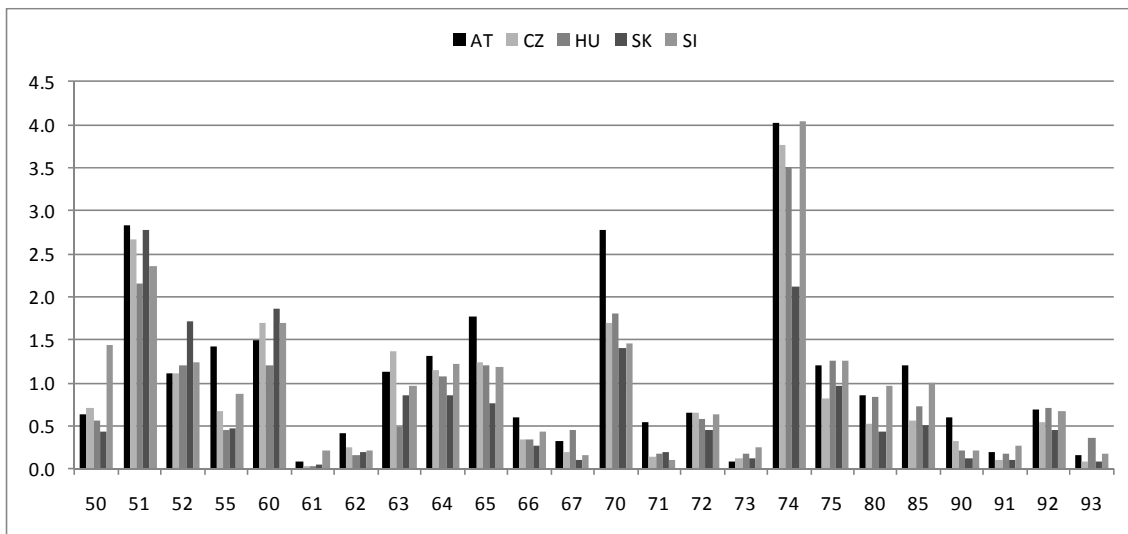
Comparison over time and with Austria

When looking at correlation coefficients across time for forward linkages of service industries, less dynamics can be observed compared to backward linkages regardless which measure is used. Correlation coefficients between 1995 and 2005 are very high (moderate changes can be observed in Austria and Slovakia using the Rasmussen-linkage indicator only). In addition, differences between the new member states and Austria are small and have remained so over time. Again only Slovakia is slightly different from Austria (see Tables 15 and 16).

Table 15

Correlation of forward linkages (Rasmussen linkage index)

BL services	AT 1995	AT 2000	AT 2005
AT 1995	1.00		
AT 2000	0.99	1.00	
AT 2005	0.85	0.87	1.00

BL services	CZ 1995	CZ 2000	CZ 2005
CZ 1995	1.00		
CZ 2000	0.91	1.00	
CZ 2005	0.94	0.98	1.00

BL services	HU 1998	HU 2000	HU 2005
HU 1998	1.00		
HU 2000	0.97	1.00	
HU 2005	0.96	0.99	1.00

BL services	SK 1995	SK 2000	SK 2005
SK 1995	1.00		
SK 2000	0.83	1.00	
SK 2005	0.86	0.95	1.00

BL services	SI 1996	SI 2000	SI 2005
SI 1996	1.00		
SI 2000	0.95	1.00	
SI 2005	0.97	0.95	1.00

BL services	AT 1995	AT 2000	AT 2005
CZ 1995	0.92	0.92	0.91
CZ 2000	0.78	0.81	0.97
CZ 2005	0.80	0.83	0.96
HU 1998	0.73	0.77	0.92
HU 2000	0.83	0.86	0.97
HU 2005	0.77	0.80	0.96
SK 1995	0.71	0.68	0.64
SK 2000	0.68	0.68	0.86
SK 2005	0.73	0.73	0.87
SI 1996	0.76	0.78	0.90
SI 2000	0.75	0.78	0.91
SI 2005	0.75	0.78	0.92

Source: Authors' calculations.

Table 16

Correlation of forward linkages (Output-weighted linkage index)

BL services	AT 1995	AT 2000	AT 2005
AT 1995	1.00		
AT 2000	0.98	1.00	
AT 2005	0.90	0.93	1.00

BL services	CZ 1995	CZ 2000	CZ 2005
CZ 1995	1.00		
CZ 2000	0.95	1.00	
CZ 2005	0.97	0.99	1.00

BL services	HU 1998	HU 2000	HU 2005
HU 1998	1.00		
HU 2000	0.99	1.00	
HU 2005	0.98	0.99	1.00

BL services	SK 1995	SK 2000	SK 2005
SK 1995	1.00		
SK 2000	0.89	1.00	
SK 2005	0.90	0.95	1.00

BL services	SI 1996	SI 2000	SI 2005
SI 1996	1.00		
SI 2000	0.98	1.00	
SI 2005	0.97	0.97	1.00

BL services	AT 1995	AT 2000	AT 2005
CZ 1995	0.86	0.89	0.93
CZ 2000	0.81	0.86	0.96
CZ 2005	0.81	0.86	0.95
HU 1998	0.78	0.84	0.92
HU 2000	0.84	0.89	0.95
HU 2005	0.83	0.88	0.95
SK 1995	0.76	0.74	0.68
SK 2000	0.72	0.74	0.80
SK 2005	0.80	0.81	0.84
SI 1996	0.83	0.86	0.91
SI 2000	0.82	0.85	0.93
SI 2005	0.78	0.83	0.92

Source: Authors' calculations.

3.4 Key sector analysis

Classifying service industries according to their backward and forward linkages in key, leading, basic and independent industries using the Rasmussen linkage indicator provides the following picture across the region for the year 2005 (see Table 17):

- Key service industries (strong forward and strong backward linkages) are wholesale trade (NACE 51), land transport (NACE 60), other transport (NACE 63) and other business services (NACE 74).

- Leading industries (weak forward and strong backward linkages) are air transport (NACE 62), insurance (NACE 66), organizations (NACE 91) and culture (NACE 92).

- Main basic industry (strong forward and weak backward linkages) is real estate activities (NACE 70).
- Independent industries (weak forward and weak backward linkages) are water transport (NACE 61), public administration (NACE75), education (NACE 80) and other services (NACE 93).

Table 17

Key-sector analysis, 2005 (Rasmussen-linkage indicator)

		AT	CZ	HU	SK	SI
Sale of vehicles	50	lead	key	lead	lead	basic
Wholesale trade	51	key	key	key	key	key
Retail trade	52	lead	key	lead	key	key
Hotels & restaurants	55	basic	lead	lead	ind	lead
Land transport	60	key	key	key	key	key
Water transport	61	ind	ind	ind	ind	ind
Air transport	62	lead	lead	lead	lead	lead
Other transport	63	key	key	ind	key	key
Post & telecomm.	64	key	basic	basic	key	key
Financial intermediation	65	key	key	basic	basic	basic
Insurance	66	lead	lead	lead	lead	lead
Aux. Financial services	67	key	lead	key	ind	ind
Real estate activities	70	basic	key	basic	basic	basic
Renting of mach. & equ.	71	ind	lead	ind	lead	ind
Computer services etc.	72	lead	key	ind	lead	ind
R&D	73	lead	ind	ind	lead	ind
Other business services	74	key	key	basic	key	key
Public administration etc.	75	ind	ind	ind	ind	ind
Education	80	ind	ind	ind	ind	ind
Health and social work	85	ind	ind	ind	lead	lead
Sewage, disposal etc.	90	key	lead	lead	lead	ind
Organizations	91	lead	lead	lead	lead	lead
Culture	92	lead	lead	key	lead	lead
Other services	93	ind	ind	ind	ind	ind
Key industries		8	9	4	6	6
Leading industries		8	8	7	10	6
Basic industries		2	1	4	2	3
Independent industries		6	6	9	6	9

Notes: Key = key industry; lead = leading industry; basic = basic industry; ind = independent industry.
Source: Authors' calculations.

Overall, two major findings emerge from these results: First, community services (NACE 75-93) are either independent industries (public administration, education, health and social services, other services) or leading industries (sewage & disposal, organizations, culture); meaning that both forward and backward linkages are either small or that only stronger backward linkages exist. Second and more interesting, it would have been ex-

pected from the former two chapters that service industries are classified as basic industries as more service industries were found among the top 5 industries with high forward linkages than it was the case with backward linkages. This hypothesis can not be supported as the number of basic industries is rather small. This can be explained by the fact that those services with high forward linkages also possess strong backward linkages and hence are classified as key industries. Two industries, post & telecom (NACE 64) and financial intermediation (NACE 65), have strong forward linkages and are either classified as key or basic under a range of countries (see Table 17).

When looking at the number of these different industries across countries in 2005 (see Table 17 at the bottom), one can find that most key industries were located in the Czech Republic (9) and Austria (8), the least in Hungary (4), while Slovakia and Slovenia lay in between with 6 key industries. The number of leading industries was highest in Slovakia (10) but also in the other countries the number was pronounced (6-8). Basic industries were less numerous in all countries (between 1 and 4); independent industries were mostly found in Hungary and Slovenia (9), but also in the other countries (6).

Table 18

Key sector analysis over time (Rasmussen-linkage indicator for service industries)

		1995	2000	2005
	Key industries	5	7	8
AUSTRIA	Leading industries	6	10	8
	Basic industries	5	2	2
	Independent industries	8	5	6
	Key industries	3	7	9
CZECH	Leading industries	6	7	8
REPUBLIC	Basic industries	6	0	1
	Independent industries	9	10	6
	Key industries	4	3	4
HUNGARY	Leading industries	9	11	7
	Basic industries	4	3	4
	Independent industries	7	7	9
	Key industries	4	4	6
SLOVAK	Leading industries	8	11	10
REPUBLIC	Basic industries	3	2	2
	Independent industries	9	7	6
	Key industries	6	6	6
SLOVENIA	Leading industries	9	5	6
	Basic industries	2	1	3
	Independent industries	7	12	9

Source: Authors' calculations.

When looking at changes in the classification of industries over time, certain general trends but also marked country differences emerge: Between 1995 and 2005, the number of 'key' and 'leading' industries increased in Austria, the Czech Republic and the Slovak Republic, while that of 'basic' and 'independent industries' declined. This would point to an **increase** of backward linkages but also of forward linkages in these three countries. In Hungary and Slovenia, however, the number of 'key industries' stayed the same, that of 'leading industries' declined and the number of 'independent industries' grew. This would point to a **decrease** of backward linkages in these two latter countries rather (see Table 18).

Looking further on detailed data and on shifts within industry categories, provides a more detailed and differentiated picture for each country. First, detailed data are mapped for each country and year in the Annex giving an overall impression of how industries shifted across time (see Figures C.1-C.5 in the Annex). Second, main shifts of industries between different industry categories are highlighted in the text.

- In Austria, industries shifted right and upwards over time implying an increase in backward and forward linkages (see Figure C.1). There seems to be a more pronounced change of backward linkages, as a main shift from basic to key industries occurred (4 industries).

- In the Czech Republic, industries shifted right, pointing to an increase of backward linkages (see Figure C.2). A considerable shift from basic to key industries (5 industries) took place (one industry more than in Austria). Remarkably, computer services (NACE 72) classified as an independent industry in 1995 and 2000 became a key industry in 2005.

- In Hungary, the picture of industries seems to have remained the same for 1995 and 2005 (compare Figure C.3), not much change seems to have taken place (only 5 industries changes in the classification system). Backward linkages declined somewhat, with 3 industries changing from leading industries to independent industries.

- In Slovakia, industries shifted right and upwards, indicating growing backward and forward linkages in this country (Figure C.4). Overall, 6 industries changed from independent industries to leading industries (for 4 industries it was the other way round). Other transport (NACE 63), formerly and independent industry already became a key industry in 2000 and 2005.

- In Slovenia, an upward movement of industries can be observed between 1995 and 2005 depicting growing forward linkages on the one hand (Figure C.5). On the other hand, five industries changes from leading industries to independent industries indicating a decline in backward linkages.

Two additional findings can be observed in the data: First, community services (NACE 75-93) are rather stable and in most cases did not change their classification between 1995 and 2005. Second, backward linkages developed differently over time: between 1995

and 2000 backward linkages increased and industries first shifted to the right while be-
tween 2000 and 2005 backward linkages slightly decreased again and industries shifted
back, except in Hungary where changes were minor.

We do not present detailed results on key sectors using the output-weighted linkage indica-
tor, as results turned out to be less marked over time. Overall, using this indicator, in 2005
service industries are mostly classified as independent industries (8-10 in Austria, the
Czech Republic and Slovenia, 12 in Hungary and 15 in Slovakia) or as key industries
(5-11). No basic industries were identified in this case except in Slovenia (1), the number of
leading industries is small (4-7). Changes over time were minor, again the number of key
and leading industries slightly increased in Austria and the Czech Republic, that of inde-
pendent industries decreased. In the other countries it was the other way round, with Slo-
vakia now showing a more inferior picture than before.

4 Knowledge-intensive business services in the NMS

Knowledge-intensive business services (KIBS, including e.g. IT-consulting, R&D services,
legal activities, accounting etc) play an increasingly important role as suppliers of interme-
diate inputs to the rest of the economy (see OECD, 2007; Kox and Rubalcaba, 2007;
European Commission, 2004). However, according to Stare (2005), the new member
states still lag behind in knowledge-intensive services – though there have been some
examples of catching-up recently (see e.g. Engman, 2007). This part of the study looks in
detail at the role of knowledge-intensive business services in the new member states'
economies and compares it to that in Austria.

This part is structured as follows: The first section looks at the definition of KIBS, the sec-
ond investigates structural characteristics on the supply and on the use side, as well as
KIBS service intensities. The third section presents backward and forward linkages first
and then classifies KIBS into key, leading, basic and independent industries accordingly. In
addition, we compare KIBS to selected medium-high- and high-technology industries (of-
fice machinery, electrical machinery, communication equipment, medical & optical equip-
ment and motor vehicles) in this section in order to investigate their differences.

4.1 Definition and methodological approach

The definition of 'knowledge-intensive business services' is still not consistently used in the
literature and different terms and classifications are applied in the various studies. One of
the reasons is that existing data sources do often not supply the necessary details for
analysis. The OECD (2007) provides one definition for knowledge-intensive business ser-
vices. According to this source, KIBS include professional services, such as IT-consulting

(72)[12], R&D services (73), legal activities, accounting, marketing and advertising, business consulting and human resource development, all of them included in NACE rev. 1 74. Because of the broad aggregation, category 74 also includes operational services, such as industrial cleaning, security services and secretarial services. Together, KIBS and operational services are often subsumed under the term 'business services'.

Input-output data from EUROSTAT are provided at a 2-digit level, with industries being classified according to the NACE rev. 1 classification system[13], products according to CPA.[14] At this level of aggregation it is not possible to separate operational services from other business services (NACE/CPA 74). Hence, we subsume the following activities/products under the term 'knowledge-intensive business services' for this part of the paper:

- Computer & related activities (NACE/CPA 72)[15]

- Research and development (NACE/CPA 73)[16]

- Other business activities (NACE/CPA 74)[17]

In this third part of the study, information gathered in the previous two parts is used to analyse these three categories.

4.2 Structural characteristics of KIBS

4.2.1   Structural characteristics of the supply side

Output size

Looking at output shares, the three service categories investigated are very different in terms of their size: while other business services is one of the largest service sectors (also one of the largest sectors in the total economy), R&D belongs to the smallest service sectors and computer services is a medium-sized sector lying in between. Table 19 presents the five largest service products in the NMS and Austria in 2005: In the Czech Republic,

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[12]   ISIC Rev 3. classification system, identical to NACE rev.1 on the 2-digit level.

[13]   NACE – Nomenclature générale des activités économiques dans les communautés européennes, Classification of Economic Activities in the European Community.

[14]   CPA – Classification of Products by Activity.

[15]   Including on a detailed level hardware consultancy (72.1), software consultancy and supply (72.2), data processing (72.3), database activities (72.4), maintenance and repair of office, accounting and computing machinery (72.5), and other computer related activities (72.6).

[16]   Including research and experimental development on natural sciences and engineering (73.1) and on social sciences and humanities (73.2).

[17]   Including legal activities (74.11), accounting, book-keeping and auditing activities, tax consultancy (74.12), market research and public opinion polling (74.13), business and management consultancy activities (74.14), management activities of holding companies (74.15), architectural and engineering activities and related technical consultancy (74.2), technical testing and analysis (74.3), advertising (74.4), labour recruitment and provision of personnel (74.5), investigation and security activities (74.6), industrial cleaning (74.7), and miscellaneous business activities n.e.c. (74.8).

Hungary and Slovenia other business services (CPA 74) ranked first, in Austria second, while in Poland and Slovakia it came only at the fourth and fifth place. Output shares (in the total economy) ranged between 7% in Austria and 3.5% in Slovakia. R&D (CPA 73) again had shares below 0.5% in all countries and computer services (CPA 72) ranged in between, accounting for shares between 1-2% of the total economy.

Table 19

Five most important service products (nominal shares), 2005

		Austria				**Czech Republic**	
Rank	CPA		Share in %	Rank	CPA		Share in %
1	S70	Real estate activities	7.31	1	S74	Other business activities	5.61
2	S74	Other business activities	6.56	2	S51	Wholesale trade	4.58
3	S51	Wholesale trade	5.99	3	S70	Real estate activities	4.23
4	S85	Health and social work	4.41	4	S75	Public administration etc.	3.22
5	S75	Public administration etc.	4.02	5	S60	Land transport	3.15
			28.29				20.79
		Hungary				**Poland**	
Rank	CPA		Share in %	Rank	CPA		Share in %
1	S74	Other business activities	5.80	1	S52	Retail trade	5.84
2	S70	Real estate activities	5.09	2	S51	Wholesale trade	5.56
3	S75	Public administration etc.	4.77	3	S70	Real estate activities	5.45
4	S51	Wholesale trade	4.74	4	S74	Other business activities	4.93
5	S52	Retail trade	3.31	5	S60	Land transport	3.75
			23.71				25.52
		Slovak Republic				**Slovenia**	
Rank	CPA		Share in %	Rank	CPA		Share in %
1	S60	Land transport	4.79	1	S74	Other business activities	5.55
2	S51	Wholesale trade	4.30	2	S51	Wholesale trade	5.14
3	S70	Real estate activities	4.27	3	S70	Real estate activities	4.83
4	S75	Public administration etc.	4.12	4	S75	Public administration etc.	4.10
5	S74	Other business activities	3.54	5	S52	Retail trade	3.69
			21.02				23.31

Notes: For Poland and the Slovak Republic 2004 data.
Source: Eurostat supply tables; authors' calculations.

Comparing the three service sector in the NMS with those in Austria, we would have expected output shares to be smaller in the NMS and larger in Austria in 1995, as KIBS were said to have been underdeveloped at the beginning of our period of investigation in the new EU member states (see Stare, 2005). However, this hypothesis is not supported by the data in this respect. In fact, the NMS (Czech Republic, Hungary and especially Slovenia) had larger shares than Austria in 1995 in other business services, but even R&D shares were slightly larger compared to Austria for all NMS; only in computer services Austria showed larger shares than the NMS in 1995. In all countries and sectors, shares grew between 1995 and 2005, with Austria showing a pronounced shift towards other business services, now getting ahead of the NMS. Only shares for R&D fell in the Czech Republic

and Slovakia during the period investigated. Hence in 2005, Austria had larger shares compared to the NMS in business services, in computer services, and in R&D compared to the Czech and Slovak Republic (see Figure 20). These results should however be interpreted cautiously as we cannot distinguish price and quantity effects based on these data; further, methodological changes and differences in accounting for services might differ as well across countries.

Figure 20
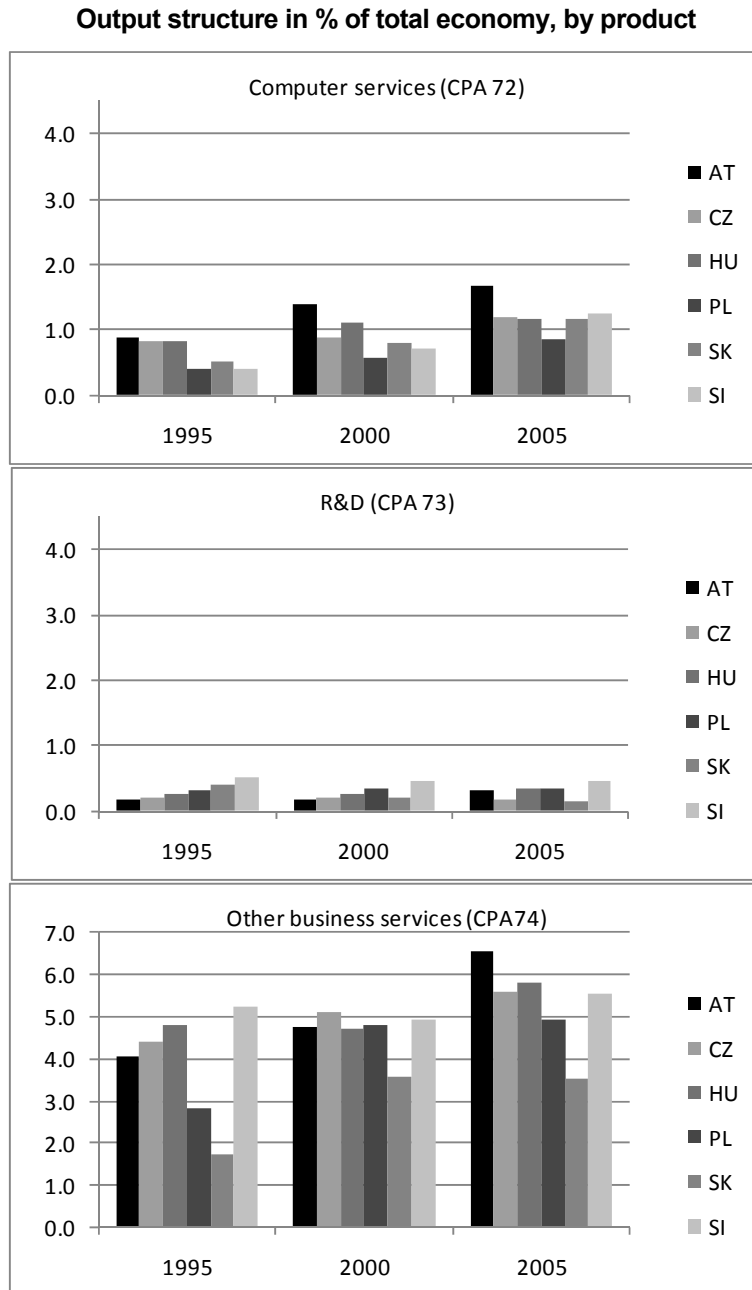
Output structure in % of total economy, by product

Notes: For Hungary 1998, for Poland and Slovenia 1996, for Poland and the Slovak Republic 2004 data.
Source: Eurostat supply tables; authors' calculations.

Import shares and import quotas

Looking at imports (defined as the share of individual imports in total imports), services are generally less imported than manufacturing products and account for only a relatively small share of total imports. Hence, computer services and R&D have only minor shares in all countries (between 0.5% and 1% and less than 0.5% respectively in 2005). The only exception is business services, which accounts for relatively larger shares: In 2005, it ranged around 2% in Poland and Slovakia, 3% in Slovenia, the Czech Republic and Austria and 4% in Hungary.

Figure 21

Share of imports in total imports, by product

Notes: For Hungary 1998, for Poland and Slovenia 1996, for Poland and the Slovak Republic 2004 data.

Source: Eurostat supply tables; authors' calculations.

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Overall, between 1995 and 2005 different trends can be discerned for the three service products regarding their imports shares. Import shares of computer services grew in all countries, those of R&D were mostly stable (in Hungary no R&D imports were recorded in 1995 and 2000). In other business services, the trend varied according to country: Import shares fell in the Czech Republic, Hungary and Slovakia, remained stable in Austria and Poland and grew in Slovenia (see Figure 21).
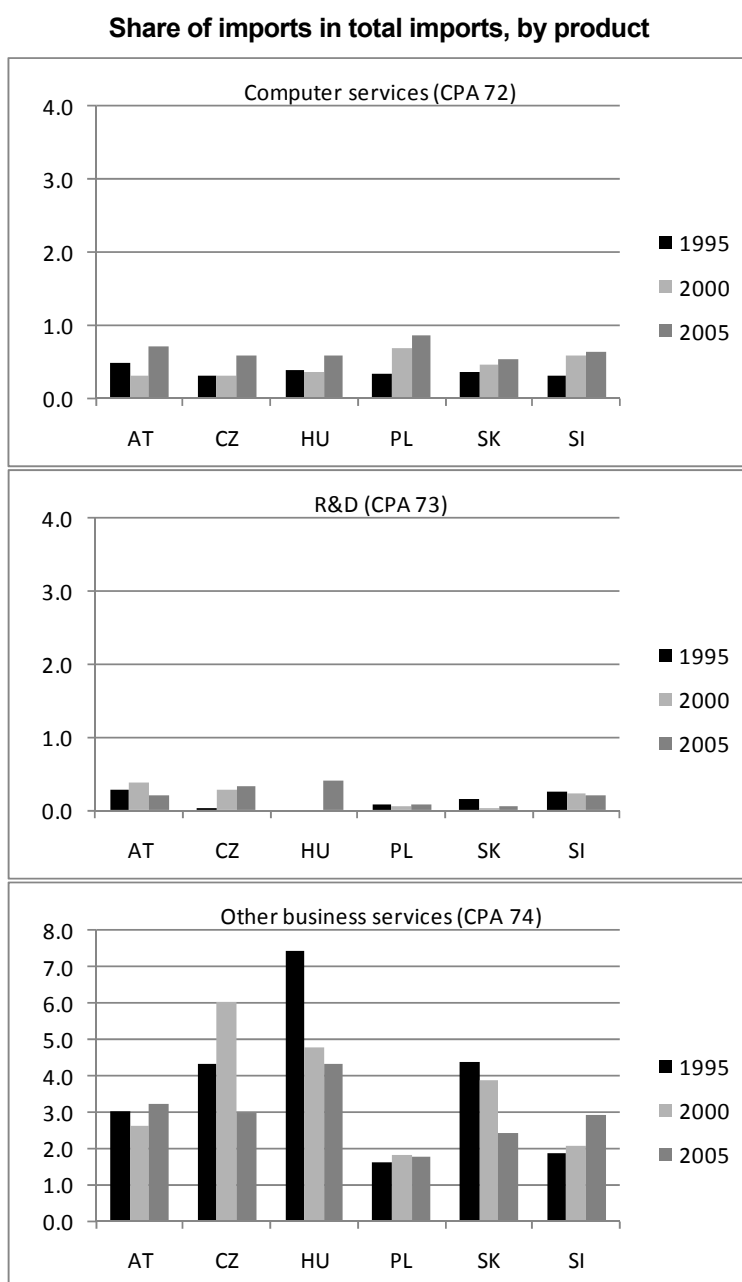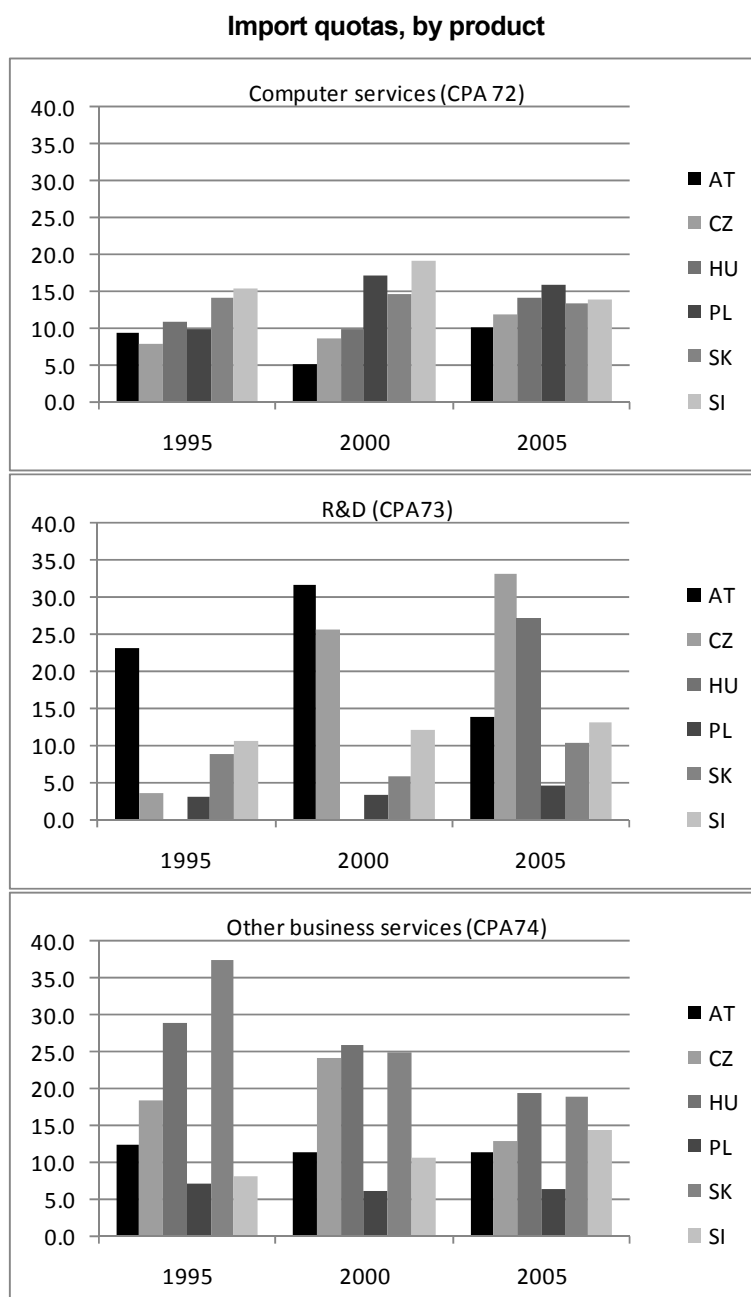
Figure 22

Import quotas, by product

Notes: For Hungary 1998, for Poland and Slovenia 1996, for Poland and the Slovak Republic 2004 data.

Source: Eurostat supply tables; authors' calculations.

Import quotas, i.e. the shares of individual imports in total supply of a product, reached about 10% of total supply in 2005 for most of the three service products and countries (see Figure 22). However, there were certain exceptions: in Poland, the import quota for computer services was over-proportionately higher (16%) in that year, while those for R&D and other business services were lower (5-6%). In the Czech Republic and Hungary, import quotas for R&D were higher (33% and 27%); in Hungary and Slovakia import penetration reached 19% in other business services.

Interestingly import penetration for other business services was remarkably higher in 1995 in the Czech Republic, Hungary and Slovakia (38%), but fell until 2005. In Austria and Poland, import penetration of other business services was rather stable, while in Slovenia it grew. In computer services and R&D, import penetration grew in most countries (except R&D in Austria).

4.2.2 Structural characteristics of the use side

Use structure of service products

Figure 23 presents the use structure of service products in 2005, distinguishing between intermediates, final consumption, gross capital formation (GCF) and exports. Pronounced differences can be observed between the three sectors: Other business services were mainly used as intermediates, accounting for 80% of total output. Computer services and R&D were also mainly used as intermediates; however, shares were much lower and reached about 40-60% and 40-70% respectively. Computer services also served as products for gross capital formation (40% in Austria; 20-34% in the NMS); in Poland also for final consumption (14%, mainly by households). R&D were also exported in Austria (50%) or rather consumed by governments in the NMS (share of final consumption between 20 and 44%).

Export intensities

Export intensities (share of exports in the total use of a product) of the three service products in focus vary to a quite extent according to product, country and year (see Figure 24). In 2005, export shares hovered slightly above 10% for computer services and slightly below 10% for R&D and business services. However, there were a couple of exceptions on the lower (e.g. Poland) and upper range (e.g. Austria, especially with an export share of almost 50% for R&D). In addition, the Czech Republic had an over-proportionate export share in computer services in that year (14%), Hungary in R&D (21%) and Slovakia in other business services (15%). Austria held higher export shares than the NMS in all three service categories.

Comparing export intensities for the years 1995 and 2005, export intensities of computer services and R&D increased from very low levels in 1995 to pronounced shares in 2005 in

most countries. There were two exceptions: in Slovakia shares remarkably declined in the same time period and in Slovenia the export intensity of computer services slightly declined. In other business services, export intensities were smaller in 2005 compared to 1995 in the Czech Republic, Poland and Slovakia on the one hand, but higher in Hungary and Slovenia on the other. In Austria, the export share remained stable (see Figure 5).

Figure 23
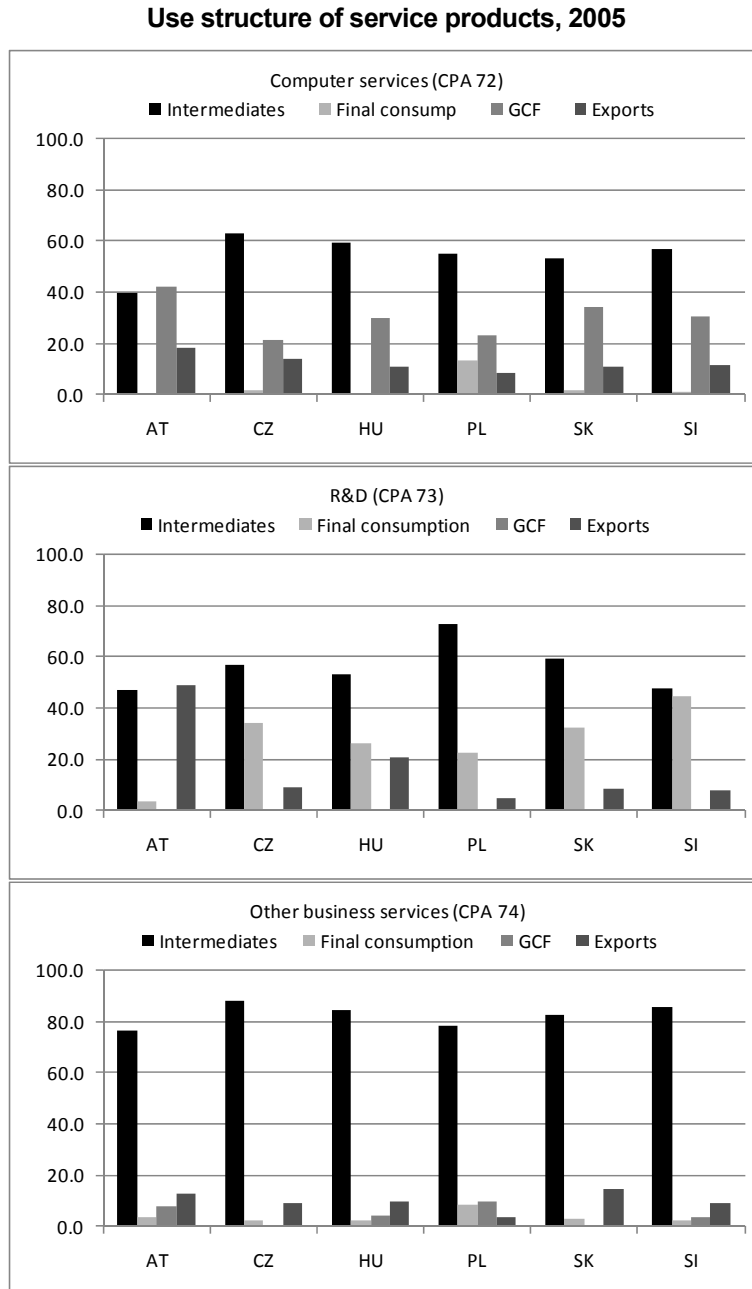
Use structure of service products, 2005

Notes: For Poland and the Slovak Republic 2004 data.

Source: Eurostat use tables; authors' calculations.

Figure 24

Export intensity, by product
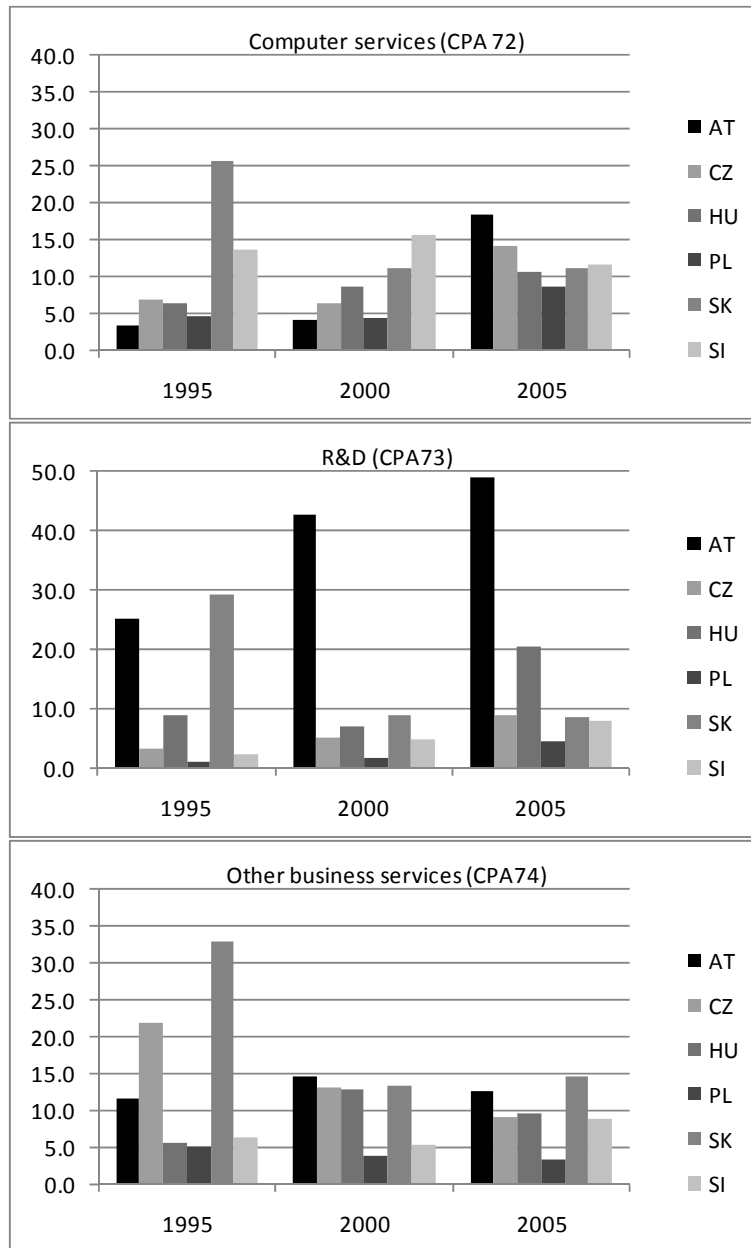
Computer services (CPA 72)

R&D (CPA73)

Other business services (CPA74)

Notes: For Hungary 1998, for Poland and Slovenia 1996, for Poland and the Slovak Republic 2004 data.

Source: Eurostat use tables; authors' calculations.

Looking at the share of service exports in total exports, shares are very small. Only other business services, accounts for shares of 1% (Poland) to 2% in the NMS and of about 3.55 in Austria in 2005 (see Figure 25).

Figure 25

Share of exports in total exports, by product

Computer services (CPA 72)

	1995	2000	2005

R&D (CPA 73)

	1995	2000	2005

Other business services (CPA 74)

	1995	2000	2005

Notes: For Hungary 1998, for Poland and Slovenia 1996, for Poland and the Slovak Republic 2004 data.

Source: Eurostat use tables; authors' calculations.

Structure of intermediates

When looking on the structure of intermediate products in the economies of Austria and the NMS, other business services are the most important intermediates in all countries, except in Slovakia. Table 20 presents the five most important intermediate products, with other business services ranking first. Only in Slovakia it ranked third, behind electricity and motor vehicles. In 2005, the share of other business service intermediates was largest in Austria with 11.4%, followed closely by Hungary (10.6%), Slovenia (10.2%), but also the Czech

Republic (9%). In Poland and Slovakia the shares were somewhat smaller (7.6% and 6% respectively). Again, computer services and R&D are less important intermediates. Their shares ranged between 1% and 1.5% and below 0.5% respectively in 2005.

Table 20

Five most important intermediate products (nominal shares), 2005

		Austria				**Czech Republic**	
Rank	CPA		Share in %	Rank	CPA		Share in %
1	S74	Other business services	11.38	1	S74	Other business services	9.05
2	S40	Electricity	6.22	2	S45	Construction	6.52
3	S70	Real estate activities	5.28	3	S27	Basic metals	5.46
4	S45	Construction	4.63	4	S28	Fabricated metal prod.	4.67
5	S27	Basic metals	4.50	5	S23	Coke & refineries	4.39
			32.00				30.08
		Hungary				**Poland**	
Rank	CPA		Share in %	Rank	CPA		Share in %
1	S74	Other business services	10.64	1	S74	Other business services	7.59
2	S32	Communication equipm.	7.08	2	S15	Food & beverages	6.54
3	S24	Chemicals	4.56	3	S01	Agriculture	6.11
4	S34	Motor vehicles	4.41	4	S24	Chemicals	5.74
5	S31	Electrical machinery	4.17	5	S45	Construction	5.00
			30.87				30.99
		Slovak Republic				**Slovenia**	
Rank	CPA		Share in %	Rank	CPA		Share in %
1	S40	Electricity	10.33	1	S74	Other business services	10.21
2	S34	Motor vehicles	8.62	2	S27	Basic metals	7.31
3	S74	Other business services	6.05	3	S45	Construction	6.84
4	S27	Basic metals	5.81	4	S28	Fabricated metal prod.	5.52
5	S45	Construction	4.82	5	S24	Chemicals	5.33
			35.63				35.22

Notes: For Poland and the Slovak Republic 2004.
Source: Eurostat use tables; authors' calculations.

Comparing the shares for 2005 with those in 1995, shares for all three categories were larger in 2005 with only some exceptions. Shares fell in computer services in Austria and in R&D in Slovakia and Slovenia. In other business services, shares remained stable on a high level in Hungary (compare Figure 26).

Figure 26

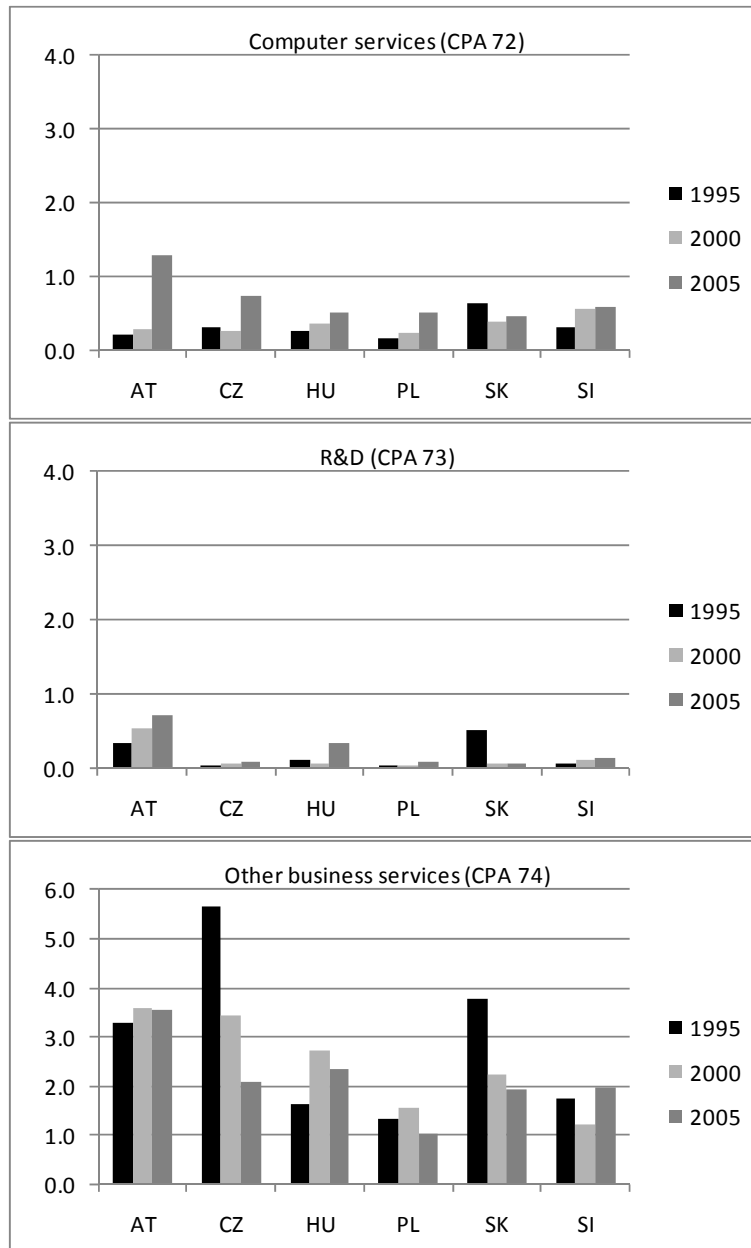**Share of services intermediates in total intermediates, by product**
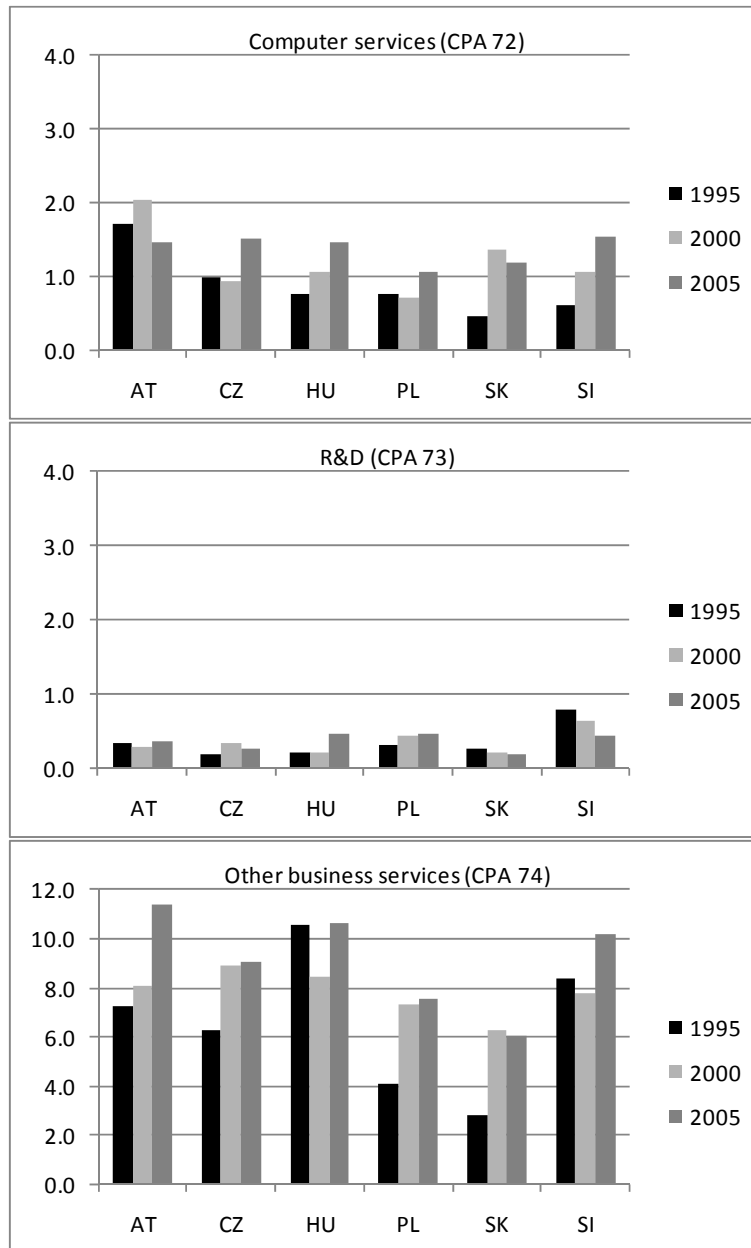
Notes: For Hungary 1998, for Poland and Slovenia 1996, for Poland and the Slovak Republic 2004 data.

Source: Eurostat use tables; authors' calculations.

4.2.3 KIBS service intensities

When looking at service intensities of the individual countries for KIBS sectors in 2005 (for calculation see Part I, Box 1), service intensities were highest for Hungary, the Czech Republic, Slovenia and Austria in that year, and somewhat smaller for Poland and Slovakia (see Table 21). Interestingly, already in 1995, the three NMS held higher KIBS intensities than Austria. Compared to 1995, service intensities grew most in Austria, the Czech and

Slovak Republics and Poland. In Hungary and Slovenia it grew only slightly but from an already very high level in 1995.

Comparing Austria with the NMS using a shift-share analysis, differences can be split into a structural term and an intensity term. Interestingly, for those NMS showing larger overall intensities in 2005, it is the intensity term which is positive, while the structural term is negative (see Table 22). Hence, the KIBS intensity by industry increased more strongly in these countries as compared to Austria, while the output structure is less based on KIBS than in Austria.

Table 21

KIBS service intensities

	1995	**2000**	**2005**
Austria	4.30	5.14	6.73
Czech Republic	4.64	6.42	6.92
Hungary	6.58	5.98	7.36
Poland	2.85	4.61	5.08
Slovak Republic	2.18	4.97	4.48
Slovenia	6.06	5.51	6.82

Notes: For Hungary 1998 data, for Poland and Slovenia 1996 data, for Poland and Slovakia 2004 data.
Source: Eurostat use tables, authors' calculations.

Table 22
Differences in services intensities with respect to Austria 2005, KIBS (72-74)

Country/Year	**CZ1995**	**CZ2000**	**CZ2005**	**HU1998**	**HU2000**	**HU2005**	**PL1996**	**PL2000**	**PL2004**
Structural Term	-0.99	-1.23	-1.14	-0.63	-0.49	-0.39	-0.82	-0.20	-0.27
Intensity Term	-1.11	0.92	1.33	0.48	-0.25	1.02	-3.06	-1.92	-1.38
Total	**-2.09**	**-0.31**	**0.19**	**-0.14**	**-0.74**	**0.63**	**-3.88**	**-2.12**	**-1.65**

Country/Year	**SK1995**	**SK2000**	**SK2004**	**SI1996**	**SI2000**	**SI2005**
Structural Term	-1.03	-0.99	-0.84	-1.37	-0.63	-0.43
Intensity Term	-3.51	-0.78	-1.41	0.70	-0.58	0.52
Total	**-4.54**	**-1.76**	**-2.25**	**-0.67**	**-1.21**	**0.09**

Source: Eurostat use tables; authors' calculations.

4.3 Linkages and key sector analysis: a comparison of high-technology sectors with KIBS industries

In this chapter we will compare five high technology sectors with knowledge-intensive business sectors in terms of their backward and forward linkages and their classification in the system of key sectors (key, leading, basic and independent industries). We want to

observe whether there are main differences between these two industry groups. We have selected the following high-technology sectors for comparison purposes (according to Hatzichronoglou, 1997): office machinery (NACE 30) and communication equipment (NACE 32) – classified as high technology sectors; electrical machinery (NACE 31), medical & optical equipment (NACE 33) and motor vehicles (NACE 34) – classified as medium-high technology industries.

Figure 27

Backward linkages of KIBS and high-technology sectors (Rasmussen linkage indicator), 2005

Figure 28

**Backward linkages of KIBS and high-technology sectors
(Output-weighted linkage indicator), 2005**

Source: Authors' calculations.

Looking at backward linkages as revealed by the Rasmussen-linkage index, linkages differ rather according to industry and not according to industry groups (see Figure 27). Largest backward linkages for 2005 were found for electrical machinery (NACE 31) and motor vehicles (NACE 34) on the one hand and computer services (NACE 72) and other business services (NACE 74) on the other. Overall, variation is very small.

Figure 29

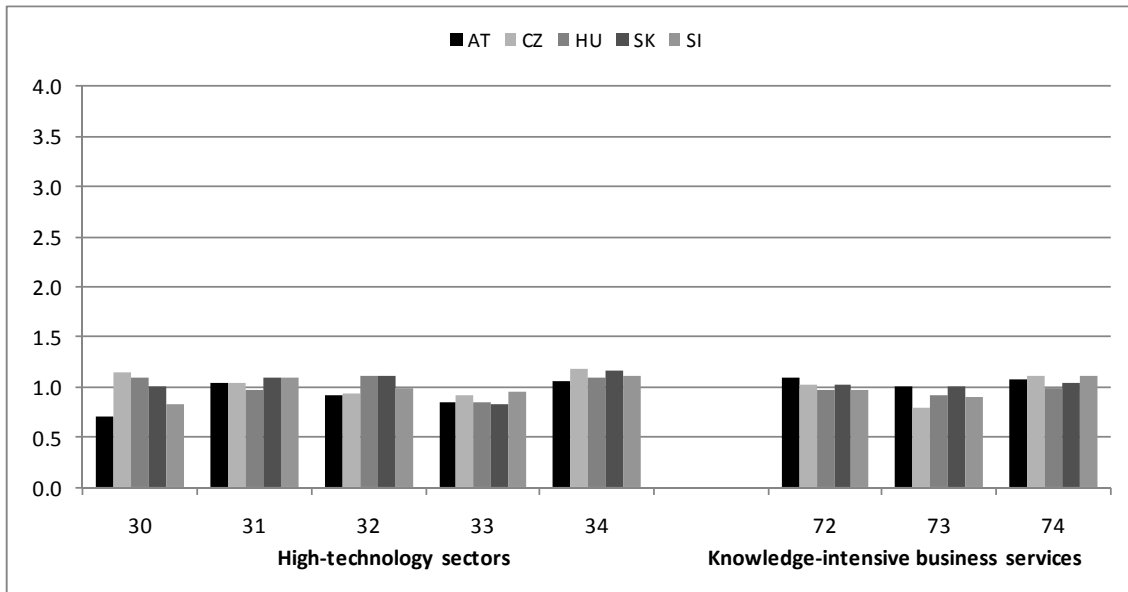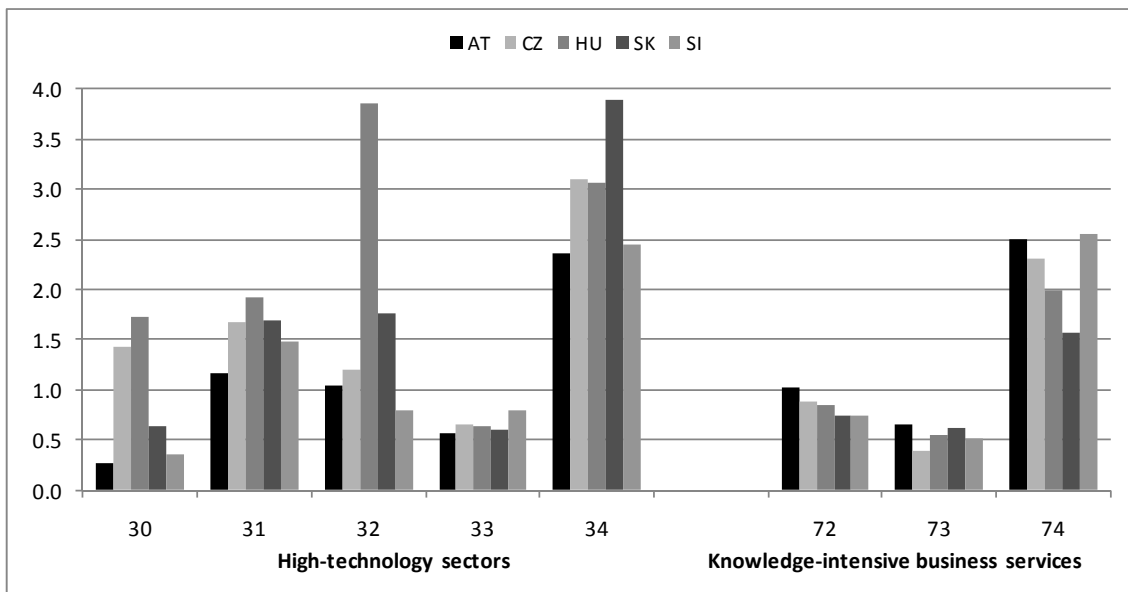**Forward linkages of KIBS and high-technology sectors (Rasmussen linkage indicator), 2005**
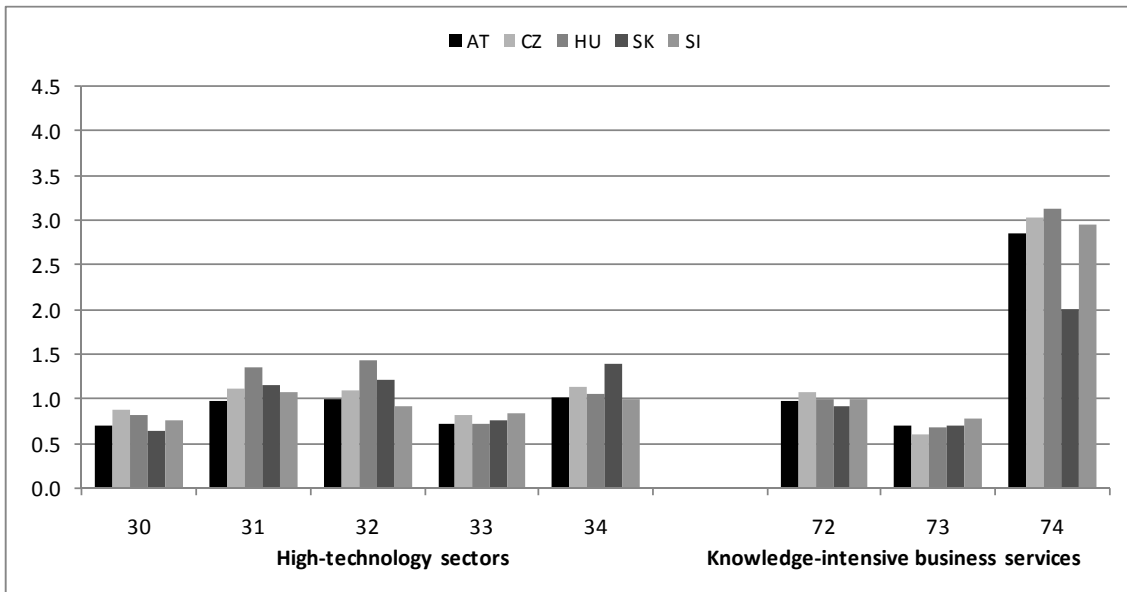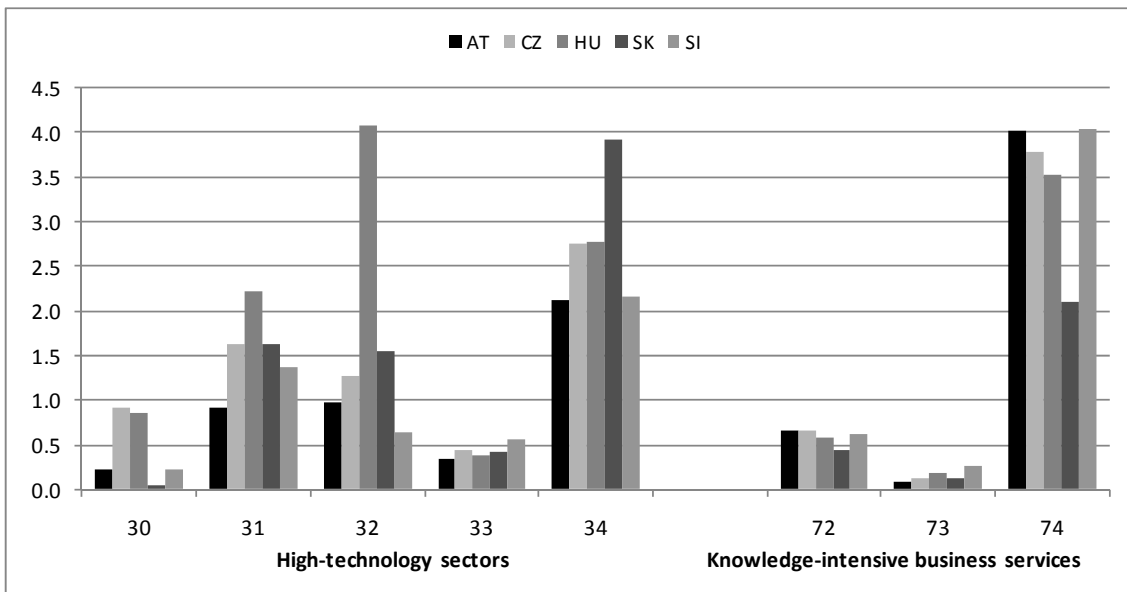

Figure 30

**Forward linkages of KIBS and high-technology sectors
(Output-weighted linkage indicator), 2005**

Source: Authors' calculations.

When calculated with the output-weighted index, backward linkages differ a lot, taking into account the relative size of the various sectors in the total economy (compare Figure 28). Motor vehicles (NACE 34) and other business services (NACE 74) showed high linkages in all countries in 2005, office machinery (NACE 30) in the Czech Republic and Hungary, electrical machinery (NACE 31) in all NMS, communication equipment (NACE 32) in Hungary (very high value) and Slovakia. Otherwise, for office machinery (NACE 30), medical & optical equipment (NACE 33) as well as for computer services (NACE 72) and R&D (NACE 73) backward linkages were low. Interestingly, compared to Austria, the NMS have higher backward linkages in the high-technology sectors and lower ones in the KIBS sectors.

Looking at forward linkages measured by the Rasmussen-linkage index, other business services (NACE 74) shows the highest values for the total economy in all countries (except Slovakia). For other industries, measures again do not differ according to industry groupings but according to industries again. R&D (NACE 73) has the lowest forward linkages from all industries observed. Overall, compared to Austria, the NMS have slightly higher forward linkages in the high-tech sectors and about the same linkages in the KIBS sectors (see Figure 29). When observing forward linkages calculates with the output-weighted index, results resemble those of backward linkages presented above (see Figure 30).

Table 23

Key-sector analysis for KIBS and high-technology sectors (Rasmussen-linkage indicator), 2005

		AT	CZ	HU	SK	SI
High-technology sectors						
Office machinery	30	ind	lead	Lead	lead	ind
Electrical machinery	31	lead	key	Basic	key	key
Communication equipm.	32	ind	basic	Key	key	ind
Med. & opt. Instruments	33	ind	ind	Ind	ind	ind
Motor vehicles	34	key	key	Key	key	lead
Knowledge-intensive business sectors						
Computer services etc.	72	lead	key	Ind	lead	ind
R&D	73	lead	ind	Ind	lead	ind
Other business services	74	key	key	Basic	key	key

Source: Authors' calculations.

Classification of industries according to their backward and forward linkages into key, leading, basic and independent industries provides the following picture (see Table 23): Other business services (NACE 74) is a key industry with strong backward and forward linkages in all countries except in Hungary where it is classified as basic industry. Interestingly, computer services (NACE 72) is a key industry in the Czech Republic. In the other countries it is either classified as a leading industry (strong backward and weak forward linkages, Austria and Slovak Republic) or an independent industry (overall weak linkages; Hungary, Slovenia). Also R&D (NACE 73) is either an independent or leading (Austria,

Slovakia) industry. From the high technology industries, motor vehicles (NACE 34) is a key industry in all countries except in Slovenia, electrical machinery (NACE 31) in the Czech and Slovak Republic and Slovenia, and communication equipment (NACE 32) in Hungary and Slovakia. Medical & optical equipment industries (NACE 33) are independent industries in all countries.

Figure 31

KIBS: Rasmussen linkage indicator, 2005
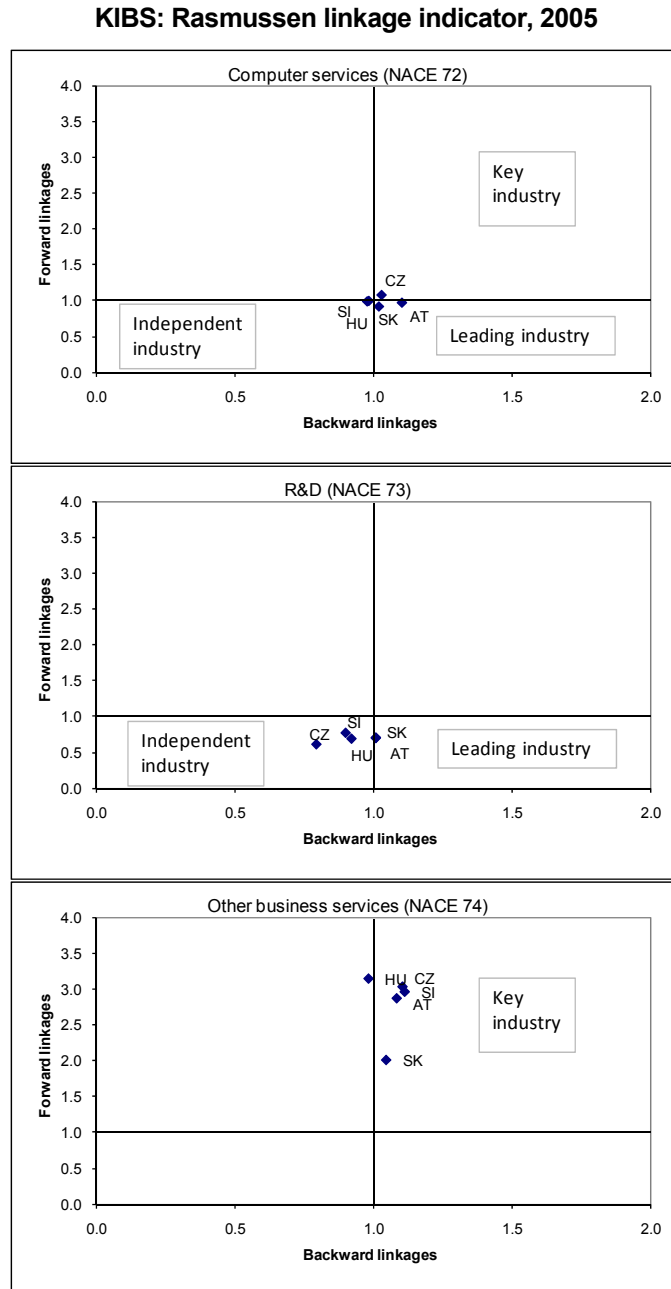
Source: Authors' calculations.

While Table 23 provides a first insight into the classification of industries, looking at the data gives more detailed information. Figures 31 and 32 show KIBS and the high-

technology sectors across the region for 2005. As correlation of structures across the NMS is high (see Part II), industries do not vary a lot across countries and are placed rather close to each other. This is especially evident in computer services (NACE 72) where countries are clustered around 1 and hence are either classified as key (Czech Republic), leading (Austria, Slovakia) or independent industries (Hungary, Slovenia) (see Figure 31). The strength of key industries – i.e. the distance to the 1-axis – is rather small in the high-technology sectors but pronounced for other business services (NACE 74). However, this is a more general problem as mentioned in Drejer (2002) where she criticizes the weak strength of key industries.

Figure 32

High-technology industries: Rasmussen linkage indicator, 2005

Figure 32 (contd.)

Medical & optical equipment (NACE 33)

Motor vehicles (NACE 34)
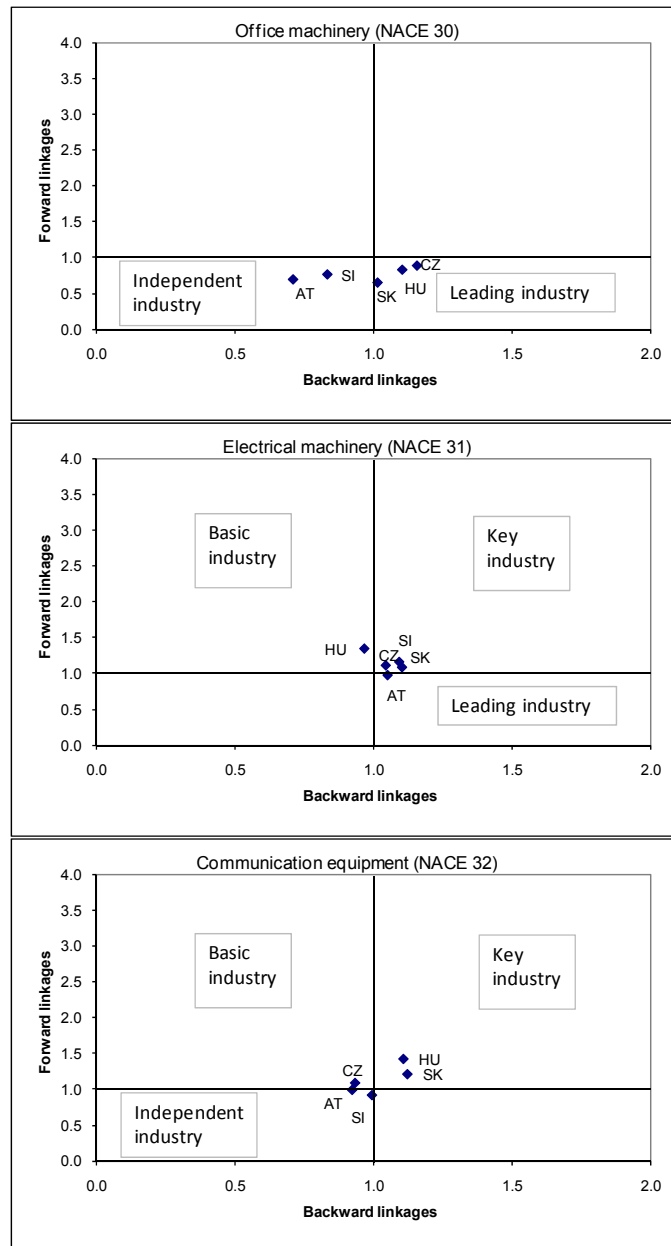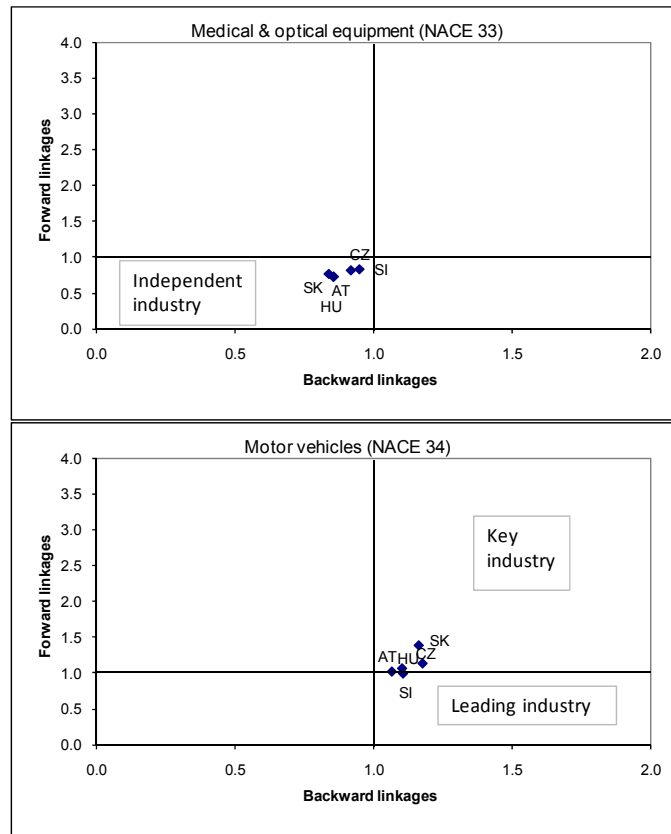
Source: Authors' calculations.

Table 24

Key-sector analysis for KIBS
Rasmussen-linkage indicator, 1995, 2000, 2005

			1995	2000	2005
	Computer services etc.	72	key	key	lead
AUSTRIA	R&D	73	ind	ind	lead
	Other business services	74	basic	basic	key
	Computer services etc.	72	ind	ind	key
CZECH	R&D	73	ind	ind	ind
REPUBLIC	Other business services	74	basic	key	key
	Computer services etc.	72	lead	ind	ind
HUNGARY	R&D	73	ind	ind	ind
	Other business services	74	basic	basic	basic
	Computer services etc.	72	ind	ind	lead
SLOVAK	R&D	73	ind	lead	lead
REPUBLIC	Other business services	74	key	key	key
	Computer services etc.	72	lead	ind	ind
SLOVENIA	R&D	73	lead	ind	ind
	Other business services	74	key	key	key

Source: Authors' calculations.

Certain interesting changes took place in the industry classification between 1995 and 2005: On the positive side - depicting an increase in linkages - other business services (NACE 74) shifted from being a basic industry to a key industry in Austria and the Czech Republic. Computer services (NACE 72) became a key industry in the Czech Republic in 2005. Certain shifts from independent to leading industries took place as well (Austria, Slovakia). On the negative side – indicating a decrease in linkages – changes were observed as well, e.g. in Austria, where computer services (NACE 72) was a key industry in 1995 and 2000 and became a leading industry in 2005. In addition, changes took place in Slovenia and Hungary, where some industries shifted from being leading to independent industries (see Table 24).

5   Conclusions

Overall, services play a major role in the economies of the countries under investigation: In Austria, services accounted for 60% of total output and 70% of total value added in 2005, while in the new member states (NMS) Czech Republic, Hungary, Poland, Slovakia and Slovenia shares ranged between 40-50% in output and 60-64% in value added respectively. Between 1995 and 2005, structural change towards services took place in the NMS both on the production and use side. However, still major structural differences exist in comparison to Austria, which shows a higher dynamics than the NMS and turns out to be a moving target.

Looking at **structural features of broad service categories**, the following results have been found:

- In terms of output structure, there still exist major differences between the new member states and Austria: In the NMS, a strong focus on manufacturing (including mining & manufacturing) prevails on average, while services are still underrepresented, particularly business services (JK).

- However, between 1995 and 2005, ongoing structural change towards the services sectors is clearly visible in the NMS but also in Austria. The data suggest that convergence processes are taking place though at a slow rate.

- Characteristic production is quite high in the NMS but still below that of Austria. It increased steadily in the Czech and Slovak Republic but fell slightly in the other NMS and Austria.

- Not surprisingly, trade is heavily focused on manufacturing as well: almost 90% of total imports are industrial products, compared to 7-10% of service imports, which is due to the immanent characteristics of service products. Import quotas in business services (JK) are still larger in the NMS than in Austria, pointing to a greater need for these services in the NMS. However, between 1995 and 2005 these rates declined in most countries.

- When looking at exports, again almost 90% of total exports are industrial products. Service products with high export-ratios include trade & hotels (GH) and transport (I). Export ratios for business services (JK) are comparably lower in the NMS than in Austria and have also been decreasing in some of them.

- With respect to the use of services as intermediates there is evidence that less service inputs are used in general and particularly so in manufacturing industries in the NMS compared to Austria. Especially business service products (JK) are used less in the NMS than in Austria. However, there is a small tendency towards of an increased use of services between 1995 and 2005, also for business services.

- In 1995, service intensities for market services (CPA 50-74) were close to the Austrian level in the Czech Republic, Hungary and Slovenia, but below the Austrian level in Slovakia and Poland. Service intensities increased over time, the most pronounced changes taking place in the Czech Republic and Austria. Hence Austria turned out to be a moving target, which the NMS except the Czech Republic could not follow.

Turning to the concept of linkages, linkages i.e. the interconnectedness of sectors among each other, subsume two types of interactions in the input-output framework: First, those linkages with 'upstream sectors' of the economy from which a sector buys its inputs, and second, those with 'downstream sectors' of the economy to which it sells its output (backward and forward linkages). Interaction and interconnectedness are said to have increased over time.

As service industries were underdeveloped under the former system in the new EU member states, it is interesting to look at its features and changes over time. Generally, service industries perform better at forward linkages than at backward linkages as services are important suppliers of inputs to other industries along the value chain. However, when combining in a key sector analysis, less service industries turned out to be basic industries only (strong forward and weak backward linkages) but key industries rather, depicting strong forward and backward linkages. Main key industries are wholesale trade (NACE 51), land transport (NACE 60), other transport (NACE 63) and other business services (NACE 74), of which the latter has the most prominent position. Post & telecom (NACE 64) and financial intermediation (NACE 65) are either classified as key or basic under a range of countries.

In comparison to Austria, services in the NMS seem to be slightly less intertwined with the rest of the economy as indicated by less service industries among the main 5 industries economy-wide when looking at forward linkages. When analysing key sectors, service industries is Czech Republic seems to be as much linked to the rest of the economy as service industries in Austria, whereas services are less intertwined in Hungary, Slovakia and Slovenia.

Over time, especially backward linkages have grown (particularly between 1995 and 2000), meaning that services have become more important as users of inputs from the economy. In addition, also forward linkages have increased. This is especially true for Austria, the Czech and Slovak Republic, while there has been not much change in Hungary and in Slovenia only forward linkages increased while backward linkages slightly decreased.

Further, one has to keep in mind that data for the whole economy were analysed in this part of the study and hence a distinction between the domestic economy and imports could not be made which will be an interesting avenue for further research.

As regards knowledge-intensive business services and other business services in particular, these services have an important role in the economies of the NMS and Austria – both in terms of output shares and as being the major intermediate product in these countries. In the period between 1995 and 2005, their importance even increased. The other two sectors, i.e. computer services and R&D, play only a minor role as their output size is rather small (computer services is a medium-sized industry, while R&D is very small). While output and intermediate shares grew for computer services, those of R&D remained mostly stable.

Looking at import penetration rates and export intensities, both indicators grew in computer services and R&D between 1995 and 2005, while they fell in some countries in other business services providing no uniform picture for this category. Some specialization on computer services might be detected for the Czech Republic, as export intensity was quite high in 2005 and the sector turned into a key industry recently. Interestingly, although Slovakia showed the lowest service intensity in the region, export intensity of other business services was the highest of all countries in 2005.

Comparing KIBS in the NMS with those in Austria, we would have expected NMS lagging behind Austria at the beginning of the investigated time period and catching-up thereafter. However, this hypothesis was not supported in this respect as the 'gap' was not revealed by the data for some countries: Service intensities and output shares of other business services were larger in the Czech Republic, Hungary and Slovenia compared to Austria in 1995. One interesting finding is that Austria showed a pronounced shift towards 'other business services' until 2005 and passed the NMS in some respects. More research is needed in order to look at the causes of these findings.

Overall, one has to keep in mind that input-output data are available in nominal values only, hence differences across countries and time might be due to difference in quantities or in relative prices. Research in this field would be interesting too and could bring new insights.

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Annex A

Table A.1

Classification of products and industries

CPA / NACE	Description (NACE)	Name
01	Agriculture, hunting and related service activities	Agriculture
02	Forestry, logging and related service activities	Forestry
05	Fishing, operating of fish hatcheries and fish farms	Fishing
10	Mining of coal and lignite; extraction of peat	Coal mining
11	Extraction of crude petroleum and natural gas	Petroleum & mining
12	Mining of uranium and thorium ores	Uranium
13	Mining of metal ores	Metal ores
14	Other mining and quarrying	Other mining
15	Manufacture of food products and beverages	Food & beverages
16	Manufacture of tobacco products	Tobacco
17	Manufacture of textiles	Textiles
18	Manufacture of wearing apparel; dressing and dyeing of fur	Apparel
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness	Leather & shoes
20	Manufacture of wood and of products of wood and cork, except furniture	Wood products
21	Manufacture of pulp, paper and paper products	Paper
22	Publishing, printing and reproduction of recorded media	Publ. & print
23	Manufacture of coke, refined petroleum products and nuclear fuels	Coke & refineries
24	Manufacture of chemicals and chemical products	Chemicals
25	Manufacture of rubber and plastic products	Rubber & plastic
26	Manufacture of other non-metallic mineral products	Non-met. Min. prod.
27	Manufacture of basic metals	Basic metals
28	Manufacture of fabricated metal products, except machinery and equipment	Fabricated metal prod.
29	Manufacture of machinery and equipment n.e.c.	Machinery (non-electr.)
30	Manufacture of office machinery and computers	Office machinery
31	Manufacture of electrical machinery and apparatus n.e.c.	Electrical machinery
32	Manufacture of radio, television and communication equipment and apparatus	Communication equipm.
33	Manufacture of medical, precision and optical instruments, watches and clocks	Med. & opt. instruments
34	Manufacture of motor vehicles, trailers and semi-trailers	Motor vehicles
35	Manufacture of other transport equipment	Other transport equipm.
36	Manufacture of furniture; manufacturing n.e.c.	Furniture
37	Recycling	Recycling
40	Electricity, gas, steam and hot water supply	Electricity
41	Collection, purification and distribution of water	Water
45	Construction	Construction
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale services	Sale of vehicles
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	Wholesale trade
52	Retail trade, except of motor vehicles and motorcycles; repair of personal and h	Retail trade
55	Hotels and restaurants	Hotels & restaurants

Table A.1 (continued)

CPA / NACE	Description (NACE)	Name
60	Land transport; transport via pipelines	Land transport
61	Water transport	Water transport
62	Air transport	Air transport
63	Supporting and auxiliary transport activities; activities of travel agencies	Other transport
64	Post and telecommunications	Post & telecomm.
65	Financial intermediation, except insurance and pension funding	Financial intermediation
66	Insurance and pension funding, except compulsory social security	Insurance
67	Activities auxiliary to financial intermediation	Aux. financial services
70	Real estate activities	Real estate activities
71	Renting of machinery and equipment without operator and of personal and household	Renting of mach. & equ.
72	Computer and related activities	Computer services etc.
73	Research and development	R&D
74	Other business activities	Other business services
75	Public administration and defence; compulsory social security	Public administration etc.
80	Education	Education
85	Health and social work	Health and social work
90	Sewage and refuse disposal, sanitation and similar activities	Sewage, disposal etc.
91	Activities of membership organization n.e.c.	Organizations
92	Recreational, cultural and sporting activities	Culture
93	Other service activities	Other services
95	Private households with employed persons	Private households
FISIM	Financial services indirectly measures	FISIM

Table A.2

Aggregation to sections

A	Agriculture, hunting and forestry	01-02
B	Fishing	05
C	Mining and quarrying	10-14
D	Manufacturing	15-37
E	Electricity, gas and water supply	40-41
F	Construction	45
G	Wholesale &retail trade; repair of motor vehicles, motorcycles & personal & household goods	50-52
H	Hotels and restaurants	55
I	Transport, storage and communication	60-64
J	Financial intermediation	65-67
K	Real estate, renting and business activities	70-74
L	Public administration and defence; compulsory social security	75
M	Education	80
N	Health and social work	85
O	Other community, social and personal service activities	90-93
P	Private households with employed persons	95

Annex B

Description of data problems

Problems referring to supply tables:

- Negative entries appeared in the Hungarian 1998 and 2000 tables, the Polish 1996 table, the Slovak 2000 and 2004 tables and the Slovenian 1996 table and especially concerned data on wholesale or retail trade products (other products were concerned as well in the Hungarian 1998 data and the Slovak 2000 data). According to Prof. Beutel from the Konstanz University of Applied Sciences and author of the Eurostat Input-Output Manual (2008) we made the following recalculations: The negative transactions in the product matrix were set to zero and reallocated as internal consumption of the industry. The amount was deducted from trade and transport margins in the row where it was added before and deducted from the trade and transport margin in the row where it was set to zero.

- Negative import data: Slovenian supply tables exhibit negative import values for certain transport and insurance services for the years 1996 and 2000. This is due to the use of different CIF/FOB adjustment procedures (generally imports by products are valued on a CIF base, while total imports are valued FOB). Up to 2003, the Slovenian adjustment process follows the SNA 1993, from 1994 onwards the SNA 1995. In the former case the adjustment is done by product using an adjustment column, while in the latter case there is no adjustment column and only an aggregate adjustment is made.[18] In the original Slovenian data hence we find a column reporting imports CIF and a column with the CIF/FOB adjustment for the years 1996 and 2000. In the Eurostat data, this distinction vanishes and we find the sum of these two columns which is labelled 'imports CIF' but in fact shows imports FOB. These values might then become negative for some transport and insurance services. We made the following recalculations (according to Prof. Beutel, see above): We set the negative import transactions to zero and added the amount to the column 'taxes less subsidies on products').

Problems referring to use tables:

- Financial intermediation services indirectly measured (FISIM)[19]: ESA 97 introduced a fictitious branch, which made it possible to use this variable for the measurement of general economic activity without the need to estimate distribution according to consumers. Since January 1, 2005, member states are obliged to allocate FISIM among user industries.[20] Hence, we can find this fictitious branch in many countries before 2005

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[18] For a detailed description see Eurostat (2008), p. 113 or UN (1999), p.29-32.

[19] Defined as an indirect measure of the value of financial intermediation services provided but for which financial institutions do not charge explicitly. See Eurostat (2008), p.556 and 106.

[20] Commission Regulation (EC) No 1889/2002 of 23 October 2002 on the implementation of Council Regulation (EC) No 448/98 complementing and amending Regulation (EC) No 2223/96 with respect to the allocation of financial intermediation services indirectly measured (FISIM) within the European System of national and regional Accounts (ESA).

in the use tables in our database (see Table 1 for countries and years concerned). In order to adjust these data, we added FISIM proportionally to all industries in row 65 (financial intermediation). This resulted in higher intermediate inputs in all industries, and as FISIM was subtracted from net operating surplus; in lower value added.

- Gross capital formation: There are three categories of gross capital formation: gross fixed capital formation, changes in valuables and changes in inventories (followed by a column stating the sum of changes in valuables & inventories). The provision of data for changes in valuables is however voluntary and hence often missing in the use tables. As data for this category is small and rather scarce[21] we added this category in our templates to the column gross fixed capital formation. We hence deleted the column 'change in valuables' and the column 'changes in valuables & inventories'.

- Gross operating surplus is defined as the sum of consumption of fixed capital and the net operating surplus. In our database data for consumption of fixed capital is not provided for some countries and years (Hungary 1998 and 2000, Poland 1996).

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[21] The category of valuables includes precious metals and stones (gold, diamonds etc.), jewels made from them, as well as paintings and sculptures recognized as works of art, which are acquired as stores of value and not to be used for production or consumption purposes. Eurostat (2008), p. 154.

Annex C

Figure C.1

AUSTRIA: Rasmussen linkage indicator, 1995, 2000, 2005
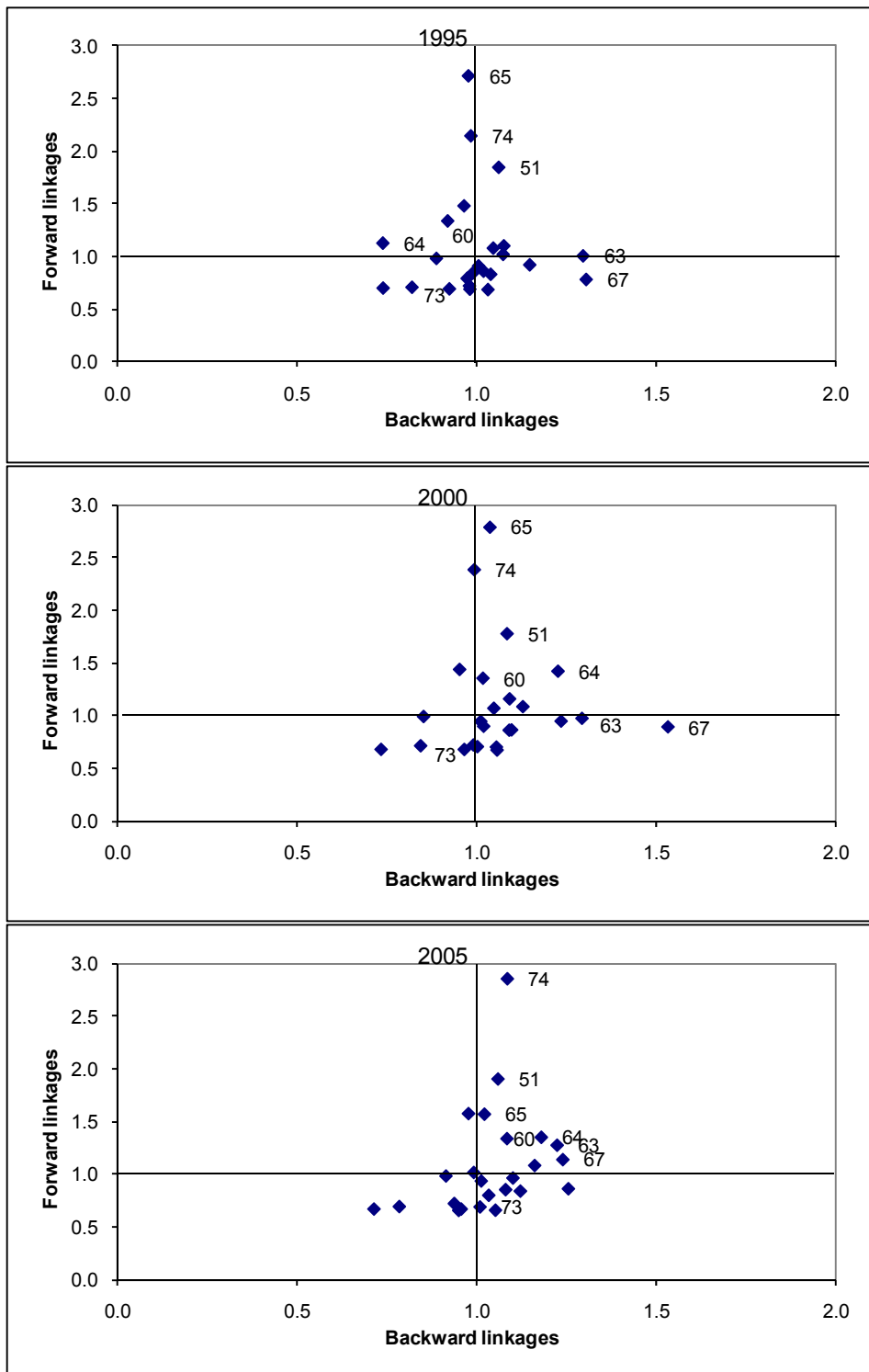
Notes: 51 (Wholesale trade); 60 (Land transport); 63 (Other transport); 64 (Post & telecomm.); 65 (Financial intermediation); 67 (Aux. financial services); 73 (R&D); 74 (Other business services)

Source: Authors' calculations.

Figure C.2

CZECH REPUBLIC: Rasmussen linkage indicator, 1995, 2000, 2005

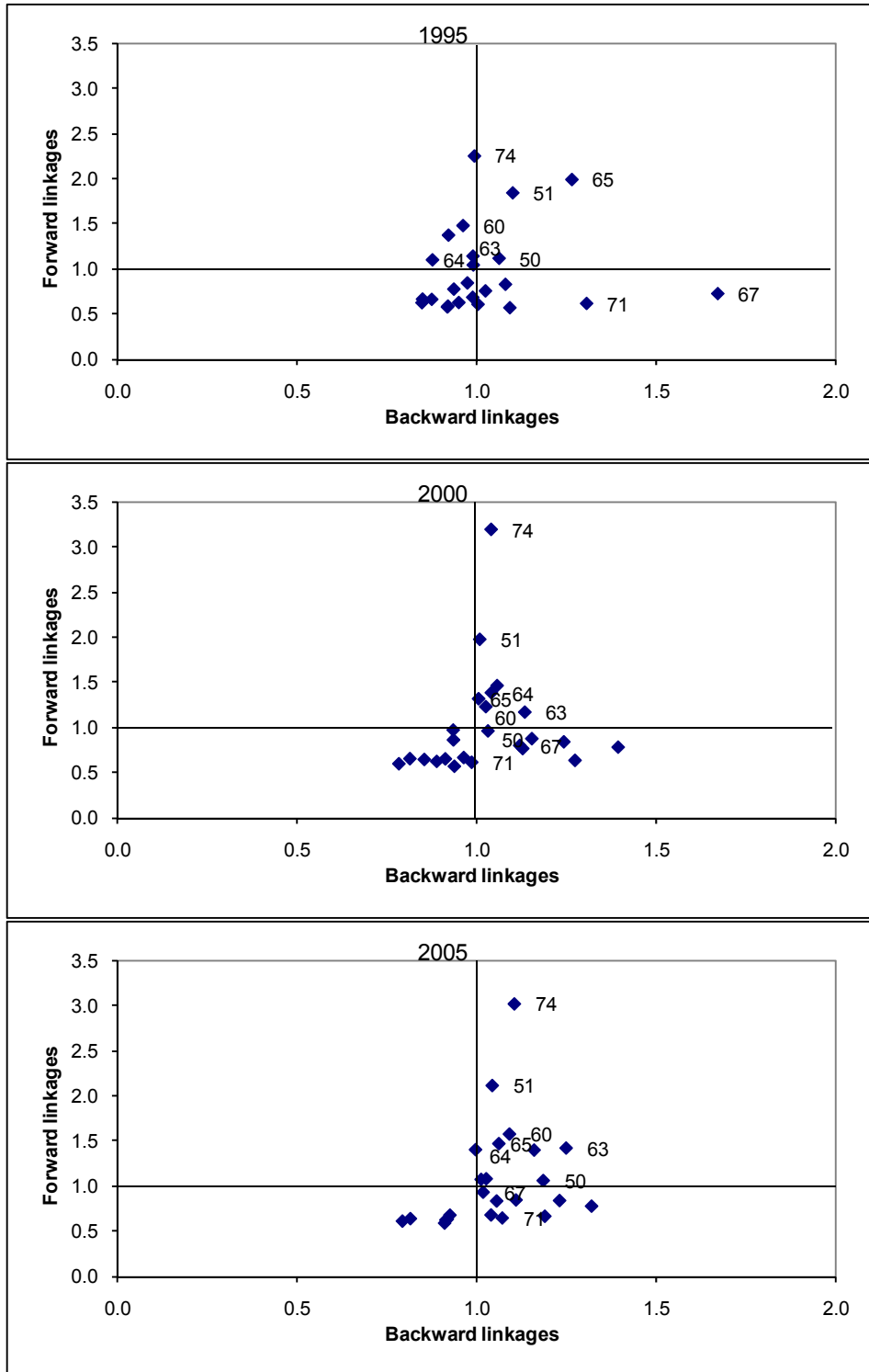*Notes:* 50 (Sales of vehicles); 51 (Wholesale trade); 60 (Land transport); 63 (Other transport); 64 (Post & telecomm.); 65 (Financial intermediation); 67 (Aux. financial services); 71 (Renting of machinery); 74 (Other business services)
Source: Authors' calculations.

Figure C.3

HUNGARY: Rasmussen linkage indicator, 1998, 2000, 2005

Notes: 51 (Wholesale trade); 60 (Land transport); 62 (Air transport); 63 (Other transport); 64 (Post & telecomm.); 65 (Financial intermediation); 67 (Aux. financial services); 74 (Other business services)

Source: Authors' calculations.

Figure C.4

SLOVAK REPUBLIC: Rasmussen linkage indicator, 1995, 2000, 2005

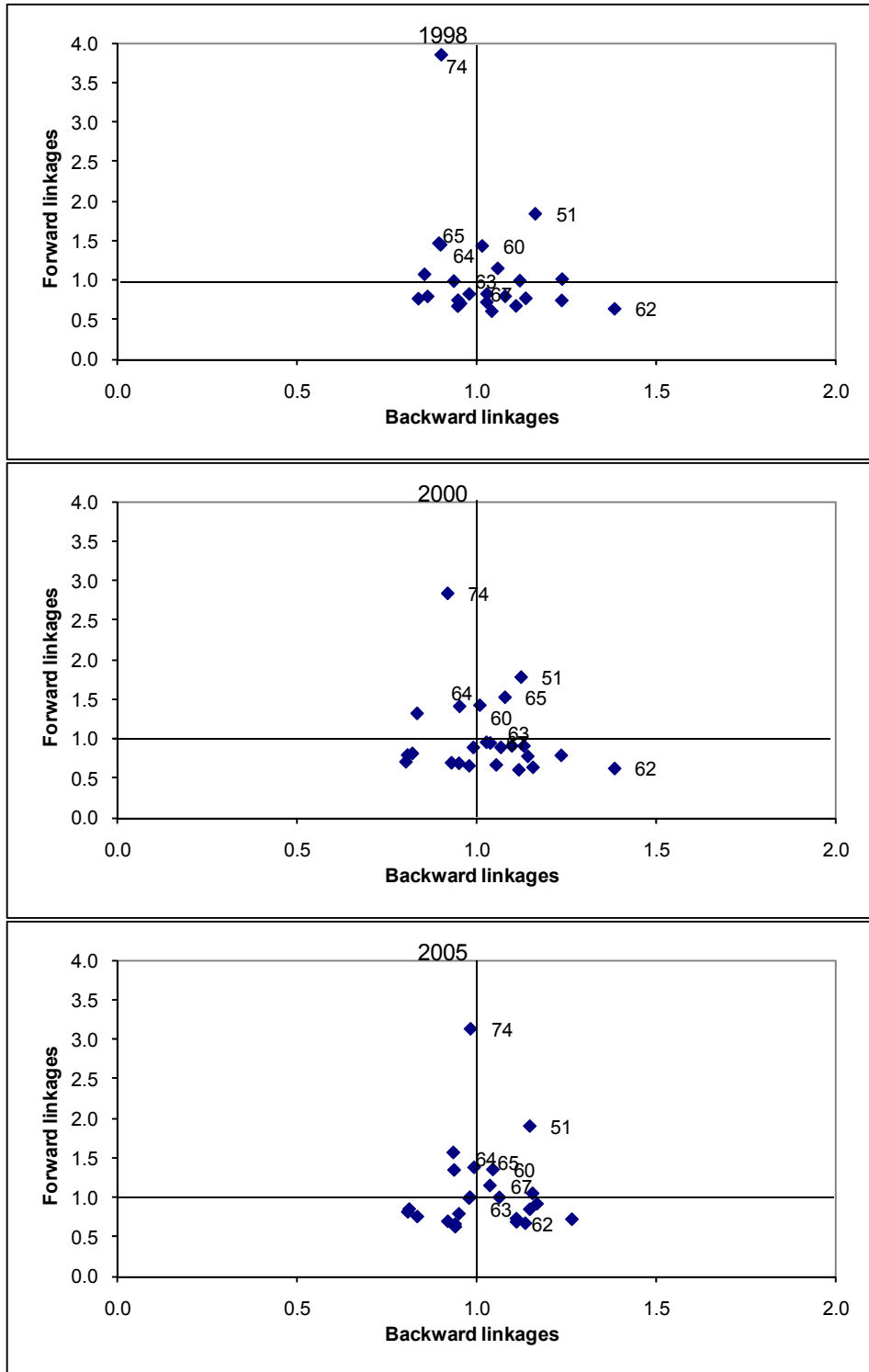*Notes:* 51 (Wholesale trade); 60 (Land transport); 63 (Other transport); 64 (Post & telecomm.); 65 (Financial intermediation); 67 (Aux. financial services); 74 (Other business services)

Source: Authors' calculations.

Figure C.5

SLOVENIA: Rasmussen linkage indicator, 1996, 2000, 2005

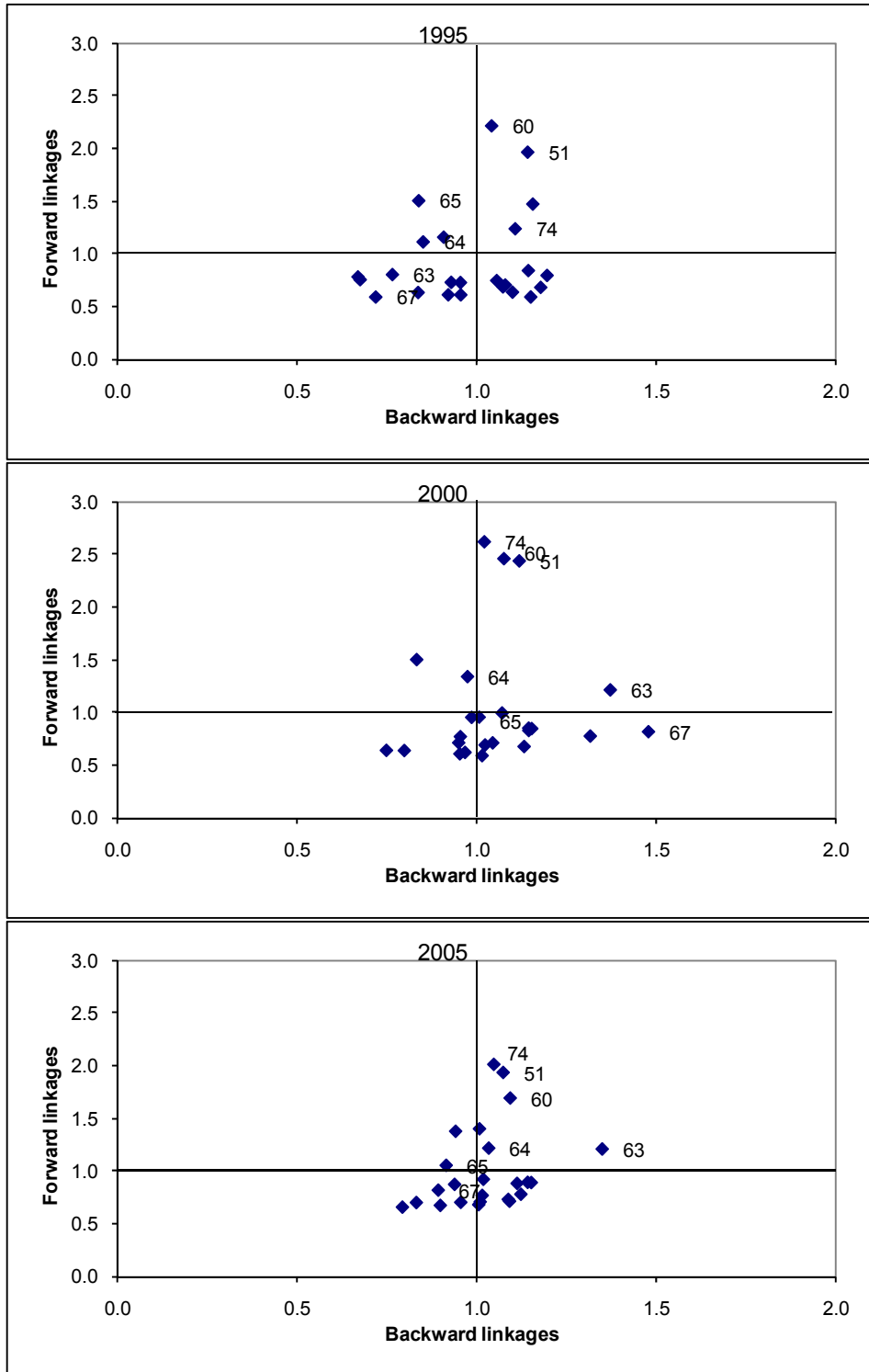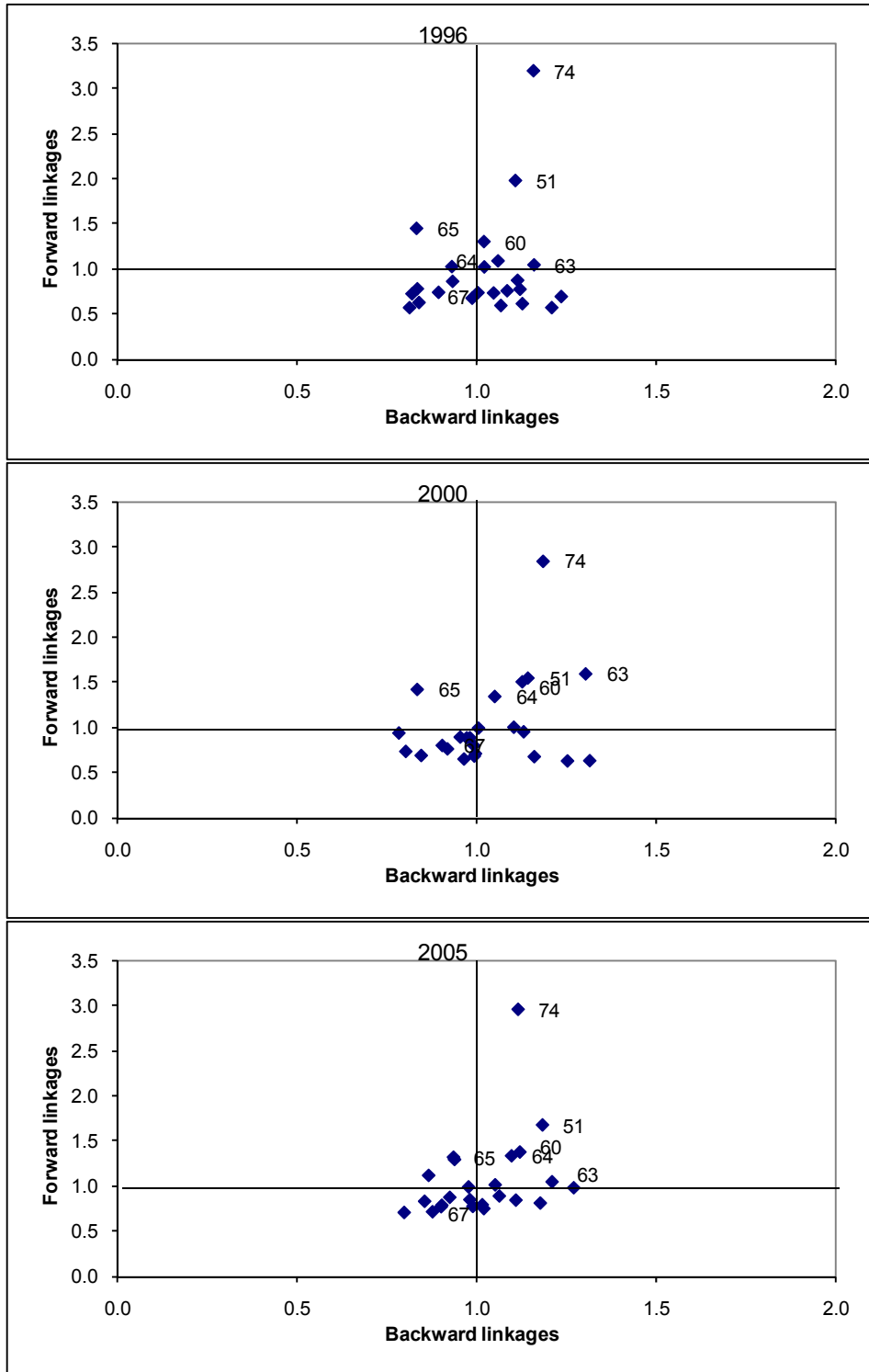*Notes:* 51 (Wholesale trade); 60 (Land transport); 63 (Other transport); 64 (Post & telecomm.); 65 (Financial intermediation); 67 (Aux. financial services); 74 (Other business services)

Source: Authors' calculations.

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