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Services, Vertical Linkages, and Development: The Case of the Baltic Countries

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This article investigates structural changes and the role of services in final production in the economies of Baltic countries, following the vertically integrated sector approach to the input–output model. The analysis of the period 2000–2014 was conducted using the World Input–Output database. The results show significant differences in the technological intensity of manufacturing, in intersectoral links, and in the functional role of services in the economy. Although the Baltic countries have small economies, affected by common shocks, this area is far from homogeneous structurally. The results offer a case study of great interest for small emerging countries.

Keywords: baltic countries, input-output, KIBS, structural change, vertically integrated sector

JEL Classification: L60, O14, P20, P51

Changes in sectoral composition and their consequences for key economic factors, such as productivity and growth, have attracted a considerable amount of attention (Baumol 1967; Peneder 2003; Schettkat and Yocarini 2006). The advanced economies have shown a gradual shift toward services and a simultaneous decrease in agriculture and manufacturing in terms of both total employment and total value added. Even some developing countries seem to have followed a similar pattern (Akarçay Gürbüz 2011; Cruz 2015). Indeed, moving to a service-based economy has widely been recognized as a natural stage in the transition from being a developing economy to a developed economy (Cheng and Blanchard 2009). In this way, increases in the level of income and in living standards contribute to a growing demand for services, with a general shift in preferences and tastes to intangible consumption goods (Gregory and Russo 2006). However, in the recent literature, a consistent portion of the tertiary sector consists of growth in services as an input for manufacturing firms, because of

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increasing vertical integration between different sectors (Pilat and Wölfl 2005). These integration dynamics stimulate spillovers and knowledge dissemination, with a positive effect on the competitiveness of the entire system of production (Castellacci 2010; Di Cagno and Meliciani 2005). Therefore, the increasing share of services is related to a general reorganization of the economic structure of production (Bryson and Daniels 2010; Falk and Peng 2013).

The turn toward services, therefore, can be appreciated not only through value added and employment growth but also through the greater intensity of use of service inputs by all activities that shape production (Camacho Ballesta, Melikhova, and Peinado 2012). Accordingly, the present analysis of this change focuses on producer services. These services are important, because they assume a central role in terms of production, information processing, knowledge diffusion, and innovation (Miozzo and Miles 2002). Indeed, as Mas-Verdú, Alba, and Garcia Alvarez-Coque (2011) highlight, the activities come from their own diverse perspectives. Thus, manufacturing demonstrates a strong tendency to absorb innovative capacity, whereas services are more likely to spread innovation. However, the empirical literature on the effects of the transition to a service-based economy has not always relied on an accurate measure of the phenomenon. For instance, the traditional approach does not allow researchers to distinguish producer services from consumer services. It is based on an arbitrary classification of service categories that does not accurately reflect the impact of producer services on the economy, which hinders reliable analysis (Cheng and Daniels 2014). Input–output (I–O) analysis has been helpful in answering these questions because it has several advantages. In particular, it allows researchers to measure the amount of increased value added in services that feeds either final demand or intermediate demand, avoiding the inaccuracies related to imputation based on their prevailing destination adopted by the traditional approach.

This article analyzes the role of services in final production, following the vertically integrated sector approach to the I–O model (Momigliano and Siniscalco 1982; Pasinetti 1973; Sraffa 1960). The conventional view of the role of services is not conclusive with respect to vertically integrated sectors because it captures the value added generated by the value chain (Gregory and Russo 2003). By adopting a subsystem methodology, this work measures the level of activity triggered by final demand in every sector, by using the contributions of direct and indirect inputs of services. The previous literature considers this issue a useful, if unnecessary, qualification of structural change, as it completes the information on the way in which the internal organization of the economic system is changing.

The main studies essentially observe the evolution of production in advanced economies (Ciriaci and Palma 2016; Montresor and Marzetti 2011), while less attention has been reserved for structural transformations in the emerging and transition economies. The article contributes to the literature by presenting the case of the Baltic states—Lithuania, Latvia, and Estonia. The Baltics are small open economies, and the only former Soviet republics that have adopted the euro.

Analysis of the period 2000–2014 was conducted using the World Input–Output database (WIOD, 2016). These data are compared with those of larger economies in Central Europe, such as those that compose the Visegrád Group—the Czech Republic, Hungary, Poland, and Slovakia (hereinafter, the V4 countries)—and in the euro area (hereinafter, the euro12 countries),[1] and the results show significant differences not only among the three regions but also within the Baltic area. These differences are apparent in the level of technological intensity

in manufacturing, in the intersectoral links, and in the functional role of services in the economy. The Baltic economies have performed well in the past two decades relative to other transition countries, but they face specific challenges in organizing production, which will require government and industrial policy responses. These responses are related to the ability to sustain economic growth from structural change that will alter the technological composition of manufacturing and the relationships between industry and services.

Although the Baltics are small economies, affected by common shocks, this area is far from homogeneous structurally. The results in this article offer a case study of great interest to small emerging countries. The remainder of the article is organized as follows. The second section presents the main features of the process of economic transition; the third section describes the methodology and dataset adopted; the fourth section shows the results relative to the economic structure and intermediate uses; the fifth section describes the structural interlinkages following a subsystem approach; and some final remarks conclude the article.

SERVICES AND THE TRANSITION PROCESS IN CENTRAL AND EASTERN EUROPE: THE CASE OF THE BALTIC COUNTRIES

The issue of structural change in the Central and Eastern European countries (CEECs) has gained relevance in studies of emerging economies. In these countries, the process of transition has been difficult. The restructuring of productive sectors, macroeconomic stabilization, and institutional reforms have constituted the most important challenges. Most CEECs inherited from central planning an inefficient industrial sector and, above all, an underdeveloped service sector, in particular as it relates to market activities (Havlik 2015; Landesmann and Stehrer 2002). In the early 1990s, the countries began to transition to a market economy with a relative abundance of agricultural production, the presence of raw materials, and unskilled labor (Zaghini 2005). Services were neglected under the planned economy. In Marxist ideology, in fact, the determinants of economic development were essentially material inputs, so the computation of net material product (NMP) omits most service activities considered nonproductive (Bergson 1961; Gregory 1976, 1982). Consequently, strong industrialization has been a disadvantage for these countries, because structural distortions and inefficiencies in production have hindered the development of the service sector (Havlik 2015).

Despite the manufacturing heritage, however, services have made great strides. Most studies agree that changes in the economic structure have been among the key determinants of growth in these countries and of these countries' ability to achieve convergence with the average gross domestic product (GDP) per capita in the European Union (EU) (Próchniak 2011). Growth in services has been influenced principally by a confluence of factors, such as the foreign direct investment (FDI) flows, the liberalization of markets, and the implementation of structural reforms. Globalization has had a prominent impact on FDI, and its benefits in the host country have occurred above all in the transition and developing countries. The accession to membership in the EU by these countries also benefits their inward FDI flows, fostering development. In this regard, Sass and Fifekova (2011) highlight that the region is becoming strong and expanding economically and has become an incredibly popular destination for FDI in business services.

The Baltics have experienced a higher level of transition to a service-based economy as well as a higher level of internationalization of their economy than the other CEECs.[2] Although these

states are now fully integrated with EU institutions and have achieved a high degree of financial and fiscal stability, their per capita income is still below the European average (about 65% of the EU average).

The financial crisis over the past few years was more severe in these countries, with GDP growth that remained largely modest after 2009, and output has still not recovered its pre-crisis trajectory (Staehr 2015).[3] Following the exogenous shocks, structural weaknesses have deepened. Many studies document the difficulties that the service sector faces in becoming stronger, smarter, and more diversified. In effect, "there is still a lot of untapped potential for the services sector, both internally and externally, but the challenges to live up to it are mounting as well" (Swedbank 2016, 1).

However, although the Baltic countries have some similarities in terms of geography, size, development, demography, and economic structure (Poissonnier 2017), major differences emerge among them in terms of intersectoral linkages. Despite the high level of interest in the role of services in structural change, existing analyses of small open developing economies, such as the Baltic countries, are limited.

Following the argument that the growing role of services is a sign of advanced development, this article seeks to establish a link between the growth in services and aggregate demand using a subsystem approach. By aggregating the production phases for vertically integrated sectors, it evaluate the value-added creation of final demand for goods and services produced domestically (Schettkat and Salverda 2004) and thus provides empirical evidence on changes in services' functional role and makes some policy recommendations.

METHODOLOGY AND DATASET

Theories on economic growth show that growth changes the structure and composition of an economy. Studies on structural change offer an analytical representation of the economic structure. The complexity of structural change is probably better investigated using an analytical framework that permits a better measurement of particular aspects of the transformation process, describing the economic system and its development path (Silva and Teixeira 2008).

In an analysis of the structure of production, vertical integration of the economy is a logical device that has been widely applied in social accounting and in economic theory (Scazzieri 1990). Pasinetti (1973)'s theoretical work is in this category. Beginning with an inter-industrial analysis according to Leontief's I–O matrix, he derived synthetic notions, such as subsystems or vertically integrated sectors, that are considered essential in dynamic analysis.

Pasinetti's subsystem features a generalization of the concept of subsystem elaborated by Sraffa. As Sraffa has highlighted (1960, 89): "the commodities forming the gross product . . . can be unambiguously distinguished as those which go to replace the means of production and those which together form the net product of the system." The economy can be decomposed into as many parts as there are goods that contribute to the net product, "in such a way that each part is in a self-replacing state with a net product of one commodity only" (Harcourt and Massaro 1964, 717). These parts can be called "subsystems." The subsystem is then an aggregation that analytically represents all the activities undertaken (directly or indirectly) to satisfy final demand for a specific good or service, given the stock of fixed capital. In this way, it can identify a causal relationship that involves interindustry linkages. Here, "each subsystem is characterized by a

particular growth rate and explicitly included the quantities of intermediate products necessary to ensure the growth of productive capacity that is required to achieve a given growth in final consumption" (Landesmann and Scazzieri 1993, 305).

Therefore, this analytical scheme emphasizes demand-driven growth, such that the intersectoral linkages are described according to the relationship between, on the one hand, final goods, and, on the other hand, all the requirements for production. This approach provides that each sector be considered on the basis of its contribution to the production of the final good.

The conversion from sectors to subsystems is achieved by the Γ operator:

$$\Gamma = (\hat{p})\ (I - A)^{-1}\ \hat{\alpha} \tag{1}$$

In Equation (1), A is the coefficient matrix derived from the I–O table; $(I - A)^{-1}$ represents the Leontief inverse, in which the generic element s_{ij} measures the value of the output of branch i that is directly or indirectly needed to obtain a unitary value of the output of branch j available for final use; the generic element of vector $\boldsymbol{\rho}$ ($\rho_I = v_i/x_i$) represents the ratio between value added (v_i) and total output at current prices (x_i) of branch i; lastly, the generic element of vector $\boldsymbol{\alpha}$ (α_i) measures output at current prices of branch i destined for final use; and the caret indicates that the underlying vector is transformed into a diagonal matrix that has the components of the vector on the principal diagonal and zero elsewhere.

The matrix $\boldsymbol{\Gamma}$ can be examined from two different angles: if observed it horizontally, each row i points out the part of value added related to branch i that is directly or indirectly used by each subsystem j; vertically, however, each column j indicates the shares of value added related to each branch that are directly or indirectly used by the specific subsystem j.

The methodology permits the study of structural change in an economy by separating it into two categories: intermediate input and final demand. In fact, it makes it possible to evaluate any change due to internal determinants (the outsourcing of noncore activities, demand for innovative inputs from manufacturing and service firms, etc.) of the share of services in the mix of direct inputs used by different sectors. Integration can then be seen as a process that modifies the boundaries of production and varies the sectoral contribution to the economy.

This article is based on the World Input–Output Database (WIOD) release 2016. The database provides world I–O tables (WIOT) for the period 2000–2014. The values are expressed in millions of dollars. In addition, the cover data for fity-six sectors are classified according to the International Standard Industrial Classification revision 4 (ISIC Rev. 4). The database thus allows us to conduct a more accurate and complete analysis of the characteristics of the structure of production than the previous version, which was based on a 35-sector classification. The data on employment in socioeconomic accounts (SEAs) at the industry level are under construction, so the analyses are conducted using value added. However, many studies on structural change have shown that using data on employment or value added does not produce significant differences in the interpretation of economic dynamics (Camacho Ballesta, Melikhova, and Peinado 2012; Montresor and Marzetti 2011).

Furthermore, the study enables us to appreciate the functional role of the services in the entire structure of production using up-to-date data. To our knowledge, this new dataset has only been adopted by Timmer et al. (2016), who present an approach based on global import intensity (GII). They find that the increase in the GII during the period 2000–2008 was due to a

combination of two forces: high aggregate demand and continuous fragmentation of international production. However, since 2011, demand has shifted to services, which are less trade intensive than goods. They thus argue that trade ratios are likely to remain low in the near future.

The following overview of the structure of the Baltic economies in this article is therefore the first work in the literature to embrace this new database.

ECONOMIC STRUCTURE, OPENNESS TO TRADE, AND INTERMEDIATE USES

Before embarking on a subsystem approach, we start with an evaluation of the characteristics of the structure of production and of the changes that have taken place since 2000. We break down the structure of the national economy into six industry groups: agriculture, industry (manufacturing and public utilities), construction, market services, and non-market services. Table 1 presents some interesting statistics in this respect. In all the Baltic countries, the share of agriculture decreases between 2000 and 2014; conversely, some differences emerge in the evolution of the prominence of manufacturing. Similar development and intensity can be detected in Lithuania and Estonia, which also show a greater share of manufacturing in the total compared to both Latvia (only 16% in 2014) and the euro12. Specifically, in 2014 the value exceeds 22% in Lithuania and is just over 20% in Estonia. The V4 countries, by contrast, are characterized by the stronger presence of manufacturing, exceeding 26% of the economy in 2014. As for services, an increasing share of market services in the economy over the same period is evident across the Baltic countries. Moreover, the relative share of value added is higher in market services than non-market services. Therefore, these results indicate that the sectoral structure of the Baltic economies is much more similar to that of the euro12 than to that of the V4 countries.

As pointed out at the beginning of this article, the transition economies have intensified their international trade, thus increasing their external dependence. An openness index has been created to help us understand this phenomenon, which is calculated as the ratio of the sum of exports and imports to total output. The results provide a useful summary of the relationship between trade and the structure of production (Table 2). Lithuania, for instance, has relatively higher performance than do its partners, with a growth rate more than 30% points higher. In

TABLE 1
Sectoral Shares in Value Added (percentage values)

	Agriculture		Industry		Construction		Market services		Nonmarket services	
	2000	2014	2000	2014	2000	2014	2000	2014	2000	2014
Estonia	6.0	4.9	20.7	20.2	5.9	6.5	50.4	51.1	17.0	17.3
Lithuania	7.0	3.8	22.9	22.7	6.0	7.5	44.2	50.0	19.9	16.0
Latvia	5.2	3.7	19.4	16.0	6.9	6.8	48.5	54.8	19.8	18.5
V4	5.5	4.6	24.5	26.0	7.5	6.6	45.1	45.2	17.3	17.5
EURO12	2.8	2.0	21.7	18.7	5.7	5.1	48.5	50.7	21.4	23.5

Source: Authors' calculation based on WIOD (2016).

TABLE 2
Openness Index: Total Trade (Exports Plus Import) as Share of Total Output (percentage values)

	2000	2008	2014
Estonia	44.7	57.9	66.7
Lithuania	40.6	58.8	73.7
Latvia	33.2	39.3	46.8
V4	37.6	47.5	55.2
EURO12	32.7	36.1	40.2

Source: Authors' calculation based on WIOD (2016).

2014, the impact of trade was also significant in Estonia, where it reaches 73.7% of output, while Latvia is characterized by lower trade intensity (46.8%). Even though the Baltics are small countries, the differences among them are much more evident in comparison with other areas in terms of the level and dynamics of growth.

To complete the overview of comparative advantage, we use a second indicator, the normalized total trade balance (NTTB) (Table 3). It has a value between –100 and 100 (percent), with positive values indicating that the country is a net exporter and negative values indicating that the country is a net importer (ITC 2015).

$$\text{NTTB(Normalized Total Trade Balance)} = \left(\frac{X-M}{X+M}\right)*100, \tag{2}$$

where X and M represent, respectively, total exports and imports. The I–O tables can be used to determine which portion of the increase in international trade was used to meet foreign final demand and which portion was for intermediate demand.

The data show that the Baltic countries are mostly net exporters of intermediate goods. With regard to "final" use, we define them as net importer countries (Table 3). If we consider the

TABLE 3
Normalized Trade Balance Index: Exports Minus Import Divided by Total Trade (percentage values), 2014

	BALTIC		EURO12		V4		World	
	Intermediate	Final	Intermediate	Final	Intermediate	Final	Intermediate	Final
Estonia	−12	1	8	−33	−61	−82	3	−5
Lithuania	38	−6	20	−29	−2	−61	9	−5
Latvia	−23	5	−2	−57	−37	−73	5	−17
Czech Republic	21	70	1	20	−4	14	−3	25
Hungary	15	76	−5	28	−13	−3	−8	32
Poland	26	68	1	5	21	0	0	10
Slovakia	24	58	0	30	−8	−15	−7	25

Source: Authors' calculation based on WIOD (2016).

results by area, different conditions emerge. Specifically, the Baltic countries are net importers from the V4 and the euro12, but the former has a larger negative balance. The V4 countries, on the contrary, are net exporters of final goods. Moreover, the results indicate strong trade integration between the Baltics and the V4.

We can conclude, then, that the Baltic states have a comparative advantage in intermediate goods, evidenced, on the one hand, by their specialization in products from natural resources (i.e., wood, copper, mineral fuel) (Remeikiene, Startiene, and Dumciuviene 2015; Zaghini 2005) and, on the other hand, by the growth in high-tech products. It is also evident that many of these exported products are only assembled in the Baltic countries and have low domestic value added (Staehr 2015). In this framework, imports are an important vehicle for accelerating the modernization of the structure of production so as to sustain the diversification of industrial development. These characteristics allow us to introduce the main concepts used in the remainder of the section.

The structural analysis cannot neglect the size of intermediate goods in the economy as a whole, in particular in manufacturing and services. This section, in fact, shows the direct requirements for intermediate goods to obtain one unit of final demand in a sector. Furthermore, a question arises as to which part of the phenomenon is directly imputable to imports and which to domestic supply.

Table 4 reports the share of intermediate goods in total output, which indicates the difference between manufacturing and services. Intermediate goods on average exceed 65% of total output, while services comprise about 40%. Over the period under study, major changes occurred more in manufacturing than in services, with a larger and increasing share of intermediate goods in the industrial sector (e.g., in Latvia it grew by six percentage points). Therefore, the results highlight that manufacturing has the largest requirements for intermediate goods, which confirms our assumptions regarding the fragmentation of the value chain that is leading to more and more intensive use of inputs by activities of any type. In terms of direct effects, the Baltic countries are relatively similar to the V4. This means that the level of intermediate demand for inputs does not differ much from one area to another. As for the euro12, some divergences arise regarding manufacturing production.

The next step is to examine the composition of intermediate inputs from an international perspective. The increase in fragmentation of the international value chain can affect these phenomena. Feenstra and Hanson (1999) were among the first to evaluate the role of

TABLE 4
Share of Intermediate Uses in Total Output by Manufacturing and Services (percentage values)

	Total		Manufacturing		Services	
	2000	*2014*	*2000*	*2014*	*2000*	*2014*
Estonia	55.3	54.5	66.9	69.4	48.0	45.3
Lithuania	45.7	46.1	66.5	64.2	31.2	32.6
Latvia	52.8	55.4	62.7	68.1	48.4	46.1
V4	53.7	55.8	67.3	70.5	42.9	42.1
EURO12	48.6	49.5	64.8	68.2	37.7	38.8

Source: Authors' calculation based on WIOD (2016).

fragmentation, measuring it as imported intermediate inputs as a share of total intermediate inputs used in a specific sector. This index is revised so that some additional effects on the economy as a whole can be considered.

The generalization involves two measures of fragmentation based respectively on the share of imported inputs and on the share of intermediate exports in the value of total output in each country. In this way, we can gauge the effects of increasing fragmentation of global value chains on the economy as a whole on both the demand side and the supply side.

Table 5 shows the differences among the countries. The Baltic countries have a larger increase in the trade of intermediate goods than other areas. In particular, imported intermediate inputs on total output grew by nine percentage points in Lithuania, from 11.3% to 20.4%, and by six percentage points in Estonia, from 15.9% to 21.6% over this period However, Latvia seems to be affected less by this phenomenon. In addition, the share of exports increased by about 12% points in Estonia, from 11.6% to 23.1%, and by 15% points in Lithuania, from 9.5% to 24.6%. Greater intensity is seen in manufacturing activities that require more imported inputs in production. For instance, in the V4, it is more than 30%, whereas in Estonia and Lithuania, the share of imported intermediate inputs is about 40%. Nevertheless, these values are much lower for services. Indeed, the foreign input requirements do not exceed 12% and 15%, respectively, and no significant changes occur over the period.

In sum, intermediate use is increasing. This is very interesting, because it shows the prevailing trend of integration among sectors in economic production. Even though the extent of intermediate inputs indicates the large role of external inputs in manufacturing, the central contribution of the domestic market is confirmed. It, therefore, highlights that increasing competition in emerging countries and organizational changes that follow global value chains have created two parallel trends. The globalization of production, which has led to international fragmentation of the relationship between manufacturing firms, has been accompanied by the transition to a service-based economy, which reflects the prevalence of domestic supply.

TABLE 5
Share of Imported Intermediate Inputs and Share of Intermediate Exports in Total Output by Manufacturing and Services (percentage values)

		Total		Manufacturing		Services	
		2000	2014	2000	2014	2000	2014
Estonia	Import	15.9	21.6	26.0	38.5	10.1	12.1
	Export	11.6	23.1	22.9	45.2	6.5	12.8
Lithuania	Import	11.3	20.4	23.5	39.9	3.7	7.2
	Export	9.5	24.6	14.9	39.5	7.3	15.6
Latvia	Import	11.0	14.1	18.6	24.8	7.5	8.7
	Export	9.3	15.6	17.3	30.1	7.0	11.2
V4	Import	13.1	18.5	23.0	32.7	6.6	7.6
	Export	10.3	17.3	19.1	30.0	5.2	8.5
EURO12	Import	9.6	12.4	18.2	24.4	4.7	6.4
	Export	9.5	12.9	20.0	26.3	4.5	6.9

Source: Authors' calculation based on WIOD (2016).

Consequently, the domestic dimension of this process is crucial in an analysis based on integration between manufacturing and services. This is especially important in the analysis, which focuses on the domestic part of the picture, using domestic I–O tables.

STRUCTURAL INTERLINKAGES AND THE ROLE OF SERVICES: THE SUBSYSTEM APPROACH

As mentioned, a subsystem accounts for the direct and indirect effects of all the inputs and thus reveals the interconnections through "forward" and "backward" linkages, respectively (Cheng and Daniels 2014; Duguleana and Duguleana 2016; Melikhova et al. 2015). To synthesize the different types of information in the I–O tables, an index is defined as follows:

$$\varepsilon = \frac{\sum^{i=1} n\Gamma_{row}}{\sum^{j=1} n\Gamma_{column}} \tag{3}$$

where the numerator represents the amount of value added supplied from a particular sector to production, derived from the total in the row for each activity i in the $\mathbf{\Gamma}$ matrix; the denominator represents the amount of value added demanded by each sector with respect to the other activities, derived from the total of the column for each activity j in the $\mathbf{\Gamma}$ matrix. In the event that $\varepsilon > 1$, forward linkages prevail, but if $\varepsilon < 1$, backward linkages are stronger.

Table 6 shows some relevant differences among activities. Specifically, manufacturing and construction have more "backward" influence because they purchase many inputs from the rest of the production system. Indeed, the ε index is well below one in both activities. The Baltic countries show relatively similar values, although in Estonia the coefficient of manufacturing decreased over the period under study. Compared with other activities, however, agriculture and services are suppliers. Agriculture declined in two of the three countries and was notably higher in Estonia. Furthermore, not surprisingly, dissimilar services exhibit different patterns. Therefore, forward linkages are larger in market services, which indicates greater demand pressure on this sector (Cheng and Daniels 2014). Except in Lithuania, their role also increased

TABLE 6
ε Index-Ratio of Amount of Value Added Supplied from Sector to Production System to Amount of Value Added Demanded by Each Sector with Respect to Other Activities

	Estonia		Lithuania		Latvia	
	2000	2014	2000	2014	2000	2014
Agriculture	2.31	3.29	2.55	1.09	7.13	1.47
Manufacturing	0.38	0.18	0.26	0.27	0.25	0.27
Public utilities	1.53	1.48	2.52	0.45	1.99	1.65
Construction	0.21	0.26	1.07	0.81	0.41	0.36
Market services	4.14	5.45	6.39	5.33	3.91	4.59
Nonmarket services	0.13	0.16	0.07	0.13	0.13	0.17

Source: Authors' calculation based on WIOD (2016).

over the period (in Estonia the index rose from 4.14 to 5.45, and in Latvia it grew from 3.91 to 4.59). The remaining sectors had very low values.

Confirming the characteristics of "producer input," in accordance with the broad literature on producer services addressed above, these findings indicate that market services are essential inputs for most activities and a crucial factor in enhancing the integration of production (Camacho Ballesta and Rodriguez Molina 2009). Forward linkages in market services are sizable in all periods, assuming greater importance as intermediate consumption in production. Consequently, even though these countries are small open economies, their production systems are able to provide intermediate inputs domestically.

Therefore, the contribution of services is not only taken into account on the basis of its share of total value added but is increasingly important in the dynamics of the economic system as a whole. Thus, the process of transition to services represents an advanced stage of economic development, as it reflects progressively more intensive use of services in many activities. Findings have also been obtained for other larger transition countries, such as the Czech Republic, Hungary, Poland, and Slovakia (Melikhova et al. 2015).

The next step is aimed at understanding the relation between market services and the rest of the economy. Following the $\mathbf{\Gamma}$ matrix, the degree of integration of market services into the different subsystems can be assessed. In particular, the level of transition to services in many subsystems can be investigated through the share of direct and indirect inputs of services in the production of final goods.

Table 7 shows the share of market services in each subsystem in 2014. In agriculture, the Baltic countries show a significant share of intermediate services (about 24%), as much as 26.6% in Latvia. This value is higher than in the V4 (16.2%) and the euro12 (19.3%). Conversely, no apparent differences seem to emerge in other subsystems (public utilities and non-market services). A larger amount of intermediate inputs is used by market services, on average 94.8% across the Baltics. A remarkable gap exists in comparison to the V4, for which this share of the total drops by five percentage points. Finally, the share of intermediate services in manufacturing in the Baltics is about 25%. These results show a substantial similarity with the V4 (24.3% on average), while the gap with the euro12 is again large (29.4%).

In sum, the subsystem approach to I–O reveals that the Baltic economies are still behind the euro12. From the point of view of the division of labor and of variety in services, these economies need to put in place structural changes to close the gap with their EU partners, in particular, in more industrialized economies, such as Lithuania.

TABLE 7
Share of Market Services into Each Subsystem (value added, percentage values), 2014

	Agriculture	Manufacturing	Public utilities	Construction	Market services	Nonmarket Services
Estonia	20.5	26.1	21.4	27.2	94.3	13.5
Lithuania	24.0	23.0	10.2	10.0	95.6	11.3
Latvia	26.6	27.9	22.3	29.7	94.1	14.3
Baltic (Average)	24.0	24.9	17.1	20.8	94.8	12.8
V4	16.2	24.3	18.0	22.1	89.5	11.2
EURO12	19.3	29.4	23.8	26.3	93.5	12.9

Source: Authors' calculation based on WIOD (2016).

The results highlight the need for a careful assessment of the importance of intersectoral chains, because industrial development may depend on the quality of the services that they adopt (Gallouj 2002). Many authors have shown that intersectoral interaction is more intense between manufacturing and business services, particularly knowledge-intensive business services (KIBS). KIBS are recognized as important carriers of new knowledge development in manufacturing; indeed, they can promote product differentiation and increase the quality or technology content of manufactured goods (Ciriaci and Palma 2016, 56). As mentioned, the integration of these services is one way for manufacturing to gain knowledge and skills (Barney 1991) as well as advantages in exports, value added, product innovation, employment, and productivity growth (Baker 2007; Castaldi 2009; Castellacci 2010; Dachs et al. 2014; François and Woerz 2008; Guerrieri and Meliciani 2005; ten Raa and Wolff 2001; Tomlinson 2000; Wolff 2006).

In the following, we explore two important issues: the contribution of KIBS to the economy and industrial composition by technological intensity. Actually, these issues need not be considered individually but, rather, can be observed jointly in a strategic framework.

Table 8 appraises the level of vertical integration of KIBS[4] in subsystems. KIBS are becoming more relevant to production in different industries. The proportion of intermediate consumption of KIBS is higher in market services, on average 10% in the Baltic countries. In Estonia, it is 14.4%, while in Lithuania it is 7.7%—values comparable with those in the V4 (12.2%) and the euro12 (14. %). In manufacturing, few differences are seen among Baltic countries. The contribution of KIBS to the production of final demand for industrial goods, in fact, varies by just one percentage point, for example, from 2.8% in Lithuania to 3.8% in Estonia. However, the Baltics are characterized by a smaller share of KIBS in manufacturing than in the euro12 (8.9%), and the V4 countries have similar levels of these activities. However, among the Baltics, Lithuania is characterized by the smallest share of KIBS (2.9% vs. 6.4% in Estonia).

However, the structure of production in each country can affect the quality and the intensity of integration, because every industry produces, uses, and transforms knowledge differently (Strambach 2008). The technological levels of the different branches of industrial production and the knowledge intensity of services have largely been taken into consideration. Many studies find that intersectoral integration is strongly influenced by the technological characteristics of final production (Falk and Peng 2013; François and Woerz 2008). For example, KIBS seem to play an increasing role in technologically advanced subsystems (Ciriaci and Palma 2016). Hence, the functional role of these activities is tested after we control for the technological intensity of manufacturing (Table 9).

TABLE 8
Share of KIBS into Each Subsystem (value added, percentage values), 2014

	Agriculture	Manufacturing	Public Utilities	Construction	Market Services	Nonmarket Services
Estonia	2.0	3.8	3.2	6.4	14.4	2.5
Lithuania	2.2	2.8	1.7	2.9	7.7	1.7
Latvia	3.0	3.5	2.8	6.2	10.0	2.7
Baltic (Average)	2.4	3.2	2.4	4.9	10.0	2.2
V4	1.9	4.0	3.4	4.8	12.2	1.9
EURO12	3.8	8.9	6.4	7.3	15.7	4.6

Source: Authors' calculation based on WIOD (2016).

TABLE 9
Manufacturing Industries Classified Based on Technology According to International Standard Industrial Classification Revision 4 (ISIC Rev. 4)

Technological intensity	Code	Description
Low Tech	C10-C12	Manufacture of food products, beverages, and tobacco products
Low Tech	C13-C15	Manufacture of textiles, wearing apparel, and leather products
Low Tech	C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
Low Tech	C17	Manufacture of paper and paper products
Low Tech	C18	Printing and reproduction of recorded media
Medium Low Tech	C19	Manufacture of coke and refined petroleum products
Medium High tech	C20	Manufacture of chemicals and chemical products
High Tech	C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
Medium Low Tech	C22	Manufacture of rubber and plastic products
Medium Low Tech	C23	Manufacture of other non-metallic mineral products
Medium Low Tech	C24	Manufacture of basic metals
Medium Low Tech	C25	Manufacture of fabricated metal products, except machinery and equipment
High Tech	C26	Manufacture of computer, electronic, and optical products
Medium High Tech	C27	Manufacture of electrical equipment
Medium High Tech	C28	Manufacture of machinery and equipment n.e.c.
Medium High Tech	C29	Manufacture of motor vehicles, trailers, and semi-trailers
Medium High Tech	C30	Manufacture of other transport equipment
Low Tech	C31_C32	Manufacture of furniture; other manufacturing
Medium Low Tech	C33	Repair and installation of machinery and equipment

Source: OECD 2003.

Our analysis is based on a well-known classification adopted by the Organisation for Economic Co-operation and Development (OECD 2003),[5] which divides manufacturing into four categories: high tech (HT), medium high tech (MHT), medium low tech (MLT), and low tech (LT).

Low-tech manufacturing is the main subsystem in terms of value added in all the Baltics (Table 10). These industries' share of total manufacturing varies between 63.8% in Latvia and 55.8% in Estonia. In the V4, the value is lower, only 32.2%. Again, however, the differences between the Baltics and the euro12 are relevant. In 2014, the low-tech subsystem indeed accounts for 29.1% of total value added in manufacturing as a whole. A similar trend is seen in the evolution of the share of final demand in low-tech subsystems. In all cases, we see a decrease in the relative weight, although in the Baltics the decline is greater (about 15% points).

In other subsystems, for example, the share of the medium-low-tech subsystems increases proportionally everywhere, with greater intensity in the Baltics. Nevertheless, even though the trends in the level of technological intensity are similar, the share is always larger in the euro12 than in the Baltics. In particular, considering the medium- and high-tech subsystems, the share in 2014 is 13.8% in the Baltics, compared with 42.5% in the euro12 and 37% in the V4. As for the high-tech subsystems, the proportion is twice as high in the euro12 as in the Baltics.

Moreover, we should consider that different national characteristics in the Baltics also tend to emerge in this context. For instance, Estonia is the most technologically advanced country,

TABLE 10
Share of Manufacturing Subsystem by Technological Intensity in Total Manufacturing (value added, percentage values)

	LT		MLT		MHT		HT	
	2000	2014	2000	2014	2000	2014	2000	2014
Estonia	74.3	55.8	13.5	20.1	8.4	16.3	3.7	7.8
Lithuania	71.7	59.6	20.8	24.7	5.8	13.5	1.8	2.2
Latvia	80.4	63.8	10.6	17.6	5.8	11.7	3.2	6.9
Baltic (average)	74.6	59.6	16.4	21.9	6.3	13.8	2.6	4.7
V4	42.6	32.2	21.0	23.7	30.5	37.0	5.9	7.0
EURO12	32.9	29.1	17.4	18.8	38.4	42.5	11.3	9.6

Source: Authors' calculation based on WIOD (2016).

where the medium–high-tech and high-tech subsystems together comprise 24% of total manufacturing value added. However, in Latvia it is about 18%, and in Lithuania about 15%.

Finally, the data describe a clear situation: albeit with appropriate distinctions, the Baltics have an industrial structure that is relatively less dependent on technologically intense production compared not only with the euro12 but also with the V4. This pattern, as mentioned earlier, is consistent with previous evidence that showed the weak convergence concerning KIBS. Therefore, although structural change seems to be more pronounced in the Baltic countries, differences exist among countries in their transition to a service-based economy. In sum, the subsystem approach to I–O shows many discrepancies across the value chain in final production, which are most obvious in terms of differences in technological intensity.

CONCLUSION

This article empirically investigates the ways in which the evolution of service activities has contributed to the overall transition to a service-based economy. Based on the WIOD database, covering a recent period (2000–2014), it focuses on structural change in the Baltic countries in terms of value added. However, despite much empirical evidence on sectoral interrelations in advanced countries, the link between services and the rest of the structure of production in emerging economies has been the focus of little attention in the literature. The analysis thus offers an interesting case study of small open transition economies.

In this work, a subsystem approach to I–O tables was adopted to obtain the indirect and direct total effects necessary to satisfy demand for final output. Briefly, it measures all the activities that need to be integrated to create final production in a specific branch. By classifying each sector according to final goods, the subsystem identifies the contribution of every single sector within each production process and illustrates the extent to which the organization of the economy influences final production.

The analysis shows that the Baltics are characterized by a higher level of service activities than the V4, although they have experienced different patterns of transition to a service-based economy, and a gap between them and the euro12 remains. The relationships between

manufacturing and services, considering the level of technological intensity and the contribution of KIBS to final demand for manufacturing output, explain these differences.

The findings highlight a certain degree of cross-country heterogeneity. The share of market services in the manufacturing subsystem is much smaller in the Baltics than in both the V4 and the euro12, with a larger gap regarding the role of KIBS. Moreover, in these countries, the low-tech manufacturing subsystems are considerably larger, although their share of total value added decreases over the period. Regarding technological composition, our analysis indicates that structural change takes place gradually over time.

The evidence presented in this article allows us to conclude that a deep transformation of the economic structure is necessary in the Baltic countries and, should it occur, will have two important results: increased technological intensity in manufacturing and greater use of knowledge-intensive inputs. These two salient results can strengthen integration between manufacturing and services. Finally, we find valid reasons for assuming that the structural adjustment process has not concluded and that, with the accession to the euro, further industrial restructuring and relocation will occur in the Baltic states.

Through the subsystem approach, we reveal evidence of substantial differences in the Baltics, with interesting implications that are useful for making industrial policy.

Assuming that the dynamics of structural change are increasingly conditioned by the technological intensity of manufacturing and that the relationship between innovative services and product quality is particularly close, it is necessary to identify those industries that are highly influenced by inputs of knowledge. This can be a sustainable way to promote activities in which higher added value will stimulate greater knowledge spillover to the rest of the production system. In fact, many authors have shown that innovation in the economy largely comes not from production as a whole but primarily from the specific position of a group of industries that drive innovation (Miozzo and Miles 2002; Preissl 2007; Zdrazil, Kraftova, and Mateja 2016).

The process of internationalization has supported these transition countries in the development of services and increased their role in the economy. The remarkable international turn in the Baltic states could be a mechanism for promoting convergence in the production structure to higher technological levels, and FDI flows can continue to be a principal driver of modernization and thus of economic growth. They have certainly contributed significantly to restructuring in these countries. A broad consensus has been reached in the literature that countries that attract FDI to higher-tech industries have consequently achieved higher rates of productivity growth (Damijan et al. 2013; Dellis, Sondermann, and Vansteenkiste 2017), so it may be assumed that well-functioning economic structures can be important determinants of FDI inflows. From this perspective, governments can improve their policies by promoting complementary actions in FDI-attracting interventions and structural change targeting new industrial specialization.

Although this article broadens and enriches the literature, it has some limitations and offers opportunities for further research. For example, as explained earlier, the first relates to testing the role of services, taking the labor force into consideration. The data might provide greater information on trends, given that some processes operate primarily through employment, rather than output. A second avenue of research could aim to determine whether the heterogeneity across individual countries that emerged from our analysis is inherent in the way in which competitive market services operate and evolve over time and the way in which they differ in terms of skill intensity and the tradability, acquisition, and use of information technology.

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Notes

1. The countries considered are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain.
2. In particular, Estonia is competitive with countries such as Ireland and Denmark (Camacho Ballesta, Melikhova, and Peinado 2012).
3. The severe financial crisis, the backwardness of the structure of production, and the low quality of institutions are among the main factors contributing to the slowdown in convergence and the stagnation in GDP. Some authors advance a hypothesis on a "middle-income trap" (Foxley and Sossdord 2011).
4. The definition of KIBS using the ISIC Rev. 4 includes: computer programming, consultancy, and related activities; information service activities (J62-J63); computer programming, consultancy, and related activities; information service activities (M69-M70); architectural and engineering activities; technical testing and analysis (M71); scientific research and development (M72); and advertising and market research (M73).
5. The relevant criterion for this classification is the average R&D intensity, defined as the ratio of total R&D expenditures to total turnover.

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