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Estonia in Global Value Chains

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Estonia in Global Value Chains

Abstract

In this study, we analyse Estonia's position in global value chains using World Input-Output Data and firm-level data. We find that 69% of Estonia's total exports are intermediate goods and services, exceeding the EU average (65%). Two-thirds of Estonian imports are intermediates. Our findings suggest that Estonia is heavily involved in vertically and geographically fragmented production even though its most significant trading partners are its neighbouring countries. We also analyse the value chains of two significant companies operating in the Estonian economy along with their GDP contributions. According to our findings, the GDP contributions generated by the exports of these two companies vary significantly from one another. The euros generated from exports do not contribute equally to the national economy.

Key words: Global value chains, GVC, GDP, exports, gross domestic product, value added, Estonia, granular

JEL: D22, F14, F6, F62, F68, L2

Viro globaaleissa arvoketjuissa

Tiivistelmä

Tässä raportissa analysoidaan Viron asemaa globaaleissa arvoketjuissa käyttämällä sekä kansainvälistä panos-tuotos -aineistoa (WIOD) että yritystason dataa. Tulokset osoittavat, että 69 % Viron viennistä on välituotteiden ja -palveluiden vientiä, mikä ylittää EU:n keskiarvon. Kaksi kolmasosaa Viron tuonnista on välituotteita ja -palveluita. Tulokset viittaavat siihen, että Viro on suuressa määrin osallisena vertikaalisesti sekä maantieteellisesti pirstoutuneissa tuotantoketjuissa, vaikkakin Viron suurimmat kauppakumppanit ovat sen lähimmät naapurimaat. Raportissa analysoidaan myös kahden merkittävän Virossa toimivan yrityksen arvonketjua ja niiden tuottamaa bkt-vaikutusta. Tulokset osoittavat, että näiden välillä on erittäin suuria eroja sen suhteen, miten niiden vienti vaikuttaa Viron bkt:een. Jokainen viennistä saatu euro ei synnytä samanlaista hyötyvaikutusta kansantalouteen.

Asiasanat: Globaali arvoketju, arvonlisä, bkt, jalostusarvo, vienti, Viro

JEL: D22, F14, F6, F62, F68, L2

1 Introduction

An increasing volume of products and services is being produced by **Global Value Chains** (GVCs), any one of which may involve dozens or even hundreds of firms worldwide. Since the early 1990s GVCs have been a worldwide phenomenon in manufacturing; since the 2000s, GVCs have been a worldwide phenomenon in tradable services. Backer and Miroudot (2013) suggest that *more than half* of global trade is composed of transactions in the context of GVCs. They note that the rise of GVCs has been fuelled by technological progress, cost, access to resources and markets, and trade policy reforms.

The smooth operation of a GVC requires the instant transfer of instructions, the quick and cheap movement of intermediate inputs and final outputs, and a certain modularity of functions that do not occur within a single organizational structure in a specific location (Grossman and Rossi-Hansberg, 2008). The operation of GVCs depends on coherent contractual, governing, and legal principles, which are shaped by national policies in multinational enterprises' (MNEs) home and host locations.

Based on the results of this study and our previous summarizing report (Ali-Yrkkö and Rouvinen, 2013), we can draw the following conclusions:

- Value added in GVCs is often dominated by their *intangible aspects,* including the creation and appropriation of intellectual property.

- Value added has a tendency to migrate to either the very early or the very final stages of the value chain (a phenomenon known as the *smiling curve* of the value chain). Furthermore, particularly for consumer products, distribution channels (including wholesalers and retailers) often create a large share of total value. Value added that is attributable to goods assembly/processing has diminished over time.[1] However, in business-to-business products, this trend is less obvious and a large variance exists among industries. (Ali-Yrkkö et al., 2011, Seppälä and Kenney, 2013; Seppälä and Kalm, 2013; Seppälä et al., 2014; Ali-Yrkkö and Rouvinen, 2015a).

- Our two case companies have positioned themselves differently within their respective value chains. Whereas Ericsson Eesti AS focuses on manufacturing, Hekotek AS has a larger spread over development, manufacturing and marketing activities. In manufacturing, as in the case of Ericsson Eesti AS, most of the inputs are imported from outside Estonia. Hekotek AS, however, utilizes a more local supplier network within Estonia, thus generating larger multiplier effects within the Estonian economy.

- Our GVC case studies suggest that there are three mutually non-exclusive ways for a company to capture disproportionately large amounts of value in GVCs: 1) being the orchestrator or brand owner, 2) controlling the customer/user interface and 3) retaining a gate-keeping position (e.g., by cornering the market for a key input). Looking at Ericsson Eesti AS from this perspective, it can be seen that none of these methods are clearly employed to retain value added inside of Estonia. In the case of Hekotek AS, it can be

[1] This is not to say that these middle stages are unimportant; clearly, they are crucial. Nevertheless, as a rule, their relative role has diminished over time.

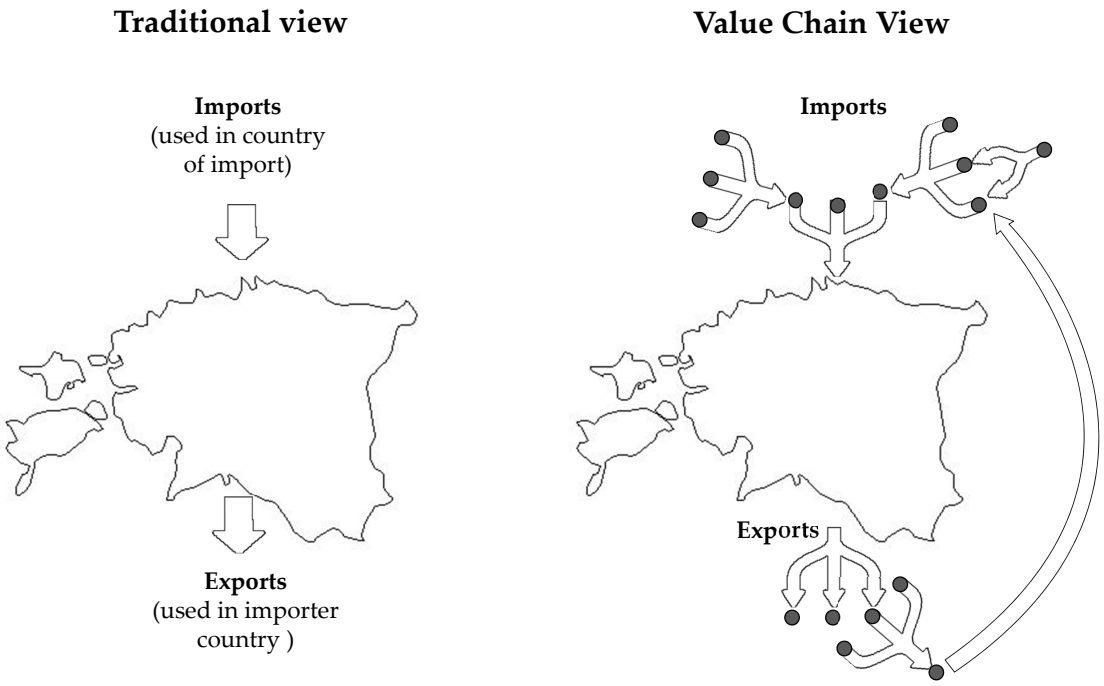
observed that all of these methods are at play on some level for the benefit of the Estonian economy.

– From the viewpoint of the national economy, the impact of new manufacturing operations established in Estonia varies significantly. This variation depends on two elements: value creation and value capturing capabilities. Value creation capability can be affected by attracting supporting functions, investments and intellectual property, and by generating spillover effects. Value capturing capability usually depends on transfer pricing practices[2] and the juridical location of the company's profit centre.

The time span from national chains to GVCs has been relatively short (Baldwin, 2006; Baldwin, 2012). Just a few decades ago, value chains operated predominantly on a national basis. Thus, activities that transformed raw materials to components and final products were primarily located in a single country. Although some products were exported and imported, by and large it was believed that exports and imports consisted largely of final products (Figure 1.1).

In this report, we consider what the rise of GVCs implies for Estonia. In Chapter 2, we analyse the composition of Estonian foreign trade using international input-output data which enable us to separate the trade of intermediate and final goods from each other, and to compare their respective shares to those of other countries. In Chapters 3 and 4, we deepen the analysis by focusing on the value creation of two major exporters of Estonia. In Chapter 5, we conclude and propose policy implications based on our results.

Figure 1.1 The view of international trade has changed



[2] For further information on transfer pricing and value added, see Seppälä et al. (2014).

2 What Does Estonia Trade: Final Products or Intermediates?

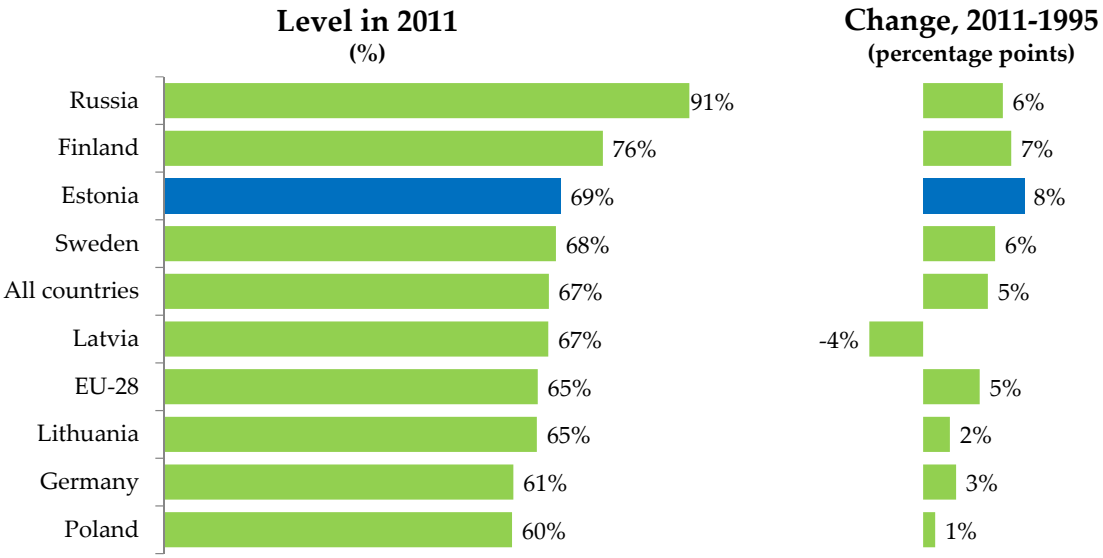
In recent decades, an increasing number of companies have focused on their core businesses and withdrawn from other areas. As a part of this development, value chains have become longer as firms have outsourced some activities (e.g., component and sub-assembly manufacturing) that were previously made locally and in-house. As a result, value chains have become longer and more complex than before.

Raw materials, components and services used to produce final products and services are called intermediates. The classification of products into intermediates and final products is based on Broad Economic Categories (BEC Revision 3) classification (see Dietzenbacher et. al., 2013, page 84). Based on this classification, however, diesel engines and many other business-to-business products are also defined to intermediates although they are rarely perceived as such. Despite the fact that the classification is not perfect, it is the best international categorization that can be used to separate intermediates from final goods/services.

As much as 69% of Estonia's total exports are intermediates, exceeding the EU average (65%). In Lithuania and Latvia the corresponding proportions are slightly lower than in Estonia but compared to Poland, the difference is remarkable (9 percentage points).

Estonia's position is opposite that of Finland and Russia. Intermediates account for more than 75% of Finland's total exports and 90% of Russia's exports. Russia's high share of intermediates is mostly explained by its role as an exporter of oil, gas and other raw materials. There is no such single explanation for Finland's high share of intermediates. As previously mentioned, however, intermediates include some products that are not usually perceived as such.

Figure 2.1 Share of intermediates of total exports and the change between 1995 and 2011, %



Note: Figures represent year 2011 (the most recent year in WIOD data).
Source: Authors. Data Source: WIOD database.

Box 1 What data do we use to measure exports and imports?

The empirical analyses in this chapter are based on the *World Input-Output Database* (WIOD). The WIOD combines input-output tables for different countries, providing national figures on trade between different industries. In other words, WIOD is an international version of national input-output data.

WIOD provides tools for measuring international trade and interaction in more detail than before. For example, it allows us both to measure international inter-industry trade in intermediates and to combine these data with information on the domestic production structure. This means analysing inter-industry trade along international production chains.

WIOD has been developed and is maintained by an international working group based at the University of Groningen in the Netherlands. The data are publicly available at http://www.wiod.org. Timmer et al. (2015, 2014, 2013) and Los et al. (2015) have provided detailed descriptions of the database.

Technically, WIOD is a time series of input-output tables for 1995–2011. Annual data are provided for 35 industries and 40 countries: 27 EU members and 13 other major economies. The data cover 85% of the global economy.

WIOD has been assembled by combining national input-output data with UN *Comtrade* statistics on international trade. In addition, WIOD includes data on employment and wages based on EU KLEMS figures. Figure T.1 illustrates the part of the WIOD data used in this report. A one-year cross-section of WIOD is called a *World Input-Output Table* (WIOT).

The left-hand side of WIOT describes inter-industry intermediates trade in various countries. It is a description of the international production structure. For example, WIOT cell (a) describes the share of total production in industry (1) in country (1) that the same industry uses in the same country as an intermediate product. The same applies to all other cells on the diagonal. Cell (b) describes the use of intermediates produced by industry (1) in country (1) by industry (1) in country (M). This is the intermediate exports for country (1) and intermediate imports for country (M). Cell (c) describes the

Figure T.1 One-year cross-section of WIOD data (WIOT)

			Intermediate product use							Final product use			Total use
			Country 1			…	Country M			Country 1	…	Country M	
			Industry 1	…	Industry N	…	Industry 1	…	Industry N				
Production	Country 1	Industry 1	(a)				(b)			(d)			(f)
		…											
		Industry N										(e)	
	…	…											
	Country 2	Industry 1											
		…											
		Industry N	(c)										
Value added			(g)										
Total output			(f)										

value of imports in industry (1) in country (1) from a particular industry (N) in another country (M). This is intermediate imports for country (1) and intermediate exports for country (M). The part matrices on the WIOT diagonal thus describe each country's internal input-out structure. Cells outside the diagonal have corresponding exports and imports interpretations.

The right-hand side of WIOT describes the value of final consumption by country. Cell (d) describes the value of domestic final demand in country (1). Cell (e) indicates the value of foreign final demand in country (M) from industry (N) in country (1). This is final production exports for country (1) and final production imports for country (M).

In addition, the right-hand side of WIOT provides data on total demand for production (f) in a particular industry in the country and accordingly, on the bottom line, data on the industry's total output (f). These two figures are analogous in WIOT. The table also includes data on value added in each industry (g). WIOD gives the value of output in US dollars for the year in question.

The export and import figures reported by different countries are not necessarily mutually consistent. National discrepancies are reconciled when assembling the WIOD data. For this reason, the WIOD data for Estonia, for instance, are not necessarily exactly the same as the export and import figures reported by Statistics Estonia.

The high share of intermediates exported potentially indicates that businesses in the country concerned have been successful in their attempts to engage with GVCs. However, it is possible that producers of intermediate products are much more likely to have subcontracting roles.

In Estonia, the share of intermediate exports has risen. In 1995, the share was 8 percentage points lower than in the most recent figure. Similar development has been witnessed in several other countries. Since 1995, the share of intermediates in total exports has increased by an average of 5 percentage points.

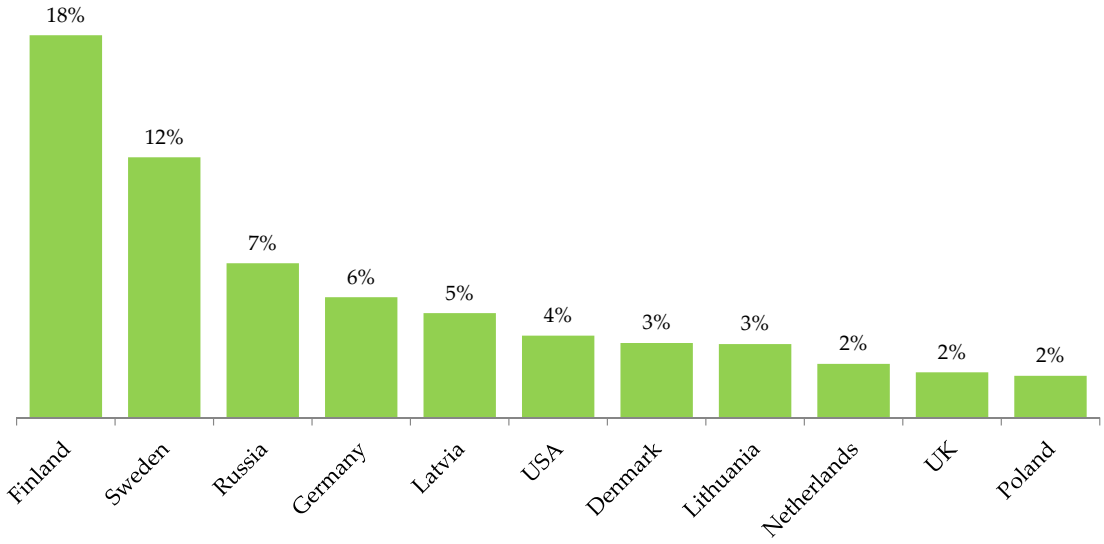
In Finland, the share of intermediates has risen by 7 percentage points and in Sweden it has risen by 6 percentage points. In Latvia, however, the reverse is the case. Latvia's current share of intermediates is lower than in 1995.

Where does Estonia export its intermediates? Up to 18% of Estonia's intermediates are exported to Finland (Figure 2.2.).

In addition to Finland, Sweden and Russia are important direct destinations of Estonia's intermediate exports. In sum, the top 10 destination countries account for almost two-thirds of Estonia's total intermediate exports. For the residual one-third, the most important destination region is the rest of the European Union; an additional 9% (not included in top 10 destinations presented in Figure 2.2) of Estonia's total intermediate exports is directed to the area. Regarding other destinations, it is interesting that Asia (including the Middle East and Australia) only account for 5% of the Estonian total intermediate exports[3].

[3] It should be noted, however, that based on WIOD data, 21% of Estonian total intermediate exports is directed to 'the rest of the World' without a specific destination country.

Figure 2.2 Top 10 destinations of Estonian intermediate exports

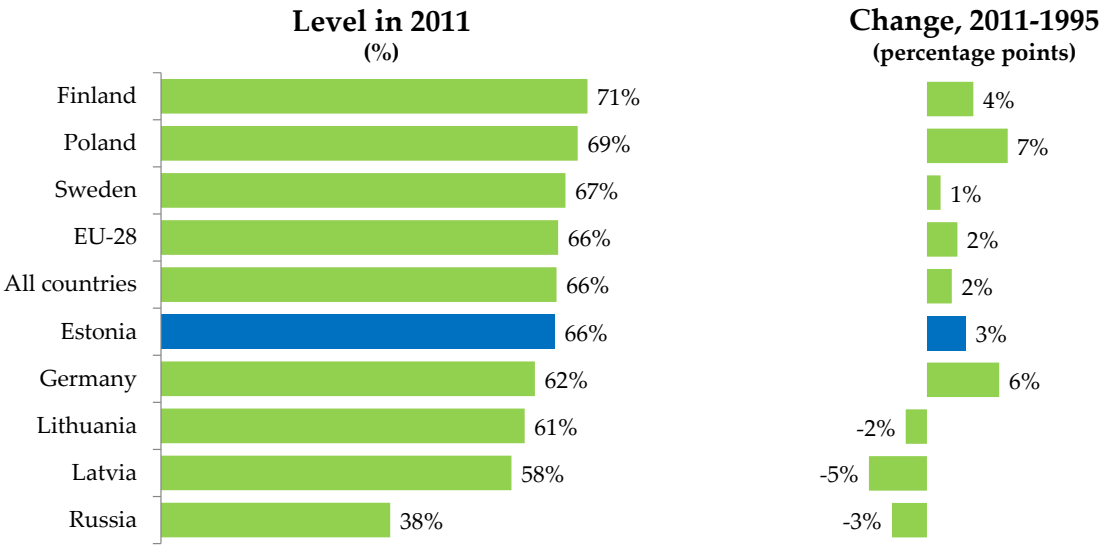


Note: Share of ten major direct export destinations of Estonia's total intermediate exports, %.
Source: Authors' calculations based on WIOD data. Figures represent year 2011 (the most recent year in WIOD data).

It should be noted that these top 10 countries are not necessarily the ultimate destinations of products exported from Estonia. In contrast, it is very likely that these intermediates are processed further in the receiving countries and then exported to third countries.

The high share of intermediate exports of total Estonian exports raises the question of the corresponding proportion concerning imports. Figure 2.3 describes the role of intermediates in Estonian imports.

Figure 2.3 The share of intermediates of total imports in 2011 and change between 1995 and 2011, %



Data Source: Authors. WIOD database.

Intermediates account for two-thirds of the total imports of Estonia, very close to both the average of EU-28 countries and the average of all countries. In Lithuania and Latvia, the corresponding shares are slightly lower (61% and 58%) than in Estonia.

Has the importance of intermediate imports changed over time? The right-hand side of Figure 2.3 reveals that at a global level there has been hardly any change since 1995 in intermediate imports as a proportion of total imports.

At the country level, however, there have been some changes. In Estonia and Finland, the shares of intermediate imports have increased by 4 percentage points since 1995. In Lithuania and Latvia, the proportion of intermediates has decreased.

In sum, these results show that Estonia participates actively in GVCs. It imports components and other intermediates from other countries, engages in its own value adding activities, and exports the products to other countries, where local companies continue the process. The main contribution of this chapter is that to our knowledge, this is the first time when Estonian intermediate and final goods trade have been quantified and benchmarked to other countries.

3 Exports versus Value Added: Lessons from Estonia's Biggest Exporter, Ericsson Eesti AS

In this chapter, we will conduct a deeper exploration of value chains. We analyse the role of Swedish-based multinational Ericsson in Estonia (see also Seppälä, 2015). We chose Ericsson as our case company because it has large-scale manufacturing operations in Estonia. The focus of our analysis is to compare the development of exports and the value added created in Estonia.

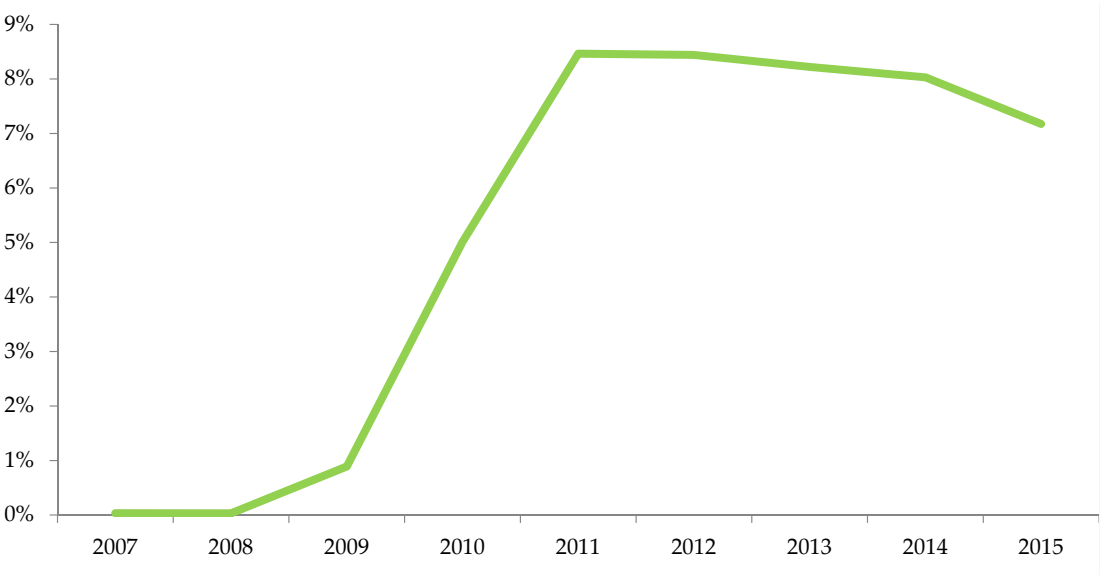
Ericsson had a remarkable impact on the Estonian economy even before it had its own large-scale operations in the country. However, the company's impact was indirect because Ericsson had outsourced manufacturing activities to Elcoteq Oy (a Finnish company offering electronic manufacturing services) having production in Estonia.

In June 2009, Ericsson acquired the majority of Elcoteq's production plant in Tallinn, Estonia. After the acquisition, activities previously reflected in Elcoteq's figures were reflected in Ericsson's in-house figures. As a consequence, Ericsson's share of total Estonian exports grew rapidly (Figure 3.1).

After the acquisition, Ericsson's Estonia-produced volume climbed sharply. In 2010 and 2011, Ericsson Eesti's exports increased rapidly, raising Ericsson's share of Estonia's total exports. In terms of the share of exports, the peak year was 2011, when Ericsson Eesti accounted for 8.5 per cent of Estonia's total exports. In the next few years, exports grew slightly in absolute terms, peaking in 2014. That year, the value of Ericsson's exports reached 1.36 billion euros.

As mentioned above, however, exports are measured in gross terms that do not consider that some inputs are imported. Therefore, export growth does not necessarily equal GDP growth. This holds both at the national level and at the company level. Whereas GDP measures the

Figure 3.1 Ericsson's exports' share of total Estonian exports, %



Source: Authors' calculations. Data are based on Ericsson Eesti's annual reports and Statistics Estonia (aggregate exports). The figures have been calculated as follows: Exports of Ericsson Eesti AS / Total exports of Estonia.

value of all activities within a country, value added measures the value of all activities within a firm. Because our goal is to consider Ericsson's role in Estonia, we must carefully confine our analysis to activities within Estonia and exclude Ericsson's operations in other countries.

Thus, we next analyse the development of Ericsson's value added in Estonia and compare it to exports (Figure 3.2).

The value added by firm i (in our case Ericsson Eesti AS) in year t can be calculated empirically in two ways. First, it can be calculated by decreasing purchases from net sales (both items concern Ericsson Eesti):

$$VALUE\_ADDED_t^i = Net\_sales_t^i - Purchases_t^i \quad (1)$$

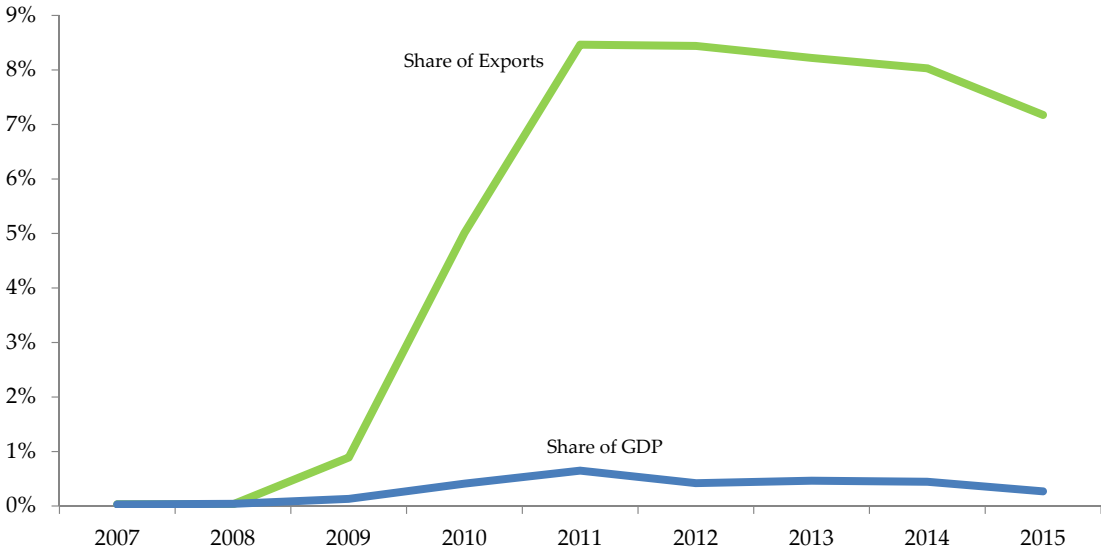
However, information about purchases is often difficult to obtain from publicly available financial statements. Consequently, value added is often (e.g., Ali-Yrkkö and Rouvinen, 2015b; Seppälä et al., 2014) calculated using Equation 2:

$$VALUE\_ADDED_t^i = Operating\_profit_t^i + Depreciation_t^i + Labor\_costs_t^i + rents_t^i \quad (2)$$

Although our value added calculations are based on Equation (2), we also cross-checked the figures using Equation 1. The results of these two alternative methods were almost identical.

Notwithstanding Ericsson Eesti's exports from Estonia exceed 1 billion euros, it does not create a great deal of value added in Estonia. For instance, in 2015, the value of Ericsson Eesti's exports was 1,15 billion euros, whereas its value added in Estonia was less than 50 million eu-

Figure 3.2 Ericsson' share of Estonian Exports and GDP, %



Source: Authors' calculations based on the annual reports of Ericsson Eesti and Statistics Estonia and Eurostat. The share of GDP is calculated as follows: Ericsson's value added in Estonia (in current prices) / Estonian GDP at basic prices.

ros, corresponding to 0.3% of Estonian GDP (at basic prices). This substantial difference between exports and value added is explained by imported intermediates that Ericsson Eesti uses in its production. However, Ericsson Eesti also uses some intermediates that are sourced from Estonia. The value added of those purchased or subcontracted domestic intermediates is not included in Figure 3.2.

From the viewpoint of economic growth, it is interesting to consider Ericsson Eesti's contribution to GDP growth. As Gabaix (2011) pointed out '*idiosyncratic firm-level shocks can explain an important part of aggregate movements and provide a microfoundation for aggregate shocks*'. The contribution ($CONTR_t^i$) is calculated as follows:

$$CONTR_t^i = \frac{VALUE\_ADDED_{t,(t-1)}^i - VALUE\_ADDED_{t-1}^i}{GDP_{t-1}}, \quad (3)$$

where

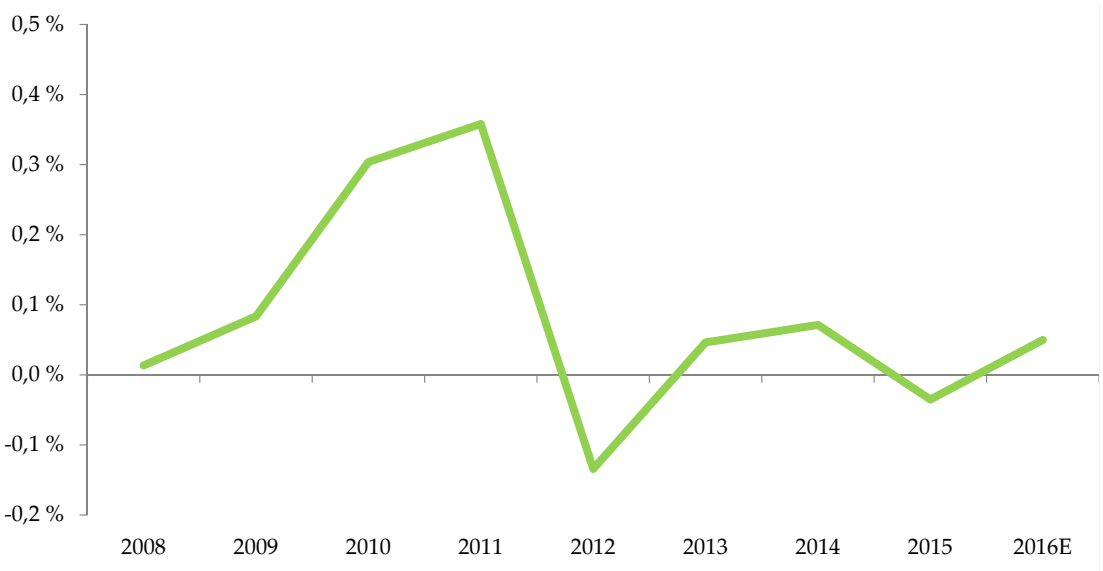
$VALUE\_ADDED_{t,(t-1)}^i$ = Ericsson Eesti AS's value added in year t (in t-1 prices)

$VALUE\_ADDED_{t-1}^i$ = Ericsson Eesti AS's value added in year t-1 (in current prices)

GDP_{t-1} = Estonian GDP in current (base) prices

It turns out that Ericsson contributed significantly to the Estonian economy in 2010–2011 (Figure 3.3). After that the contribution has decreased, and even been negative in some years (in 2012 and 2015).

Figure 3.3 Ericsson Eesti's contribution to Estonian GDP growth, percentage points



Note: The figures describe Ericsson Eesti's contribution to Estonia's GDP growth. The figure for year 2016 has been calculated as follows: First, we estimated Ericsson's exports for 2016 by assuming that Ericsson Eesti's exports' percentual growth between 2015 and 2016 is the same as the percentual growth of the Estonian total electronics exports in the same period. Second, we assumed that the ratio (value added/exports) has not changed. Third, we multiplied Ericsson Eesti's estimated exports (in 2016) by the ratio (value added/exports). The figures do not include indirect effects.
Source: Authors' calculations based on the annual reports of Ericsson Eesti AS and Statistics Estonia and Eurostat.

We proceed by analysing the impacts of changes in Ericsson Eesti AS's exports to Estonian GDP growth based on different scenarios. Currently (in December 2016), Ericsson Eesti AS is struggling and has launched a cost and efficiency programme to improve its financial performance.

From the viewpoint of the Estonian economy, the potential effects of this struggle are unclear. On the one hand, impacts will be negative if Ericsson Eesti AS's sales volumes decline or if it reduces its headcount in Estonia. On the other hand, impacts might be positive if the compa-

Table 3.1 The impact of changes in Ericsson Eesti AS's exports on Estonian GDP growth, percentage points

	(a) Assumed that value added/ exports is 4.1% (current level)	*(b) Assumed that value added/ exports is 5.7% (average 2011–2015)*
Ericsson Eesti AS's exports grow 20%	0.10%	0.25%
Ericsson Eesti AS's exports grow 10%	0.07%	0.20%
Ericsson Eesti AS's exports decline 10%	0.01%	0.12%
Ericsson Eesti AS's exports decline 20%	-0.03%	0.07%

Source: Authors' calculations.

ny will transfer manufacturing operations from other countries to Estonia. In Table 3.1, we have calculated the GDP impacts of various scenarios concerning the development of Ericsson Eesti AS's exports.

If Ericsson Eesti AS's exports (in market prices) from Estonia change by 20%, the impact on GDP growth will be fairly modest. There are two main reasons for these results. First, the major driver is the relatively low level of value added compared to exports. Based on the current level of value added to exports (4.1%), the 20% decline in Ericsson Eesti AS's exports (in market prices) would diminish Estonian GDP growth by only 0.03 percentage points (column *a* in Table 3.1). In addition to value added, the second driver of growth contributions is the fact that prices decline rapidly in the electronics industry. During the past five years, prices in the Estonian electronics industry have experienced an average annual decline of 12 per cent[4].

It should be noted that the ratio of value added to exports (concerning Ericsson Eesti AS) has recently dropped to 4.1% (in 2015). The corresponding figure in the period 2011–2015 was, on average, 5.7%. In column (b), we present the results based on an assumption that the ratio returns to this longer-term level. Our results highlight the importance of the value added ratio. If Ericsson Eesti AS's exports (in market prices) drop by 20% while the value added ratio increases to 5.7%, the joint effect on GDP growth will be positive (+0.07 percentage points).

4 Exports versus Value Added: Lessons from the Medium-sized Enterprise Hekotek AS

In this chapter, we take a closer look at firm-specific value chains. We analyse the role of the Estonian-based firm Hekotek AS, an Estonian company specializing in woodworking technologies that focuses on the manufacturing of sawmill and energy sector equipment. Hekotek AS employs a staff of 100 people. In 2015, the company reported revenue of 54.7 million euros.

4.1 Data description and methodology

We chose Hekotek as our case company because it is an export-oriented company with large-scale design and manufacturing operations in Estonia. Our focus is to analyse Hekotek's exports and the value added created in Estonia, comparing Ericsson Eesti AS and Hekotek AS from the value added perspective for the year 2015.

The core data in this study were directly provided by Hekotek itself. These data consisted of a) product- and firm-level information on the prices of intermediate products when purchased by Hekotek AS from subcontractors, and b) sales to customers. The data were collected in two semi-structured workshops with Hekotek's top management—i.e., their chief executive officer, chief financial officer and one other person from their information and technology department—at the company's headquarters in Estonia between June and December 2016. Each

[4] The calculation is based on Statistics Estonia data and uses the following time series concerning the electronics industry: Value added at current prices and chain-linked volume, change compared with previous period, percentages. First, we used these figures to calculate the value added in *t-1* prices. Second, we calculated the price indexes by dividing the value added (in *t* prices) by value added (in *t-1* prices). Then, we assumed that the prices of Ericsson's products have changed in the same amount as they have in Estonia's overall electronics industry.

workshop lasted two to three hours. The workshops were followed by emails to complete the data collection. The primary sources of Hekotek's financial information were the company's chief executive officer and the chief financial officer. The workshops were used to collect firm and product-specific financial data, including the following:

- Hekotek's exports from Estonia
- sales pricing
- the firm-level income statement and balance sheet
- the bill of materials, including the price and the name of each component's supplier
- the list of all suppliers.

Because Hekotek had limited financial information about their suppliers, we used the suppliers' financial statements and balance sheets, as reported to the Estonian public authorities and as indicated in the ORBIS database by Bureau van Dijk Electronic Publishing (DvDEP). For the companies that we identified as direct suppliers to Hekotek AS, all available financial statements and balance sheets were examined. When company records were missing from the database, we resorted to corresponding information on companies identified as their direct competitors.

Value added breakdown at the firm-level

At the firm-level, the total value added (Y_t^i) by firm *i* in year *t* equals its net sales. This amount consists of all value-adding activities by firm *i* itself ($VALUE\_ADDED_t^i$) and the value added by each tier *c* in the rest of the value chain.

$$Y_t^i = VALUE\_ADDED_t^i + \sum_{c=1}^{N} Y_t^c \tag{4}$$

To keep the breakdown between the value chain participants simple, we divide the total value added into three categories: Hekotek AS itself, first tier suppliers, and suppliers of suppliers (2nd tier and onwards). First, we calculate the value added by Hekotek AS by using equation (1) presented before (in this case *i*=Hekotek AS).

Then we calculate the value added by 1st tier suppliers ($Y_t^{c=1}$) by using the information of Hekotek's annual purchases (P_t^s) from each of its first tier supplier *s* and multiply that amount by the value added margin[5] of the supplier ($VA\_MARGIN_t^s$), and then sum up those figures:

$$Y_t^{c=1} = \sum_{s=1}^{X} P_t^s \, x VA\_MARGIN_t^s, \tag{5}$$

where

$$VA\_MARGIN_t^s = \frac{Operating\_profit^s + Depreciation^s + labor\_costs^s}{Net\_sales^s} \tag{6}$$

By manipulating the equation (4) it is easy to solve the value added created by suppliers on 2nd and further tiers (denoted by $Y_t^{c=2}$):

[5] The ORBIS database does not include the item 'rents'.

$$Y_t^{c=2} = Y_t^i - VALUE\_ADDED_t^i - Y_t^{c=1} \quad (7)$$

Until now, we have described how to calculate value added by value chain participants without taking its geographical location into account. To approximate the geographical breakdown of the total value added we proceed as follows. The total value added is allotted into four geographical regions: Estonia, Finland, other EU countries and the rest of the world. We approximate the geographical breakdown separately for the first tier suppliers and further tier suppliers (2nd tier and onwards).

For each of the first tier suppliers, we allocate the value added according to their headquarter location. Thus, when a first tier supplier has its headquarter (firm headquarters, not the headquarters of the entire group) in Estonia, we allocate the value added by that supplier to Estonia. Respectively, if the headquarter is in Finland, we allocate the value added by that supplier to Finland. Most of Hekotek's suppliers are companies that operate locally without their own foreign subsidiaries. Therefore, all of their manufacturing, R&D and other business functions are co-located in a single country.

For each of the further tier suppliers (2nd tier and onwards) geographical allocation is more difficult because our data does not include information about the suppliers of the first tier suppliers. As a result, we have allocated the value added by the further tier suppliers by using the following principles:

1) If the 1st tier supplier is located in Estonia, we divide the value added created by its supply chain equally to all regions except Finland (1/3 to Estonia, 1/3 to EU others, and 1/3 to others). This is due to the fact that in the absence of accurate information, we consider it is improbable that the proportion of sourcing performed by an average Estonian company from Finland would be in any way significant for our intents and purposes.

2) If the 1st tier supplier is located in Finland, we divide the value added created by its supply chain equally to all regions except Estonia (1/3 to Finland, 1/3 to EU others, and 1/3 to others). This is due to the fact that in the absence of accurate information, we consider it is improbable that the proportion of sourcing performed by an average Finnish company from Estonia would be in any way significant for our intents and purposes.

3) In cases in which a 1st tier supplier is headquartered in EU country other than Estonia or Finland (EU others), the value added of that supplier's suppliers is equally distributed over two regions: 1/2 to EU others, and 1/2 to others. In cases in which a supplier is headquartered outside of the European Union (the rest of the world), the value added of that particular supplier's suppliers is completely allocated to the rest of the world.

Although we recognize that the geographical division of the value added by the further tier suppliers (2nd tier and onwards) is a ballpark estimate, it is our belief that summed up these estimates are at least of the right order.

Value added breakdown at the product-level

In the product-level analyses we followed mainly the same principles as in the firm-level analyses. At the product-level, the total value added (U) of the case product equals its sales price

(without VAT). This consists of all the value adding activities of firm *i* (in our case Hekotek AS) related to the case product (*VALUE_ADDED*) and the value added of each tier *c* in the rest of the value chain of the case product.

$$U = VALUE\_ADDED + \sum_{c=1}^{N} U^{c} \tag{8}$$

We calculate the value added created by Hekotek AS to this product by subtracting all purchased components and services (related to the case product) from the price for which Hekotek sells the product (U). We do this in two steps. The first step is straightforward because our product level data includes all the components and services that are directly related to the case product, along with their prices. Thus, the sum of these direct purchases is subtracted from the sales price. The second step is more complex because we have to allocate some share of the indirect purchases to the product level. These indirect purchases are not related to any single product but rather concern the case company in general. These include, for example, purchases related to travelling, advertising, technology and auditing. Based on the information obtained from the CFO (Chief Financial Officer) of Hekotek, we allocate a share of these indirect purchases to the case product. Due to confidentiality agreement made with the case company, we are not allowed to brealdown these purchases in detail.

Then we calculate the value added of the 1st tier suppliers in a similar way as in the case of the firm-level analysis. The case product includes 1 776 purchased items. First, we multiply the price of a component or other item h (P_h^f) purchased from supplier f by the value added margin[6] of the supplier f (VA_MARGIN^f), and then sum up those figures:

$$U^{c=1} = \sum_{h=1}^{X} P_h^f \, x VA\_MARGIN^f \,, \tag{9}$$

where

$$VA\_MARGIN^f = \frac{Operating\_profit^f + Depreciation^f + labor\_costs^f}{Net\_sales^f} \tag{10}$$

The geographical breakdown of the case product is calculated by using the same principles as in the firm-level analyses.

We first examine and compare the exports and value added contributions of Hekotek AS and Ericsson Eesti AS to the Estonian economy. After firm-level results, we deepen the analysis by focusing on a single product (one project delivery) by Hekotek AS.

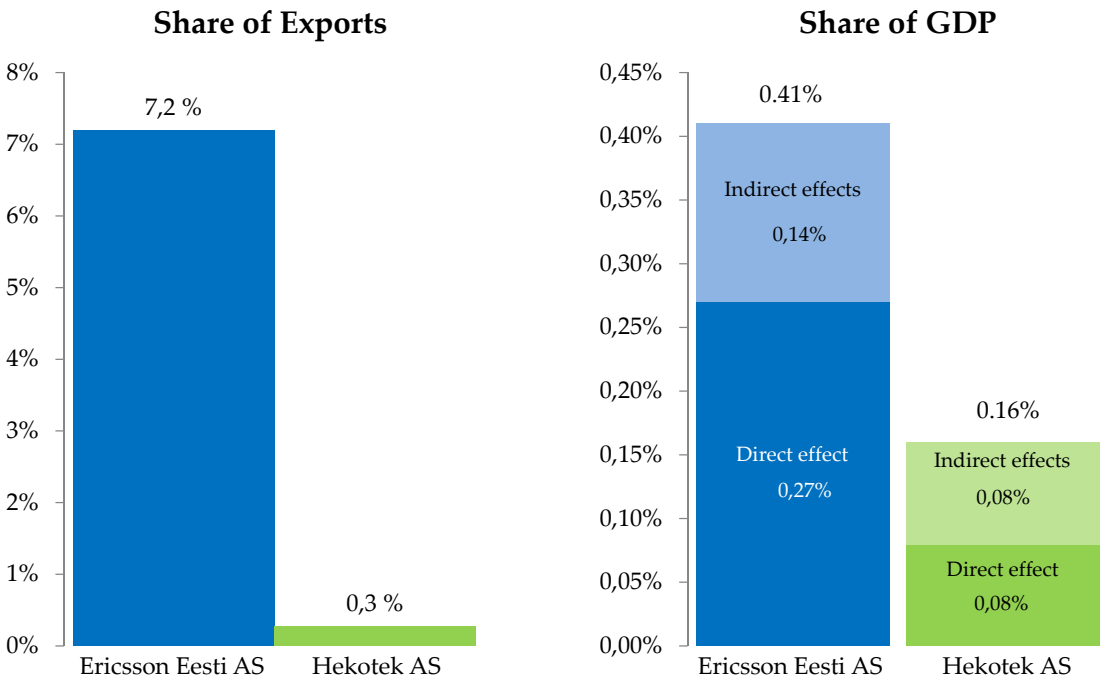
4.2 Firm-level analysis

As presented in Figure 3.1, the value of Ericsson Eesti's exports totalled 1.15 billion euros in 2015. During the same time period, Hekotek's exports totalled 39 million euros. Whereas Ericsson Eesti AS thus represented 7.2% of Estonia's total exports, Hekotek's share was a mere 0.3% (the left-hand side of Figure 4.1.).

As specified in Figure 3.2, the value added by Ericsson Eesti AS in Estonia was less than 50 million euros in 2015, comprising 0.27% of the Estonian GDP (at basic prices). This represents

[6] The ORBIS database does not include the item 'rents'.

Figure 4.1 Relative shares of Hekotek AS and Ericsson Eesti AS of total Estonian exports in 2015



Source: Authors' calculations.

the direct effect of Ericsson Eesti AS to the Estonian GDP (the right hand side of Figure 4.1). The corresponding effect of Hekotek AS exceeds 13.6 million euros, translating to 0.08% of the Estonian GDP (at basic prices).

We proceed by analysing the multiplier (indirect) effects of the case companies inflicted by their purchases from Estonia. To our knowledge, Ericsson purchases very few electronic or other physical components from Estonia[7]. However, the company also purchases services and other intangibles, at least some of which are definitely acquired from Estonia. In 2015, these purchases totalled 42.1 million euros[8]. Although we do not have accurate information about the sourcing countries of these items, we can make educated guesses regarding their countries of origin because the annual report includes a detailed breakdown on the types of purchased services (see Ericsson Financial Report 2015, page 21, amendment 13)[9]. When these multipli-

[7] The annual reports of Ericsson and our other sources do not include information about countries from which Ericsson sources its components and materials. Based on our knowledge of the electronics industry, we assumed that all components and materials are imported outside of Estonia.

[8] Ericsson Eesti's business service purchases are reported as 42.06 million euros (Ericsson Financial Report 2015, page 21, amendment 13).

[9] We assumed, for instance, that Ericsson Eesti AS purchased all of its energy from Estonia. We divide the purchase costs of training, IT and hired personnel equally between Estonia and the rest of the European Union. Correspondingly, we divide the purchase costs of office, travel and other assorted purchases equally between Estonia, the rest of the European Union, and the rest of the world. As a robustness test, we changed the location assumptions regarding the subitems with the most uncertainty and recalculated the indirect effects of Ericsson Eesti AS. Based on these calculations, Ericsson Eesti AS's total contribution (including the value added of Ericsson Eesti AS itself and the value added created through its purchases from Estonia varies between 66 million and 76 million euros, corresponding to a minimum of 0.38% and a maximum of 0.44% of the Estonian GDP.

er effects of are taken into account, Ericsson Eesti AS's share of the Estonian GDP increases to 0.41%.

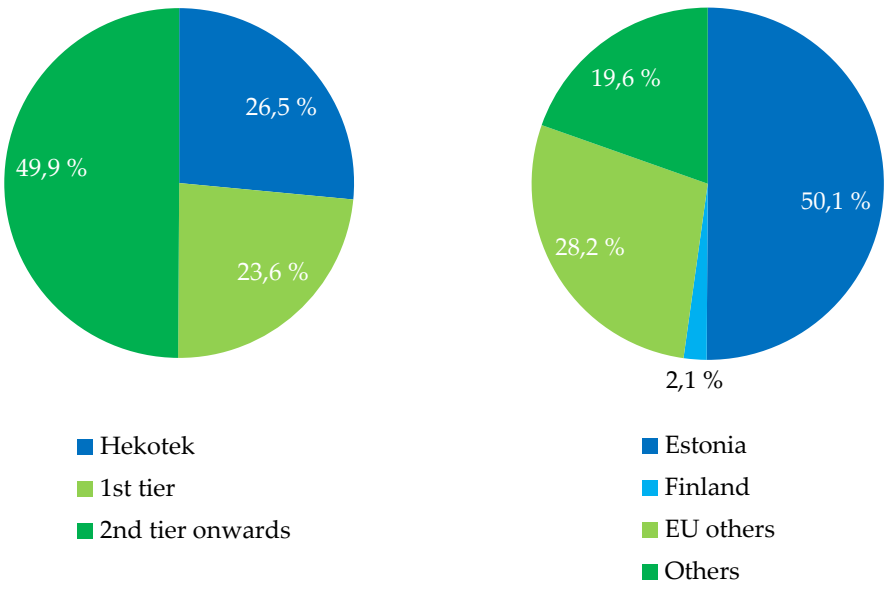
In contrast to Ericsson Eesti, Hekotek AS uses many intermediate inputs purchased from Estonian companies from within the Estonian economy. These purchases from Estonia form the basis of our multiplier effect calculations but, as described earlier, these amounts are not entirely attributable to Estonia. Based on the methodology described in Chapter 4.1, Hekotek's contribution increases to 27.3 million euros, which corresponds to 0.16% of the Estonian GDP (at basic prices) (see the right-hand side of Figure 4.1).

These results imply that the perceived role of the largest companies in the economy varies significantly depending on the indicator. Due to the large variation in the amounts of intermediates and their sourcing countries, export figures poorly describe the significance of companies to the Estonian GDP.

We proceed by analysing more deeply the value creation of Hekotek AS. First, we consider the organizational breakdown of value added between the value chain participants. We then analyse the geographical breakdown of the value added, also including regions other than Estonia.

On average, Hekotek AS's value added contribution to each product it designs, manufactures and delivers to its final customer is 26.5% (see Figure 4.2). The remaining value added—namely, 73.5% of the product price—is divided between the first tier of suppliers providing Hekotek AS with intermediate inputs directly (23.6%), and lower tiers of suppliers that provide intermediates to higher tiers of suppliers (49.9%).

Figure 4.2 Hekotek's total added value by supply chain participants and economic geography (firm-level)



From the perspective of economic geography, the average total value added of Hekotek's products is divided as follows: the Estonian economy receives 50.1% of every euro of sales by Hekotek to its customers, Finland receives 2.1%, other EU countries receive 28.2%, and countries outside of the EU capture 19.6%. To put these numbers into perspective, in the case of Ericsson Eesti AS, the Estonian economy receives an average of 6% of every euro of sales (see Figure 3.2 for an illustration).

4.3 Product-level analysis

We deepen our analysis by focusing on a single product (one project delivery) by Hekotek AS. Based on our interviews, the chosen product/project is representative of all of Hekotek AS's operations. The case product/project is composed of several machines and other equipment. The product structure includes as many as 1 776 different parts or components.

Unlike a broad firm-level analysis, a product-level analysis seeks to identify cause and effect relationships to objectively assign the value added of each generic business function[10] and the purchases involved down to the component level. Once the value added produced by each activity has been identified, it is then attributed to each product/project in relation to their use in each activity. In this way, the product-level analysis describes the value added of each product/project on a more detailed level and directs attention to finding new ways for decreasing costs of inputs and increasing profits, thus increasing the total added value produced by companies (Seppälä et al., 2014).

Next, we illustrate the product-level value added contributions of various supply chain participants and geographical distributions. We calculate the value added of Hekotek AS and each of its suppliers by using the methods described in Chapter 4.1.

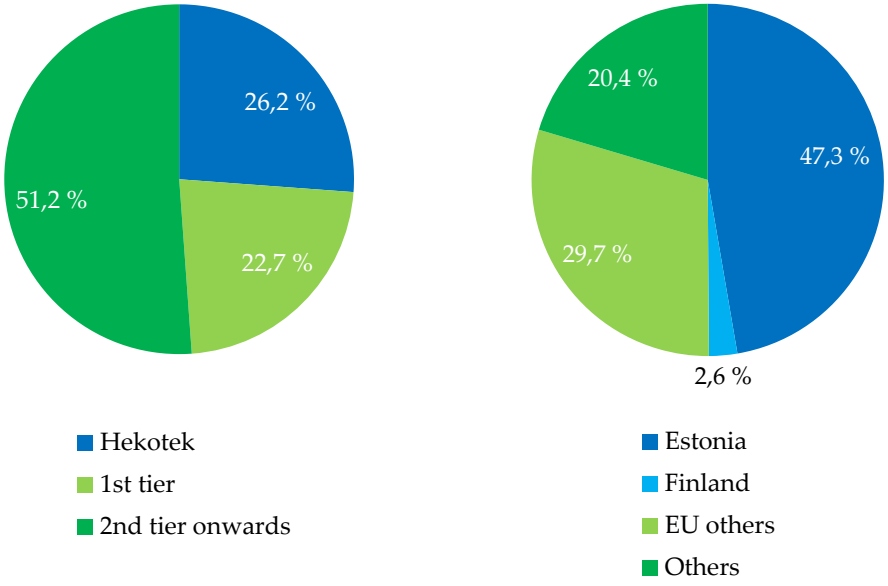
When examining a specific product designed, produced and assembled by Hekotek AS, our analysis shows that Hekotek's value added contribution is 26.2%. The rest of the value added, 73.8%, is divided between the first tier and the lower tiers as follows: the first tier constitutes 22.6% and the second tier and other tiers capture 51.2% (see Figure 4.3).

From the economic geography perspective, Hekotek's product-level value added is divided as follows: the Estonian economy receives 47.3% of every euro from Hekotek selling a single product to a customer, Finland receives 2.6%, other EU countries receive 29.7%, and countries outside of the EU receive 20.4%.

These analyses and results indicate that it is important not only to understand companies' exports as a part of the national economy but also to understand each company's value added contribution and its multiplier effects.

[10] Generic business functions comprise of strategic management, product or service development, marketing, sales and account management, intermediate input and material production, procurement, operations, transportation, logistics and distribution, general management and corporate governance, human resource management, technology and process development, firm infrastructure (e.g. building maintenance and IT systems) customer and after-sales service (for more information, see Sturgeon and Gereffi, 2009).

Figure 4.3 Hekotek's total added value by supply chain participants and economic geography (product-level)



5 Conclusions and implications for policy

In this study, we analysed Estonia in GVCs. Our results are based on statistical analyses using WIOD data (World Input-Output Database), firm-level data (Ericsson Eesti AS and Hekotek AS) and product-level data (Hekotek AS).

Our results suggest that Estonia is heavily involved in production that is both vertically and geographically fragmented. Close to 70% of Estonia's total exports are intermediate goods and services that are used in later stages of production abroad. This share is higher the average in both the EU and other Baltic countries but is lower than in Finland. Estonia exports the majority of its intermediates to its neighbouring countries. These countries, however, are not necessarily the ultimate destinations of products exported from Estonia. From the viewpoint of trade policy, it would be interesting to analyse what the ultimate destinations of Estonian exports actually are. The role of intermediates is also substantial in imports. Two thirds of Estonian imports are intermediates, a share that is very close to the average of both EU-28 countries and all countries.

Our case study of Ericsson Eesti AS's operations in Estonia confirms the important role of imported intermediates. Because there are large amounts of imported intermediates, export figures poorly describe the significance of Ericsson Eesti AS for Estonian GDP. In terms of (gross) exports, Ericsson Eesti AS accounts for as much as 7.2% of Estonia's total exports. Thus, the role of a single company is substantial. The picture, however, changes remarkably when we analyse the value creation in Estonia. Our results reveal that Ericsson Eesti AS's (including multiplier effects through its purchases from Estonia) share of Estonian GDP is only 0.41 percent. In comparison, Hekotek AS represents 0.2% of Estonia's exports, but our results reveal that if the multiplier effect is taken into account, Hekotek's share of the Estonian GDP

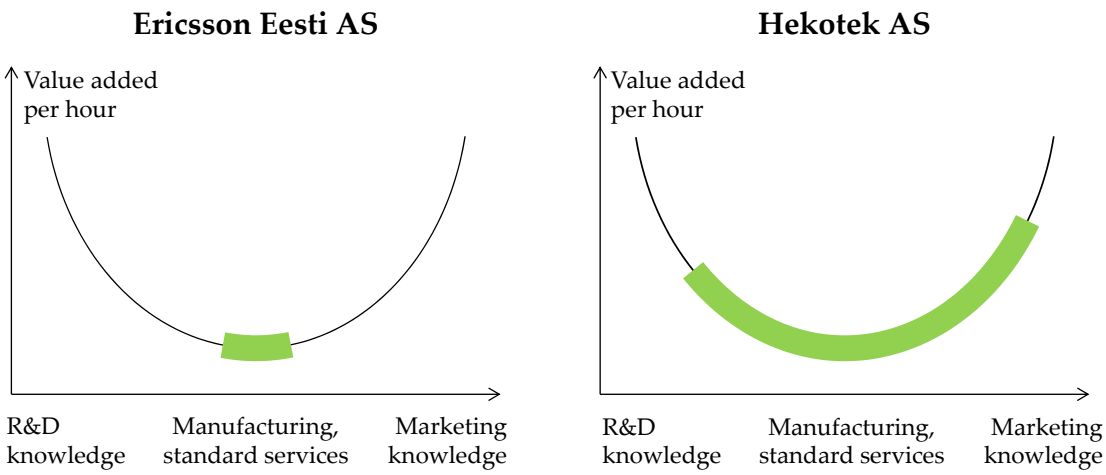
is estimated at 0.16%. To elaborate, in 2015, Nokia—the firm with the greatest value added created in Finland (including multiplier effects)—accounted for 1.5 percent of Finnish GDP (Ali-Yrkkö et al., 2016; for more information see also Ali-Yrkkö et al., 2015). The big difference between the exports and the value added figures explains why changes in Ericsson Eesti AS's exports have a fairly modest impact on Estonia's GDP growth overall.

Based on the above considerations, we conclude that overlooking the multiplier effect by focusing on export figures alone can lead to drastically varying observations from when taking the effect into account. Restricting oneself to the metrics of exports, one might be inclined to conclude that it takes 36 Hekotek AS-sized companies to make up for one Eesti Ericsson AS in the Estonian economy. However, by acknowledging the multiplier effect and expanding one's focus to the total value added created in the Estonian economy, one can conclude that it only takes two and a half such companies to substitute for the effects of one Ericsson Eesti AS.

In addition to the multiplier effect, another striking difference between Ericsson Eesti AS and Hekotek AS is that of the labour tasks housed by the two companies in Estonia. Ericsson's operations in Estonia consist almost purely of manufacturing activities, whereas Hekotek has a full range of activities located in Estonia (Figure 5.1). These activities also include R&D, design, selling and marketing tasks. Furthermore, Hekotek's intellectual property is also located in Estonia.

Our results have several policy implications. National accounts take great care in distilling the value added created within national borders, whereas imports and exports are based on the gross-value concept. Our case study concerning Ericsson Eesti AS (a subsidiary of Swedish-based multinational company focused on the telecommunications industry) shows that when we take imported intermediates into account and use value added-based information, we come up with strikingly different conclusions about the role of Ericsson Eesti AS in Estonia than when using gross value of exports.

Figure 5.1 The positioning of the two case companies on the smiling curve



Note: The green curves describe tasks located in Estonia.
Source: Adapted from Tsai, T. and Everatt, D. (2006); Mudambi (2008).

This finding seems to suggest our policy conclusion—namely that concerted efforts should be taken to utilize value-added based trade statistics. To dig deeper into the consequences of global trade in tasks, value added-based data on trade flows is needed. Two international databases (Trade in Value Added by OECD and WIOD by Groningen University) can be used in comprehensive analyses. Moreover, national trade statistics can be combined with national input-output statistics to analyse trade in terms of value added. Such trade data based on the metrics of value added would reveal new information about which countries are in fact the most important trade partners for Estonia. Consequently, this could prove highly relevant to the Estonian trade policy.

Our second policy conclusion is related the fact that firm-level shocks in very large companies (such as Ericsson Eesti AS) can explain an important part of aggregate economic fluctuations. Therefore, economic policy makers should seek to understand whether the fluctuations in the economy are caused by a mere handful of highly influential companies, or by a larger group of assorted actors. In the pursuit of this knowledge, understanding which companies are the most significant ones for the economy is a mandatory prerequisite.

Thus, we suggest that to determine the degree of multiplier effects present in the Estonian economy and to identify the key companies in this respect, a list should be compiled of the largest companies in terms of value added, together with their domestic purchases. Although these purchases cannot be determined directly from any publicly reported financials, they are essential to determining which companies contribute the most value added with the highest multiplier effects, along with how large a portion of increased exports can be explained by an increase in imported intermediates. (For further information, see Ali-Yrkkö et al., 2015; Ali-Yrkkö et al., 2016)

Our third policy conclusion concerns the circumstances that enable global value chains to operate. It is paramount to take steps to ease and streamline international trade procedures and to develop and invest in ports, airports, fast data communications and other supporting infrastructure required by foreign trade. This policy conclusion is not directly derived from our results but it is more of a generic suggestion, enabling the functioning of global value chains in the first place.

Our fourth policy conclusion relates to the smiling curve presented in Figure 5.1, and concerns the question of what steps should Estonian companies take to move to higher value added positions in global value chains, and how could the government support these efforts. It is by no means easy to come up with a quick remedy that the government could apply in order to help companies orchestrate GVCs and develop their brands. What the government can quite easily do, however, is to support the R&D efforts of Estonian companies across the board. Value added in GVCs is often dominated by their intangible aspects, including the creation and appropriation of various forms of intellectual property. By owning intellectual property, such as patents, a company may reach a gate-keeping position in GVC. R&D operations tend to be resource-intensive and SMEs often lack the adequate knowledge and the capabilities to pursue such upgrading efforts (for additional information on value chain upgrading methods, see Kaplinsky and Morris, 2001; Fernandez-Stark et al., 2012). In addition to their direct effects, R&D investments also create spillover effects within the economy (Griliches, 1979).

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