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ORIGINAL PAPER

Export and productivity in global value chains: comparative evidence from Latvia and Estonia

Konstantins Benkovskis[1,2] · Jaan Masso[3] · Olegs Tkacevs[1] · Priit Vahter[3] · Naomitsu Yashiro[4]

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Abstract

This paper investigates the effect of exporting on productivity, often referred to as "learning by exporting", in the context of global value chains (GVCs). Although the rise of GVCs raised hopes that it would facilitate knowledge transfer from technologically advanced foreign buyers, empirical evidence on its role in learning by exporting is scant. We use data of Latvian and Estonian firms to observe how learning by exporting differs across types of exports associated with different kinds of participation in GVCs. We find that productivity gains resulting from export entry are significantly larger for specific types of exports, such as exports of knowledge-intensive services, intermediate goods and re-exports. These exports correspond to activities that generate high value added within GVCs. Our findings indicate that the intensity of interactions with global buyers alongside exporters' room for technology catch-up define the extent of learning by exporting in GVCs.

Keywords Productivity · Knowledge transfer · Global value chain · Exports · Latvia · Estonia

JEL Classification F12 · F14 · O19 · O57

1 Introduction

Firms that start exporting may improve productivity by absorbing new knowledge from foreign buyers. However, empirical evidence on this so-called "learning by exporting" (LBE) has been mixed at best (for example, Keller 2004; Wagner 2007). Furthermore, empirical evidence suggests that LBE is far from a general

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✉ Olegs Tkacevs
Olegs.Tkacevs@bank.lv

Extended author information available on the last page of the article

phenomenon, but is conditional on several factors including room for technological catch-up (Blalock and Gertler 2004; van Biesebroeck 2005), exports destination (De Loecker 2007) or the scope of exported goods and exports destinations (Masso and Vahter 2015). This paper explores how LBE is shaped by the types of exports, each associated with participation in different segments of global value chains (GVCs). Over the past three decades, the decline in trade, transportation and communication costs have allowed firms to fragment production processes and tasks globally, giving rise to global value chains and magnified trade volume (Baldwin 2012; Amador and Cabral 2016). Intermediate goods and services incorporated at various stages of the production process comprise more than 60 per cent of global trade (World Bank 2019). Yet, empirical evidence on the implication of GVCs to LBE is so far scant.

Case studies on GVCs have documented that GVC participation offers firms, especially from emerging economies, opportunities to absorb knowledge transfer through interaction with global buyers such as multinational enterprises (MNEs) (Gereffi 1999; Giuliani et al. 2005; Simona and Axèle 2012; Atkin et al. 2017). This notion of "learning by supplying" (Alcacer and Oxley 2014) is close to the concept of LBE. Exporters supplying highly complex or customised goods or services to GVCs may enjoy closer interaction and thus stronger knowledge transfer from global buyers. As a result, they may realise larger productivity gains than exporters supplying generic or standardised goods or services. GVC studies have also highlighted uneven distribution of value added among GVC participants (Gereffi 1999; Kaplinsky 2000; Dedrick et al. 2010). For instance, the participants supplying knowledge-intensive inputs such as core components or research and development services often create disproportionally larger value added than those supplying generic goods or services, such as assembly services. These participants also enjoy stronger bargaining power over other participants, thereby gaining larger profit margins. These observations suggest that exporters of knowledge-intensive goods or services realise larger productivity gains.

We use a matched firm-level dataset of Estonian and Latvian firms to test the above hypotheses. We examine whether LBE is stronger for some types of exports that involve stronger interactions with global buyers and are associated with activities that generate high value added within GVCs. We indeed find that exports of non-transport services and re-exports result in significantly larger productivity gains than exports of final goods. Although activities that generate high value added are often considered to be those located in upstream or far downstream segments of GVCs (for example, Baldwin 2012), we find that exporters from upstream or far downstream industries do not enjoy larger productivity gains. Our findings suggest that LBE in GVCs is defined by the scope of knowledge transfer and not by the positioning of an industry within a value chain.

This study adds several novel perspectives to the existing research on learning by exporting. First, it is a first attempt to capture LBE in the context of GVCs by exploring the heterogeneity of LBE that stems from the difference in exporters' role within GVCs. Second, it employs the estimation method by De Loecker (2013), which allows export status to affect a firm's total factor productivity (TFP) endogenously, in contrast to the majority of the previous studies on LBE that assume that

TFP levels are determined exogenously from exporting.[1] Third, the inclusion of service exporters relates this paper to a relatively small number of studies that use service trade firm-level data (such as Breinlich and Criscuolo 2011; Malchow-Moller et al. 2015).

Latvia and Estonia are suitable countries for studying the effect of exports and GVC participation on productivity, not least for their considerable room for productivity catch-up against the most advanced OECD economies (OECD 2018, 2019). Due to the small size of their economies, access to foreign markets is essential for their firms to take advantage of economies of scale and to make major qualitative changes such as upgrading technologies or improving skills. Past studies have indeed found supportive evidence of LBE for both countries (Masso and Vahter 2015). Also, higher productivity is particularly important for the competitiveness of these economies, as labour shortages due to international outward migration and population ageing fuel strong upward pressure in wage growth (OECD 2018, 2019).

The rest of the paper is structured as follows. Section 2 formulates several hypotheses on LBE in the context of GVCs through a brief review of GVC literature. Section 3 describes data and provides some descriptive statistics. Section 4 explores the determinants of export entry and estimates the impact of entry to different types of exports on firm productivity by applying the difference-in-difference analysis. Section 5 provides a conclusion.

2 Learning by exporting in global value chains

This section reviews the literature on global value chains (GVCs) and other relevant studies to deduce hypotheses on how different types of exports result in different extent of "learning by exporting" (LBE). It pays attention particularly to how each type of export differs in the extent of knowledge transfer from global buyers and in its role within GVCs.

GVCs are globalised networks of interlinked manufacturing and service activities that take place in different segments of value chains (Baldwin 2012). There is a plethora of direct and indirect evidence of knowledge transfer within GVCs through interactions between global buyers and local suppliers (Gereffi 1999; Javorcik 2004; Giuliani et al. 2005; Simona and Axèle 2012). For instance, the involvement of global buyers in suppliers' innovation and technology upgrading improves suppliers' productivity (Pietrobelli and Saliola 2008; Alcacer and Oxley 2014), although it seems to benefit mostly suppliers with sufficiently high technological capabilities (Alcacer and Oxley 2014; Brancati et al. 2017). The importance of direct buyer–seller interactions in knowledge transfer is also corroborated by observations that firms exporting directly to foreign buyers are found to outperform those exporting indirectly through intermediaries (Davies and Jeppesen 2015).

[1] To the best of our knowledge, De Loecker (2013) and Manjon et al. (2013) are the only other studies employing a similar approach to infer LBE.

Exports of intermediate goods and services are likely to involve stronger buyer–seller interactions and thus knowledge transfer than exports of final goods. For instance, Gereffi et al. (2005) argue that when the specifications of product or services are complex and cannot be codified, which is often the case for manufacture of sophisticated parts and components, global buyers seek to exchange tacit knowledge through face-to-face interactions and a high level of coordination. Furthermore, because consumption and production of services often occur simultaneously, closer buyer–seller interactions are needed to ensure that the seller delivers services that match buyers' demand (Love and Ganotakis 2013).

Exports of intermediate goods or services are also one way to participate in activities within GVCs that generate high value added. Studies on GVCs have documented very uneven distribution of value added generated by GVCs among participants (Gereffi 1999; Kaplinsky 2000; Dedrick et al. 2010; Rungi and Del Prete 2018). In general, value added is concentrated in GVC participants supplying unique inputs that define the competitiveness of final goods or services. These participants exercise strong bargaining power over other suppliers that provide more generic inputs, and appropriate the lion's share of the total value added generated by GVCs (Jacobides et al. 2006; Dedrick et al. 2010). This is the case of providers of knowledge-intensive services that increasingly define competitiveness of manufacturing, as they add higher value to final products (Miroudot and Cadestin 2017). Conversely, those supplying well-standardised and often labour-intensive goods or services (such as base materials or mass production of final goods using imported components) generate relatively low value added, as they face fierce competition that drives down their profit margins (Kaplinsky 2000).

Service exporters may also enjoy larger productivity gains than final goods exporters due to the intangibility of services (La et al. 2005; Gallouj 2002; Love and Ganotakis 2013). Since services are by nature intangible, their production involves less physical capital than goods production and relies more on knowledge-based capital that does not depreciate with production scale (Gallouj 2002; Miles 2005). This allows service exporters to scale up or replicate their services with little additional costs, thereby enjoying large economies of scale and delivering their products faster than goods exporters. This, combined with the stronger interactions with global buyers due to the inseparability of consumption and production of services, can result in a more significant improvement in productivity due to faster learning and knowledge transfer from global buyers (Contractor et al. 2007; Love and Ganotakis 2013). These observations yield our first hypothesis:

H1 Exporters of intermediate goods and services enjoy larger productivity gains than exporters of final goods.

Some types of services, such as telecommunications, energy and transportation services require large physical infrastructure. Exports of these services would then necessitate sizable upfront investments, thus creating entry barriers and limiting a quick scaling up of service production to serve foreign markets. This

motivates us to formulate the second hypothesis on LBE associated with different types of service exports, namely exports of transport services, comprising a significant segment of Latvian and, to a lesser extent, Estonian exports, and exports of other services, mostly knowledge-intensive services. Transport services and knowledge-intensive services are also likely to differ substantially in terms of value added they generate within GVCs, given their very different roles in value chains.

H2 Exporters of knowledge-intensive services enjoy larger productivity gains than exporters of infrastructure-based services, such as transport services.

Re-exports comprise an important share in Baltic states' (particularly, Latvian) trade. They accounted for 28% of Latvian merchandise exports over the period between 2005 and 2013 (Benkovskis et al. 2016). Re-exports, defined as simultaneous exports and imports of similar goods within a narrow time window (Damijan et al. 2013; Benkovskis et al. 2016), can be interpreted in two ways. First, these can be activities that involve an intensive use of imported inputs. Firms that both import and export are more productive than firms that either only export or import (Muûls and Pisu 2009; Castellani et al. 2010; Smeets and Warzynski 2013; Bernard et al. 2018). This may be due to the self-selection of most productive firms into such trade involving sunk costs for both exporting and importing, but can also be that learning effects are stronger, given that importing on its own increases productivity (Halpern et al. 2015). For example, Damijan et al. (2013) reported that 70% of Slovenian exporters engage in exports and imports of products from the same 8-digit Combined Nomenclature product category, and these exporters enjoy larger improvements in productivity and profitability compared to other exporters. Second, re-exports can be a trade intermediation service that joins parties with large information asymmetries (Feenstra and Hanson 2004). In this case, re-exporters may generate substantial value added by providing knowledge-intensive services that interlink participants within GVCs. Indeed, Latvia's re-exports have been associated with non-negligible profit margins (Benkovskis et al. 2016). These observations motivate our third hypothesis:

H3 Re-exporters, or firms that export and import same goods, enjoy larger productivity gains than other goods exporters.

The extent of LBE is also shaped by several characteristics of exporters, namely, their technological capabilities that define their ability to absorb external knowledge and thus room for learning. Exporters with initially high productivity levels are likely to have higher technological capabilities, which would allow them to absorb more external knowledge acquired through interactions with global buyers (Cohen and Levinthal 1989, 1990). This hypothesis is supported by studies such as Dai and Yu (2013), Albornoz and Ercolani (2007) or Liu and Buck (2007) that document that larger R&D expenditure is associated with higher impacts of exporting on productivity. On the other hand, exporters with initially

lower productivity levels have more to gain from exposure to foreign knowledge sources due to the larger gap in technology and productivity against the frontier. This "technology gap" effect is the firm-level equivalent of the idea that one can expect faster convergence with the productivity frontier and larger technology transfers from abroad in the case of more backward regions or countries [e.g., as argued in Findlay (1978), building on Veblen (1915) and Gerschenkron (1952)]. Indeed, Salomon and Jin (2008) reported that Spanish firms from technologically lagging industries enjoy larger improvements in productivity from exporting than those from technologically advanced industries. Also, Love and Ganotakis (2013) find that British SMEs with relatively low innovation intensity tend to gain more from exporting. It is therefore not clear a priori whether the absorptive capacity or this technology gap effect is more important for LBE. However, we expect that LBE is shaped by the initial productivity level of exporters in one way or another:

H4 Productivity gains from exporting are dependent on exporters' initial productivity levels.

3 Data and descriptive statistics

3.1 Data

This paper uses administrative data on financial statements and international trade on Latvian firms during the period from 2006 to 2015 and Estonian firms from 1995 to 2014. We exploit the Central Statistical Bureau's (CSB) comprehensive firm indicator dataset and Latvijas Banka's dataset on foreign ownership to obtain a database on Latvian firms' balance sheets and profit and loss statements as well as additional information including the number of employees, foreign capital shares, and industrial classification. We further match the database with customs data on eight-digit Combined Nomenclature (CN8)-level goods trade flow provided by the CSB, and Latvijas Banka's services trade database. Similarly, we use the Statistics Estonia's Business Registry and the Statistical Profile of Enterprises to build a comprehensive database on Estonian firms' corporate activities. We then match it with Statistics Estonia's database on international goods trade and Eesti Pank's dataset on services trade.

Data processing was harmonised between the Latvian and Estonian datasets to the greatest possible extent to allow comparison between these two countries. Establishments in financial and insurance, public administration, education, health care, arts and entertainment sectors are excluded. In addition, observations with extreme values were identified and dropped using the method by Lopez-Garcia et al. (2015), that involves a multi-step exclusion procedure based on the values of various ratios (capital, turnover, labour costs, intermediate inputs and value added to labour or capital). We end up with a sample of around 100,000 Latvian firms and 90,000 Estonian firms in the most recent year.

Table 1 The share of exporters in total number of firms, employment and turnover in the most recent year, %

Type of exports	Latvia			Estonia		
	Number of firms	Employment	Turnover	Number of firms	Employment	Turnover
All exporters (goods and services)	4.6	30.7	51.7	4.1	41.4	57.9
Goods exporters	4.2	24.3	43.2	2.1	26.5	42.8
Exporters of intermediate inputs	2.3	12.1	19.8	1.3	18.4	29.5
Exporters of final goods	2.1	11.9	19.5	0.7	10.3	11.3
Re-exporters	1.8	14.2	31.0	0.7	20.2	33.9
Service exporters	0.4	8.1	12.1	2.4	23.9	32.5
Transport service exporters	0.3	4.7	6.2	0.0	2.2	1.7
Non-transport service exporters	0.2	3.6	6.4	2.4	22.2	31.6

The most recent available year for Latvia is 2015 and for Estonia it is 2014

3.2 Types of exporters and measures of upstreamness

We define intermediate and final goods exporters as firms exporting products categorised as intermediate and final goods respectively in the OECD BTDIxE end-use classification, which is used to construct the OECD-WTO Trade in Value Added (TiVA) database. This allows a comparison of our findings with recent GVC studies that employ a TiVA database (for example, Amador and Cabral 2016). Following Benkovskis et al. (2016), we define re-exporters as firms exporting and importing goods that fall under the same 8-digit Combined Nomenclature (CN) code within the period of 12 months. As regards service exports, we distinguish transport service exporters from other service exporters, given the considerable share of transport services in service exports, particularly in Latvia, and their dependence on -physical transportation infrastructure, which may result in different pattern of LBE as compared to other service exports (see above). Non-transport service exports include exports of knowledge-intensive services such as ICT and professional services, that comprise important shares in service exports in both countries (OECD 2018, 2019).

In the most recent year, about 4–5% of Latvian and Estonian firms exported either goods or services. Latvian exporters are mainly goods exporters, while in Estonia there are almost as many firms exporting services as exporting goods (Table 1). While these shares are not mutually exclusive, as some firms export both goods and services, such firms only comprise small shares (2.7% and 10.7% of the total number of Latvian and Estonian exporters over 2006–2014, respectively). In Latvia, about 2% of firms are intermediate goods exporters, while about the same share of firms are final goods exporters. In Estonia, the share of firms exporting intermediate goods (1.3%) is higher than the share of final goods exporters (0.7%). The share of re-exporters is somewhat higher in Latvia than in Estonia. Furthermore, more than

half of Latvian service exporters export transport services, while almost all Estonian service exporters export non-transport services.

3.3 Exporters' position in GVCs

Knowledge-intensive activities that generate high value added within GVCs are often considered to be located in the upstream or far downstream segments of GVCs (Baldwin 2012; Ye et al. 2015). We employ two indicators to capture the position of firms within GVCs. The first is an industry-level index of the upstreamness proposed by Antràs et al. (2012) and Fally (2011), which measures the average distance between an industry's production and the final demand for its product.[2] A high value implies that an industry is located in upstream segments of GVCs. The second is a firm-level indicator, proposed by Kee and Tang (2016), which captures the share of intermediate input in a firm's output. A lower share indicates that a firm is participating in upstream segments of GVCs, as such a firm would require fewer intermediate inputs than firms in more downstream segments that, for example, assemble imported parts into final goods. We also observe the share of imported inputs in total intermediate inputs: a higher share of foreign intermediate inputs indicates greater involvement in the GVCs.

Table 2 shows that exporters in both countries belong to industries that are rather similar in terms of their positioning within production chains, as the average levels of the upstreamness index are similar across export types. However, as expected, exporters of final goods exhibit a somewhat lower index, implying that they are located in more downstream segments than exporters of intermediate goods or re-exporters. Regarding the intensity of intermediate input use in production, the provision of non-transport services seems to require a relatively smaller share of intermediate input. Interestingly, in Latvia this share is dominated by foreign intermediate input, which accounts for as much as 70%, whereas in Estonia it is almost exclusively domestic.

4 The effect of GVC participation

4.1 Determinants of GVC participation

We now move to a causal analysis on the effects of entry into different types of exports on productivity. To this end, two elements are essential: the definition of export entry and an estimate of firm-level productivity.

[2] We follow Antràs et al. (2012) and Fally (2011) to measure upstreamness as $U = [I - \Delta]^{-1}1$, where U is the vector of upstreamness measures by industry ($U \geq 1$, larger values correspond to higher levels of upstreamness), Δ denotes the square matrix containing the shares of sector i's total output that is purchased by industry j, and $\mathbf{1}$ is a column vector of ones. The upstreamness of Latvian and Estonian industries between 2000 and 2014 was calculated using data from the World Input–Output dataset (WIOD, www.wiod.org) and is available upon request.

Table 2 Summary of upstreamness measures

Type of exports	Latvia			Estonia		
	Upstreamness index	Intermediate input share	Foreign share	Upstreamness index	Intermediate input share	Foreign share
All exporters (goods and services)	2.72	0.65	0.34	2.75	0.60	0.16
Goods exporters	2.71	0.65	0.33	2.70	0.71	0.30
Exporters of intermediate inputs	2.83	0.68	0.27	2.76	0.71	0.32
Exporters of final goods	2.53	0.65	0.31	2.56	0.69	0.39
Re-exporters	2.69	0.59	0.65	2.69	0.71	0.51
Service exporters	2.81	0.57	0.45	2.79	0.54	0.08
Transport service exporters	2.82	0.64	0.29	2.04	0.63	0.53
Non-transport service exporters	2.78	0.45	0.71	2.80	0.54	0.07

While the most general definition of export entrant would be firms that did not export at time t–1 but do so at time t, these firms also include intermittent exporters that stop exporting soon after entry. Such firms may not be able to absorb significant knowledge from foreign markets or global buyers.[3] This paper therefore sets two different definitions for export entry. In the baseline, we employ the most general definition of export entrants. However, as a robustness analysis, we define export entrants as firms that did not export in both t–2 and t–1 and start to export in period t and continue exporting in period $t+1$. We call such firms *persistent* entrants.

This paper employs total factor productivity (TFP) as a measure of firm-level productivity. Since TFP is not observable from the data, we estimate it using the approach by De Loecker (2013). This approach assumes that TFP evolves according to an endogenous Markov process where previous export status and export strategies (export intensity, the number of exported products and exports destinations) exert an additional impact.[4] Detailed information on the estimation procedure is available in online appendix.

The causal effect of export entry should be inferred by observing whether firms that started exporting experience larger gains in productivity level compared to a hypothetical case, where these firms did not start exporting. Since such a counterfactual is not available, we proxy it with the change in productivity of non-exporting firms. In order to address the self-selection of firms with originally superior performance (including higher productivity levels) into exporting, we employ the Propensity Score Matching (PSM; Rosenbaum and Rubin 1983) which constructs the sample of non-exporters with very similar ex-ante likelihood of export entry with the actual participants. This approach has been widely employed by previous studies on LBE (Girma et al. 2004; De Loecker 2007).

The first step in this exercise is a Probit estimation of the probability (propensity score) of export entry. The probability for a firm to start exporting is assumed to be a function of its productivity level and other factors that are likely to enable firms to overcome the initial costs of export entry (the vector Z on the right). They include firm size, firm age, liquidity ratio, return on assets, capital-to-labour ratio, state and foreign ownership—the covariates that were used in earlier studies.

$$Prob\left(Exportentry_t\right) = \Phi\left(\Pr oductivity_{t-1}, Z_{t-1}\right) \tag{1}$$

The explanatory variables of the Probit model are lagged one period before export entry to ensure that they are unaffected by the entry itself (i.e. to avoid reverse causality).[5]

[3] Past studies have shown that the share of intermittent export entrants is high. For instance, only 66% of Estonia's new exporters survive to the second year of exporting (Masso and Vahter 2014; ECB CompNet 2014).

[4] As robustness analysis, we employ TFP estimated from a simpler, more parsimonious model, where an endogenous Markov process only accounts for export status and does not include terms related to export strategies.

[5] One limitation of this standard analysis is that the timing of the decision of entry is unobservable and can in fact occur before the actual year of entry. Another limitation is that this framework cannot capture the export entry by firms that start exporting in the year of their creation. In Latvia, such firms comprise about 15%, and in Estonia, about 23% of new exporters.

Table 3 Probit estimation of the probability of export entry

Variable	Latvia	Estonia
Log(TFP)_{t-1}	0.295***	0.077***
$\text{Log(employment)}_{t-1}$	0.328***	0.365***
$\text{Log(employment)}^2_{t-1}$	−0.024***	−0.031***
Age_{t-1}	−0.024***	−0.030***
Age^2_{t-1}	0.000	0.000
Capital to labour ratio_{t-1}	0.061***	0.083***
Liquidity ratio_{t-1}	−0.174***	0.060
ROA_{t-1}	0.021	0.045*
State ownership dummy_{t-1}	−0.758***	−0.293***
Foreign ownership dummy_{t-1}	0.157***	0.458***
Constant	−2.768***	−3.664***
Number of observations	86,857	93,914
Log-likelihood	−9742.18	−16,253.70
Pseudo R^2	0.171	0.128

*Significant at 10%, **significant at 5%, ***significant at 1%

Table 3 displays the estimation results of the Probit regression for both countries. They give a clear indication of self-selection of more productive firms into export entry, as higher productivity increases the probability of export entry.

The estimated coefficients of the Probit regressions are used to calculate the propensity score of all firms, which is used to create the counterfactual control groups of two non-entrants with very close probability of export entry with respect to the actual entrants.[6] The control group constructed by matching can be regarded as the proper counterfactual for export entrants (the results of the balancing property test of prior differences between the treated and the control group can be found in online appendix).

4.2 Baseline results of the difference-in-difference analysis

In order to identify the ex post productivity gains from exporting, the study applies the following difference-in-difference (DiD) regression framework on the sample of exporters and matched non-exporters:

$$Y_{it+l} = \beta_0 + \beta_1 Z_{it-1} + \beta_2 X_{it} + \sum_k \beta_{3k} X_{it} * Z_{kit-1} + \sum_m \beta_4 X_{it} * D_{mit} + \varepsilon_{it} \quad (2)$$

where l is the time period after the export entry in time t. We follow the effect of exports entry until the third year of entry (therefore, l takes a value between 0 and 2). Y_{it+l} is a change in TFP in each period against its initial pre-entry level in $t-1$. X_{it} is a dummy variable that denotes export entry in year t. We allow the effects

[6] We ensure that matching occurs within the same year and the same two-digit sector. The standard condition of common support is used when choosing two nearest neighbours.

Table 4 The effect of export entry on TFP

Variable	Latvia			Estonia		
	t	t+1	t+2	T	t+1	t+2
Exports entry$_{t-1}$ (X_{t-1})	0.325***	0.197***	0.167***	0.298***	0.131***	0.109***
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	6953	6953	6953	12,151	12,151	12,151
R^2	0.434	0.412	0.400	0.362	0.294	0.306

*Significant at 10%, **significant at 5%, ***significant at 1%. Dependent variables are all in natural logs. Period t+l denotes l years after the year of export entry. The analysis includes only the sample of export entrants and matched non-exporters. Incumbent exporters, that export for the full sample period, are not taken into account. Total factor productivity is estimated using the method developed by De Loecker (2013)

of export entry to be heterogenous across firms by including interactions between the export entry dummy and their initial characteristics Z_{kit-1}, where β_{3k} is a vector of coefficients for each characteristic k. The difference in the effect of export entry across different types of exports is captured by interacting X_{it} with D_{mit}, a dummy variable indicating each type of exports. Specifically, D_{mit} is a vector of dummy variables indicating exports of intermediate goods, transport services, non-transport services as well as re-exports. The base category of exporters is therefore the category of final goods exporters. The hypotheses laid out in the Sect. 2 are tested by observing the coefficient β_4, which identifies additional productivity gains associated with each type of exports.

Before estimating the full model described in Eq. (2), we estimate a simpler DiD regression that does not include the last two interaction terms and thus identifies the general effect of exporting on productivity. The estimation indicates significant LBE in all three periods that follow export entry (see Table 4). The estimated effect is particularly large in the year of export entry, amounting to increased productivity of around 38.0% for Latvia (35.0% for Estonia) compared to the control group.[7] The productivity of export entrants as compared to non-exporters is 21.8% (14.0%) higher in $t+1$ and 18.2% (11.5%) in the third year of export entry (e.g. $t+2$).[8]

We now differentiate the effect of export entry by types of exports and allow the effect to depend on the prior levels of productivity by including two interactive terms. Table 5 summarises the estimation results. The coefficient on the export entry dummy X_{it} now captures productivity gains by exporters of final goods. The evidence of a long/lasting learning effect is scarce among Estonian final goods

[7] For example, for Latvia it is calculated as $exp(0.325)-1$, where 0.325 is the parameter estimate from the DiD regression model.

[8] One possible explanation for large productivity gains in the short run is that learning by exporting occurs quickly because export entrants have a very low initial knowledge base. An alternative interpretation is that the productivity gains in the period of export entry are driven partly by an increase in capacity utilisation, as firms take advantage of higher demand, which dissipates in the medium term as firms adjust their production capacity to larger demand.

Table 5 The effect of export entry on TFP across different types of exports

Variable	Latvia			Estonia		
	t	t+1	t+2	T	t+1	t+2
Exports entry$_{t-1}$ (X_{t-1})	0.644***	0.300***	0.253***	0.506***	0.195*	0.194
X_{t-1}*Log(TFP_{t-1})	−0.164***	−0.076***	−0.058**	−0.003	0.000	−0.003
X_{t-1}*Exports of intermediate goods$_{t-1}$	−0.003	0.068***	0.065***	0.024	0.038**	0.037*
X_{t-1}*Re-exports$_{t-1}$	0.102***	0.165***	0.127***	0.043**	0.063***	0.042*
X_{t-1}*Exports of transport services$_{t-1}$	0.000	0.085***	0.051	−0.081***	−0.012	−0.018
X_{t-1}*Exports of other services$_{t-1}$	0.225***	0.155**	0.122*	0.140***	0.145***	0.100***
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	6953	6953	6953	12,151	12,151	12,151
R^2	0.448	0.423	0.406	0.384	0.301	0.310

*Significant at 10%, **significant at 5%, ***significant at 1%. Dependent variables are all in natural logs. Period t+1 denotes 1 year after the year of export entry. The analysis includes only the sample of export entrants and matched non-exporters. Incumbent exporters, that export for the full sample period, are not taken into account. Total factor productivity is estimated using the method developed by De Loecker (2013)

exporters. While they experience a sizable and significant gain in TFP on the year of export entry, such a gain dissipates quickly and becomes statistically insignificant in the third year of export entry. In contrast, Latvian final goods exporters enjoy significant productivity gains throughout the period observed.

Exporters of intermediate goods enjoy stronger and more persistent productivity gains than exporters of final goods in both countries, thereby supporting our first hypothesis (H1). As for service exporters, the results differ between exporters of transport services and non-transport services. In both countries, exports of non-transport services that include knowledge-intensive services result in the largest productivity gains among the types of exports considered, whereas productivity gains from exports of transport services do not statistically differ from those of final goods exporters. The finding on exporters of non-transport services thus also supports H1 as well as our second hypothesis (H2). For Latvia, and to a lesser extent for Estonia, re-exports result in significantly larger productivity gains than exports of final or intermediate goods, confirming our third hypothesis (H3). Productivity gains from re-exports are long-lasting, implying significant LBE. As the bulk of Latvian and Estonian re-exporters (70% and 46% in the latest available year respectively) are found in the wholesale and retail sectors, our finding is in line with Malchow-Moller et al. (2015) reporting that the productivity growth in the Danish private sector is largely driven by exporters in these industries.

Finally, concerning our last hypothesis (H4) on the role of absorptive capacity and the technology gap in LBE, Latvian firms with lower initial productivity levels enjoy larger productivity gains from exporting. It is therefore likely that larger technology gaps that increase the benefits of external knowledge play a more important

role in LBE of Latvian firms than the constraints from lower absorptive capacity. On the other hand, we observe only a weakly significant relation for Estonian firms, which does not unambiguously support H4. However, such a vague relation between ex ante productivity levels and ex post productivity gains may be due to the technology gap effect and the constraints from lower absorptive capacity cancelling out each other.

4.3 Robustness analysis

We infer the robustness of the baseline results through several exercises. First, we narrow the scope of exporters to persistent export entrants by omitting intermittent exporters (see Sect. 4.1). Second, we use alternative measures of productivity, such as labour productivity, calculated directly from the dataset as value added per employee and TFP estimated from a more parsimonious specification with endogenous Markov process. Finally, we match export entrants with five non-exporters with the closest propensity scores instead of two in the baseline model and employ TFP estimated from a simpler, more parsimonious model, where an endogenous Markov process only accounts for export status (see footnote 9). All estimation results are available in online Appendix.

Omitting intermittent exporters strengthens the overall LBE for both countries. It does not alter the core results for Latvia and even increases the productivity gains from exports of non-transport services and re-exports. However, in the case of Estonia, the somewhat weak productivity gains associated with exports of intermediate goods and re-exports become statistically insignificant, therefore not lending support to hypotheses H1 and H3.

Using labour productivity as the measure of firm-level productivity does not alter the baseline findings, although it weakens the statistical significance of additional productivity gains associated with exports of intermediate goods. Initial labour productivity levels now contribute negatively to productivity gains in both Estonia and Latvia, while such negative relation was only found for Latvia in the baseline model. The importance of technology gap, and hence the room for catch-up thus outweighs the limitation of absorptive capacity in both countries, supporting the hypothesis H4.

Employing an alternative estimation method for TFP and matching exporters with the five closest neighbours produces results that are fairly similar to the baseline, particularly for Latvia. The productivity gains associated with exports of intermediate goods and re-exports again turn statistically insignificant for Estonia.

4.4 LBE and positioning in GVCs

In this sub-section, we aim to capture the heterogeneity in learning by exporting across exporters that participate in different segments of GVCs. For that purpose, we use the industry-level indicator of upstreamness and the firm-level share of intermediate inputs (see Sect. 3.2 for the interpretation of these indicators). We are

Table 6 The effect of export entry on TFP depending on a position in GVC

Variable	Latvia			Estonia		
	t	t+1	t+2	T	t+1	t+2
Exports entry$_{t-1}$ (X_{t-1})	−0.090	−0.171	−0.118	−0.079	−0.117	−0.076
X_{t-1}*Log(TFP_{t-1})	−0.159***	−0.067***	−0.054*	0.009	0.012	0.005
X_{t-1}*Upstreamness index$_{t-1}$	0.547***	0.387***	0.300**	0.418***	0.204**	0.177
X_{t-1}*Upstreamness index$^2_{t-1}$	−0.098***	−0.070***	−0.052**	−0.079***	−0.038*	−0.032
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	6953	6953	6953	11,208	11,208	11,208
R^2	0.449	0.416	0.402	0.381	0.306	0.320

*Significant at 10%, **significant at 5%, ***significant at 1%. Dependent variables are all in natural logs. Period t+1 denotes 1 year after the year of export entry. The analysis includes only the sample of export entrants and matched non-exporters. Incumbent exporters that export for the full sample period are not taken into account. Total factor productivity is estimated using the method developed by De Loecker (2013)

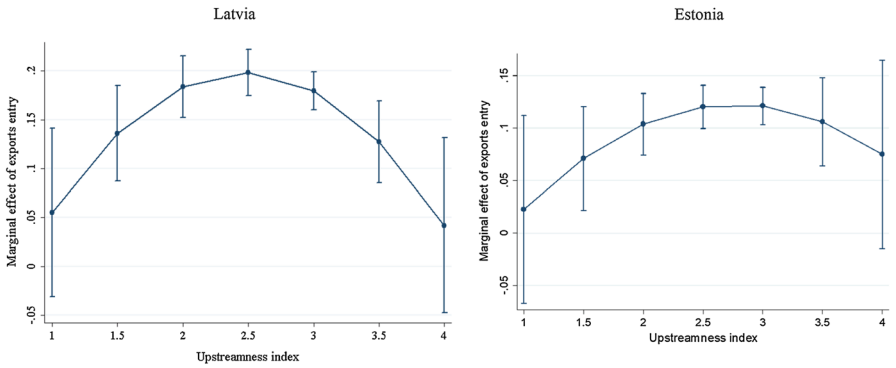

Fig. 1 The non-linear effect of the upstreamness index on LBE in *t+2*. *Note*: The figure is based on the coefficients reported in Table 6

particularly interested in identifying the effect of exporters' positioning in GVCs on LBE generated by their entry into foreign markets.

Table 6 reports the results from estimating Eq. (2) that include the interaction between export entry dummy X_{it} and the upstreamness index instead of the interaction between X_{it} and D_{mit}. For both countries, the upstreamness of the industry that exporters fall under seems to significantly affect the extent of LBE. Furthermore, such an effect is nonlinear: LBE appears to be strongest for exporters from sectors falling within the medium range of the upstreamness index (Fig. 1), while it is weaker or even insignificant for exporters from sectors at high or low levels of the upstreamness indicator.

For example, Latvian exporters from sectors at high levels of the upstreamness index such as metal production industry (upstreamness index 3.44 in 2014) or

Table 7 The effect of export entry on TFP depending on intensity of use of intermediate input

Variable	Latvia			Estonia		
	t	t+1	t+2	t	t+1	t+2
Exports entry$_{t-1}$ (X_{t-1})	0.975***	0.474***	0.323***	0.685***	0.284**	0.250*
X_{t-1}*Log(TFP_{t-1})	−0.153***	−0.068***	−0.052*	0.014	0.010	0.006
X_{t-1}*Intermediate input intensity$_{t-1}$	−0.570***	−0.218***	−0.090	−1.045***	−0.477***	−0.353**
X_{t-1}*Intermediate input intensity$^2_{t-1}$	0.065***	0.010	0.035**	0.812***	0.361**	0.256
X_{t-1}*Foreign input intensity$_{t-1}$	0.043	0.095***	0.109***	0.009	0.018	0.000
X_{t-1}*Foreign input intensity$^2_{t-1}$	−0.003**	−0.009***	−0.010***	0.002	−0.001	0.000
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	6931	6931	6931	12,138	12,138	12,138
R^2	0.469	0.426	0.410	0.389	0.303	0.311

*Significant at 10%; **significant at 5%; ***significant at 1%. Dependent variables are all in natural logs. Period t+1 denotes 1 year after the year of export entry. The analysis includes only the sample of export entrants and matched non-exporters. Incumbent exporters that export for the full sample period are not taken into account. Total factor productivity is estimated using the method developed by De Loecker (2013)

low levels such as the manufacture of coke and refined petroleum products (1.90) have smaller productivity gains compared to exporters from sectors at medium levels of the upstreamness index, like electrical equipment manufacture (2.58) or wholesale trade (2.97). In particular, exporters from far upstream industries like warehousing and support activities for transportation (upstreamness index of 4.20) or far downstream industries (manufacture of food, drinks and tobacco products, 1.42) do not seem to enjoy LBE, as their productivity gains are statistically insignificant. The inverted U-shape pattern of LBE depicted in Fig. 1 seems at odds with GVC literature or related empirical studies that document the concentration of value added in the upstream and far downstream segments of GVCs (see Sect. 2).

Table 7 reports the results of estimating Eq. (2) that include the interaction between the export entry dummy and the intensity of intermediate input use, instead of the interaction between X_{it} and D_{mit}. The results imply that LBE is stronger for firms with lower intensity in the use of intermediate inputs. The effect of intermediate inputs use is non-linear, especially for Estonian firms (Fig. 2). While this seems to indicate stronger LBE particularly in upstream segments of GVCs, we also find that Latvian exporters using foreign inputs more intensively reap larger productivity gains, whereas the intensity of foreign input use does not have a significant effect on the extent of LBE by Estonian firms. Overall, these findings do not point to a clear relationship between the positioning of firms within GVCs and the strength of LBE.

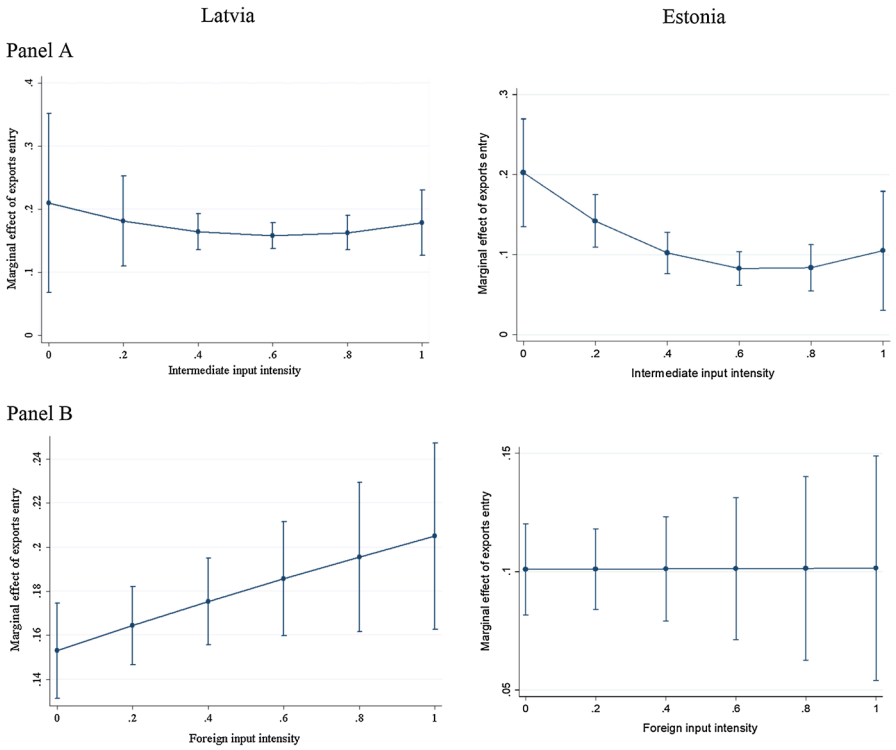

Fig. 2 The non-linear effect of the intermediate input share on LBE in $t+2$. *Note* The figure is based on the coefficients reported in Table 7

5 Discussion and conclusions

This study explores whether the positive effects of export entry on productivity, often referred to as "learning by exporting" (LBE), depend on the types of exports that are associated with different kinds of participation in global value chains (GVCs).

After controlling for the self-selection of more productive firms in exporting, we find that while exporting in general boosts the TFP of Estonian and Latvian firms by 35% and 38%, some types of exports are associated with significantly larger productivity gains than others. For instance, exports of knowledge-intensive services result in significantly larger productivity gains than exports of final goods. Similarly, exports of intermediate goods and re-exports result in stronger LBE for Latvian firms, while such evidence is somewhat weaker for Estonian firms.

Our findings suggest that LBE in GVCs is defined by the extent of interactions with global buyers. Interactions with foreign customers constitute an essential element in exports of knowledge-intensive services or trade intermediation services such as re-exports. Although the literature on "learning by supplying"

(Alcacer and Oxley 2014) suggests that exports of intermediate goods involve closer buyer–seller interactions, we found only somewhat fragile evidence of stronger LBE. However, exports of intermediate goods would involve limited knowledge transfer from MNEs if exporters have relatively high capabilities and/or the exported intermediate goods are well standardised or modularised (Gereffi et al. 2005). This could be the case for exports of wood products, which comprise important shares in both Latvia's and Estonia's exports.

While it is often considered that activities generating high value added are concentrated in upstream and far downstream segments of GVCs (Baldwin 2012; Ye et al. 2015), we find that firms from industries located in upstream or far downstream segments of GVCs do not enjoy stronger LBE compared to those from industries positioned in the middle of the value chain. One possible interpretation of this result is that the position of an industry in GVCs is a poor predictor of the value added generated within GVCs: exporting goods or services belonging to upstream or far downstream industries does not guarantee that the economy is specialised in knowledge-intensive activities that generate high value added within GVCs. Furthermore, policy makers should not label business activities in downstream industries as low value added if they yield high profits.

We also find that firms with initially lower productivity levels enjoy larger productivity gains from exporting. This suggests that the room for technology catch-up is a more important determinant of LBE than the extent of absorptive capacity. This provides a case for targeting policy measures that promote exports and GVC participation towards firms with greater room to boost productivity from GVC participation. Policymakers should at least ensure that such support measures do not impose large administrative burdens on applicants, which act as entry costs that effectively exclude small and less productive firms (Benkovskis et al. 2018).

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Affiliations

Konstantins Benkovskis[1,2] · Jaan Masso[3] · Olegs Tkacevs[1] · Priit Vahter[3] · Naomitsu Yashiro[4]

Konstantins Benkovskis
Konstantins.Benkovskis@bank.lv

Jaan Masso
Jaan.Masso@ut.ee

Priit Vahter
Priit.Vahter@ut.ee

Naomitsu Yashiro
Naomitsu.Yashiro@oecd.org

[1] Monetary Policy Department, Bank of Latvia, K. Valdemara 2a, Riga 1050, Latvia

[2] Department of Economics, Stockholm School of Economics in Riga, Strelnieku iela 4a, Riga 1010, Latvia

[3] School of Economics and Business Administration, University of Tartu, J. Liivi 4, 50409 Tartu, Estonia

[4] Economics Department, OECD, 2 rue Andre Pascal, 75775 Paris Cedex 16, France