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The impact of productivity on export transitions: revisited evidence from the Vietnamese manufacturing sectors

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ABSTRACT

The effect of total factor productivity (TFP) on exports particularly interests policy-makers and economists, but empirical evidence is ambiguous. This paper uses the 6-wave panel data in 2010-2015 to investigate the impact of TFP on export transitions at the firm level. We distinguish different types of export transitions, namely start, stop, continuity, fluctuation, and striving, and different phases of export transition. The Generalised Method of Moments (GMM) estimation is applied to control for endogeneity and unobserved time-invariant specific components. The results reveal that (i) the effect of productivity on export (the self-selection hypothesis) is heterogeneous, depending on specific sectors and types and phases of export transitions; (ii) productivity growth does not necessarily result in positive effects on and lead to participation in types and phases of export transitions. Our results also reveal strong evidence of favourable sunk cost in long-run export striving in nearly all sectors, and unlike previous studies, empirical results show a negative effect of sunk cost in some manufacturing sectors. Policy-makers should create dynamic comparative advantages and favourable environments for new exporters, focus the relevant policies on productivity stimulus, and strengthen the likelihood of survival for the domestic firms in the competitive global markets.

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1. Introduction

In an increasingly globalised world, the relationship between firm performance and exporting is of particular interest to policy-makers and economists, especially from the works of Bernard and colleagues in 1995 (Bernard et al., 1995) and consequently in 1999 (Bernard & Jensen, 1999a) and 2004 (Bernard & Jensen, 2004a). It is crucial for developing and emerging economies that have pursued an export-led growth strategy, such as China (Xinzhong (2022); Elliott et al. (2016)), Croatia (Buturac et al., 2019), Poland (Gabrielczak & Serwach, 2018), Gulf Cooperation Council countries, namely, Bahrain, Kuwait, Oman, Saudi Arabia and the United Arab Emirates (Kalaitzi & Chamberlain, 2021), and Vietnam (Ngo & Nguyen, 2020). The total factor productivity (TFP), expressed as the proportion of output not explained by the inputs used in production, is considered an endogenous engine of economic growth and plays a significant role in economic transformation (Tinbergen (1942); Abramovitz (1956); Solow (1957); Jones (1995); Romer (1990); Krugman (1997); Klenow and Rodriguez-Clare (1997)). Along the mainstream of export-led development, there also are strong logical arguments and empirical evidence that exporting contributes significantly to economic growth (Emery (1967); Michaely (1977); Balassa (1978); Jung and Marshall (1985); Edwards (1993); Kneller and Pisu (2007); A. Sharma et al. (2018)). Economists believe that firms well-operated in domestic markets with total productivity growth will look for opportunities in international markets.

Recent literature on international trade postulates the crucial role of productivity in firms' integration into global markets (B.-Y. Aw and Hwang (1995); Arnold and Hussinger (2005); M. Kim and Choi (2019); Gabrielczak and Serwach (2018)). Therefore, the impact of TFP on export has been a highly discussed topic in the trade and economics literature (Dalgıç et al. (2021); B.-Y. Aw and Hwang (1995); B. Y. Aw et al. (2008)). The self-selection hypothesis is a prominent strand of theoretical explanations for the relationship between productivity and exporting at the firm level. According to this hypothesis, due to the existence of sunk costs associated with selling abroad and fiercer competition in international markets (Roberts and Tybout (1997); Bernard and Jensen (1999b); Bernard and Wagner (2001)), the more productive firms tend to become exporters. In other words, the hypothesis emphasises a causal linkage from productivity to exporting. While the theoretical arguments of the view seem to be rational, the empirical evidence is mixed (Gabrielczak and Serwach (2018); Segarra-Blasco et al. (2022)). Some studies report evidence for self-selection (Segarra-Blasco et al. (2022); M. Kim and Choi (2019); Arnold and Hussinger (2005); Head and Ries (2003); Delgado et al. (2002); Bernard and Jensen (1999b); Clerides et al. (1998)). Some others do not (Gabrielczak and Serwach (2018); B. Y. Aw et al. (2000)). In this regard, further empirical analyses of the impact are needed.

The current article investigates the impact of manufacturing firms' productivity on exporting transitions in an increasingly open economy with rapid growth, Vietnam. It is one of the fastest-growing economies globally, with an annual gross domestic product (GDP) growth of about 7% in decades, and non-agricultural sectors currently contribute more than 80% to the national GDP. These achievements resulted from structural reforms 'Doi Moi', which started in the 1980s and included deregulations of input and output markets and the liberalisation of domestic and international trades. We focus our analysis on the manufacturing sector due to its importance in the economic growth of developing countries (Targetti, 2005). The industry generally has higher productivity, more output growth, and more job creation than the agricultural or services sectors (Wells and Thirlwall (2003); Millin and Nichola (2005); Li and Zhang (2008)). In Vietnam, the industry contributed around 15.0% to the national GDP and had an average growth rate of 14.4% in 2017 (Ngo & Nguyen, 2020). It has been considered an engine of economic growth due to its pivotal role in industrialisation.

Why are firms involved in exports? What is the export behaviour related to productivity differences among firms? The paper thus analyses these questions empirically by using a sample of a six-wave panel of Vietnamese firms in 12 manufacturing sectors at the firm level. The data are collected annually from the Vietnam Annual Enterprise Survey (VAES) from 2010 to 2015 by Vietnam's General Statistics Office (GSO). The self-selection hypothesis is examined by applying the Generalised Method of Moments (GMM) estimation, which controls endogeneity issues and unobserved and time-invariant factors.

Our article contributes to the literature in several aspects. First, previous studies examining the impact of firm productivity on export use export status (whether a firm's export is observed at the time of the survey) as a proxy for exporting. Our study goes a step forward by examining the export status over time and at a specific point in time by classifying the export status of a firm into several phases, such as export start (export entry), export stop (export exit), export continuity (export persistence), export fluctuation, and export striving. These phases better represent the different stages of export transitions and enable us to understand how productivity affects firms' export transformation. Second, previous examinations of the self-selection hypothesis have not considered the issue of firm heterogeneity. Our study explores how firms characterised by different labourers exhibit different levels of the impact of productivity on export transitions. Third, while most firm-level previous studies examined the impact at an aggregate level of the entire manufacturing sector, our study uncovers the impact at a disaggregate level of twelve manufacturing sectors. Fourth, several previous studies did not satisfactorily solve the endogeneity problem. As described previously, exporting firms might have systematically different characteristics from non-exporting firms. In addition, exporting firms might also differ at various export transition stages. Some variables included in the productivity equations estimated in previous studies are likely endogenous. Although some authors took into account the endogeneity of the export (S. I. Kim et al. (2009); C. Sharma and Mishra (2011); Maggioni (2012)), most of the studies use fixed or random effects estimators, which are not able to account for time-varying factors. Our study uses a Generalised Method of Moments (GMM) system estimator, which considers all regressors' endogeneity. Last, our study is the first to examine the impact of productivity on export transitions at the firm level in the manufacturing sectors in Vietnam, a typical country of rapid growth and increasing international integration.

The remainder of the article is organised as follows. Section 2 presents the literature background on the impact of productivity on exporting. Data and methods are shown in section 3. Section 4 presents and discusses the empirical results, and section 5 concludes.

2. Literature background

It is well-known in the literature that the positive association between productivity and exporting may reflect that only the most productive firms survive in the highly competitive export market, and exporters with productivity declines will exit. That is, the self-selection hypothesis says that the more productive firms are the ones that tend to become exporters. The increasing availability of longitudinal data at the firm level has been widely documented in several developed and developing countries. Micro-level evidence on this issue is available in the United States (Bernard and Jensen (1999b)), Taiwan, and Korea (B. Y. Aw et al., 2000), Colombia, Mexico, and Morocco (Clerides et al., 1998), Spain (Delgado et al., 2002), German (Arnold & Hussinger, 2005), as well as in Thailand, Indonesia, the Philippines, and South Korea (Hallward-Driemeier et al., 2002).

Bernard and Jensen (1999b) are among the first to find causality from productivity to exporting with the U.S. manufacturing firms in 1983-1992 by using VARs models with three lags each of productivity growth and export growth. Before that, Clerides et al. (1998) uncovered clear evidence of the importance of self-selection among exporters in three countries, Colombia, Mexico, and Morocco, in the 1980s.

Successful cases of new Asian industrial countries give more insights into the relationship between productivity and trade performance. B. Y. Aw et al. (2000) discovered evidence of self-selection in Taiwan (China) manufacturing firms in 1981, 1986, and 1991. However, the authors obtain no proof of entry and exit from the export market relating to productivity for the case of Korea in 1983, 1988, and 1993. A systematic study by Hallward-Driemeier et al. (2002) used firm-level data from five East Asian countries, namely Indonesia, Korea, Malaysia, the Philippines, and Thailand, in 1996-1998 to confirm that more productive firms self-select into exporting. The authors derive total factor productivity (TFP) from a Cobb-Douglas production framework.

Studies for developed countries give a broader view of the self-selection hypothesis. Delgado et al. (2002), using a sample of Spanish manufacturing firms from 1991 to 1996 and employing, show evidence supporting the self-selection of more productive firms in the export market. On top of that, Arnold and Hussinger (2005), measuring TFP by Olley and Pakes (1996) procedure and using a matching technique, attain a causal influence of high productivity on export performance in German manufacturing in the years from 1992 to 2000.

Until recently, more attempts have been conducted by scholars. A recent study by M. Kim and Choi (2019) with a panel dataset from South Korea in 24 manufacturing industries in two years, 2006 and 2013, measuring TFP by the semi-parametric estimation method found two channels that feature the net effects of innovation on export, namely positive technology spillovers, and adverse market rivalry spillovers. The R&D of foreign multinational enterprises dominates the negative intra-industry spillovers. Gabrielczak and Serwach (2018), who use the Olley–Pakes algorithm to estimate firm-level productivity, realise there is no effect of firm-level productivity on exports in Poland. On the other hand, Segarra-Blasco et al. (2022) got a robust self-selection process from productivity to export, using a sample of European manufacturing firms between 2001 and 2004.

In general, the impact of productivity on exports has received much attention from scientists and policy-makers. However, the empirical evidence is generally mixed or unclear, and not all confirm a clear impact. In addition, given the diverse theoretical literature on productivity, trade, and the heterogeneity of manufacturing sectors, it is not surprising that the empirical evidence of the impact of productivity on exporting is mixed. Possible explanations behind the diverse conclusions may include different definitions of export statuses and aggregate analysis.

Foreign markets endure firms with a specific sunk cost to join and a high competition environment to survive ((Roberts & Tybout, 1997); (Bernard & Jensen, 1999a)). These burdens can change the firms' behavior in the market, whether to join or to exit, continue or temporarily stop. Analyses that only observed the export stay or the export stop might not fully capture the main dynamics of operation in the international markets. Further exploitation of the export status gives fruitful insights. For example, Girma et al. (2002) find that firms with higher productivity levels are more likely to export, where export is defined as either exporting or switching to export. However, the authors find no effect of productivity on the switch to non-export.

Since intra-industry firm heterogeneity ((C. L. V. Le & Harvie, 2010); (B.-Y. Aw & Hwang, 1995)), aggregate analysis at the sector or country level may hide the real impact. The firm-level study is more accurate since one can avoid changes in macroeconomic factors that often complicate time series analysis (B.-Y. Aw & Hwang, 1995). In the last decade, we have observed increasing studies focusing on sectoral analysis by exploring rich datasets at the firm level. Those may include specific manufacturing sectors such as electrical equipment (Nguyen Viet Tung & Oyama, 2018), textile and apparel (T.-N. Le & Wang, 2017), and wood (Vu et al. (2019); Hieu et al. (2011); Putzel et al. (2012)).

3. Data and methods

3.1. Data

The data for our analysis is from the Vietnam Annual Enterprise Survey (VAES). The survey is carried out annually by Vietnam's General Statistical Office (GSO). The surveys collected information on firms' activities, including industries, labour and wages, assets and liabilities, the status of export and import of goods, and business performance (including turnover, cost of goods, administration costs, and net profit). The list of manufacturing sectors and the number of respective firms in each year are summarised in Table 1.

3.2. Methods

3.2.1. TFP estimation

Ackerberg et al. (2006) suggest a procedure to tackle several problems commonly mentioned in the literature on TFP estimation: the endogeneity between the input variables and unobserved productivity, or multicollinearity among inputs Ngo and Nguyen (2020). TFP in the current paper is estimated following Ackerberg et al. (2006) using value-added production. The estimation is done separately for all twelve

Table 1. Number of firms by manufacturing sectors, 2010–2015.

	Manufacturing sector	2010	2011	2012	2013	2014	2015	Total
1	Food	1,788	1,806	1,783	1,775	1,760	1,178	10,090
2	Textiles	644	647	641	628	630	476	3,666
3	Wearing apparel	1,318	1,343	1,336	1,330	1,295	975	7,597
4	Leather	412	421	421	425	413	339	2,431
5	Wood	739	741	729	716	695	454	4,074
6	Paper	670	668	658	659	650	400	3,705
7	Printing	478	510	499	510	469	234	2,700
8	Chemicals	568	573	562	563	546	430	3,242
9	Rubber and plastics	1,055	1,058	1,041	1,025	1,004	642	5,825
10	Fabricated metal	1,444	1,454	1,429	1,384	1,400	853	7,964
11	Electrical equipment	307	316	303	306	305	243	1,780
12	Furniture	753	745	718	712	711	550	4,189

Source: Authors' calculation from VAES 2010-2015.

sectors described in Table 1. Our value-added specifications include two primary inputs as regressors: the number of labourers and capital. We posit a Cobb-Douglas production function and estimate production functions separately for each sector.

The estimated production function is reported in Table 2, which shows that workers (in natural logarithm) and capital (in natural logarithm) are significant in all industries at a 1 per cent significance level. In each case, tests for under-identification, weak identification, and first-stage F-tests confirm the validity of the instruments.

3.2.2. Export transitions

Given that the main objective of the current paper is to examine the export impact on productivity, we may need to go into details of various stages in the export market, reflecting the market fluctuations and firms' adjustment processes. The stages of export include various statuses such as entering, staying, and leaving the market and the intervals. In this aspect, we follow the new classification by Ngo and Nguyen (2020) to identify various export transitions from 2010 to 2015. The export status of a firm is represented by one of the following six categories: export start (export entry), export stop (export exit), export fluctuation (fluctuation-down, fluctuation-up), export striving, and export continuity (export persistence). The 'export start' is defined as starting to export in the current year and not exporting in the previous years, whereas the 'export stop' means exiting in the current year and exporting at least two consecutive years up to the last year. The 'fluctuation-down' means escaping in the current year and exporting in the previous years, and the 'fluctuation-up' means exporting in the current year and exiting in the last years. The 'export striving' means exporting in at least two consecutive years up to the current year, and the 'export continuity' means exporting in all the survey years. Details of export transitions are presented in Supplement S.

3.2.3. Self-selection testing

We examine the self-selection hypothesis by tackling all of the above issues, following pioneer studies by Roberts and Tybout (1997), Clerides et al. (1998), and Bernard and Jensen (2004b). They have developed dynamic optimising models to analyse exporting firms' entry and exit decisions. In these models, firms' export transitions (EXPTRAN) depend on foreign market entry/exit costs and profits. Firm i involved

Table 2. Estimation of Cobb-Douglas production function, 2010–2015.

Variable	(1) Food	(2) Textiles	(3) Wearing apparel	(4) Leather	(5) Wood	(6) Paper
Capital (ln)	0.5170***	0.4730***	0.0341	0.1390***	0.3890***	0.3260***
	(0.0513)	(0.0192)	(0.0227)	(0.0362)	(0.0349)	(0.0493)
Labour (ln)	0.7120***	0.7550***	1.1050***	0.9310***	0.9010***	1.0410***
	(0.0724)	(0.0332)	(0.0378)	(0.0385)	(0.0862)	(0.109)
Observations	4,865	2,010	4,445	1,525	1,820	1,770
Wald test statistic of constant returns to scale	85.48***	152.7***	50.19***	24.73***	23.71***	30.35***
Sargan-Hansen test statistic	4.19×10^{-9}	6.84×10^{-9}	3.03×10^{-8}	2.89×10^{-8}	1.45×10^{-9}	1.78×10^{-7}

Variable	(7) Printing	(8) Chemicals	(9) Rubber and plastics	(10) Fabricated metal	(11) Electrical equipment	(12) Furniture
Capital (ln)	0.2600***	0.6210***	0.4260***	0.4820***	0.5760***	0.2230***
	(0.0596)	(0.0328)	(0.0448)	(0.0429)	(0.0478)	(0.0680)
Labour (ln)	1.1170***	0.5970***	0.7890***	0.4900***	0.6200***	0.9470***
	(0.179)	(0.0577)	(0.0562)	(0.108)	(0.0660)	(0.106)
Observations	970	1,825	2,765	3,360	1,040	2,445
Wald test statistic of constant returns to scale	8.442***	51.99***	107.8***	0.0583	57.84***	5.093***
Sargan-Hansen test statistic	4.93×10^{-8}	9.18×10^{-9}	6.12×10^{-9}	6.456	1.59×10^{-8}	8.96×10^{-8}

Note: The estimation followed Ackerberg et al. (2006) (value-added procedure); Z-test statistics are in parenthesis; Wald test of constant returns to scale; Proxy variables: raw material expenses, and the test for the over-identifying restrictions is based on Sargan-Hansen's J-test. Technical calculations of value-added, production costs, intermediate materials, and revenues followed. Source: Authors' estimation from VAES 2010–2015.

in export transitions in year t ($EXPTRAN_{ikt} = 1$) if current and expected revenues (R_{iky}) are more significant than current-period costs C_{it} in addition to sunk cost N (if any):

$$EXPTRAN_{it} = \begin{cases} 1 \ \ if \ \ R_{it} > \ C_{it} + N(1 - \ EXPTRAN_{it-1}) \\ \quad 0 \ \ otherwise \end{cases} \tag{1}$$

In a dynamic framework, our baseline empirical specification is

$$EXPTRAN_{it} = \alpha + \beta TFP_{it} + \gamma EXPTRAN_{it-1} + \delta X_{it} + \sum_{j} \delta\phi_j Time_j + \varepsilon_{ikt} \tag{2}$$

Equation (2) indicates that export transitions depend on TFP, firm characteristics, and time. Export transitions can be one of six alternatives: start, stop, continuity, fluctuation-down, fluctuation-up, and striving. X is a vector of firm-specific control variables. We include firm-specific characteristics, including the revenue (natural logarithm of value-added per labour), capital stock (natural logarithm of capital stocks per labour), size of employment (natural logarithm of labour), human capital (natural logarithm of wage), and firm age (years of operation in natural logarithm). $Time_j$ is a vector of year.

One major challenge when estimating Equation (2) is the endogeneity problem, leading to biased estimation. We employ the GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998) to overcome this problem. The Blundell and Bond estimator (also called the system GMM estimator) combines the regression expressed in the first differences (lagged values of the variables in levels are used as instruments) with the original equation expressed in levels (this equation is instrumented with lagged differences of the variables) and allows us to include some additional instrument variables (C. Sharma, 2014). We follow Ngo and Nguyen (2020) in choosing predetermined exogenous instruments and strict exogenous variables.

A detailed estimation of Equation (2) is developed through the following equations:

$$start_{it} = \beta_{1j} TFP_{it} + \gamma_{1j} start_{it-1} + \delta_1 X_{it} + \kappa_{1I} + \varepsilon_{1it}, \tag{2.1}$$

$$stop_{it} = \beta_{2j} TFP_{it} + \gamma_{2j} stop_{it-1} + \delta_2 X_{it} + \kappa_{2I} + \varepsilon_{2it}, \tag{2.2}$$

$$continuity_{it} = \beta_{3j} TFP_{it} + \gamma_{3j} continuity_{it-1} + \delta_3 X_{it} + \kappa_{3I} + \varepsilon_{3it}, \tag{2.3}$$

$$flucdown_{it} = \beta_{4j} TFP_{it} + \gamma_{4j} flucdown_{it-1} + \delta_4 X_{it} + \kappa_{4I} + \varepsilon_{4it}, \tag{2.4}$$

$$flucup_{it} = \beta_{5j} TFP_{it} + \gamma_{5j} flucup_{it-1} + \delta_5 X_{it} + \kappa_{5I} + \varepsilon_{5it}, \tag{2.5}$$

$$striving_{it} = \beta_{6j}TFP_{it} + \gamma_{6j}striving_{it-1} + \delta_6 X_{it} + \kappa_{6I} + \varepsilon_{6it}. \tag{2.6}$$

Which 'start', 'stop', 'continuity', 'fluctuation-down', 'fluctuation-up', and 'striving' are six statuses of export transition as described in Section 3.2.2. In equations (2.1) to (2.6), the participation decision does not depend on exporting history if the sunk cost is not high in exporting. The truth exists if γs is equal to zero or not. Equations (2.1) to (2.6) are estimated for twelve manufacturing sectors.

4. Empirical results

4.1. Statistical analysis

The description of the variables in models (2.1)—(2.6) is presented in Table 3 to compare several firm characteristics and TFP among six groups of export transitions. In general, exporting firms in any export status, namely start, stop, continuity, fluctuation-down, fluctuation-up, and striving, have a higher level of TFP, value-added per employment, total capital per employment, wages, and higher number of employees than never-exporting ones. In addition, firms leaving export still have higher levels of TFP, value-added per employment, total wages, and a higher number of labourers than firms having just started to export.

Regarding firms that fluctuated from exporting, fluctuated-up firms in exporting have higher TFP levels, value-added per employment, total wages, and the number of employees than down-fluctuated firms. Finally, striving firms do not consistently outperform fluctuated firms at the TFP level, especially in the long run. However, in terms of value-added per employment, total capital per employment, total capital per employment, wages, and the number of employments, striving firms outperform fluctuated firms in the medium and long runs.

4.2. Estimation results and discussions

Table 4 presents the estimation results of the influence of TFP on export transition by manufacturing sectors, namely (1) the food sector, (2) textiles, (3) wearing apparel and (4) leather. Arellano-Bond (A.B.) tests indicate that the high levels of autocorrelation have been solved in most cases, except for the export continuity in the short run and fluctuation-up in the two-year transition (food sector); the export continuity in the short-run (textiles); the export continuity in the short-run (wearing apparel); the export continuity in the short run; stop, continuity, fluctuation-up in the medium-run (leather sector). In addition, Hansen J statistics prove the validity of instrument variables in most cases, except for the export striving in four- and five-year transitions (food sector), the export continuity in four-year transition (textiles), the export started in three- and four-year transitions (wearing apparel sector), and the export start, export continuity in two-year transition (leather sector). Thus, we focus our discussions on the relevant results only.

The estimation results in Table 4 for the food sector show that TFPs are insignificant in all scenarios, implying that the self-selection hypothesis is not supported. The estimated coefficients on the lagged 'start' are statistically significant and negative in

Table 3. TFP and firm characteristics by export-transition firms, 2010–2015.

Variable	Non-exporting	Start	Stop	Cont	Fldown	Flup	Striving
Two-year export transition							
TFP level	5.919	$6.178^{a***, b***}$	$6.278^{a***, b***}$	6.374^{a***}			
Value-added pe. (ln)	8.915	$9.345^{a***, b***}$	$9.237^{a***, b}$	9.568^{a***}			
Total capital pe. (ln)	5.603	$5.836^{a***, b**}$	$5.677^{a**, b***}$	5.893^{a***}			
Total wages (ln)	3.904	$4.842^{a***, b***}$	$4.817^{a***, b***}$	5.493^{a***}			
Total employees (ln)	7.654	$8.882^{a***, b***}$	$8.82^{a***, b***}$	9.74^{a***}			
Three-year export transition							
TFP level	5.921	$6.267^{a***, b***}$	$6.349^{a***, b}$	6.426^{a***}	$6.124^{a***, b***, d}$	$6.423^{a***, b, c***, d***}$	$6.221^{a***, b***}$
Value-added pe. (ln)	8.946	$9.257^{a***, b***}$	$9.378^{a***, b***}$	9.643^{a***}	$9.16^{a***, b***, d***}$	$9.397^{a***, b***, c***, d***}$	$9.488^{a***, b***}$
Total capital pe. (ln)	5.668	$5.691^{a, b***}$	$5.779^{a**, b***}$	5.933^{a***}	$5.745^{a, b***, d***}$	$5.749^{a*, b***, c, d***}$	$5.946^{a***, b}$
Total wages (ln)	3.833	$4.717^{a***, b***}$	$4.94^{a***, b***}$	5.553^{a***}	$4.489^{a***, b***, d***}$	$5.004^{a***, b***, c***, d}$	$4.947^{a***, b***}$
Total employees (ln)	7.621	$8.749^{a***, b***}$	$9.04^{a***, b***}$	9.876^{a***}	$8.461^{a***, b***, d***}$	$9.169^{a***, b***, c***, d}$	$9.125^{a***, b***}$
Four-year export transition							
TFP level	5.935	$6.287^{a***, b***}$	$6.349^{a***, b**}$	6.494^{a***}	$6.368^{a***, b*, d}$	$6.45^{a***, b, c, d***}$	$6.273^{a***, b***}$
Value-added pe. (ln)	8.993	$9.307^{a***, b}$	$9.52^{a***, b***}$	9.72^{a***}	$9.246^{a***, b***, d***}$	$9.462^{a***, b***, c***, d*}$	$9.525^{a***, b***}$
Total capital pe. (ln)	5.733	$5.785^{a, b***}$	$5.928^{a***, b}$	5.963^{a***}	$5.669^{a, b***, d***}$	$5.795^{a, b***, c*, d***}$	$5.964^{a***, b}$
Total wages (ln)	3.785	$4.616^{a***, b***}$	$5.046^{a***, b***}$	5.611^{a***}	$4.623^{a***, b***, d***}$	$4.989^{a***, b***, c***, d}$	$4.983^{a***, b***}$
Total employees (ln)	7.623	$8.694^{a***, b***}$	$9.235^{a***, b***}$	9.997^{a***}	$8.673^{a***, b***, d***}$	$9.197^{a***, b***, c***, d}$	$9.218^{a***, b***}$
Five-year export transition							
TFP level	5.976	$6.093^{a, b***}$	$6.452^{a***, b}$	6.555^{a***}	$6.38^{a***, b**, d}$	$6.5^{a***, b, c, d*}$	$6.358^{a***, b***}$
Value-added pe. (ln)	9.053	$9.351^{a***, b***}$	$9.586^{a***, b***}$	9.777^{a***}	$9.304^{a***, b***, d***}$	$9.519^{a***, b***, c***, d***}$	$9.635^{a***, b***}$
Total capital pe. (ln)	5.793	$5.934^{a, b}$	$5.935^{a, b}$	5.982^{a***}	$5.742^{a, b***, d***}$	$5.816^{a, b**, c, d***}$	$6.01^{a***, b***}$
Total wages (ln)	3.742	$4.539^{a***, b***}$	$5.093^{a***, b***}$	5.665^{a***}	$4.615^{a***, b***, d***}$	$5.113^{a***, b***, c***, d***}$	$5.01^{a***, b***}$
Total employees (ln)	7.635	$8.662^{a***, b***}$	$9.295^{a***, b***}$	10.109^{a***}	$8.678^{a***, b***, d***}$	$9.381^{a***, b***, c***, d***}$	$9.329^{a***, b***}$

Note: Abbreviations: pe.: per employee; Cont: continuity; Fldown: fluctuation-down; Flup: fluctuation-up.
[a]: compared alternatives such as start, stop, continuity, fluctuation-down, fluctuation-up, striving, and non-exporting, respectively. [b]: compared between continuity and alternatives such as start, stop, fluctuation-down, fluctuation-up, and striving, respectively. [c]: compared between fluctuation-up and fluctuation-down. [d]: compared between striving and one of the alternatives, such as fluctuation-down and fluctuation-up, respectively. Source: Authors' calculation from VAES 2010-2015.

Table 4. TFP and export transitions by manufacturing sectors (Part 1), 2010–2015.

Food products (Observations: 4,835; Number of firms: 967)

	Two-year			Three-year						Four-year						Five-year					
Variable	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.start	−0.330 **			0.435						−0.371						−0.013***					
TFP	0.006	0.002	−0.0003	0.004	0.009	−0.010	0.0001	−0.005	0.004	−0.001	0.006	−0.008	−0.001	−0.001	0.003	−0.0004	0.003	−0.009	0.0001	0.001	0.0001
L.stop		−0.200			0.448						−0.178						−0.024***				
L.CONT			0.870***			0.221						0.222						−1.070			
L.FLDOWN							−0.109 *						−0.023***						−0.0179***		
L.FLUP								−0.050***						−0.426						−0.037***	
L.strive									−0.174						0.061						1.143
Hansen J test	8.987	8.646	4.762	1.626	21.20	3.594	8.892	16.09	2.531	2.894	3.351	20.21	10.14	7.901	8.339 **	7.737	2.575	10.72	8.363	6.565	21.71***
Wald test	185.3***	30.65***	6984***	322.2***	348.6***	11956***	61.06***	368.7***	418***	40.44***	76.94***	2836***	77.65***	72.51***	659.8***	25.27***	37.38***	732.9***	39.51***	64.82***	1038***
AR (2) test	−1.097	−0.062	−4.559***	0.682	1.344	−0.325	1.291	1.874 *	−1.627	−0.211	−0.601	−0.149	0.670	−0.511	−0.880	0.605	−1.308	0.097	−0.640	−0.115	−0.114
INST	19	19	15	17	26	14	17	24	14	16	16	16	22	19	14	20	20	18	20	20	18

Textiles (Observations: 2,005; Number of firms: 2,005)

Variable	**Two-year**			**Three-year**						**Four-year**						**Five-year**					
	start	**stop**	**CONT**	**start**	**stop**	**CONT**	**FLDOWN**	**FLUP**	**striving**	**start**	**stop**	**CONT**	**FLDOWN**	**FLUP**	**striving**	**start**	**stop**	**CONT**	**FLDOWN**	**FLUP**	**striving**
L.start	−0.403 **			0.485						0.002						−0.019***					
TFP	−0.002	0.003	−0.034	−0.002	0.008	−0.022	0.004	0.005	−0.032	−0.001	0.002	0.012	0.005		−0.061***	−0.001	0.003	−0.014	0.005	0.003	−0.011
L.stop		0.284			0.314						−0.016 **						−0.007				
L.CONT			0.801***			0.432						−0.150						0.766***			
L.FLDOWN							−0.034 **						−0.031 **						−0.003		
L.FLUP								−0.037 **						−0.023***						−0.025***	
L.strive									−0.199						0.148						0.354***
Hansen J test	14.35	18.17	3.043	15.16	8.624	0.518	14.48	14.57	3.499	12.80	6.294	6.547*	9.502	11.26	4.015	8.132	4.645	11.76	5.283	4.604	7.755
Wald test	40.29***	14.64	2786***	249***	92.13***	36754***	68.84***	94.94***	142.8***	75.67***	29.21***	1628***	140.3***	78.91***	154.5***	10.10	7.024	6871***	10.98	21.27 **	175.8***
AR (2) test	−1.479	0.921	−2.554 **	1.160	0.665	0.097	0.853	1.069	−0.531	−1.444	−0.443	−1.644	1.429	−1.480	−0.389	−0.890	1.499	−0.393	1.275	1.206	0.668
INST	23	23	19	21	21	14	24	24	17	22	22	14	22	22	16	20	20	20	20	20	20

Wearing apparel (Observations: 4,425; Number of firms: 885)

Variable	Two-year			Three-year						Four-year						Five-year					
	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.start	−0.011			−0.598						−0.345						−0.015***					
TFP	0.011	0.008	−0.006	0.010	0.0003	−0.039 *	0.003	−0.001	−0.007	0.005		0.027	−0.004	−0.00002	−0.043***	−0.0003	0.003	0.022	0.004	−0.001	−0.015
L.stop		−0.158			−0.277						−0.357						−0.917				
L.CONT			0.836***			0.685***						0.759						−0.391			
L.FLDOWN							−0.029***						0.062						−0.013***		
L.FLUP								−0.044***						−0.051***						−0.054***	
L.strive									−0.087						0.190						0.440***
Hansen J test	10.18	16.84	0.293	13.42 *	2.783	2.060	13.09	14.62	2.405	8.855 **	1.783	4.862	9.276	16.68	1.999	5.430	4.627	10.35	10.69	13.23	12.63
Wald test	71.44***	45.82***	4055***	86.71***	110.6***	16644***	254.9***	529.1***	374.3***	53***	60.21***	3432***	71.06***	182.1***	751.5***	24.26***	25.05***	942***	47.87***	67.59***	505.6***
AR (2) test	0.502	−0.170	−4.777***	−1.461	−1.047	−0.671	1.271	1.219	−0.343	−1.196	−0.951	0.173	0.309	0.623	−1.278	0.211	1.114	0.306	0.561	−0.277	0.208
INST	23	23	15	19	17	17	24	24	17	14	16	16	19	22	16	20	18	18	20	20	20

(continued)

Table 4. Continued.

Variable	Food products (Observations: 4,835; Number of firms: 967)																				
	Two-year			Three-year						Four-year						Five-year					
Variable	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
Variable	Leather and related products (Observations: 1,520; Number of firms: 304)																				
	Two-year			Three-year						Four-year						Five-year					
	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.start	−0.081***			−0.006						−0.002						−0.006					
TFP	0.0002	−0.036 **	0.009	−0.002	−0.008	−0.059 *	−0.006	0.006	0.009	−0.002	−0.002	0.003	−0.007	0.001	−0.040	−0.003	−0.002	0.007	−0.003	−0.001	
L.stop		−0.090***			0.515 **						−0.018***						−0.019 **				
L.CONT			0.818***			0.791***						0.855***						2.734			
L.FLDOWN							−0.168 **						−0.048 **						−0.006		
L.FLUP								−0.136***						0.257						−0.071***	
L.strive									−0.003						−0.369						0.162 **
Hansen J test	22.75 *	21.66	11.48 **	5.470	7.047	12.46	13	13.30	18.61	5.116	6.415	10.26	10.64	10.39	4.726	3.768	3.734	12.24*	8.848	3.914	8.306
Wald test	120.3***	62.10***	1446***	43.32***	120.3***	8825***	41.68***	93.55***	130.2***	56.62***	43.40***	8988***	49.99***	15.98	69.72***	1.415	7.179	12210***	6.879	31.32***	66.17***
AR (2) test	1.333	1.609	−2.826***	−1.018	1.957 **	2.691***	1.514	1.726 *	−1.012	−0.753	−0.214	3.330***	1.290	0.678	−1.220	−0.478	−1.064	1.359	−0.258	−0.981	0.859
INST	26	26	15	24	21	19	24	24	24	22	22	19	22	19	14	20	20	18	20	20	20

Note: The main variables related to export transitions are presented. Controlling variables include the natural logarithm of value-added per labour, the natural logarithm of capital stocks per employment, the natural logarithm of employment, the natural logarithm of wage, the natural logarithm of age, dummies for years are on request.
***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Method of estimation: GMM. Abbreviations: L.: one-year lag; CONT: continuity; INST: number of instruments; AR (2): Arellano-Bond test for autocorrelation of the second order. Source: Authors' estimation from VAES 2010-2015.

short- and long runs. The results indicate that the sunk cost of the export market entry influences the firms' exporting decisions and thus plays a burden. The sunk cost hypothesis is supported as the lagged coefficient of 'stop' has a significantly negative sign in the long-run transition. Finally, export fluctuation negatively affects the current transition status, but no effect exists in 'striving' to export.

Regarding textiles, the results in Table 4 prove that TFPs are not statistically significant, implying that TFP is not a determining factor of export decision for this sector, except for the case of the export striving, which is significant at a 1 per cent level and has a negative sign. The results probably suggest that, in the case of the Vietnamese textile sector, exporting firms have a high comparative advantage ((Gabagambi, 2013), (T.-N. Le & Wang, 2017)). Thus more elevated levels of TFP may induce firms to strive less to export. The estimated coefficients on the lagged export start are statistically significant and negative in the short- and long runs, implying that the retrospective cost from the export participation burdens the firms' operation. The sunk cost hypothesis also stood in the lagged coefficient of 'stop' with a significantly negative sign in the medium-run transition. However, persistence in export has a significant and positive effect on the current exporting decision in the case of the long run. Finally, exporting fluctuations adversely affect the recent export transition, whereas the positive impact of the lagged export striving is found in the long run.

Concerning the wearing apparel sector, Table 4 proves that TFPs are not statistically significant, implying that TFP does not affect the export decision by firms, except for the two significantly negative cases of the export continuity at a three-year transition and the export striving at a four-year transition. As in the case of the textile sector, Vietnam is believed to have a high comparative advantage in the wearing apparel sector with low-cost labour and imported materials (Dao et al., 2021), and thus exporting firms may have less incentive to strike more for export once they have a strong stand in the international market. The estimated coefficient on the lagged export start has a significantly negative sign in the long-run perspective. The sunk cost of being a rival in the export market does affect the firms' export intensity. However, persistence in export has a significant and positive effect on the current exporting decision in the case of the medium run. Finally, exporting fluctuations negatively affect the recent export transition, whereas the positive impact of the lagged export striving is observed in the long run.

The estimation results for leather products in Table 4 also prove that TFPs are not statistically significant, except for the cases of the export stop in the two-year transition and the export continuity in the three-year change, which are harmful and significant at a 1 per cent level. In addition, exporting fluctuations negatively influence the current export transition, whereas the lagged export striving has a positive effect in the long run.

Table 5 presents the estimation results of sectors such as (1) wood, (2) papers, (3) printing, and (4) chemicals. The Arellano-Bond (A.B.) tests indicate that the high levels of autocorrelation have been solved in most cases, except for the export continuity in the short run, the stop and the continuity in the three-year transition, the fluctuation-up in four- and five-year transitions (wood sector), the export continuity in the

Table 5. TFP and export transitions by manufacturing sectors (Part 2), 2010–2015.

	Wood and products of wood/cork (Observations: 1,820; Number of firms: 364)																				
	Two-year			Three-year						Four-year						Five-year					
Variable	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.start	−0.073 ***			−0.010						−0.006						−0.018 **					
TFP						0.033 **							0.005			0.001		−0.024	0.001		
L.stop		−0.074 ***			1.011 ***						−0.012						−0.010				
L.CONT			0.867 ***			0.634 ***						0.807 ***						0.864			
L.FLDOWN							−0.038 **						−0.042 **						−0.032 ***		
L.FLUP								−0.048 ***						−0.052 ***						−0.027 ***	
L.strive									−0.539						−1.198						0.458 ***
Hansen J test	18.92	12.89	4.032	13.51	5.419	18.02 **	15.63	12.35	1.145	10.45	15.80	13.14	8.281	10.37	2.104	7.118	11.19	11.74	8.081	5.969	4.727
Wald test	281.3 ***	264.1 ***	2565 ***	72.86 ***	358.1 ***	1414 ***	42.22 ***	89.84 ***	544.9 ***	75.59 ***	62.46 ***	2409 ***	62.23 ***	137.3 ***	633.3 ***	7.511	5.260	497.4 ***	21.76 **	18.35 **	133.1 ***
AR (2) test	1.205	0.262	−3.300 ***	−0.711	3.262 ***	1.963 **	0.690	0.420	−1.020	−0.757	−0.970	0.701	1.020	1.776 *	−1.123	−0.597	0.579	−0.609	0.603	1.791 *	0.106
INST	26	26	15	24	21	19	24	24	14	22	22	22	22	22	19	20	20	18	20	20	20
Variable	Paper and paper products (Observations: 1,765; Number of firms: 353)																				
	Two-year			Three-year						Four-year						Five-year					
	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.start	0.310			0.800 **						−0.015 *						−0.012					
TFP		−0.003				0.017				−0.001											0.002
L.stop		−0.045 ***			0.374						−0.008						−0.013				
L.CONT			1.037 ***			0.694 **						0.537*						0.825 ***			
L.FLDOWN							−0.017						−0.015 **						−0.026 **		
L.FLUP								−0.026 *						−0.037 **						−0.027 ***	
L.strive									−0.368						−0.459						0.385 ***
Hansen J test	12.59	12.22	2.204	12.99	5.539	3.032	8.721	18.01	7.732	12.24	8.959	8.145	9.816	13.57	2.245	7.474	4.945	7.408	6.983	5.336	4.047
Wald test	59.28 ***	42.24 ***	2109 ***	309.3 ***	96.62 ***	2944 ***	68.13 ***	75.29 ***	118.3 ***	57.38 ***	46.54 ***	2683 ***	65.88 ***	35.94 ***	337.8 ***	21.33 **	1.852	4505 ***	15.45	14.77	168.3 ***
AR (2) test	1.339	−0.931	−3.376 ***	2.565 **	1.249	1.187	0.774	0.536	−1.707 *	−1.796	0.432	0.549	−0.093	0.592	−0.697	0.117	0.243	1.642	1.441	−0.384	0.333
INST	19	26	15	21	17	14	24	24	17	22	22	16	22	22	16	20	20	20	20	20	20
Variable	Printing and reproduction of recorded media (Observations: 965; Number of firms: 193)																				
	Two-year			Three-year						Four-year						Five-year					
	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.start	−0.065 ***			−0.010						−0.001						−0.004					
TFP	−0.027	0.016	0.031	0.003	−0.002	−0.006		−0.001	0.00902	0.001	0.001	0.007	−0.0003	−0.005	−0.002	−0.0002	0.0001	−0.005	0.001	−0.002	−0.006
L.stop		−0.084 **			0.004						0.002						−1.164*				
L.CONT			0.851***			0.850 ***						0.861 ***						0.832 ***			
L.FLDOWN							−0.078						−0.108						−0.020 *		
L.FLUP								−0.103						−0.084						−0.031 *	
L.strive									−0.005						0.040						0.152 *
Hansen J test	7.852	22.02	0.793	9.262	13.56	8.416	16.84	9.694	15.88	8.812	5.523	10.89	9.629	9.511	10.58	4.141	2.798	5.874	7.994	5.532	4.445
Wald test	78.68 ***	26.26 ***	1215 ***	54.64 ***	37.87 ***	7923 ***	15.52	11.27	56.39 ***	19.68**	4.368	1050 ***	19.33 ***	9.522	76.71 ***	0.759	103.1 ***	442.9 ***	5.784	3.923	27.29 ***
AR (2) test	0.368	1.018	−0.944	−1.135	0.324	1.210	0.811	0.416	−1.459	−0.535	−0.929	0.961	1.069	0.564	−1.012	−1.466	1.363	−0.987	0.602	1.732 *	−0.411
INST	26	26	15	24	24	24	24	24	24	22	20	22	22	22	22	20	20	20	20	20	20
Variable	Chemicals and chemical products (Observations: 1,825; Number of firms: 365)																				
	Two-year			Three-year						Four-year						Five-year					
	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.start	−0.048 ***			0.002						2.333						−0.003					
TFP	0.0003	0.003	0.019	−0.001	−0.0003	0.011	0.001	0.001	−0.001	−0.001	−0.001	0.033	0.001	−0.003	−0.001	0.0003	−0.0001	−0.0003	0.001	0.0003	0.004
L.stop		−0.038 **			−0.008 **						−0.018 ***						−0.002				

(*continued*)

Table 5. Continued.

	Wood and products of wood/cork (Observations: 1,820; Number of firms: 364)																				
	Two-year			Three-year						Four-year						Five-year					
Variable	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.CONT			0.817 ***			0.203						0.138						0.605 ***			
L.FLDOWN							−0.083						0.001						−0.007		
L.FLUP								−0.042						1.273						−0.033 ***	
L.strive									−0.543						0.102						0.124 ***
Hansen J test	20.54	21.32	2.961	14.41	14.16	0.170	15.80	14.54	3.991	4.070	9.633	3.105	8.712	3.505	0.941	9.061	7.390	27.74 ***	5.350	3.540	4.373
Wald test	246.6 ***	54.93 ***	2285 ***	72.96 ***	95.44 ***	1973 ***	21.48 **	82.79 ***	185 ***	32.72 ***	47.79 ***	728.1 ***	21.50 **	296.8 ***	196.2 ***	5.195	0.838	7044 ***	5.642	34.59 ***	163.3 ***
AR (2) test	1.250	0.143	−4.281 ***	−0.993	−1.348	0.335	0.568	0.593	−1.009	−0.200	−0.164	0.023	−1.134	1.267	−0.069	1.832 *	−1.285	−0.993	−1.049	1.598	−0.746
INST	26	26	15	23	24	14	24	24	17	18	22	14	22	19	16	24	20	20	20	24	20

Note: The main variables related to export transitions are presented. Controlling variables include the natural logarithm of value-added per labour, the natural logarithm of capital stocks per employment, the natural logarithm of employment, the natural logarithm of wage, the natural logarithm of age, dummies for years are on request. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Method of estimation: GMM. Abbreviations: L.: one-year lag; CONT: continuity; FLDOWN: fluctuation-down; FLUP: fluctuation-up; INST: number of instruments; AR (2): Arellano-Bond test for autocorrelation of the second order. Source: Authors' estimation from VAES 2010-2015.

short run, the start and the striving in the medium-run (paper sector), the export fluctuation-up in the long run (printing sector), and the export continuity in the short run, the start in the long-run (chemicals sector). Moreover, Hansen J statistics prove the validity of instrument variables in most cases, except for the export striving in four- and five-year transitions (wood sector) and the export continuity in the long-run evolution (chemicals sector). Thus, we only discuss relevant results where the mentioned tests are favourable.

TFPs are insignificant in all scenarios regarding the wood sector, implying that the self-selection hypothesis is not supported. The main explanation is that wood is labour-intensive, and most export is raw materials (Putzel et al., 2012). The lagged exporting start has a significantly negative sign in the short- and long-run perspectives. The sunk cost of entering the export market influences the firms' decisions. The sunk cost hypothesis also stayed in the lagged coefficient of 'stop' with a significantly negative sign in the short-run transition. However, persistence in export has a significant and positive effect on the current exporting decision in the case of the medium run. Finally, export fluctuations negatively affect the mid- and long-run export transitions, whereas striving to export is the only long-term effect.

TFPs are not statistically significant for paper products, implying that TFP is not an essential factor in the export decision. The lagged export start has a significantly negative sign in the medium-run perspective. The sunk cost of international trade influences the firms' exporting decisions and also plays a burden. The sunk cost hypothesis is reinforced in the lagged coefficient of 'stop' with a significantly negative sign in the short-run transition. However, persistence in export has a significant and positive effect on the current exporting decision in the case of both medium and long runs. Finally, exporting fluctuations negatively affect the medium- and long-run export transition, whereas the lagged striving to export has a positive effect in the long run.

Regarding the printing sector, TFPs are also not statistically significant, playing no role in the export decision in the study sample. The lagged export start is significantly negative in the short-run perspective, and the sunk cost of international economic integration negatively influences the firms' export decisions. The sunk cost hypothesis is also maintained in the lagged coefficient of 'stop' with significantly negative signs in the short- and long-run transitions. However, persistence in export has a significant and positive effect on the current exporting decision in all spectrums. Finally, export fluctuation negatively affects the long-run export transition, whereas the positive impact of lagged 'striving' to export is observed in the long run.

In the chemicals sector, TFPs are also not statistically significant. The lagged export start has a significantly negative sign in the short-run perspective. The sunk cost of competing in the export market negatively influences the firms' decisions. The sunk cost hypothesis is also sustained in the lagged coefficient of 'stop' with significantly negative signs in the short- and medium-run transitions. Finally, export fluctuation negatively affects the long-run export transition, whereas we observe the positive effect of lagged 'striving' to export in the long run.

Table 6 presents the estimation results in the field of (1) rubber, (2) fabricated metal, (3) electrical equipment, and (4) furniture. Arellano-Bond tests indicate that

Table 6. TFP and export transitions by manufacturing sectors (Part 3), 2010–2015.

	Rubber and plastics products (Observations: 2,755; Number of firms: 551)																				
	Two-year			Three-year						Four-year						Five-year					
Variable	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.start	−0.088 ***			0.441						0.817						−0.017 ***					
TFP				−0.001			0.002	0.002			−0.0001	0.035***									
L.stop		−0.061 ***			0.416 **						−0.017 ***						−0.010 **				
L.CONT			0.827***			1.013						0.084						0.685 ***			
L.FLDOWN							−0.033 **						−0.049 **						−0.024 ***		
L.FLUP								−0.039 ***						−0.052 ***						−0.053 ***	
L.strive									0.130						−0.230						0.301 ***
Hansen J test	11.87	19.58	1.139	6.357	2.648	0.275	14.47	14.15	3.959	14.83*	10.21	3.519	11.49	9.347	4.474	5.565	7.427	19.32**	5.790	9.291	4.399
Wald test	372.3 ***	103.6 ***	2271 ***	60.07 ***	233.7 ***	35675 ***	76.18 ***	70.58 ***	340.8 ***	216.2 ***	74.10 ***	2637 ***	65.01 ***	95.48 ***	272.8 ***	17.10 *	9.659	13162 ***	19.89 **	44.25 ***	307.8 ***
AR (2) test	−0.198	0.253	−4.296 ***	0.612	2.015 *	1.365	1.618	0.524	0.264	1.437	0.554	−0.196	1.316	0.061	−0.398	0.314	0.132	−0.700	0.164	0.0122	−1.054
INST	26	26	15	17	17	14	24	24	17	19	22	14	22	22	16	20	20	20	20	20	20
Variable	Fabricated metal products (Observations: 3,350; Number. of firms: 670)																				
	Two-year			Three-year						Four-year						Five-year					
	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.start	−0.057 ***			0.338						−0.351						−0.008 *					
TFP		−0.001	0.035 **			0.007															
L.stop		−0.044 ***			−0.004 **						−0.004						−0.003				
L.CONT			0.861 ***			0.944 ***						0.437 ***						1.062 ***			
L.FLDOWN							−0.030 **						−0.462						−0.007 **		
L.FLUP								−0.044 **						−0.051 **						−0.025 ***	
L.strive									0.076						−0.494						0.321 ***
Hansen J test	28.80 **	21	3.743	16.73 **	16.65	5.266	9.439	15.43	1.473	11.94	10.85	1.451	6.329	12.63	7.004 *	11.13	8.881	96.11 ***	3.745	5.743	29.29 ***
Wald test	421.9 ***	354.2 ***	8670 ***	283.4 ***	103.6 ***	18643 ***	326.5 ***	94.88 ***	163 ***	129.1 ***	66.90 ***	2485 ***	38.09 ***	110.4 ***	241 ***	7.444	2.328	750.3 ***	25.88 ***	23.71 ***	152.8 ***
AR (2) test	1.508	2.029 **	−2.848 ***	1.098	−1.708*	3.345 ***	1.727 *	1.699 *	0.369	−0.681	−0.713	1.329	−1.133	1.726 *	−1.859 *	−0.751	−0.406	−1.622	−0.841	1.344	−0.713
INST	26	26	15	21	24	14	24	24	14	19	22	14	16	22	14	20	20	16	20	20	20
Variable	Electrical equipment (Observations: 1,035; Number of firms: 207)																				
	Two-year			Three-year						Four-year						Five-year					
	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.start	−0.086 ***			−0.002						2.541						−1.001 ***					
TFP	−0.020	0.003	0.040	0.003	0.003	−0.026	0.001	−0.008	0.043 **	−0.0003	−0.001	0.017	−0.0001	−0.007	−0.021	0.00001	−0.0001	0.034	−0.00001	−0.003	0.003
L.stop		−0.053 ***			−0.004						−0.008						−0.001				
L.CONT			0.692 ***			0.795 ***						1.276						−1.953			
L.FLDOWN							−0.093 **						−0.012						−0.010		
L.FLUP								−0.066 **						−0.063						−0.034 *	
L.strive									0.021						0.739						0.277 ***
Hansen J test	11.72	11.07	4.264	13.94	14.22	10.22	13.38	14.49	3.947	4.778	14.21	1.077	13.89	14.44	2.889	4.244	5.575	9.812	6.164	7.434	7.310
Wald test	115.4 ***	59.46 ***	633.7 ***	68.36 ***	54.79 ***	4932 ***	31.56 ***	21.88 **	117.5 ***	2.199	36.25 ***	32638 ***	20.78 **	16.13 *	438.9 ***	871761 ***	1.173	495.4 ***	2.942	8.261	138.4 ***
AR (2) test	0.108	0.668	−2.741 ***	−0.984	−1.056	1.750 *	1.180	0.714	0.044	0.715	0.090	0.851	−0.294	0.750	0.584	−0.676	−0.960	−1.083	−0.937	−0.553	−1.728 *
INST	26	26	15	24	24	19	24	24	17	16	22	16	22	22	16	20	20	18	20	20	20
Variable	Furniture (Observations: 2,445; Number of firms: 489)																				
	Two-year			Three-year						Four-year						Five-year					
	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.start	−0.0744 ***			−0.004						−0.007						−0.003					
TFP	0.012	0.003	0.0163	−0.001	0.006	−0.022	−0.001	0.008	0.019	0.003	0.009	0.008	−0.001	0.010	−0.024	0.001	0.002	−0.005	0.001	0.002	−0.004
L.stop		−0.055 ***			−0.162						−0.168						−0.015**				

(*continued*)

Table 6. Continued.

	Rubber and plastics products (Observations: 2,755; Number of firms: 551)																				
	Two-year			Three-year						Four-year						Five-year					
Variable	start	stop	CONT	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving	start	stop	CONT	FLDOWN	FLUP	striving
L.CONT			0.786 ***			0.731 ***						0.797 ***						0.793 ***			
L.FLDOWN							−0.019						−0.035*						−0.003		
L.FLUP								−0.032 ***						−0.051 ***						−0.025 ***	
L.strive									−1.330 *						0.479						0.434 ***
Hansen J test	13.91	12.36	4.095	13.69	8.245	7.457	13.42	16.44	4.439	5.743	5.582	4.496	13.28	7.309	4.959	6.428	5.437	3.626	11.86	6.251	2.363
Wald test	255.3 ***	121.6 ***	2566 ***	118.2 ***	62.61 ***	15434 ***	43.72 ***	96.88 ***	818.1 ***	29.24 ***	36.34 ***	19551 ***	65.18 ***	122.4 ***	459.1 ***	1.032	10.88	8457 ***	6.683	31.30 ***	187.5 ***
AR (2) test	−0.235	−0.690	−4.533 ***	−1.855 **	−0.241	1.473	0.579	−0.642	−1.780 *	0.086	−0.169	0.733	1.185	0.978	−0.110	1.599	1.252	−0.109	1.200	0.615	1.055
INST	26	26	15	24	17	24	24	24	17	22	16	22	22	22	14	20	20	20	20	20	20

Note: The main variables related to export transitions are presented. Controlling variables include the natural logarithm of value-added per labour, the natural logarithm of capital stocks per employment, the natural logarithm of employment, the natural logarithm of wage, the natural logarithm of age, dummies for years are on request. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Method of estimation: GMM (Arellano & Bond, 1991). Abbreviations: L.: one-year lag; CONT: continuity; FLDOWN: fluctuation-down; FLUP: fluctuation-up; INST: instruments; AR (2): Arellano-Bond test for autocorrelation of the second order. Source: Authors' estimation from VAES 2010-2015.

the high levels of autocorrelation are solved in most cases, except for the export continuity in the short run, export stop in medium-run transition (rubber sector); the export stop and 'continuity in the short run; continuity, fluctuations in a three-year transaction; fluctuation-up, striving in a four-year trade (fabricated metal sector); the export continuity in the short run and three-year commerce; striving in the long run (electrical equipment sector); the export continuity in the short run; start in the three-year transition; striving in the four-year transition (furniture sector). Moreover, Hansen J statistics prove the validity of instrument variables in most cases, except for the export start and continuity in respective four- and five-year transitions (rubber sector) and the export continuity in four-year transition (fabricated metal sector). Thus, we only discuss relevant results strengthened by the favourably mentioned tests.

Regarding the rubber sector, the estimated coefficient on TFP is not significant in most scenarios, except for the case of the export continuity in a four-year transition, implying that the self-selection hypothesis is supported in this case. Understandably, latex processing is mainly labour-intensive, rubber product manufacturing requires much higher technology than raw material processing, and Vietnam exports up to 80% of natural rubber production (Tran et al., 2018). The lagged export start has a significantly negative sign in the short- and long-run perspectives. The sunk cost of competing with other businesses in the world market adversely affects the firms' export decisions. The sunk cost hypothesis is also borne in the lagged coefficients of 'stop' with a significantly negative sign in the short-, medium- and long-run transitions. Finally, exporting fluctuations negatively affect the medium- and long-run export transitions, whereas no effect exists in 'striving' to export.

TFPs are not statistically significant in all equations with robust test results concerning the fabricated metal sector. The coefficient of the lagged export start is significantly negative in the long-run perspective, and the export sunk cost negatively endures the firms' exporting decision. Persistence in export has a significantly positive effect on exporting decisions in the case of the long run. Finally, exporting fluctuations negatively affect the long-run export transition, whereas the positive impact of the lagged export striving exists in the long run.

Concerning the electrical equipment, TFPs are not statistically significant, implying that productivity is not a source of export decision, except for the case of the export striving in a four-year transition, which is positively significant at a 1 per cent level. One explanation is that although the electrical equipment sector is said to be an export-oriented industry, the sector is characterised by labour intensity in the assembly of components and final products, and thus, it is accompanied by low technology (Goto & Arai, 2017). The sunk cost hypothesis is held in the lagged of 'start' for the short- and long-run perspectives and the lagged coefficient of 'stop' in the short-run transition. Persistence in export has no significant effect on exporting decisions in all cases. Finally, exporting fluctuations negatively affect the three-year and long-run export transitions, whereas the positive impact of lagged 'striving' to export is confirmed in the long run.

TFPs are not statistically significant in the furniture sector in all cases, implying that productivity does not affect the export decision in our sample. It is proven that the furniture sector in Vietnam. However, it has grown in export turnover and still faces many weaknesses in terms of size, cooperation, innovation and technology, and skilled labourers that may hide productivity (Huynh (2017); Hoang et al. (2015)). The lagged export start has a significantly negative sign in the short-run perspective. The export sunk cost bears a burden. The sunk cost hypothesis is also tolerated in the lagged coefficient of 'stop' with significantly negative signs in the short- and long-run transitions. Such sunk costs can be evident from the relatively high production costs, such as the cost of forest certification (Maraseni, Hoang, Cockfield, Vu, & Tran, 2017) in applying advanced technology (Huynh, 2017). However, persistence in export has a significantly positive effect on export decisions in the case of both medium- and long-run perspectives. Finally, exporting fluctuations negatively affect the medium- and long-run export transition, whereas the positive association of the lagged export striving is identified in the long run.

5. Conclusions and implications

In recent years, the relationship between total factor productivity and firms' exports has regained considerable interest in scientific communities and policy-makers, especially in increasing globalisation, regional integration, and trade war. This article examines the impact of total factor productivity on export transitions using a representative sample of Vietnamese manufacturing firms. The current paper estimates firms' TFP with the AFC procedure. We distinguish different types of export transitions, namely export start, export stop, export continuity, export fluctuation, and export striving, and various stages of export transition, namely the short-run (or two-year transition), the medium-run (three- and four-year transitions), and the long-run (five-year transition). The impact of total factor productivity on export transitions is estimated using GMM estimation to control endogeneity and unobserved time-invariant specific components.

Our results indicate that the effects of productivity on export are heterogeneous depending on specific manufacturing sectors, specific types of export transition, and specific phases of export transition and that productivity does not necessarily lead to export decisions. Our results support the selection mechanism described in recent theoretical models of international trade with heterogeneous firms. We do not find evidence that productivity growth leads to exporting decisions in twelve manufacturing sectors. However, regarding export exit, higher productivity decreases the probability of stopping export in the leather sector in the short run. We find that productivity growth reduces the likelihood of export persistence in the wearing apparel sector (in the medium-term with a three-year transition) and leather products (in the medium-term with a three-year change).

Nevertheless, a positive influence is found in wood products (in the medium term with a three-year transition), rubber products (in the medium term with a four-year change), and fabricated metal products (in the short time with a two-year transition). We do not find any evidence that productivity can affect export fluctuations regarding export fluctuations. For export striving, productivity does not strengthen export efforts in textiles (in the medium-term with a three-year transition), wearing apparel (in the medium-term with a three-year change), and electrical equipment (in the medium-term with a three-year transition).

Our results also reveal strong evidence of favourable sunk cost in the case of long-run export striving in nearly all sectors, except for the food sector. The reasonable sunk cost is also found for the possibility of export continuity in textiles (in the long-term), wearing apparel (in the medium-term with a three-year transition); leather products (in the medium-term with three-year transition); wood products (in the medium-term with four-year transition); paper products (in the medium- and long-terms); printing (in the short-, medium-, and long-term); fabricated metal products (in medium-term with four-year and long-term); and furniture (in both medium- and long-term).

Unlike previous studies, our results find a negative effect of sunk cost in some manufacturing sectors, mainly relating to export types of 'start', 'stop', 'fluctuation-down', and 'fluctuation-up'. More specifically, the negative sunk cost exists for export 'start' in the food sector (in the short- and long-term), textiles (in the short- and long-term), wearing apparel (in the long-term), wood sector (in the short- and long-term), paper products (in the medium-term with four-year transition), printing (in the short-term), chemicals products (in the short-term), rubber products (in the short- and long-term), fabricated metal products (in the short- and long-term), electrical equipment (in the short- and long-term), and furniture (in the short-term). The negative sunk cost is also found for export 'stop' in food products (in the short-term), textiles (in the medium-term with a four-year transition), leather products (in the short-, medium-, and long-term), wood products (in the short-term), paper products (in the short-term), printing (in the short- and long-term), chemicals products (in the short- and medium-term), rubber products (in the short-, medium, and long-term), electrical equipment (in the short-term), and furniture (in the short- and long-term). The negative sunk cost exists for 'fluctuation-down' or 'fluctuation-up' in food products (in the medium- and long-terms); textiles (in the medium- and long-terms); wearing apparel (in the medium- and long-terms); leather products (in the medium- and long-terms); wood products (in the medium- and long-terms); paper products (in the medium- and long-terms); printing (in the long-term); chemicals and chemical products (in the long-term); rubber products (in the medium- and long-terms); fabricated metal products (in the long-term); electrical equipment (in the medium- and long-terms); and furniture (in the medium- and long-terms).

These findings show that policy-makers in developing countries should create more dynamic comparative advantages than traditional advantages, such as abundant natural resources and cheap labour. Creating a favourable environment for new exporters should reduce sunk costs. In addition, it appears more convincing that the trade and economic policies should focus on productivity enhancement that helps firms enter the international market and will, in turn, increase the likelihood of survival of domestic firms in the highly competitive global markets.

The paper bears some limitations. First, the article covers six years, and it is essential to note that 2010–2015 represents a part of the global recovery from the Great Recession of 2008 to 2009. Thus, careful generalisation from the empirical results must be taken. Second, export transitions may be deeply affected by market demand

and trade barriers, which are not sufficiently mentioned in the current paper due to the lack of data. Third, some policy implications may be hidden by the export of high-tech products that call for more explorations in the future.

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