

# Productivity growth and job reallocation in the Vietnamese manufacturing sector

Nguyen Khac Minh  
*TIMAS, Thang Long University, Hanoi, Vietnam*  
Phung Mai Lan  
*Faculty of Economics and Management,  
Thuy Loi University, Hanoi, Vietnam, and*  
Pham Van Khanh  
*Thang Long University, Hanoi, Vietnam*

## Abstract

**Purpose** – The purpose of this paper is to measure TFP growth and job reallocation in the Vietnamese manufacturing industry after the Doimoi period.

**Design/methodology/approach** – The study uses firm-level panel data from Vietnam's annual enterprise survey data for 2000–2016 period in the Vietnamese manufacturing industry using Olley–Pakes static and dynamic productivity decomposition methods.

**Findings** – The aggregate productivity estimated from the WRDG method increased 2.323 percent, of which over 40 percent is due to the reallocation toward more productive firms. Olley–Pakes dynamic decomposition according to ownership, scale and industry shows that the contribution of private and state-owned firms and the contribution of small and medium firms and large firms to the TFP growth are 133, –33 percent, 58.56 and 41.44 percent, respectively. The within-firm productivity and net entry components are the main reasons for TFP growth rather than reallocation. The results show that the composition of the aggregate TFPs, estimated from WRDG, OP, LP and ACF, is correlated very high (over 80 percent) except for net entry components.

**Research limitations/implications** – The major limitation of this study is that the authors compute an aggregate productivity index using actual employment-based shares (still misallocation in labor), rather than optimal employment-based shares (no misallocation in labor).

**Originality/value** – Job reallocation between industries is attracting attention in developing countries, especially transition economies. However, knowledge about job reallocation among industries is limited. This paper assesses the level of job reallocation among private and state-owned firms, small and medium firms and large firms in Vietnam.

**Keywords** Vietnam, Manufacturing industry, Job reallocation, Private- and state-owned firms, Small and medium firms and large firms

**Paper type** Research paper

## 1. Introduction

The reallocation of resources between production units plays a crucial role in explaining productivity and potential growth. One of the most studied aspects is whether the growth in aggregate productivity is mainly due to the contribution of firms' own TFP improvement, the resource reallocation among firms or the firm's entry and exit (firm turnover). There are



useful theoretical frameworks that explain the different paths of growth and failure of individual firms in the market, e.g., Jovanovich (1982). Firm's turnover is considered as an important source of productivity growth due to the entry of new firms and the exit of less productive firms (Aw *et al.*, 2001), and the reallocation of resources and market share from less to more productive firms (Melitz, 2003). There are two main approaches among empirical studies related to firm turnover and productivity. First, studies provide empirical evidence on the relationship between firm's turnover patterns and productivity differentials. Second, studies decompose the contribution of firm's turnover to aggregate productivity growth. Changes in industry productivity growth are decomposed into elements corresponding to: productivity improvement of continuing firms; a reallocation of market share from less productive to more productive firms; and the contributions of the exit of less productive firms and simultaneous entry of firms.

However, these studies often considered the role of reallocating market share (not labor share). Besides, the models are only limited to static decomposition which does not evaluate the separate contribution of firm-level productivity change and the reallocation of market share among survivors. Recent studies directly controlled a deviation of entry and exit flow of firms and aggregate productivity changes within the framework of the theory model of heterogeneous enterprises using the decomposition of dynamic models.

### *1.1 Dynamic productivity model in the analysis of reallocation*

Studying on dynamic productivity, Olley and Pakes (1996) focus on the telecommunications equipment industry. The restructuring of the telecom equipment industry involved significantly entry and exit and big changes in traditional companies. The study shows that the algorithm provided significantly different and reliable estimates of coefficients of production functions rather than traditional estimation procedures. Using firm-level data, the study indicates that mainly increased productivity is the result of reallocating capital toward higher productivity firms. It is a capital reallocation, not an increase in the efficiency of input allocations or in average productivity. Melitz and Polanec (2015) follow dynamic productivity decomposition performed by Olley and Pakes (1996) with firms entering and exiting in the manufacturing industries in Slovenia during the 1995–2000 periods. The authors claim that the decomposition of the aggregate productivity change into four similar parts reveals a deviation in the measurement of entry and exit. The results emphasize that the magnitude of relative measurement deviation to other methods can be significantly combined with entry and exit over the period, accounting for 10 percent of aggregate productivity growth. In contrast, reallocation of market share among survivors plays a more important role in the change in TFP. Following Olley and Pakes' decomposition method, Collard-Wexler and Loecker (2015) examine the reallocation of resources across producers and technology in the US steel industry. They measure the impact of new technology for producing steel-minimill-on-industry-wide productivity in the US steel industry, using plant-level data for the period from 1963 to 2002. They show that the minimill's entry and the level of higher competition are major factors responsible for unusually high productivity growth in the US steel industry, leading to substantial productivity growth for the industry as a whole. Lan and Minh (2018) applied static and dynamic Olley–Pakes decomposition method to examine the impact of technology spillover, reallocation of resources and competition to the productivity of Vietnamese manufacturing enterprises in the period 2000–2015. They show that the competitive effect in the reallocation process plays an important role in the productivity growth of manufacturing sectors.

However, they do not directly correspond to a measure of job reallocation and productivity growth of the economy in transition.

1.2 Job creation, destruction and job reallocation

Job creation and job destruction are topics that have been written by many authors such as Bilsen and Konings (1998), Davis and Haltiwanger (1992) and Bojnec *et al.* (1998). For example, Bojnec *et al.* (1998) use a unique firm-level data based on traditional and newly established private firms to investigate gross job flows and labor demand in a transition period in Slovenia. They find that job destruction dominates job creation in the early years of transition, but later in the transition job destruction diminishes. They also find that newly established private firms are the most dynamic ones in terms of job creation. They estimate a reduced labor demand equation controlling for ownership and competitive pressure and find that the estimated employment elasticity with sales is rather low, 12 percent. Loecker and Konings (2006) follow Olley and Pakes (OP) and Foster *et al.*'s (2001) decomposition method and find the importance of entry and exit in job reallocation. They show that firm entry and exit are important in the creative destruction process and TFP is increased mainly due to existing firms' increasing efficiency and through the net entry of firms. They also point out that state firms should become more efficient when jobs are destroyed, while private firms are characterized by the reallocation of employment to the more productive firms.

This study uses Wooldridge's method to estimate TFP and follows the decomposition method of Loecker and Konings (2006) to examine job reallocation across industries; ownership as well as firm size in the Vietnamese manufacturing industry. We also compare the results of dynamic decomposition from TFP estimated by different methods.

The next section provides the methodology for estimating firms' total factor productivity (TFP) as well as the procedure of static and dynamic decomposition of aggregate TFP. In Section 3 we describe the data set and summarize the main results. The last section provides the conclusion.

2. Methodology

2.1 The methods of estimating TFP

We start by assuming a Cobb–Douglas production function as follows:

$$Y_{it} = A_{it}K_{it}^{\beta_k}L_{it}^{\beta_l},$$

where  $Y_{it}$  denotes real value-added in firm  $i$  in period  $t$ ,  $L_{it}$  the labor input,  $K_{it}$  the real capital input and  $A_{it}$  the Hicksian neutral efficiency level of firm  $i$  in period  $t$ . Production function after taking natural logs is as follows:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \varepsilon_{it},$$

where  $y_{it}$  denotes log real value-added in firm  $i$  at time  $t$ ,  $l$  the log of labor,  $k$  the log of real capital and:

$$\ln(A_{it}) = \beta_0 + \varepsilon_{it},$$

where  $\beta_0$  measures the mean efficiency level across firms and over time,  $\varepsilon_{it}$  is the time and producer specific deviation, which can be decomposed into two components: an observable component (or at least predictable) ( $v_{it}$ ) and unobservable component, a white noise error term ( $u_{it}^q$ ):

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + v_{it} + u_{it}^q, \tag{1}$$

where  $\omega_{it} = \beta_0 + v_{it}$  represents firm-level productivity. In empirical studies, after estimating (1), researchers solve for  $\omega_{it}$ . The estimated productivity can then be calculated as follows:

$$\hat{\omega}_{it} = \hat{v}_{it} + \hat{\beta}_0 = y_{it} - \hat{\beta}_k k_{it} - \hat{\beta}_l l_{it}. \tag{2}$$

Productivity in levels can be obtained as exponential of  $\hat{\omega}_{it}$ , i.e.,  $\varphi_{it} = \exp(\hat{\omega}_{it})$ . It has been shown that estimation (1) uses OLS which leads to biased productivity estimates, caused by the endogeneity of input choices and selection bias. Olley and Pakes (1996) developed a consistent semi-parametric estimator. This estimator addresses the simultaneity problem by using a firm's investment decision to proxy for unobserved productivity shocks ( $i_t = \omega(l_{it}, k_{it})$ ). In OP algorithms, it requires that investment is strictly increasing in productivity, this allows to express unobservable productivity as a function of observable variables  $\omega_{it} = h(i_{it}, k_{it}) = i^{-1}(i_{it}, k_{it})$ . Because only observations with positive investment can be used when estimating (1), this can lead to a significant loss in efficiency. So Levinsohn and Petrin (2003) (LP) use intermediate inputs rather than investment as a proxy ( $m_{it} = \omega(m_{it}, k_{it})$ ). LP's estimation algorithm differs from the algorithm introduced by OP in two important respects. First, they use intermediate inputs to proxy for unobserved productivity, rather than investment. The second difference between the approach using OP and LP is in the correction for selection bias.

Both OP and LP assume that there is at least one input that can be adjusted at no cost and will react to the new information immediately. However, as Akerberg *et al.* (2006) (ACF) and Bond and Soderbom (2005) stated, for the labor coefficient to be identified in the first stage of the estimation algorithm, it requires that there exists some variation in the data, independent of investment (or intermediate inputs for LP).

The main difference between ACF's approach and OP and LP is that, in ACF's approach, they inverse "conditional" rather than "unconditional" input demand functions to control for unobserved productivity. This leads to results in a first stage that do not identify the coefficients on labor input. Instead, all coefficients are estimated in the second stage.

Thus, all three semi-parametric-algorithms of OP, LP and ACF use the two-step estimation procedure to obtain consistent estimates of input elasticity. Wooldridge (2009) (WRDG) proposes to address the OP/LP problems by replacing the two-step estimation procedure with a generalized method of moments (GMM).

We briefly discuss Wooldridge's (2009) algorithm starting from the Cobb–Douglas production function (1). In particular, he shows how to write the moment restrictions in terms of two equations: these have the same dependent variable ( $y_{it}$ ) but are characterized by a different set of instruments. This approach has useful features with respect to previously proposed estimation routines:

- (1) it overcomes the potential identification issue highlighted by ACF in the first stage; and
- (2) robust standard errors are easily obtained, accounting for both serial correlation and/or heteroskedasticity.

The first step by OP/LP, the estimation of the parameters is addressed under the assumption that:

$$E(e_{it}|l_{it}, k_{it}, m_{it}, l_{it-1}, k_{it-1}, m_{it-1}, \dots, l_{i1}, k_{i1}, m_{i1}) = 0. \tag{3}$$

Without imposing any functional form on the control function  $\omega_{it} = h(k_{it}, m_{it})$ . The second assumption exploits the Markovian nature of productivity. Following OP/LP, productivity according to the first-order Markov process is as follows:

$$E(w_{it}|l_{it}, k_{it}, m_{it}, l_{it-1}, k_{it-1}, m_{it-1}, \dots, l_{i1}, k_{i1}, m_{i1}) = E(w_{it}|w_{it-1}) = f(h(k_{it-1}, m_{it-1})). \tag{4}$$

Assumptions (3) and (4) directly lead to the formulation of the following two equations:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + h(k_{it}, m_{it}) + v_{it}, \tag{5}$$

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + f[h(k_{it-1}, m_{it-1})] + u_{it}. \tag{6}$$

In the estimation the approach is to deal with the unknown functional form using  $n$ th-order polynomials in  $k_{it}$  and  $m_{it}$ , where the limiting case with  $k_{it}$  and  $m_{it}$  (i.e.  $n = 1$ ) entering linearly should always be allowed.

The orthogonality condition on the error term ( $u_{it}$ ) is given by:

$$E(u_{it} | k_{it}, l_{it-1}, k_{it-1}, m_{it-1}, \dots, l_{i1}, k_{i1}, m_{i1}) = 0. \quad (7)$$

To estimate  $\beta_l$  and  $\beta_k$ , Wooldridge (2009) assumed that  $h(k_{it}, m_{it})$  contains all polynomials of order 3 or less in the form:

$$h(k_{it}, m_{it}) = \lambda_0 + c(k_{it}, m_{it})\lambda. \quad (8)$$

Wooldridge (2009) also assume that  $f(\cdot)$  can be approximated by a polynomial in  $h$ :

$$f(h) = \rho_0 + \rho_1 h + \dots + \rho_n h^n. \quad (9)$$

Equations (8) and (9) can be substituted into Equations (5) and (6) to give the following equations:

$$y_{it} = a + \beta_l l_{it} + \beta_k k_{it} + c_{it} \lambda + \varepsilon_{it} \quad (t = 1, 2, \dots, T), \quad (10)$$

and:

$$y_{it} = \theta + \beta_l l_{it} + \beta_k k_{it} + \rho_1 (c_{it-1} \lambda) + \dots + \rho_n (c_{it-1} \lambda)^n + u_{it} \quad (t = 1, 2, \dots, T), \quad (11)$$

where  $\alpha$  and  $\theta$  are the new constant parameters obtained through the aggregation of all constant terms,  $c_{it} = c(k_{it}, m_{it})$ .

The GMM estimators are applied to estimate Equations (10) and (11). Once  $\beta_l$  and  $\beta_k$  are obtained, the firm's TFP can be computed by using Equation (2).

## 2.2 Static and dynamic decomposition

2.2.1 Static analysis: Olley–Pakes decomposition. Following OP, the aggregate TFP of industry  $j$  at time  $t$  ( $\Phi_{jt}$ ) is calculated as a share-weighted average of firm productivity  $\varphi_{ijt}$ :

$$\Phi_{jt} = \sum_i S_{ijt} \varphi_{ijt}, \quad (12)$$

where  $s_{ijt}$  stands for a firm-specific weight of firm  $i$  in industry  $j$  at time  $t$ . Given our interest in the process of job reallocation induced by productivity growth in manufacturing, we compute an aggregate productivity index using job share, rather than output-based market share:

$$S_{ijt} = \frac{L_{ijt}}{\sum_i L_{ijt}}, \text{ and } S_{ijt} \geq 0 \text{ and sum to } 1.$$

To assess how the evolution of aggregate TFP depends on firm-level improvement in TFP vs reallocation of employment between firms, this work follows the approach proposed by Bartelsman *et al.* (2013) that is based on Olley and Pakes' (1996) decomposition method. This decomposition method splits the aggregate productivity index ( $\Phi_t$ ) into an unweighted mean and a sample covariance term. Formally the index  $\Phi_t$  is decomposed as:

$$\Phi_t = \bar{\varphi}_t + \sum_i (s_{it} - \bar{s}_t) (\varphi_{it} - \bar{\varphi}_t) = \bar{\varphi}_t + \text{cov}_t^{OP}, \quad (13)$$

where  $\bar{\varphi}_t$  represent unweighted mean productivity:  $\bar{\varphi} = (1/N_t) \sum_i \varphi_{it}$ .

The second term on the right-hand side of (13) ( $\text{cov}_t^{OP}$ ) is known as the Olley–Pakes covariance. The covariance changes over time as resources are reallocated across the existing firms.

The same decomposition of the aggregate TFP in Equation (13) could be broken down by some different categories  $\nu$  (by ownership or by size or by industry):

$$\Phi_t(\nu) = \bar{\varphi}_t(\nu) + \sum_i (s_{it}(\nu) - \bar{s}_t(\nu)) (\varphi_{it}(\nu) - \bar{\varphi}_t(\nu)) = \bar{\varphi}_t(\nu) + \text{cov}_t^{OP}(\nu). \quad (14)$$

These decompositions will help us to understand whether the average productivity of light industry (L) and heavy industry (H) (or small and medium-sized (SM) firms with large-scale firms (LA), or private owned (PR) and state-owned (ST) firms) evolved differently.

From where the within-industry decomposition can be defined as:

$$\Phi_t = \sum_{\nu \in SET} s_t(\nu) (\bar{\varphi}_t(\nu) + \text{cov}_t^{OP}(\nu)). \quad (15)$$

where SET denotes sets of H, L or SM, LA or PR, ST. This decomposition reflects both the actual component change, the un-weighted average and the covariance term, as well as the job share of the particular type.

*2.2.2 Decomposition between categories following Collard-Wexler and Loecker (2015).* In order to measure the importance of reallocation of resources among the categories mentioned above, we apply the same type of decomposition, but now the unit of observation is a category (heavy or light industry, small and medium or large firms, private or state-owned firms). This allows us to isolate the between-type reallocation component in aggregate productivity:

$$\Phi_t = \bar{\Phi}_t + \sum_{\nu \in SET} \left( s_t(\nu) - \frac{1}{2} \right) (\Phi_t(\nu) - \bar{\Phi}_t) = \bar{\Phi}_t + \text{cov}_t^B, \quad (16)$$

where  $\text{cov}_t^B$  is the “Between covariance” measuring the level of resource reallocation to categories, contributed to the aggregate productivity for the entire industry.

*2.2.3 Dynamic decomposition.* The above decomposition shows only a static version that may not reflect the dynamic impact of firms’ entry or exit on aggregate productivity. The dynamic decomposition method considers four distinct sets of producers in a given time window  $t-1$  and  $t$ , where  $t$  is a one year window. More specifically, dynamic productivity decomposition examines the origin of productivity changes by three types of firms: survivors ( $S$ ), entrants ( $E$ ) and exiters ( $X$ ). An entering firm in the industry is defined as a firm whose market share has increased from 0 and an exiting firm is defined as a firm with a market share of zero in each time window. Aggregate productivity growth can be decomposed as follows:

$$\begin{aligned} \Delta\Phi_t &= \sum_{i \in S} (s_{it}\varphi_{it} - s_{it-1}\varphi_{it}) + \sum_{i \in S} s_{it}\varphi_{it} - \sum_{i \in S} s_{it}\varphi_{it-1} \\ &= \sum_{i \in S} (s_{it}\varphi_{it} - s_{it-1}\varphi_{it-1}) + \sum_{i \in S} (s_{it}\varphi_{it-1} - s_{it-1}\varphi_{it-1}) + \sum_{i \in S} (s_{it}\varphi_{it-1} - s_{it-1}\varphi_{it-1}) \end{aligned}$$

$$\begin{aligned}
 & + \sum_{i \in S} (s_{it-1} \varphi_{it} - s_{it-1} \varphi_{it}) + \sum_{i \in E} s_{it} \varphi_{it} - \sum_{i \in X} s_{it-1} \varphi_{it-1} \\
 & = \left( \sum_{i \in S} s_{it-1} \Delta \varphi_{it} \right) + \left( \sum_{i \in S} \varphi_{it-1} \Delta s_{it} \right) \\
 & \quad + \left( \sum_{i \in E} \Delta s_{it-1} \Delta \varphi_{it} \right) + \left( \sum_{i \in E} s_{it} \varphi_{it} - \sum_{i \in X} s_{it-1} \varphi_{it-1} \right). \tag{17}
 \end{aligned}$$

In (17), the first term is the sum of changes in productivity with the share of labor at time  $t-1$ , which is referred to as a pure within-firm productivity increase or simply firm improvement; the second term is the sum of change in labor share multiplied by productivity at time  $t-1$  and is referred to as the reallocation component (reallocation); the third term is the sum of the product changes in labor share and productivity and is referred to an interaction term or the covariance component and the last term is a net entry component (net entry).

We further split up every component in the decomposition represented in Equation (17) according to ownership (private and state owned), industry (heavy and light industries) and size (small and medium firms and large firms).

### 3. Empirical research results

#### 3.1 Data and basic patterns of gross job flows

**3.1.1 Data.** The data used in this study are obtained from the set of GSO annual survey data for firms from 2000 to 2016. We exclude observations that have not positive or lost value such as property, revenue and labor. Information is available on 535,165 firms from 2000 to 2016. Variables in value are expressed in units of Vietnam dong and deflated. In this study, value added (VA) is used to estimate TFP at the firm level. Data on VA are not available and are measured based on the income approach. Information on income compensation, fixed asset depreciation and profitability is available in the enterprise survey. Appendix 2 shows descriptive statistics on average, maximum and minimum values of capital, labor, value added, revenue and profit of the manufacturing industry.

**3.1.2 Basic patterns of gross flows.** We measure gross job flows as defined by Davis and Haltiwanger (1992). Job creation rate (pos) is the sum of all job gains at expanding and new establishments within a sector that is divided by the sector size. In the same way, we also define job destruction (neg) as the sum of all job losses at shrinking and dying establishments within a sector that is divided by the sector size.

We determine that the sum of the two gives a measure for gross job reallocation (gross) and the difference between them generating net employment growth (net). If we take the difference between the ratio of gross job allocation and the absolute value of net employment growth, we will get a measure of excess job reallocation (excess). Such a measure tells us how much volatile job is taking place after having accounted for the job reallocation that is needed to meet certain aggregate job growth rates. This measure can be considered a better measure of the real churning that is happening in the labor market.

We define two other measures that represent the role of entry and exit in the sum of all job gains and the sum of all job losses. The first measure is the average of the entry over the sum of all job gains (Entry/Pos) and the second measure is the average of the exit over the sum of all job losses (Exit/Neg) for the year, respectively. The share of total entry and exit in job reallocation can be defined as (Entry+Exit)/Gross.

In the post-Doimoi period, the policies of equitization and enterprise law took effect, the economy had many changes especially many old jobs have been no longer appropriate and destructed, and many new jobs were created. Table II shows that on average the job creation rate (pos) and job destruction rate (neg) during 2000–2016 in the Vietnamese manufacturing sector are 20.42 and 12.06 percent, respectively. Thus, the job creation rate dominates the job destruction rate. This conclusion contradicts the conclusion of Loecker and Konings (2006). However, our conclusion is reasonable because Vietnam's manufacturing sector accounts for a very small proportion and labor of the industry sector only accounts for about 10 percent of the population before the Doimoi period. From Doimoi period, many policies have been implemented, leading many old jobs canceled while the number of new jobs created by many private firms established and growing rapidly. Table I indicates the evolution of gross job flow over time and the annual average of the gross job reallocation is 32.48 percent during 2000–2016. Excess job reallocation fluctuates around the average value of 23.52 percent, indicating the ability to create and destroy high jobs simultaneously.

The last three rows in Table I show that on average 41.77 percent of all job creation is accounted for by firms' entry and 34.13 percent of all job destruction is accounted for by firms' exit. The combined contribution of entry and exit of firms in the Vietnamese manufacturing sector during the period in job reallocation is 38.94 percent.

In Table II, we slice the data into different subsets (by ownership, by industry and by size) that are most affected by Vietnamese government policies during the Doimoi period to highlight the heterogeneity of firms in terms of gross job flows. Specifically, in each subset, we divide it into two opposing sets: private and state-owned firms (second column), heavy and light industries (third column), SMEs and large firms (fourth column).

We find that job creation is concentrated in private firms with job creation rates in state-owned firms averaging only 7.78 percent, much lower than the private firms 22.47 percent. However, the rate of job destruction of state-owned firms and private firms is almost the same (12.48 vs 11.77 percent). So in this period, the state-owned firms have been

Contents	2000–2001	2007–2008	2008–2009	2014–2015	2015–2016	Average 2000–2016
Number of entry firms	3,539	11,717	12,811	20,861	18,757	10,987
Number of exits firms	2,013	5,539	8,462	11,285	13,633	7,539
Job creation (Pos)	11.97	19.65	18.38	16.95	18.68	20.42
Job destruction (Neg)	16.72	13.26	14.72	11.17	15.00	12.06
Net employment growth rate (Net)	-4.75	6.40	3.66	5.79	3.69	8.36
Gross job reallocation (Gross)	28.70	32.91	33.11	28.12	33.68	32.48
Excess job reallocation (Excess)	23.95	26.51	29.44	22.34	29.99	23.52
Entry	1.68	10.33	8.51	5.76	8.08	8.53
Exit	11.12	2.74	3.41	3.38	6.89	4.12
Share of entry in job creation						41.77
Share of exit in job destruction						34.13
Share of entry and exit in job reallocation						38.94

Source: Calculated from GSO data

**Table I.**  
Aggregate job  
flows (%)

Contents	By ownership	By industry	By size
	State-owned firms	Heavy manufacturing firms	Large firms
Pos	7.78	23.51	16.37
Neg	12.48	13.49	9.12
Net	-4.70	10.02	7.25
Gross	20.26	37.00	25.49
Excess	14.22	26.71	17.66
Entry	0.00	11.32	6.56
Exit	2.39	5.07	2.49
Share of entry in job creation	0.00	48.15	40.04
Share of exit in job destruction	19.14	37.56	27.26
Share of entry and exit in job reallocation	11.79	44.29	35.47
Contents	Private-owned firms	Light manufacturing firms	Small and medium firms
Pos	22.47	20.38	26.57
Neg	11.77	10.88	16.38
Net	10.71	9.50	10.19
Gross	34.24	31.25	42.95
Excess	23.28	21.67	32.06
Entry	9.51	8.12	11.51
Exit	3.87	3.24	6.60
Share of entry in job creation	42.34	39.85	43.32
Share of exit in job destruction	32.91	29.76	40.31
Share of entry and exit in job reallocation	39.10	36.34	42.17

**Table II.**  
Aggregate job flows  
by ownership, by  
industry and by  
category (%)

**Source:** Calculated from GSO data

downsizing substantially because of the renovation and equitization. This shows that private-owned firms are net job creators, while state-owned firms are net job destroyers. Thus, the Doimoi policy has motivated the private sector to develop more dynamically than the state economic sector.

The last three lines of the upper and lower parts of Table II show that the contribution to the job destruction explained by the firm exit is 32.91 percent in the private sector while only 19.14 percent in the state-owned firms. This reflects the fact that the government still subsidizes state-owned firms (such as Thai Nguyen iron and steel plant with heavy losses has been invested). This also reflects the impact of equitization policy as well as the business laws enacted in the Doimoi period, and the market forces in the private sector outperform the state sector. So if new firms are more efficient they could push out old and inefficient firms; we expect the important role of entry and exit in the private sector where the restructuring process seems to be taking place and replacing unproductive state-owned firms with more productive private firms.

The estimated indicators of job creation, job destruction, the rate of job reallocation as well as employment growth are presented in Table II. We can draw some conclusions:

- (1) The average job creation rates in heavy and light industries[1] are almost the same (23.51 and 20.38 percent); meanwhile, these rates are much different for large firms and small and medium firms (16.37 and 26.57 percent).
- (2) The average job destruction rates in heavy and light industries are almost the same (13.49 and 10.88 percent); meanwhile, these rates are much different for large firms and small and medium firms (9.12 and 16.38 percent). That respects the fact that the state still subsidy for large firms even though they are inefficient and on the other hand many private firms grow rapidly (Hoa Phat Steel, for example).

- (3) The average gross job flows in heavy and light industries are 37.0 and 31.25 percent. These ratios, as shown in Table II, show an inverse relationship between gross job flows and firm size, which is a common pattern for market economies.
- (4) In the heavy and light industrial firms as well as the large firms and small and medium firms, the contribution to job creation by firm entry is almost more than 40 percent. This can be explained by the fact that although the state-owned economic sector has narrowed, the private sector has grown rapidly in both heavy industry and light industry. And not only many small firms are formed but also private firms are growing rapidly.

### 3.2 Results of decompositions

We rely on the estimated productivity by the WRDG's method to show the importance of reallocation, both cross and within categories (private vs state-owned firms, heavy vs light industry, large vs small and medium firms) in productivity growth that makes us to investigate the importance of entry and exit in productivity growth.

*3.2.1 Static decomposition of productivity growth.* Table III provides the results of aggregate TFP decomposition into components to consider their role in aggregate TFP changes from 2000 to 2016.

Table I shows that the gross job reallocation is 26.27 percent during the period. Thus, the reallocation of employment has contributed an important part in the productivity growth of manufacturing. This indicates that the impact of the Vietnamese government's post-renovation policies has helped the market mechanism work well and through which reallocation of resources has helped firms improve productivity.

The results of the within decomposition at Table III show that the aggregate TFP of private and the state-owned firms, heavy and light industry, large and small and medium firms has changed to 3.093, -0.796, 0.315, 1.030, 0.936 and 1.361, respectively. In which, reallocation resources of the above-mentioned industries contributed 30.13, 11.18, 49.21, 37.77 and 21.28 percent, 29.02 percent among aggregate TFP growth, respectively. Thus, the reallocation of labor forces is toward the most productive firms. This reflects the fact that it

	Job allocation		Job allocation		Job allocation	
Aggregate TFP	2.323	2.323	2.323		2.323	
Olley_Parkes						
Decomposition	2.323	2.323	2.323		2.323	
Unweighted average	1.293	1.293	1.293		1.293	
Covariance	1.031	1.031	1.031		1.031	
Between decomposition	2.323	2.323	2.323		2.323	
Unweighted average	2.354	2.354	2.743		2.299	
Between Covariance	-0.030	2.271	-0.420		0.025	
Within decomposition	2.323	2.323	2.323		2.323	
	Light industry	Heavy industry	State owned	Private owned	Small and medium firms	Large firms
Aggregate TFP	1.030	0.315	-0.769	3.093	1.361	0.963
Unweighted average	0.640	0.161	-0.684	2.160	0.966	0.758
Within Covariance	0.389	0.155	-0.086	0.932	0.395	0.205

**Notes:** The aggregate TFP of manufacturing firms increased by 2.323 percent during the study period. Olley-Pakes static decomposition shows that this increase is due to the contribution of the firm becoming more productive (56 percent) and the job reallocation from unproductive firms to more productive firms (44 percent)

**Source:** Estimated from GSO data

**Table III.**  
Static decompositions  
of productivity  
growth change  
2000-2016 (%)

is happening in the manufacturing sector of Vietnam after innovation (the share of total entry and exit in gross of heavy manufacturing firms is the highest (49.9 percent)).

*3.2.2 Dynamic decomposition of productivity growth.* Table IV presents the results of dynamic decomposition. Its columns show the results of TFP decomposition into components. Its rows report the results in one-year window decomposition for the entire sample.

Aggregate productivity rose by 2.323 percent over the entire period while the internal firm improvement component accounted for 4.633 percent, lower than the results for the US steel industry by Collard-Wexler and Loecker (2015). The change in TFP is less than firm improvement because of the contribution of the reallocation component and the covariance component is negative. Improvements within the enterprise are positive across all time windows except for the first two windows. This result demonstrates that most of the productivity growth is explained by the internal improvement component. Thus, the restructuring of firms in the Vietnamese manufacturing industry, reflected in the aggregate job creation and job destruction process, seems to have resulted in substantial within-firm productivity growth and entry components.

Meanwhile, the reallocation components which are negative in most time windows (except for the years 2000–2001, 2008–2009 and 2011–2012) indicate that the within-firm productivity growth is the main component for TFP growth. This result is consistent with the findings of Loecker and Konings (2006) for Slovenian manufacturing. In addition, the negative components between firms for most time windows suggest that growth in productivity has been associated with a process in which more productive firms are downsizing faster than less productive firms. The estimated results of productivity growth, productivity improvement and reallocation components for the years 2008–2009, 2011–2012 suggest that positive productivity growth of manufacturing is due to firm-improvement and the reallocation of resources from unproductive firms to more productive firms.

The covariance term tells us how the level of productivity change is correlated with changes in employment. This component is negative in all time windows, which shows that firms that increase in terms of productivity become smaller in size. This conclusion holds

Period	Total change	Firm improvement	Reallocation	Covariance	Net entry	Entry	Exit
2000–2001	-0.051	-0.043	-0.147	-0.170	0.308	0.640	0.332
2001–2002	-0.413	-0.168	0.030	-0.274	0.000	0.334	0.334
2002–2003	0.031	0.191	-0.107	-0.132	0.079	0.298	0.220
2003–2004	0.017	0.091	-0.134	-0.081	0.141	0.346	0.205
2004–2005	-0.074	0.005	-0.021	-0.069	0.012	0.232	0.220
2005–2006	0.223	0.275	-0.051	-0.094	0.093	0.339	0.246
2006–2007	0.343	0.398	-0.190	-0.138	0.273	0.452	0.180
2007–2008	0.073	0.403	-0.113	-0.325	0.108	0.366	0.258
2008–2009	0.589	0.641	0.089	-0.297	0.156	0.476	0.319
2009–2010	-0.092	0.144	-0.064	-0.143	-0.029	0.319	0.348
2010–2011	0.090	0.088	-0.031	-0.167	0.200	0.542	0.343
2011–2012	0.420	0.498	0.090	-0.157	-0.011	0.304	0.315
2012–2013	0.062	0.052	-0.054	-0.081	0.145	0.510	0.365
2013–2014	0.133	0.720	-0.114	-0.545	0.073	0.478	0.404
2014–2015	0.664	0.765	-0.099	-0.222	0.220	0.514	0.295
2015–2016	0.308	0.572	-0.252	-0.196	0.185	0.563	0.379
Total	2.323	4.633	-1.170	-3.092	1.952	6.714	4.762

Source: Estimated from GSO data

**Table IV.**  
Dynamic decomposition of productivity growth (%)

true for all transitional economies, especially the post-socialist economy, as is the case with Loecker and Konings (2006).

More importantly, however, the net firm entry component explains 1.952 percent of the observed aggregate productivity growth over the sample period, while the industry aggregate productivity growth is 2.323 percent in the same period during the period.

The decomposition results show that the contribution to aggregate TFP growth of the firm improvement component clearly dominates the net entry component as it is over two times the magnitude on average (4.633 vs 1.952 percent). However, for a number of years such as 2001–2005, 2010–2011 and 2012–2013, the contribution of net entry to aggregate productivity growth dominates the contribution of firm improvement. The creative destruction process taking place in Vietnam’s manufacturing sector is not due to the reallocation of employment between existing firms and the covariance component, but the entry of more productive firms replacing inefficient firms and improving productivity within the firms. This suggests that encouraging firms’ entry is important to improve aggregate productivity.

Table V presents a summary of the results of this decomposition broken down by categories (more details in Appendix 3). Total change in TFP of all subsets shows positive productivity growth except state-owned firms (–0.769 percent). Thus, the contribution of private-owned and state-owned firms to its productivity growth is 133 and –33 percent, respectively. Similarly, the contribution of small and medium enterprises and large enterprises is 58.56 and 41.44 percent, respectively.

We can note that the growth of aggregate TFP reported in Table V is mainly due to firm improvement component and net entry component, except the case of state-owned firms (since the net entry of state-owned firms is negative). In other words, in general, firms have become more efficient in accordance with the above analysis. So after Doimoi, the restructuring of firms, reflected in the process of aggregate job creation and job destruction, seems to have resulted in an improvement in the efficiency within firms, making firms more productive. For example, the contributions of firm improvement component for the light industry, heavy industry and other industries are 2.755, 0.653 and 1.224 percent, respectively. On the other hand, the reallocation component of almost all categories (except for small and medium firms) in Column 4 is negative. These two results give the conclusion that growth in productivity has been associated with a process in which more productive firms are downsizing faster than less productive firms in most categories. This conclusion is consistent with the conclusion when we decompose TFP for the entire manufacturing industry above.

The negative covariance component for all categories in Column 5 suggests that firms increasing productivity in all categories become smaller in size.

Period	Total change	Firm improvement	Reallocation	Covariance	Net entry	Entry	Exit
State-owned firms	–0.769	0.397	–0.740	–0.357	–0.069	0.866	0.936
Private firms	3.093	4.236	–0.430	–2.734	2.021	5.848	3.826
Light industry	1.030	2.755	–0.809	–1.738	0.822	3.247	2.425
Heavy industry	0.315	0.653	–0.398	–0.471	0.531	1.813	1.282
Other industry	0.979	1.224	0.038	–0.882	0.599	1.654	1.056
Small and medium firms	1.361	1.748	0.338	–1.640	0.914	3.587	2.673
Large firms	0.963	2.884	–1.507	–1.452	1.038	3.127	2.089

Source: Estimated from GSO data

**Table V.**  
Dynamic decomposition of productivity growth by category (%)

Comparing the net entry and the firm improvement component, we find that the contribution of the net entry components of heavy manufacturing firms to their productivity growth is higher than the contribution of the firm improvement component. This shows that the creative destruction process in large firms is not caused by reallocation of employment among existing firms, but rather by the entry of more productive firms replacing unproductive firms. A typical example is that Hoa Phat Steel firm is a private firm newly established after Doimoi, but now it is dominating and becoming the largest steel job share in Vietnam.

This suggests that encouraging firm entry or exit in the Vietnamese manufacturing industry is important for aggregate productivity growth. Therefore, policies fitting into the competitive market, by removing the barriers to entry and exit of firms, are necessary to help improve aggregate productivity.

*3.2.3 Sensitive analysis.* To consider whether TFPs that are estimated from four different methods (WRDG, LO, OP and ACF) have different conclusions when using the same Olley–Pakes dynamic decomposition, we calculated the Spearman rank correlation to see the correlation between the total changes in aggregate TFP estimated from four methods (WRDG, LP, OP and ACF). The results are reported in Tables VI and VII.

The first part of Table VI presents the correlation between the total change in the aggregate TFP, and the second part of this table presents the correlation between the firm improvement components. It is clear that the changes in aggregate TFP estimated from different methods and the firm improvement components are very highly correlated (always higher than 0.80). Correlations between the total changes in TFP estimated from WRDG and from LP, OP are also typically higher than 0.95.

Part 1 of Table VII presents the correlation between the reallocation components and Part 2 is showing the correlation between the net entry components. The results in Part 1 of Table VII give the same conclusion as drawn from Table VI, but the results in Part 2 of Table VII are slightly different.

**Table VI.**  
Spearman rank correlation of total change components (or of firm improvement components)

	WRDG	Total change			Firm improvement components			
		LP	OP	ACF	WRDG	LP	OP	ACF
WRDG	1.000				1.000			
LP	0.9824*	1.000			0.9794*	1.000		
OP	0.9618*	0.9912*	1.000		0.9794*	1.000*	1.000	
ACF	0.8912*	0.8824*	0.8647*	1.000	0.8294*	0.8059*	0.8059*	1.000

**Notes:** PW matrix (obs = 16). \*Statistical significance at 5 percent  
**Source:** Estimated from GSO data

**Table VII.**  
Spearman rank correlation of reallocation components (or of entry components)

	WRDG	Reallocation components			WRDG	Entry components		
		LP	OP	ACF		LP	OP	ACF
WRDG	1.000				1.000			
LP	0.9941*	1.000			0.7971*	1.000		
OP	0.9794*	0.9853*	1.000		0.9412*	0.8676*	1.000	
ACF	0.8974*	0.8959*	0.8886*	1.000	0.7290*	0.5714*	0.7099*	1.000

**Notes:** PW matrix (obs = 16). \*Statistical significance at 5 percent  
**Source:** Estimated from GSO data

#### 4. Conclusion

The purpose of this paper is to consider whether the industrialization process in Vietnam's manufacturing industry after Doimoi is one of creative destruction. In order to check the robustness of the decomposition results, we applied Olley–Pakes dynamic decomposition for the aggregate TFP, estimated from WRDG, OP, LP and ACF. The results show that the composition of the aggregate TFPS is correlated very high (over 80 percent) except net entry components. Estimated results show that: first, the growth of aggregate productivity using the WRDG method is found 2.323 percent. Second, the Olley–Pakes dynamic decomposition shows that the contribution of private and the contribution of small and medium firms and large firms to the TFP growth are positive and account for 133, 58.56 and 41.44 percent, respectively. Third, job reallocation among the firms shows that the within-firm productivity and net entry components are the main reason for TFP growth rather than reallocation. Fourth, thus, the process of creative destruction take place in Vietnam's manufacturing sector is not due to the reallocation of employment between existing firms and the covariance component, but the entry of more productive firms replacing inefficient firms and improve productivity within the firms. This suggests that encouraging firms' entry is important to improve aggregate productivity. There are some policy implications suggested from the research results: the establishment of a policy that fits into the competitive market, by removing the barriers to entry and exit of firms, is necessary to help improve aggregate productivity. Besides, the government should also encourage and support firms improving productivity, especially for small and medium firms to improve aggregate productivity.

#### Note

1. According to German *et al.* (2011), we divide industrial into broad categories of sector: light industry, heavy industry and other. A light industry consists of food products and beverages, tobacco products, textiles, wearing apparel, dressing and dyeing of fur, tanning and leather products, furniture, etc. Heavy manufacturing comprises coke, refined petroleum and nuclear fuel, chemicals and chemical products, rubber and plastic products, other non-metallic mineral products, basic metals, fabricated metal products.

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**Appendix 1**

Prior to the Doimoi, heavy industry was considered as a foundation and a priority for development. In this period, the majority of foreign investment and aid were concentrated on building large-scale plants (the investment capital for heavy industry increased more than 12 times while investment for light industry increased about 7 times) while the resources are limited, the economy is difficult, thought rushed heavy industry does not serve timely agriculture and light industry should lead to crisis, lose weight serious structure.

After the renovation, the policy of industrialization has changed significantly since the development of heavy industry has gradually shifted to the direction of heavy industry development with the degree of power and agriculture and the consumer goods industry. In the period of 1987–1996, the economy gradually improved, quality and gradually escaped from the crisis. In the period of 1997–2006, agriculture and processing industry were considered as the breakthroughs and priorities of Vietnam. Therefore, from 2007 to now, Vietnam’s industrial policy has shifted to encourage the development of high-tech, complementary software technology to gradually develop the economy in depth.

Period	Before renovation Period 1960–1986	Period 1987–1996	After renovation Period 1997–2006	Period 2007–now
Industrialization policy	To prioritize the development of heavy industry on the basis of developing agriculture and light industry	Agriculture is the leading front, developing heavy industry with level, power. Take agriculture, consumer goods industry and export as the focus	To accelerate the industrialization and modernization of agriculture, to make breakthroughs in combination with the processing industry	To encourage the development of high technologies, processing industries, software technology and subsidiary technologies.
Prioritize	Heavy industry	Light industry	Light industry	High technology, processing industry

**Note:** Vietnam’s industrialization policy has changed considerably before and after the renovation

**Table A1.**  
Vietnam industrialization policy before and after Doimoi

## Appendix 2

The relative size of light and heavy industries dropped steadily over the period. By 2016, light and heavy industry accounted for 32.0 and 34.9 percent of the total capital employed in the manufacturing sector, respectively. The light industry remains the most labor-intensive sector, employing 61.6 percent of the total labor vs 17.2 percent for heavy industry are reported in Table AIV.

Variables	Manufacturing industry 2000–2016	Light manufacturing 2000–2016	Heavy manufacturing (2000–2016)
<i>Capital (K)</i>			
Mean	12,583.62	11,577.38	13,208.75
SD	137,997.30	77,804.89	130,393
Skewness	115.83	30.56572	88.51467
<i>Labor (L)</i>			
Mean	114	177	63
SD	664	935	190
Skewness	48	36	13
<i>Value added (VA)</i>			
Mean	2,750.14	3,059.499	2,169.043
SD	45,819.22	25,120.77	16,484.12
Skewness	200.24	51.65395	39.67112
<i>Revenue</i>			
Mean	17,537.06	17,325.57	14,835.99
SD	356,862.20	122,137.3	176,914.2
Skewness	217.70	42.96253	135.3425
<i>Profit</i>			
Mean	902.73	760.2117	719.2143
SD	34,459.93	14,936.26	9,864.679
Skewness	227.07	74.9064	60.13158
Observations	535,165	214,894	178,873

Source: Calculated from GSO data

**Table AII.**  
Description statistics

	Light industry	Total change	Firm improvement	Reallocation	Covariance	Net entry	Entry	Exit
2000–2001		-0.185	-0.175	-0.448	-0.342	0.779	1.589	0.810
2001–2002		-0.990	-0.355	-0.100	-0.499	-0.037	0.815	0.852
2002–2003		0.108	0.530	-0.346	-0.254	0.179	0.711	0.532
2003–2004		0.065	0.253	-0.392	-0.138	0.342	0.834	0.491
2004–2005		-0.249	-0.049	-0.067	-0.102	-0.031	0.531	0.562
2005–2006		0.672	0.772	-0.152	-0.174	0.227	0.856	0.629
2006–2007		0.963	1.099	-0.594	-0.261	0.719	1.145	0.426
2007–2008		0.090	0.851	-0.333	-0.658	0.230	0.851	0.621
2008–2009		1.764	1.929	0.145	-0.643	0.333	1.173	0.840
2009–2010		-0.298	0.347	-0.190	-0.310	-0.145	0.745	0.891
2010–2011		0.369	0.210	-0.054	-0.269	0.482	1.304	0.822
2011–2012		1.121	1.229	0.247	-0.286	-0.068	0.688	0.756
2012–2013		0.747	0.496	-0.137	-0.004	0.392	1.245	0.854
2013–2014		0.408	1.945	-0.402	-1.502	0.366	1.344	0.977
2014–2015		2.183	2.184	-0.210	-0.360	0.569	1.312	0.742
2015–2016		0.978	1.761	-0.871	-0.408	0.496	1.438	0.942
Total		7.743	13.027	-3.905	-6.211	4.833	16.580	11.747
Light industry		3.176	7.342	-2.730	-3.326	1.890	7.954	6.063
Heavy industry		0.829	1.746	-1.296	-0.869	1.248	4.369	3.121
Other industry		3.738	3.939	0.120	-2.016	1.695	4.258	2.563
State-owned firms		-2.005	1.160	-2.261	-0.659	-0.245	2.389	2.634
Private firms		9.748	11.867	-1.644	-5.552	5.078	14.191	9.114
Small and medium firms		3.582	4.103	0.530	-2.970	1.919	7.693	5.774
Large firms		4.162	8.923	-4.435	-3.241	2.914	8.888	5.973

**Note:** TFP is estimated by OP method

**Table AIII.**  
Dynamic decompositions of productivity growth change 2000–2016 (percent)

Light industry	Total change	Firm improvement	Reallocation	Covariance	Net entry	Entry
2000–2001	-0.122	-0.111	-0.309	-0.276	0.574	1.177
2001–2002	-0.744	-0.277	-0.024	-0.422	-0.021	0.606
2002–2003	0.070	0.377	-0.235	-0.208	0.136	0.534
2003–2004	0.042	0.180	-0.274	-0.120	0.255	0.623
2004–2005	-0.169	-0.021	-0.045	-0.095	-0.008	0.404
2005–2006	0.466	0.547	-0.105	-0.145	0.169	0.630
2006–2007	0.686	0.787	-0.407	-0.215	0.522	0.842
2007–2008	0.090	0.678	-0.232	-0.535	0.179	0.644
2008–2009	1.229	1.342	0.132	-0.506	0.261	0.870
2009–2010	-0.203	0.262	-0.133	-0.243	-0.089	0.564
2010–2011	0.224	0.154	-0.046	-0.242	0.357	0.973
2011–2012	0.807	0.912	0.176	-0.241	-0.040	0.525
2012–2013	0.385	0.263	-0.103	-0.059	0.283	0.927
2013–2014	0.286	1.436	-0.264	-1.106	0.220	0.950
2014–2015	1.471	1.540	-0.165	-0.321	0.417	0.964
2015–2016	0.663	1.208	-0.576	-0.324	0.354	1.052
Total	5.179	9.278	-2.611	-5.057	3.569	12.286
Light industry	2.179	5.310	-1.814	-2.747	1.430	5.902
Heavy industry	0.606	1.270	-0.882	-0.726	0.944	3.276
Other industry	2.395	2.697	0.086	-1.584	1.196	3.108
State-owned firms	-1.412	0.247	-1.417	-0.086	-0.155	1.487
Private firms	6.555	8.943	-1.141	-4.971	3.725	10.798
Small and medium firms	2.605	3.109	0.481	-2.490	1.504	5.995
Large firms	2.575	6.168	-3.091	-2.568	2.065	6.291

**Note:** TFP is estimated by LP method

**Table AIV.**  
Dynamic  
decompositions of  
productivity growth  
change 2000 no 2016  
(percent)

Period	Total change	Firm improvement	Reallocation	Covariance	Net entry	Entry	Exit
2000–2001	0.001	0.012	–0.091	–0.033	0.113	0.277	0.164
2001–2002	–0.117	–0.049	–0.037	–0.046	0.016	0.175	0.159
2002–2003	0.038	0.071	–0.065	–0.027	0.058	0.178	0.119
2003–2004	0.020	0.037	–0.076	–0.018	0.077	0.198	0.121
2004–2005	–0.020	0.004	–0.024	–0.016	0.016	0.145	0.128
2005–2006	0.073	0.094	–0.047	–0.021	0.046	0.181	0.135
2006–2007	0.088	0.115	–0.124	–0.028	0.125	0.231	0.107
2007–2008	–0.009	0.130	–0.085	–0.036	0.075	0.209	0.134
2008–2009	0.139	0.069	–0.031	–0.024	0.052	0.184	0.132
2009–2010	0.010	0.065	–0.036	–0.024	0.065	0.200	0.135
2010–2011	0.041	0.046	–0.037	–0.030	0.062	0.232	0.170
2011–2012	0.067	0.073	–0.002	–0.014	0.010	0.153	0.144
2012–2013	0.021	0.033	–0.037	–0.019	0.043	0.206	0.163
2013–2014	0.065	0.090	–0.047	–0.025	0.047	0.210	0.163
2014–2015	0.107	0.126	–0.077	–0.023	0.081	0.197	0.116
2015–2016	0.035	0.074	–0.106	–0.014	0.081	0.223	0.141
Total	0.558	0.953	–0.945	–0.398	0.947	3.179	2.233
Light industry	0.245	0.652	–0.633	–0.260	0.486	1.692	1.206
Heavy industry	0.050	0.133	–0.238	–0.063	0.218	0.777	0.560
Other industry	0.263	0.168	–0.074	–0.075	0.243	0.710	0.467
State-owned firms	–0.435	0.058	–0.408	–0.023	–0.062	0.422	0.485
Private firms	0.993	0.895	–0.537	–0.374	1.009	2.757	1.748
Small and medium firms	0.445	0.389	–0.120	–0.233	0.409	1.631	1.222
Large firms	0.112	0.565	–0.825	–0.165	0.538	1.548	1.010

**Note:** TFP is estimated by ACF method

**Table AV.**  
Dynamic decompositions of productivity growth change 2000–2016 (percent)

### Corresponding author

Phung Mai Lan can be contacted at: lanpm@tlu.edu.vn

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