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Optimum firm size in Vietnam: Does subcontracting matter?

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Abstract

Purpose – This study investigates the optimum size for manufacturing firms and the impact of subcontracting on firms' likelihood of achieving their optimal scale in Vietnam.

Design/methodology/approach – Using data from the enterprise census in 2017 and 2021, the paper first estimates the production function to identify the optimum firm size for manufacturing firms and then applies the logit model to investigate factors associated with the optimal firm size.

Findings – The study reveals that medium-sized firms exhibit the highest level of productivity. Nevertheless, a consistent trend emerges, indicating that nearly 90% of manufacturing firms in Vietnam operated below their optimal scale in both 2017 and 2021. An analysis of the impact of subcontracting on firms' likelihood to achieve their optimal scale emphasizes its crucial role, especially for foreign firms, exerting an influence nearly five times greater than that of the judiciary system.

Practical implications – The paper's findings offer crucial policy implications, suggesting that initiatives aimed at enhancing the overall productivity of the manufacturing sector should prioritise facilitating contract arrangements to encourage firms to reach their optimal size. These insights are also valuable for other countries with comparable firm size distributions.

Originality/value – This paper provides the first empirical evidence on the relationship between firm size and productivity as well as the role of subcontracting in firms' ability to reach their optimal scale in a country with a right-skewed distribution of firm sizes.

Keywords Optimum firm size, Subcontracting, Vietnam

Paper type Research paper

1. Introduction

Large firms benefit more from economies of scale and are therefore more productive than small enterprises (Van Biesebroeck, 2005; Leung *et al.*, 2008; De and Nagaraj, 2014). However, the larger the size, the more the enterprises are limited by their management capacity (Coase, 1937; Robinson, 1962; Williamson, 1967). On the other hand, smaller firms have more flexible management and can adapt more quickly to technological changes, making them more productive (Dhawan, 2001; Taymaz, 2005). So, which firm has the highest productivity or which firm size is optimum in terms of productivity? Answering this question is important for countries that aim to boost productivity. This is because encouraging firms to reach their optimal size ultimately enhances productivity across industries and thus, the overall productivity of the country.

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The question of promoting firms to reach their optimum size is more critical for Vietnam, as its business sector contributes over 60% of GDP (GSO, 2020), but is dominated by small firms. While Vietnamese firms exhibit strength in equity positions with low leverage ratios, their profitability has demonstrated weakness even prior to the COVID-19 pandemic (Kroeger, 2020). Notably, larger firms generally maintained relatively stronger liquidity positions, yet numerous small and service sector firms faced liquidity constraints even before the pandemic (Kroeger, 2020). Nevertheless, Vietnamese firms are concentrated in the service sector, comprising approximately 70% of firms for the 2017–2021 time periods (Tran and Do, 2023). Although the number of manufacturing firms increased from 68,087 in 2017 (representing roughly 15% of all firms) to 86,805 in 2021 (equivalent to 16% of total firms), the majority of these firms operate in low-tech manufacturing (Tran and Do, 2023). Despite this, the manufacturing sector contributed nearly 17% to GDP in 2020 (Vu, 2022). This study aims to examine the optimal size for manufacturing firms in Vietnam by estimating firm labour productivity (LP) as a function of firm size and other control variables. Despite LP being defined solely based on labour, it is a commonly utilised metric in the literature (De and Nagaraj, 2014). This prevalence could be attributed to the direct linkage between labour productivity and enhanced living standards (Sargent *et al.*, 2001).

While conventional literature often defines optimal firm size in terms of its lowest production cost (Williamson, 1967; Dhawan, 2001), this paper defines optimal firm size as the point at which a firm achieves its highest LP. This definition is grounded in duality theory, which translates productivity efficiency into cost efficiency (Dhawan, 2001). The study is specifically focused on the manufacturing sector due to its notable unconditional convergence in labour productivity (Rodrik, 2013). By pinpointing the optimum size for manufacturing firms, we aim to inform the design of policies that encourage firms to reach their optimal size, ultimately enhancing productivity across the entire industry. This, in turn, positions the country to catch up with highly productive nations.

Studies that assess productivity as a function of firm size often rely on asset-based measurements, consistently revealing that smaller firms tend to be more productive. For example, Dhawan (2001) observes higher productivity among small firms in the USA, while De and Nagaraj (2014) demonstrate that small manufacturing firms outperform their larger counterparts in India, a nation marked by a dualistic firm size distribution. However, the use of asset-based metrics for firm size is less appropriate in developing countries, where small firms are recognized as essential pillars of employment (ILO, 2021).

In this study, we measure firm size in terms of employment. This measurement is particularly fitting for populous countries like Vietnam, where both large and small firms play pivotal roles as primary sources of new employment. Our contribution to the literature lies in providing the *first-ever* identification of the optimum firm size in a country marked by a typical "skewed to the right" distribution of firm sizes, as categorised by the insightful work of Mazumdar and Sarkar (2013). This empirical analysis marks the first attempt to utilise the relationship between firm size and productivity to assess the optimal size of firms in Vietnam for the recent period spanning from 2017 to 2021. Previous studies have primarily focused on the relationship between productivity and firm size in the agricultural sector during the period from 2000 to 2009 and in the manufacturing sector up to 2016 (Ngo and Tran, 2020; Pham *et al.*, 2020; Nguyen *et al.*, 2014). "The second contribution of the paper is that it provides the first empirical evidence regarding the role of subcontracting on firms' likelihood to obtain their optimum size". Scale economies suggest that larger enterprises can leverage outsourcing to gain comparative economic advantages (Görzig and Stephan, 2002; Moretti and Valbonesi, 2015). Conversely, smaller firms may benefit from subcontracting arrangements with larger counterparts to acquire management skills and technology, facilitating their growth up to a certain threshold (Mazumdar and Sarkar, 2013; Tran, 2015a).

Consequently, subcontracting emerges as a significant factor influencing firms to attain their optimal size.

If the findings confirm the significance of subcontracting in determining optimal firm size, it raises concerns for Vietnam regarding reshoring. The ongoing reshoring trend, driven by factors such as the pandemic, lack of resilience and geopolitical conflicts (Bailey *et al.*, 2018; Canello *et al.*, 2022; Delis *et al.*, 2019; Gray *et al.*, 2013), poses a potential risk for Vietnamese firms that are relatively new entrants to the global value chain (GVC). These firms are now facing the prospect of downsizing subcontracting activities due to geographical reorganization.

Similar to Vietnam, micro and small firms are also dominant in the developing world, including in some Asian countries such as Thailand, Indonesia, the Philippines, Bangladesh and India (Mazumdar and Sarkar, 2013). These countries are characterised by a sizeable population and low labour productivity (Khuong, 2014, p. 8). Additionally, workers are often found in microfirms and have low wages. Furthermore, there exists a significant discrepancy in productivity between micro and larger firms (Mazumdar and Sarkar, 2013). Therefore, examining the optimum firm size and the role of subcontracting for firms to attain their optimum size is not only relevant to Vietnam but may also provide insights for other countries that have similar firm size distributions.

2. Optimum firm size and productivity

The theory of firms suggests that large firms benefit from economies of scale and market power, resulting in cost reduction and productivity increases (Dhawan, 2001). However, when they go beyond a certain size, inefficiencies may arise due to coordination problems (Coase, 1937; Robinson, 1962) and losses of managerial control (Williamson, 1967). On the other hand, small firms seem to be more flexible and adaptive to management and technological changes (De and Nagaraj, 2014). Dhawan (2001) offers a comprehensive overview of the advantages and disadvantages of both small and large firms.

Empirical studies that evaluate the optimum size of firms are based on either their lowest costs or their highest productivity. Nevertheless, most studies in this vein focus on productivity. To ascertain the optimal firm size in terms of productivity, the literature employs various measures of firm size, yielding diverse outcomes. Among these measures, employment emerges as the most widely utilised, with empirical studies presenting mixed findings. For instance, examining manufacturing firms across nine African countries, Van Biesebroeck (2005) asserts the superior productivity of large firms.

In Asia, Mazumdar and Sarkar (2013) examined the relationship between firm size and performance by calculating labour productivity as value-added per worker and classifying firm size distributions in the manufacturing sector across 11 countries. Their analysis reveals distinct patterns: developed nations like Japan, Hong Kong, Taiwan and Korea exhibit an equitable distribution characterised by relatively equal labour productivity across different firm size groups. In contrast, developing countries such as Thailand, Vietnam and Bangladesh showcase a "skewed to the right" distribution [1], while India, Indonesia and the Philippines exhibit a dualistic pattern. These distributions, marked by a prevalence of microfirms, contribute to the phenomenon known as the "missing middle" (Mazumdar and Sarkar, 2013), i.e. the absence of small and medium-sized enterprises (SMEs). Microfirms in these countries exhibit lower labour productivity than their larger counterparts (Mazumdar and Sarkar, 2013). In a related study, Mazumdar (2009) affirms that the smallest firm group demonstrates the lowest productivity in India. On the other hand, Bigsten and Gebreeyesus (2007) and Aw *et al.* (2001) find that smaller firms are more productive in Ethiopia and Taiwan, respectively.

Studies employing asset-based definitions of firm size and estimating productivity as a function of this metric are less prevalent but tend to yield relatively conclusive results. Notably, Dhawan (2001), utilising data from a comprehensive panel of publicly traded US firms, finds that small firms exhibit greater productivity. Similarly, De and Nagaraj (2014) show that small manufacturing firms are more productive than their large counterparts in India, a nation characterized by a dualistic distribution. However, it is crucial to acknowledge that the measurement of firm size based on assets may be less suitable for developing countries, where small firms are considered the key foundation of employment (ILO, 2021).

By adopting the employment-based approach to delineate firm size, this study adds to the literature empirical evidence on the relationship between firm size and productivity in a developing country characterized by a "skewed to the right" distribution. The methodology involves estimating the Cobb–Douglas production function to pinpoint the optimum firm size. This choice is motivated by existing literature, specifically studies such as Dhawan (2001) and Mundlak (1996), which have demonstrated the consistency and efficiency of estimates derived through this estimation approach. Furthermore, as highlighted in the introduction, determining the optimum firm size from a production efficiency perspective inherently involves solving the dual problem of cost efficiency.

Identifying the optimal firm size within the manufacturing sector holds significant implications for developing countries. Encouraging firms to attain their optimal size is equivalent to fostering productivity across the entire industry. If firms in the middle of the size distribution, i.e. SMEs are the most productive group, the government in these countries should focus on policies to promote microfirms to grow to this optimum size. Otherwise, they should not worry about their lack of preparation for supporting small firms (ILO, 2021).

3. Determinants of optimum firm size: the role of subcontracting

The literature underscores the pivotal role of a firm's entrepreneurial manager in determining the optimum firm size. According to conventional economic theory, while large firms may benefit from economies of scale and market power [2], their managerial control could wane, leading to inefficiencies when the size surpasses the entrepreneurial manager's management capabilities (Coase, 1937; Robinson, 1962; Williamson, 1967). In contrast, modern economic principles posit that managers of small firms tend to be more inclined towards risk-taking and innovation (Audretsch, 1995; Scherer, 1991). This, coupled with the less incumbent organisational structure, makes small firms better at adapting to environmental and technological changes (Carlsson *et al.*, 1994; Christensen and Bower, 1996; Mazumdar and Sarkar, 2013; Utterback, 1996). Thus, this paper tests the hypothesis that the optimal firm size does not tend to be very small or large. Instead, the optimal firm size tends to fall within the medium size range.

In addition to internal factors inherent to a firm, external environments play a significant role in determining firm size, with market size and institutional factors being notable contributors. Better access to the market can increase the demand for a firm's products, providing incentives for the firm to increase its production scale (Tran and La, 2018) and thus, become larger. Furthermore, large firms in developing countries with weak institutions can benefit from biased behaviour from governmental agencies (De and Nagaraj, 2014) and thus maintain their larger size. On the other hand, small firms with lower power of access to markets and other services such as finance and government contracts remain smaller.

Another influential factor in determining the optimum firm size is subcontracting. Large enterprises can outsource segments of their production process based on a cost-benefit analysis (Görzig and Stephan, 2002; Moretti and Valbonesi, 2015) through contractual arrangements with smaller firms. On the other hand, small firms find advantages in being subcontractors for larger counterparts through two mechanisms: firstly, by leveraging the

resources of large firms to compensate for their limited market access and other resources and secondly, by gaining valuable management skills and technology from their larger counterparts through subcontracting arrangements (Mazumdar and Sarkar, 2013; Tran, 2015a). These advantages contribute to the growth of small firms, allowing them to reach a certain threshold. The paper hypothesises that being subcontractors for large firms increases a firm's likelihood of obtaining its optimum size.

Evidence from Asian countries has shown that subcontracting between large and SMEs plays a vital role in boosting the growth of firms in the small and medium size ranges (Mazumdar and Sarkar, 2013). This leads to equitable firm size distributions during the course of development in high productivity nations such as Japan, Taiwan and Korea. On the other hand, in countries with low LP and characterised by "skewed to the right" and dualistic firm size distributions, such as Vietnam, Thailand and India, subcontracting activities are nearly absent (Mazumdar and Sarkar, 2013; Tran, 2015a). In these nations, the majority of microfirms are concentrated at the lower end of the labour productivity distribution.

Given the importance of subcontracting for the existence of the middle firm size class, Vietnam as well as other countries characterised by "skewed to the right" and dualistic firm size distributions, should be concerned about the trend of reshoring. The recent reshoring trend, influenced by factors such as the pandemic, lack of resilience and geopolitical conflicts (Bailey *et al.*, 2018; Canello *et al.*, 2022; Delis *et al.*, 2019; Gray *et al.*, 2013), negatively affects the likelihood of firms entering the global value chain through subcontracting arrangements with foreign enterprises. Thus, a study on how subcontracting affects the optimum size of firms can provide scientific evidence to design policies that promote firms in achieving their optimal scale.

4. Data and methodology

4.1 Data

The study uses data from the two latest enterprise censuses (ECs), conducted by the General Statistics Office (GSO) of Vietnam in 2017 and 2021. The EC collects information on all aspects of business operations, such as firm ownership, assets, revenues, labour payments, taxes and all other information related to business activities in 2016 and 2020. This information enables us to estimate the production function. It is important to note that GSO conducts an enterprise census annually. However, except for the years 2017 and 2021, detailed information necessary for estimating the production function was collected in other years within the time period of 2017–2021 through sample surveys. Therefore, this paper estimates the optimum firm size using the census years 2017 and 2021 only.

In this paper, we first identify the optimum firm size of the manufacturing sector by estimating the Cobb–Douglas production function. Then, we estimate the logit model to investigate factors associated with the optimum firm size. To estimate the production function, the study included only businesses that were still in operation in the surveyed years. In addition, some businesses lack information about the value of fixed assets and their depreciation. After eliminating these missing values, the total remaining observations for 2017 and 2021 are 65,097 and 82,205, respectively, losing about 10 and 9% of the observations [3]. However, the remaining sample distribution quite accurately reflects the population distribution in terms of size, ownership form and region [4]. Therefore, it can be considered that businesses that are removed from the population due to missing values can be considered random and do not affect the estimated results.

To evaluate the effects of subcontracting on a firm's optimal size, it is crucial to identify which firms engage in subcontracting activities. The EC includes a specific question that enables the identification of all firms working as subcontractors for foreign firms. For domestic subcontractors, we base it on the sample survey. It is noteworthy that, in addition to

the census, GSO conducts sample surveys for specific information on each industrial sector. The specific questionnaire designed for the manufacturing sector survey contains a question that determines whether a firm is engaged in subcontracting, regardless of whether the subcontracting activity is for domestic or foreign entities.

To distinguish which firms are subcontractors of domestic or foreign firms, this sample dataset is merged with the census. This merging process enables the separation of subcontractors from domestic and foreign firms. However, as the identification of subcontractors of domestic firms relies on the sample, the number of observations reduces to 61,032 in 2017 and to 24,155 in 2021. The sharp reduction in the number of firms in 2021 after merging is primarily due to the COVID-19 pandemic. Consequently, while still conducting the census to gather general information for estimating the production function, GSO limited the sample size to specific industries, including the manufacturing sector.

4.2 Methodology

To determine the optimum size of manufacturing firms, the paper uses the augmented Solow model as follows:

$$Y = AK^{\alpha}L^{\delta}H^{\gamma} \tag{1}$$

Equation (1) includes two parts: the core and augmented parts. The core part is the Cobb–Douglas production function with Y indicating outputs, K represents capital and L demonstrating labour. The augmented part adds to the production function total factor productivity (TFP – A) and human capital (H).

Equation (1) can be rewritten in per capita terms by dividing by labour as

$$y = A\left(\frac{K}{L}\right)^{\alpha} L^{\delta+\alpha-1}H^{\gamma} = Ak^{\alpha}L^{\delta+\alpha-1}H^{\gamma} \tag{2}$$

where $y = Y/L$ represents LP, which is calculated by taking a firm value added (VA) devided by the average number of workers in the studied year and $k = K/L$ reflects capital intensity. Taking logarithm of (2) gives:

$$lny = lnA + \alpha lnk + \beta lnL + \gamma lnH \tag{3}$$

Equation (3) shows that besides capital intensity (k) and labour, other factors such as TFP (A) and human capital (H) also affect labour productivity.

To identify the optimum size of manufacturing firms, the research bases on the Vietnamese regulation (Resolution 39/2018) [5] to classify the labour factor on the right hand side of Equation (3) into different size categories, reflecting dummy variables: from 1 to 4 workers and 5 to 9 workers for micro firms; from 10 to 24 workers and 25 to 49 workers for small enterprises; from 50 to 99 workers and 100 to 199 workers for medium size and from 300 to 999 workers and 1,000 workers or more for large firms. The size-range variable that has the highest coefficient in the parameter vector of interest, β, is the optimum size.

The estimation of the optimal firm size is conducted separately for the EC datasets of 2017 and 2021, utilising Eq. (3). This approach is adopted for two reasons. Firstly, the data for each year are independently collected through the enterprise census, enabling the identification of the firm's optimal size for the entire population in each respective year. Secondly, combining the datasets from the two censuses may lead to the removal of duplicate firms, thereby reducing the number of observations. This reduction in the sample size can impact the statistical power of tests. Therefore, to maintain the independence of yearly observations, the paper does not pool the data and estimate the optimal firm size separately for 2017 and 2021. Once the optimum size is determined, the paper classifies firms into two categories, including

optimum and nonoptimum, and assigns 1 to those that are at their optimum scale and 0 otherwise. It then estimates the following logit model to examine determinants of optimum firm size, with a particular focus on subcontracting, using the dataset from the subcontracting sample:

$$y = \delta + \beta sub + \theta X + \gamma Z \tag{4}$$

In Eq. (4), y equals 1 if a firm is at its optimum size and 0 otherwise; *sub* is a vector of variables, indicating whether a firm is a subcontractor for a domestic or foreign firm; X is a vector of firms' management capacity, including gender, age and education and Z is a vector of external environment factors, including market size and institutions.

4.3 Empirical specification and variable measurement

In Eq. (3), labour productivity is measured as firms' value-added (VA) per worker. To estimate Eq. (3), a set of variables that can proxy for TFP (A) and human capital (H) needs to be identified. Isaksson (2007) summarises four groups of factors affecting TFP, which in turn influence LP. The first group is firms' managerial ability, which can be measured through managers' education level (degrees obtained) and experience (represented by the managerial age) (De and Nagaraj, 2014). The second group is firm competition, which can be presented in an ownership form. Nguyen *et al.* (2014) argue that state-owned companies rarely maximize profits and thus have no incentive to increase competition. Empirical studies, such as De and Nagaraj (2014), also measure TFP as a function of ownership types. The third group is firms' research and development (R&D) activities. Other factors, such as the proportion of female workers in firms (Nguyen *et al.*, 2014) and import–export activities (De and Nagaraj, 2014), can also influence a firm's LP; thus, these variables are included in the model.

The fourth group includes institutions, integration and location, with location advantages being the most significant contributors to TFP. The least affluent regions are often situated in areas with inadequate infrastructure, limiting market access to the region. These challenges hinder the exploitation of economies of scale to enhance productivity. Presently, Vietnam is divided into six regions: the Northern Mountains, the Red River Delta, the Northern Central and Central Coast, the Central Highlands, the Mekong River Delta and the South East. We exclude Hanoi from the Red River Delta and Ho Chi Minh City from the South East, as they are two metropolitan areas in Vietnam with the highest development pace. Consequently, firms located in these metropolitan areas possess significantly more advantages than those located elsewhere. In summary, we consider eight regions to account for location advantages.

In addition to the local endowment advantages, externalities such as clustering with other firms in the same industry can also affect a firm's LP. This industry concentration, known as localisation in the literature of the agglomeration economy, shows that firms can benefit from input–output linkages, transportation costs, labour matching and learning from each other when locating nearby (Tran, 2015b; Tran and La, 2018; Tran *et al.*, 2022). Lall *et al.* (2004) summarise three methods of measuring localisation economies. These include own-industry employment in the region, own-industry establishment and an index of concentration that reflects a disproportionately high concentration of the industry in the region in comparison to the nation. This study uses the third method for measuring the localisation index as follows:

$$Spec_{d,s,t} = \frac{L_{s,d,t}/L_{d,t}}{L_{s,t}/L_t} \tag{5}$$

where: $L_{s,d,t}$ is the employment of industry s in area d at time t, $L_{d,t}$ is the total number of workers in area d at time t; $L_{s,t}$ is the total employment of industry s at time t nationwide and L is the total number of workers in the country in year t. The measurement of variables used to

estimate the production function, along with their descriptive statistics, are documented in Table A1 in Appendix.

The estimation of Eq. (4) requires the identification of variables in the vector Z. Market size can be measured in terms of population or employment (Tran *et al.*, 2022). As population is deemed more suitable for reflecting product demand, this study measures market size as the logarithm of population in area d. Regarding institutions, the paper chooses the index of the judiciary system, one of the ten components of the provincial competitiveness index of Vietnam, as a proxy for institutions [6]. This choice is made because contract enforcement and dispute resolution are often cited as factors impeding firm performance in Vietnam (Tran *et al.*, 2009). These aspects of institutions are reflected in the judiciary index. To avoid the problem of endogeneity, the paper uses the lagged variables of market size and the judiciary system in 2014 and 2018. It should be noted that due to the incompatible enumeration of districts between 2014 and 2017, the merging of the subcontracting sample with the district dataset on market size reduced the number of observations in the subcontracting sample from 61,032 to 53,745 in 2017. Table A2 in Appendix provides the measurement and descriptive statistics of the determinants of a firm's optimal size.

5. Empirical results

5.1 Firm size distribution in Vietnam

Previous studies, using the EC in 2012 (Nguyen *et al.*, 2014) and subsequent years in 2017 and 2021 (Tran and Do, 2023), reveal that firm size in Vietnam follows the "skewed to the right" distribution. This distribution is characterised by a substantial number of microfirms and a limited number of small and medium enterprises, leading to what is known as the "missing middle" distribution (Mazumdar and Sarkar, 2013). Nevertheless, these studies find that the middle group, i.e. the SMEs, exhibits the highest labour productivity. Similar findings are observed in studies analysing data from the EC in the earlier period from 2000 to 2005 (Shaffer and Le, 2013), indicating that firms in the middle range of the size distribution have the highest labour productivity [7].

Similar to the broader population, the manufacturing sector in Vietnam exhibits a right-skewed distribution of firm sizes. Figure 1 illustrates the distribution of firm sizes using data from the EC for the manufacturing sector in both 2017 and 2021. As shown in Figure 1a and b, the majority of manufacturing firms in Vietnam fall into the category of microfirms, particularly in 2021 (Figure 1b). The second-largest category consists of small enterprises with fewer than 25 workers. The number of firms gradually decreases as size increases, a pattern observed consistently in both 2017 and 2021 (Figure 1a and b).

5.2 Optimum firm size in the Vietnamese manufacturing sector

To determine the optimum firm size, the study estimates Equation (3) with the independent variables outlined in Section 4.3, and the dependent variable is the logarithm of firm labour productivity, using the EC datasets of 2017 and 2021. Additionally, we include control variables for firm characteristics, such as the proportion of female workers, whether the firm has its own website, engagement in import–export activities and investment in R&D. The optimal size is identified as the size at which the marginal effects of firm size (indicated by the size-range dummy variables) on labour productivity are maximized.

When estimating this model using the ordinary least squares (OLS) method, misleading results may arise due to endogeneity in the capital intensity variable (k), given its dependence on outputs. To address this potential bias, the study substitutes capital intensity with its lagged variable from the preceding year, achieved by merging the EC data in 2017 with 2016 and 2021 with 2020. This substitution eliminates the two-way effect, as current output cannot

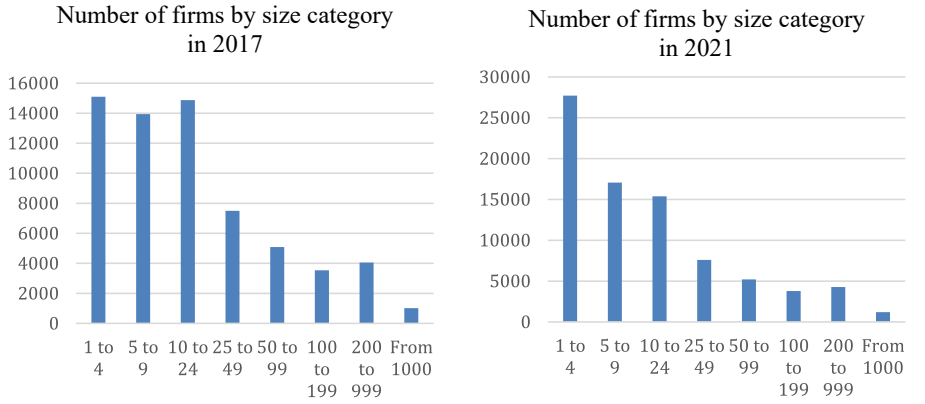


Figure 1.
Size distribution of manufacturing firms

Source(s): Authors' calculation using EC in 2017, 2021

influence past capital. However, the merging of data reduces the number of observations to approximately 19% in 2017 and 12% in 2021.

Tables 1 and 2 present the estimated results of Eq. (3) for the years 2017 and 2021. For each year, three specifications are considered. Specification 1 presents the OLS estimation, while specification 2 illustrates the OLS with lagged variable k from the previous year. We also document results estimated from the merged dataset (specification 3), which includes only the subcontracting sample, to check for the robustness of size effects on firm LP.

Results from Tables 1 and 2 reveal a slight difference in the coefficient of capital in the OLS estimation with the full dataset and the one with the lagged variable. However, for other independent variables, both estimation methods exhibit largely unchanged signs and magnitudes of coefficients. Consequently, this study employs OLS estimation with the complete dataset (specification 1) from EC in 2017 and 2021 to avoid significant observation loss when determining the optimum firm size. Results from specification 3 in Tables 1 and 2 validate the robustness of the marginal effects of firm size, along with all other control variables, on labour productivity.

Based on the estimated results from specification 1 in Tables 1 and 2, a graph is constructed illustrating the scale advantage, measured by the difference between the coefficients of each firm size category and that of the microfirm group with fewer than five employees (used as the reference in estimated specifications). These differences in estimated coefficients showcase the gap in labour productivity among manufacturing firms in various groups compared to the microfirm group. The graphical representation is presented in Figure 2a and b.

Figure 2a and b show that the gap in labour productivity follows an inverted U-shape, and this is true for both 2017 and 2021. The gap in LP (reflected by the blue column chart) increases with firm size. It reaches its highest value in the medium-sized group, from 100 to less than 200 workers. Specifically, the LP of this group was 82.3 and 46.7% higher than that of the microfirm group in 2017 (Figure 2a) and 2021 (Figure 2b), respectively. Beyond these thresholds, the gap in labour productivity gradually diminishes (as illustrated in Figure 2a and b), with a more pronounced reduction observed in 2021.

The findings suggest that firm size serves as a significant driver of labour productivity due to its potential to foster learning among workers and provide other scale advantages. However, the observed inverted U-shape implies the existence of a turning point in the trade-

	(1) OLS with full dataset		(2) Model with lagged k		(3) Model with subcontracting sample	
k	0.169***	(88.07)	0.171***	(41.29)	0.168***	(88.03)
Sex	−0.022**	(−2.17)	−0.0235**	(−2.15)	−0.027***	(−2.65)
Age	0.024***	(8.28)	0.024***	(7.42)	0.028***	(9.56)
Age squared	−0.000***	(−7.40)	−0.000***	(−5.72)	−0.000***	(−8.60)
Manager education level†						
Bachelor's degree	−0.220***	(−9.20)	−0.235***	(−9.44)	−0.233***	(−10.01)
College degree or less	−0.291***	(−11.38)	−0.348***	(−13.00)	−0.307***	(−12.32)
Short-term education	−0.319***	(−11.26)	−0.407***	(−13.68)	−0.341***	(−12.37)
No certificates	−0.377***	(−13.55)	−0.439***	(−15.00)	−0.390***	(−14.46)
Other	−0.285***	(−9.68)	−0.354***	(−11.43)	−0.307***	(−10.76)
Firm ownership††						
Collective	−0.756***	(−12.25)	−0.862***	(−13.57)	−0.739***	(−12.38)
Private company	−0.375***	(−7.31)	−0.524***	(−10.30)	−0.385***	(−7.77)
Limited company	−0.338***	(−6.57)	−0.403***	(−7.91)	−0.326***	(−6.55)
Foreign company	−0.117**	(−2.26)	−0.070	(−1.36)	−0.100**	(−2.01)
Firm size†††						
5–9 workers	0.437***	(35.08)	0.516***	(37.46)	0.361***	(29.06)
10–24 workers	0.584***	(46.18)	0.751***	(54.90)	0.502***	(40.07)
25–49 workers	0.672***	(42.82)	0.886***	(53.45)	0.583***	(38.11)
50–99 workers	0.764***	(41.83)	1.036***	(54.09)	0.674***	(38.05)
100–199 workers	0.823***	(38.59)	1.142***	(51.03)	0.732***	(35.61)
200–999 workers	0.817***	(37.81)	1.110***	(48.85)	0.721***	(34.52)
From 1,000 workers	0.770***	(20.94)	1.021***	(27.32)	0.671***	(19.13)
Region††††						
Red River Delta (other)	0.0514**	(2.33)	−0.0952***	(−3.89)	0.0501**	(2.38)
Northern Central and Central Coast	−0.0176	(−0.77)	−0.101***	(−3.99)	−0.00827	(−0.38)
Central Highlands	−0.0744**	(−1.99)	−0.153***	(−3.65)	−0.0705**	(−1.97)
South East (other)	0.125***	(5.46)	−0.00519	(−0.20)	0.126***	(5.71)
Mekong River Delta	0.146***	(6.02)	0.0523*	(1.96)	0.147***	(6.34)
Ha Noi	0.0514**	(2.31)	−0.226***	(−9.19)	0.116***	(5.36)
Ho Chi Minh	0.144***	(6.01)	−0.264***	(−10.08)	0.176***	(7.50)
% of female workers	−0.376***	(−21.28)	−0.368***	(−18.90)	−0.356***	(−20.60)
Website	0.114***	(12.27)	0.135***	(13.80)	0.105***	(11.57)
Import–export activities	0.318***	(27.40)	0.324***	(25.84)	0.307***	(25.19)
R&D	0.084***	(7.21)	0.269***	(19.93)	0.073***	(6.57)
Ln(localisation index)	0.015***	(4.96)	0.012***	(3.79)	0.013***	(4.41)
Constant	3.004***	(33.87)	2.729***	(27.43)	3.030***	(34.99)
No. of obs	65,097		53,562		61,032	
Adjusted R^2	0.321		0.275		0.327	
F-statistics	963		635		926	
Prob > F	0.000		0.000		0.000	

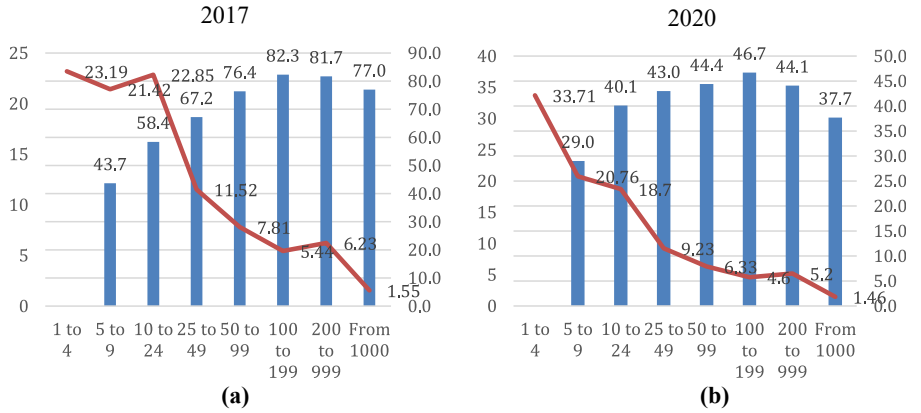
Note(s): †Obtaining master's degree or higher is the reference group
††State-owned enterprise is the reference group
†††Firms having from 1 to 4 workers is the reference group
††††Northern Mountains is the reference group
t statistics in parentheses
*p < 0.10, **p < 0.05 and ***p < 0.010
Source: Authors' estimation using EC 2017

Table 1.
Determinants of firms' labour productivity – 2017

	(1) OLS with full dataset		(2) Model with lagged k		(3) Model with subcontracting sample	
k	0.170***	(104.81)	0.141***	(82.52)	0.181***	(56.95)
Sex	−0.024***	(−2.65)	−0.018*	(−1.96)	−0.027*	(−1.65)
Age	0.035***	(13.03)	0.013***	(6.87)	0.023***	(5.01)
Age squared	−0.000***	(−11.82)	−0.000***	(−6.75)	−0.000***	(−4.86)
Manager education level†						
Bachelor's degree	−0.092***	(−3.79)	−0.109***	(−4.47)	−0.113***	(−3.74)
College degree or less	−0.179***	(−6.96)	−0.229***	(−8.75)	−0.202***	(−5.70)
Short-term education	−0.251***	(−8.77)	−0.283***	(−9.71)	−0.272***	(−6.34)
No certificates	−0.266***	(−9.29)	−0.301***	(−10.33)	−0.300***	(−6.94)
Other	−0.146***	(−5.57)	−0.163***	(−6.14)	−0.205***	(−6.12)
Firm ownership††						
Collective	−0.835***	(−11.75)	−0.880***	(−12.39)	−0.679***	(−7.72)
Private company	−0.350***	(−5.58)	−0.377***	(−6.19)	−0.245***	(−4.26)
Limited company	−0.286***	(−4.55)	−0.283***	(−4.64)	−0.155***	(−2.69)
Foreign company	−0.155**	(−2.46)	−0.129**	(−2.11)	0.008	(0.14)
Firm size†††						
5–9 workers	0.290***	(27.42)	0.254***	(23.04)	0.240***	(9.17)
10–24 workers	0.401***	(35.49)	0.345***	(29.39)	0.335***	(13.82)
25–49 workers	0.430***	(28.95)	0.364***	(23.87)	0.343***	(12.82)
50–99 workers	0.444***	(24.97)	0.379***	(20.94)	0.394***	(14.75)
100–199 workers	0.467***	(22.47)	0.386***	(18.39)	0.431***	(16.13)
200–999 workers	0.441***	(20.88)	0.342***	(16.08)	0.420***	(15.35)
From 1,000 workers	0.377***	(10.88)	0.267***	(7.82)	0.382***	(10.18)
Region††††						
Red River Delta (other)	0.016	(0.87)	0.0216	(1.12)	0.062**	(2.33)
Northern Central and Central Coast	−0.206***	(−10.53)	−0.226***	(−11.01)	−0.128***	(−4.28)
Central Highlands	−0.224***	(−6.61)	−0.269***	(−7.67)	−0.152***	(−2.78)
South East (other)	0.197***	(10.55)	0.181***	(9.29)	0.136***	(5.02)
Mekong River Delta	0.031	(1.47)	−0.010	(−0.47)	−0.009	(−0.30)
Ha Noi	0.049***	(2.59)	0.016	(0.81)	0.155***	(4.79)
Ho Chi Minh	0.213***	(11.64)	0.124***	(6.50)	0.211***	(7.15)
% of female workers	−0.164***	(−11.32)	−0.172***	(−11.34)	−0.470***	(−18.10)
Website	0.152***	(10.99)	0.177***	(12.88)	0.173***	(9.44)
Import–export activities	0.279***	(24.15)	0.288***	(24.69)	0.206***	(13.08)
R&D	0.125***	(6.82)	0.148***	(7.99)	0.159***	(7.42)
Ln(localisation index)	0.024***	(9.17)	0.029***	(10.47)	0.030***	(6.80)
Constant	3.082***	(33.57)	3.767***	(40.26)	3.454***	(26.58)
No. of obs	82,205		72,380		24,155	
Adjusted R^2	0.295		0.268		0.336	
F-statistics	1,078		831		382	
Prob > F	0.000		0.000		0.000	

Note(s): †Obtaining master's degree or higher is the reference group
††State-owned enterprise is the reference group
†††Firms having from 1 to 4 workers is the reference group
††††Northern Mountains is the reference group
t statistics in parentheses
*p < 0.10, **p < 0.05 and ***p < 0.010
Source(s): Authors' estimation using EC 2021

Table 2.
Determinants of firms' labour productivity – 2021



Note(s): The right-hand side vertical axis in each graph indicates the percentage of firms within each size group (depicted by the solid orange line). Meanwhile, the left-hand side vertical axis represents the disparity in labor productivity across size groups relative to the reference group with a very small scale of of less than 5 employees (illustrated in a blue column chart)

Source(s): Authors' calculation using EC in 2017, 2021

Figure 2.
Differences in labour productivity by firm size

off between scale and cost advantages, possibly linked to limitations in management capacity. This outcome aligns entirely with the theory of optimal firm size, which posits that costs may surpass benefits if the enterprise becomes too large (Scherer and Ross, 1990; Coase, 1937). Furthermore, it is in line with a recent research overview on the relationship between productivity and scale, demonstrating that smaller enterprises often enjoy a productivity advantage (Dhawan, 2001; De and Nagaraj, 2014).

While the findings reveal that the optimal operational scale for manufacturing enterprises in Vietnam is medium-sized, the scale advantages (indicated by the gap in LP between the medium-size and micro firms) decrease over time. A notable reduction in the productivity gap between medium-sized and microfirms is evident in 2021 (Figure 2b) compared to 2017 (Figure 2a). This may be attributed to the global impact of the COVID-19 pandemic on economies worldwide, and Vietnam is no exception.

In Figure 2a and b, the orange solid line illustrates the distribution of firm sizes, with accompanying numbers representing the percentage of firms in each category group. These figures underscore that a substantial majority of Vietnamese manufacturing enterprises are relatively small, accounting for 86.78% in 2017 (Figure 2a) and 88.74% in 2021 (Figure 2b) of firms below the optimal scale. Using data from the EC in 2012, Nguyen *et al.* (2014) also found that 90% of firms in Vietnam operate under the optimum scale. These findings suggest that, to enhance labour productivity (LP) in the manufacturing sector, policy initiatives should prioritise fostering the growth of manufacturing firms, particularly towards achieving medium size. The subsequent section will delve into the role of subcontracting in facilitating Vietnamese manufacturing firms to reach their optimal scale, specifically the medium size.

5.3 Optimum firm size and subcontracting

As highlighted in Section 3, subcontracting plays a crucial role in fostering the growth of firms towards medium size in highly productive Asian countries. Regrettably, this influential factor is notably weak in Vietnam (Tran, 2015a). Large firms, particularly those engaged in

export activities, seldom engage in subcontracting arrangements with small firms (Shaffer and Le, 2013). Similarly, using data from the non-state SME surveys implemented by the Centre Institute for Economics and Management of Vietnam in collaboration with the Stockholm School of Economics in Sweden in Vietnam during the period from 1996 to 2011, Tran *et al.* (2009) and Tran (2015a) reveal that subcontracting activities are not prevalent among non-state firms. Additionally, contractual arrangements are primarily observed between small enterprises within the same district [8]. Moreover, subcontracting with foreign firms, which offers opportunities for heightened productivity through the transfer of technologies and knowledge, constitutes a modest proportion, just exceeding 3% in 2002 and reaching 11% in 2011 (Tran, 2015a).

This subsection investigates the determinants of optimum firm size, with a particular focus on the role of subcontracting. To estimate Eq. (4), we assign 1 to the dependent variable if firms are at the optimum scale (i.e. firms belong to the medium range size from 100 to 199 workers) and 0 otherwise. The marginal effects of independent variables, estimated from the logit model using the subcontracting sample, are presented in Table 3 for 2017 and Table 4 for 2021.

Results from Tables 3 and 4 affirm the existing literature, indicating that managerial ability, as proxied by the education level of the firm manager, serves as a significant determinant of the optimum firm size. The coefficients associated with education dummy variables suggest that a higher degree of entrepreneurial manager education is correlated with an increased likelihood of the firm achieving its optimal size. These results remain consistent for both years, 2017 and 2021.

It is noteworthy that, in 2017 (Table 3), market access – measured by the logarithm of the district population – did not significantly contribute to firms reaching their optimum scale. However, in 2021 (Table 4), it exhibits positive effects on the probability of firms achieving their optimum scale. This phenomenon may be attributed to the impact of the pandemic. The restrictions on communications in 2021 disrupted the supply chain beyond the local region.

	Marginal effects (dy/dx)	*z*-stat
Subcontracting with domestic firms	0.028***	7.90
Subcontracting with foreign firms	0.045***	6.96
Sex	0.005**	2.05
Age	0.009***	10.14
Age squared	−0.000***	−7.97
Manager education level[†]		
Bachelor's degree	−0.037***	−4.66
College degree or less	−0.081***	−10.32
Short-term education	−0.094***	−11.82
No certificates	−0.093***	−11.74
Other	−0.052***	−6.04
Judiciary system	0.011***	7.73
Ln(district population)	−0.002	−1.52
No. of obs	53,754	
Pseudo R^2	0.059	
LR	1,446	
Prob > χ^2	0.000	

Note(s): [†]Obtaining master's degree or higher is the reference group
t statistics in parentheses
*$p < 0.10$, **$p < 0.05$ and ***$p < 0.010$
Source(s): Authors' estimation using EC 2017

Table 3.
Determinants of optimum firm size – 2017

	Marginal effects (dy/dx)	z-stat
Subcontracting with domestic firms	0.058***	5.63
Subcontracting with foreign firms	0.217***	22.87
Sex	0.041***	5.21
Age	0.027***	11.72
Age squared	−0.000***	−8.55
Manager education level†		
Bachelor's degree	−0.173***	−11.54
College degree or less	−0.381***	−23.18
Short-term education	−0.454***	−25.28
No certificates	−0.443***	−24.41
Other	−0.197***	−12.06
Judiciary system	0.045***	7.07
Ln(district population)	0.012**	2.42
No. of obs	24,155	
Pseudo R^2	0.091	
LR	2899.10	
Prob > χ^2	0.000	

Note(s): †Obtaining master's degree or higher is the reference group
t statistics in parentheses
*$p < 0.10$, **$p < 0.05$ and ***$p < 0.010$
Source(s): Authors' estimation using EC 2021

Table 4.
Determinants of optimum firm size – 2021

Consequently, reliance on the local market aided firms in maintaining production scale and influenced the likelihood of achieving their optimum size.

The parameter of interest, subcontracting, emerges as an important determinant of optimum firm size, as shown in Tables 3 and 4. Specifically, being a subcontractor of a foreign firm elevates the likelihood of reaching optimum size by 0.045% points, nearly double the impact of contractual agreements with domestic enterprises in 2017 (Table 3). Furthermore, the influence of subcontracting with domestic and foreign enterprises on the probability of firms achieving their optimum size surpasses that of the quality of the judiciary system by more than two and four times, respectively. Similarly, the results from Table 4 highlight that being a subcontractor for foreign firms has an impact nearly five times greater than the influence of the judiciary system.

Sensitivity analysis

Large firms often prefer to subcontract production activities to medium-sized firms rather than smaller ones. Consequently, medium-sized firms may have more subcontracting arrangements than their smaller counterparts. This dynamic suggests that the optimum firm size may not be a consequence of subcontracting but rather its cause, leading to the problem of endogeneity. Addressing this issue typically involves using panel data, valid instrumental variables (IVs) or lagged variables. However, none of these options are available in the current context.

Therefore, this paper conducts a sensitivity analysis by separately estimating the determinants of the optimum firm size for subcontracting with domestic and foreign firms. This analytical approach is grounded in the observations outlined at the beginning of this subsection, indicating that subcontracting arrangements with domestic firms are primarily prevalent among small businesses, whereas subcontractors of foreign enterprises tend to be larger firms. Thus, estimating the determinants of the optimal firm size for each type of subcontracting activity reduces the heterogeneity in firm size and mitigates potential endogeneity concerns.

The estimated specifications, presented in Appendix Tables A3 and A4 and segregated for each type of subcontracting, validate the robustness of subcontracting activities. Moreover, the observed effects are notably more pronounced compared to when both types of subcontracts are estimated in a unified model. However, it is important to acknowledge that our approach aims to mitigate rather than completely eradicate the issue of endogeneity.

6. Conclusion

Using data from the enterprise census in Vietnam in 2017 and 2021, this paper estimates the optimum size for manufacturing firms. This study provides the first empirical evidence on the relationship between firm size and productivity in a country characterized by a "skewed to the right" distribution of firm sizes. Findings from the estimated production function indicate that medium firms, employing between 100 and less than 200 workers, demonstrated the highest level of productivity during the study period.

Nevertheless, it is noteworthy that almost 90% of manufacturing firms in Vietnam operate below the optimal scale. This pattern persists in both 2017 and 2021. Given the current emphasis in Vietnam on enhancing labour productivity, our findings hold significant implications for policy formulation. This is because facilitating manufacturing firms to attain their optimal size can contribute to an increase in the overall labour productivity of the industry. Consequently, this enhancement at the industry level can positively impact the productivity of the entire nation.

We also explore the factors that influence the likelihood of firms achieving their optimal size. The results indicate that, in addition to conventional factors such as market access and the quality of institutions, subcontracting – especially with foreign firms – is a crucial factor influencing firms in attaining their optimum scale. The impact of contractual arrangements with foreign firms is nearly five times greater than that of the judiciary system.

The findings suggest that while the recent reshoring has not negatively affected the Vietnamese economy thus far, its continuation in the future could affect opportunities for contractual agreements with foreign firms. Therefore, alongside efforts to improve the legal system, policy designs aimed at promoting manufacturing sector productivity by facilitating firms to achieve their optimum size to maximise labour productivity should prioritise the encouragement of subcontracting. As many other developing countries also grapple with a high proportion of micro and small firms, the results from the paper are not only pertinent to Vietnam but also hold significance for countries with a similar distribution of firm sizes.

It is important to recognize that the results presented in this paper regarding the optimal firm size pertain to the period from 2017 to 2021, with the final year being influenced by the COVID-19 pandemic. Consequently, future research endeavours should consider extending the analysis to incorporate data from new enterprise censuses, enabling an examination of the optimal firm size under normal circumstances. Moreover, while the findings in this paper underscore the significance of subcontracting activities with both domestic and foreign firms in facilitating firms to achieve their optimal size, it is acknowledged that the issue of endogeneity cannot be entirely eliminated. Hence, future studies in this domain are encouraged to explore strategies to address this limitation.

Notes

1. In a "skewed to the right" distribution, the majority of firms are clustered on the left, indicating their small size, while few large firms are located farther away on the right side of the distribution.
2. Specifically, Knight argues that a firm can use its market power in the monopoly situation to expand to an unlimited scale.

3. It should be noted that although GSO carries out the censuses, only 22% of the observations were repeated. This is because many new businesses were established or ceased operations during the studied period (https://www.gso.gov.vn/px-web-2/?pxid=V0501&theme=Doanh%20nghi%E1%BB%87p, (20/2/2024)).
4. The distribution of the sample and population are available in the Supplementary Tables.
5. See detailed information at https://thuvienphapluat.vn/van-ban/Doanh-nghiep/Nghi-dinh-39-2018-ND-CP-huong-dan-Luat-Ho-tro-doanh-nghiep-nho-va-vua-366561.aspx
6. See https://pcivietnam.vn/ for more detailed information about the Vietnam provincial competitiveness index.
7. Shaffer and Le (2013) define small and medium size is from 100 up to 500 workers.
8. The hierarchical administrative division of Vietnam starts from provinces under the management of the central government. Each province has smaller administrative units called districts, and the districts break down into communes.

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Appendix

The supplementary material for this article can be found online.

Supplementary material

The supplementary material for this article can be found online.

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