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Impact of Investment Climate on Total Factor Productivity of Manufacturing Firms in Vietnam

Mai Huong Giang ^{1,2}, Tran Dang Xuan ^{1,*} , Bui Huy Trung ^{2,3}, Mai Thanh Que ² and Yuichiro Yoshida ¹

¹ Graduate School for International Development and Cooperation (IDEC), Hiroshima University, Kagamiyama 1-5-1, Higashi Hiroshima 739-8529, Japan; giangmh.hvnh@gmail.com (M.H.G.); yuichiro@hiroshima-u.ac.jp (Y.Y.)

² Banking Academy, No 12 Chua Boc Street, Dong Da District, Hanoi 1000004, Vietnam; trungbh.hvnh@gmail.com (B.H.T.); quemt@hvn.edu.vn (M.T.Q.)

³ Graduate School of Social Sciences, Hiroshima University, Kagamiyama 1-2-1, Higashi Hiroshima 739-8525, Japan

* Correspondence: tdxuan@hiroshima-u.ac.jp; Tel./Fax: +81-82-424-6927

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Abstract: Investment climate has been acknowledged as a key factor that significantly influences economic performance. Improving the investment climate may foster the development of the private sector by creating sustainable jobs and opportunities for entrepreneurs, which contributes to sustained poverty reduction in developing countries. This research examined the relationship between the investment climate and firm productivity by exploring a unique panel dataset of 1310 enterprises operating in the manufacturing sector in Vietnam. Productivity was measured as the total factor productivity (TFP) obtained by production function estimation using Levinsohn and Petrin's approach. Investment climate factors included infrastructure, labor skills, regulatory governance and institutions, and access to finance. It was shown that restrictions on the investment climate were harmful to firm productivity. The lack of Internet and financial accessibility, low educational level of employees, administrative burden and the cost of bribery were negatively associated with firm TFP. The results indicate that access to Internet and finance, and quality of labor should be further enhanced while administrative burden and corruption should be significantly reduced to strengthen the TFP. The findings of this study may provide insights for policymakers who aim to improve the investment climate and firm productivity and thereby contribute to the sustainable growth of the country.

Keywords: investment climate; total factor productivity; small and medium enterprises; Vietnamese manufacturing sector

1. Introduction

Investment climate is defined as a set of location-specific factors shaping the opportunities and incentives for firms to invest productively, create jobs, and expand [1]. A good investment climate drives growth by reducing the cost of doing business, thus encouraging investment, and resulting in higher and more reliable productivity. In contrast, a poor investment climate is seen as constituting barriers to entry, exit, and competition. The fact is that transnational enterprises prefer to invest in firms in countries having a sound business climate, where cost, delay, and risk are minimized. Furthermore, in developing countries, improving the environment for investment and productivity growth may foster the development of the private sector by creating sustainable jobs and opportunities for entrepreneurs, which contributes to sustained poverty reduction [1].

The recent findings arising from studies on investment climate have been acknowledged as central to improving economic performance. For example, it has been conceptually accepted and empirically demonstrated that the investment climate can have significant impacts on economic growth [2,3] and firm growth [1,4–6]. However, few studies have investigated the association between the investment climate and firm productivity. Furthermore, since policymakers are constrained by resource limitations, the path to investment climate reform may be a long one, especially in developing countries. Some policies, such as interest rates and tax reform, can be implemented relatively quickly. In contrast, some other changes, such as improving the quality of the workforce and constructing infrastructure, might take years to complete. Therefore, it is essential that policymakers prioritize and direct policies that will have the largest impacts and can be quickly realized. This can be done effectively only when the question of which and how investment climate factors affect firm productivity can be answered.

This research aimed to explore the impact of the investment climate on firms' total factor productivity (TFP) by employing a novel micro-dataset of small and medium manufacturing firms in Vietnam. There are several reasons for considering Vietnamese enterprises as the ideal setting to conduct this study. First, in the past few years, the Vietnamese economy has experienced a significant decline in growth, which is partly due to the reduction in productivity growth. To be specific, the country's labor productivity growth decreased from 5.3% in 1990–2000 to 4.4% in 2000–2012 and 4.2% in 2007–2016 [7]. In 2017, Vietnam's labor productivity (measured by purchasing power parity) was approximately 7%, 17.6%, 36.5%, 42.3%, and 56.7% of that in Singapore, Malaysia, Thailand, Indonesia, and the Philippines, respectively [8]. There was also a sharp decline in TFP growth, from a sizeable 2.5% in 1990–2000 to a meager 0.1% in 2000–2012 [7]. This worsening of productivity performance indicates that Vietnam's current development strategy has been inadequate. Therefore, in order to accelerate growth and strengthen the foundation of prosperity and competitiveness, productivity should be the main focus of the country's reform initiatives; thus, the exploration of Vietnam's TFP at the firm level is of great value, as the results are likely to have important policy implications. Second, although Vietnam has been increasingly considered an attractive prospect for investors in recent years, significant challenges and limitations related to its investment climate, such as poor infrastructure, shortage of skilled labor, and corruption, have remained. This is reflected in the country's low ranking (77th out of 140 countries) in the Global Competitiveness Report released by the World Economic Forum in 2018 [9]. The report is based on 98 indicators, organized into 12 pillars, that evaluate the productivity and efficiency of 140 countries. Within the region, Vietnam lagged far behind its neighbors Singapore (2nd), Malaysia (25th), Thailand (38th), Indonesia (45th), and the Philippines (56th). In addition, some key areas were ranked extremely low, including product market (102nd), business dynamism (101st), skills (97th), institutions (94th), and communication technology adoption (95th). According to another report by the World Bank [10], Vietnam was 68th among 190 economies for the "ease of doing business" aspect. Starting a business (123rd) and resolving insolvency (129th) were the two lowest ranked factors. Third, in recent years, the investment climate and its association with total factor productivity have received attention from several Southeast Asian countries, including Indonesia [11], the Philippines [12], and Thailand [13], but this is not the case for Vietnam, despite the low rankings assigned to the country in the two reports mentioned above. To date, there have been only a few studies that investigated the effects of Vietnam's investment climate on its firm productivity. Trung and Itagaki [14] conducted an analysis based on a survey of 200 agro-enterprises to examine the impacts of several rural investment climate variables on total factor productivity in North Vietnam. Some other studies utilized the World Bank's investment climate assessment survey data in 2004 and 2005. For instance, Trung and Kaizoji [15] found that the investment climate had a crucial function in generating firm productivity. Another study by Pham [16] focused on the relationship between the investment climate and Vietnamese firms' technical efficiency.

This article improves upon the preceding works in various ways. First, this research is the first to explore the relationship between the investment climate and firm total factor productivity. Firm productivity in the previous above-mentioned studies was principally measured by TFP obtained from

the estimation of the production function. The traditional Ordinary Least Square (OLS) technique was frequently employed to estimate the production function. However, the use of this approach may lead to several estimation problems, including the simultaneity problem and sample selectivity bias [17]. The estimation methodology proposed by Levinsohn and Petrin [18] addresses these problems by applying the notion that unobserved firm productivity shocks can be approximated by a non-parametric function of an observable firm characteristic—specifically, an intermediate input—and, as a result, unbiased estimates of production function coefficients can be obtained. However, to date, this approach has not yet been applied to investigate how TFP is associated with the investment climate in Vietnam. Second, a large and up-to-date dataset from a specific country was used in this study. This allowed us to mitigate the unobserved effects in the productivity measurement that are due to homogeneous culture and economic features, thus providing a better estimation. Most of the existing studies have focused on a group of transition economies and found weak evidence of a relationship between the investment climate and firm productivity, which was partly due to the wide divergence in the cultural and economic characteristics of these countries. In addition, Kinda, Plane, and Véganzonès-Varoudakis [6] and Escribano and Guasch [5] showed that cross-country studies have suffered from omitted variable bias or endogeneity problems. Third, this paper helps enrich the current research in the literature stream of investment climate and firm TFP, specifically in the context of a developing country such as Vietnam. Drawing on a unique and up-to-date dataset of 1310 Vietnamese manufacturing enterprises from 2011 to 2015, our empirical results imply that the investment climate constraints are detrimental to firm productivity. Poor quality of labor, lack of Internet accessibility, burdensome administrative procedures, corruption, and lack of access to finance were found to be major restrictions with significant influences on firm TFP. Furthermore, at the sector level, although several studies have compared manufacturing and service firms, there have been few that have looked at subsectors of manufacturing [19]. Our study examined the potential differences in the effects of investment climate factors on firm TFP across different manufacturing industries. The empirical results show that some sectors are more sensitive than others to investment climate deficiencies. These findings provide suggestions to policymakers for improving the investment climate and firm productivity, thus supporting the sustainable development of the country.

The remainder of this paper is organized as follows. Section 2 presents the methodology, empirical model, and data used in the study. In Section 3, descriptive statistics are discussed first and the main findings are then reported. Section 4 briefly summarizes the literature on the relationship between the investment climate and firm productivity and discusses the empirical results. Section 5 concludes the paper.

2. Methodology

2.1. Measurement of Firm Productivity

Productivity is defined as a ratio of output to a measure of input [20]. This definition is consistently applied and has been accepted in a large number of studies [21]. To measure productivity, there are two principal options, including (i) partial factor productivity (PFP) and (ii) total factor productivity (TFP) [20]. PFP is defined as the ratio between output and a specific input factor (capital or labor). Meanwhile, TFP quantifies the productivity as a ratio of the output produced to an index of composite inputs. In other words, TFP is the weighted average capacity of all inputs [22]. The output can be determined by gross output or value added. To measure TFP, there are two main directions in the literature: non-parametric approaches (TFP index, Data Envelopment Analysis (DEA)) and parametric approaches (Estimation of the production function and Stochastic Frontier Analysis (SFA)). The frequent techniques to estimate the production function include OLS estimation, the Olley and Pakes method, and the Levinsohn and Petrin approach.

In this study, TFP was obtained from the production function to measure firm productivity. Accordingly, the index of relative TFP for each firm i at time t can be generally defined as follows:

$$\theta_{it} = \frac{Y_{it}}{f(K_{it}, L_{it})} \quad (1)$$

where Y_{it} is the output of firm i at time t , K_{it} is the capital input of firm i at time t , L_{it} is the labor input of firm i at time t , and $\theta_{it} = 1$ indicates the central tendency of TFP. If a firm's θ value is above 1, it indicates a high TFP relative to the other firms, whereas a value below 1 indicates a low TFP. Rearranging (1) as an equation of Y_{it} , we have:

$$Y_{it} = f(K_{it}, L_{it})\theta_{it} \quad (2)$$

The next feature in (2) is the production technology, which can be explained by different hypotheses. Among others, the translogarithmic production and the Cobb–Douglas functions are the two most commonly used methods. It is argued that both approaches have good mathematic properties. However, the elasticity of the production to the inputs in the Cobb–Douglas function allows for easier interpretation than the translogarithmic production. To be more specific, the translog technique generally suffers from a collinearity problem among the regressors [6]. Thus, in this study, we assumed that the production technology followed Cobb–Douglas production functions. Equation (2) can be written as follows:

$$Y_{it} = AK_{it}^{\alpha}L_{it}^{\beta}\theta_{it} \quad (3)$$

As described above, TFP differences reflect shifts in output while holding inputs constant. Therefore, to construct the output/input ratio that measures TFP, the individual inputs must be weighted appropriately when generating a single-dimensional input index [21]. In this case, the Cobb–Douglas production function provided an easy and correct weighting. From Equation (3), the inputs were aggregated by taking the exponent of each factor of its respective output elasticities. Syverson [21] argued that this more generally holds as a first-order approximation of any production function. Transforming (3) into a linear expression by taking the logarithm of both sides of the equation, we have:

$$\ln Y_{it} = \ln A + \alpha \ln K_{it} + \beta \ln L_{it} + \ln \theta_{it} \quad (4)$$

Assuming $\theta_{it} = e^{u_{it}}$, we can rewrite (4) as:

$$\ln Y_{it} = \ln A + \alpha \ln K_{it} + \beta \ln L_{it} + u_{it} \quad (5)$$

From Equation (5), the natural logarithm of the TFP index is equal to the residual term u_{it} in the econometric production function.

In practice, Equation (5) can be estimated using the OLS estimation technique. However, it was previously shown that estimations using the OLS model can result in biased productivity estimates since the estimation suffers from the endogeneity of input choices and selection bias [8]. An alternative approach was proposed by Levinsohn and Petrin [18]. This technique was built upon a study by Olley and Pakes (OP) [23]. The main idea behind this methodology is that an intermediate input can be used as a proxy for the unobserved firm productivity and unbiased estimates of the production function. Levinsohn and Petrin [18] presented the production function in Equation (5) as follows:

$$\ln Y_{it} = \ln A + \alpha \ln K_{it} + \beta \ln L_{it} + \gamma \ln M_{it} + \omega_{it} + \varepsilon_{it} \quad (6)$$

where ω_{it} is productivity, and ε_{it} is unpredicted shocks.

In this equation, the residual u_{it} was split into two elements, ω_{it} and ε_{it} . The intermediate input was also added as a freely variable input. The intermediate input's demand function is given as:

$$\ln M_{it} = f_M(\omega_{it}, \ln K_{it}) \quad (7)$$

The demand function for intermediate inputs must be monotonic in the firm productivity element ω_{it} for all relevant $\ln K_{it}$ to qualify as a valid proxy [18]. Levinsohn and Petrin [18] assumed that input and output were common across firms and that there was no error in the demand function in Equation (7) above.

Assuming monotonicity holds, the intermediate input's demand function can be inverted to yield ω_{it} as a function of capital and intermediate inputs:

$$\omega_{it} = f_{\omega}(\ln M_{it}, \ln K_{it}) \quad (8)$$

Substituting Equation (8) into Equation (6), we can rewrite the production function as follows:

$$\ln Y_{it} = \beta \ln L_{it} + \phi(\ln M_{it}, \ln K_{it}) + \varepsilon_{it} \quad (9)$$

where

$$\phi(\ln M_{it}, \ln K_{it}) = \ln A + \alpha \ln K_{it} + \gamma \ln M_{it} + f_{\omega}(\ln M_{it}, \ln K_{it})$$

Equation (9) can be used to estimate the coefficient of labor β , but not the other parameters of capital and intermediate inputs. The estimation of β is reasonable since the function $\phi(\ln M_{it}, \ln K_{it})$ controls for unobserved productivity.

Another important assumption is that productivity follows a Markov process [18,23]. Accordingly, ω_{it} can be written as:

$$\omega_{it} = E[\omega_t | \omega_{t-1}] + \zeta_{it} \quad (10)$$

Substituting Equation (10) into Equation (6), we have:

$$\ln Y_{it} = \ln A + \alpha \ln K_{it} + \beta \ln L_{it} + \gamma \ln M_{it} + E[\omega_t | \omega_{t-1}] + \zeta_{it} + \varepsilon_{it}$$

or we can write:

$$\ln Y_{it}^* = \alpha \ln K_{it} + \gamma \ln M_{it} + E[\omega_t | \omega_{t-1}] + \eta_{it}^* \quad (11)$$

where $\ln Y_{it}^* = \ln Y_{it} - \beta \ln L_{it}$; $\eta_{it}^* = \zeta_{it} + \varepsilon_{it}$.

In Equation (11), the term η_{it}^* was assumed to be uncorrelated with $\ln K_{it}$, but this generally does not hold for the case of $\ln M_{it}$ [18]. Therefore, to facilitate calculation, the assumption that η_{it}^* is uncorrelated with $\ln M_{i(t-1)}$ was used. Then, Equation (11) will produce consistent estimates of the coefficients α and γ . Furthermore, parameter β was obtained from Equation (8) in a previous step. Hence, once consistent estimates of parameters α , β , and γ of the production function in Equation (6) were determined, we were able to consistently estimate the firm-level TFP.

2.2. Firm Productivity and Investment Climate

In the second stage, with the firm TFP having been estimated, the relationship between the investment climate and productivity was investigated. However, it has been argued that the heterogeneity of firm productivity can be explained by different factors, not only by investment climate determinants. Hence, a set of firm-specific variables, including firm size, age, and export, was incorporated into the model. Regarding the external environment, the investment climate variables were classified into four broad groups. The first group was infrastructure, which included two variables: electric supply (ELE) and Internet usage (ITN). The next set of investment climate variables was labor skills, represented by two variables: the percentage of employees with low education (EDU) and a dummy variable for training employees (TRN). Another group was regulatory governance and institutions containing two variables: time to obtain a business registration application (OBT) and informal fee paid (INF). Finally, the access to finance group included two variables: bank loan (LOAN) and overdraft facility (OVER). The basis for selecting these firm-specific and investment climate variables was the studies by Bastos and Nasir [24], Escribano and Guasch [5], Dollar et al. [4], and Kinda, Plane, and Véganzonès-Varoudakis [6].

To examine the impacts of the investment climate on firm productivity, we first estimated TFP using Equation (6). Then, Equation (12) was used to obtain an estimate; in this case, the obtained TFP is the dependent variable, whereas the explanatory variables are sets of firm-specific factors and investment climate factors:

$$TFP_{it} = \sum_j \delta_j F_{ijt} + \sum_k \pi_k I_{ikt} + \mu_{it} \quad (12)$$

where F_{ijt} is firm-specific factor j of firm i at time t ; I_{ikt} is investment climate factor k of firm i at time t ; μ_{it} is a “white noise” error term.

It is worthwhile to note that the estimate from Equation (12) may suffer from several potential econometric problems. Accordingly, the empirical results should be interpreted with caution. First, there is a possibility that endogeneity issues and reverse causality for several variables may arise [25,26]. The former situation is that some third variable, such as unobserved firm characteristics, affects the independent variables and the TFP simultaneously. If this third variable is not explicitly controlled, the error term will absorb the impact of this variable and hence, will be correlated with the independent variables, causing biased and inconsistent estimates [26]. Furthermore, the estimation of the effects of some variables on firm TFP may lead to problems of causality. For example, with the access to finance variables, it is probably true that more productive firms tend to make greater use of credit than less productive ones, as it is more profitable to the former. In order to address these problems, several remedies have been proposed in the literature. First, to investigate the true impact of investment climate variables on subsequent TFP, lagging method can be used by regressing the TFP in the following year on investment climate variables in Equation (13):

$$TFP_{i(t+1)} = \sum_j \delta_j F_{ijt} + \sum_k \pi_k I_{ikt} + \mu_{it} \quad (13)$$

This method provided a crude way to examine the direction of causality in the relationship between potentially endogenous variables [26]. Second, to address the endogeneity issues, year and industry fixed effects can be added in Equation (14) to control for unobserved firm characteristics that may simultaneously affect investment climate variables and the TFP.

$$TFP_{i(t+1)} = \sum_j \delta_j F_{ijt} + \sum_k \pi_k I_{ikt} + \varphi_t + \tau_{industry} + \mu_{it} \quad (14)$$

where φ_t is year fixed effects; $\tau_{industry}$ is industry fixed effects.

However, it is argued that the above fixed effects only control for time-invariant firm information. There may still be unobserved time-varying firm characteristics that simultaneously affect investment climate factors and the TFP. Hence, another method is to include potential control variables that jointly influence the investment climate factors and the TFP. In this study, firm size, firm age, and exports were added in Equation (15) as control variables.

$$TFP_{i(t+1)} = \sum_j \delta_j F_{ijt} + \sum_k \pi_k I_{ikt} + \sum_m \rho_m CONTROL_{imt} + \varphi_t + \tau_{industry} + \mu_{it} \quad (15)$$

where $CONTROL_{imt}$ is control variable m of firm i at time t .

Since the firm TFP was relatively persistent, it is also necessary to include the lagged dependent variable to make sure the attendant autocorrelation does not affect our estimates [26]. In Equation (16), we added the lagged dependent variable TFP_{it} to test whether the investment climate variables, relied on past productivity TFP_{it} , had incremental explanatory power for future productivity $TFP_{i(t+1)}$.

$$TFP_{i(t+1)} = \sum_j \delta_j F_{ijt} + \sum_k \pi_k I_{ikt} + \sum_m \rho_m CONTROL_{imt} + TFP_{it} + \mu_{it} \quad (16)$$

The above approaches are potential remedies to deal with the endogeneity issues. However, it is important to note that the residual endogeneity may still lead to an inconsistent estimation of direct impact of investment climate on firm TFP even though all the factors discussed above were controlled [26]. Alternative methods proposed in the literature to achieve consistency of investment

climate coefficients were the instrumental variable (IV) approach and the dynamic models estimated by generalized method of moments (GMM). The former employed instruments that need to be correlated with endogenous regressors (the investment climate variables) but not with the structural residual of the TFP. The latter proposed by Arellano and Bond [27] can be used to estimate the following model:

$$TFP_{i(t+1)} = \sum_j \delta_j F_{ijt} + \sum_k \pi_k I_{ikt} + \sum_m \rho_m CONTROL_{imt} + TFP_{it} + \varphi_t + \tau_{industry} + \mu_{it} \quad (17)$$

However, due to the availability of data and the lack of valid instrumental variables given the large number of factors considered in our analysis, these two approaches (the IV approach and GMM method) were not performed in this study. Li [26] showed that even without a valid instrumental variable, a combination of methods adding fixed effects and control variables appeared to work efficiently. Hence, in this research, we utilized the model in Equation (18) which included control variables, year fixed effects and industry fixed effects as our benchmark model and reported the results obtained by estimating Equations (12)–(16) as supplementary information.

$$TFP_{it} = \sum_j \delta_j F_{ijt} + \sum_k \pi_k I_{ikt} + \sum_m \rho_m CONTROL_{imt} + \varphi_t + \tau_{industry} + \mu_{it} \quad (18)$$

Another issue may arise when investigating the relationship between investment climate and firm TFP is that two or more independent variables in the regression correlated with each other, causing the multicollinearity problem. Our approach to addressing this problem was to check the robustness of the main model by estimating regressions using a single independent variable at a time, along with basic control variables (firm size, firm age, exports, year fixed effects, and industry fixed effects).

2.3. Data

To estimate firm-level TFP and the effects of the investment climate on firm productivity, we used Vietnamese small and medium enterprise (SME) survey data from 2011, 2013, and 2015 [28–30]. The survey was from a project under the collaboration of three partners: the Central Institute for Economic Management (CIEM) of Ministry of Planning and Investment of Vietnam, the Institute of Labor Science and Social Affairs (ILSSA), and the Development Economics Research Group (DERG) of the University of Copenhagen. It is considered to be one of the most comprehensive datasets available on small and medium Vietnamese firms. The survey tracked over 2500 enterprises that were mobile in the manufacturing sector in nine provinces in Vietnam. It contained 134 questions (with many questions further divided into parts) and covered information on enterprise history, firm performance, employment, investment climate, and owner background characteristics. In accordance with Rand and Tarp [31], the enterprises in this survey can be categorized into three groups based on their number of employees at the end of the surveyed years: (i) micro-sized firms (1–10 workers); (ii) small-sized firms (11–50 workers), and (iii) medium-sized firms (51–300 workers).

In undertaking the analysis of the data, it was observed that some variables constituting the inputs and output of the production function were not available every year for all firms. Therefore, it was necessary to take several steps to clean up the data. In this study, a balanced panel dataset used for regressions was constructed. Thus, only the firms with information on inputs and output available for every year of the research period were used. Each firm in the survey was provided with a unique code that remained unchanged over years, which allowed us to generate a panel dataset following individual firms. The final data formed a balanced panel dataset of 1310 enterprises that were mobile in the manufacturing sector from 2011 to 2015.

2.4. Statistical Analyses

The hypothesis that each coefficient is different from 0 was tested by determining the *p*-value. To reject the hypothesis, the *p*-value had to be lower than a pre-set value. There were three different threshold levels used in this study: 0.1, 0.05, and 0.01. If a *p*-value was smaller than one or more of

these values, it indicated that the variable had a significant influence on the dependent variable; the lower the value, the more significant.

3. Results

3.1. Descriptive Statistics

The definitions and summary statistics of the variables used in the study are described in Table 1. Although there are three size categories of enterprises—micro, small, and medium (<10, 11–50, and 51–300, respectively)—only two of them (micro and small sizes) were applied to the model to compare with the omitted medium size (51–300 employees). The figures indicate that firms at the micro size (<10 employees) accounted for 72.62% of the dataset, whereas small- and medium-sized companies were 21.57 and 5.81%, respectively. Consequently, exporters made up only 7.09% of all firms in the sample.

Table 1. The definition and summary statistics of variables.

Variables	Description	Number of Observations	Mean	SD
LnY	The logarithm of value added (Y) calculated by subtracting intermediate, indirect, and raw material costs from the total revenue from sales at the end of the survey year.	3930	6.0582	1.4941
LnK	The logarithm of capital (K), which is defined as the total book value of assets at the end of the survey year.	3930	7.3658	1.6592
LnL	The logarithm of labor (L), which is defined as the total number of regular workers at the end of the survey year.	3930	1.9077	1.0756
LnM	The logarithm of raw materials (M) at the end of the survey year.	3930	3.8274	2.0352
TFP	Total Factor Productivity (in logs)	3930	2.7251	0.6521
MICRO	Dummy variable for micro firms (=1 if the number of employees is less than 10)	3930	0.7262	0.4459
SMALL	Dummy variable for small firms (=1 if the number of employees is equal to or larger than 10 and smaller than 50)	3930	0.2157	0.4114
AGE	Number of years since the firm established (in logs)	3930	2.5915	0.5939
EXP	Dummy variable for export (=1 if the firm exported their products)	3930	0.0709	0.2568
ITN	Dummy variable for internet access (=1 if the firm had no internet access)	3930	0.6229	0.4847
ELE	Dummy variable for electricity (=1 if the firm experienced insufficient power for production in the survey year)	3930	0.0508	0.2198
EDU	The percentage of workers who do not have at least a college or university degree	3930	0.9666	0.0678
TRN	Dummy variable for untrained workers (=1 if the firm reports that it did not normally train existing workers (less than 50% of total workers were trained))	3930	0.9424	0.2328
OBT	The logarithm of days to obtain business registration application (including Business registration certificate, Tax code registration certificate, and Seal Engraving permit)	3930	2.8619	0.8446
INF	Informal or communication fee paid as a percentage of total costs	3930	0.0011	0.2909
LOAN	Dummy variable for bank loan (=1 if the firm reported that it did not have a bank loan)	3930	0.7073	0.4550
OVER	Dummy variable for overdraft facility (=1 if the firm reports that it did not have an overdraft facility)	3930	0.7933	0.4049

SD: Standard Deviation.

For the investment climate factors, 62.29% of the enterprises had no access to the Internet, while there were 5.08% that reported that they experienced insufficient power for production. With respect to labor capacity, there was a high proportion of employees who did not have at least a college or university degree (96.66%). Furthermore, 94.24% of the companies reported that they did not normally train their existing workers. The data showed that the average time to obtain a business

registration application was approximately 26.44 days. For the purpose of estimation, this variable was transformed into logarithmic terms (Table 1). In addition, bribes paid by firms accounted for 0.11% of the total costs. It was revealed that, within the access to finance dimension, 70.73% of companies did not have a bank loan, and 79.33% could not use overdraft facility.

3.2. Investment Climate and Firm Productivity

Table 2 shows the estimated effects of firm-specific and investment climate factors on total factor productivity obtained by the Levinsohn and Petrin estimation of the production function. The model included control variables, year fixed effects and industry fixed effects.

Table 2. Investment climate and Total factor productivity of manufacturing firms (Whole sample).

Variables	Dependent Variables of TFP Based on Levinsohn and Petrin [18]
Firm-specific factors	
MICRO	0.1488 *** (0.0513)
SMALL	0.0904 * (0.0478)
AGE	−0.1067 *** (0.0196)
EXP	0.1793 *** (0.0429)
Investment climate factors	
Infrastructure	
ITN	−0.1422 *** (0.0277)
ELE	−0.0543 (0.0519)
Labor skills	
EDU	−0.6113 *** (0.1686)
TRN	−0.0045 (0.0445)
Regulatory governance and institutions	
OBT	−0.0244 ** (0.0134)
INF	−0.1535 *** (0.0353)
Access to finance	
LOAN	−0.0531 ** (0.0242)
OVER	−0.0990 *** (0.0294)
Constant	3.6063 *** (0.1714)
Year fixed effects	Yes
Industry fixed effects	Yes
Observations	3930
R-squared	0.1018

Values reported in parentheses are robust standard errors (SE); *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

In terms of firm-specific factors, the results in Table 2 show that both micro and small firms exerted significant and positive impacts on TFP (14.88%, $p < 0.01$ and 9.04%, $p < 0.1$, respectively) as compared to the medium-sized enterprises, which were omitted from the regression. This implies that smaller firms tended to be more productive than the bigger ones, and micro enterprises (<10 workers) obtained the most dynamic TFP values. Firm size classification in this study was based on the number of employees, which followed a large number of studies in the literature on TFP and its correlates [15,24,25,32]. However, Dang, Li, and Yang [33] argued that the use of different measures of firm size in econometric models might affect the empirical results. Thus, we checked the robustness of our model by using total assets as alternative proxy of firm size. The results showed that the coefficients of firm size measured by total assets as well as other regressors confirmed the findings of our benchmark model in terms of both sign and statistical significance (Supplementary Materials, Table S1).

With respect to the impact of firm age, it has been theoretically suggested that due to learning by doing, firm productivity would increase with age. However, our results show that older firms were 10.67% less productive than younger ones. Another finding is that exporters accounted for only 7.09% of all firms in the dataset, but this factor had a notably positive impact on firm productivity (17.93%, $p < 0.01$).

Turning to the effects of investment climate factors, it can be generally concluded that deficiencies in the investment climate had considerable negative impacts on firm productivity. For the infrastructure dimension, 62.29% of the companies did not have access to the Internet, and they displayed a notably negative TFP (−14.22%, $p < 0.01$). On the other hand, only 5.08% experienced insufficient power, and this factor did not have significant impacts on TFP (−5.43%). Within the labor capacity group, the proportion of workers who did not obtain at least a college or university degree was 96.66% of the total number of employees, which exhibited the maximum impact on TFP compared with the other variables (−61.13%, $p < 0.01$). In contrast, although 94.24% of the surveyed firms reported that workers in their companies were not trained regularly, this had trivial impacts on TFP (−0.45%). The findings also reveal that, in term of regulatory governance and institutions, it took approximately 26.44 days for a firm to complete administrative procedures, which had unfavorable influences on TFP (−2.44%, $p < 0.05$). Similarly, communication fees paid by firms accounted for 0.11% of total costs, with substantially negative impacts on TFP (−15.35%, $p < 0.01$). Regarding financial variables, it was found that enterprises without a bank loan (70.73%, Table 1) and without overdraft facility (79.33%, Table 1) suffered significantly unfavorable effects on TFP from these factors (−5.31%, $p < 0.05$ and 9.9%, $p < 0.01$, respectively).

As discussed in the previous section, to deal with the endogeneity issues, results of our benchmark model were compared with those obtained by estimating Equations (12)–(16). In general, it was shown that the coefficients of investment climate variables were robust across different empirical models (Supplementary Materials, Table S2). Furthermore, we also regressed TFP on each investment climate factor at a time to further check for multicollinearity. The results implied that impacts of all investment climate variables in these regressions were similar to those reported in Table 2 (Supplementary Materials, Table S3).

In order to provide additional evidence for our empirical results, it was worthwhile to assess if the effects of the investment climate on firm productivity varied across sectors. The SME survey data covers firms in 18 manufacturing sectors. However, since the number of observations in some sectors was small, we divided the 18 sectors into 6 broad categories: (1) Food and beverages, (2) Non-metal and plastic materials, (3) Metal and machinery products, (4) Wood products and furniture, (5) Textiles, and (6) Others. Table 3 shows the estimation results for individual sectors.

Table 3. Investment climate and Total factor productivity across individual sectors.

Variables	Food and Beverages	Non-Metal and Plastic Materials	Metal and Machinery Products	Wood Products and Furniture	Textiles	Others
MICRO	0.1306 (0.1421)	0.0901 (0.1107)	0.2710 *** (0.1048)	0.1764 (0.1081)	0.1630 (0.1367)	0.6074 * (0.3479)
SMALL	0.1140 (0.1312)	−0.0200 (0.1022)	0.2636 *** (0.1012)	0.1313 (0.1012)	0.0868 (0.1214)	0.1841 (0.3381)
AGE	−0.0495 (0.0361)	−0.0395 (0.0536)	−0.0954 ** (0.0380)	−0.1990 *** (0.0451)	−0.1617 ** (0.0664)	−0.3431 ** (0.1399)
EXP	0.4358 *** (0.1146)	0.1143 (0.1040)	−0.0737 (0.1170)	0.1457 ** (0.0728)	0.2406 ** (0.1101)	0.3814 (0.2611)
ITN	−0.1448 ** (0.0657)	−0.2474 *** (0.0716)	−0.1812 *** (0.0530)	−0.0360 (0.0563)	−0.0440 (0.0835)	−0.1544 (0.1547)
ELE	−0.0619 (0.1099)	−0.2442 (0.1454)	−0.2457 ** (0.0983)	−0.1632 (0.1124)	−0.1420 (0.1379)	−0.1860 (0.3624)
EDU	0.0926 (0.4811)	−0.2065 (0.3875)	−0.2259 (0.2928)	−0.5950 *** (0.3722)	−0.2990 ** (0.6266)	−1.0753 (0.6755)
TRN	−0.0580 (0.1112)	−0.0220 (0.1029)	−0.0337 (0.0838)	−0.0392 (0.0956)	0.1026 (0.1208)	1.0215 ** (0.3946)
OBT	−0.0855 *** (0.0247)	0.0359 (0.0451)	−0.0293 (0.0270)	−0.0030 (0.0273)	−0.0143 (0.0445)	0.1124 (0.1000)
INF	−0.0531 (0.0816)	−0.2607 *** (0.0844)	−0.0293 (0.0942)	−0.1208 * (0.0685)	−0.2865 *** (0.1044)	−0.2200 ** (0.1087)
LOAN	0.0083 (0.0530)	−0.0027 (0.0653)	−0.0670 (0.0485)	−0.1174 *** (0.0454)	−0.0307 (0.0793)	−0.4426 *** (0.1505)
OVER	−0.1202 (0.0738)	−0.0680 (0.0697)	−0.1421 ** (0.0561)	0.0237 (0.0625)	−0.2165 ** (0.0886)	0.1134 (0.1478)
Constant	2.9177 *** (0.4709)	2.6084 *** (0.4138)	3.3893 *** (0.2990)	4.6218 *** (0.3708)	4.2107 *** (0.6049)	2.1672 *** (0.7698)
Observations	1087	531	930	888	383	111
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.1207	0.0914	0.1140	0.1354	0.1472	0.2683

Values reported in parentheses are robust standard errors (SE); *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Compared with the empirical results in Table 2, the effects of investment climate factors across industries are slightly mixed. For the infrastructure dimension, Internet accessibility had significant influences on the Food and Beverages (−14.48%, $p < 0.05$), Non-Metal and Plastic Materials (−24.74%, $p < 0.01$), and Metal and Machinery Products (−8.12%, $p < 0.01$) sectors, of which the highest effect observed was in the Non-metal and Plastic Materials industry. Furthermore, the results in Table 3 validate the trivial impacts of electricity supply on firm productivity, as this was observed in almost all industries. The Metal and Machinery Products sector was the only one affected by this variable (−24.57%, $p < 0.05$). With respect to labor capacity factors, the educational levels of workers displayed notably negative effects on TFP in Wood Products and Furniture (−59.5%, $p < 0.01$) and Textiles (−29.9%, $p < 0.05$), while training of employees did not have significant impacts on TFP in most of the sectors, which confirms the results found for the whole sample. It was shown that, regarding regulatory governance and institutions, administrative burden only significantly affected the TFP of the Food and Beverages sector, with estimated effects (−8.55%, $p < 0.01$) that were much higher than those for the whole sample (−2.44%, Table 2). In contrast, there were four sectors reporting the unfavorable impacts of corruption on firm productivity, of which Non-metal and Plastic Materials (−26.07%, $p < 0.01$) and Textiles (−28.65%, $p < 0.01$) exhibited the most remarkable effects. Two sectors, Food and Beverages and Metal and Machinery products, were not affected by this determinant. Within the access to finance group, having no bank loan caused a significantly negative TFP in Wood Products and Furniture (−11.74%, $p < 0.01$) and Others (−44.26%, $p < 0.01$), while firm productivity in Metal

and Machinery products and Textiles was shown to be influenced by the overdraft facility variable (-14.21% , $p < 0.05$ and -21.65% , $p < 0.05$, respectively).

4. Discussion

The link between the investment climate and economic performance has been widely discussed in recent years. At the macroeconomic level, empirical studies have shown that a better investment climate can foster economic and firm growth [2,3,34]. However, at the micro level, few studies have examined the relationship between the investment climate and firm productivity. Some have used cross-country data to analyze this linkage, but they found weak evidence of the role of the investment climate in driving firm productivity. For instance, Kinda, Plane, and Véganzonès-Varoudakis [6] applied a stochastic frontier analysis to eight manufacturing industries in five Middle Eastern and North African countries and showed negligible impacts of the investment climate on firms' technical efficiency. Using pooled data across four countries—Bangladesh, China, India, and Pakistan—Dollar, Hallward-Driemeier, and Mengistae [4] investigated the effects of eight investment climate variables on garment firms' TFP measure using Levinsohn and Petrin's [18] approach. The results showed that only two variables, power outages and customs delays, significantly affected the firm TFP. The trivial impacts of investment climate found in these studies could be explained by the wide variation in the cultural and economic characteristics of different countries. Using a dataset from a specific country could address this potential issue. In fact, the empirical evidence for a single country provides stronger associations between the investment climate and firm productivity. Subramanian, Anderson, and Lee [35] pointed out that indicators of a poor investment climate, consisting of customs clearance delays and utility service interruptions, had significant and unfavorable impacts on firm productivity in the cases of China and Brazil. The productivity in their study was measured as the TFP from a production function using the OLS estimation technique. Sur, Zhang, and Chen [36] studied the relationship between the investment climate and firm productivity as measured by value added per worker in Pakistan and revealed that access to and quality of electricity supply, transportation-related problems, cost of finance, and cumbersome loan procedures posed major obstacles.

In the context of Vietnam, several studies have examined the link between the investment climate and firm productivity. Trung and Itagaki [14] carried out a survey on 200 agro-enterprises in North Vietnam and calculated TFP using the OLS method. They also investigated the relationship between the rural investment climate and TFP. The results showed that Internet accessibility and regional advantages exhibited positive impacts on TFP, while administrative procedures, outages, and policy uncertainties negatively affected TFP. Our findings confirm the effects of Internet accessibility and administrative procedures on the TFP of manufacturing firms. Trung and Kaizoji [15] used a similar OLS technique to estimate firm TFP, and they found that the investment climate has a crucial function in generating firm productivity. In addition, the study focused on the effects of corruption and revealed that corruption was favorable to firm productivity. They argued that corruption worked as "speed money" to improve the efficiency of public service provision or provide leeway for entrepreneurs to bypass inefficient regulations. The findings of our research are the opposite, as they showed that bribery was negatively correlated with firm productivity. Another study by Pham [16] focused on the relationship between the investment climate and Vietnamese manufacturing firms' technical efficiency. The author found that good quality infrastructure and finance, a transparent investment environment, and a safe society improved firms' technical efficiency, which is in line with the findings of our study.

From a methodological aspect, while most of the existing studies employed traditional OLS estimation to measure firm TFP, this research was the first to investigate the relationship between the investment climate in Vietnam and firm TFP. In addition, the previous papers were principally based on cross-sectional analysis. Our study exploited a balanced panel dataset that provided more information on firm characteristics and investment climate variables and, hence, produced better and more reliable estimations. With respect to investment climate factors, a comprehensive set of four broad dimensions—infrastructure, labor capacity, regulatory governance and institutions, and

access to finance—were considered. According to the World Bank [37], infrastructure is a significant constraint to firm productivity and competitiveness in developing countries. It plays an important role in complementing other production inputs. Furthermore, it also increases productive efficiency by generating externalities across firms and sectors, and, therefore, it fosters private productivity [38]. Poor infrastructure has emerged as a severe problem for firms in developing countries because it increases business costs or revenue losses. Adenikinju [39] found that the poor state of electricity delivery and power interruptions markedly raised cost burdens on businesses in Nigeria. Escribano, Guasch, and Pena [40] concluded that infrastructure deficiencies adversely affected firm productivity in Africa, with 40–80% of the infrastructural effect belonging to the power sector. Kinda, Plane, and Véganzonès-Varoudakis [6] revealed that Middle Eastern and North African firms faced the constraints of poor or lack of Internet connection and electricity supply. In this study, the negative impacts of Internet inaccessibility on firm TFP are confirmed (-14.22% , $p < 0.01$). This number is also similar to the findings of Escribano and Guasch [5], who found the effects of access to the Internet on productivity that ranged from 11% to 15% in Guatemala, Honduras, and Nicaragua. In contrast, we could not find any statistically significant link between electricity delivery and TFP. This might be attributed to the small proportion of firms reporting that they experienced insufficient power for production. It seems that the problem of power outages has been reduced in recent years in Vietnam. However, under the current period of digital revolution, it is crucial for firms in Vietnam to have access to the Internet in order to receive relevant market information, facilitate more effective firm production, monitor delivery chains, and create new business opportunities, all of which might improve the firm productivity.

The relationship between labor capacity and firm productivity has been the subject of remarkable concern in previous empirical studies. Almus [41] found a significantly positive link between academic degrees and the growth of German firms. Colombo and Stanca [42] indicated that an increase in training intensity, measured by the share of trained workers, was associated with a growth in value added per worker in Italy. Another study by Bernier and Cousineau [43] showed that a Canadian firm could improve their productivity by increasing expenditures on structured training. Biggs [44] argued that labor skills were poor in developing countries, and this, in turn, affected the operation of firms. Our findings reveal that the percentage of employees with low education (96.66%) had remarkably negative impacts (-61.13% , $p < 0.01$) on TFP, which is in line with previous empirical studies. However, the fact that firms in Vietnam do not regularly train their workers (94.24%) was not significantly associated with lower TFP. These results may suggest that to improve the labor capacity in Vietnam, focus should be placed on the development of high-quality human resources instead of short-term training programs.

It has been argued that efficient governance and institutions may create suitable incentives or reduce unnecessary expenses, hence encouraging investors to do business productively [3,45]. Governance and institutions may influence firm productivity through various channels, such as political changes, legal and judicial systems, red tape and bureaucracy, regulation, and corruption. The effects of corruption and bureaucracy on firm performance have been emphasized in the recent literature. While some reports concluded that corruption is harmful to businesses [46–49], others showed that corruption was a factor that stimulates a firm's business [15,31,50]. In this study, we found that bribery was negatively correlated with firm productivity (-15.42% , $p < 0.01$, Table 2). This result supports the argument that corruption works as “a tax” that reduces both the return to private capital and internal funds and, therefore, decreases firm productivity. In addition, the findings show that a longer time taken to complete business registration was associated with negative TFP (-2.48% , $p < 0.05$). Starting a business in Vietnam was ranked 123rd out of 190 countries, according to the Doing Business report 2018 [10], and the country's score was lower than the regional average (East Asia and the Pacific). These results suggest that consideration needs to be given to administrative procedure reform, together with perfecting the economic management mechanism to build an equal, fair, and transparent environment for business.

The World Bank [1] indicated that a developed financial market improves access to credit, expanding production and creating opportunities for firms to manage risks. Empirical evidence has revealed that the deficiency of external financial sources was a crucial obstacle to firm performance. Carlin, Schafferand, and Seabright [51] reported that a high cost of finance adversely affected firm output. Kinda, Plane, and Véganzonès-Varoudakis [6] demonstrated that the cost and access to financing explained firm performance discrepancies in the Middle East and North Africa. The study of Nguimkeu [52] revealed that the lack of access to credit negatively affected the gross margins of retail enterprises in Cameroon. Several studies have discussed an inventory model EOQ (economic order quantity), with a delay in payments in the presence of imperfect production and trade policies of enterprises [53–55].

Our results are in line with these previous studies. Firms without a bank loan and overdraft facility were 5.34% ($p < 0.05$) and 10.01% ($p < 0.01$), respectively, less productive than those with these capabilities. This may be due to the fact that a large proportion of small and medium enterprises have not been able to utilize banking services. In this study, the figures show that 70.73% of firms did not receive a bank loan and 79.33% did not have overdraft facility. A report by CIEM et al. [56] revealed that a lack of capital and access to credit were the most serious obstacles to productivity in Vietnam's small and medium enterprises. The main reasons that firms have problems with loan access are difficulties obtaining bank clearance and the lack of available collateral for a loan. Therefore, it is suggested that the government contributes to and enhances access to finance and that it intensifies efforts to assist firms in generating bankable projects.

There is considerable diversity in the quality of the investment climate among countries and the effects of the investment climate on firm productivity. For instance, macroeconomic instability, economic and regulatory policy uncertainty, and corruption were found to be the most severe business obstacles in Indonesia [11]. A report by the Asian Development Bank (ADB) [12] showed that bribery, infrastructure bottlenecks, and access to credit significantly affected firm productivity in the Philippines. Firm productivity in Thailand was found to be associated with labor skills, regulations and logistics, public power supply, and access to finance [13]. In addition, the TFP levels differ significantly among countries. Seker and Saliola [57] conducted a cross-country analysis of TFP performances of manufacturing firms in 69 emerging economies. They found that average TFP of Vietnamese enterprises ranged from 1.16 to 4.01 (depending on different specifications), which was in line with our result (2.73, Table 1). Within the South East Asia region, these numbers were slightly lower than those of Indonesia (average TFP ranged from 1.18 to 4.83) but ahead of Thailand (1.06 to 2.78) and Malaysia (1.14 to 3.37). However, compared to some other regions, TFP performances of Vietnamese firms lagged far behind. For instance, Uzbekistan (1.39 to 8.54) and Kyrgyzstan (1.66 to 9.81) in Central Asia; Brazil (1.39 to 6.76) and Chile (1.11 to 13.19) in Latin America; Moldova (1.58 to 9.11) and Czech (1.33 to 16.89) in Eastern Europe were countries that exhibited notably TFP [57]. Due to these significant variations in the investment climate and firm TFP across countries, the role of local governance is important [4]. Many countries have aimed to reform their investment climate. Some of them made significant changes and were rewarded with faster growth and greater poverty reductions. For instance, Estonia, Lithuania, and Latvia have aggressively pursued investment climate improvements since their independence in the early 1990s. The keys to development in these countries were the intelligent use of free zones, low and flat corporate income tax rates, high personal computer and Internet use, and a focus on competitiveness [58]. All three countries are now among the global leaders in the international index for the ease of doing business (ranked 12th, 16th, and 19th in 2018, respectively [10]) due to their noticeable ability to adjust and change business conditions. Referencing the actions taken by these countries may help Vietnam to successfully improve its investment climate and the productivity of its firms, and hence contribute to the sustainable growth of the country.

The empirical results in this paper also yield some important managerial implications for enterprises. First, since it was found that educational levels of employees affected firm productivity, managers should focus on recruiting well-educated workers. However, this has been a challenge for

firms in Vietnam due to the low-quality labor force of the country, especially for small and medium enterprises. In 2018, the figures showed that the proportion of Vietnam's labor force aged 15 and over who had at least a university or college degree was relatively low at 6.79% [59]. Therefore, in order to improve the education levels of workers, firms should have appropriate strategies, such as better working conditions or salary, attractive compensation, and benefit package policies, to attract higher-quality labor. Another result of this study is that employee training did not have significant effects on firm TFP. This could be partly due to the ineffectiveness of training programs offered by firms in the survey. These programs should be designed to equip workers with the necessary skills to enhance individual productivity. Regarding the firms' credit accessibility, the study indicates that a high proportion of the firms did not have a bank loan or overdraft facility, which caused notably negative impacts on firm TFP. The main cause is the weakness of the financial system, but, from the view of banking institutions, firms' lack of profitability and lack of acceptable collateral are also important causes. Hence, small, and medium enterprises should focus on their financial performance in order to meet the bank requirements and be able to attain bank credit, which will be beneficial to their productivity.

5. Conclusions

This study investigated the links between the investment climate and firm productivity by exploiting a dataset of 1310 Vietnamese manufacturing enterprises from 2011, 2013, and 2015. The productivity was measured as TFP, which was obtained by production function estimation using the Levinsohn and Petrin's [18] approach. To date, this is the first study that has applied this methodology to examine TFP and its association with the investment climate in Vietnam. The main ideas underlying this methodology are the use of intermediate input as a proxy for the unobserved firm productivity and the estimation of unbiased production function coefficients. With respect to investment climate factors, four broad dimensions—infrastructure, labor capacity, regulatory governance and institutions, and access to finance—were considered.

The findings of this study are relevant to policymakers in Vietnam for enhancing the investment climate and productivity, as it points out major restrictions faced by manufacturing firms and, hence, suggests where reform efforts should be focused. It was empirically shown that constraints related to quality of labor, Internet accessibility, administrative procedures, corruption, and access to finance significantly impaired firm TFP. Of these factors, the quality of labor was found to be the most serious obstacle, as 96.66% of the employees of the surveyed firms did not obtain at least a college or university degree, and this has had a notably negative impact on TFP (−61.13%). Therefore, improving the educational level of human resources may greatly benefit firm productivity. However, to achieve that, a lot of time and cost are required. In the short term, policymakers should provide specific services that firms need, including infrastructure and access to financial services. The empirical results indicate that high proportions of firms have no Internet access (62.29%), bank loans (70.73%), and overdraft facilities (79.33%), and these firms were found to be 14.22%, 5.31%, and 9.9%, respectively, less productive than firms utilizing the above services. Thus, extending Internet accessibility and providing more access to finances should be considered to enhance firm productivity. Furthermore, the study reveals that the administrative burden and the cost of bribery had unfavorable influences on TFP (−2.44% and −15.35%, respectively). Hence, it is crucial for the government to simplify administrative procedures and to especially reduce corruption to create a favorable and transparent environment for businesses. This study also provides a link between the investment climate and firm productivity across various industries in the manufacturing sector in Vietnam. It was found that some sectors were more sensitive than others to investment climate deficiencies. For instance, among the sectors examined, the Non-metal and plastic materials sector was most affected by the Internet accessibility constraint (−24.74%), and these effects were even stronger than those on the manufacturing industry as a whole. The results also show that the influences of the educational levels of workers on TFP only mattered in the Wood products and furniture (−59.5%) and Textiles

(−29.9%) sectors. Similarly, administrative burden was more of a significant problem in the Food and beverages sector (−8.55%) compared with the others. Corruption had the most remarkable effects on TFP in two sectors: Non-metal and plastic materials (−26.07%) and Textiles (−28.65%). Of the access to finance group factors, the unfavorable impacts of having no bank loan on TFP were found in Wood products and furniture (−11.74%) and Other sectors (−44.26%), while firm productivity in the Metal and machinery products and Textiles sectors were more affected by the overdraft facility variable (−14.21% and −21.65%, respectively). These findings can be used to design appropriate industrial policies to enhance TFP in each corresponding industry. The utilization of the achievements of this research may help promote the investment climate and firm productivity in Vietnam, and thus effectively contribute to the stability and sustainable growth of the country.

Although our findings yield important policy implications and contribute to the investment climate and firm productivity analysis literature, there are still some limitations to this research. First, it is possible that some of the investment climate factors were a proxy for broader measures of government efficiency. If so, the coefficients of these variables could be overestimates of the likely returns on a particular reform, such as a target measure to improve administrative burden. This issue can be partly addressed over time since the data collection efforts continue. Second, to mitigate the endogeneity problem, IV approach and dynamic models estimated by GMM were considered as effective approaches but were not conducted in this study due to the lack of data and valid instrumental variables. Therefore, more empirical efforts are needed to enable the discharge of spurious effects, as well as to establish real causal relationships between the investment climate and firm productivity. These issues will be implemented in further stages of this research path.

Supplementary Materials: The following are available online at <http://www.mdpi.com/2071-1050/10/12/4815/s1>, Table S1: Estimation results for alternative measure of firm size. Table S2: Estimation results for different approaches dealing with endogeneity. Table S3: Regression with a single determinant of firm TFP.

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References

1. World Bank. *World Development Report 2005: A Better Investment Climate for Everyone*; World Bank and IBRD: Washington, DC, USA, 2005.
2. Hall, R.E.; Jones, C. Why do some countries produce so much more output per worker than others? *Q. J. Econ.* **1999**, *114*, 83–116. [[CrossRef](#)]
3. Bosworth, B.; Collins, S.M. The empirics of growth: An update. *Brook. Pap. Econ. Act.* **2003**, *2003*, 113–206. [[CrossRef](#)]
4. Dollar, D.; Hallward-Driemeier, M.; Mengistae, T. Investment climate and firm performance in developing economies. *Econ. Dev. Cult. Chang.* **2005**, *54*, 1–31. [[CrossRef](#)]
5. Escribano, A.; Luis Guasch, J. *Assessing the Impact of the Investment Climate on Productivity Using Firm-Level Data: Methodology and the Cases of Guatemala, Honduras, and Nicaragua*; SSRN Scholarly Paper No. 755070; Social Science Research Network: Rochester, NY, USA, 2005.
6. Kinda, T.; Plane, P.; Véganzonès-Varoudakis, M.A. Firm productivity and investment climate in developing country: How does Middle East and North Africa manufacturing form? *Dev. Econ.* **2011**, *49*, 429–462. [[CrossRef](#)]
7. Khuong, V.M. *The Dynamics of Economic Growth: Policy Insights from Comparative Analyses in Asia*; Edward Elgard: Cheltenham, UK, 2013; ISBN 978-0-85-793964-7.

8. General Statistics Office of Vietnam (GSO). *Statistical Yearbook 2016*; Statistical Publishing House: Hanoi, Vietnam, 2017.
9. World Economic Forum. *Global Competitiveness Report 2018*; World Economic Forum: Geneva, Switzerland, 2018.
10. World Bank. *Doing Business 2018: Reforming to Create Jobs*; World Bank Group: Washington, DC, USA, 2018.
11. Asian Development Bank (ADB). *Joint Asian Development Bank and World Bank Report 2005: Improving the Investment Climate in Indonesia*; Asian Development Bank: Manila, Philippines, 2005.
12. Asian Development Bank (ADB). *Asian Development Bank Report 2005: Improving the Investment Climate in Philippines*; Asian Development Bank: Manila, Philippines, 2005.
13. World Bank. *Thailand Investment Climate Assessment Update*; World Bank Group: Washington, DC, USA, 2008.
14. Trung, T.Q.; Itagaki, K. Agro-enterprise performance and rural investment climate: Evidence from the North of Vietnam. *Int. Bus. Manag.* **2012**, *2*, 28–36.
15. Trung, N.B.; Kaizoji, T. Investment climate and firm productivity: An application to Vietnamese manufacturing firms. *Appl. Econ.* **2017**, *49*, 4394–4409. [[CrossRef](#)]
16. Pham, D.L. Investment Climate and Technical Efficiency: Evidence from Vietnamese manufacturing. In Proceedings of the International Conference on International Trade and Investment (ICITI), Moka, Mauritius, 20–21 December 2011.
17. Van Beveren, I. Total factor productivity estimation: A practical review. *J. Econ. Surv.* **2012**, *26*, 98–128. [[CrossRef](#)]
18. Levinsohn, J.; Petrin, A. Estimating production functions using inputs to control for unobservables. *Rev. Econ. Stud.* **2003**, *70*, 317–341. [[CrossRef](#)]
19. Clarke, G.R.G. *Assessing How the Investment Climate Affects Firm Performance in Africa: Evidence from the World Bank's Enterprise Surveys*; World Background Paper IV; World Bank Group: Washington, DC, USA, 2011.
20. Organization for Economic Co-operation and Development (OECD). *Measuring Productivity: Measurement of Aggregate and Industry-Level Productivity Growth*; OECD Publishing: Paris, France, 2001.
21. Syverson, C. What determines productivity? *J. Econ. Lit.* **2011**, *49*, 2326–2365. [[CrossRef](#)]
22. Owyong, D.T. *Productivity Growth: Theory and Measurement*; APO Productivity Papers; APO: Tokyo, Japan, 2000; pp. 19–29.
23. Olley, G.S.; Pakes, A. The dynamics of productivity in the telecommunications equipment industry. *Econometrica* **1996**, *64*, 1263–1297. [[CrossRef](#)]
24. Bastos, F.; Nasir, J. *Productivity and the Investment Climate: What Matters Most? World Bank Policy Research Working Paper No. 3335*; World Bank: Washington, DC, USA, 2004.
25. Fernandes, A.M. Firm productivity in Bangladesh manufacturing industry. *World Dev.* **2008**, *36*, 1725–1744. [[CrossRef](#)]
26. Li, F. Endogeneity in CEO power: A survey and experiment. *Invest. Anal. J.* **2016**, *45*, 149–162. [[CrossRef](#)]
27. Arellano, M.; Bond, S. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Rev. Econ. Stud.* **1991**, *58*, 277–297. [[CrossRef](#)]
28. CIEM; ILSSA; UCPH; UNU_WIDER. *Vietnam Small and Medium Enterprise Survey 2011*; UNU_WIDER: Hanoi, Vietnam, 2011.
29. CIEM; ILSSA; UCPH; UNU_WIDER. *Vietnam Small and Medium Enterprise Survey 2013*; UNU_WIDER: Hanoi, Vietnam, 2013.
30. CIEM; ILSSA; UCPH; UNU_WIDER. *Vietnam Small and Medium Enterprise Survey 2015*; UNU_WIDER: Hanoi, Vietnam, 2015.
31. Rand, J.; Tarp, F. Firm-level corruption in Vietnam. *Econ. Dev. Cult. Chang.* **2012**, *60*, 571–595. [[CrossRef](#)]
32. Van Biesebroeck, J. Firm size matters: Growth and productivity growth in African manufacturing. *Econ. Dev. Cult. Chang.* **2005**, *53*, 545–583. [[CrossRef](#)]
33. Dang, C.; Li, Z.; Yang, C. Measuring firm size in empirical corporate finance. *J. Bank. Financ.* **2018**, *86*, 159–176. [[CrossRef](#)]
34. Lucas, R.E., Jr. On the mechanics of economic development. *J. Mon. Econ.* **1989**, *22*, 3–42. [[CrossRef](#)]
35. Subramanian, U.; Anderson, W.P.; Lee, K. *Measuring the Impact of the Investment Climate on Total Factor Productivity: The Cases of China and Brazil*; World Bank Policy Research Working Paper 3792; World Bank Group: Washington, DC, USA, 2005.

36. Sur, M.; Zhang, J.; Chen, K. The investment climate and enterprise performance in rural Pakistan: Implications for rural non-farm employment generation. *J. Asia Pac. Econ.* **2014**, *19*, 488–505. [[CrossRef](#)]
37. World Bank. *World Development Report 1994: Infrastructure for Development—Executive Summary*; World Bank Group: Washington, DC, USA, 1994.
38. Holtz-Eakin, D.; Schwartz, A.E. *Spatial Productivity Spillovers from Public Infrastructure: Evidence from State Highways*; NBER Working Paper No. 5004; National Bureau of Economic Research, Inc.: Cambridge, MA, USA, 1995.
39. Adenikinju, A. *Analysis of the Cost of Infrastructure Failures in a Developing Economy: The Case of the Electricity Sector in Nigeria*; AERC Research Paper No. 148; AERC Publications: Nairobi, Kenya, 2005.
40. Escribano, A.; Guasch, J.L.; Pena, J. *Impact of Infrastructure Constraints on Firm Productivity in Africa*; Africa Infrastructure Country Diagnostic Working Paper No. 9; World Bank Group: Washington, DC, USA, 2008.
41. Almus, M. What characterizes a fast-growing firm? *Appl. Econ.* **2012**, *34*, 1497–1508. [[CrossRef](#)]
42. Colombo, E.; Stanca, L. *The Impact of Training on Productivity: Evidence from a Large Panel of Firms*; Working Paper No. 134; University of Milano-Bicocca, Department of Economics: Milan, Italy, 2008.
43. Bernier, A.; Cousineau, M. The impact of training on productivity in Canadian firms: Estimating distributed lags from WES 1995–2005. *J. Interdiscip. Soc. Sci.* **2010**, *5*, 231–239.
44. Biggs, T. *Assessing Export Supply Constraints: Methodology, Data, and Measurement*; Framework Paper for the AERC Collaborative Research Project on “Export Supply Response Capacity Constraints in Africa”; Routledge: Abingdon, UK, 2007.
45. Rodrik, D.; Subramanian, A.; Trebbi, F. Institutions rule: The primacy of institutions over geography and integration in economic development. *J. Econ. Growth* **2004**, *9*, 131–165. [[CrossRef](#)]
46. Shleifer, A.; Vishny, R.W. Corruption. *Q. J. Econ.* **1993**, *108*, 599–617. [[CrossRef](#)]
47. Mo, P.H. Corruption and economic growth. *J. Comp. Econ.* **2001**, *29*, 66–79. [[CrossRef](#)]
48. Fisman, R.; Svensson, J. Are corruption and taxation really harmful to growth? Firm level evidence. *J. Dev. Econ.* **2007**, *83*, 63–75. [[CrossRef](#)]
49. Aterido, R.; Hallward-Driemeier, M.; Carmen, P. Big constraints to small firms’ growth? Business environment and employment growth across firms. *Econ. Dev. Cult. Chang.* **2011**, *59*, 609–647. [[CrossRef](#)]
50. Acemoglu, D.; Verdier, T. Property rights, corruption and the allocation of talent: A general equilibrium approach. *Econ. J.* **1998**, *108*, 1381–1403. [[CrossRef](#)]
51. Carlin, W.; Schaffer, M.; Seabright, P. *Where Are the Real Bottlenecks? A Lagrangian Approach to Identifying Constraints on Growth from Subjective Survey Data*; CEPR Discussion Paper No. 5719; Centre for Economic Policy Research: London, UK, 2006.
52. Nguimkeu, P. Some effects of business environment on retail firms. *Appl. Econ.* **2016**, *48*, 1647–1654. [[CrossRef](#)]
53. Sarkar, B.; Sana, S.S.; Chaudhuri, K. An inventory model with finite replenishment rate, trade credit policy and price-discount offer. *J. Ind. Eng.* **2013**, *2013*, 672504. [[CrossRef](#)]
54. Sarkar, B. An EOQ model with delay in payments and stock dependent demand in the presence of imperfect production. *Appl. Math. Comput.* **2012**, *218*, 8295–8308. [[CrossRef](#)]
55. Sakar, B. An EOQ model with delay in payments and time varying deterioration rate. *Math. Comput. Model.* **2012**, *55*, 367–377. [[CrossRef](#)]
56. CIEM; ILSSA; UCPH; UNU_WIDER. *Characteristics of the Vietnamese Business Environment: Evidence from a Survey in 2015*; Central Institute of Economic Management: Hanoi, Vietnam, 2016.
57. Seker, M.; Saliola, F. A cross-country analysis of total factor productivity using micro-level data. *Cen. Bank Rev.* **2018**, *18*, 13–27. [[CrossRef](#)]
58. Mihailova, V.; Dodu-Gugea, L. *Ways of Improving the Investment Climate in the Republic of Moldova. Case Study: Baltic States*; Center for Studies in European Integration (CSIE) Working Papers Series; Information Society Development Institute: Chisinau, Moldova, 2016; Volume 3, pp. 19–33.
59. General Statistics Office of Vietnam (GSO). *Report on Labor Force Survey Quarter 1, 2018*; Statistical Publishing House: Hanoi, Vietnam, 2018.

