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# Business Development and Provincial Income in Vietnam: The Role of Labor Market Conditions

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# Business Development and Provincial Income in Vietnam: The Role of Labor Market Conditions

## Abstract

Labor market conditions (LMC) play an important role in business development (BD) and provincial income, yet their interaction at the provincial level in Vietnam remains underexplored. This study examines how LMC are associated with BD and Gross Regional Domestic Product (GRDP) per capita across 63 provinces during 2018–2023, using data from the Vietnam General Statistics Office (GSO) and the Provincial Competitiveness Index (PCI). A simultaneous equation framework estimated by three-stage least squares (3SLS) is applied to capture the interdependence between enterprise density and GRDP per capita. The findings reveal a nonlinear and bidirectional relationship, with diminishing marginal effects at higher development levels. LMC and selected PCI dimensions are associated with enterprise activity and income differences, while regional disparities persist. The results highlight the importance of balanced regional development, improved labor allocation, and stronger institutional quality to support sustainable BD and reduce provincial gaps.

## JEL classification

J21, J24, L26, R11, C33

## Keywords

business development, labor market conditions, Provincial Competitiveness Index, GRDP per capita, Vietnamese provinces

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## 1. Introduction

Since the introduction of the Đổi mới reforms in 1986, Vietnam has undergone profound economic transformation. The transition from a centrally planned system to a more market-oriented economy has generated sustained economic growth, rising living standards, and rapid structural change. Alongside this national progress, however, substantial disparities remain across provinces. While Ho Chi Minh City, Ha Noi, Binh Duong, and Quang Ninh have developed vibrant business sectors and relatively high-income levels, many provinces in the Northern Midlands and Mountainous Areas and parts of the Mekong Delta continue to lag. These persistent differences suggest that regional development in Vietnam remains uneven despite decades of economic expansion.

Understanding the factors underlying provincial development has therefore become an important issue for both researchers and policymakers. Among the determinants frequently highlighted in the literature, LMC play a central role. The availability of skilled labor, labor mobility, unemployment, and labor market formalization influence firms' ability to recruit workers, expand production, and improve productivity. At the same time, business activity affects employment opportunities, wage formation, and income generation. Consequently, labor markets and business development are closely linked components of the regional development process.

A large body of research has investigated the role of labor markets, human capital, institutions, and infrastructure in shaping economic performance. Existing studies generally find that skilled labor and favorable institutional environments support firm formation, productivity growth, and regional development. However, much of the empirical literature examines business activity and income separately. In many studies, business development is treated as a determinant of economic growth, whereas income is modeled as an outcome influenced by labor market and institutional characteristics. Such approaches implicitly assume a unidirectional relationship and may overlook the possibility that business activity and income evolve together through mutually reinforcing mechanisms.

This limitation is particularly relevant in the context of Vietnam. Provincial economies differ substantially in terms of enterprise density, labor market structures, migration patterns, governance quality, and development levels. A higher concentration of firms may contribute to income growth through employment creation, productivity improvements, and local economic dynamism. Conversely, higher income levels may encourage business expansion by increasing market demand and improving economic opportunities. These interactions suggest that business development and income may be jointly related rather than independent outcomes. Nevertheless, empirical evidence examining this relationship within a unified provincial framework remains limited.

The present study addresses this gap by examining business development and provincial income simultaneously while accounting for labor market conditions and institutional quality. Rather than treating enterprise density and income as separate phenomena, the study recognizes the possibility that both variables are interconnected and may influence one another within a broader regional development system. Such an approach is particularly

relevant for Vietnam, where considerable heterogeneity exists across provinces despite a common national policy framework.

This study contributes to the literature in three ways. First, it extends existing research by analyzing business development and provincial income within a simultaneous framework rather than examining them independently. This approach allows the analysis to capture potential interdependence between enterprise activity and economic performance. Second, the study provides comprehensive evidence from all 63 Vietnamese provinces over the period 2018–2023, offering an updated assessment of how labor market conditions and institutional quality are associated with regional economic outcomes. Third, the analysis explicitly considers the possibility of nonlinear relationships between business development and income, recognizing that the strength of these associations may vary across provinces at different stages of development.

The study is guided by the following research question:

How are business development and provincial income related at the provincial level in Vietnam when analyzed within a simultaneous and nonlinear framework?

To address this question, the analysis first examines whether business development and provincial income exhibit a bidirectional relationship when considered jointly. It then investigates how labor market conditions, including trained labor, unemployment, migration, and labor market formalization, are associated with these outcomes. Finally, the study explores the role of institutional quality, measured by the PCI, within the same empirical framework.

The empirical analysis employs a balanced panel dataset covering 63 provinces during the period 2018–2023. A fixed effects model is first estimated to control for unobserved provincial heterogeneity. Subsequently, a system of simultaneous equations estimated using 3SLS is applied to capture the interdependence between enterprise density and GRDP per capita. The estimated relationships are interpreted as conditional associations within an integrated provincial development framework rather than as definitive causal effects.

By examining labor markets, business development, and provincial income within a single analytical framework, this study contributes to a more comprehensive understanding of regional development dynamics in Vietnam. The findings provide useful insights for policymakers seeking to strengthen local business environments, improve labor market outcomes, and promote more balanced economic development across provinces.

## **2. Literature review**

### **2.1 Theoretical framework**

Research on regional economic development generally shows that labor markets, institutions, and business activity are closely connected. In the neoclassical growth framework, income gaps across regions are expected to narrow over time as poorer regions grow faster than richer ones. This process depends on convergence in capital, human capital, and institutional

conditions. Labor mobility plays an important role by allowing workers to move to regions with higher productivity and wages (Barro & Sala-i-Martin, 1991; Mankiw et al., 1992).

In developing economies, structural transformation is another key mechanism. The dual-economy model explains how labor gradually shifts from agriculture to more productive industrial and service sectors. As modern sectors expand and absorb labor, wages increase and create incentives for firm formation (Lewis, 1954; Gollin, 2014). However, this process depends on the ability of regions to create stable jobs and provide adequate labor market institutions and training.

Endogenous growth theory highlights the role of human capital and innovation. The Uzawa–Lucas model suggests that skill accumulation generates knowledge spillovers that support long-term growth (Lucas, 1988). Romer (1990) argues that innovation depends on economic incentives shaped by policies and institutional conditions. In this context, business development and labor market outcomes evolve together. Productive firms increase demand for skilled labor, while a more skilled workforce encourages entrepreneurship and innovation (Aghion & Howitt, 1992).

The relationship between LMC and BD can be explained through several mechanisms. A higher level of human capital improves firm productivity and reduces hiring costs. At the same time, higher unemployment may lead individuals to start businesses when formal jobs are limited. On the other hand, high unemployment can also signal weak demand, which discourages firm entry. These opposing effects suggest that the relationship between LMC and BD is not clear-cut and may vary across regions.

Infrastructure and institutions also shape business conditions. New Economic Geography suggests that better transport and logistics reduce trade costs and attract firms and skilled workers, although this may increase regional inequality (Krugman, 1991). Institutional quality also matters. Transparent regulations, low entry barriers, and effective governance help create a favorable environment for firms (Porter, 1990). Foreign direct investment can further support development through technology transfer and linkages with domestic firms, depending on local capacity (Rodriguez-Clare, 1996).

Overall, these theories suggest that labor markets, institutions, business activity, and income are jointly determined. Business development both responds to and influences labor market outcomes, creating feedback effects rather than a one-way relationship.

## **2.2 Empirical literature**

### **2.2.1 Labor markets, human capital, and firm dynamics**

Empirical studies confirm the importance of labor market conditions and human capital for firm performance. Cross-country evidence shows that labor flexibility and skills are positively associated with firm creation and productivity growth (Banerjee & Duflo, 2005). More recent research also finds that interactions between labor skills and firm productivity help stabilize economic fluctuations (Abbritti & Consolo, 2024).

Studies on China and India highlight the role of resource allocation. Hsieh and Klenow (2009) show that distortions reduce productivity, while Song et al. (2011) find that firm dynamics and labor market reforms contributed to China's growth. Improvements in infrastructure and reductions in spatial frictions also support firm entry and expansion (Dinlersoz & Fu, 2022).

In Southeast Asia, labor informality and limited social protection remain major constraints for small and medium enterprises (International Labor Organization, 2018). Empirical findings on unemployment and business formation are mixed. Some studies support the idea of necessity entrepreneurship, while others find that high unemployment discourages firm creation due to weak demand.

In Vietnam, provincial competitiveness has been linked to infrastructure, wages, and employment outcomes (Doan et al., 2018). However, most studies use single-equation models and do not fully capture the interaction between labor markets and business activity.

### **2.2.2 Infrastructure, institutions, and the business environment**

A large body of research emphasizes the role of infrastructure and institutions in shaping business activity. Infrastructure investment improves market access and reduces spatial barriers (Dinlersoz & Fu, 2022). Urban infrastructure also affects the location of firms and regional concentration (Heshmati & Rashidghalam, 2020).

Institutional quality is another important factor. Studies show that better regulations and financial access support firm entry and productivity (Aghion et al., 2019). In Vietnam, indicators such as PCI and PAPI reveal differences in governance across provinces (VCCI, 2023, 2024; CECODES et al., 2024). The World Bank (2016) also identifies institutional constraints as a key challenge for private sector development.

Cross-country evidence suggests that stronger institutions are associated with opportunity-driven entrepreneurship and better economic outcomes (Aparicio, Urbano, & Audretsch, 2016).

### **2.2.3 Bidirectional relationships and system-based evidence**

Economic variables such as business activity, employment, and income often move together. Higher firm density is associated with job creation and income growth, while higher income and better labor conditions encourage further business expansion (Hsieh & Klenow, 2009).

To analyze these relationships, researchers often use system-based methods such as 3SLS, which allow multiple equations to be estimated jointly (Zellner & Theil, 1962). In this study, 3SLS is used to capture interdependence and correlated errors across equations. The results are interpreted as conditional associations rather than causal effects.

## **2.3 Literature synthesis and research gap**

The literature shows that labor market conditions, institutions, and infrastructure are important for business activity and income. However, many studies examine these factors separately and do not consider their joint dynamics.

In Vietnam, most provincial studies still rely on single-equation approaches, which may overlook the interaction between business development and income. This limitation is important given the large differences across provinces in labor markets and institutional quality.

This study addresses the gap by applying a simultaneous framework that analyzes BD and GRDP per capita together, while accounting for LMC and institutional quality. The use of 3SLS allows the study to capture interdependence across variables and provide a more comprehensive view of regional development.

## **2.4 Hypotheses**

Based on the discussion above, the following hypotheses are proposed:

H1: BD and provincial income are positively associated within a jointly determined system.

H2: The relationship between BD and provincial income is nonlinear within the simultaneous system.

H3: Labor market conditions, including trained labor and unemployment, are associated with BD and provincial income.

H4: Institutional quality, measured by PCI indicators, is associated with BD and provincial income.

## **3. Methodology and Data**

### **3.1 Theoretical background and Empirical motivation**

This study investigates the interrelationship between BD, LMC, institutional quality, and provincial income in Vietnam. The research is grounded in three complementary theoretical perspectives. Endogenous growth theory (Lucas, 1988; Romer, 1990) emphasizes the role of human capital accumulation, innovation, and knowledge spillovers in sustaining productivity and income growth, suggesting that enterprise activity is both a driver and an outcome of economic expansion. Agglomeration theory (Krugman, 1991) further argues that spatial concentration of firms generates increasing returns through labor pooling, input linkages, and information spillovers, implying that enterprise density and income may reinforce one another over time. Institutional theory (Acemoglu et al., 2001) highlights the importance of governance quality, secure property rights, and lower transaction costs in shaping entrepreneurial incentives and economic performance.

Although many empirical studies estimate single-equation panel models to examine either firm activity or income separately, the theoretical framework implies a bidirectional and mutually reinforcing relationship. Accordingly, this study adopts a system-based empirical approach that allows BD and income to evolve jointly rather than assuming a strictly one-directional causal structure.

### 3.2 Empirical model

The empirical analysis proceeds in two stages. First, a FE panel model is estimated as a benchmark specification in which BD is regressed on LMC and provincial economic indicators (PEI) while controlling for province-specific and time-specific effects. The model is specified as:

$$BD_{it} = \alpha + \beta_{j1} LMC_{jit} + \beta_{k2} PEI_{kit} + \varepsilon_{it}$$

where BD is Business Development, LMC is a vector of J Labor Market Conditions, and PEI is a vector of K Provincial Economic Indicators (including GRDP per capita and PCI indicators), and  $\varepsilon$  is random error term. Province fixed effects ( $\mu_i$ ) control for time-invariant characteristics such as geography and historical industrial structure, while time effects ( $\lambda_t$ ) capture macroeconomic shocks common to all provinces. Although the FE estimator mitigates omitted variable bias arising from unobserved heterogeneity, it does not address potential simultaneity between enterprise density and income.

To account for feedback effects, the study employs a simultaneous equation system estimated using 3SLS. In this framework, the logarithm of enterprise density is modeled as a function of the logarithm of GRDP per capita, its squared term, labor market variables, and institutional indicators. Conversely, the logarithm of GRDP per capita is specified as a function of the logarithm of enterprise density, its squared term, and the same set of explanatory variables. The structural equations of the 3SLS model are specified as follows:

$$\text{Equation 1: } \ln BD_{it} = \alpha_0 + \alpha_1 \ln GRDP_{it} + \alpha_2 \ln GRDP_{it}^2 + \alpha_3 LMC_{it} + \alpha_4 PCI_{it} + \mu_i + \lambda_t + \varepsilon_{1,it}$$

$$\text{Equation 2: } \ln GRDP_{it} = \beta_0 + \beta_1 \ln BD_{it} + \beta_2 \ln BD_{it}^2 + \beta_3 LMC_{it} + \beta_4 PCI_{it} + \mu_i + \lambda_t + \varepsilon_{2,it}$$

In this system, BD and GRDP are treated as endogenous variables, while LMC and PCI are included as key exogenous determinants influencing both equations. Province fixed effects ( $\mu_i$ ) and time effects ( $\lambda_t$ ) are incorporated to control for unobserved heterogeneity across provinces and over time. Squared terms of BD and GRDP are included in the opposite equations to allow for potential nonlinear relationships.

The system is estimated using 3SLS, which addresses simultaneity between BD and income and enables joint estimation while accounting for possible contemporaneous correlation in the error terms. The nonlinear specification implies that the marginal effects of income on enterprise density, and of enterprise density on income, may vary across different levels of development. Accordingly, the estimated coefficients are interpreted as conditional relationships within an interdependent provincial development framework rather than as strictly causal structural parameters.

### **3.3 Variables and Measurement**

Business development (BD) is measured as the number of active enterprises per 1,000 inhabitants in each province as of December 31 each year. This measure captures enterprise density rather than absolute firm counts, ensuring comparability across provinces of different population sizes. In the regression analysis, the variable is transformed into natural logarithmic form. Changes in the number of active enterprises per 1,000 inhabitants and GRDP per capita by province in Vietnam (2018–2023) is shown in Appendix 1. The correlation matrix and summary statistics of the variables are presented in Appendix 2 and 3, respectively.

Provincial income is measured by GRDP per capita expressed in million Vietnamese dong per person and is also transformed into logarithmic form in the econometric estimations.

Labor market conditions include the population growth rate, net migration rate, the percentage of trained labor force aged 15 and above, the unemployment rate, and the percentage of labor force covered by unemployment insurance. These indicators capture demographic dynamics, human capital quality, labor market slack, and the degree of labor market formalization.

Institutional quality is proxied by sub-indices from the PCI, including entry costs, land access and tenure security, transparency, time costs, informal charges, policy bias, proactivity of provincial leadership, business support services, labor policy, and law and order. Each index is measured on a scale from 0 to 10, with higher values indicating a more favorable business environment.

### **3.4 Data Sources**

The study employs a balanced panel dataset covering 63 provinces in Vietnam over the period 2018–2023, resulting in 378 province-year observations. Data on enterprise counts, labor market indicators, migration statistics, and GRDP per capita are obtained from the General Statistics Office, while institutional indicators are collected from annual PCI reports published by the VCCI.

The provincial-year panel structure enables the analysis to exploit within-province variation over time while controlling for unobserved heterogeneity, thereby providing a consistent framework for examining the joint evolution of enterprise density, LMC, institutional quality, and income across Vietnamese provinces.

## **4. Result and discussion**

### **4.1 Empirical result**

The empirical analysis examines the relationship between BD and provincial income using a sequence of estimators with increasing structural complexity. Pooled OLS is first employed as a baseline to describe cross-provincial associations without accounting for unobserved heterogeneity or simultaneity. The FE estimation is then applied to control for time-invariant

provincial characteristics and serves as the main benchmark in the single-equation framework, capturing within-province variation over time. Finally, a simultaneous-equation approach using 3SLS is introduced to analyze the joint determination of BD and GRDP per capita, relaxing the exogeneity assumptions imposed in OLS and FE. The results for the BD model under these three estimation methods are reported in Table 1.

**Table 1. Regression results for BD in Vietnam**

| Variable                                                        | Pooled OLS |                                               | FE        |           |
|-----------------------------------------------------------------|------------|-----------------------------------------------|-----------|-----------|
|                                                                 | Coef.      | Std. Err.                                     | Coef.     | Std. Err. |
| Population growth rate (%)                                      | -0.037*    | 0.022                                         | -0.010    | 0.007     |
| Net emigration rate (%)                                         | 0.011***   | 0.003                                         | 0.003***  | 0.001     |
| Percentage of trained labor force (aged 15 and above) (%)       | 0.025***   | 0.003                                         | 0.010***  | 0.002     |
| Unemployment rate (%)                                           | 0.036***   | 0.012                                         | 0.012***  | 0.004     |
| Percentage of labor force covered by unemployment insurance (%) | 0.008***   | 0.003                                         | -0.005*   | 0.003     |
| Natural logarithm of GRDP per capita (million VND per person)   | 0.541***   | 0.059                                         | 0.445***  | 0.045     |
| Entry costs (PCI index, 0–10)                                   | -0.017     | 0.026                                         | 0.007     | 0.007     |
| Land access and tenure (PCI index, 0–10)                        | 0.037      | 0.033                                         | -0.014    | 0.009     |
| Transparency (PCI index, 0–10)                                  | 0.001      | 0.029                                         | 0.000     | 0.008     |
| Time costs (PCI index, 0–10)                                    | 0.054**    | 0.027                                         | 0.003     | 0.007     |
| Informal charges (PCI index, 0–10)                              | -0.021     | 0.033                                         | -0.008    | 0.009     |
| Policy bias (PCI index, 0–10)                                   | 0.012      | 0.019                                         | 0.001     | 0.005     |
| Proactivity of provincial leadership (PCI index, 0–10)          | -0.027     | 0.031                                         | 0.010     | 0.008     |
| Business support policy (PCI index, 0–10)                       | 0.037*     | 0.022                                         | 0.002     | 0.006     |
| Labor policy (PCI index, 0–10)                                  | -0.027     | 0.022                                         | 0.005     | 0.007     |
| Law and order (PCI index, 0–10)                                 | -0.123***  | 0.030                                         | 0.017*    | 0.009     |
| Constant                                                        | -1.057**   | 0.437                                         | -0.721*** | 0.195     |
| Observations: 378                                               |            | Observations: 378                             |           |           |
| F(16, 361) = 87.45                                              |            | Groups: 63                                    |           |           |
| Prob > F = 0.000                                                |            | F(16, 299) = 38.54                            |           |           |
| R <sup>2</sup> = 0.795                                          |            | Prob > F = 0.000                              |           |           |
| Adjusted R <sup>2</sup> = 0.786                                 |            | R <sup>2</sup> (Within) = 0.673               |           |           |
| Root MSE = 0.283                                                |            | R <sup>2</sup> (Between) = 0.704              |           |           |
|                                                                 |            | R <sup>2</sup> (Overall) = 0.671              |           |           |
|                                                                 |            | $\rho$ = 0.980                                |           |           |
|                                                                 |            | (variance due to individual effects)          |           |           |
|                                                                 |            | F-test (all $u_i = 0$ ): F(62, 299) = 107.81, |           |           |
|                                                                 |            | p = 0.000                                     |           |           |

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Table 1 reports pooled OLS and FE estimates for BD, measured as the logarithm of active enterprises per 1,000 inhabitants. The F-test strongly rejects the null of no province-specific effects, confirming substantial unobserved heterogeneity and supporting the use of FE. The within  $R^2$  of 0.673 and the high value of  $\rho$  (0.980) indicate that enterprise density is largely shaped by persistent structural differences across provinces.

In the pooled OLS model, population growth is negatively associated with BD, but this effect disappears in the FE specification, suggesting that the initial relationship reflects time-invariant provincial characteristics rather than short-run demographic changes. In contrast, net migration and the share of trained labor remain positive and statistically significant in both models. The FE estimates imply that provinces experiencing higher in-migration and improvements in workforce skills tend to record higher enterprise density over time. The unemployment rate is also positively related to BD, consistent with the presence of necessity-driven entrepreneurship. Unemployment insurance coverage shows a positive association in OLS but turns negative in FE, indicating that once unobserved heterogeneity is controlled for, broader social protection may slightly reduce necessity-based firm entry.

Institutional variables display weaker within-province effects. Several PCI components are significant in pooled OLS, but most lose significance in the FE model, implying that their influence is largely absorbed by fixed provincial characteristics. Notably, the law and order index shifts from negative in OLS to positive in FE, suggesting that improvements in legal institutions within provinces over time are associated with modest increases in enterprise density. Other institutional dimensions do not show significant short-term effects in the FE specification, indicating that they may shape long-run structural differences rather than immediate changes in business activity.

Overall, the contrast between pooled OLS and FE results highlights the importance of controlling for unobserved heterogeneity and suggests potential endogeneity between BD and income, motivating the subsequent system-based 3SLS analysis.

**Table 2. VIF regression results for the multicollinearity test**

| Variable                                                        | VIF  |
|-----------------------------------------------------------------|------|
| Percentage of labor force covered by unemployment insurance (%) | 5.42 |
| Natural logarithm of GRDP per capita (million VND per person)   | 3.39 |
| Informal charges (PCI index, 0–10)                              | 2.94 |
| Net emigration rate (%)                                         | 2.84 |
| Percentage of trained labor force (aged 15 and above) (%)       | 2.29 |
| Law and order (PCI index, 0–10)                                 | 2.24 |
| Proactivity of provincial leadership (PCI index, 0–10)          | 2.14 |
| Time costs (PCI index, 0–10)                                    | 2.12 |
| Population growth rate (%)                                      | 1.78 |
| Labor policy (PCI index, 0–10)                                  | 1.46 |
| Land access and tenure (PCI index, 0–10)                        | 1.41 |
| Unemployment rate (%)                                           | 1.25 |
| Policy bias (PCI index, 0–10)                                   | 1.22 |

|                                           |      |
|-------------------------------------------|------|
| Business support policy (PCI index, 0–10) | 1.18 |
| Transparency (PCI index, 0–10)            | 1.17 |
| Entry costs (PCI index, 0–10)             | 1.15 |
| Mean VIF                                  | 2.12 |

Multicollinearity was assessed using the VIF. The results show no serious concern. Most VIF values are around two, with a mean of 2.12, indicating limited linear dependence among the regressors. The highest VIF is 5.42 for unemployment insurance coverage, followed by log GRDP per capita (3.39) and informal charges (2.94). Although unemployment insurance shows some correlation with other variables, its VIF remains within commonly accepted thresholds. Overall, the evidence suggests that multicollinearity is not severe and is unlikely to bias or distort the regression estimates.

Heteroskedasticity was tested using both the Breusch-Pagan and White tests. The results reported in Table 3 clearly reject the null hypothesis of homoskedasticity. The Breusch-Pagan test yields a chi-square statistic of 56.20 with one degree of freedom, while the White test reports a chi-square value of 244.56 with 152 degrees of freedom; in both cases, the p-values are 0.000. This indicates that the variance of the error terms is not constant across observations.

**Table 3. Results of the heteroscedasticity test**

| Test          | H0               | $\chi^2$ | df  | p-value | Conclusion |
|---------------|------------------|----------|-----|---------|------------|
| Breusch-Pagan | Homoskedasticity | 56.20    | 1   | 0.000   | Reject H0  |
| White         | Homoskedasticity | 244.56   | 152 | 0.000   | Reject H0  |

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

The presence of heteroskedasticity is not unexpected given the large structural differences across Vietnamese provinces in infrastructure, economic scale, enterprise composition, and institutional quality. Both cross-sectional disparities and changes over time can generate uneven residual variation. In addition, the close relationship between enterprise density and income suggests potential simultaneity, meaning the two variables may be jointly determined.

Under these conditions, relying only on pooled OLS or FE models may lead to biased inference, especially if reverse causality exists between BD and income. To address this issue, the analysis adopts a simultaneous-equation framework estimated by 3SLS, which accounts for feedback effects and correlated disturbances across equations.

The system is specified asymmetrically based on economic reasoning. Unemployment insurance coverage is included only in the BD equation because it mainly influences labor market behavior and firm entry decisions. In contrast, land access and tenure security are included only in the income equation, as they primarily affect investment incentives, capital allocation, and productivity rather than the number of firms. These theory-based exclusion restrictions help identify the system and better capture the interdependence between BD and provincial income.

**Table 4. Model estimation results based on the 3SLS estimation method**

| Variable                                                                                                        | eq1 BD      |            | eq2 GRDP    |            |
|-----------------------------------------------------------------------------------------------------------------|-------------|------------|-------------|------------|
|                                                                                                                 | Coefficient | Std. Error | Coefficient | Std. Error |
| Natural logarithm of GRDP per capita (million VND per person)                                                   | 52.239***   | 16.081     |             |            |
| Squared term of the natural logarithm of GRDP per capita (dimensionless)                                        | -5.643***   | 1.756      |             |            |
| Natural logarithm of the number of active enterprises per 1,000 inhabitants (enterprises per 1,000 people)      |             |            | 5.091***    | 0.649      |
| Squared term of the natural logarithm of the number of active enterprises per 1,000 inhabitants (dimensionless) |             |            | -1.201***   | 0.170      |
| Population growth rate (%)                                                                                      | 0.293*      | 0.155      | 0.165***    | 0.057      |
| Net emigration rate (%)                                                                                         | 0.009       | 0.014      | -0.010      | 0.006      |
| Percentage of trained labor force (aged 15 and above) (%)                                                       | 0.017       | 0.014      | -0.006      | 0.007      |
| Unemployment rate (%)                                                                                           | 0.041       | 0.063      | 0.042       | 0.029      |
| Percentage of labor force covered by unemployment insurance (%)                                                 | -0.050**    | 0.021      |             |            |
| Entry costs (PCI index, 0–10)                                                                                   | -0.019      | 0.140      | 0.046       | 0.062      |
| Land access and tenure (PCI index, 0–10)                                                                        |             |            | -0.186**    | 0.076      |
| Transparency (PCI index, 0–10)                                                                                  | 0.142       | 0.160      | 0.135*      | 0.070      |
| Time costs (PCI index, 0–10)                                                                                    | -0.049      | 0.149      | -0.001      | 0.064      |
| Informal charges (PCI index, 0–10)                                                                              | -0.633**    | 0.260      | -0.137*     | 0.083      |
| Policy bias (PCI index, 0–10)                                                                                   | 0.346**     | 0.145      | 0.076*      | 0.046      |
| Proactivity of provincial leadership (PCI index, 0–10)                                                          | -0.429**    | 0.209      | -0.047      | 0.073      |
| Business support policy (PCI index, 0–10)                                                                       | 0.170       | 0.125      | 0.008       | 0.052      |
| Labor policy (PCI index, 0–10)                                                                                  | -0.079      | 0.117      | -0.146***   | 0.056      |
| Law and order (PCI index, 0–10)                                                                                 | 0.161       | 0.182      | 0.238***    | 0.076      |
| Constant                                                                                                        | 114.151***  | 35.280     | -0.290      | 1.009      |
| Obs                                                                                                             |             | 378        |             | 378        |
| Params                                                                                                          |             | 16         |             | 16         |
| RMSE                                                                                                            |             | 1.535      |             | 0.665      |
| chi2                                                                                                            |             | 58.780     |             | 173.330    |
| P>chi2                                                                                                          |             | 0.000      |             | 0.000      |

Note: \*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Table 4 reports the 3SLS estimation results for the simultaneous system of equations linking BD, measured by enterprise density, and GRDP per capita. The chi-square statistics indicate that both equations are jointly significant ( $\chi^2 = 58.78$  for the BD equation and  $\chi^2 = 173.33$  for the income equation,  $p < 0.01$ ), suggesting that the system captures meaningful structural relationships between the two outcomes at the province level.

The model is specified to capture bidirectional and non-linear relationships between BD and GRDP. The results provide clear evidence of a nonlinear and bidirectional association between enterprise density and provincial income per capita.

In the BD equation, GRDP enters the model in logarithmic form through  $\ln\text{GRDP}$  and its squared term  $\ln\text{GRDP}^2$ . The estimated coefficient on  $\ln\text{GRDP}$  is positive and statistically significant (52.239,  $p < 0.01$ ), while the coefficient on  $\ln\text{GRDP}^2$  is negative and significant ( $-5.643$ ,  $p < 0.01$ ). Because the dependent variable is  $\ln\text{BD}$ , where BD denotes the number of active enterprises per 1,000 inhabitants, despite constant coefficients the total effect cannot be interpreted as constant effects. Thus, the marginal effects vary across provinces and over time.

The marginal effect of GRDP on BD is given by:

$$\frac{\partial \ln\text{BD}_{it}}{\partial \ln\text{GRDP}_{it}} = \alpha_1 + 2\alpha_2 \ln\text{GRDP}_{it}$$

Substituting the estimated coefficients yields:

$$\frac{\partial \ln\text{BD}_{it}}{\partial \ln\text{GRDP}_{it}} = 52.239 - 11.286 \ln\text{GRDP}_{it}$$

This expression indicates that the elasticity of enterprise density with respect to income varies with the level of GRDP per capita and therefore cannot be interpreted as a constant percentage effect. Importantly, the coefficient on  $\ln\text{GRDP}^2$  ( $-5.643$ ) does not represent an independent marginal effect; rather, it determines how the total elasticity changes as income rises. Consequently, no single constant numerical value can be attributed to the effect of  $\ln(\text{GRDP})^2$  on BD in isolation.

To obtain economically meaningful magnitudes, this marginal effect is evaluated at representative levels of GRDP per capita based on the empirical distribution (see Table 5).

**Table 5. The GRDP per capita used for marginal effect evaluation (in levels)**

| GRDP per capita (million VND) | Distribution point | $\ln\text{GRDP}$ |
|-------------------------------|--------------------|------------------|
| 48.0                          | 25th percentile    | 3.871            |
| 60.5                          | Median             | 4.103            |
| 73.9                          | Mean               | 4.303            |
| 81.5                          | 75th percentile    | 4.401            |

Source: Author's calculation based on descriptive statistics of main variables (2018–2023)

At lower-income provinces (25th percentile), a 1% increase in GRDP per capita is associated with an 8.6% increase in enterprise density. At the median income level, the elasticity declines to 5.9%, and further to 2.6% in upper-income provinces (75th percentile). This confirms a strong but diminishing responsiveness of business formation to income growth, consistent with a nonlinear development pattern.

A similar nonlinear specification is observed in the income equation. Business development, measured as the number of active enterprises per 1,000 inhabitants, enters the GRDP equation through  $\ln BD$  and its squared term  $\ln BD^2$ , while the dependent variable is  $\ln GRDP$ . The total marginal effect of  $BD$  variable on income is therefore expressed as:

$$\frac{\partial \ln GRDP_{it}}{\partial \ln BD_{it}} = \beta_1 + 2\beta_2 \ln BD_{it}$$

Using the estimated coefficients, this marginal effect becomes:

$$\frac{\partial \ln GRDP_{it}}{\partial \ln BD_{it}} = 5.091 - 2.402 \ln BD_{it}$$

Accordingly, the impact of changes in number of active enterprises per 1,000 inhabitants on income growth varies with the existing level of business concentration and should be interpreted as a conditional elasticity rather than a fixed percentage response. Similarly, the coefficient on  $\ln BD^2$  ( $-1.201$ ) does not measure a direct marginal effect of squared enterprise density on income. Instead, it captures the curvature of the relationship by governing how the elasticity of GRDP with respect to enterprise density evolves as  $\ln BD$  increases. As a result, no single constant effect of  $\ln BD^2$  on  $\ln GRDP$  can be reported outside the marginal effect framework. No direct statement about increasing or decreasing returns is made at this stage, as the turning point is examined separately.

To interpret this elasticity meaningfully, the marginal effect is evaluated at representative levels of enterprise density based on the empirical distribution.

**Table 6. The number of active enterprises per 1,000 inhabitants used for marginal effect evaluation (in levels)**

| Activing enterprises per<br>1,000 inhabitants<br>(enterprises per 1,000 people) | Distribution point | $\ln BD$ |
|---------------------------------------------------------------------------------|--------------------|----------|
| 2.7                                                                             | 25th percentile    | 0.993    |
| 3.8                                                                             | Median             | 1.335    |
| 5.2                                                                             | Mean               | 1.651    |
| 5.5                                                                             | 75th percentile    | 1.705    |

Source: Author's calculation based on descriptive statistics of main variables (2018–2023)

Table 6 reports the distribution of enterprise density used to compute marginal effects. The results show that the income impact of business density is stronger in provinces with lower initial firm concentration. At the 25th percentile, a 1% increase in enterprise density is associated with a 2.7% rise in GRDP per capita, but this effect declines to 1.9% at the median and to around 1.0% in more business-intensive provinces, indicating diminishing returns as markets mature.

Population growth has positive and significant semi-elastic effects in both equations, suggesting that market expansion supports enterprise activity and income once simultaneity is accounted for. Net migration, however, becomes insignificant, and most labor market variables, including the share of trained labor and the unemployment rate, lose significance in the simultaneous framework. This implies that their earlier effects were partly driven by

reverse causality or unobserved provincial characteristics. Unemployment insurance coverage remains negatively associated with enterprise density, consistent with a reduction in necessity-based entrepreneurship.

Institutional quality continues to matter selectively. In the BD equation, informal charges show a strong negative association, while provincial policy support is positive and proactivity is negative, possibly reflecting structural differences across provinces. In the income equation, transparency and law enforcement are positively linked to GRDP per capita, whereas land access and labor policy display negative short-run effects that may capture adjustment costs during reform. Other PCI components become insignificant once joint determination is modeled, indicating that their influence operates through longer-term structural channels.

Overall, the 3SLS results suggest that BD and income growth in Vietnam co-evolve through nonlinear and mutually reinforcing dynamics. The estimated coefficients should therefore be interpreted as conditional semi-elasticities within a simultaneous system, rather than as isolated causal effects.

**Table 7. Estimated turning points in BD and GRDP from the 3SLS**

| Nonlinear relationship         | $\beta_1$     | $\beta_2$ | Turning point<br>(log) | Turning point<br>(level)                 |
|--------------------------------|---------------|-----------|------------------------|------------------------------------------|
| BD $\rightarrow$ GRDP_pc (eq2) | 5.091***      | -1.201*** | 2.119                  | 8.3 enterprises per<br>1,000 inhabitants |
| GRDP_pc $\rightarrow$ BD (eq1) | 52.239**<br>* | -5.643*** | 4.628                  | 102.2 million VND<br>per capita          |

Note: \*\*\*p<0.01

Table 7 summarizes the estimated critical values derived from the nonlinear 3SLS system. These thresholds indicate the levels at which the marginal association between enterprise density and GRDP per capita changes direction and are reported in both logarithmic and level terms.

To derive the turning points, consider the quadratic specification applied in both equations:

$$\ln Y_{it} = \alpha + \beta_1 \ln X_{it} + \beta_2 (\ln X_{it})^2 + \varepsilon_{it}$$

The marginal effect of  $\ln X$  on  $\ln Y$  is obtained by taking the first derivative with respect to  $\ln X$ :

$$\frac{\partial \ln Y_{it}}{\partial \ln X_{it}} = \beta_1 + 2\beta_2 \ln X_{it}$$

The turning point is defined as the value of  $\ln X$  at which the marginal effect equals zero. Setting the derivative equal to zero yields:

$$0 = \beta_1 + 2\beta_2 \ln(X^*)$$

which implies:

$$\ln(X^*) = -\frac{\beta_1}{2\beta_2}$$

Applying this formula to the income equation gives  $\ln BD^* = 2.119$ , corresponding to approximately 8.3 enterprises per 1,000 inhabitants. For the BD equation,  $\ln GRDP^* = 4.628$ , equivalent to about 102.2 million VND per capita.

Economically, these results confirm a nonlinear relationship. Below the estimated thresholds, increases in enterprise density or income are associated with stronger gains in the other variable. Beyond these levels, the marginal effect declines, suggesting diminishing returns as provinces reach more mature stages of development.

Because both variables are treated as endogenous within a simultaneous-equation framework, the estimated coefficients should be interpreted as conditional associations within a jointly determined system rather than as one-directional causal effects.

## 4.2 Discussion

This chapter interprets the empirical findings as conditional associations within a simultaneous-equation framework rather than as identified causal effects. Once BD and provincial income are modeled jointly and nonlinearly, the results show that the two variables evolve together through a mutually reinforcing but diminishing interaction. At lower levels of development, higher income is associated with stronger firm entry, and greater enterprise density is linked to higher GRDP per capita. However, beyond the estimated thresholds, these marginal associations weaken, indicating that growth does not follow an unlimited cumulative pattern but gradually flattens as provinces reach more mature stages.

Population growth remains positively associated with both enterprise density and income once simultaneity is accounted for, highlighting the role of market size in supporting economic activity. In contrast, net migration does not exhibit a systematic association with either outcome in the simultaneous system. Traditional labor market indicators, including the share of trained labor and the unemployment rate, lose statistical significance, suggesting that labor conditions and business activity adjust together rather than operating as independent short-run drivers. Unemployment insurance coverage shows a negative association with enterprise density, consistent with a reduction in necessity-driven entrepreneurship.

Institutional quality displays differentiated associations. Lower informal charges and stronger provincial policy support are linked to higher enterprise density, while transparency and law enforcement are positively associated with income levels. Some institutional indicators, such as land access and labor policy, show negative short-run associations with income, which likely reflect transitional adjustment pressures rather than adverse structural effects.

Overall, the findings indicate that provincial development in Vietnam is shaped by interconnected and nonlinear dynamics among enterprise density, income, demographic change, and selected institutional conditions. The simultaneous framework provides a coherent description of these joint patterns, but the results should be interpreted as descriptive relationships within a jointly determined system rather than as definitive causal mechanisms.

## **5. Conclusion**

This study investigates the effects of LMC and PEI on BD in Vietnam using balanced panel data for 63 provinces over the period 2018–2023. The empirical strategy combines pooled OLS and FE estimations with a 3SLS simultaneous equation framework in order to model BD and provincial income jointly, thereby accounting for interdependence and potential feedback effects between enterprise density and GRDP per capita.

The results reveal a nonlinear and bidirectional relationship between BD and GRDP per capita, with diminishing marginal effects at higher levels of development. Population growth is positively associated with firm formation and income when both outcomes are estimated simultaneously, whereas short-run migration effects remain limited. Once simultaneity is addressed, conventional LMC indicators, including skill intensity and unemployment, lose statistical significance, suggesting that labor market outcomes are largely endogenous to business activity. Institutional quality also plays an important role: informal charges are negatively associated with firm entry, while greater transparency and supportive provincial policies correspond to stronger economic performance. Overall, provincial disparities reflect not only labor market conditions but also deeper institutional and structural differences across provinces.

### **5.1 Policy recommendations**

From the findings of this study, several practical policy implications can be suggested, bearing in mind that they are based on observed empirical relationships rather than definitive causal conclusions.

First, development policy should place greater emphasis on balanced regional growth. Expanding economic activity further in already developed provinces may bring limited additional benefits, while widening regional disparities. Strengthening infrastructure, improving connectivity, and investing in basic urban planning in less-developed provinces can ease pressure on major economic centers, support local market expansion, and contribute to poverty reduction.

Second, labor market policy should focus more on improving how labor is allocated across regions and sectors. Facilitating labor mobility, addressing skill mismatches, and enhancing job matching services can help firms access suitable workers and improve productivity. Simply increasing formal training without improving allocation mechanisms may not be sufficient to support sustainable BD.

Third, improving the institutional environment remains crucial. Reducing informal costs, simplifying administrative procedures, enhancing transparency, and ensuring consistent law enforcement can create a more stable and predictable business climate. Such improvements are especially important for encouraging productive private investment in less-developed provinces.

Fourth, provincial policy initiatives should concentrate on enabling rather than directly steering private sector activity. Better coordination across provinces and a focus on reducing

compliance burdens can help create a more supportive environment for firm entry and growth.

Finally, land and labor regulations should be designed with enough flexibility to accommodate ongoing structural changes, including industrial upgrading and green transition processes. Ensuring that regulations both protect workers and allow economic adaptation will be important for sustaining income growth over the long term.

In general, narrowing regional disparities and promoting sustainable BD in Vietnam requires a coordinated approach that addresses institutional quality, labor allocation, and spatial development together.

## 5.2 Limitations and future directions

Although this study applies a nonlinear framework, it assumes that the effects of key determinants on BD and income are broadly similar across provinces. In reality, provinces differ in terms of geography, economic structure, policy capacity, and resource conditions, which may lead to different development patterns.

Future research could extend the model by allowing for greater heterogeneity across regions, sectors, and stages of development. More flexible specifications, including interaction effects and dynamic or spatial dimensions, would help capture feedback mechanisms and time-varying policy impacts more accurately. Further work should also place stronger emphasis on improving modelling strategies and identification approaches in order to move closer to credible causal interpretation.

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## Appendix

### Appendix 1. Changes in the number of active enterprises per 1,000 inhabitants and GRDP per capita by province in Vietnam (2018–2023)

| Year                    | 2018    | 2019    | 2020    | 2021    | 2022    | 2023    | Total    |
|-------------------------|---------|---------|---------|---------|---------|---------|----------|
| BD,<br>enterprises/1000 | 291     | 304     | 323     | 337     | 351     | 364     | 1,970    |
| GRDP, gdp_pc            | 3,901.3 | 4,208.5 | 4,334.7 | 4,631.8 | 5,243.4 | 5,611.8 | 27,931.5 |

Source: Authors computation based on GSO (2018-2023)

## Appendix 2. Correlation matrix

| Variables                  | ln_enterprise<br>s_per1000 | pop_<br>growth | net_<br>emig | traine_<br>labor | unemplo<br>y_<br>rate | unemplo<br>y_<br>insur | ln_gdp_pc | pci_<br>entry | pci_<br>land | pci_<br>transp | pci_<br>time | pci_<br>informal | pci_<br>policy | pci_<br>proact | pci_<br>business | pci_<br>labor | pci_law |
|----------------------------|----------------------------|----------------|--------------|------------------|-----------------------|------------------------|-----------|---------------|--------------|----------------|--------------|------------------|----------------|----------------|------------------|---------------|---------|
| ln_enterprise<br>s_per1000 | 1.000                      |                |              |                  |                       |                        |           |               |              |                |              |                  |                |                |                  |               |         |
| pop_growth                 | 0.308***                   | 1.000          |              |                  |                       |                        |           |               |              |                |              |                  |                |                |                  |               |         |
| net_emig<br>trained_labor  | 0.601***                   | 0.587***       | 1.000        |                  |                       |                        |           |               |              |                |              |                  |                |                |                  |               |         |
| unemploy_<br>rate          | 0.706***                   | 0.285***       | 0.393***     | 1.000            |                       |                        |           |               |              |                |              |                  |                |                |                  |               |         |
| unemploy_<br>insur         | 0.246***                   | 0.174***       | -0.002       | 0.185***         | 1.000                 |                        |           |               |              |                |              |                  |                |                |                  |               |         |
| ln_gdp_pc                  | 0.793***                   | 0.457***       | 0.737***     | 0.649***         | 0.086*                | 1.000                  |           |               |              |                |              |                  |                |                |                  |               |         |
| pci_entry                  | 0.802***                   | 0.245***       | 0.535***     | 0.601***         | 0.169***              | 0.804***               | 1.000     |               |              |                |              |                  |                |                |                  |               |         |
| pci_land                   | -0.103**                   | -0.088*        | -0.118**     | -0.064           | -0.048                | -0.106**               | -0.114**  | 1.000         |              |                |              |                  |                |                |                  |               |         |
| pci_transp                 | 0.082                      | -0.013         | 0.036        | -0.028           | 0.143***              | 0.091*                 | 0.168***  | -0.130**      | 1.000        |                |              |                  |                |                |                  |               |         |
| pci_time                   | 0.005                      | 0.001          | 0.090*       | -0.057           | 0.080                 | 0.001                  | -0.021    | -0.007        | -0.027       | 1.000          |              |                  |                |                |                  |               |         |
| pci_informal               | 0.207***                   | -0.128**       | 0.042        | 0.088*           | 0.219***              | 0.173***               | 0.290***  | 0.042         | 0.370***     | -0.113**       | 1.000        |                  |                |                |                  |               |         |
| pci_policy                 | 0.115**                    | 0.154***       | -0.031       | 0.097*           | 0.208***              | 0.106**                | 0.273***  | 0.134***      | 0.478***     | 0.156***       | 0.656***     | 1.000            |                |                |                  |               |         |
| pci_proact                 | -0.076                     | -0.051         | -0.043       | 0.134***         | 0.006                 | -0.061                 | -0.032    | 0.008         | 0.212***     | 0.027          | 0.269***     | 0.253***         | 1.000          |                |                  |               |         |
| pci_business               | 0.086*                     | -0.057         | 0.010        | 0.135***         | 0.117**               | 0.151***               | 0.220***  | 0.161***      | 0.403***     | 0.047          | 0.472***     | 0.595***         | 0.211***       | 1.000          |                  |               |         |
| pci_labor                  | 0.215***                   | 0.157***       | 0.166***     | 0.091*           | 0.145***              | 0.158***               | 0.136***  | -0.116**      | -0.018       | 0.080          | 0.091*       | -0.032           | -0.130**       | -0.062         | 1.000            |               |         |
| pci_law                    | 0.301***                   | 0.190***       | 0.238***     | 0.370***         | 0.145***              | 0.297***               | 0.215***  | 0.151***      | -0.082       | 0.182***       | 0.018        | -0.158***        | 0.085*         | -0.103**       | 0.143***         | 1.000         |         |
|                            | -0.018                     | 0.136***       | -0.046       | 0.148***         | 0.001                 | 0.061                  | 0.166***  | -0.121**      | 0.334***     | -0.128**       | 0.367***     | 0.615***         | 0.171***       | 0.627***       | 0.196***         | 0.197***      | 1.000   |

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

**Appendix 3. Descriptive statistics of main variables (2018–2023)**

| Statistics      | GRDP per capita<br>(million VND per person) | Activating enterprises per<br>1,000 inhabitants<br>(enterprises per 1,000 people) |
|-----------------|---------------------------------------------|-----------------------------------------------------------------------------------|
| Observations    | 378                                         | 378                                                                               |
| Mean            | 73.893                                      | 5.212                                                                             |
| Std. Dev.       | 45.222                                      | 4.661                                                                             |
| Min             | 26.100                                      | 1.300                                                                             |
| 25th percentile | 48.000                                      | 2.700                                                                             |
| Median          | 60.500                                      | 3.800                                                                             |
| 75th percentile | 81.500                                      | 5.500                                                                             |
| Max             | 372.100                                     | 29.300                                                                            |
| Skewness        | 3.044                                       | 3.033                                                                             |
| Kurtosis        | 15.803                                      | 13.124                                                                            |