

Bac Truong Cong

Article

The impact of metropolises' characteristics on provincial economic structure transformation: Evidence from Vietnam

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FINANCIAL ECONOMICS | RESEARCH ARTICLE

The impact of metropolises' characteristics on provincial economic structure transformation: evidence from Vietnam

Bac Truong Cong^{1*}

Abstract: Economic structure transformation is widely recognized as a crucial role in sustainable development. However, the existing literature almost focused on the change inside certain economic areas and ignored the external relationship. This raises the question about the role of factors outside in economic structure transformation at the prefecture-level. This paper takes Vietnam as the study area to fill this gap and examines the impact of metropolis's characteristics on the provinces' economic structural transformation. Using data of provincial economic structure from 2015 to 2018 collected from the General Statistics Office of Vietnam, the econometric analysis with instrument variables for panel data is performed. The results show that metropolises play an important role in the economic structure change of provinces through certain roles: destination of migration and start-point of remittances, the market for goods and services, hubs of information and knowledge.

Subjects: Development Studies; Regional Development; Economics and Development; Economics; Development Economics

Keywords: Economic structure transformation; prefecture-level; regional linkages; instrument variables; metropolis; Vietnam

1. Introduction

Economic structural transformation or structural transformation or structural change is usually defined as the reallocation of economic activity across the broad sectors of agriculture, manufacturing, and services (Diao, McMillan et al., 2019; Herrendorf et al., 2014; Kuznets, 1973) plays an important role in development. In history, along with each country's economic development is the economic structural change (Rodrik, 2016). The change in structures accompanies modern economic growth, enabling a sustained increase in productivity and living standards



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PUBLIC INTEREST STATEMENT

Economic structure transformation plays a crucial role in sustainable development; therefore, it has attracted the massive attention of researchers. Taking Vietnam as the case study, this paper indicates that the economic structure transformation in provinces is affected by metropolises' characteristics. More specifically, to promote the provincial transformation, increasing salary or improving the system of healthcare and education in metropolises are suggested. In addition, policies for enhancing the information linkages and developing the market are also brilliant solutions.

(Loayza & Raddatz, 2010; McMillan & Headey, 2014), even fostering urbanization, creating new social category habits (Rodrik, 2016). The economic structure is also considered to provide opportunities or make new combinations that evolve into new growth paths (Boschma, 2015). Besides that, the economic structure also has a closed relationship to resilience and the ability to deal with unique challenges (Davies, 2011; Groot et al., 2011). From the policy's viewpoint, it can be seen as a policy instrument towards resilience to return to the previous equilibrium after a shock or disturbance across various disciplines (Van Aswegen & Retief, 2020). For these reasons, the large surge of interest in economic structural change has indeed fed a large discussion and investigation (McMillan & Headey, 2014). However, these studies almost mention structural transformation at the country-level while the prefecture-level studies are minimal. The existing literature also focuses on the forces of transformation, which are changes inside certain economic areas and ignored the external relationship. Clearly, any areas are covered by the regional linkages and divided into unequal development known as either urban/core or rural/periphery. As Evans (1990) has argued, any discussions on development need to consider rural-urban linkages with regard to both economic development and structural transformation. This raises the question about the impact of regional linkages in provinces' economic structural transformation in theoretical and empirical research.

To fill this gap, this study's main objective is to connect the existing literature and provide an extended picture of provincial economic structural transformation from regional linkages. Evidence is sought from experiments with all provinces in Vietnam, a developing country, which has undergone a drastic change in the economic structure. After 30 years of economic and political reform in 1986, Vietnam experienced transforming from one of the world's poorest nations into a lower middle-income country and became one of the fastest-growing countries in the world. The important part of this accelerated economic pace is labor shifting from agriculture to manufacturing and services. In 2019, Viet Nam's GDP growth got 7.02%, nearly to 7.08% in 2018, which was one of the fastest growth rates in the region. From 1989 to 2019, GDP per capita increased by 4.9 times, reaching over US\$ 2700 in 2019¹ and this process also continues at the prefecture-level. Viet Nam's contemporary similarities to a large number of developing countries make its experiences highly relevant for many regional and extra-regional stakeholders; therefore, the investigation of these provinces can be seen as the well-represented case study in the investigation of provincial economic structural transformation. Considering the provinces as the peripheries and metropolises as the core, the study employs regional linkages' theories to set up the hypotheses about metropolises' characteristics that impact provincial structure change. The econometric analyses are then performed before interpreting key results and making a few concluding remarks that also point toward future research. The findings help clarify what role metropolises can play in the provincial structure change and what kind of incentives should be developed to promote this transformation.

The rest of this study is organized as follows: The second section revisits previous related studies' results and develops the hypotheses. In the third section, the methodology and data are introduced. The fourth section contains the main findings. The discussion is provided in the fifth section. The sixth section concludes the study and provides the direction for future research.

2. Theoretical backgrounds and hypothesis developments

2.1. Structural transformation

The economic structural transformation has been investigated for a long time, and the two main mechanisms through which the process of structural change can occur have been proposed: Demand and Supply-side explanations. From the viewpoint of demand-side explanation, the role of non-homotheticities whereby goods differ in income elasticity is the main issue (Foellmi & Zweimüller, 2008; Kongsamut et al., 2001). From the viewpoint of supply-side explanation, sectoral productivity difference is focused (Bustos et al., 2019; Duarte & Restuccia, 2010; Gollin et al., 2002; Ngai & Pissarides, 2007). These give the message from their analysis that improvements in agricultural productivity can hasten industrialization. Combining both mechanisms,

some models to explain the structural transformation are constructed by scholars like Caselli and Coleman (2001), Buera and Kaboski (2009), Boppart (2014), Herrendorf et al. (2014), and Comin et al. (2015). These studies attempt to investigate the determinants of economy-wide structural transformation by using cross-country data. As for the regional level, the structural change in areas also bases on the improvement in agricultural productivity (Balisacan et al., 2011; Gollin, 2018; Hazell et al., 2007) or increase in income (Barrett et al., 2001; Haggbblade et al., 2010; Hossain, 2004). However, there are existences of unequal development in different areas with any country, which are known as either urban/core or rural/periphery. It combines population size and population density thresholds to capture the full settlement hierarchy. Therefore, the determinants of structural change of each area could have different origins or characteristics.

2.2. Regional linkages

From the regional linkage perspectives, in his famous research, the French economist Francois Perroux introduced the growth pole theory or theory of polarized development (Perroux, 1955). He argues that development is unbalanced; it does not appear everywhere all at once but appears in points or development poles with variable intensities and spreads along diverse channels and with varying terminal effects to the whole of the economy. Also, in the same way, Friedman (1966) creates so-called theories of uneven development in the core-periphery relationship in which the core dominates, whilst the periphery is dependent. He tries to represent the regional space economy that experiences four stages, from discrete equilibrium, aggregated non-equilibrium, to a diffused stage, and network equilibrium, which corresponds to pre-industrial, transitional, industrial, and post-industrial stages, respectively. Along with regional development description, the nearly simultaneous publications of two scholars: Hirschman (1958) and Myrdal (1957), argued that the center affects the surrounding areas negatively and positively. Hirschman's "trickling down" effects (conceptually analogous to Myrdal's spread effects) are positive effects, which are the increase of center's purchases and investments in the nearby areas and the absorption of the underemployed in some of the nearby areas by the center, thereby increasing per capita incomes in the surrounding areas. In contrast, Hirschman's polarization effects (or backwash effects respectively in Myrdal's terms) are the negative effects that include migration from the neighboring areas to the center, especially of the more skilled and trained workers, and weak production in the outlying area, caused by superior center competition. In developed countries, it is well established that urban centers are engines of regional growth (Berdegué et al., 2015; Partridge et al., 2007; Wu & Gopinath, 2008). Specifically, Douglass (1998) and Tacoli (2003) suggested that rural development is linked to urban functions and roles through a set of flows: people, production, commodities, money, and information between rural and urban areas. Also, a large number of studies indicate that stronger rural-urban linkages could also play a crucial role in poverty reduction in developing countries (Akkoyunlu, 2015; Cali & Menon, 2013; Christiaensen & Todo, 2014). According to these authors, the regional linkages play a crucial role in the development both in the urban core and in the rural surroundings. Especially, the urban is considered as the origins of change motivation, and it affects rural areas in some different ways.

2.3. Hypothesis developments

As mentioned, the investigation of economy-wide structural change can ignore the relationship between dichotomy areas because different areas also belong to the country's territory. However, as for separated areas, if the analyses ignore the regional linkages, they may lead to misunderstanding about origins and the role of determinants. With dichotomy areas within the country, metropolises can be considered as cores, and provinces are peripheries. In this section, some hypotheses of provincial structural change based on regional linkages are developed. Following previous studies, the main mechanisms of structural change are increasing productivity or income; therefore, any source affecting productivity or income will lead to structural transformation. The hypothesis developments below will be proposed based on the regional linkages which consider the role of urban areas in the rural structural transformation.

2.3.1. Destination of migration and start-point of remittances

The flow of labor and money exists hand in hand, and they are usually known as migration and remittances. The directions of them are opposite; the out-migration from rural to urban will lead the remittances to move from urban to rural in where migrants' household live (Gray, 2009; Y. Lu, 2013; McCarthy et al., 2006; Mobrand, 2012). Labor migration between rural and urban areas has become the core impetus for rural change especially, agricultural transformation in traditional farming areas (Caulfield et al., 2019; Food and Agriculture Organization of the United Nations, 2017; Ge et al., 2020; Milbourne & Kitchen, 2014). Directly, migration affects rural structural change in the form of losing labor in agricultural activities, leading to agricultural productivity declines (Hussain et al., 2016, 2018; Shi, 2018; Taylor & Castelhana, 2016). Indirectly, migration contributes significantly to rural structural change through remittances, which is the main effect (Ajaero & Onokala, 2013; Gray & Bilsborrow, 2014). Remittances of migrants increase the rural household's income (D. L. Nguyen et al., 2017; Samaratunge et al., 2020), complement the deficiency of money in the rural household, which is used to invest in increasing the agricultural productivity by using more of pesticides, chemical fertilizers, applying new technologies (Caulfield et al., 2019); that reduces the value of labor, thus removing labor from agriculture (Bhandari & Ghimire, 2016) or increase the consumption. Almost remittance's expenditure is used for food, clothing, health care, education but the hierarchy of expenditure depend on the household's characteristics (Samaratunge et al., 2020; D. L. Nguyen et al., 2017; Thapa & Acharya, 2017; Garip, 2014; Sikder & Ballis, 2013; Adams & Cuecuecha, 2013). The increase of non-agricultural product demand brings a good opportunity for rural industries and services (D. L. Nguyen et al., 2017). While flows of labor and money have both positive and negative effects on rural areas and rural households, the previous studies show that loss in labor in agriculture is compensated by increased access to money (McCarthy et al., 2006; Taylor & Castelhana, 2016) thus any factors which promote the migration is proposed as positive effect to rural transformation. As for the cause of rural-urban migration, the motivation for rural-urban migrants has often been analyzed under the push-pull theory (Cho et al., 2019; L. D. Nguyen et al., 2015; Ge et al., 2020; Hoffmann et al., 2019). Here, pull factors are social, economic, political, or environmental incentives in the urban area, while push factors are incentives in the rural area that force people to out-migrate. However, in this paper's scope, which analyses the role of urban area in rural structural change, the pull factors are focused. From the pull factors viewpoint, social and economic opportunities are the principal. Job opportunities with high income, better education, and living conditions (Cho et al., 2019; L. D. Nguyen et al., 2015; Hoffmann et al., 2019; Mamgain & Reddy, 2017). Some previous researches try to separate the impacts from migration and remittances; however, in real life, the factors shaping migration also shape remittances' distribution and potential impacts. This is also what makes studying separated remittance or migration impacts so complicated (Taylor & Castelhana, 2016). To avoid the endogeneity phenomena in models and estimate the overall effects of migration and remittance, this paper does not separate each effect and uses the hypotheses based on migration reasons because there can be no migrant remittances without migration. Synthesizing the above arguments, I propose the following hypotheses:

H1: Monthly average income per capita in metropolises have a positive and significant influence on the provincial transformation

H2: The ratio of a qualified teacher and high degree to total teachers of general education in metropolises has a positive and significant influence on provincial transformation.

H3: The ratio of postgraduate health staff to total health staffs in hospitals in metropolises has a positive and significant influence on the provincial transformation.

2.3.2. Expansion of land usage

A large population characterizes urban areas, and rapid urban population growth has led to increasing demand for urban land, particularly for housing and for other various urban uses (Aguilar et al.,

2003). Urban expansion encroaches on extensive farmland areas and negatively impacts agricultural landscape patterns, a decline in agricultural land-use intensity (Jiang et al., 2013; Su et al., 2014; Yu et al., 2019). Combining with remittance effects, rural-urban migration promotes their cropland abandonment (C. Lu, 2020; Lorenzen et al., 2020). The conversion of agricultural land to urban uses leads to rapid transformations in rural areas' agricultural production (Thuo, 2013). As an urban expansion, their demand for surrounding rural land grows, giving rise to speculation and putting upward pressure on land prices (Diao, Magalhaes et al., 2019). This could increase the opportunity costs of engaging in agriculture in these areas relative to non-farm activities (Cali & Menon, 2013) and lead households to enter the rural non-farm sector (Cobbinah et al., 2015).

However, the primary of which is population increase through natural growth and immigration (Thuo, 2013), and some studies have shown shreds of evidence of rural-urban migration on farmland usage in rural (Caulfield et al., 2019; Ge et al., 2020; Qin & Liao, 2016). Therefore, to estimate the role of urban in rural transformation through expansion and remove the endogeneity of migration, the instrument variable is urban special land.

Hence, the fourth hypothesis is proposed as the following:

H4: The ratio of land used in manufactured purpose to total areas of land in metropolises has a positive and significant influence on the provincial transformation.

2.3.3. Market for goods and services

Urban areas have three categories of functions: marketing, production, and service functions (Otsuka, 2007). Through increasing urban demand along with agricultural growth that raises incomes of rural households, agricultural consumption linkages lead to the development of the rural non-farm economy, particularly through increases in informal trade and local food processing (Christiaensen, 2007; Haggbblade et al., 1989; Otsuka, 2007). Also, urban consumers relate the demand change of diversified diet, including fruits, vegetables, dairy, and meat, which creates opportunities along with the processed foods (Rodrik, 2016). To analyze the independent effects of metropolises' characteristics, which are market roles for provinces, this study removes the effects of migration by using the data of the metropolises' population without migration as the explanatory variable.

Thus, the fifth hypothesis is proposed as the following:

H5: The population without migration in metropolises has a positive and significant influence on the provincial transformation.

2.3.4. Hubs of information and knowledge

Flows of information between rural and urban areas include information on markets, from price fluctuations to consumer preferences, information on employment opportunities for potential migrants in both urban and rural areas (Habitat, 2017; Hatcher, 2017; Sietchiping et al., 2014), and the sharing of knowledge and technology between the two areas (Srivastava & Shaw, 2016). These flows provide data that are tied to helping farmers improve their productivity, yields, and profitability during the course of their normal business of growing agricultural produce, such as weather updates, crisis and risk management information (Ajani & Agwu, 2012; Miller et al., 2013) that are acquired through radio and television broadcasts and information centers are urban areas (Wattenbach et al., 2005). With flows of information about the demand in urban areas, households in rural areas can access timely and necessary information that restricts selling their harvests below fair value and predicts the time to sell products at a high price (Miller et al., 2013). Any relevant agricultural information that farmers can apply to their farms to help them make informed decisions about their farming enterprises could increase agricultural productivity and income (Ajani, 2014; Chapman &

Slaymaker, 2002). Besides, urban areas as “the engines of growth and hubs for creativity and innovation” (Li et al., 2019), and they provide a favorable environment for knowledge diffusion (Glaeser et al., 1992). When technology change in agriculture is strongly labor-saving, like the case, genetically engineered plants create more crop yields, it can foster industrialization (Bustos et al., 2016). Information and communication technologies (ICT) are powerful tools, especially the Internet, which people use to share, distribute, gather information, and communicate through computers and computer networks (Biggs, 2003). Therefore, the level of using the internet in metropolises is chosen as the explanatory variable that indicates the role of metropolises as hubs of information and knowledge.

And, the sixth hypothesis is proposed as the following:

H6: The ratio of internet subscribers over the total population in metropolises has a positive and significant influence on provincial transformation.

Building on existing literature and empirical evidence, my research framework assumes that the economic structural transformation is determined by a variety of factors related to metropolises (Figure 1).

3. Methodologies and data

3.1. Methodology

This paper applies descriptive statistics to data of metropolises and provinces to provide insight into metropolises’ characteristics and changes in provincial structure. Furthermore, panel data that provide information on individual behavior, both across individuals and over time, are used to analyze the relationship between the metropolises’ characteristics and provincial transformation. The panel data include the information of all 63 provinces in Vietnam in the period from 2015 to 2018. Because metropolises affect provincial transformation through many factors that have complex relationships, this paper uses some instrument variables that remove the models’ endogeneity phenomena. The simplest type of panel data models is a pooled OLS model, which has been given the form in Equation (1):

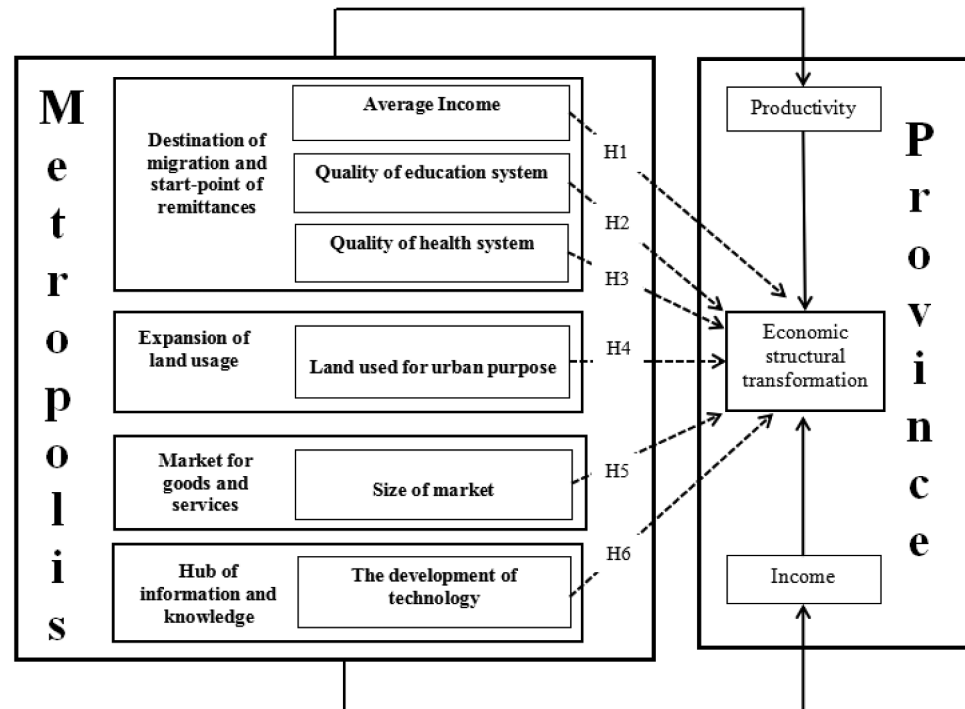
$$NAS_{it} = \beta_0 + X_{it}\beta + \mu_{it} \quad (1)$$

Where: NAS_{it} is the non-agricultural share of province $i \in (1, 2, \dots, 63)$ in year $t \in (2015, \dots, 2018)$. β_0 is the intercept. X is a matrix of predictor variables which are described in Table 1. β is a vector of regression coefficients to be estimated. μ is a random disturbance term with a mean of 0. In this model, the coefficients are estimated by OLS with a sample of 252 ($i \times t$) observations, not recognizing the panel structure of data. This model assumes homoskedasticity and no correlation between province i ’s observations in different periods (or between different provinces in the same period). However, this is the most restrictive panel data model and is not used much in the literature because each province has specific characteristics that may or may not influence the predictor variables. Therefore, two other types of panel data models with a treatment of the individual effect are also employed: Fixed effects model and Random effects model (Croissant & Millo, 2008; Hausman, 1978). These models will help to capture province-specific heterogeneity if there is evidence of significant differences across provinces. Equation (2) describes the Fixed effects model:

$$NAS_{it} = \alpha_i + X_{it}\beta + \mu_{it} \quad (2)$$

where: α_i ($i = 1, 2, \dots, 63$) is the unknown intercept for each province (63 province-specific intercepts). Fixed effect model controls the impact of the provincial characteristics on predictor variables by capturing these characteristics in intercept. On the other hand, unlike the fixed effects model, the

Figure 1. Research framework and hypotheses.



variation across provinces in random effects model is assumed to be random and uncorrelated with the predictor variables included in the model. Equation (3) indicates the random effects model.

$$NAS_{it} = \alpha + X_{it}\beta + \omega_i + \mu_{it} \quad (3)$$

Table 1. Description of key variables

Variable	Description
Dependent variable	
NAS	Value added share in Non-Agriculture of Province (%)
Independent variable	
Income	Monthly average income per capita in metropolis (Million VND)
QuaTeacher	The ratio of qualified teacher and high degree to total teachers of general education in metropolis (%)
QuaHealth	The ratio of postgraduate health staffs to total health staffs in hospital in metropolis (%)
LandRate	The ratio of land used in manufactured purpose to total areas of land in metropolis (%)
Population	The population without migration in metropolis (Million persons)
Internet	The ratio of internet subscribers over total population in metropolis (%)

Where α is constant term, ω_i is random error term with mean 0 and variance (σ_ω^2). To choose the suitable model, this paper also implements the tests. The F test and Breusch-Pagan Lagrange multiplier test are used for testing panel effect based on the pooling model's result (Breusch & Pagan, 1980), while

the Hausman test is implemented to decide between fixed or random effects. This test has the null hypothesis is that the preferred model is random effects versus the alternative the fixed effects.

3.2. Data

This study uses panel data with a sample size of 252 observations that contains 63 provinces in Vietnam in 4 years from 2015 to 2018, so this is a balanced panel. All of the information in panel data are extracted from the annual statistical yearbook of the General Statistics Office of Vietnam. The three most common economic structural transformation measures are based on employment shares, value added shares, and final consumption expenditure shares (Herrendorf et al., 2014). In this study, the value-added share in non-agriculture of provinces is used as the observation variable, representing the non-farm share of provinces. Besides that, the metropolis is the five biggest cities (municipality) that are administratively on the same level as provinces, and they are Ha Noi, Ho Chi Minh, Da Nang, Hai Phong, and Can Tho.

4. Results

4.1. Graphics and descriptive statistics

From a spatial perspective, changes in the spatial distribution of the value-added share in non-agriculture (NAs) in Vietnam can be seen visually from Figure 2. The quantile map shows that the distribution is unevenly distributed for all 63 provinces; most provinces have over 60% of non-agriculture share. Especially, two areas in which the provinces with the highest non-agriculture share located are areas around Ho Chi Minh city and Ha Noi city.

It can be seen from Figure 3, the NAs average of provinces increase over time while the difference between the highest and lowest value almost has no significant changes over time from 68.4% in 2015 to 72% in 2018. Besides, Figure 4 shows the divergence in NAs average of groups of provinces that are affected by the different metropolises. Provinces affected by Ha Noi and Hai Phong have the highest average of NAs with over 73%, while this value is lowest in provinces around Can Tho, nearly 63%.

As for descriptive statistics, the NAs get a minimum value of 45.02% and a maximum value of 93.14%. The ratio of a qualified teacher (QuaTeacher) ranged from 97.234% to 100%, while the ratio of qualified doctor (QuaDoctor) ranged from 25.271% to 35.391%, and the ratio of internet subscribers (Internet) ranged from 9.055% to 67.813%. The largest population of the metropolis (Population) is 7.650 million people, which is more than 13 times the smallest population at 0.569 million people. The per capita income (Income) between metropolises also gets the huge difference from 2.843 million Dong to 6.177 million Dong per month. On the other hand, the ratio of land used in manufactured purpose (LandRate) ranges from 0.878% to 5.262%, with a mean of 3.2% (Table 2).

The correlation matrix and multicollinearity test are summarized in Table 3. The correlation coefficient between some explanatory variables is quite high (LandRate, QuaDoctor; Internet) but

Figure 2. Metropolis and value-added share in non-agriculture in provinces in Vietnam.

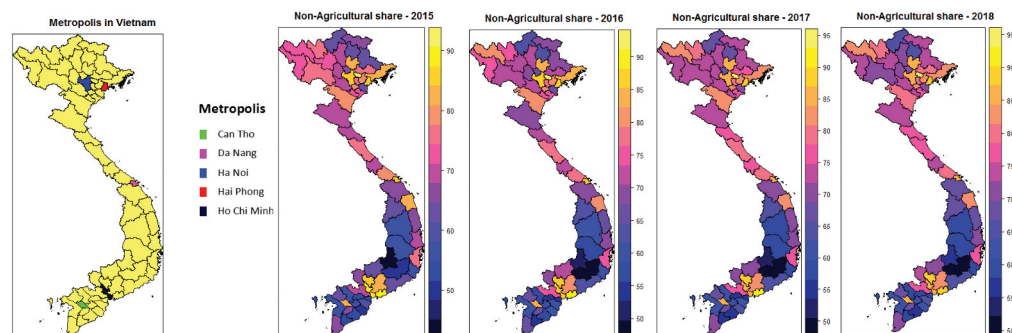
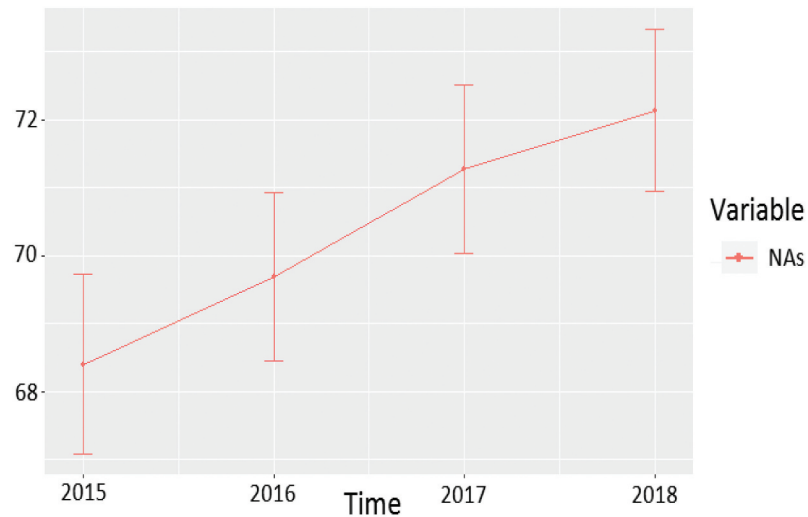


Figure 3. NAs average of all provinces over time.



still less than 0.8. When we do the regression analysis with panel data, the multicollinearity problem is not a big issue as the explanatory variables can correlate with each other, except perfect correlation cases (Wooldridge, 2010). Besides that, the multicollinearity test shows that the variance inflation factor VIF of each variable is lower than 3, and the means of VIF (1.7296) is less than 5. This implies that it is impossible to conclude the model exists multicollinearity, and all independent variables could be included in the regression. With panel data, serial correlation testing is necessary; however, serial correlation tests apply to macro panels with long time series, not a problem in micro panels with very few years (Torres-Reyna, 2010). In this research, I use the panel with 63 provinces in a period of 4 years, so serial correlation is not a big issue in regression.

4.2. Panel data econometrics analysis

This paper estimate model for the value-added share in Non-Agriculture of the province by using three models: Pooled OLS, fixed effects, and random effects model. The estimation results in Table 4 show that

Figure 4. NAs average of provinces separated by metropolis's effects over time.

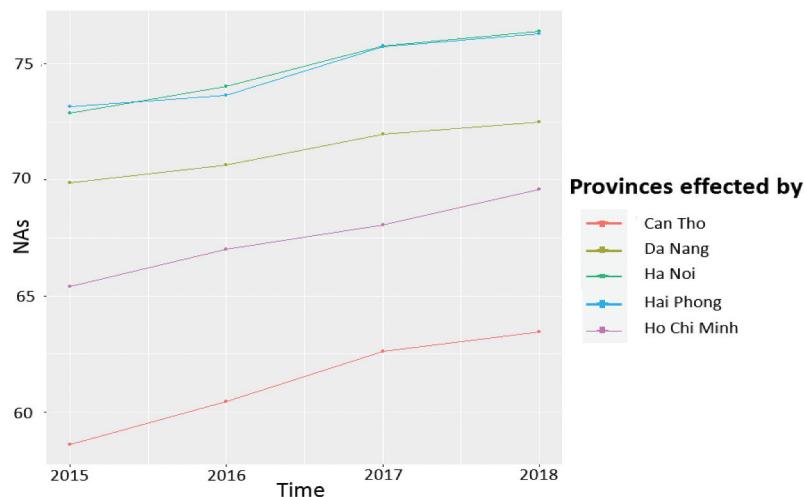


Table 2. Descriptive statistics of variables

Variables	Mean	SD	Min	Max
NAs	71.650	10.177	45.020	93.140
Income	4.718	0.984	2.843	6.177
QuaTeacher	99.365	0.676	97.234	100.00
QuaDoctor	29.173	2.711	25.271	35.391
Population	4.452	2.493	0.569	7.650
LandRate	3.200	1.220	0.878	5.262
Internet	36.319	22.054	9.055	67.813

Pooled OLS model has a different coefficient and significance level of explanation variables compared to fixed effects and random effects model. The F test for individual effects and Breusch-Pagan Lagrange multiplier test get the value 162.87 and 347.06, respectively (and the p-value < 2.2e-16), we reject the null hypothesis of no panel effect that mean the Pooled OLS model is not chosen to analyze the estimation results. The coefficient estimates of all the determinants of value-added share in non-agriculture of the province have consistent signs with minor differences in magnitudes and significant levels between the fixed effects and random effects model, indicating the robustness of these estimates. However, the Hausman test shows the p-value is not significant (p-value = 0.1332), demonstrating the random effects model is more specification. Therefore, random effects model is used to illustrate the effect of each variable. The results from column 4 in Table 4 indicate that coefficients of explanatory variables: Income, QuaTeacher, QuaHealth, Population and Internet (0.6760, 0.4784, 0.2597, 0.5083, and 0.0887, respectively) are positive and significant at a 0.05 level with every t-statistics is higher than 2.2; therefore, hypotheses H1, H2, H3, H5, H6 are supported. Nevertheless, the LandRate, which is a ratio of land used in manufactured purpose to total area land in a metropolis, has a positive coefficient (1.1081). Still, it is insignificant at 0.05 level (p-value = 0.2356), which means the hypothesis H4 is not supported. The R-squared and adjusted. R-squared of random effects model is 0.4784 and 0.4656, respectively. This statistic indicates that the explanatory variables can explain 46.56% of the variance in the value-added share in non-agriculture of the province in the model (Income, QuaTeacher, QuaHealth, Population, LandRate, and Internet).

5. Discussion

5.1. Spatial distribution of value added share in non-agriculture of province

The value-added share in non-agriculture of provinces (NAs) is unequally distributed. Almost the high value of NAs are clustering around the metropolis; however, there is a difference between metropolises. The NAs of provinces close to Ha Noi and Ho Chi Minh city is really high (over 80%),

Table 3. The correlation matrix and multicollinearity test

Variables	Income	QuaTeacher	QuaDoctor	Population	LandRate	Internet
Income	1	0.2218	0.5730	0.1854	0.7370	0.3567
QuaTeacher	0.2218	1	0.2194	-0.1913	-0.0289	0.2768
QuaDoctor	0.5730	0.2194	1	-0.1405	-0.6470	-0.5275
Population	0.1854	-0.1913	-0.1405	1	0.1403	0.6203
LandRate	0.7370	-0.0289	-0.6470	0.1403	1	-0.5782
Internet	0.3567	0.2768	-0.5275	0.6203	-0.5782	1
VIF	2.5772	1.3732	1.9916	1.0438	1.1838	2.2080
Mean VIF	1.7296					

while NAs in neighboring provinces of Da Nang and Can Tho city is almost lower than 70% (Figure 2). The reason for this divergence is the difference between metropolises. Although they are also metropolises, Ha Noi and Ho Chi Minh city have specific characteristics that help these metropolises play crucial roles in NAs of neighboring provinces. Basically, the economic scale of these cities is dominant than the rest of the metropolises. However, the economic scale difference is the general understanding that contains lots of factors and complex relationships between them. In these factors, monthly income per capita, the ratio of quality teachers, the ratio of quality health staffs, the ratio of internet subscribers and population are separated and have a significant contribution. In Figure 4, the average NAs of provinces affected by Ho Chi Minh city is lower than other metropolises because these provinces contain not only areas approximately but also far from metropolis while areas more close to cities get a higher probability to engage in non-agricultural activities (Diao, Magalhaes et al., 2019).

5.2. Role of metropolises in economic structural transformation in provinces

One of the obvious roles of metropolises that affect the provinces is the destination of migration and the start-point of remittances. However, migration and remittances have a complex relationship, and analytically, the impacts of remittances cannot be studied in isolation of migration decisions because many of the same variables, observed and unobserved, influence both migration and remittances (Taylor & Castelhana, 2016). Therefore, this study uses the instrument variables to capture the migration and remittance. Because there can be no migrant remittances without migration, these variables are characteristics of destination (metropolises), which are exogenous to migration; that is, they cannot be shaped by migration. As hypothesized, this study finds evidence that metropolises' effects on the provincial structural transformation through the role of migration destination and remittance starting-point (hypotheses: H1, H2, H3). Specifically, it is found that better living conditions in metropolises are positively correlated to value value-added in non-agriculture of neighboring areas. Monthly average income, the ratio of a qualified teacher, the ratio of postgraduate health staff are metropolises' characteristics which are pull-factors of migration from the provinces and then remittance from metropolises. The increase of income, higher quality of education, or higher quality of health system in metropolises all lead to increased NAs in provinces. So, it is clear that the total effects of migration and remittances on provincial structural transformation are positive.

Table 4. Results from panel econometric models for the value added share of non-agriculture

Dependent variable: value added share of non-agriculture

	Pooled OLS model	Fixed effects model	Random effects model
Intercept	-4.5034		4.3206
Income	-0.8102	0.7852*** (3.6891)	0.6760*** (3.4898)
QuaTeacher	0.5221	0.4848*** (2.9510)	0.4784*** (3.0005)
QuaDoctor	0.4322	0.3003*** (3.4398)	0.2597*** (3.5683)
Population	-1.2120*** (-2.5999)	0.4849* (1.8984)	0.5083** (2.4910)
LandRate	3.0024*** (3.4038)	0.7661	1.1081 (1.1860)
Internet	0.3104*** (5.2259)	0.039	0.0887** (2.2470)
R-Squared:	0.1937	0.5463	0.4784
Adj. R-Squared:	0.1739	0.3777	0.4656
Breusch-Pagan Lagrange Multiplier Test	347.06***		
F test for individual effects	162.87***		
Hausman Test	9.8035		

Note: t statistics in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

The expansion of land usage in metropolises is expected to increase the NAs in neighboring provinces (hypothesis H4), like evidence of previous research like Cobbinah et al. (2015) or Thuo (2013) however the results show that this hypothesis is not supported. This difference exists because the expansion of land usage in metropolises contains lots of purposes in which residential construction is dominant, while this study uses the data of manufacturing land. Previous research analyzes the single effect of land expansion in metropolises on neighboring provinces, so combining residential construction land in data could be suitable. However, this study considers different aspects of metropolises' effects, so if using the residential construction land, there will be the existence of the correlation between the land for residential construction and migration or other characteristics related to population. Therefore, manufacturing land is the instrument variable which not only indicates the metropolises' characteristics but also helps to identify between the effects of land usage expansion in metropolises and the effects of migration. In general, as evidenced in previous researches, the expansion of land usage in metropolises affects NAs. Still, it is mainly from the pressure of residential land demand while there is no evidence supporting that the land usage for manufacturing purposes in metropolises affects NAs in neighboring provinces.

Metropolises are the markets that help to consume the goods and services from provinces (hypothesis H5). The results in Table 4 show that the increase of demand for provincial products through population growth leads to an increase of NAs in neighboring provinces. The special point here is that the size of the market is calculated by the population without the migration, which can cause the misjudging between the metropolises' effects and effects from the causality of migration. Through separating effects, this study finds out the evidence which supports the dependence of NAs in provinces on the characteristics of metropolises, the area with a high population.

Metropolises' effects on NAs in provinces are displayed clearly through the metropolises' role as hubs of information and knowledge. More people using the internet in metropolises lead the more NAs in provinces (hypothesis H6). By sharing information from metropolises, the households in provinces can approach more non-agricultural activities, knowledge, and useful information, then increase the value-added in non-agricultural sectors.

From the above results, it is clear that policymakers could focus on some specific characteristics of metropolises to enhance the transformation in neighboring provinces. Policies of salary or improving system of healthcare and education are suggestions. Playing the roles of the market for goods and services from neighboring areas, the metropolises with great connection ability not only have to develop the distribution system in its market but also try to expand the size market globally. Besides that, investment in improving information linkages between metropolises and provinces that supports people to approach the knowledge and information timely is also a brilliant way of promoting structural transformation in provinces. There is no less critical suggestion that any policies related to the provincial change should also consider the role of metropolises.

6. Conclusion

This study analyzes metropolises' effects on the provincial structural transformation by using the value-added in non-agriculture as a proxy. The results indicate that metropolises play crucial roles in structural transformation in provinces through some functions: destination of migration and start-point of remittances, markets for goods and services, and hubs of information and knowledge. Nevertheless, no evidence shows that the metropolises' expansion of land usage with manufacturing purpose leads to value-added in non-agriculture in provinces. Besides that, this study helps to change the way related people understand the structural transformation in certain areas. Instead of analyzing structural transformation through inside factors of certain areas, these findings supply a wide view of structural transformation with the outside relationships that open a new direction for future research. Another contribution of this study is using the instrument variables. These variables help to solve the endogeneity and separate different effects that present the role of metropolises. In terms of methodology, my analysis is based on a hypothetical, simplified design that provinces are affected by

nearest metropolises. Thus, I recommend that the deep examination of distance and its influence on metropolises' effects be conducted to improve validity.

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