THE TRANSFORMATION OF CHINA'S TRADE STRATEGY UNDER THE NEW ECONOMY

by

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ACKNOWLEDGEMENTS

When I write this part, my mood is relatively relaxed, because the body part of my dissertation has been completed. My Ph.D. program can be divided into two stages. In the first stage, I completed most of the courses and passed comprehensive exams for macroeconomics and microeconomics. While in the second stage, I took a longer four-year dissertation research. Looking back on the past, happy, disappointed, nervous, frustrated, but luckily, I persevered. I would like to express my sincere gratitude to those who have inspired, helped, and shaped me.

First, I would like to thank my primary advisor Professor Butkiewicz for his great help in the completion of the dissertation. We first met in the fall semester of 2018 when he was our professor of Monetary Economics. His insights into the Great Depression and the Great Recession are still fresh in my memory. His elegant speech and manners made me eager to ask him to be my academic advisor.

The topic of this dissertation was determined at the beginning of 2020. At that time, the outbreak of COVID-19 forced us to temporarily leave the campus we were familiar with. In April of that year, after many discussions with my advisor, I roughly determined my research direction and research methods. My advisor provided me with academic guidance and moral encouragement during what would have been a difficult time for most people. His expertise in this field inspired me to combine the growth model and threshold regression model further fully.

In addition, I would like to thank the other professors on the Committee, including Professor Falaris, Professor Beck, and Professor Campbell. Their expertise in their respective fields contributes greatly to my dissertation. Despite their busy schedules, they spent a lot of time discussing my ideas with me and made helpful comments.

I also want to thank my family, including my wife Fumiao Yang, and my parents. They have given me the most company and accepted my emotions. Encourage me when I am depressed, and comfort me when I am nervous. It was because of the support they gave me that let me succeed in the Ph.D. program.

Finally, I want to say thank you to my ordinary but hardworking self. I made a decision I like and stuck to it for six years.

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ABSTRACT

China implemented an export-oriented trade strategy with the goal of maximizing its trade surplus and foreign exchange reserves. After more than 30 years of rapid economic growth, the economic growth rate has gradually changed from high-speed growth to medium growth. The shortage of a surplus labor force and the aging problem make China lose its comparative advantage in some industries. The rapid urbanization and the increasing proportion of the middle class make the domestic market have greater consumption potential. China adjusts its fertility policy, from strictly limiting one child per family to encouraging two or three children per family. These characteristics at the current stage inspire leaders to review the export-oriented strategy, taking the initiative to expand imports which may drive technological progress and economic growth.

In this paper, I applied the threshold regression model to the traditional growth model, using the data relevant to the labor market, urbanization, and fertility rate respectively, to delineate different economic development stages. As the dependent variable, the real GDP per capita growth rate is taken on an annual basis which is used to reflect the different effects of net exports on economic growth on each side of a threshold. This paper supports the adjustment of trade strategy to meet the current economic and social characteristics and promote economic growth.

Chapter 1

INTRODUCTION

China has turned from a closed economy to an open economy since it implemented the reform and opening-up policy in 1978. In terms of foreign trade, China adopts an export-oriented trade strategy, pursuing a trade surplus and accumulating foreign exchange reserves to the greatest extent. In terms of trade policy, China has introduced various export subsidy policies to promote and reward exports. In terms of exchange rate policy, China adopts a fixed or managed floating exchange rate system, which devalues its currency by pegging it to the target exchange rate, thus making exports more competitive. In addition, China has made reasonable use of its status as a developing country and the rules of the World Trade Organization to protect its domestic industries and promote exports. Since China joined the WTO in 2001, its exports have maintained a high growth rate.

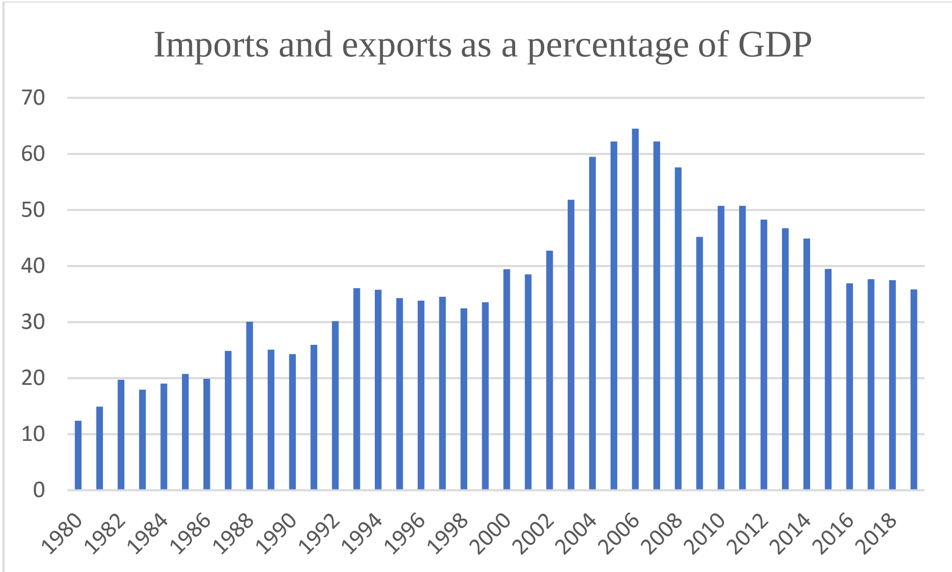


Figure 1.1 Trade growth of China
Source: World Bank Open Data

In 2006 China overtook Japan to become the world's largest holder of foreign exchange reserves. China's foreign exchange reserves stood at $3,216.522 billion in December 2020, an increase of US $38.032 billion on a month-on-month basis, which is expected to increase to US $3,191 billion from US $3,178.49 billion in November, the central bank said. It is worth mentioning that most of China's foreign exchange reserves are in US dollars, which is the most liquid international currency in international trade and also the most important reserve currency. China's huge foreign exchange reserves have provided an important buffer for China to avoid the impact of two major international financial crises. At the same time, as the world's primary reserve and circulating currency, holding dollars can buy anything China needs for its economic development.

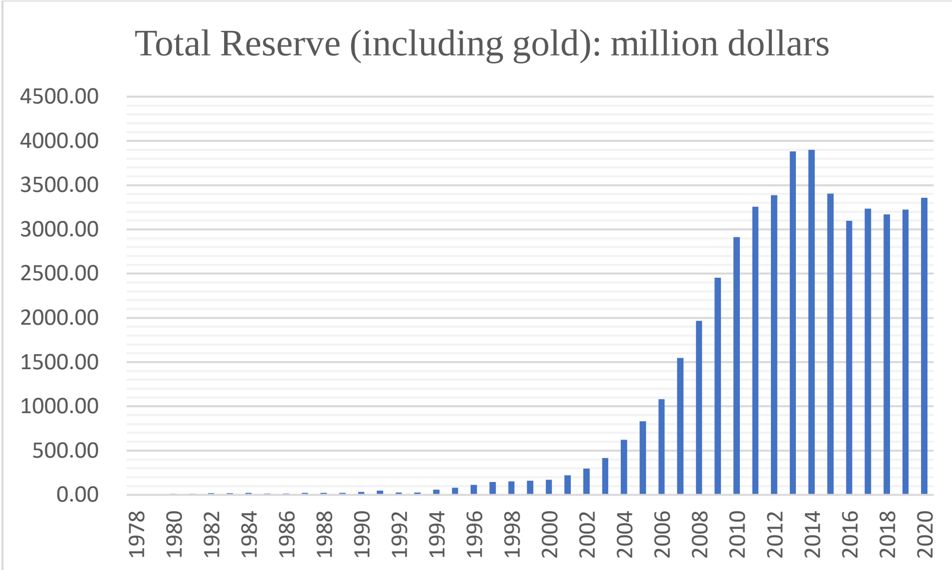


Figure 1.2 China's total reserve including gold
Source: World Bank Open Data

However, with the continuous improvement of China's economic development level, China's economy has entered an obvious new stage of development: China's labor resource is no longer a large surplus, so it is no longer cheap, and labor costs keep rising. Figure 1.3 shows that China has higher manufacturing labor costs than Mexico and Vietnam.

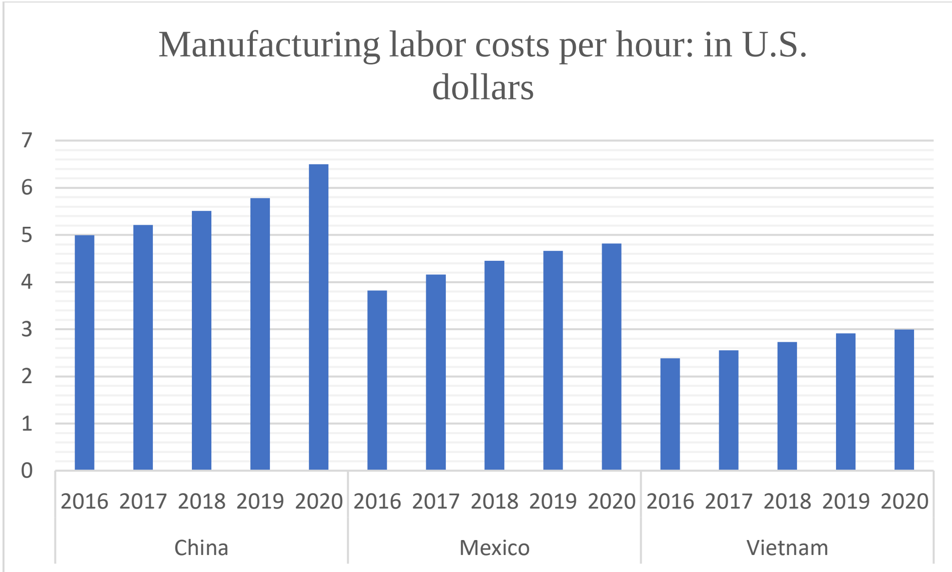


Figure 1.3 Manufacturing labor costs per hour for China, Vietnam, and Mexico (2016 to 2020)
Source: IHS; Website (Source Today)

Although the level of technology has been greatly improved, there is still much room for improvement in China’s capacity for independent innovation. China is faced with severe environmental and resource constraints. All these mean that the internal and external environment for China to implement its export-oriented trade strategy has changed fundamentally. Implementing an export-oriented trade strategy and pursuing export and trade surplus to the greatest extent can no longer adapt to the current stage of economic development.

China's current economic development stage is characterized by the following: First, the transition from high-speed growth to medium-high growth, as China's growth rate converges to a steady-state equilibrium. Figure 1.4 shows that China's GDP growth rate has been below double digits since 2010 and is in a continuous downward trend. The gap between urban and rural areas and between regions has been narrowed. The share of personal income in the economy has increased, and more people have benefited from the development. Third, economic growth has been driven by innovation instead of factors and investment.

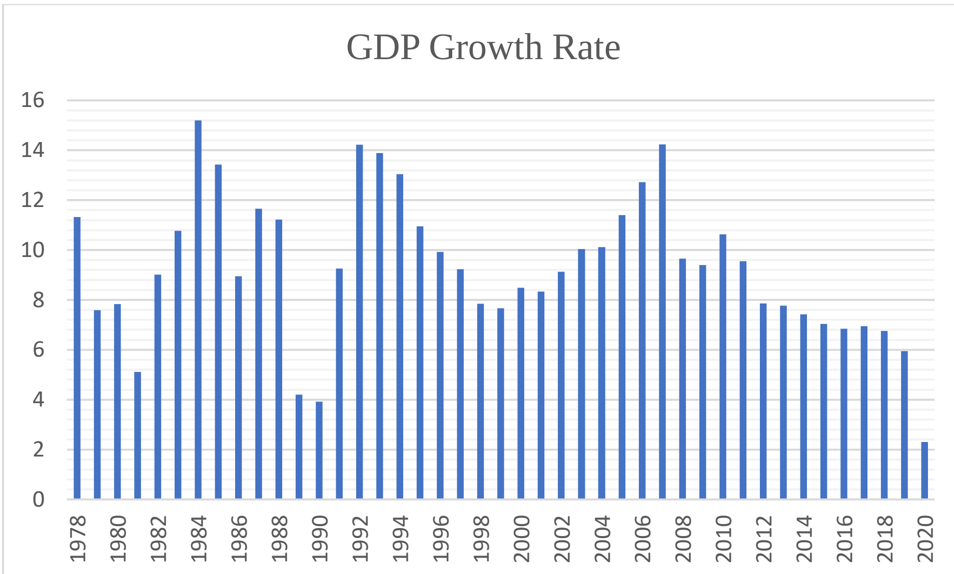


Figure 1.4 China's GDP growth rate
Source: World Bank Open Data

In addition, China's major policies have also undergone a series of adjustments. To control China's overpopulation, the Chinese government proposed a one-child policy in the 1970s. If a couple has more than one child, they will face a range of penalties such as losing their jobs and substantial fines. This policy is more strictly enforced in cities than in the countryside. This policy controls China's population effectively. However, since the end of the demographic dividend and the serious population aging problem, China changed its fertility policy, from strictly limiting one child per family to encouraging two or three children per family. Raising the fertility rate could be effective in promoting economic development. The effect of the implementation of this policy was not satisfactory, to some extent, because China's current trade policy hindered its implementation. I'll explain why in my fifth part.

Nevertheless, China's official level has recognized the importance of switching its trade strategy. "Actively expanding imports and not pursuing trade surplus" has become China's new foreign trade model at the policy level. Such a new trade pattern is undoubtedly a shift from the export-oriented past. Since 2017, Chinese leaders have stated on several occasions that China will "actively expand imports and not pursue a trade surplus." In addition, China held the first China International Import Expo (CIIE) in Shanghai in November 2018.

I have paid attention to some research on trade strategy under different economic features, and my research on trade strategy will be carried out from the following aspects. First, the change of labor supply in the labor market. The arrival of Lewis’s turning point and the serious demographic aging problem fully reveal that cheap labor is no longer China's comparative advantage; Second, consumer groups expand, and consumption structure changes. With the rapid development of China's urbanization, the consumption demand of rural residents after they come to the city is increased due to the improvement of labor demand, and the demand for a higher quality of life in the city (education, medical care, housing, etc.); Third, a series of major policy changes in China, especially the transition from a strict one-child policy to a three-child policy to encourage fertility. The implementation effect of the new population policy is closely related to the trading strategy; Finally, China is facing the pressure of industrial structure upgrading and adjustment, and emerging industries and high-tech industries are facing opportunities and challenges. Through the analysis of these aspects, my research answers why China takes the initiative to expand imports and how to optimize the import structure. However, for such a transformation of foreign trade mode that has already begun to be implemented, there is no rigorous academic demonstration based on a theoretical model in the academic circle. This paper applies the threshold regression model to the traditional growth model to demonstrate the necessity of trade strategy transformation.

The rest of this paper is arranged as follows: The second part is the literature review. The third part introduces my data. The fourth part will demonstrate the threshold model and specifications. The fifth part reveals empirical results, and the sixth part is about relevant tests. The last part is about conclusions.

Chapter 2

LITERATURE REVIEW

The relationship between trade and economic growth is a topic of constant discussion. In general, the increase in the total volume of trade brought about by trade liberalization is always conducive to better promoting the international division of labor and specialization, achieving the optimal allocation of resources worldwide, and thus promoting economic growth and welfare improvement. However, whether trade surplus or trade deficit can better and continuously promote economic growth, this is a highly controversial question in academic circles both theoretically and empirically. The author believes that even for the same country, distinct stages of economic development require different trade development strategies.

2.1: Exports Drive Economic Growth

A large number of theoretical and empirical studies generally argue that an export-oriented trade strategy is conducive to the realization of economic catch-up in low - and middle-income countries (Balassa, 1978; Feder, 1982; Edwards, 1998). Munirathinam et al., (1998) investigate the effects of the Canada-U.S. Trade Agreement (CUSTA) on U.S. exports of agricultural products. On the basis of the framework, most empirical studies on the impact of export promotion strategies followed by developing countries are based on the evaluation of trade openness. Empirical research about the effect of this liberalization process has treated exports as the principal channel for growth (Ahmad et al., 2003).

Tsaurai et al., (2012) studied the causal relationship between export growth and economic growth and found there is an obvious unidirectional Granger causality from export growth to real GDP per capita. Lahrech, (2018) aims to use the annual multivariate time series data from 1975 to 2015 to investigate the relationship between Morocco's trade and economic growth, focusing on the role of exports and imports. These results show that Morocco's imports are driven by exports, which create demand for technology, raw materials, and consumer goods. Fofana et al. (2018) aim to analyze the relationship between foreign direct investment (FDI), and this paper points out that the improvement of the export sector may strengthen the economic growth activities of West Africa and the common experience of attracting foreign direct investment. Some scholars have further considered the impact of export complexity and technological progress on economic growth based on exports. Jarreau et al. (2012) suggested that it is necessary to distinguish the different sources of China's export upgrading (export regime and enterprise type) to truly measure technological progress and exports impact on economic growth.

Jung and Marshall (1985) analyzed the data of 39 developing countries and found strong evidence supporting the export-oriented trade strategy and argued that the industrialization of later developing countries should take the strategy of export orientation. Gibson et al. (1992) also found that export-oriented trade is the best development strategy for developing countries in the study of the Four Asian Tigers (Singapore, Hong Kong, Taiwan, and South Korea). Dawson and Hubbard (2004) studied the data from 14 central and Eastern European countries from 1994 to 1999 and reached the conclusion that an export-oriented strategy can promote economic growth. Tan, et al.

(2007) used a vector error correction model to distinguish between long and short-term factors and tested the export-oriented economic growth hypothesis of four Asian economies (Singapore, South Korea, Taiwan, and Thailand). Other influential studies include Balassa, (1988), Halpern, (1992), Kaminski, (1999), Pérez-Toro, (1999), Aswicahyono et al., (2000), Kaplinsky et al., (2009).

2.2: Imports Drive Economic Growth

Some scholars pay attention to the effect of imports on economic growth. Theoretical research suggests that the promotional effect of imports on economic growth is mainly through the two channels of imports intermediate inputs and technology introduction (Awokuse, 2007). Coe and Helpman (1995) used the endogenous growth model to analyze the impact of R&D capital stock in domestic and trading partner countries on domestic economic growth. They found that the more import trades a country has, the more significant promotional effect foreign R&D investment has on its own economy. They develop an intertemporal endogenous growth model that explicitly accepts foreign technology imports as a factor of production (Zou, 1999). Çetintaş et al. (2009) analyses the relationships between export, import, and economic growth for the 13 transition economies. Their empirical result finds a unidirectional causality from economic growth to export, and a bidirectional causality relationship between import and growth. Islam et al., (2011) implement Auto-Regressive Distributed Lags (ARDL) to cointegration to explore long-run relation; and the Granger procedure within the Vector Error Correction Model (VECM) to test the direction of causality between imports and economic growth for a sample of forty countries each from high, upper-middle, lower-middle, and low-income–nations. Mishra, (2012) attempts to investigate the dynamics of the relationship between imports and economic growth in India for the period 1970–1971 to 2009–2010. Lawrence and Weinstein (2014) also believe that imports are an important medium and channel for the transmission of growing technological progress from developed countries to developing countries.

However, some studies have shown that imports do not promote economic growth, or even inhibit economic growth. Evans (2013) tested the relationship between imports and growth in nine South African provinces from 1996 to 2001 by using panel causal analysis and found that the import liberalization strategy could not effectively improve the economic performance of South African provinces. Taghavi, et al. (2012) used the VAR model to investigate the data of Iran from 1962 to 2011, and the results showed that in the long run, exports had a direct positive effect on growth, while imports had a significant negative effect on the economy.

At the same time, some economists argue that both trade surpluses and deficits are unsustainable because international trade automatically balances out through exchange rate adjustments.

As far as developed countries are concerned, the research on economic growth focuses more on human capital and technological progress, and there is little literature on the economic growth of developed countries that are studied from the perspective of international trade. Developed countries have advantages in human capital and technology, so it is of limited effect to realize technological progress and human capital improvement through imports and finally to drive economic growth.

Based on the above two points, this paper intends to study the relationship between imports and economic growth from the following perspective. I believe that the study of the role of trade surplus or trade deficit in promoting economic growth needs to distinguish the stage of development in an economy. While developing and emerging economies mostly prefer export-led trade strategies, the export-driven growth picture may change if their stage of economic development reaches a higher stage. With the process of economic development, developing countries will have more and more characteristics of developed countries, such as high urbanization, mature industrial system, and low fertility. However, the economic growth of developed countries led by the United States does not depend on exports.

Chapter 3

DATA

3.1: Research Question

Inspired by Hansen (1999), I decided to apply threshold regression to my research. My research question is when the threshold variable passes a certain threshold, whether reducing trade surplus and increasing imports can optimize import structure and promote economic growth.

3.2: Data Sources

The data covers 17 countries from 1980 to 2019. Countries include Austria, Belgium, China, Cyprus, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom, the United States. The main reasons for choosing these countries include firstly, these countries belong to developed countries and have completed industrialization and urbanization, so they can be used as reference for China; Secondly, these countries have complete data and reliable statistical methods. All data are from World Bank Open Data. To make sure the panel is stationary and not spurious regression. I did the unit root test for all the variables and then I did the cointegration test. Since the panels are strongly balanced and without time gaps, Levin-Lin-Chu is used to test for unit roots. The results show that the panels are stationary.

According to the results of Pedroni cointegration tests, all panels are cointegrated and regressions are not spurious regressions.

3.3: Data Descriptions

Table 3.1 shows the summary statistics for the main variables I use for the regressions. Threshold variables used in my model include the unemployment rate, the urban population growth rate, and the fertility rate. Regional variables used in the regression include the proportion of net exports to GDP. Other variables used include real GDP per capita growth rate, one-period (one year) lag of real GDP per capita, gross domestic savings, GDP deflator, population density, size of government: government consumption expenditure, international openness: sum of exports and imports, and foreign direct investment (FDI) inflow. The gross domestic savings is used to reflect the savings, I use the proportion of gross domestic savings in GDP to measure this indicator. The formula used to calculate the GDP deflator is the ratio of nominal GDP divided by real GDP multiplied by 100. Population density is midyear population divided by land area in square kilometers. The government size is the proportion of government consumption expenditure attributed to the GDP. International openness is the proportion of exports and imports attributed to the GDP. Foreign direct investment is the net inflow of investment as a percentage of GDP. To sum up, the savings rate, net export, government size, openness, and technology are all the selected proxy variables in the percentage of GDP. The unemployment rate and urban population growth rate are percentages. The measures of inflation and population density are at their actual level.

Table 3.1: Summary Statistics

	Mean	Std.Dev	Min	Max
Growth rate of GDP per capita	2	2.66	-8.513	13.690
Log GDP per capita (t-1)	10.314	0.796	6.066	11.385
Savings rate (% of GDP)	26.002	6.7	11.331	51.087
Net exports (% of GDP)	1.892	4.326	-17.809	16.944
Unemployment (%)	6.897	4.126	0.2	26.094
Urban population growth (%)	0.961	0.976	-1.602	5.296
Fertility rate	1.665	0.269	1.13	2.666
Inflation rate	75.328	22.568	17.425	114.432
Population density	160.563	125.963	11.186	511.78
Size of government (% of GDP)	19.349	4.028	9.372	27.935
International Openness (% of GDP)	69.818	34.093	12.425	166.255
Technology Transfer (% of GDP)	5.049	18.057	-2.592	199.14

Chapter 4

THRESHOLD REGRESSION

4.1: General Equation

Inspired by Hansen (1999), I decided to apply threshold regression to my research. The following shows the main regression equation:

$$y_{it} = \mu_i + \beta_1' x_{1it} + \beta_2' x_{2it} + \beta_3' x_{3it} I(q_{it} \leq \gamma) + \beta_4' x_{3it} I(q_{it} > \gamma) + e_{it} \qquad (1)$$

In this equation, x_1 and x_2 are the main explanatory variables, x_3 is the regional variable, q is the threshold variable and γ is the estimated threshold of q. Equation (1) represents the threshold regression model, where function I(.) is an indicator function. Or we can use equation (2) as alternative intuitive writing of equation (1).

$$y_{it} = \begin{cases} \mu_i + \beta_1' x_{1it} + \beta_2' x_{2it} + \beta_3' x_{3it} + e_{it}, & q_{it} \leq \gamma, \\ \mu_i + \beta_1' x_{1it} + \beta_2' x_{2it} + \beta_4' x_{3it} + e_{it}, & q_{it} > \gamma. \end{cases} \qquad (2)$$

We can roughly think of the threshold regression equation as a piecewise function. This function is divided into two segments by the threshold variable.

Thresholds delineate one state from another. There is one effect for one set of coefficients up to the threshold and another effect for another set of coefficients beyond it.

My interest parameters are β_3 and β_4. β_3 reflects the relationship between the regional variable and dependent variable when the threshold variable is smaller than its threshold. β_4 reflects the relationship between the regional variable and dependent variable when the threshold variable is greater than its threshold.

To use this method, first, I need to make sure how many thresholds I need; Second, find the optimal threshold; Third, do the regression with the optimal threshold. Part 6 of this paper tests the threshold effect for each threshold variable and verifies whether a single threshold or multiple thresholds are better. The F statistic in the tests indicate that the single threshold is optimal for all three threshold variables. In these regressions, the dependent variable is always the real GDP per capita growth rate.

4.2: Specific Equation

Butkiewicz and Gordon's (2012) growth model estimates the economic growth effect of offshore banking in host territories. This growth model provides some reference and inspiration for my threshold regression model.

The characteristics of the new normal economy include the saturation of the labor market and the shortage of a surplus labor force. I use the data of the unemployment rate to reflect this characteristic, and in this regression, the threshold of my model should be a value of the unemployment rate, for example, an 8.5 percent unemployment rate. The coefficients on independent variables will be significantly different when unemployment is smaller or greater than the threshold. In addition, the development of urbanization and the implementation of the fertility policy are aimed at adapting to the new phased economic characteristics. Therefore, the urbanization growth rate has become another threshold variable in threshold regression analysis.

Equation (3) below presents the estimated equation.

$$Growth_{it} = \beta_0 + \beta_1 y_{it-1} + \beta_2 Savings_{it-1} + \beta_3 Regime_{it-1} I(q_{it-1} \leq \gamma) + \beta_4 Regime_{it-1} I(q_{it-1} > \gamma) + \beta_{5+n} \sum_{n=0}^{4} X_{it-1} + \delta_t + \varepsilon_{it} \tag{3}$$

The left-hand side of this equation is the real GDP per capita growth rate in country i at time t. Economic growth is estimated by the logarithm of the one-period lag of real GDP per capita (y), the savings rate (Savings), the regime-dependent variable (Regime) net exports, and main control variables (X). A series of control variables reflect different levels that affect a country's economic growth, including inflation, population density, government size, openness, and technological progress. The savings rate is measured as gross domestic savings. Some literature also uses gross capital formation to measure it. The inflation rate is measured as the GDP deflator. The population density is people per square kilometer of land area. The size of the government is measured as government consumption expenditure. International openness is measured as the sum of exports and imports. The savings rate, net export, government size, openness, and technology are the percentage of GDP. Part 3.3 explained the definition and form of each variable. In Butkiewicz and Gordon (2012), saving is a proxy for capital and population density (people per square kilometer) is used to proxy for the level of human capital. Population density is always connected with immigration, urbanization, and population demographics. But the more intuitive is to reflect the population growth of a region. Foreign investment inflow is a good indicator of technology transfer, but the technology transfer brought by foreign capital has a periodicity and a lag in the effect, so I took the value of lagged one year (t-1) as the current value. The issue of exogeneity and other economic factors also have a certain lagged effect on economic growth. As shown in equation (3), this model takes the country fixed effect (δ_t) into account. The application of the country-fixed effect in threshold regression analysis is different from the general situation. Wang (2015) introduced adding a country-fixed effect to threshold regression.

Chapter 5

REGRESSION ESTIMATES

5.1: Insufficient Labor Force and Capacity

According to the threshold regression method, I did regression in the case of no threshold, single threshold, double thresholds, and triple thresholds. The regression result is when the optimal threshold number is selected. After selecting the unemployment rate as my first threshold variable, I made two regressions respectively. One sample did not include China and the other included China. I divided my samples into two groups according to whether China is included or not because I wanted to observe whether China is my sample outlier. I divide them into four categories: without control variables and country fixed effect, with control variables but without country fixed effect, without control variables but with country fixed effect, and with control variables and country fixed effect. A higher real GDP growth rate at period t may affect savings, net exports, unemployment, and other variables at t as well as be affected by them. Considering the probability of reverse causality, I lag 1 period (t-1) of these variables on the right side of the equation.

First, when the country fixed effect is not considered but control variables are included, the estimated unemployment rate threshold obtained by the model is 11.135%.

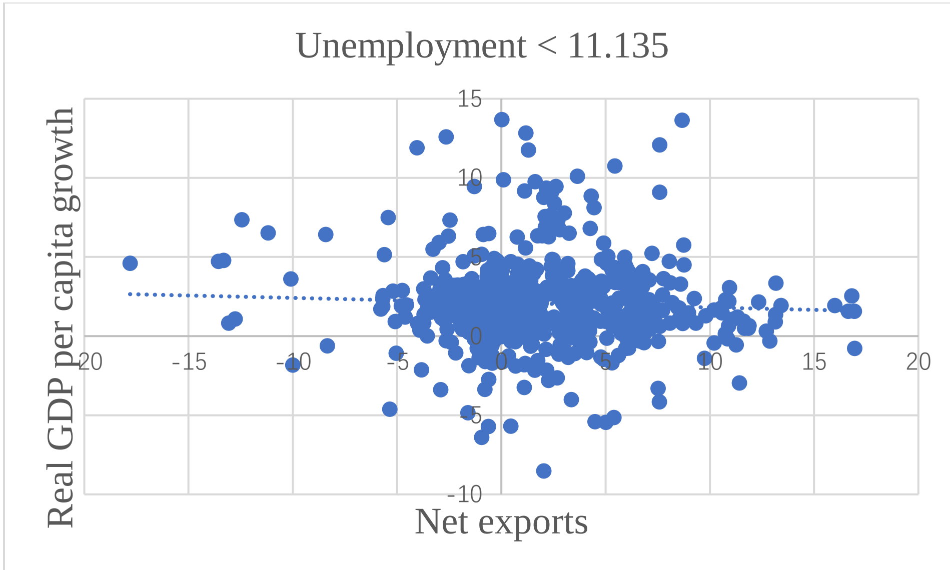


Figure 5.1 Correlation between real GDP per capita Growth and net export (below)

These figures show that the correlation between net exports and economic growth is different. When unemployment is smaller than the value of threshold 11.135%, the correlation is negative. When unemployment is greater than the value of threshold 11.135%, the correlation changes to positive.

The appendix shows the correlations between economic growth and net exports with different threshold variables.

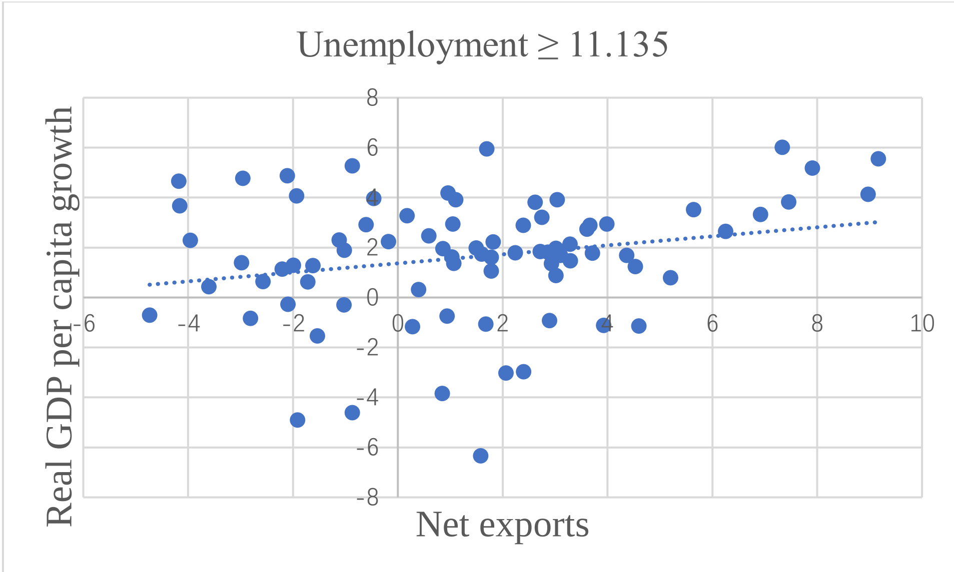


Figure 5.2 Correlation between real GDP per capita Growth and net export (above)

Table 5.1: Growth estimates with the unemployment rate as the threshold and including China

	1	2	3	4
Dependent variable: growth rate of GDP per capita				
Log GDP per capita (t-1)	-2.017*** (0.00)	-1.837*** (0.00)	-2.028*** (0.00)	0.387 (0.438)
Savings rate (t-1)	0.046** (0.011)	0.034 (0.112)	0.084** (0.014)	-0.025 (0.597)
Net exports (t-1) (Unemployment rate $\leq \gamma$)	0.061** (0.027)	0.042 (0.237)	0.042 (0.22)	0.148*** (0.00)
Net exports (t-1) (Unemployment rate $> \gamma$)	0.372*** (0.00)	0.177*** (0.00)	0.230*** (0.00)	0.495*** (0.00)
Inflation rate (t-1)		-0.012*** (0.006)		-0.035*** (0.00)
Population density (t-1)		-0.001* (0.083)		0.0004 (0.996)
Size of government (t-1)		-0.084*** (0.00)		-0.153* (0.062)
International Openness (t-1)		-0.002 (0.459)		0.0007 (0.935)
Technology Transfer (t-1)		-0.004 (0.378)		-0.011* (0.052)
Country fixed effects	No	No	Yes	Yes
Number of observations	663	663	663	663
Threshold values	11.135	3.984	5	11.135

Note: * Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

From the results of the table, the main explanatory variables, the one-period lags of real GDP per capita and savings, have a significant impact on economic growth, whether control variables and country fixed effect are added or not. Solow (1956) pointed out that due to the diminishing returns of factor inputs, the initial per capita GDP explains that the economic growth rate will converge to its steady state. Therefore, the estimated coefficient of one-period lag of real GDP per capita is a negative value and provides an estimated value of convergence rate. In addition, Solow (1956) also discussed that more savings will promote faster economic growth because high savings raise the steady state of per capita income. For the most important coefficient in the threshold regression model, an expected result about the estimated coefficient of net export is obtained. When the unemployment rate is greater than its threshold, the labor force is sufficient to make overcapacity. At this time, the expansion of the trade surplus can promote economic growth. In case one, as the increase of net exports by one percentage point, the growth rate of GDP per capita increased by 0.372 percentage points. Cases two and three have similar results, as the increase of net exports by one percentage point, the growth rate of GDP per capita increased by 0.177 and 0.23 percentage points respectively. When the unemployment rate is less than its threshold, the labor gap means insufficient production capacity. In the case one and four, the coefficients of net exports are much smaller than 0.372 and 0.495 respectively (the coefficients of net exports when unemployment is below the threshold in case one and four), they are just 0.061 and 0.148. Other than that, when unemployment is below its threshold, the coefficients of net exports in case two and three are not significant at all. That means net exports make a limited contribution to growth when unemployment is low. Each of the above cases shows that the contribution of increasing net exports to economic growth only happens when there are sufficient workers. When the labor market is tight, wages and production costs rise, and the goods produced need to be prioritized for domestic reproduction. At this point, if export is further expanded, domestic market shortage will be aggravated, and the cost of reproduction and consumption will be further increased. As for the coefficients of the logarithm of GDP per capita (t-1), the negative coefficients are consistent with my expectations. Convergence occurs because of diminishing returns to factors of production, such as physical and human capital. Butkiewicz and Yanikkaya (2004) point out that lagged initial real GDP per capita usually means the rate or speed of convergence, with rates between 2% and 3% being typical. As the results in table 5.1, the rate of convergence is about 2.017% (in case one), which is an acceptable estimation. Coefficients are negative in all cases except case four, but the coefficient is not significant. In addition, the coefficients of savings are perfectly consistent with my expectation. In case one, as the increase of savings by one unit, the growth rate of GDP per capita increased by 0.046 units. The coefficients are significant only if the value is positive.

In terms of the coefficients of the control variables, the two cases have similar results, and are highly consistent with my hypothesis. As for the control variables, the impact of inflation on economic growth is usually negative, and population density has been proved to have a negative effect on economic growth as it reflects the population growth of a region to some extent. Government size and openness have a different conclusion, government intervention in many economic theories is thought to hinder economic growth, while openness is generally believed to promote economic growth. In my research, as technology transfer is reflected by foreign direct investment inflow, I also believe that it will hinder economic growth, which has been proved by my research results. In combination with the results in table 5.1, I briefly explain the reasons for my hypothesis for the estimation of controls below, thus demonstrating the accuracy of this model estimation. It will take less space to interpret control variables in the rest of the sections, because estimating the control variables is not the focus of this paper. In case two, as the increase of inflation rate by one unit, the growth rate of GDP per capita decreased by 0.012 units. This shows that the threshold regression model supports the conclusion that inflation is not conducive to economic growth. As the increase of population density by one unit, the growth rate of GDP per capita decreased by 0.001 units. Population density could represent human capital, but the more intuitive is to reflect the population growth of a region. In the growth model, population growth reduces economic growth. At the same time, the growth of the earth's total population may exacerbate many environmental and social problems, such as traffic congestion, pollution, and rapid consumption of resources. In particular, the sample in this paper mainly includes developed countries, where the population tends to be saturated, and the marginal income of population density growth is far lower than that of other developing countries, which to some extent offsets the positive effect of human capital improvement on economic growth. This also explains that the effect of population density on economic growth in this model is very small. As the increase of government size by one percentage point, the growth rate of GDP per capita decreased by 0.084 percentage points. The result shows that in this model, government intervention is negative for economic growth. The positive effect of openness for economic growth is relatively less controversial, so I will not discuss it in detail.

As far as foreign direct investment is concerned, there is some controversy on the role of economic growth, but I prefer a negative role. Many imports and negative net exports also represent positive technology transfer. Hoppe (2005) has the same view that trade mainly realizes technology transfer through the import of capital goods and the opening of export markets. Saqib et Al. (2013) finds foreign direct investment plays a negative role in economic performance in some developing countries which have abundant resources. For these countries, the domestic investment will be beneficial to their economy, so their dependence on foreign investment should remain limited. Brecher and Diaz-Alejandro (1977) believed that foreign direct investment may have a negative impact on the economic growth of the host country if the companies funded by foreign direct investment remit excess profits back to the home country. Eller, Haiss and Steiner (2005) studied eleven countries in Central and Eastern Europe and found that foreign investment has crowded out domestic capital, thus finding that FDI has an adverse effect on economic development. So, this explains the negative coefficients on technology transfer and positive coefficients on international openness. Considering China's foreign exchange reserves of more than 3 trillion U.S. dollars, the trade deficit in the short term will not become a major concern. In the long run, the main driving force for economic growth is technological progress. The role of domestic technological progress brought by imitating and improving the purchased technical patents is often greater than that of independent research and development. As Cetintaş et al. (2009) found that there is a unidirectional causal relationship between economic growth and exports. Economic growth driven by technological progress will eventually promote exports, thus achieving a long-term balance of trade.

Table 5.2: Growth estimates with the unemployment rate as the threshold and excluding China

	1	2	3	4
Dependent variable: growth rate of GDP per capita				
Log GDP per capita (t-1)	-1.857*** (0.00)	-1.354*** (0.00)	-3.993*** (0.00)	-3.184*** (0.002)
Savings rate (t-1)	-0.023 (0.301)	0.053** (0.03)	0.012 (0.735)	0.111** (0.026)
Net exports (t-1) (Unemployment rate $\leq \gamma$)	0.073** (0.021)	0.098*** (0.004)	0.103*** (0.004)	0.151*** (0.00)
Net exports (t-1) (Unemployment rate $> \gamma$)	0.231*** (0.00)	0.293*** (0.00)	0.2826*** (0.00)	0.322*** (0.00)
Inflation rate (t-1)		-0.017*** (0.00)		-0.003 (0.792)
Population density (t-1)		-0.001* (0.095)		0.012 (0.188)
Size of government (t-1)		-0.114*** (0.00)		-0.254*** (0.002)
International Openness (t-1)		-0.001 (0.709)		-0.006 (0.542)
Technology Transfer (t-1)		-0.006 (0.198)		-0.014*** (0.009)
Country fixed effects	No	No	Yes	Yes
Number of observations	624	624	624	624
Threshold values	6.235	4.981	4.981	4.981

Note: * Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

The result in table 5.1 is based on the sample containing China, while the result in table 5.2 is obtained based on the sample excluding China. The purpose of this is to find out if China is an outlier by comparison. In terms of the thresholds of unemployment rate, the biggest difference between the samples with and without China lies in the threshold of unemployment rate. After China is included in the data, there is a big difference in the threshold of the four cases. They are 11.135, 3.984, 5, and 11.135 in four estimations when China is included, and 6.235, 4.981, 4.981, 4.981 when China is excluded. Considering the results, the most intuitive finding is that China's unemployment rate has undergone great changes in the past 40 years. After observing the data, according to the data published by the World Bank, China in the 1980s and 1990s had the same unemployment rate in some years. The unemployment rate has been on a downward trend for the last twenty years. In 2019, China's unemployment rate was 3.8%, lower than the thresholds of unemployment rate in all cases. Therefore, the experience of other developed countries is more useful for China at the current stage of development.

It can be seen from the results in table 5.2, as the main explanatory variable, the estimation coefficient of the one-period lag of real GDP per capita and savings are still significant and meet expectation. Let's focus on the coefficient of net exports. Compared with table 5.1, the coefficient of net export in Table 5.2 leads to roughly the same conclusion. Once the unemployment rate has risen enough to cross its threshold, the coefficient of net exports will be much higher than before. One interesting finding is that the net export coefficients above the thresholds are roughly three times higher than the coefficients below them, regardless of whether China is included in the sample. This is evidence that net exports have only a limited role to play in economic growth when there is a shortage of workers. At the same time, it also shows that China is not an outlier. The experience of other developed countries is also valid for China, especially in the current stage of development.

In terms of control variables, inflation and the size of government still have a negative effect on economic growth. The effect of international openness is not significant. Since negative net exports represent positive technology transfer, the coefficient of technology is still negative. Population density still plays a small negative role.

5.2: Rapid Urbanization

Using the same method and classification as in 5.1, I changed the threshold variable to the urban population growth rate.

Table 5.3: Growth estimates with the urban population growth rate as the threshold and including China

	1	2	3	4
Dependent variable: growth rate of GDP per capita				
Log GDP per capita (t-1)	-2.033*** (0.00)	-1.548*** (0.00)	-2.039*** (0.00)	0.338 (0.502)
Savings rate (t-1)	0.045** (0.01)	0.004 (0.853)	0.068** (0.046)	-0.041 (0.388)
Net exports (t-1) (Urbanization growth rate $\leq \gamma$)	0.168*** (0.00)	0.127*** (0.00)	0.199*** (0.00)	0.28*** (0.00)
Net exports (t-1) (Urbanization growth rate $> \gamma$)	0.044 (0.129)	0.227*** (0.00)	0.064* (0.065)	0.141*** (0.00)
Inflation rate (t-1)		-0.014*** (0.003)		-0.033*** (0.00)
Population density (t-1)		-0.001 (0.12)		-0.0004 (0.963)
Size of government (t-1)		-0.062*** (0.007)		-0.129 (0.117)
International Openness (t-1)		-0.006 (0.836)		-0.003 (0.7)
Technology Transfer (t-1)		-0.005 (0.348)		-0.011* (0.051)
Country fixed effects	No	No	Yes	Yes
Number of observations	663	663	663	663
Threshold values	0.905	1.961	0.905	0.922

Note: * Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Each of the above situations shows that when the urban population growth rate is higher than the threshold which means rapid urbanization, the contribution of increasing net exports to economic growth is very small, which is far less than that below the threshold. Case two is an exception, but it's still consistent with the hypothesis overall. In case three, as the increase of net exports by one percentage point, the growth rate of GDP per capita increased by 0.199 percentage points if urban growth is below its threshold. However, if urban growth rate is beyond its threshold, as the increase of net exports by one percentage point, the growth rate of GDP per capita increased by 0.064 percentage points. This is consistent with my hypothesis. It is reasonable to understand, after the rural residents come to the cities, the consumption demand increases due to the improvement of the quality of life in the city such as education, medical care, and housing. When the speed of urbanization is higher than its threshold, continuing to expand the trade surplus will not meet the needs of these people who have just poured into the city. China's poor population mainly comes from the rural areas, and there are more middle- and high-income groups in the cities. The rapid growth of the urban population has expanded the middle- and high-income groups. At the same time, urban life requires higher material consumption demand, such as housing, medical care, education and so on, so more output is needed to meet these consumption demands.

As for the coefficients of the logarithm of GDP per capita (t-1), the negative coefficients are consistent with my expectations. As the results in table 5.3, the rate of convergence is about 2.033% (in case one), which is an expected finding. Coefficients are negative and around 2% to 3% in all cases. In addition, the coefficients of savings are all positive if significant, which is perfectly consistent with my expectation. In case one, as the increase of savings by one unit, the growth rate of GDP per capita increased by 0.045 units.

In case two, as the increase of inflation rate by one unit, the growth rate of GDP per capita decreased by 0.014 units. As the increase of government size by one percentage point, the growth rate of GDP per capita decreased by 0.062 percentage points. Other controls had insignificant coefficients.

Table 5.4: Growth estimates with the urban population growth rate as the threshold and excluding China

	1	2	3	4
Dependent variable: growth rate of GDP per capita				
Log GDP per capita (t-1)	-1.831*** (0.00)	-1.532*** (0.00)	-4.071*** (0.00)	-3.377*** (0.001)
Savings rate (t-1)	-0.004 (0.835)	0.043* (0.055)	-0.009 (0.807)	0.135*** (0.007)
Net exports (t-1) (Urbanization growth rate $\leq \gamma$)	0.2*** (0.00)	0.258*** (0.00)	0.266*** (0.00)	0.307*** (0.00)
Net exports (t-1) (Urbanization growth rate $> \gamma$)	0.057* (0.053)	0.117*** (0.001)	0.123*** (0.001)	0.172*** (0.00)
Inflation rate (t-1)		-0.018*** (0.00)		-0.002 (0.871)
Population density (t-1)		-0.0005 (0.492)		0.011 (0.231)
Size of government (t-1)		-0.084*** (0.00)		-0.252*** (0.002)
International Openness (t-1)		0.0003 (0.911)		-0.003 (0.75)
Technology Transfer (t-1)		-0.007 (0.172)		-0.016*** (0.003)
Country fixed effects	No	No	Yes	Yes
Number of observations	624	624	624	624
Threshold values	0.921	0.921	0.913	0.913

Note: * Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 5.4 shows the result of excluding China in the sample. Different from the unemployment rate, there is a much smaller difference in the estimates of the threshold of urbanization speed under different cases. After China is added to the sample, only case two has a large threshold of urbanization (1.961). Most of the above situations show that when the urban population growth rate is higher than the threshold, the contribution of increasing net exports to economic growth is very small, which is far less than that below the threshold. In the sample with or without China, the coefficients of net exports are about two to three times higher when urbanization is below the threshold than when it is above it. This not only shows the stability of the estimation method but also reflects that China is not an outlier and can learn from the experience of other developed countries. In 2019, China's urban population growth rate was 2.491%, higher than the threshold value of this variable in all cases. At the same time, the estimates of the coefficients of the other independent variables and control variables are basically consistent with table 5.3.

5.3: Three-Child Policy

I apply the data of fertility rate as the third threshold variable and expect to find when the fertility rate is higher than its threshold, there is a negative correlation between net exports and economic growth. I believe that there are one or more thresholds of fertility rates that delineate demographic situations from one to another.

Table 5.5: Growth estimates with the fertility rate as the threshold and including China

	1	2	3	4
Dependent variable: growth rate of GDP per capita				
Log GDP per capita (t-1)	-2.014*** (0.00)	-1.995*** (0.00)	-2.086*** (0.00)	0.278 (0.579)
Savings rate (t-1)	0.04** (0.019)	0.012 (0.555)	0.061* (0.072)	-0.052 (0.269)
Net exports (t-1) (Fertility rate $\leq \gamma$)	0.209*** (0.00)	0.177*** (0.00)	0.173*** (0.00)	0.255*** (0.0)
Net exports (t-1) (Fertility rate $> \gamma$)	0.054** (0.049)	0.007 (0.859)	0.023 (0.553)	0.104** (0.012)
Inflation rate (t-1)		-0.009** (0.033)		-0.03*** (0.00)
Population density (t-1)		-0.002** (0.017)		-0.004 (0.695)
Size of government (t-1)		-0.064*** (0.006)		-0.151* (0.066)
International Openness (t-1)		-0.002 (0.532)		-0.006 (0.511)
Technology Transfer (t-1)		-0.006 (0.245)		-0.001* (0.077)
Country fixed effects	No	No	Yes	Yes
Number of observations	663	663	663	663
Threshold values	1.461	1.89	1.81	1.81

Note: * Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

First, I use lagged values of control variables in the threshold regression. I also apply the data of lagged one year (t-1) instead of year t to the right-hand-side variables.

Each of the cases shows that when the fertility rate is below the threshold, the contribution of net exports to economic growth could be much bigger than it is above the threshold. Take case one as an example, as the increase of net exports by one percentage point, the growth rate of GDP per capita increased by 0.209 percentage points. On the contrary, once the fertility rate is above its threshold, the positive correlation between net export and economic growth becomes much smaller. As the increase of net exports by one percentage point, the growth rate of GDP per capita just increased by 0.054 percentage points. I also get a similar conclusion in case four. The coefficients of net exports of case two and three are insignificant when the fertility rate is below the threshold, but net exports have positive and significant effect on economic growth when above its threshold in these cases.

As for the coefficients of the logarithm of GDP per capita (t-1), the negative coefficients are consistent with my expectations. Table 5.5 shows that the rate of convergence is about 2.014% (in case one). The coefficients of other cases are also typical.

The estimates of control variables are also in line with expectations, with inflation rate, population density and government size all showing significant negative effects. In case four, as the increase of inflation rate by one unit, the growth rate of GDP per capita decreased by 0.009 units. As the increase of population density by one unit, the growth rate of GDP per capita decreased by 0.002 units. As the increase of government size by one percentage point, the growth rate of GDP per capita decreased by 0.064 percentage points. Both the coefficients of openness and technology transfer are not significant.

The thresholds of the fertility rates of these four regressions are 1.461, 1.89, 1.81, and 1.81. China's fertility rate has been below these four thresholds since 1993 (the fertility rates of China are 1.838 in 1993, 1.977 in 1992, and 1.696 in 2019). China introduced a two-child policy in 2015 and a three-child policy in 2021 which aims to rapidly increase the fertility rate above two.

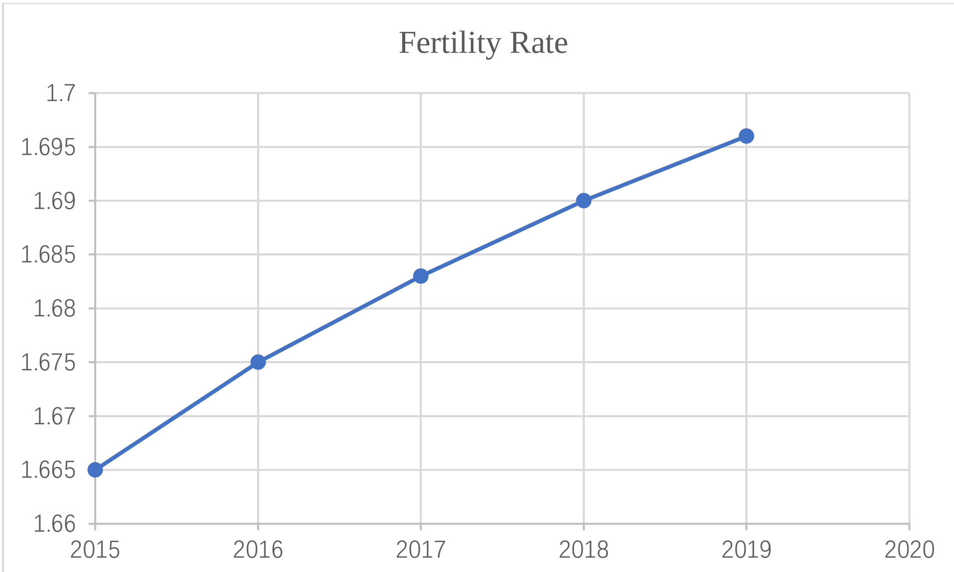


Figure 5.3 China's fertility rate since 2015
Source: World Bank Open Data

Figure 5.3 shows China's fertility rate has steadily increased since 2015. The two-child policy aims to push the fertility rate to 2 or close to 2, and the three-child policy aims to push the fertility rate above 2 and close to 3. According to my empirical results, once fertility rates are higher than their threshold, increasing net exports hinders economic growth. At the same time, to accelerate the fertility rate above two, China should import more goods and services, especially high-added value products which can satisfy continuously increasing demand due to more children and lower the cost of raising children to some degree. The change in data and empirical results effectively support my statement. Compared the coefficients of other explanatory variables and control variables with the results with previous threshold variables, these coefficients are very similar which reflects these variables in the regression and can be used to estimate economic growth very well.

Table 5.6: Growth estimates with the fertility rate as the threshold and excluding China

	1	2	3	4
Dependent variable: growth rate of GDP per capita				
Log GDP per capita (t-1)	-2.029*** (0.00)	-1.611*** (0.00)	-4.084 *** (0.00)	-3.31*** (0.001)
Savings rate (t-1)	0.00005 (0.98)	0.051** (0.021)	-0.01 (0.78)	0.141*** (0.004)
Net exports (t-1) (Fertility rate $\leq \gamma$)	0.236*** (0.00)	0.213*** (0.00)	0.222*** (0.00)	0.27*** (0.00)
Net exports (t-1) (Fertility rate $> \gamma$)	0.076*** (0.007)	0.04 (0.368)	0.067 (0.137)	0.115** (0.015)
Inflation rate (t-1)		-0.015*** (0.001)		0.001 (0.929)
Population density (t-1)		-0.001* (0.05)		0.009 (0.353)
Size of government (t-1)		-0.079*** (0.00)		-0.279*** (0.001)
International Openness (t-1)		-0.001 (0.766)		-0.006 (0.488)
Technology Transfer (t-1)		-0.008 (0.118)		-0.014** (0.01)
Country fixed effects	No	No	Yes	Yes
Number of observations	624	624	624	624
Threshold values	1.461	1.89	1.89	1.89

Note: * Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Then I exclude China from the data. In terms of threshold value under the four cases, it is highly consistent with that when China is included in the sample. Cases show the same situation as the regression including China. Net exports are a big help to growth when fertility is below a threshold, but the boost diminishes rapidly once fertility crosses it. At the same time, the estimation of other independent variables and control variables is basically consistent with Table 5.5. Therefore, China is not an outlier and could be explained well with the data.

Then, let's explain the mechanism that links fertility rate and net exports to growth. The data of main economies such as the U.S., U.K., France, and China shows there is a significant negative correlation between fertility rate and gross domestic savings.

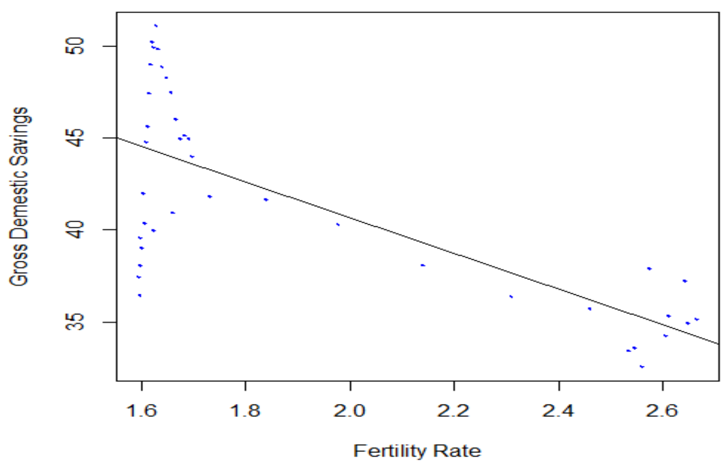


Figure 5.4 Negative relationship between fertility rate and gross domestic savings for China
Source: World Bank Open Data

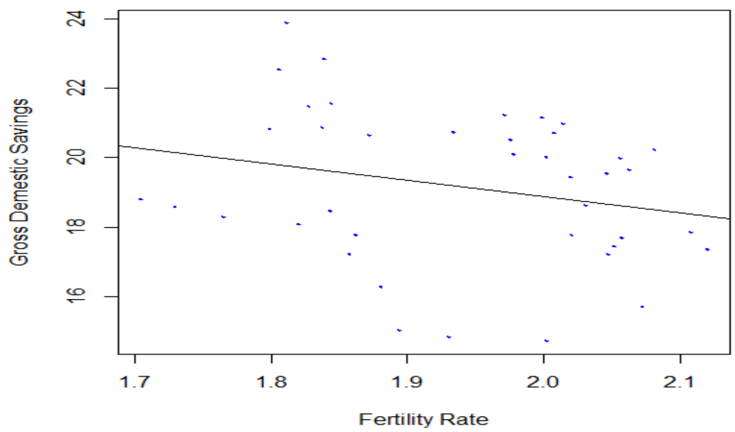


Figure 5.5 Negative relationship between fertility rate and gross domestic savings for the U.S.
Source: World Bank Open Data

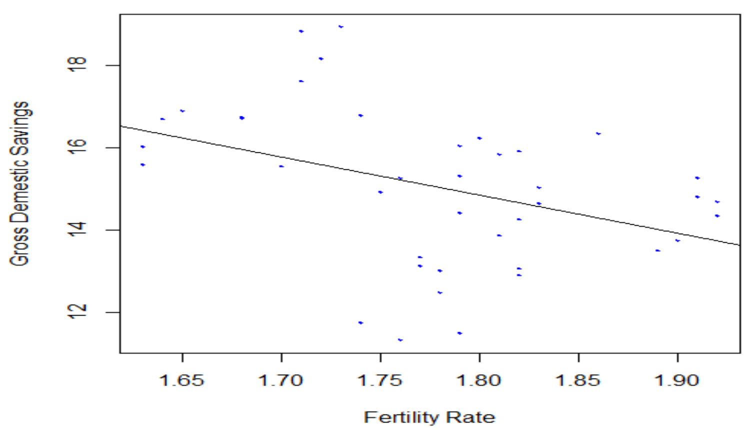


Figure 5.6 Negative relationship between fertility rate and gross domestic savings for the U.K.
Source: World Bank Open Data

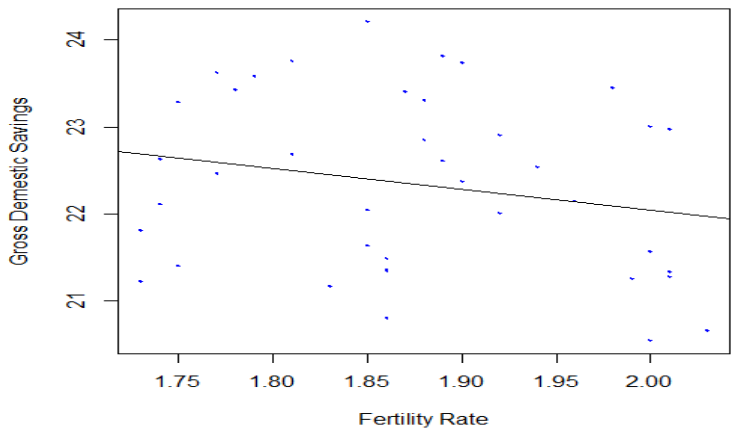


Figure 5.7 Negative relationship between fertility rate and gross domestic savings for France
Source: World Bank Open Data

These countries are major economies that have relatively large populations, GDPs, and complete industrial systems over the world, so they will be more like China. The data of these countries support the idea that as the fertility rate rises, consumption will increase, and domestic savings will decrease. Furthermore, if net foreign investment remains high, and there is now less domestic saving with more savings going to residential investment, there will be less investment in business plants and equipment. I also find a significant negative correlation between fertility rate and business investment.

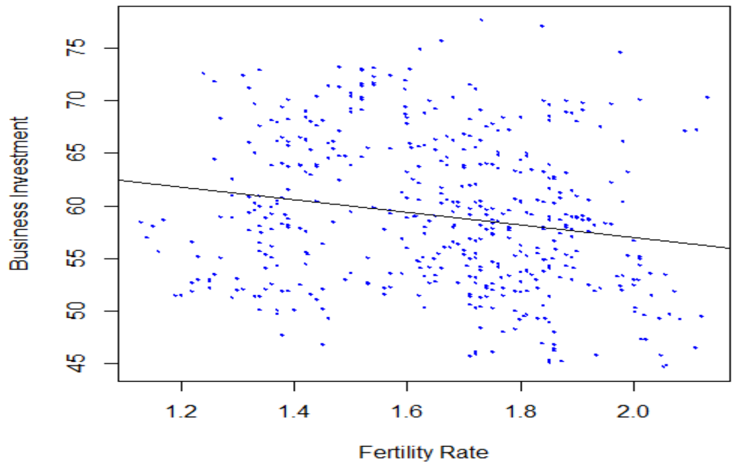


Figure 5.8 Negative relationship between fertility rate and business investment
Source: World Bank Open Data

With the data of these large economies as the U.S. and the U.K., I can find a positive correlation between fertility and residential investment.

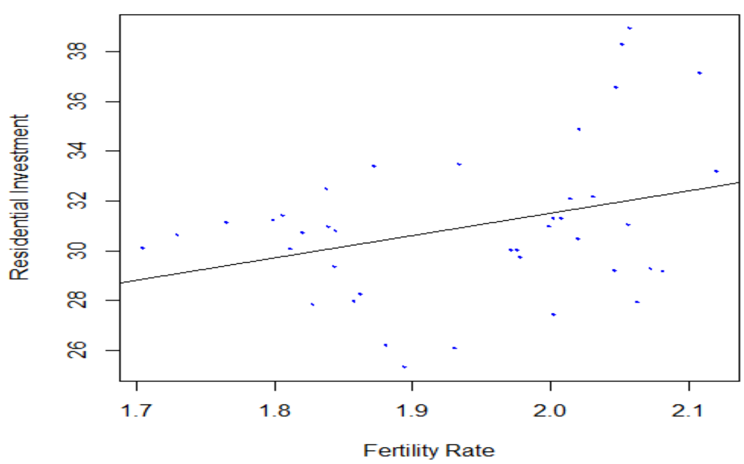


Figure 5.9 Positive relationship between fertility rate and residential investment for the U.S.
Source: World Bank Open Data

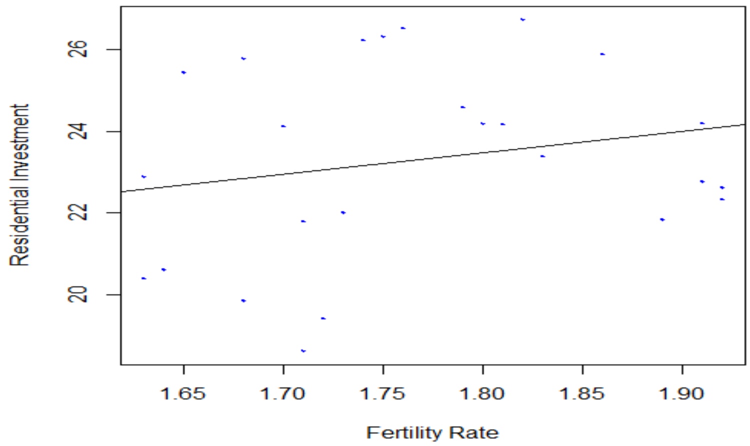


Figure 5.10 Positive relationship between fertility rate and residential investment for the U.K.
Source: World Bank Open Data

The impact of fertility on the labor force will not be apparent until several years later. At the same time, there can be a lower fertility rate and more labor force due to the last fertility peak. Just as when China implemented the one-child policy, the fertility rate was not high, but the labor force was sufficient. With the disappearance of the population dividend and the intensification of the aging problem, even if the policy of multiple births is vigorously promoted, the labor force cannot be replenished in the short term. If China wants to have enough labor force in the next few decades, it needs to raise its current fertility rate. However, the increase in fertility is bound to be accompanied by an increase in domestic demand. At this time, expanding exports will seize limited resources and commodities with domestic market, thus hindering economic growth. When the domestic market demand cannot be met due to exports, this is generally reflected in the rise of domestic prices, which leads to higher fertility costs and lower people's fertility desire.

5.4: The Best Threshold Variable

The results obtained by the three threshold variables of the unemployment rate, urbanization population growth rate, and fertility rate are in line with my expectations. However, the application of the fertility rate has obviously achieved the best results.

First, there are no unexpected estimates as far as the coefficient of net exports is concerned. No matter the results shown in table 5.5 or table 5.6, the coefficient of net export meets the requirement that when the fertility rate is lower than the threshold, there will be a large value; once the fertility rate is higher than the threshold, the coefficient will drop significantly. The unemployment rate as a threshold, the net export coefficient is also in line with expectations. However, when the urban population growth rate is taken as the threshold variable, the net export coefficient in case two of table 5.3 is an unexpected estimate. Although the overall yield can still support my hypothesis, these exceptions reflect that fertility is the best threshold variable.

Second, in terms of the variability of the threshold estimate, fertility has a narrower variability than the other two threshold variables. Table 5.7 shows the estimates of thresholds for three threshold variables. The estimated threshold of the fertility rate is basically between 1.461% and 1.89%. However, for the unemployment threshold measure, the threshold varies between estimates from 3.984% to 11.135%. Similarly, there is also a wide variability for the urban population growth rate.

Third, in terms of statistical methods or standards, data quality across countries of the fertility rate is more consistent than the other two threshold variables. The age of childbearing is generally consistent across countries, and there are well-established systems in place to record the birth of children, while there are some differences between countries in the statistics standard and ability of unemployment and urban population growth rates. This will help to obtain more stable and consistent results in different sample countries. It is precise because of the difference in statistical caliber and accuracy in different countries that leads to the wide variability in the threshold estimation of the unemployment rate and urban population growth rate. It is also because of this difference. In table 5.7, when China is included in the sample and not included in the sample, the threshold estimate of the unemployment rate is significantly different. This difference is relatively small in the statistical data on fertility, which is also the reason why more stable and accurate results can be obtained.

Table 5.7: Thresholds of Unemployment Rate, Urban Population Growth Rate and Fertility Rate

Threshold Variable: Unemployment				
	1	2	3	4
China included	11.135	3.984	5	11.135
China excluded	6.235	4.981	4.981	4.981

Threshold Variable: Urban population growth rate				
	1	2	3	4
China included	0.905	1.961	0.905	0.922
China excluded	0.921	0.921	0.913	0.913

Threshold Variable: Fertility rate				
	1	2	3	4
China included	1.461	1.89	1.81	1.81
China excluded	1.461	1.89	1.89	1.89

Note: The numbers 1, 2, 3 and 4 represent the four cases in the model about country fixed effect and control variables.

Chapter 6

TESTS ON MULTIPLE THRESHOLDS

The above results were obtained based on the single threshold model. In this section evidence is presented that the Multiple Thresholds model is not applicable. The following tests were carried out when the country-fixed effects were incorporated into the threshold regression model, and samples included China. This test is used to illustrate whether the multiple thresholds model can improve accuracy compared with the single threshold model. Tables 6.1, 6.2, and tables 6.3, and 6.4 respectively display the test results of the unemployment rate and urban population growth rate as threshold variables. Tables 6.5 and 6.6 display the test results of the fertility rate as the threshold variable. Tables 6.1, 6.3, and 6.5 reflect the inclusion of control variables.

Table 6.1: Threshold Effect Test of Unemployment Rate

Threshold	RSS	MSE	F-Stat	Prob	Ctit 10	Ctit 5	Ctit 1
Single	-	-	-	-	-	-	-
Double	2357.2265	3.7776	13.09	0.0833	12.9458	14.9479	18.9584
Triple	2314.4973	3.7091	11.52	0.9267	34.7725	40.8337	43.5664

Double: H_0: single threshold model; H_a: double thresholds model
Triple: H_0: double threshold modle; H_a: triple thresholds model

In the result of the unemployment rate, the multiple thresholds model's estimators are not significant. The F statistic of the double thresholds model is not significant at a 95%

confidence level. Therefore, both double and triple-threshold models do not receive support. Table 6.2 indicates a similar conclusion.

Table 6.2: Threshold Effect Test of Unemployment Rate

Threshold	RSS	MSE	F-Stat	Prob	Ctit 10	Ctit 5	Ctit 1
Single	-	-	-	-	-	-	-
Double	2486.1105	3.9842	13.17	0.0900	12.4835	14.5003	16.6803
Triple	2441.3519	3.9124	11.44	0.9533	33.5831	37.6532	43.6412

Double: H_0: single threshold model; H_a: double thresholds model
Triple: H_0: double threshold modle; H_a: triple thresholds model

Table 6.3: Threshold Effect Test of Urban Population Growth Rate

Threshold	RSS	MSE	F-Stat	Prob	Ctit 10	Ctit 5	Ctit 1
Single	-	-	-	-	-	-	-
Double	2410.2181	3.8625	7.55	0.3900	11.7023	14.5228	17.8595
Triple	2393.0381	3.8350	4.48	0.7600	16.0949	18.7597	23.7601

Double: H_0: single threshold model; H_a: double thresholds model
Triple: H_0: double threshold modle; H_a: triple thresholds model

As a result of the urban population growth rate, both the double and triple-threshold model's estimators are not significant. The F statistics of the double thresholds model are not significant at a 95% confidence level. Therefore, the multiple thresholds model does not receive support. Table 6.4 indicates a similar conclusion.

Table 6.4: Threshold Effect Test of Urban Population Growth Rate

Threshold	RSS	MSE	F-Stat	Prob	Ctit 10	Ctit 5	Ctit 1
Single	-	-	-	-	-	-	-
Double	2547.5681	4.0826	8.22	0.5900	16.2431	18.6332	24.4121
Triple	2516.8057	4.0333	7.63	0.8500	25.4333	29.5075	33.8628

Double: H_0: single threshold model; H_a: double thresholds model
Triple: H_0: double threshold modle; H_a: triple thresholds model

Table 6.5 shows the multiple thresholds model's estimators are not significant. The F statistic of the double thresholds model is not significant at a 95% confidence level. Therefore, both double and triple-threshold models do not receive support. Table 6.6 indicates a similar conclusion.

Table 6.5: Threshold Effect Test of Fertility Rate

Threshold	RSS	MSE	F-Stat	Prob	Ctit 10	Ctit 5	Ctit 1
Single	-	-	-	-	-	-	-
Double	2418.2488	3.8754	3.31	0.9167	12.3832	13.9979	18.3098
Triple	2398.8225	3.8443	5.05	0.4600	9.2487	12.5922	18.1765

Double: H_0: single threshold model; H_a: double thresholds model
Triple: H_0: double threshold modle; H_a: triple thresholds model

Table 6.6: Threshold Effect Test of Fertility Rate

Threshold	RSS	MSE	F-Stat	Prob	Ctit 10	Ctit 5	Ctit 1
Single	-	-	-	-	-	-	-
Double	2558.6483	4.1004	2.77	0.9200	11.2903	13.5392	17.7177
Triple	2536.8739	4.0655	5.36	0.3633	9.0404	13.3306	20.1022

Double: H_0: single threshold model; H_a: double thresholds model
Triple: H_0: double threshold modle; H_a: triple thresholds model

Chapter 7

CONCLUSIONS

This paper aims to study the role of net exports in different stages of economic growth through the application of threshold variables in threshold regression analysis. The export-oriented policy aimed at maximizing trade surplus and net exports is very effective in the early stage of China's rapid economic development. However, economic growth is coming to a new stage and the emergence of some new economic and social characteristics. Continued pursuit of export maximization can no longer adapt to the current economic development, which will hinder further economic growth.

The shortage of labor supply in the labor market restricts the development and progress of China's economy. Continued expansion of exports will only aggravate the domestic resource shortage and productivity shortage. In the model, when the unemployment rate is higher than a certain threshold, the effect of net exports on economic growth changes from positive to negative, which fully illustrates this argument.

The rapid development of urbanization in China is accompanied by an increase in the middle class and the substantial expansion of consumer demand. The urban population has become the main force of consumption, so with the urbanization rate exceeding its threshold, the effect of net exports on economic growth has become less and less obvious, even negative. Currently, the growth effect of the export sector on the economy is far from satisfying the consumption demand of urban residents.

China's policy of encouraging the birth of two and three children has not been very effective, and the population in 2022 has also shown a negative growth, which also supports the conclusions of this paper. The high cost of living and childcare has dampened the enthusiasm for childbearing, and the expansion of the export sector is exacerbating this situation. Specifically, limited resources for education and health care result in a high cost of raising children, and aspiring Chinese parents are used to pouring all their energy into a single child. In addition, the increasingly busy urban life, and the pressure on each family to support four old people make young couples tend to concentrate on their only child instead of having more children. At this time, reducing exports and appropriately increasing imports are very effective and necessary to ease resource constraints and reduce living and child-rearing costs. The result of the threshold regression model pointed out that if fertility were to increase above the threshold, this will reduce the contribution of net exports to economic growth.

REFERENCES

Ahmad, M. H., Alam, S., & Butt, M. S. (2003). "Foreign direct investment, exports, and domestic output in Pakistan." *Pakistan Development Review*, 42(4 II), 715–722. https://doi.org/10.30541/v42i4iipp.715-723

Ahmad Zubaidi Baharumshah; Salim Rashid; "Exports, Imports and Economic Growth in Malaysia: Empirical Evidence Based on Multivariate Time Series." *Asian Economic Journal*, 1999. (IF: 3)

Aswicahyono, H., & Pangestu, M. (2000). "Indonesia's recovery: Exports and regaining competitiveness." *Developing Economies*, 38(4), 454–489. https://doi.org/10.1111/j.1746-1049.2000.tb00887.x

Awokuse, T. O. (2007). "Causality between exports, imports, and economic growth: Evidence from transition economies." *Economics Letters*, 94(3), 389–395. https://doi.org/10.1016/j.econlet.2006.08.025

Babatunde, M. A., Oyeranti, O. A., Bankole, A. S., & Ogunkola, E. O. (2012). "Exports trade, employment and poverty reduction in Nigeria." *International Journal of Social Economics*, 39(11), 875–899.

Balassa, B. (1978). "Exports and economic growth. Further evidence." *Journal of Development Economics*, 5(2), 181–189. https://doi.org/10.1016/0304-3878(78)90006-8

Balassa, B. (1989). "Incentive Policies and Agricultural Performance in Sub-Saharan Africa." *In New Directions in the World Economy* (pp. 140–152). Palgrave Macmillan UK. https://doi.org/10.1007/978-1-349-10588-5_8

Bartlomiej Kaminski; "Hungary's Integration Into European Union Markets: Production and Trade Restructuring." 1999. (IF: 3)

Brecher, R. A., & Diaz-Alejandro, C. F. (1977). "Tariffs, Foreign Capital, and Immiserizing Growth. " *Journal of International Economics*, 7, 317–322. http://dx.doi.org/10.1016/0022-1996(77)90048-4

Butkiewicz, J. L., & Gordon, L. R. C. (2013). "The Economic Growth Effect of Offshore Banking in Host Territories: Evidence from the Caribbean." *World Development*, 44, 165–179. https://doi.org/10.1016/j.worlddev.2012.09.017

Butkiewicz, J. L., & Yanikkaya, H. (2004). "The Effects of IMF and World Bank Lending on Long-Run Economic Growth: An Empirical Analysis." *World Development*, 33, 371–391. https://doi.org/10.1016/j.worlddev.2004.09.006

Çetintaş, H., & Barişik, S. (2009). "Export, import and economic growth: The case of transition economies." *Transition Studies Review*, 15(4), 636–649. https://doi.org/10.1007/s11300-008-0043-0

Edwards, S. (1998). "Openness, productivity and growth: What do we really know?" *Economic Journal*, 108(447), 383–398. https://doi.org/10.1111/1468-0297.00293

Eller, M., Haiss, P., & Steiner, K. (2005). "Foreign direct investment in the financial sector: The engine of growth for central and eastern Europe? " *EuropInstitut Working Paper* No. 69, Vienna University of Economics and Business Administration. http://dx.doi.org/10.2139/ssrn.875614

Feder, G. (1982). "On Export and Economic Growth." *Journal of Development Economics*, 12: 59-73.

Fofana, K. H., Xia, E., & Traore, M. B. (2018). "Foreign direct investment, exports and economic growth: Pooled mean group (PMG) and causality analysis for west Africa." In ACM International Conference Proceeding Series (pp. 23–27). Association for Computing Machinery. https://doi.org/10.1145/3194188.3194195

Halpern, L. (1992). "The effect of costs and subsidies on trade reorientation in Hungary (1981-1990)." *Structural Change and Economic Dynamics*, 3(2), 403–419. https://doi.org/10.1016/0954-349X(92)90016-Y

Hoppe, M. (2005). "Technology transfer through trade. " Nota di Lavoro No. 19.2005. Fundazione Eni Enrico Mattei.

Islam, F., Adnan Hye, Q. M., & Shahbaz, M. (2012). "Import-economic growth nexus: ARDL approach to cointegration." *Journal of Chinese Economic and Foreign Trade Studies*, 5(3), 194–214. https://doi.org/10.1108/17544401211263964

Jarreau, J., & Poncet, S. (2012). "Export sophistication and economic growth: Evidence from China." *Journal of Development Economics*, 97(2), 281–292. https://doi.org/10.1016/j.jdeveco.2011.04.001

Jung, W. S., & Marshall, P. J. (1985). "Exports, growth and causality in developing countries." *Journal of Development Economics*, 18(1), 1–12. https://doi.org/10.1016/0304-3878(85)90002-1

Kaplinsky, R., & Morris, M. (2009). "The Asian drivers and SSA: Is there a future for export-oriented African industrialisation?" *World Economy*, 32(11), 1638–1655. https://doi.org/10.1111/j.1467-9701.2009.01253.x

Lahrech, A. (2019). "The Relation Between Trade and Economic Growth a Study of the Case of Morocco." *International Institute of Social and Economic Sciences*. https://doi.org/10.20472/iac.2018.039.025

Lawrence, R. Z., & Weinstein, D. E. (2014). "Trade and growth: import-led or export-led? Evidence from Japan and Korea." *NBER Working Paper Series*, (1), 1–5.

Mishra, P. K. (2012). "The Dynamics of the Relationship between Imports and Economic Growth in India." *South Asian Journal of Macroeconomics and Public Finance*, 1(1), 57–79. https://doi.org/10.1177/227797871200100105

Munirathinam, R., Reed, M. R., & Marchant, M. A. (1998). "Effects of the Canada-U.S. Trade agreement on U.S. Agricultural exports. " *International Food and Agribusiness Management Review*, 1(3), 403–415. https://doi.org/10.1016/s1096-7508(99)80008-1

Pérez-Toro, J. A. (2005). "Review On The Export Promotion Policies Launched By The Colombian Government. 1967-1980." *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.187968

Saqib, N., Masnoon, M., & Rafique, N. (2013, January 28). "Impact of foreign direct investment on economic growth of Pakistan. " *SSRN.* Retrieved February 24, 2023, from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2207626

Solow, R. M. (1956). "A contribution to the theory of economic growth." *Quarterly Journal of Economics*, 70(1), 65–94. https://doi.org/10.2307/1884513

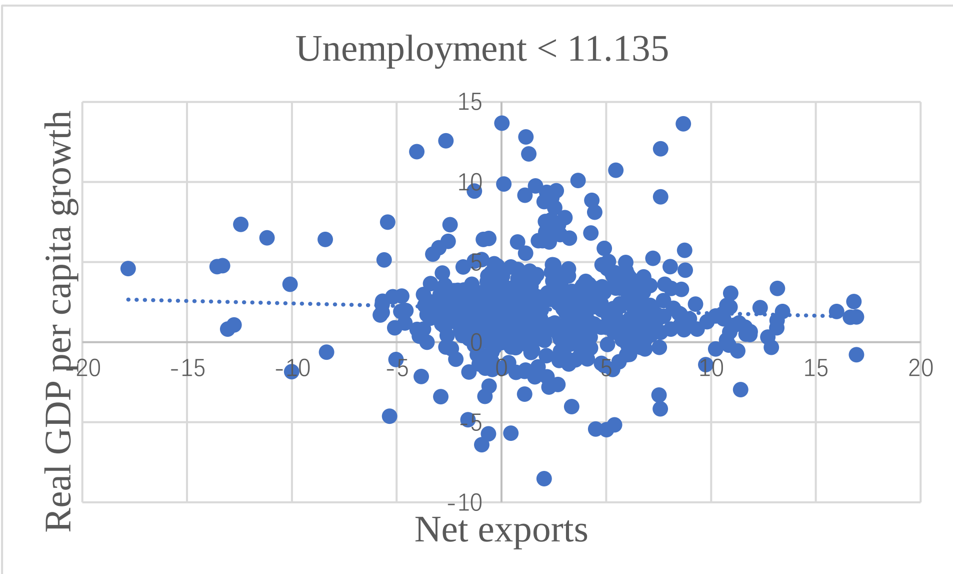
Tsaurai, K., & Odhiambo, N. M. (2012). "A dynamic causality test of exports and economic growth in Zimbabwe." *International Journal of Economic Policy in Emerging Economies*, 5(3), 231–242.

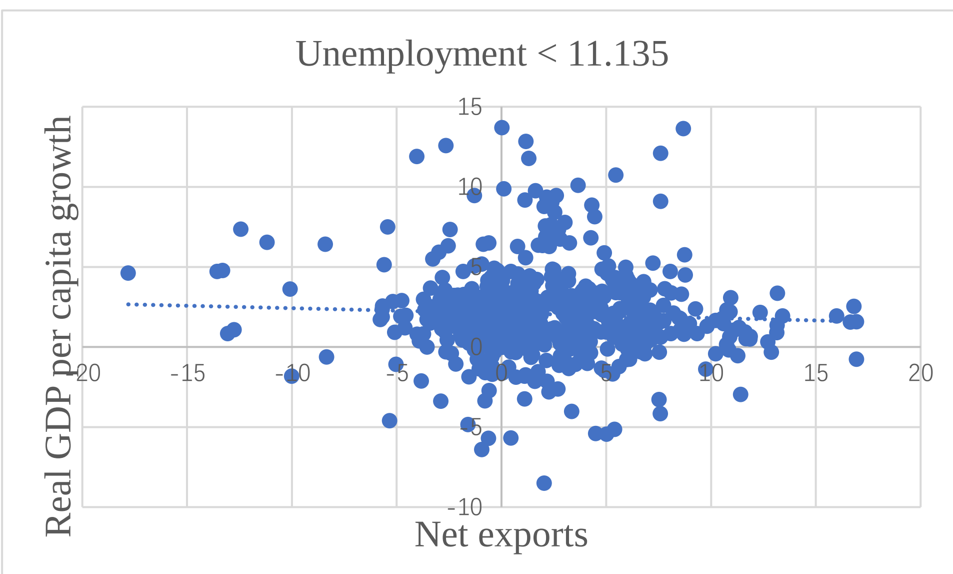
Wang, Q. (2015). "Fixed-effect panel threshold model using Stata." *Stata Journal*, 15(1), 121–134. https://doi.org/10.1177/1536867x1501500108

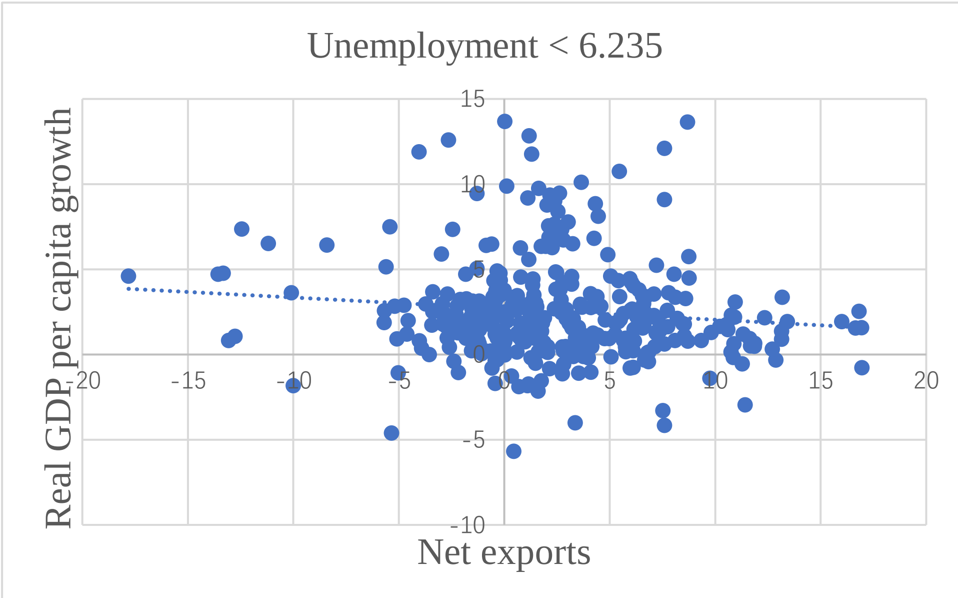
Zou, H.-F., Zhang, X., & Bank, W. (1999). "Foreign Technology Imports and Economic Growth in Developing Countries. Foreign Technology Imports and Economic Growth in Developing Countries." *World Bank Publications*.

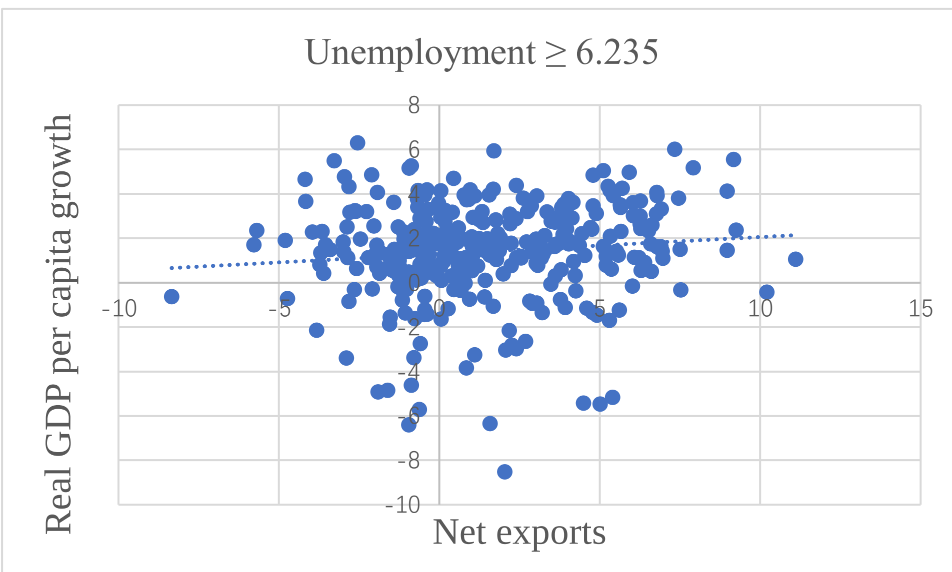
Appendix A: RELATIONSHIPS BETWEEN GROWTH AND NET EXPORTS

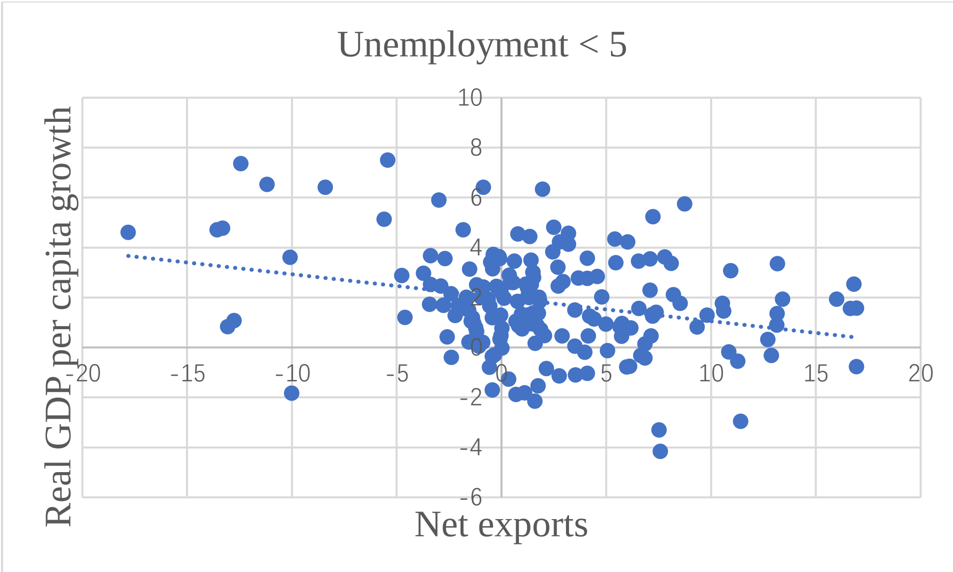
A1: Thresholds of Unemployment Rate under Four Categories

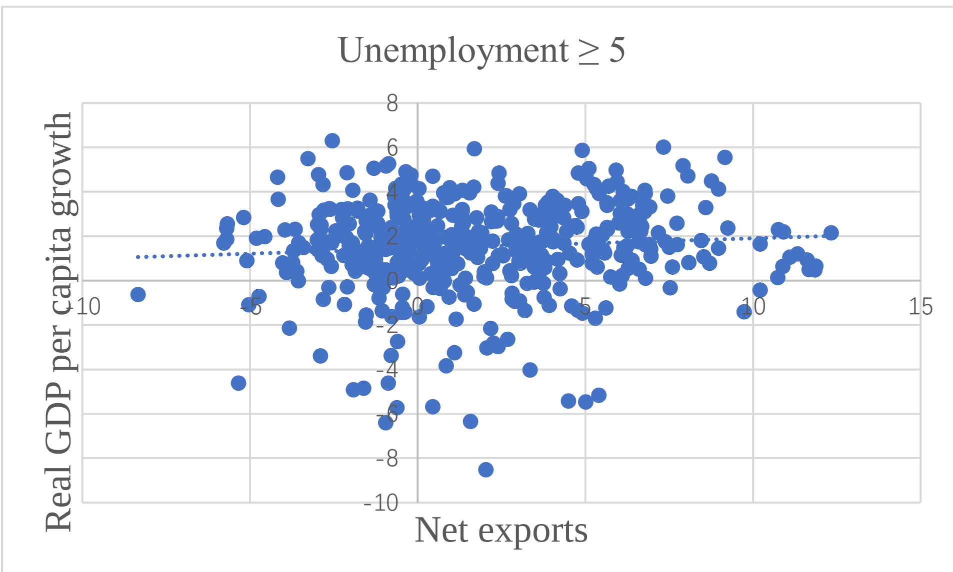


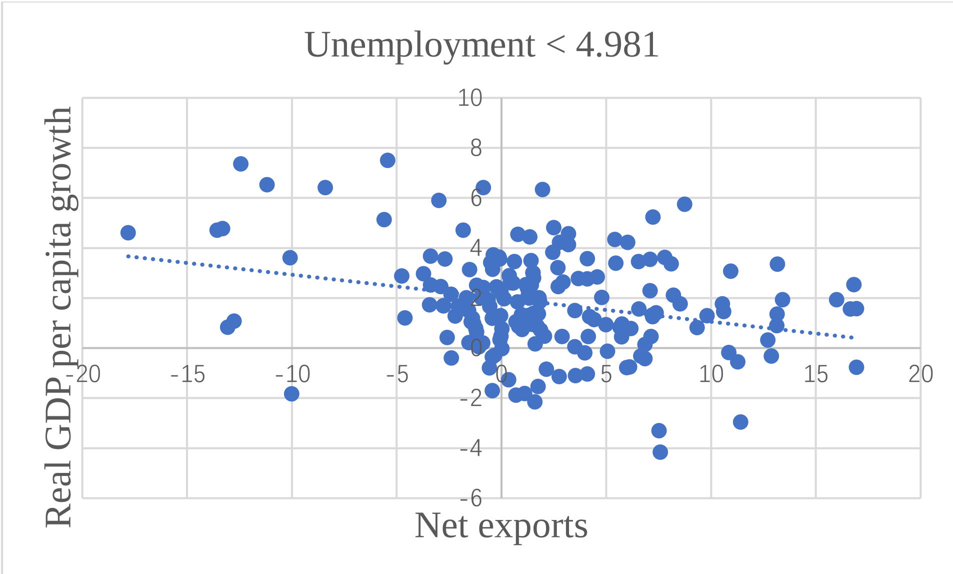


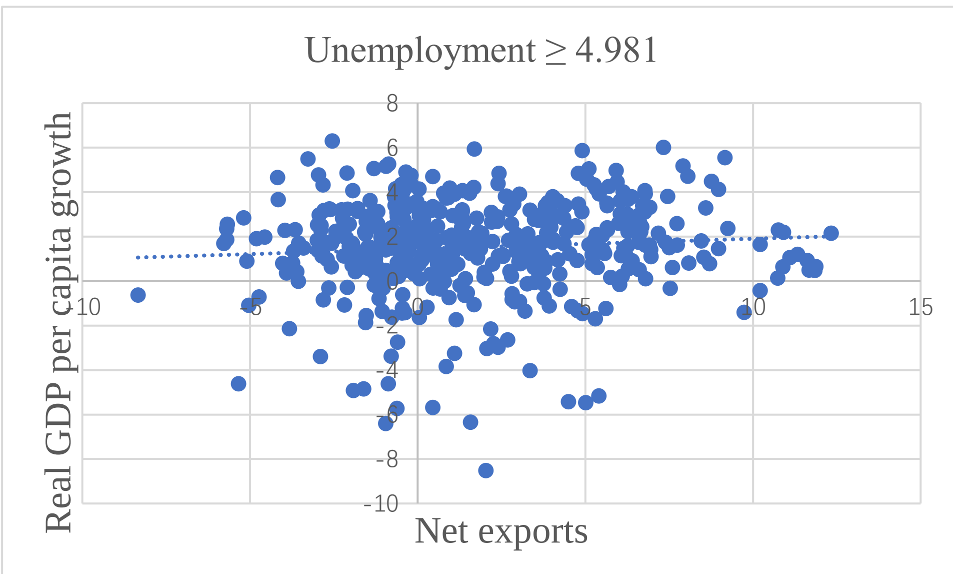

Unemployment < 6.235
Real GDP per capita growth
Net exports
15
10
5
0
-5
-10
-20
-15
-10
-5
0
5
10
15
20

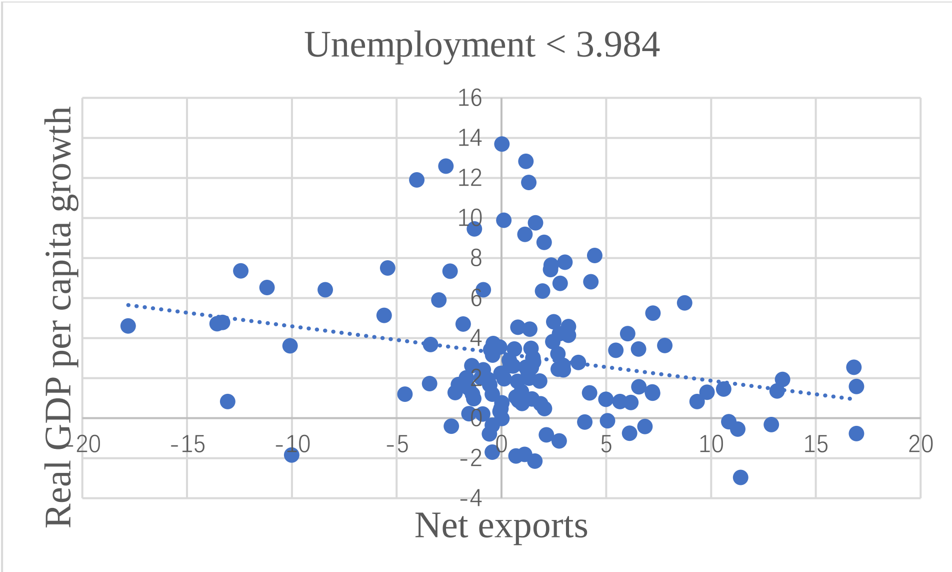

Unemployment ≥ 6.235
Real GDP per capita growth
Net exports
8
6
4
2
0
-2
-4
-6
-8
-10
-10
-5
0
5
10
15

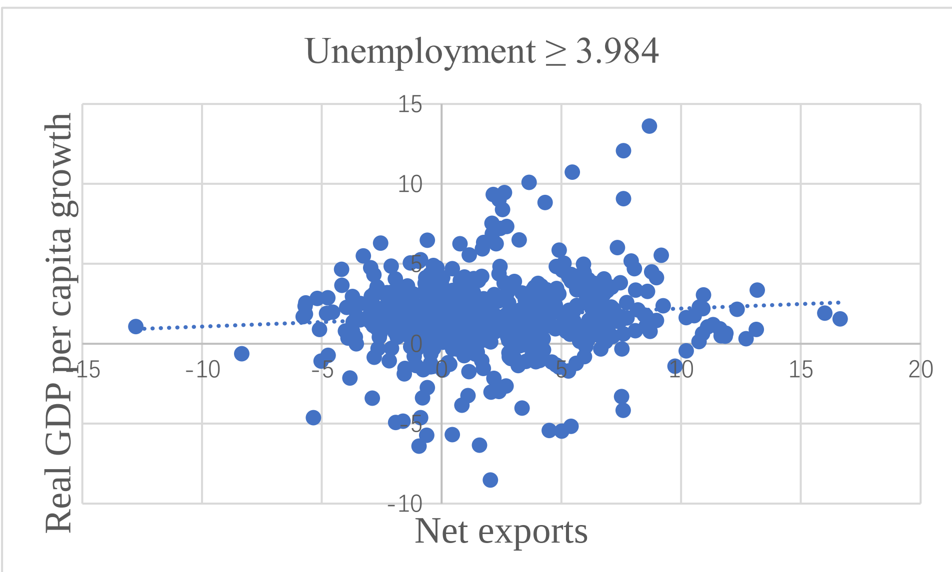

Unemployment < 5
Real GDP per capita growth
Net exports
10
8
6
4
2
0
-2
-4
-6
-20
-15
-10
-5
0
5
10
15
20


Unemployment ≥ 5
Real GDP per capita growth
Net exports
8
6
4
2
0
-2
-4
-6
-8
-10
-10
-5
0
5
10
15

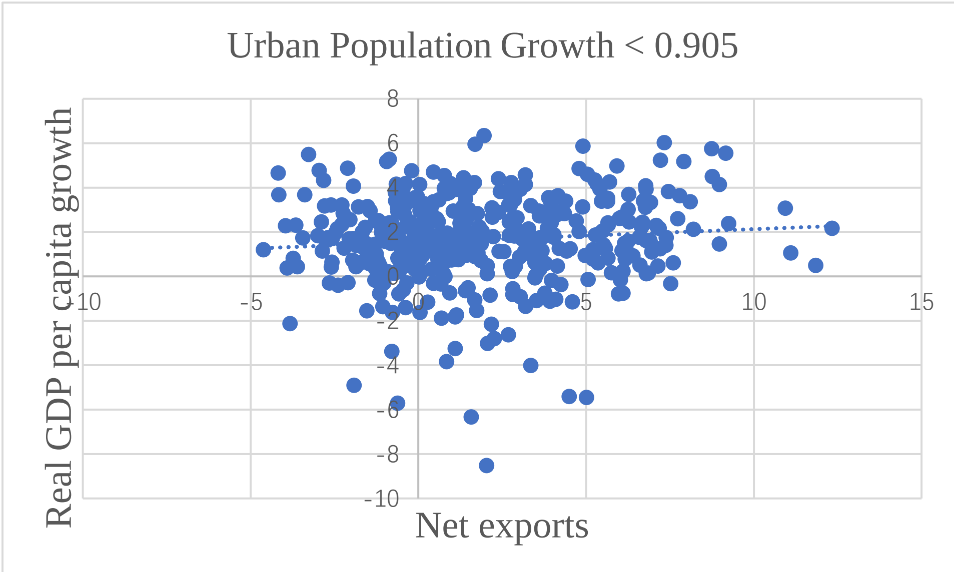

Unemployment < 4.981
Real GDP per capita growth
Net exports
10
8
6
4
2
0
-2
-4
-6
-20
-15
-10
-5
0
5
10
15
20

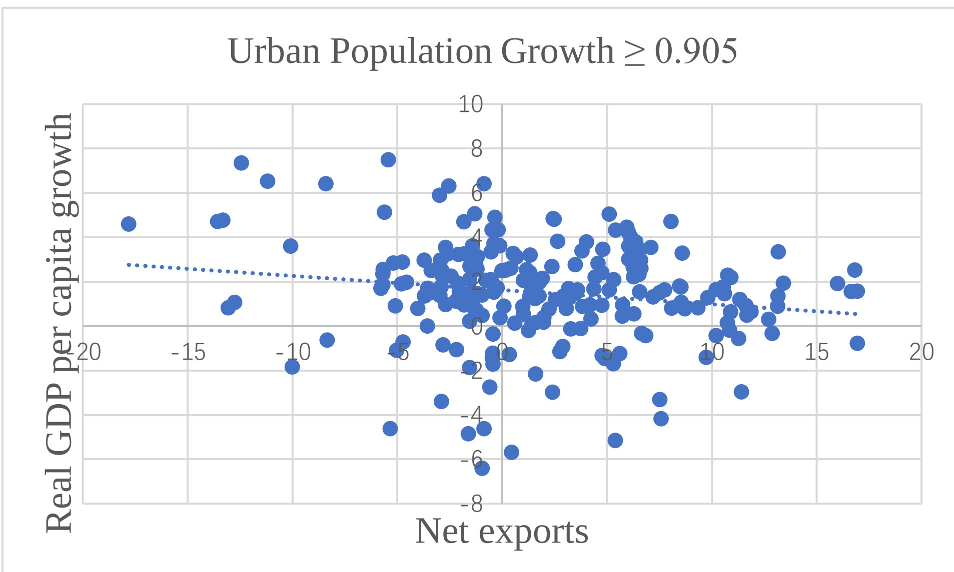

Unemployment ≥ 4.981
Real GDP per capita growth
Net exports
8
6
4
2
0
-2
-4
-6
-8
-10
-10
-5
0
5
10
15

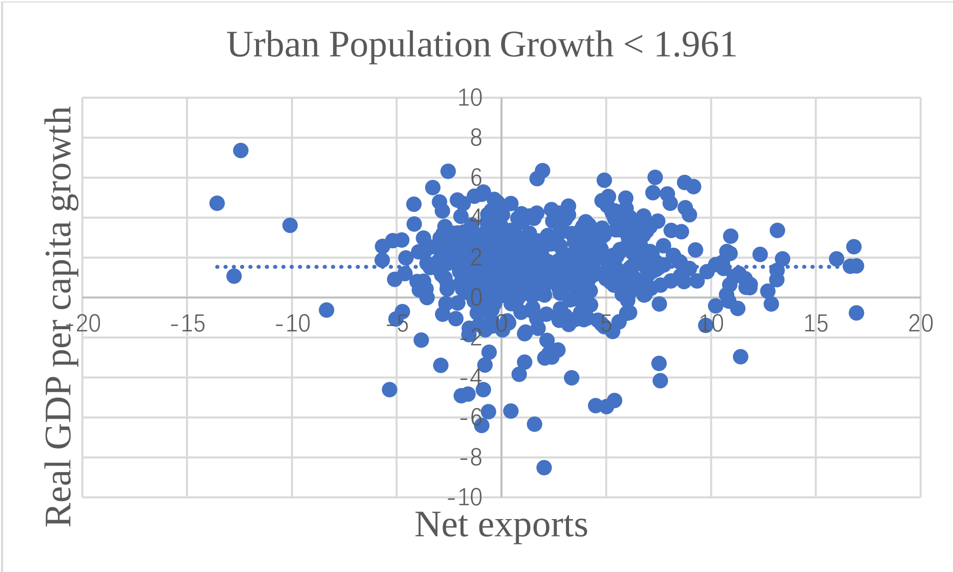

Unemployment < 3.984
Real GDP per capita growth
Net exports
16
14
12
10
8
6
4
2
0
-2
-4
-20
-15
-10
-5
0
5
10
15
20

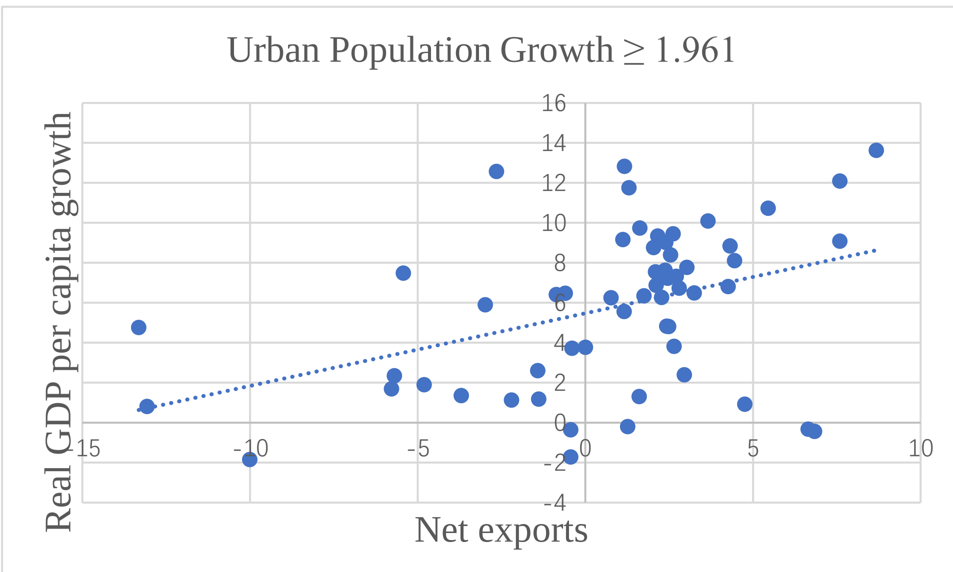

Unemployment ≥ 3.984
Real GDP per capita growth
Net exports
15
10
5
0
-5
-10
-15
-10
-5
0
5
10
15
20

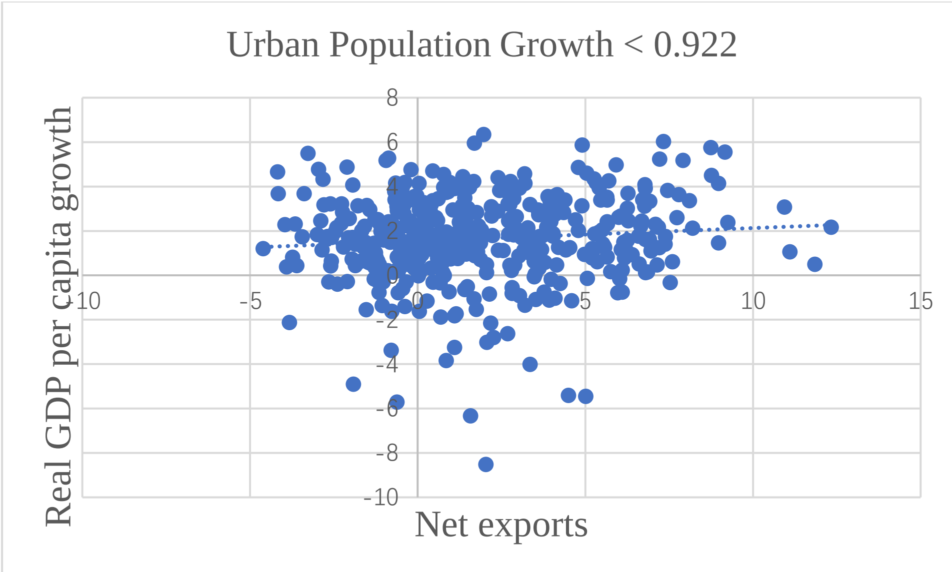
A2: Thresholds of Urban Population Growth Rate under Four Categories:

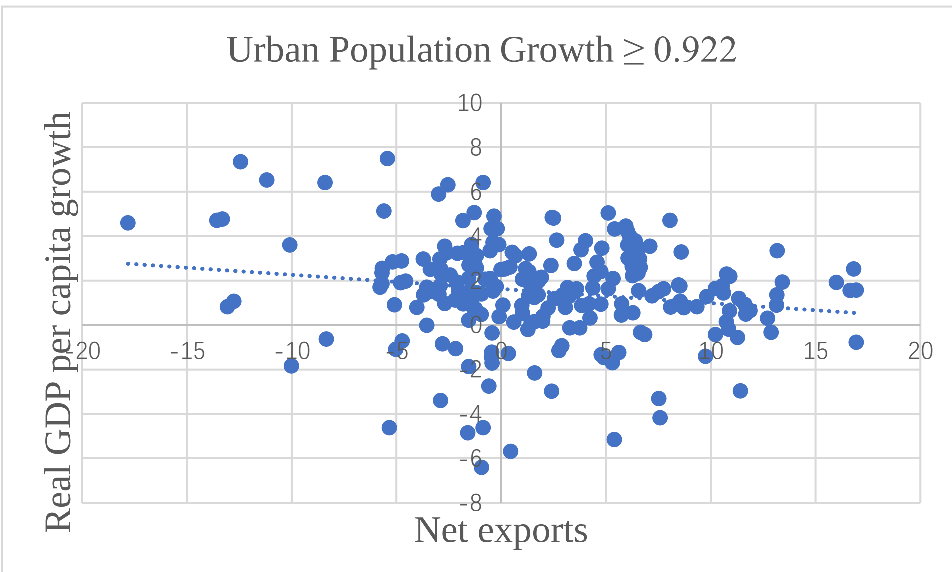


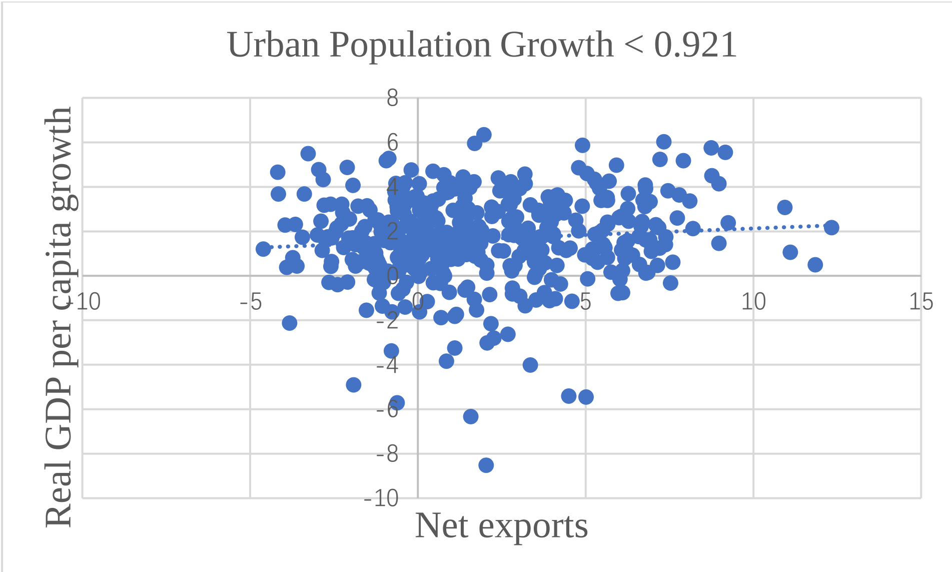


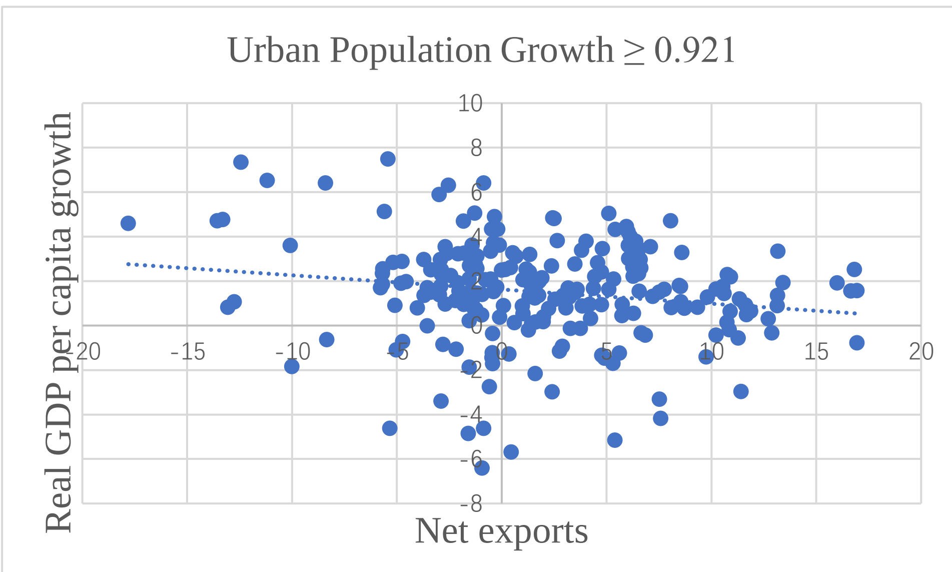

Urban Population Growth < 1.961
Real GDP per capita growth
Net exports
10
8
6
4
2
0
-2
-4
-6
-8
-10
-20
-15
-10
-5
0
5
10
15
20

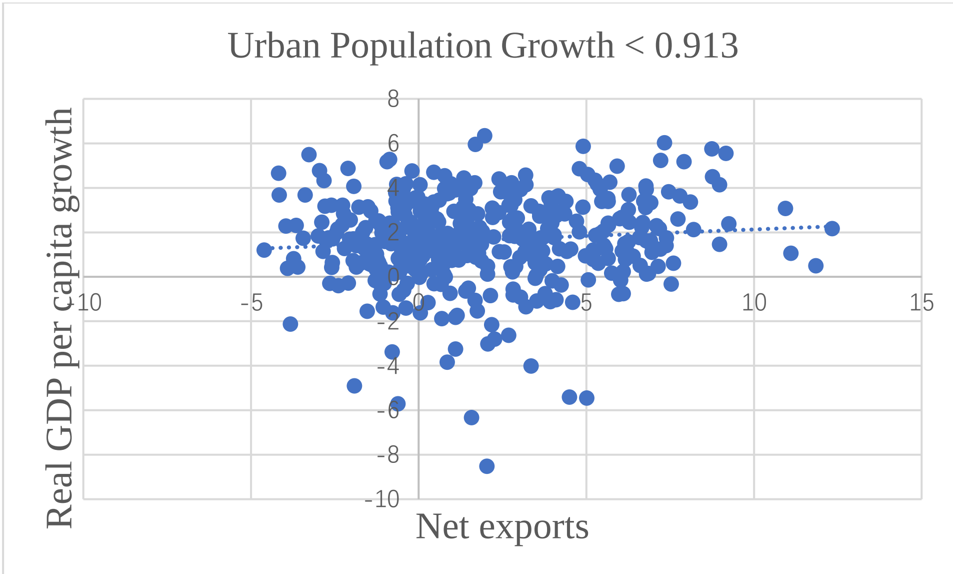

Urban Population Growth ≥ 1.961
Real GDP per capita growth
Net exports
16
14
12
10
8
6
4
2
0
-2
-4
-15
-10
-5
0
5
10

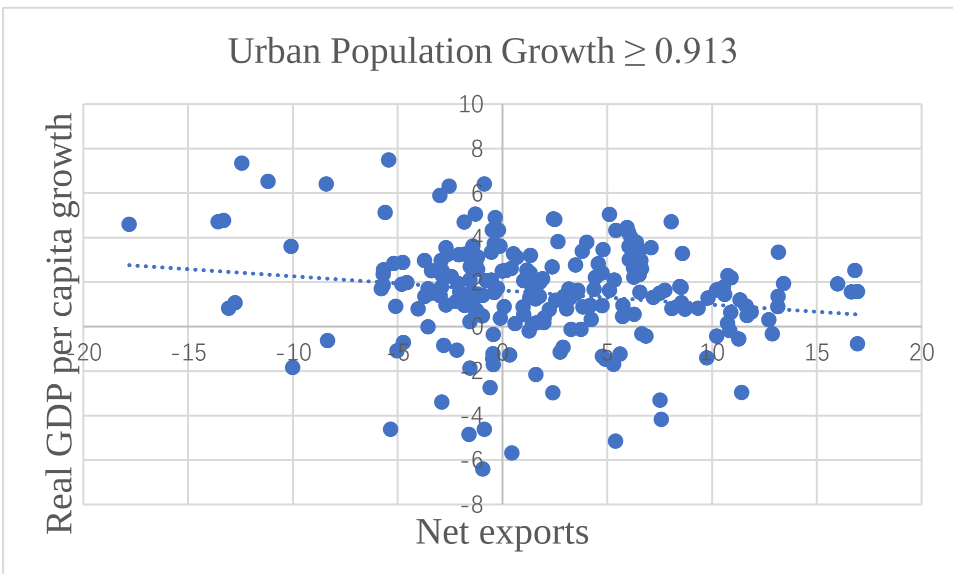

Urban Population Growth < 0.922
Real GDP per capita growth
Net exports
8
6
4
2
0
-2
-4
-6
-8
-10
-10
-5
0
5
10
15


Urban Population Growth ≥ 0.922
Real GDP per capita growth
Net exports
10
8
6
4
2
0
-2
-4
-6
-8
-20
-15
-10
-5
0
5
10
15
20

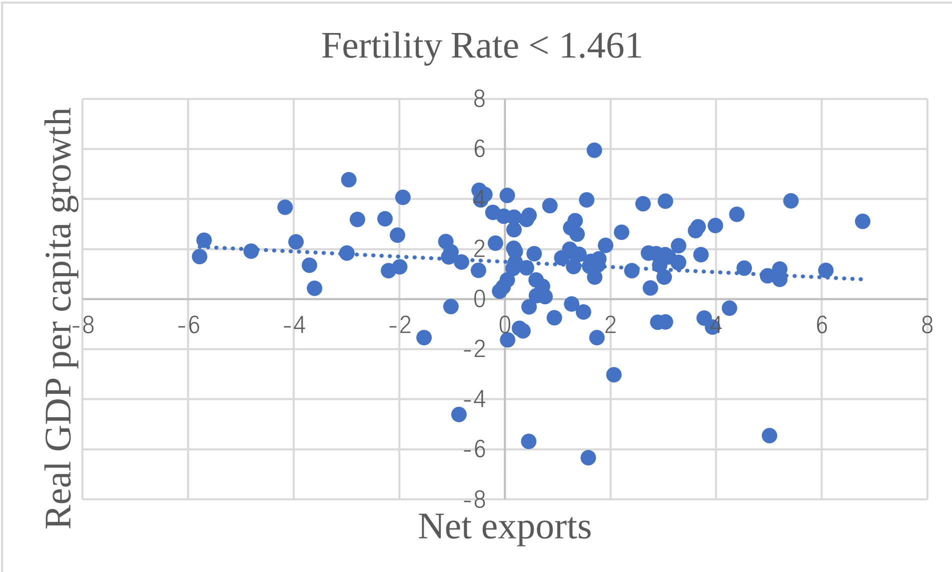

Urban Population Growth < 0.921
Real GDP per capita growth
Net exports
8
6
4
2
0
-2
-4
-6
-8
-10
-10
-5
0
5
10
15

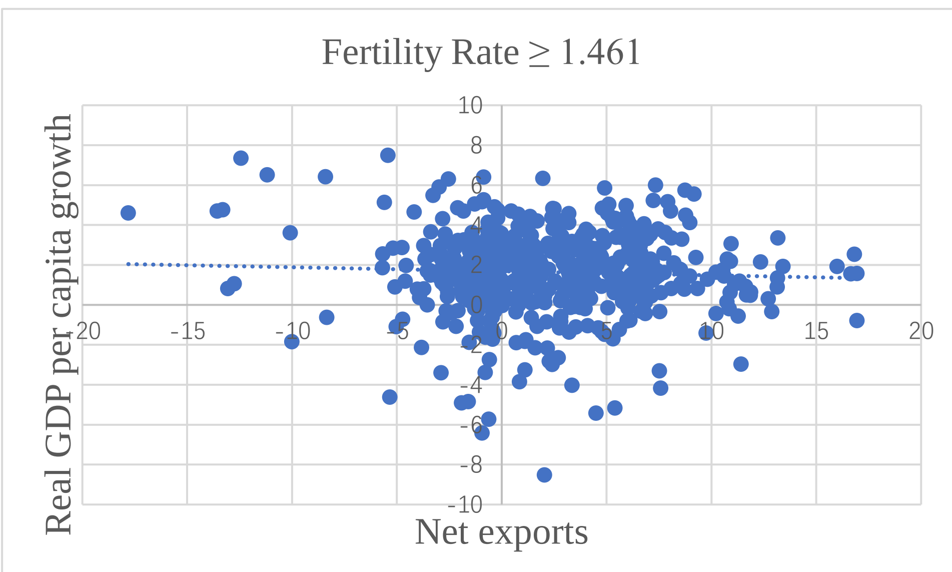

Urban Population Growth ≥ 0.921
Real GDP per capita growth
Net exports
10
8
6
4
2
0
-2
-4
-6
-8
-20
-15
-10
-5
0
5
10
15
20

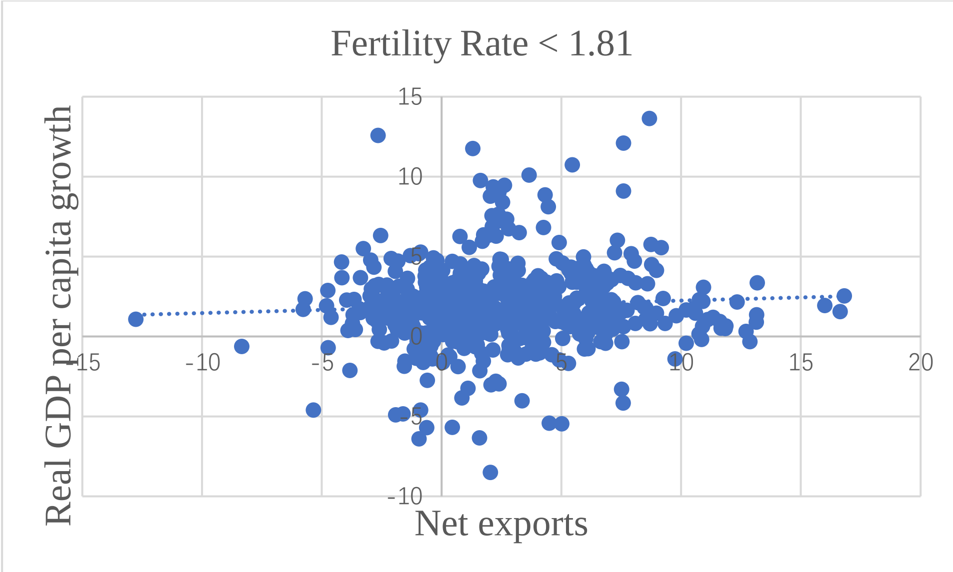

Urban Population Growth < 0.913
Real GDP per capita growth
Net exports
8
6
4
2
0
-2
-4
-6
-8
-10
-10
-5
0
5
10
15

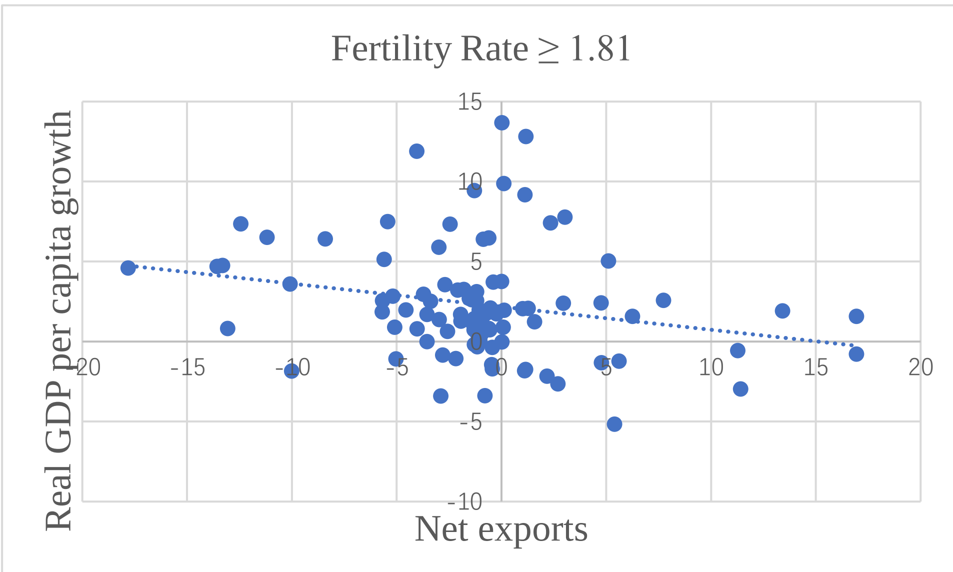

Urban Population Growth ≥ 0.913
Real GDP per capita growth
Net exports
10
8
6
4
2
0
-2
-4
-6
-8
-20
-15
-10
-5
0
5
10
15
20

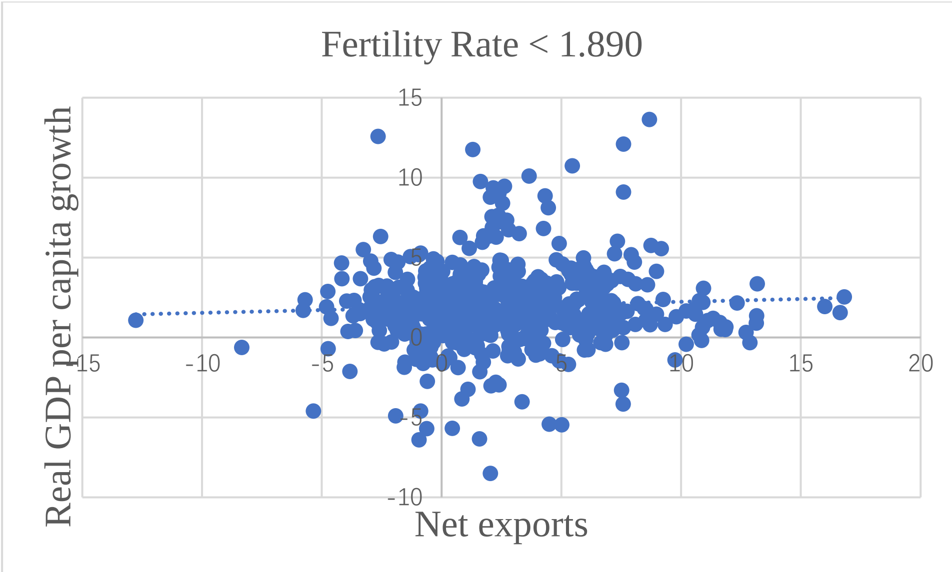
A3: Thresholds of Fertility Rate under Four Categories:

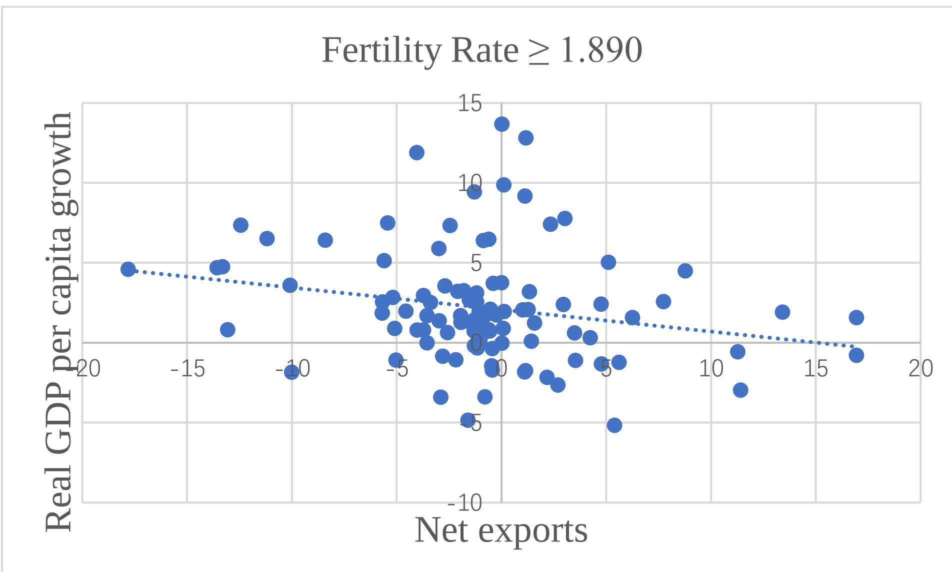





Fertility Rate < 1.81
Real GDP per capita growth
Net exports
15
10
5
0
-5
-10
-15
-10
-5
0
5
10
15
20


Fertility Rate ≥ 1.81
Real GDP per capita growth
Net exports
15
10
5
0
-5
-10
-20
-15
-10
-5
0
5
10
15
20


Fertility Rate < 1.890
Real GDP per capita growth
Net exports
15
10
5
0
-5
-10
-15
-10
-5
0
5
10
15
20


Fertility Rate ≥ 1.890
Real GDP per capita growth
Net exports
15
10
5
0
-5
-10
-20
-15
-10
-5
0
5
10
15
20