The Relationship between Population Growth and Economic Growth: the Case of Vietnam

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Abstract

The relationship between population growth and economic growth is still controversial in the literature. This article employs the Vector Autoregression (VAR) model and Granger causality test to examine the long run relationship between population growth and economic growth in Vietnam using the time series data from 1990 to 2021. The estimated results indicate that there exists a bidirectional relationship between population growth and economic growth in Vietnam. However, the population growth has had a negative impact on real per-capita income growth of the country at the same time. The findings of this research can be used as a reference point to carry out further research in this area in Asia and beyond. Some policy implications for Vietnam are also proposed.

JEL Classification: C22, J01, J11, J21, O11, O15,

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1. Introduction

According to Solow, Capital by itself cannot explain sustained economic growth, so to explain the sustained economic growth observed in most parts of the world Mankiw (2010) proposed to expand the Solow model to incorporate the other two sources of economic growth (population growth and technological progress) (Jacob et al., 2016). One of the most prominent theories of population growth is that of Malthus (1798), which states that population growth contributes negatively to per capita income and deteriorates human development index. However, technology development has made almost obsolete Malthus' theory of population growth especially in the fourth of industrial revolution. Yet many countries are still implementation policies of birth control, through family planning and contraception. The World Bank and the International Monetary Fund are putting pressure on developing countries to control birth rate growth. Countries like China, Indonesia… are still putting restrictive policies on birth. This situation has pushed us to formulate the research question that: does population growth deteriorate economic growth and per-capita income? To be able to answer this question, the author selected Vietnam, one of the most populated developing countries in the world to examine the impact of population growth on economic growth and per-capita income. Vietnam was selected just because the country has been experiencing a profound population transition over the last few decades. Vietnam entered the period of the "demographic window of opportunity" with a large young labor force and the stage of "aging population" at the same time. These demographic changes suggest that appropriate strategies and policies are needed for taking advantage of population changes for economic growth while eliminating any possible negative impact. This study was just undertaken with the following purposes: (1) analyzing economic growth and population growth of Vietnam for the past decades; (2) evaluating the impact of population growth on economic growth as well as on

per-capita income using the Vector Autoregression (VAR) model and Granger causality test; (3) Based on the results, the author will propose some policy implications for Vietnam in the future.

2. Literature Review

There are a number of well-known theories that relate population growth and income levels from the original Malthusian hypotheses to the more recent Kremerian model. These theories give a clear-cut way of thinking about the relationship between these two variables of key economic relevance. However, empirical work has lagged behind, and there is very little systematic evidence on the relationship (Jacob et al., 2016).

The relationship between population growth and economic growth is trapped in a dilemma of two contradictory Models: the Malthusian model and Kremerian model. While Malthus states that population growth as a threat to rising living standards, economist Michael Kremer has suggested that world population growth is a key driver of advancing economic prosperity. If there are more people, Kremer argues, then there are more scientists, inventors, and engineers to contribute to innovation and technological progress. As evidence for this hypothesis, Kremer begins by noting that over the broad span of human history, world growth rates have increased together with world population. This fact is consistent with the hypothesis that having more people induces more technological progress (Mankiw, 2010).

Regardless of the contradictory nature in the conclusion on the relationship between population growth and economic growth, scholars are still dangling to prove their points of views (Jacob et al., 2016). There are a few numbers of empirical studies on the relationship between population and economic growth. A majority of them uses cross-section regression to analyse the relationship between the two variables (Easterlin 1967; Thirlwall 1972; Simon 1992; Kelley and Schmidt 1996; Ahlburg 1996). Some of them found no statistically significant relationship between population growth and economic growth while other studies were not able to come to conclusive results. Dawson and Tiffin (1998) used annual time series data over the period 1950-1993 to analyse the long-run relationship between population growth and economic growth in India. The study employed cointegration and Granger causality methods and reported that there is no long-run relationship between the two variables. Moreover, population growth neither Granger causes economic growth nor is caused by it. Thornton (2001) conducted similar research on the long-run relationship between population growth and economic growth in seven Latin American countries, namely, Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela. The study used annual time series data generally over the period 1900-1994 and employed the same methods of analysis as Dawson and Tiffin (1998). The study concluded that there is no long-run relationship between the two variables in any of the seven countries. In other study, Jung and Quddus (1986) employed standard Granger causality tests to examine the linkage between population growth and economic development with annual data from several developing countries. They found no clear evidence for any causal relationship between the two variables. Kapuria-Foreman (1995) also employed the standard Granger causality tests and they reported that population growth and economic development displayed a distinct pattern of causal characterization (Darrat et al., 1999). Furuoka (2005) conducted a study on population growth and economic development (GDP) in Malaysia using Engle-Granger method and Johansen cointegration test. He found that there exists a long-run cointegration relationship between population growth and GDP as well as a bidirectional causal relation in the short-run. Simon (1989) argued that population and economic development are essentially related over the long-run horizon and should possess

minimal tendency for a short-run relationship. Another study done by Tsen and Furuoka (2005) on population and economic growth in Asian economies, including Malaysia, indicated that there is cointegration relationship between economic growth and population in Malaysia. They also found that economic growth Granger causes population growth. They used Johansen and Gregory-Hansen approaches for cointegration test and standard Granger causality test to test the existence of causal relation between the variables (Jacob et al., 2016).

Recently, Wesley and Peterson (2017) state that low population growth in high-income countries is likely to create social and economic problems while high population growth in low-income countries may slow their development. Others argue that population growth has been and will continue to be problematic as more people inevitably use more of the finite resources available on earth, thereby reducing long-term potential growth (Linden, 2017). Lianos et al. (2022) examined the relationship between population growth and economic growth in five industrialized countries (US, UK, Germany, France and Italy) for the periods 1820-1938 and 1950-2016. Using Toda-Yamamoto Granger causality tests and Sim's causality test it was found that the direction of causality during the former period was from population to GDP or bidirectional while for the latter period, it was from GDP to population.

From the review of related literature, it is obviously that the relationship between population growth and economic growth is still controversial. Until now, the literature has proposed three broad approaches to the analysis of this deep-rooted issue (Bloom et al., 2003). According to the Pessimistic View, population growth unambiguously hinders economic growth (Malthus, 1798; Kelley, 1988). In contrast, the Optimistic View, the population growth fuels economic growth. This is the main message coming from Kuznets (1960, 1967), Simon (1981), Boserup (1989), Kremer (1993) and recent contributions include Jones (2001a), Tamura (2002, 2006), Jacob (2016), Shamsul et al. (2020) and Lianos et al. (2022). A third view on the relationship between population growth and economic growth is the so-called Population Neutralism View. Accordingly, they analyzed the statistical correlation between population change and economic growth with adding other factors such as country size, openness to trade, educational attainment of the population and the quality of existing institutions. Their main findings show that there exists little cross-country evidence that population growth might either slow down or encourage economic growth (Bloom et al., 2003, p. 17). For the case of Vietnam, to the best of the author's knowledge, no study has evaluated the impact of population growth on economic growth as well as on real per-capita income using VAR model and Granger causality test with the most updated data.

3. An Analysis of Vietnam's Population Growth and Economic Growth

Table 3.1 below expresses Vietnam's population growth between 1955 and 2020. Given Vietnam's turbulent history, the country is making great strides in population growth. Currently, in 2022, Vietnam's population is 99.3 million people, a number expected to hit 100 million by the end of 2024. Vietnam's population is projected to hit its peak of 109.78 million people in 2054.

Vietnam's population is increasing by about 1% each year, adding about 1 million people per year. Despite this, the annual population growth rate is decreasing each year and eventually, the population will begin decreasing after 2055.

Vietnam's fertility rate in 1980 was 5 births per woman, which has decreased to 2.0 births per woman. This is the result of the government's "two-child policy" that limits births by issuing contraception.

Further consistent growth followed, even through the long years of the Vietnam war which you may have been assumed to have a negative sort of impact on the population of Vietnam. In fact, growth continued at a similar level throughout the second half of the 1900's and has continued further to the point where the Vietnam population of 2014 stands at just short of 93 million.

From the years of 1955 to 1990, Vietnam enjoyed positive yearly population changes of over 2% - even as much as 3% in some years. However, since that time, the increase percentage has fallen to just below a full 1%.

Table 3.1. Population of Vietnam (2020 and historical).

Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Vietnam Global Rank
2020	**97,338,579**	0.91 %	876,473	-80,000	32.5	2.06	314	37.7 %	36,727,248	1.25 %	7,794,798,739	15
2019	**96,462,106**	0.96 %	916,144	-80,000	30.9	1.98	311	37.0 %	35,686,730	1.25 %	7,713,468,100	15
2018	**95,545,962**	1.00 %	945,314	-80,000	30.9	1.98	308	36.3 %	34,658,961	1.25 %	7,631,091,040	15
2017	**94,600,648**	1.03 %	960,226	-80,000	30.9	1.98	305	35.6 %	33,642,498	1.25 %	7,547,858,925	15
2016	**93,640,422**	1.04 %	963,346	-80,000	30.9	1.98	302	34.9 %	32,635,787	1.25 %	7,464,022,049	15
2015	**92,677,076**	1.05 %	941,885	-80,000	30.5	1.96	299	34.1 %	31,635,369	1.26 %	7,379,797,139	14
2010	**87,967,651**	0.97 %	826,998	-159,994	28.5	1.93	284	30.6 %	26,910,696	1.26 %	6,956,823,603	13
2005	**83,832,661**	0.96 %	784,450	-130,200	26.4	1.92	270	27.4 %	23,000,555	1.28 %	6,541,907,027	13
2000	**79,910,412**	1.30 %	999,990	-43,200	24.2	2.25	258	24.5 %	19,568,590	1.30 %	6,143,493,823	13
1995	**74,910,461**	1.96 %	1,384,320	-78,847	22.3	3.23	242	22.3 %	16,668,571	1.30 %	5,744,212,979	13
1990	**67,988,862**	2.23 %	1,418,428	-66,465	21.1	3.85	219	20.3 %	13,817,423	1.28 %	5,327,231,061	13
1985	**60,896,721**	2.33 %	1,322,975	-65,513	20.0	4.60	196	19.6 %	11,942,117	1.25 %	4,870,921,740	13
1980	**54,281,846**	2.19 %	1,112,731	-171,779	19.1	5.50	175	19.3 %	10,464,982	1.22 %	4,458,003,514	15
1975	**48,718,189**	2.34 %	1,062,679	na	18.3	6.33	157	18.8 %	9,152,476	1.19 %	4,079,480,606	17
1970	**43,404,793**	2.77 %	1,109,168	na	18.2	6.46	140	18.3 %	7,943,534	1.17 %	3,700,437,046	17
1965	**37,858,951**	2.99 %	1,037,782	na	19.2	6.42	122	16.4 %	6,216,854	1.13 %	3,339,583,597	18
1960	**32,670,039**	3.02 %	904,519	na	21.9	6.16	105	14.7 %	4,802,582	1.08 %	3,034,949,748	17
1955	**28,147,443**	2.56 %	667,508	na	23.6	5.40	91	13.1 %	3,685,807	1.02 %	2,773,019,936	18

Source: Worldometer, website: https://www.worldometers.info/world-population/vietnam-population/, accessed on 30/9/2022.

The population growth of Vietnam has seen in the recent past is expected to continue, however, at an increasingly slower rate. By 2035, the population will be growing half as quickly as it is today. It is projected that Vietnam's population will break 100 million by 2022 (See more in Table 3.2 and Figure 3.1 below).

Table 3.2. Vietnam Population Forecast.

Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Vietnam Global Rank
2020	**97,338,579**	0.99 %	932,301	-80,000	32.5	2.06	314	37.7 %	36,727,248	1.25 %	7,794,798,739	15
2025	**101,106,835**	0.76 %	753,651	-92,816	34.6	2.06	326	41.6 %	42,039,428	1.24 %	8,184,437,460	16
2030	**104,163,519**	0.60 %	611,337	-88,025	36.7	2.06	336	45.4 %	47,248,046	1.22 %	8,548,487,400	16
2035	**106,296,108**	0.41 %	426,518	-83,146	38.5	2.06	343	49.1 %	52,215,812	1.20 %	8,887,524,213	16

Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Vietnam Global Rank
2040	**107,795,031**	0.28 %	299,785	-83,147	39.7	2.06	348	52.8 %	56,944,758	1.17 %	9,198,847,240	16
2045	**108,901,037**	0.20 %	221,201	-82,955	40.4	2.06	351	56.4 %	61,416,054	1.15 %	9,481,803,274	17
2050	**109,605,011**	0.13 %	140,795	na	41.2	2.06	353	60.0 %	65,711,413	1.13 %	9,735,033,990	16

Source: Worldometer, website: https://www.worldometers.info/world-population/vietnam-population/, accessed on 30/9/2022.

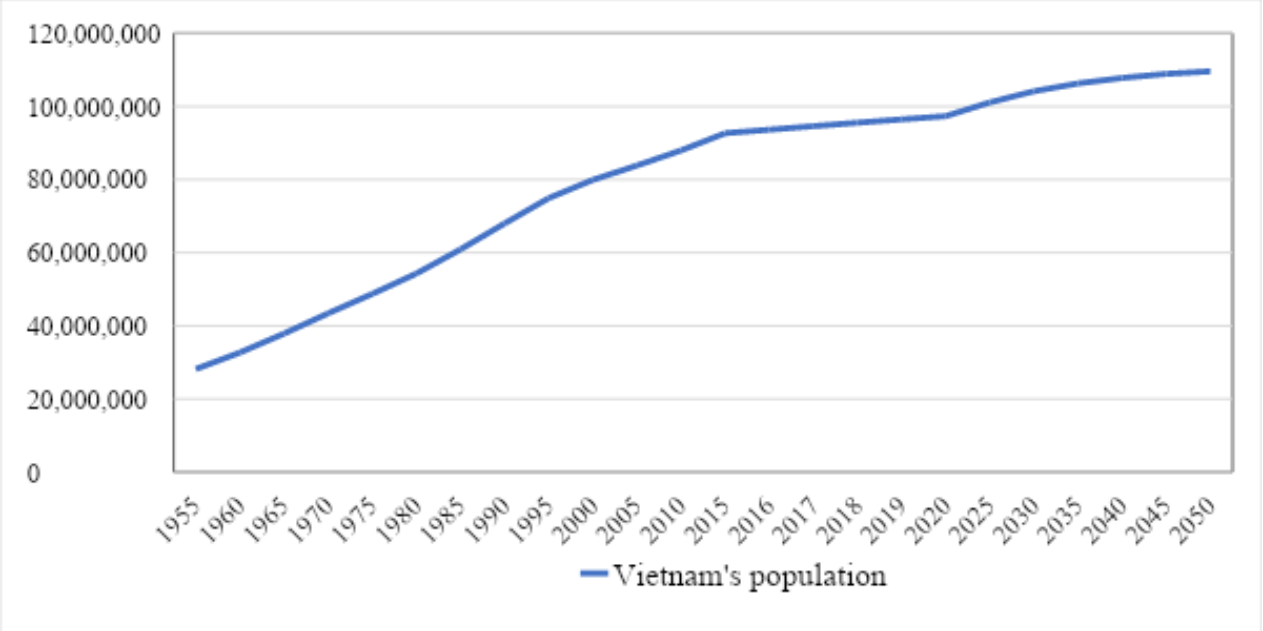

Figure 3.1. Vietnam's Population (Historical and Forecast).

Source: Worldometer, website: https://www.worldometers.info/world-population/vietnam-population/, accessed on 30/9/2022.

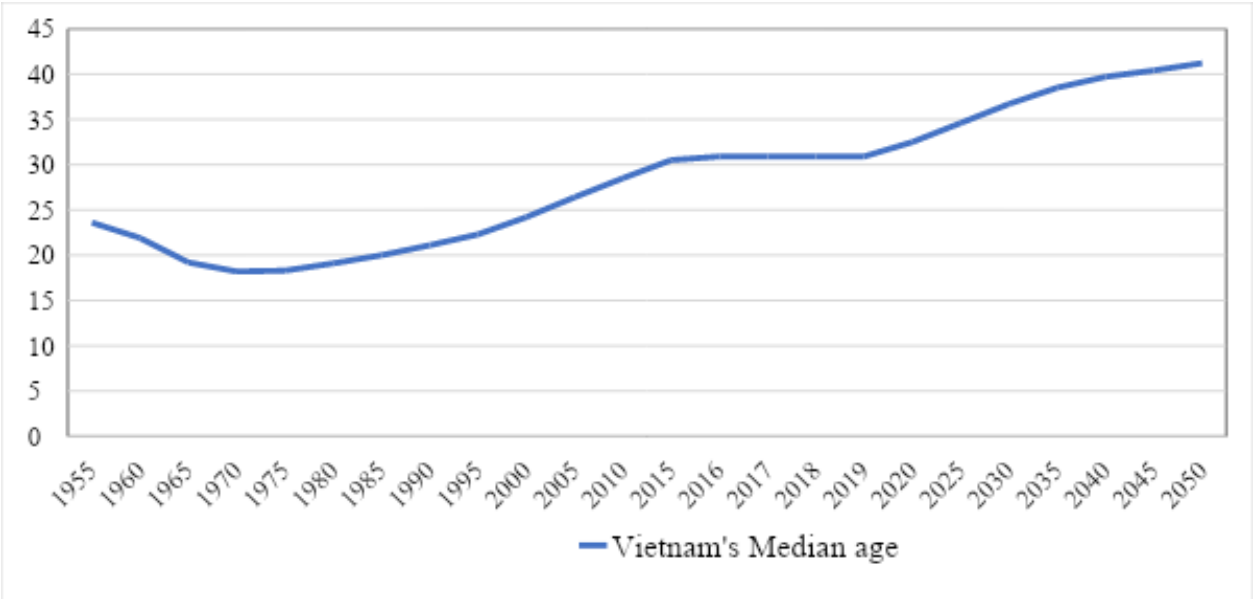

Figure 3.2. Vietnam's Median Age (Historical and Forecast).

Source: Worldometer, website: https://www.worldometers.info/world-population/vietnam-population/, accessed on 30/9/2022.

Figure 3.2 above depicts the median age of Vietnam's population from 1955 to 2050 (as forecasted by the World Bank). We clearly see the increasing trend of the median age in the population of Vietnam. If in 1955 the median age of the population of Vietnam was 23.6, by 2050 it will increase to 41.2. Currently in 2022, the median age of Vietnam's population is about 33 and Vietnam is still in the golden population phase. This means that Vietnam's population will be in aging phase in the coming years.

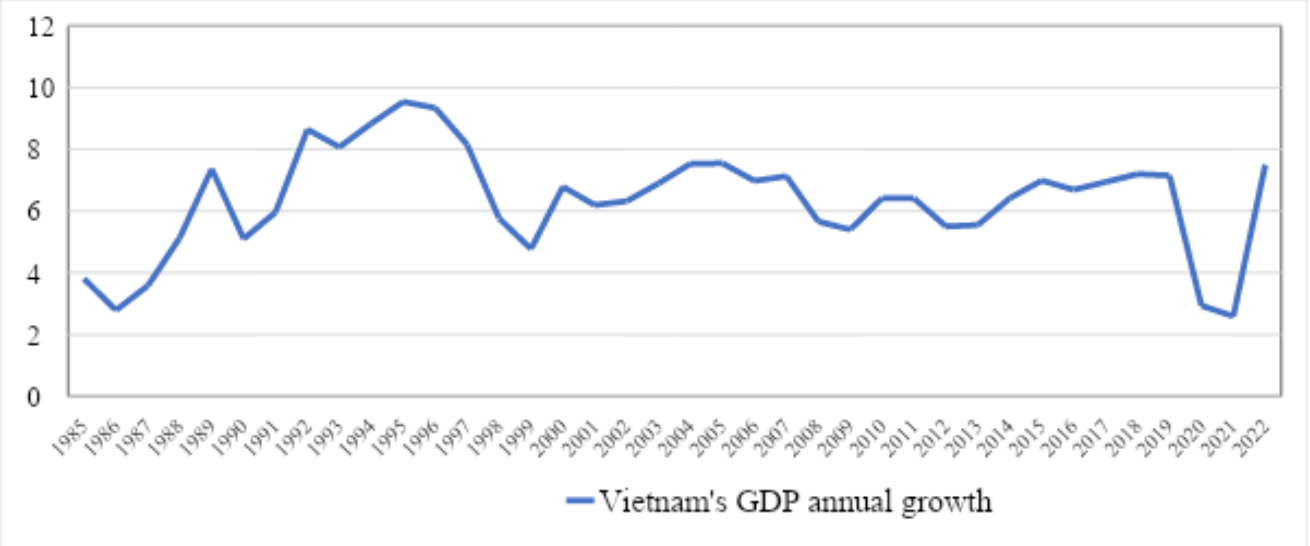

Figure 3.3. Vietnam's GDP Annual Growth.

Source: The World Bank, 2022.

Figure 3.3 illustrates Vietnam's GDP at constant price annual growth between 1985 and 2022. Vietnam is an agro-industrial state. The Vietnamese economy is one of the fastest growing among Asian countries. The average annual GDP growth rate is about 6.5% that together with stable population growth and an increase in prosperity makes Vietnam an attractive market in the long term. The level of GDP for 2021 reached more than 352 billion US dollars. The priority sectors of the economy are energy, processing industry, high-tech industry (electronics), mining, metallurgical and chemical industries. Agriculture (including forestry and fishing) remains an important area of the country's economic life. It employs about 40% of the economically active resources, and 65% of the population lives in rural area. The services market is actively developing. It accounted for 30% of the country's GDP. Since 2012 the country's trade balance has been in the surplus. Vietnam's main import positions are: machinery and equipment; computer and electronic equipment; fabrics, raw materials and consumables for light industry; rolling of ferrous metals; plastic. As an export-oriented economy, Vietnam has over 90 bilateral trade agreements and nearly 60 bilateral investment promotion and protection agreements. Vietnam's accession to ASEAN and the WTO allowed the country to strengthen its integration into the world economy and accelerate the pace of improving investment legislation, and a long-term policy aimed at improving conditions and guarantees for investors created a stable investment structure that made Vietnam one of the most attractive countries for foreign capital (Vietnam's MFA, 2022). Vietnam's economic growth reached the peak in 1995 before the Asian financial crisis took place. After the Asian financial crisis happened, the country's economic growth

slowed down and recovered from 2001 to 2007 before the 2008 global financial and economic crisis started in the USA. From 2012, Vietnam's economy recovered and achieved good growth in the period of 2013-2019. Under the impact of the COVID-19 epidemic, Vietnam's economic growth was sharply reduced and recovered to an estimated of 7.5% in 2022.

4. Methodology and Data

One limitation of the models that we have considered so far is that they impose a unidirectional relationship-the forecast variable is influenced by the predictor variables, but not vice versa. However, there are many cases where the reverse should also be allowed for-where all variables affect each other. The vector autoregressive (VAR) is a workhouse multivariate time series model that relates current observations of a variable with past observations of itself and past observations of other variables in the system. VAR models differ from univariate autoregressive models because they allow feedback to occur between the variables in the model. Such feedback relationships are allowed for in the vector autoregressive (VAR) framework. In this framework, all variables are treated symmetrically. They are all modelled as if they all influence each other equally. In more formal terminology, all variables are now treated as "endogenous." A VAR model is a generalization of the univariate autoregressive model for forecasting a vector of time series. It comprises one equation per variable in the system. The right-hand side of each equation includes a constant and lags of all of the variables in the system. To keep it simple, we will consider a two variable VAR with one lag. We write a 2-dimensional VAR (1) as:

$$y_{1,t} = c_1 + \Phi_{11,1}y_{1,t-1} + \Phi_{12,1}y_{2,t-1} + u_{1,t} \quad (1a)$$

$$y_{2,t} = c_2 + \Phi_{21,1}y_{1,t-1} + \Phi_{22,1}y_{2,t-1} + u_{2,t} \quad (1b)$$

Where $u_{1,t}$ and $u_{2,t}$ are white noise processes that may be contemporaneously correlated. The coefficient $\phi ii,\ell$ captures the influence of the ℓth lag of variable yi on itself, while the coefficient $\phi ij,\ell$ captures the influence of the ℓth lag of variable yj on yi.

If the series are stationary, we forecast them by fitting a VAR to the data directly (known as a "VAR in levels"). If the series are non-stationary, we take differences of the data in order to make them stationary, then fit a VAR model (known as a "VAR in differences"). In both cases, the models are estimated equation by equation using the principle of least squares. For each equation, the parameters are estimated by minimizing the sum of squared ui,t values.

There are two decisions one has to make when using a VAR to forecast, namely how many variables (denoted by K) and how many lags (denoted by p) should be included in the system. The number of coefficients to be estimated in a VAR is equal to $K + pK^2$ (or $1 + pK$ per equation). For example, for a VAR with $K = 5$ variables and $p = 2$ lags, there are 11 coefficients per equation, giving a total of 55 coefficients to be estimated. The more coefficients that need to be estimated, the larger the estimation error entering the forecast. In practice, it is usual to keep K small and include only variables that are correlated with each other, and therefore useful in forecasting each other. Information criteria are commonly used to select the number of lags to be included.

The VAR model is a combination of two models: univariate autoregression (AR) and simultaneous equations (SEs). The VAR model combines the advantage of AR that is easy to estimate by the method of residual minimization (OLS) and the advantage of SEs in estimating multiple equations simultaneously in the same system. The VAR model also overcomes the disadvantage of SEs

that it does not need to care about the endogeneity of macroeconomic variables that are often encountered when they interact with each other to distort the estimate when using the classical multiple regression method. This is the reason why the VAR model has become so popular in macroeconomic research. Besides, it is also the foundation for the study of co-integration by Engle and Granger (1987).

We should once again distinguish between correlation and causality. Correlation is the existence of a mutual relationship or connection between two or more processes or phenomena that tend to vary, be associated, or occur together in a way not expected on the basis of chance alone. Causality (referred to also as cause and effect) is the rational relationship between two processes, the first of which (the cause) is partially or totally responsible for the second, while the second is partially or totally dependent on the first. A process can have many causes, which beginning from the past can determine quantitatively the evolution of effects in the future. Causality cannot exist without a form of correlation; however, any correlation does not mean the existence of causality. In addition, causality cannot exist unless the cause happens prior to its effect and moreover it provides statistically significant information about its effect

Causality between two variables X and Y can be proved with the use of the so-called *Granger causality test*, named after the British econometrician Sir Clive Granger. This test makes use of Student's t-statistic and F-statistic tests and testifies when values of the variable X provide statistically significant information about the evolution of the future values of the variable Y. Let us assume that Y and X are two variables having stationary time series of data or observations. To test the null hypothesis that X does not Granger-cause Y, we first find the appropriate p lagged values of Y (the order p of the AR(p) process) to include in an AR process of Y.

$$y_t = c + \Phi_1.y_{t-1} + \Phi_2.y_{t-2} + \ldots + \Phi_p.\, y_{t-p} + \varepsilon_t \quad (1c)$$

Where: Φ_1, $\Phi_2 \ldots$ Φ_p are parameters that are calculated with the use of a computer software, and c is the intercept of the AR(p) process. Next, the equation (1d) is augmented by including lagged values of the variable X:

$$y_t = c + \Phi_1.y_{t-1} + \Phi_2.y_{t-2} + \ldots + \Phi_p.\, y_{t-p} + \omega_m.x_{t-1} + \ldots + \varepsilon_t \quad (1d)$$

Where m is the longest lag length for which the lagged value of the variable X has been proved statistically significant.

We retain in equation (1d) all lagged values of the variable X that are statistically significant (according to their t-statistic test), provided that jointly all of them contribute to the explanatory ability of equation (1d) according to the F-statistic test. The null hypothesis that variable X does not Granger-cause variable Y is accepted when no lagged values of the variable X are retained, after the application of t-statistic and F-statistic tests, in equation (1d). Otherwise, we reject the null hypothesis in favor of the alternative, and we conclude that variable X Granger-cause variable Y and thus the future values of variable Y are depended on the present values of variable X.

Combining the VAR model and the Granger causality test, in this article, the author will examine the possible relationship between Vietnam's population growth and economic growth es well as real per-capita income together with other economic variables.

Four independent variables, including LnPOPvnt, LnINVEST, LnTRADEOPvnt and LnFDIvnt, are employed to predict the relationship with Vietnam's GDP growth in duration of 1990-2021, in which:

LnGDPvnt is the natural logarithm (Ln) of Vietnam's GDP at 2015 price in USD in year t offered by the World Bank.

LnPOPvnt is the natural logarithm (Ln) of Vietnam's total population in year t offered by the World Bank.

LnINVEST is the natural logarithm (Ln) of Vietnam's total investment in the economy in year t as % of GDP offered by the World Bank.

LnTRADEOPvnt is the natural logarithm (Ln) of Vietnam's trade openness in year t calculated by the following formula: (Merchandise Exports + Merchandise Imports)/GDP.

LnFDIvnt is the natural logarithm (Ln) of Vietnam's inward FDI in year t as % of GDP offered by the GSO of Vietnam.

The data is collected from trustworthy sources such as the World Bank and the GSO of Vietnam. All of those variables are time series for the period 1990-2021. Those above variables will be calculated using the natural logarithm (Ln) form and test the stationary before running VAR model and Granger causality test using the Stata software to make it smoothly.

5. Results and Discussions

Table 5.1 and Table 5.2 below summary the estimated results using the Stata software.

Table 5.1. Summary of the Estimated Results.

Equation	Excluded	Chi2	df	Prob > Chi2	Relation
LnGDPvnt	LnPOPvnt	1.6e+07	2	0.000	Positive
LnGDPvnt	LnINVEST	177.53	4	0.000	Negative
LnGDPvnt	LnTRADEOPvnt	62.317	4	0.000	Negative
LnGDPvnt	LnFDIvnt	162.85	4	0.000	Positive
LnGDPvnt	All	8.3e+07	14	0.000	-
LnPOPvnt	LnGDPvnt	69.754	4	0.000	Positive
LnPOPvnt	LnINVEST	100.03	4	0.000	Negative
LnPOPvnt	LnTRADEOPvnt	13.674	4	0.008	Negative
LnPOPvnt	LnFDIvnt	65.765	4	0.000	Negative
LnPOPvnt	All	258.13	16	0.000	-
LnINVEST	LnGDPvnt	24.409	4	0.000	Negative
LnINVEST	LnPOPvnt	33980	2	0.000	Positive
LnINVEST	LnTRADEOPvnt	37.109	4	0.000	Positive
LnINVEST	LnFDIvnt	59.076	4	0.000	Positive
LnINVEST	All	3.2e+05	14	0.000	-
LnTRADEOPvnt	LnGDPvnt	524.28	4	0.000	Positive
LnTRADEOPvnt	LnPOPvnt	6.4e+06	2	0.000	Positive
LnTRADEOPvnt	LnINVEST	426.16	4	0.000	Positive
LnTRADEOPvnt	LnFDIvnt	303.38	4	0.000	Positive
LnTRADEOPvnt	All	2.6e+07	14	0.000	-

LnFDIvnt	LnGDPvnt	8.0966	4	0.088	-
LnFDIvnt	LnPOPvnt	38000	2	0.000	Positive
LnFDIvnt	LnINVEST	9.8233	4	0.044	Positive
LnFDIvnt	LnTRADEOPvnt	18.075	4	0.001	Positive
LnFDIvnt	All	1.5e+05	14	0.000	-

The estimated results presented in Table 5.1 above show that there exists a bi-directional causality between population growth and economic growth in Vietnam during 1990-2021. This result drives the author to share the same conclusion with Kremer (1993). This finding also supports for the Optimistic View that the population growth fuels economic growth. This is the main message coming from Kuznets (1960, 1967), Simon (1981), Boserup (1989). According to whom, larger economies can more easily build on, exploit and disseminate the flow of knowledge they produce. In other words, population growth by raising the returns to innovation induces technological change, one of the main engines of economic development. More recent contributions in the optimistic view also include Jones (2001a), Tamura (2002, 2006), Jacob et al. (2016), Shamsul et al. (2020) and Lianos et al. (2022).

Beside population growth, inward foreign direct investment (FDI) (calculated as % of GDP in this research) has been also a factor inducing economic growth in Vietnam at the same time. FDI has contributed to impressive economic growth in a number of developing countries like Vietnam. Generally speaking, FDI not only increases the supply of capital but, given the appropriate host-country policies, it can also facilitate technology transfer. Technology transfer contributes to human capital formation which can further enhance prospects of economic growth. In other words, FDI can facilitate economic growth through direct as well as indirect channels (Sajid and Nguyen, 2010). This was also indicated by Hoang et al. (2010) and Nguyen (2020) that there is a strong and positive effect of FDI on economic growth in Vietnam as a channel of increasing the stock of capital. Regarding FDI inflows into Vietnam, accumulation until March 20, 2022, 139 countries and territories have valid investment projects in Vietnam with 34,815 projects, total registered capital of 422.84 billion USD; implemented capital reaches around 250 billion USD. Currently, Korea leads, followed by Singapore, Japan, and Taiwan.

Table 5.2. Summary of the Estimated Results.

Equation	Excluded	Chi2	df	Prob > Chi2	Relation
LnGDPpervnt	LnPOPvnt	1.6e+05	2	0.000	Negative
LnGDPpervnt	All	1.6e+05	2	0.000	-
LnPOPvnt	LnGDPper	3.2783	4	0.512	-
LnPOPvnt	All	3.2783	4	0.512	-

Today it is well known that most of the world population growth is concentrated in less developed and least developed/developing countries and that such trend will persist even in the long run. Thus, a natural concern arising from these data pertains to the long-run effects of population growth/change on the growth rate of real per-capita income of its inhabitants. The estimated results presented in Table 5.2 above indicate that the population growth has had a negative impact on real per-capita income growth in Vietnam during 1990-2021 (LnGDPpervnt is the natural logarithm of GDP per capita at constant price of Vietnam at year t offered by the World Bank). This finding supports for the Pessimistic View that population growth unambiguously hinders real per-capita growth through two different channels: (a) in a world where economic resources are fixed and

technological progress is low or totally absent, the food production activity is overwhelmed by the pressures of a rapidly growing population. The available diet would then fall below the subsistence level and so would the productivity growth rate also do (Malthus, 1798); (b) when population growth is rapid, a large part of investment (typically in physical capital) is used to satisfy the needs of the growing population (''investment-diversion effect''-Kelly, 1988, p. 1699), rather than to increase the level of per-capita capital endowments. As a consequence, per-capita income growth would be lower in the presence of a higher population growth rate.

6. Concluding Remarks and Policy Implications

Concluding remarks

The major finding of this research is that there is a long-run positive relationship between population growth and economic growth in Vietnam-a developing country in Asia. The results provide empirical support in favour of the findings showing the Optimistic View in Kuznets (1960, 1967), Simon (1981), Boserup (1989), Kremer (1993). It is also aligned with the results found by the recent empirical studies such as Li et al. (2012), Li and Zhang (2015), Jacob et al. (2016), Shamsul et al. (2020) and Lianos et al. (2022). However, my finding is in stark contrast with the results found by the empirical studies conducted by Lee et al. (2011) and Park and Shine (2012). Thus, in this research the author found that the population growth has had a negative impact on real per-capita income growth in Vietnam at the same period. This finding supports for the Pessimistic View of Malthus (1798) and Kelly (1988). Overall, my research evidence supports the hypothesis that population growth fosters the long-term economic growth and has a negative impact on real per-capita income growth in a developing country. This finding can be used as a reference point to carry out further research in this area in Asia and beyond. This will remain an avenue for further research.

Policy implications

First, from the research results, Vietnam should continue to seek positive solutions to enhance the economic growth via attracting FDI inflows. Beside that, Vietnam had better review the family planning policies, and social security programs in other to enable youths to have access to job market through job creation forum and credit availability so that economic growth could be boosted. In addition, the author advises the government of Vietnam to put in place policies to encourage highly trained youths to contribute to development through research and development.

Second, Vietnam needs to achieve higher/faster economic growth than population growth based on the total factor productivity (TFP) through increasing the labor productivity and application of advance technology. This is to take Vietnam to the next level of the value chain to improve real per-capita income. This depends on many factors including industrial policy. As can be seen in Figure 3 below. Continued development into high income is possible only when people improve capabilities and work hard. Growth that depends on natural resources, FDI inflows or locational advantage will sooner or later come to a halt. Proactive industrial policy is needed to break this barrier. Vietnam's growth in the last decades has been driven by the one-time liberalization effect and large inflows of external purchasing power with young population. Now, the processes of systemic transition and global integration have deepened, Vietnam needs to create internal value to continue to grow and avoid the "middle income trap". The country has reached the point where growth towards higher income cannot be secured unless policy making is renovated significantly to activate the country's full

potential. The vision of Industrialization and Modernization must be backed by realistic industrial strategies and concrete action plans, which are currently lacking (Kenichi, 2010).

Third, development, in its true sense, must come from the upgrading of human capital rather than a lucky endowment of natural resources or a geographical advantage for receiving foreign aid and investment with low skillful workforce. Depending on the amount of these unearned advantages, a country may rise to a low-, middle- or high-income level with little effort but will eventually get stuck in that income category if it fails to build a national mindset and institutions that encourage constant upgrading of its human capital. This situation shall be called a developmental trap. If the country has moderate advantages in resources and geography initially, it will likely be caught in the middle-income trap. After all, it is natural that any people who just provide unskilled labor in offices and factories managed by foreign general directors receive no more than a few hundred dollars per month. To earn more money, they must acquire skills and knowledge demanded by the global economy, engage in innovative and value-creating activities, and send foreign general directors back home (Kenichi, 2010).

Finally, in order to become more power and prosperous, it is necessary for Vietnam to have supporting industries based on comparative advantages to help increase domestic value added. Thus, the country needs to focus on research and development to apply advanced technology in production, improving product quality, and try to reach the world's technological level. This requires a skillful, high-quality workforce. To have a high-quality workforce requires an advanced education, especially world-class universities. Vietnam needs to change the policy formulation process. This in turn requires a radical change in the public administration system. The scope and sequencing of reforms must be chosen carefully to minimize the political and social energy needed to change the system while maximizing their positive impacts. Enlightened and strong leadership, a new technocrat team, and strategic partnership with foreigners have been proposed as effective starting points that satisfy these conditions.

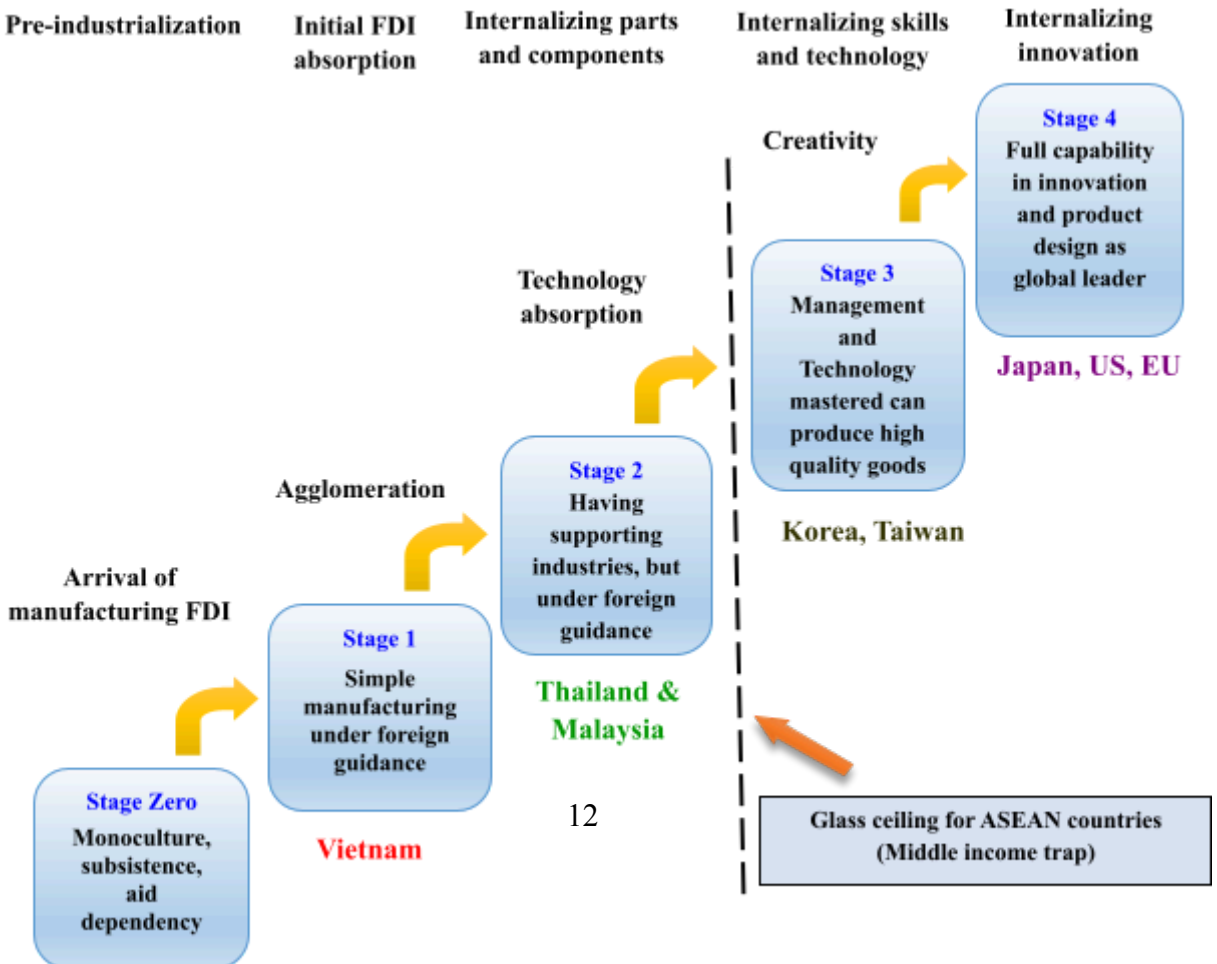

Figure 3. Stages of Catching-up Industrialization.

Source: Kenichi Ohno, 2010.

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Appendix 1. Summary of the statistics.

Variable	Mean	Std. Dev.	Min	Max
LnGDPvnt	-.001078	.0117563	-.0400829	.0250244

LnPOPvnt	18.25568	.093554	18.07655	18.4022
LnINVEST	3.359821	.2064534	2.515598	3.67797
LnTRADEOPvnt	.0462745	.0798912	-.1882305	.1742086
LnFDIvnt	.0255627	.258429	-.3300481	.913821
LnGDPpervnt	.0524879	.013109	.017066	.0741715

Appendix 2. Data resources

Variable	Data Resources
LnGDPvnt	The World Bank
LnPOPvnt	The World Bank
LnINVEST	The World Bank
LnTRADEOPvnt	GSO of Vietnam
LnFDIvnt	GSO of Vietnam
LnGDPpervnt	The World Bank

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