Age Demographics and Foreign Direct Investment

Exploring the Impact of Emerging Workforces on Foreign Direct Investment Inflows

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Abstract:

In a world with decreasing fertility and mortality rates, many countries have, during the past few decades, experienced significant changes in age demographics. The aim of this paper is to examine the relationship between age structure within a country and Foreign Direct Investments (FDI). More specifically, whether a large emerging workforce increases FDI inflows. Firstly, we present a theoretical background based on Neoclassical Growth Theory, Life Cycle Hypothesis, Overlapping Generations Model, and Demographic Dividend Theory. Apart from this, some previous research will be given in order to provide context to the subject matter. The results will be based on one fixed effects model and one random effects model. Two regressions were conducted and one of them presents a negative relationship between a relatively young population and FDI inflows, contradicting the predictions made by Neoclassical Growth theory. A discussion of a few potential causes for this connection will be provided in the last sections of the paper. In conclusion, the hypothesis is rejected. The results provide further insight into the issue and provide valuable information for policymakers as well as investors. It also highlights that even if a negative relationship was detected, proper adaptation of societal functions in order to nurture large emerging workforces could still lead to economic prosperity and growth in the future.

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1. Introduction

The labor force has always constituted the basis of productivity and has been a key driver when it comes to economic growth and a country's wealth (Tamplin 2023). It is therefore crucial for companies, as well as countries as a whole, to harness and nurture it in order to properly prosper and advance. Hence, it is safe to assert that any and all changes in the labor force structure affect productivity and should therefore be taken seriously.

Changing societies with technological advancement, innovation, and scientific discoveries have greatly impacted every sector and industry of the world, including the healthcare sector. Due to this, many populations have for a few decades steadily grown to live to older ages. The decreasing mortality rate, combined with decreasing fertility rates, has led to an increase in the overall average age for numerous populations (worldbank.org). This development, however, is limited to countries whose healthcare sectors have access to modern medicine and whose populations in turn have easy access to health care, resulting in drastic differences when it comes to average age across countries with more or less developed economies (Peters et.al. 2008).

Fertility and mortality rates directly impact the ratio between the young and old share of a population and hence, also the size of a country's workforce. Since a country's labor force is vital for productivity, a decreasing labor force should consequently lead to stagnating production (Tamplin 2023), making the country a less attractive investment. Accordingly, it is possible that changing age structures across different countries of the world will significantly impact FDI flows, which is what will be examined in this paper.

An examination of over 150 countries will be made, all in different stages of their economic development. Exactly which countries are included can be seen in the appendix. By including as many countries as possible, the results will be valid for both developed and developing countries. In this paper we will not do separate examinations of developing and developed economies, but will rather look for general relationships between emerging workforces and FDI inflows across all countries at the same time. Nonetheless, even though there will be no distinction between the two in the regressions, some speculations about how different factors might affect countries with varying economies differently will occur. The inclusion of

developing countries will give rise to missing values and lack of data which could potentially affect the reliability of the results. However, the authors of this paper consider it important to include them anyway, since most previous research has been focused on OECD countries. The countries will be observed during a period of 63 years, from 1960 to 2023 in order to facilitate the potential discovery of long term relationships.

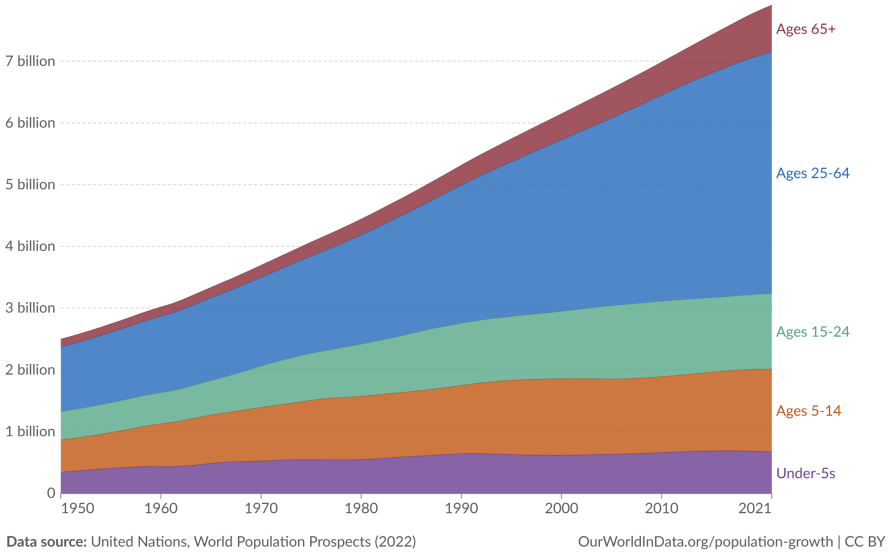
This topic is important when trying to gain a further understanding of what affects FDI. It is relevant information for investors as well as consumers, countries, and policymakers when trying to make investment decisions. Apart from this, FDI plays a significant role in driving economic growth and development (Kurtishi-Kastrati, 2013), particularly for emerging economies. Knowledge about precisely how age structure affects FDI might therefore motivate governments to implement a societal structure that harnesses their young workforce. Additionally, it can also help provide forecasts on how FDI flows, as well as economic growth might come to look in the future.

1.1 Background

Before moving on to analyzing the potential relationship, it is important to obtain a historical perspective and get an overview of how age structures in different countries have developed during the past few decades. In this section, we outline the overall trends and patterns of population growth, mortality rates, and fertility rates, as well as explain in what way this might affect productivity, economic growth, and FDI.

The average age in the world has drastically increased during the past 70 years. Presented below is the development;

Figure 1, population by age group, world.

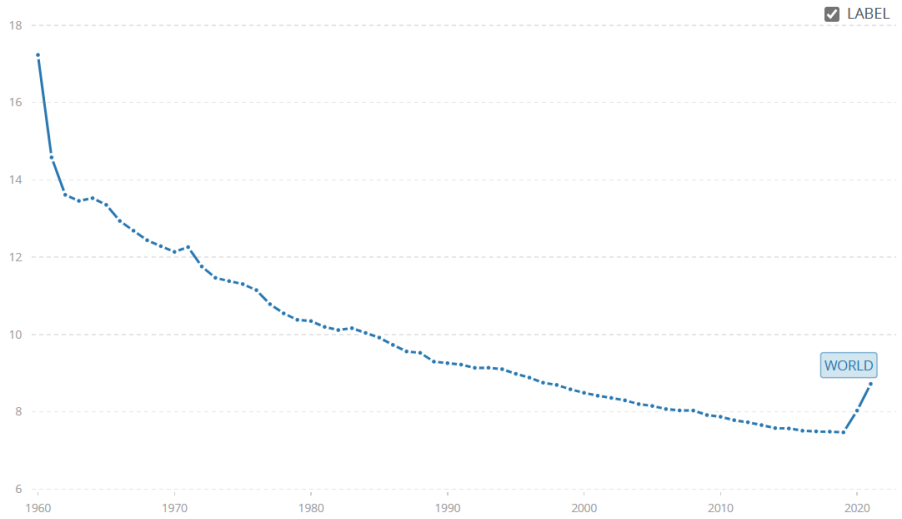


Source: ourworldindata.org

Based on the data depicted, it can be inferred that the population size has increased across all age groups, with the most significant growth observed in the 25-64 age bracket and a significant relative increase observed in the 65+ bracket. The average age of a country's population can be indicative of its economic lifecycle stage. Typically, younger populations are associated with larger workforces, which can lead to increased productivity and economic growth, making such countries potentially more attractive for Foreign Direct Investment (FDI).

One reason for the population increase is the improvements made in health care, which have decreased mortality rates. The data presented in the graph below conveys the number of deaths per 1000 inhabitants during the time period 1960 to 2021. We observe a steadily decreasing trend, except during covid 2020.

Figure 2. The number of deaths occurring during a year per 1000 inhabitants



Source: worldbank.org

The data indicates an overall growing world population who live longer lives than they did a few decades ago. However, developed countries typically have better access to modern health care (Peters et.al. 2008). This isolated information should indicate a workforce increase in most countries. However, when combined with additional information it is evident that population growth patterns differ across countries and depending on which part of the world is observed. Presented below is the development of the fertility rate within the European Union from 1960 to 2021 (number of births per woman) compared to sub-Saharan Africa.

Figure 3. Fertility rate European Union

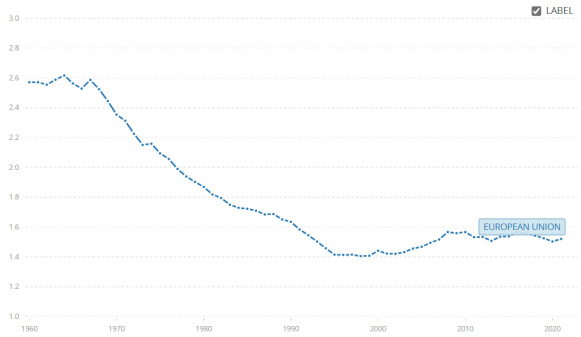
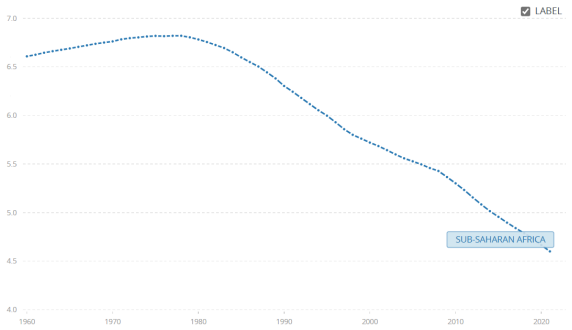


Figure 4. Fertility rate Sub-saharan Africa



Source: worldbank.org

Even though we observe a decreasing trend within both areas, it is evident that the fertility rate has constantly been at a higher rate in sub-Saharan Africa than in Europe. During 2021

the fertility rate in the European Union was 1.5 children per woman, which is lower than the reproduction rate. This implies a decreasing workforce and a large share of the population ascending into the later stages of their lives. In sub-Saharan Africa on the other hand, the fertility rate was 4.6 children per woman during 2021, far exceeding the reproduction rate.

The age distribution of a population can be shown in an “age pyramid”. Below is one age pyramid for Sweden 2023 and one for Angola 2023.

Figure 5. Population Pyramid Sweden

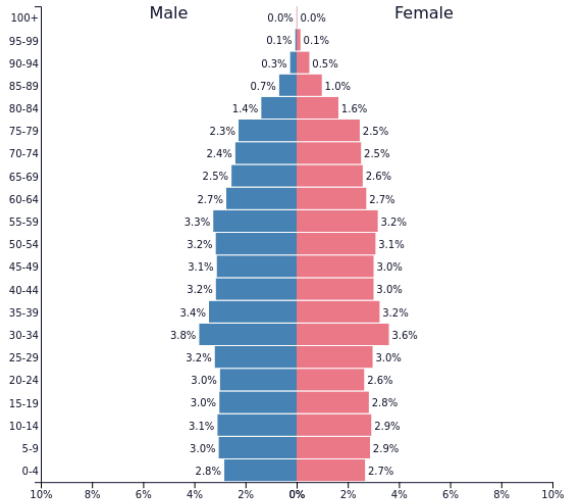
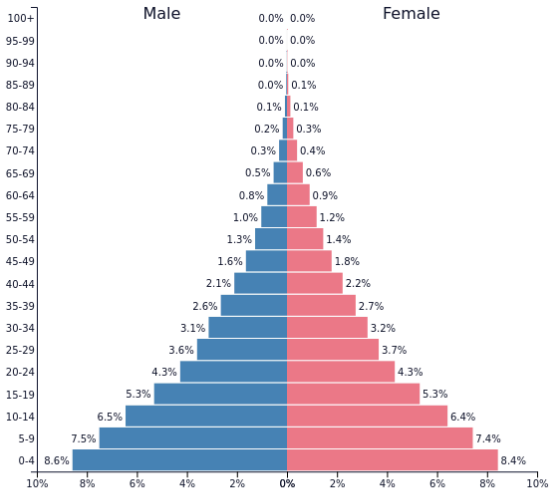


Figure 6. Population Pyramid Angola



Source: populationpyramid.net, 2023

Countries that have age pyramids with a wide base have a larger share of younger individuals, suggesting high birth rates and potential for future workforce expansion. In the pyramids presented above, we can see that Angola has a larger share of younger people when compared to Sweden. This demographic trend is often observed in developing nations. While a youthful population can be a factor in attracting FDI, due to the potential for a growing consumer market and labor force, other factors such as political stability, economic policies, infrastructure, and education levels may also play critical roles in influencing FDI inflows. As such, the aim of this paper is to gain insight into the relationship between a young population in developing countries and their corresponding FDI inflows both historically and going forward.

1.2 Purpose

The subject of investigating whether a large emerging workforce will increase FDI inflows is both interesting and highly relevant for several reasons. Firstly, understanding the dynamics between demographic shifts and economic factors is crucial for policymakers, economists and individuals, especially in developing countries where population growth rates are high. As these countries strive for economic development, insights into how a growing young population can attract FDI are invaluable. Secondly, this research is timely and relevant given the global economic landscape, where emerging markets are becoming significant players. A deeper understanding of the relationship between demographic changes and FDI can help these countries create strategies to leverage their demographic advantages. Lastly, this study contributes to the broader academic discourse on economic growth and development, providing empirical evidence and theoretical insights that can both contribute to existing research and inspire future research. Previous research has been somewhat slim and contradictory. Therefore, it is necessary to complement it and to delve deeper into the subject. By exploring this topic, we can better understand how to harness the potential of young populations to drive economic progress and attract investment, which is essential for long-term economic stability and growth. There are also a lot of theoretical frameworks that support the hypothesis and it is interesting to examine whether the theory is consistent with practice.

Based on the information above, this paper will investigate the hypothesis that a relatively young population increases FDI inflows. Our hypothesis is that a large emerging workforce should promise increasing future productivity which in turn should make the country a more attractive investment, thus increasing FDI inflows. More specifically, the central research question on which the paper will be based on is:

How does an increase in the proportion of the population aged 0-14 impact Foreign Direct Investment (FDI) inflows when controlling for economic and political variables?

So, to address this question comprehensively, the study will not only examine the direct relationship between demographic structure and FDI but will also control for various economic and political variables that could influence FDI inflows. These control variables include political stability, regulatory quality and trade openness, among others. By incorporating these factors, the research aims to isolate the effect of a young population on

FDI and provide an understanding of the relationship between the two factors. Ultimately, this paper seeks to contribute valuable insights to the field of economic development and inform policy makers on how to harness demographic trends to attract foreign investment.

2. Theory

In this section, the theoretical framework used when analyzing the results will be presented. We will start by giving a short summary of Neoclassical Growth Theory and the production function. Then we move on to present the Life Cycle Hypothesis, Overlapping Generations Model, and Demographic Dividend Theory

2.1 Neoclassical Growth Theory

The Neoclassical Growth Theory, sometimes referred to as the Solow-Swan Model, states that a country's economic growth can be sustainable through the combination of three factors, labor (L), capital (K), and technological progress (A) (Hahn, 2018). Developed by Robert Solow and Trevor Swan in 1956 it focuses on the role of technology as a key driver of growth along the two inputs, labor and capital. It explains how technology is what can lead to continuous growth while the other two inputs can have diminishing returns. The aim of the theory is to give an understanding and explanation of what causes economic growth. The model distinguishes two forms of equilibria. In the short-run equilibrium, the stock of capital, labor, and technological development are given and in the long-run equilibrium, none of these factors are given beforehand.

The model is based on three assumptions. The first one is the neoclassical production function:

$$Y_t=F(K_t, A_tL_t)$$

Which states that production (Y) at time period *t* is determined by capital accumulation (K), technological advancement (A), and labor force (L) in that same time period. It also states that technological advancement (A) determines the effective amount of labor (L).
The second assumption is that labor increases at a constant rate and the third assumption argues that part of the output produced is not consumed, but invested instead. From these three assumptions, the model identifies the three key factors explaining the economic growth mentioned above (Hahn, 2018).

In the 1950s Robert Solow further developed the model for economic growth. Based on a Cobb-Douglas function, the model states that while capital and labor can be set by a firm, or in this case a country, the technological level is given and constant.

$$Y_t=K_t^{\alpha}A_tL_t^{1-\alpha}$$

This model has proven to strongly align with existing empirical studies on economic growth and is therefore relevant to this paper (Mankiw et.al 1992).

Both labor and capital have diminishing marginal returns, indicating that if labor is held constant, the rate at which increases in capital affects production will decline and the other way around. Therefore it is often not effective to attempt to raise production solely through increases in one of the factors. A combination of both is often needed.

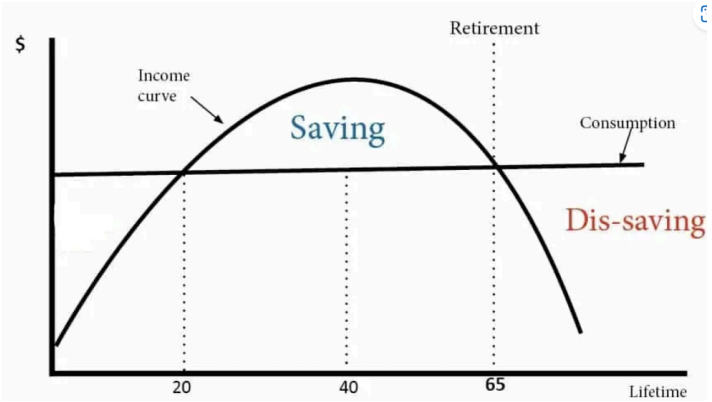
Another factor that is important to discuss is how technological advancement clearly divides developing and developed countries when it comes to productivity of labor. As presented above, technological advancement is crucial for the productivity of labor and from an investment perspective it is therefore advantageous for companies to have access to it. However, it is mostly developed countries who both have access to and are in the lead of technological development (Dedrick et.al 2014). This is disadvantageous for developing countries and could affect their investment inflows.

Since the final aim of this paper is to examine whether the relative age of a population and thus the size of the workforce, will attract foreign investments, it is highly relevant to analyze the potential role of the relationship between labor and production. Increased productivity constitutes the foundation of economic growth and is strongly correlated with FDI (Boghean & State 2015).

2.2 Life Cycle Hypothesis

Life Cycle Hypothesis, also known as Lifecycle Risk Aversion Hypothesis, developed by Modigliani and Brumberg in 1954, defines linkages between consumption patterns and income for an individual as it passes through different stages of life (Fisher 2016). It states that individuals strive to smooth out their consumption over time (Narciso, 2010) and that people tend to accumulate assets during their working years and then consume their savings after retiring. Life Cycle Hypothesis also predicts patterns concerning the degree to which individuals are risk-averse in different stages of their lives. During the initial phase of one's career, individuals often gravitate towards riskier investments, buoyed by the security of their steady income, which they anticipate will remain reliable for several years. As the income grows smaller in the last stages of a person's life they become gradually more risk averse. In conclusion, people tend to transition regarding their risk preferences when making investments.

Figure 7. Graphical Depiction of the Life Cycle Hypothesis



Source: Pettinger, 2019

There are several studies that confirm this relationship (Mason 1998, Collins 1991, etc), but these studies assume perfect capital mobility. However, this might not be a probable assumption. That perfect mobility does not exist might have numerous effects on the outcome of the model, since it may indicate barriers or costs associated with moving capital, thus impacting and potentially preventing the perfect allocation of capital (Narciso, 2010) Perfect mobility is an idealized assumption that might not reflect the complexity of the world.

Life Cycle Hypothesis provides an understanding of consumption, saving, and investment patterns in different stages of life, which is greatly relevant to this paper. The model indicates that a relatively young population might have higher savings rates and potentially more funds available for investments, while countries with an aging population may experience decreasing savings rates and potentially reduce investment capacity. Considering this perspective, an aging population may imply a decrease in FDI outflows and might weaken our initial hypothesis presented earlier in this paper.

2.3 Overlapping Generations Model

Closely related to the Life Cycle Hypothesis, the Overlapping Generations Model captures how individuals who are in different stages of their life cycles interact with each other and within a market (Narciso, 2010). It stresses the fact that individuals belonging to different generations will act at the same time and in the same markets. This helps us to take into account that people have different planning horizons and will act differently depending on their age.

The Overlapping Generations model assumes that time goes on forever and divides an individual's life into two time periods; one where the individual is young and one where it is old. The young part of the population is of working age and is therefore materialistically better off than the old part. The general idea is then that the young part of the population should compensate for the part of the population that is outside the workforce. Since time is infinite, when the initially young individuals grow old and enter into the second time period, there will be a new young generation emerging that, in turn, can compensate them (Yale University, ECON 251: Financial Theory, lecture 12).

2.4 Demographic Dividend Theory

Demographic Dividend is a concept that describes a period of increasing economic growth as a result of changing age demographics within a country. Rates of mortality and fertility highly impact the age structure within a country and is correlated with its production and economic growth (Bloom & Kotschy 2023). Demographic dividend is a model that captures previously observed patterns concerning these rates and concludes that mortality rates generally decline faster than fertility, restructuring the age demographics of a country. Consequently, this results in an expansion of young dependents that tend to increase economic growth, as they enter into working ages (Bloom & Kotschy 2023).

Initially, as health care, nutrition, and sanitation among other factors improve, the mortality rate decreases, while fertility rates remain at their prior level. Since the same amount of babies are born, but fewer of them die prematurely, this will result in a high concentration of young individuals. Initially, this will decline the economic growth, since a larger share of the population is dependent on the workforce, but as the children transition into working ages, the growth could potentially be elevated.

The large ratio of working-age people will not only increase the labor force and enhance productivity but also liberate resources that can be used for saving, educational attainment, and scientific development (Bloom & Kotschy 2023). In order for countries to harness it they need to create a socioeconomic environment that utilizes their emerging workforce properly.

The demographic dividend could, however, also turn into a demographic drag. If fertility rates are at a level lower than the long-run replacement rate (the rate at which each generation replaces themselves), the population age structure fails to stabilize. As mortality rates decrease this will increase the share of older individuals in the population and could potentially cause a drag instead of a dividend. How powerful this drag will be is uncertain (Bloom & Kotschy 2023).

This model could conceivably help explain any relationship between FDI and age structure. It is also helpful when analyzing the causes of a potentially existing connection and will therefore be used to analyze the results presented later on in this paper.

3. Previous research

To provide further context and background concerning the issue at hand, this section will outline previous research that has been conducted concerning similar subjects. Although plenty of research has been done regarding FDI and age structure in OECD countries, it is deficient when it comes to developing countries. One reason for this could be the lack of reliable data and missing values. Many of the developing countries examined lack data when it comes to both economic and political variables, potentially affecting the robustness of the results. However, since not much of previous research has included developing countries, in this paper we choose to involve them as well, despite the disadvantages. Below we will give an overview of the already existing material.

Aging Populations and FDI Outflows (Fälth, J. 2021) suggest that as a country's average age increases, the outflow of foreign direct investments might increase, perhaps with a "market-seeking" purpose toward younger economies. Fälth restricts the examination to OECD countries and China since these are the countries whose population age demographics have changed the most. The paper is based on a regression investigating the relationship between aging populations, more specifically retirement rate, and FDI outflows, including some control variables. Even though two of the control variables were significant, no conclusions could be drawn concerning the effect of retirement age on FDI outflows.

The Impact of Population Ageing on International Capital Flows (Narciso, 2010) insinuates that since demographic age transitioning occurs at different times in different countries, this should have a positive impact on the flows of capital from developed countries to developing countries. Hence, the paper examines aging on different types of capital flows, more specifically FDI and FPI (foreign portfolio investments). The examination concerns both developed and developing countries during the time period 2001 to 2007. A fixed effects regression model constitutes the foundation of the paper and the old dependency ratio is used as the independent variable. The results from the regression are highly significant and the author confirms their hypothesis.

Most of the previous research has been conducted regarding OECD countries. *Population ageing and FDI inflows in OECD countries: a dynamic panel cointegration analysis* (Mitra

& Abedin, 2020) examines OECD countries between 1980 to 2017, while *Does a shrinking labor force reduce FDI inflows in OECD countries?* (Mitra & Abedin, 2022) examines the time period from 1972 to 2019. For simplicity, we will henceforth refer to the titles rather than the authors of the paper, since they are written by the same authors. Even though they examine similar issues, the papers reach drastically different results. *Population ageing and FDI inflows in OECD countries: a dynamic panel cointegration analysis* investigates both short and long-run effects of an aging population on FDI inflows, while *Does a shrinking labor force reduce FDI inflows in OECD countries?* examines the links between the working-age population and FDI. Both papers use FDI inflows (% of GDP) as their dependent variables. However, as their independent variable, *Population ageing and FDI inflows in OECD countries: a dynamic panel cointegration analysis* uses the old age dependency ratio and share of the population who are above 65, while *Does a shrinking labor force reduce FDI inflows in OECD countries?* uses working-age individuals as their explanatory variable. Both papers use the same control variables, except that *Does a shrinking labor force reduce FDI inflows in OECD countries?* uses real GDP as their third control variable instead of real effective exchange rate.

Population ageing and FDI inflows in OECD countries: a dynamic panel cointegration analysis strongly rejects the hypothesis of the long-run effects of changing age demographics on FDI. The reason for this is that when the labor force shrinks, the demand for capital increases, which in turn increases FDI inflows. *Does a shrinking labor force reduce FDI inflows in OECD countries?* on the other hand, strongly supports the predictions made based on neoclassical growth theory; that there is a positive association between FDI and working age population. It also state that if populations continue to grow older, there will be a need for policymakers to, among other things, increase the retirement age and reform immigration laws in order to counteract the negative effects of a steadily shrinking workforce.

It is impossible to state definitively what causes these differences. However, since there are a few differences in the time period examined, the variables used, and the different regression methods used, this could be a possible explanation for the various outcomes.

The scientific papers presented above all examine trends and patterns across multiple countries. Nevertheless, there are additional studies that focus on the relationship between changing age structures and FDI within a single country. *Population Ageing and FDI Inflows*

in Japan: ARDL Approach to Cointegration Analysis (Mitra & Abedin 2020) concludes that there are no significant short-run effects within Japan. However, in the long run, they predict a positive rather than a negative relationship between the retirement rate and FDI inflows, indicating that FDI inflows increase as the population grows older. A contradictory result is reached in *Does Population Ageing Affect FDI Flows in South Korea?* (Mitra et al., 2023). The authors reach the conclusion that the predictions made by Neoclassical Growth Theory are supported in South Korea. Consistent with previous findings, these research papers reveal contradictory results as well.

4. Method

This paper will use quantitative research as its main methodology. We will compare changes in the number of people belonging to the youngest segments of a population in a country with the FDI inflows in the same country and examine if there is a relationship between the two. In order to be able to investigate this relationship, we will not restrict the examination to a subsample of countries, but will rather examine all countries for which there is relevant data.

In order to easily observe and examine potential patterns and relationships, we will conduct two regressions. The first one will include economic control variables and the second one both economic and political control variables. Data will be collected from the World Bank and the dependent variable will be FDI (foreign direct investment) inflows as a share of GDP. Below in subchapter (4.1), we will account for all control variables and why they might have an effect on FDI inflows.

In making our model we opted not to use a so-called Pooled Ordinary Least Squared regression. The main reason is that pooled OLS assumes that all observations are alike. Therefore not considering differences between individual units across the cross-sectional dimension. As such, this approach lacks the ability to distinguish between countries in our case.

Therefore we chose between a Fixed Effects model or a Random effects model. A Fixed effects model takes into account differences between the countries in our case by making dummy variables for each country. These dummy variables capture the uniqueness of each country that might account for variation not explained by our other variables and do not change over time. This makes it easier to assess how changes in independent variables affect the dependent variable within each country separately, without being affected by differences between countries.

A random effects model in panel data analysis considers both within-unit and between-unit variations by assuming that the individual-specific effects are random and uncorrelated with the independent variables. In other words, it acknowledges that there are unobserved factors that differ across countries just like the fixed effects model, but that they are not constant over time. It does this, not by making dummy variables for every country, but by estimating the variability of those unobserved factors and taking them into account.

For our two regressions, we had to choose which one of these two effects models to use. To confirm our decisions we used a test called *Hausman-test* which compares the coefficients estimated in the random effects model with those estimated in the fixed effects model. It does this to see if it can reject a null hypothesis that states that those estimates are not significantly different. In the case that the null hypothesis cannot be rejected, it indicates that the random effects model is consistent and may be used instead of the fixed effects model. Conversely, if the test indicates that the coefficients from the random effects model are significantly different from those of the fixed effects model, it indicates that the random effects model is inconsistent, and the fixed effects model is preferred.

Running the Hausman test on our two regressions we got the results showing that our first regression should be done using a fixed effects model and that our second regression should use a random effects model.

Furthermore, we ran a *Breusch-Pagan test* (Breusch, T. S.; Pagan, A. R. 1979) to test for heteroscedasticity in the residuals of our models. Heteroscedasticity occurs when the variance of our errors is not constant across observations, violating one of the assumptions of classical linear regression. Taking heteroscedasticity into account is important as it can lead to skewed estimates of the coefficients in our regressions and therefore impact the statistical

significance of them. After running the Breusch-Pagan test on both our models we found heteroscedasticity in both of them. To deal with this issue we used so-called *Heteroskedasticity-consistent standard errors*. They try to make sure that the estimates of the coefficients and their significance levels are reliable to use for statistical inference even if the variance of errors varies across the independent variables.

In the first regression, where only economic variables are included, a total of 171 countries are examined. In the second regression with both economic and political variables, due to lack of data, 151 countries are included. It is important to notice that most of the dropped countries are developing countries, making the second regression less representative for those countries than the first one. A list of the countries included for each regression as well as the regressions and the results from the other tests can be found in the appendix.

4.1 Data

In this section we will move on to account for which variables will be used in the regression and why we consider them relevant. The data presented in this text is sourced from the World Bank, a renowned international financial institution that provides comprehensive data on global development indicators, economic trends, and social progress.

Foreign direct investment (World Bank. 2023)**:** Net inflow of Foreign direct investment, referred to as FDI, is the amount of sizeable, long-term investments made by other countries' companies and governments into the reporting country. We have used this measurement relative to the reported country’s GDP in our analysis.

Population ages 0-14 (World Bank. 2023): This will measure the size of the relatively young part of the population (children between the ages 0-14) within a country as a percentage share of the total population. This will be the independent variable and the main variable of interest. The aim of the paper is to examine whether a large emerging workforce will increase FDI which is the reason for the usage of this particular variable. Neoclassical Growth Theory states that economic growth is dependent on the labor force (Hahn 2018), which is why a large emerging labor force should indicate future economic growth. This in turn might enhance the attractiveness of the country as an investment, which could lead to increasing

FDI inflows. The hypothesis of this paper is that FDI should increase if a country has a large emerging workforce.

Trade openness (World Bank. 2023)**:** Trade openness is a measure of the sum of imports and exports of goods and services as a share of GDP. It will represent the openness of the market which affects the size, effectiveness, and simplicity of a country's trade with its surroundings. This is fundamental for a country's continued growth which in turn affects investments (Ortiz-Ospina, et.al. 2018). Our aim in using this variable is to validate if there is a relationship between trade openness and FDI and to control for it in the regression. A positive relationship is expected since trade openness generally increases FDI (Zaman et.al 2018).

Gross fixed capital formation (World Bank. 2023)**:** Gross fixed capital formation, also formerly known as gross domestic fixed investment, measured as a percentage of a country's GDP is an indicator of the amount of money that goes towards a country's land improvements such as fences, drains and similar objects; machinery, construction of roads, railways, schools, hospitals, private residences, industrial buildings and the like. Our aim with the use of this variable was to try to control for a country's level of infrastructure and the impact that might have on the inflow of Foreign direct investment.

Current account balance (World Bank. 2023)**:** The current account balance as a percentage of GDP is the net sum of exports of services and goods, their net primary income, and their net secondary income. A country's primary income is its net flow of interest, profits, and dividends from investments in other countries as well as the net flow of money sent to and from migrant workers. The secondary income consists of transfers of income between a country's residents and other countries with no direct repayment of economic value. The aim of the usage of this measure in our analysis is to keep constant another economic variable that has an effect on foreign direct investment inflows.

Primary school enrollment (World Bank. 2023)**:** Aiming to take education into account, we use the net percentage of primary school enrollment within the populations of countries. This is the ratio of enrolled children of school age to the amount of children of school age in the country. This particular indicator excludes underage and overage children enrolled within each grade. This is to try to more specifically encapsulate the efficiency of the schooling system rather than just including the gross number of students enrolled, which does not

account for grade repetition and overage children entering the school system late. This difference may lead to inflated numbers in the case of the gross number of enrolled students and therefore might misrepresent the schooling system making it seem better than it is.

Regulatory Quality (Kaufmann, D.; Kraay, A. 2023):
One of the Worldwide Governance Indicators. The WGI is composed of data from international organizations, nongovernmental organizations, private firms, and others all around the world. This data is supposed to display wide-ranging views on countries' governance. They provide 6 indicators, Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. We opted to use the Regulatory Quality indicator as it aims to capture stakeholders' perceptions of a government's capacity to implement solid policies and regulations that allow and promote a stronger private sector. In our model, we used the "Regulatory Quality Estimates" where countries are given a score between -2.5 (Weak government performance) and 2.5 (Strong government performance).

5. Result

In this section, we will account for the results generated when running the regressions. Apart from this, a discussion of the significance of the regressions as well as of the variables will be presented. We will then continue to discuss the implications of the results in section 6.

Table 1:

Table 1	Model 1	Model 2
Population ages 0-14	-0.275***	-0.339
	(0.098)	(0.434)

Gross Fixed Capital Formation	0.046	0.145
	(0.061)	(0.152)
Trade Openness	0.059*	0.061***
	(0.033)	(0.022)
Current Account Balance	-0.050	-0.061
	(0.044)	(0.046)
Regulatory Quality		-0.451
		(1.088)
Primary schooling		-0.013
		(0.043)
Constant	6.341	7.380
	(4.746)	(15.536)
Number of observations	5809	1889
Overall R-squared	0.058	0.071
*** p<.01, ** p<.05, * p<.1		

Table 1 shows the coefficients for each variable as well as their standard error and significance level. In regression 1, the independent variable (population between ages 0-14) is significant at a 1% significance level, indicating a negative relationship between a young workforce and FDI inflows. In other words, this suggests that as the amount of young people within a population increases, FDI inflows decrease. More specifically it states that if the percentage of individuals between ages 0-14 increases by 1%, FDI inflows decrease by

0.27%. The standard error implies that while the strength of the relationship may fluctuate, it is highly probable that it will be negative.

In regression 1, trade openness is significant at a 10% significance level, indicating that as imports and exports as a share of GDP increase within a country, the FDI inflows increase as well. Although it is a significant relationship, it is a relatively weak one, signifying that the effect trade openness has on FDI inflows is quite small. As for the other variables in regression 1, no conclusion can be drawn regarding their effect on FDI since they are not significant.

In regression 2, trade openness is significant at a 1% significance level. The relationship is again positive indicating that FDI increases as trade openness increases. Once more, it is a relatively weak relationship, but the standard error makes it possible to conclude that the relationship is positive with high probability. No conclusion can be drawn regarding the relationship between age demographics and FDI, nor concerning any of the other variables in regression 2, due to the lack of significant results. In conclusion, not much can be said about regression 2, but the authors of this paper choose to include it, because previous research has not taken political values into consideration.

Another notable fact is that the number of observations decreases drastically in regression 2. The reason for this is that many of the countries examined in the first regression have missing values on the political variables included in the second regression. As mentioned in the method section, 20 countries are also dropped in the second regression. There is a general lack of data for developing countries but this problem intensifies when including political variables. Thus, the lessened amount of observations stems from missing values for developing countries, decreasing the amount of developing countries examined in regression 2. Therefore, the second regression is not as diversified as the first one when it comes to the inclusion of different types of economies, which is important to take into consideration when analyzing the results. On the other hand, since the independent variable of main interest for this paper is insignificant in regression 2, this effect is of limited importance as long as the results are not analyzed.

Missing values and decreasing observations also affects R-squared. As shown in the table above, R-squared for both regressions is low. This indicates that the explanatory power of the

regressions is low which should be taken into consideration. Even though regressions with low R-squared can be used as indicators of the relationship between the variables, it must not be used for predictive accuracy. Therefore, the results give an indication about the effect an increase in people aged 0-14 has on FDI inflows, however small, but can not be used to predict if demographic changes might come to affect FDI in the future.

6. Discussion

Based on the results presented in the previous section, a conclusion that there is a negative relationship between a relatively young population and FDI inflows can be drawn. In this section, we will discuss the implications of this result, as well as apply the models presented in section 2.

The results correspond to the results reached in *Population ageing and FDI inflows in OECD countries: a dynamic panel cointegration analysis* but contradicts many other research papers (Narciso (2010) and Mitra and Abedin (2022), among others). In *Population ageing and FDI inflows in OECD countries: a dynamic panel cointegration analysis,* Mitra and Abedin states that the reason for the negative relationship could be that as the labor force shrinks, there is an increase in demand for capital, which in turn increases the demand for FDI inflows. In other words, countries have to compensate for their diminishing workforce by acquiring more capital, in order to keep productivity from declining. This would increase FDI inflows in developed countries, which in turn, would decrease them in developing countries.

The results are contradictory to the predictions made by Neoclassical Growth Theory. According to the theory, a large young population should indicate a large future workforce, which in turn should increase FDI, as the productivity of the country is predicted to increase in the future. On the other hand, in accordance with Mitra and Abedin, if the labor force (L) decreases, the capital (K) has to increase in order to keep productivity (Y) constant. However, it is important to notice that if labor diminishes, the marginal return of capital decreases,

making it unsustainable to completely rely on capital to compensate for the lack of workforce.

It is also possible that, since technology (A) is a key driver in economic growth and a determinant of the degree of effectiveness of the workforce, this affects the results. It is the more advanced economies that are affected the most by population aging since they have better access to healthcare and medication (Peters et.al. 2008). However, it is mostly the same countries that have access to modern technology and are in the lead of technological advancement (Dedrick et.al 2014). Hence, the loss of workforce might be compensated by the relatively high level of technological advancement, thus not reducing the effectiveness of the workforce. Consequently, the attractiveness of developed countries as an investment option should not decline. On the other hand, Robert Solow argues in his model for economic growth that technological advancement within a country or a company is fixed and only capital and labor can be regulated (Mankiw et.al 1992). According to this, technological advancement cannot be used as an explanation as to why a negative relationship between FDI and a young labor force is estimated.

The Life Cycle Hypothesis states that as a population grows older, their savings decline in order for them to maintain the same level of consumption throughout their life (Fisher 2016). This implies that countries with a relatively old population should experience decreasing savings and therefore decreasing investments. A decreasing investment rate should affect FDI outflows, which in turn may diminish FDI inflows. This could be one of the factors causing the negative relationship presented in the results.

The concept of the Overlapping Generations Model provides valuable insights into the relationship between demographic shifts and economic outcomes. In an infinite time horizon, the model posits that the younger segment of a population, typically being materially better off, assumes the role of supporting the older segment, who tend to consume rather than invest in the later stages of life (Yale University, ECON 251: Financial Theory, lecture 12). This leads to an intergenerational transfer of resources. In the context of our study, a scenario where the proportion of the population aged 0-14 increases implies a larger cohort dependent on the workforce. This demographic shift could be perceived as a liability for the country as a whole, potentially straining its resources and infrastructure. Consequently, this imbalance in the age structure of the population may decline the economic growth rate, as resources are

diverted towards supporting dependents rather than productive investments. Moreover, investors who prioritize stability and favorable economic conditions when making decisions might be deterred from making investments. Therefore, if demographic factors contribute to economic instability or sluggish growth, it could lessen an investor's confidence and lead to a reduction in FDI inflows.

A further cause for the negative relationship can be understood through the Demographic Dividend Theory. This theory argues that as mortality rates decrease faster than fertility rates, a bulge of younger people emerges, potentially contributing to a larger future workforce (Bloom & Kotschy, 2023). Initially, the birth of this large bulge leads to a decline in economic growth due to the increased proportion of the population dependent on the workforce. Our model uses the share of the population between the ages of 0-14 as the independent variable, which, according to the Demographic Dividend Theory, suggests that a rise in this variable correlates with a short-term decline in economic growth. However, over the long term, as this cohort transitions into working-age adults, economic growth is expected to increase. Therefore, while our research focuses on the long-term perspective, the theory explains that regardless of the timeframe, a larger dependent population segment initially results in economic decline. In conclusion, Demographic Dividend Theory states that regardless of the long term effects, an increase of the amount of young people will always have an initial negative impact on the economy at any given point in time. Since economic growth and FDI are related (Kurtishi-Kastrati, 2013), this implies a negative relationship between our dependent and independent variables.

6.1 Significance and Further Research

The results presented in Section 5 are relevant for several reasons. Firstly, it is important for policymakers and investors alike when trying to predict the future and make decisions accordingly. The information is relevant for policymakers in order to properly adapt societal functions and domestically adjust to their large emerging workforce or to their aging population. For investors and multinational corporations, knowing how demographic factors influence FDI inflows can help in making informed investment decisions. They may adjust their strategies based on the demographic profile of the countries they are considering for investment.

Apart from this, the paper also contributes to the existing research and uses an independent variable, as well as some control variables, that have not been used in previous papers. It provides a more nuanced picture of how age demographics affect FDI and further insight into the complexity of the subject. It also stresses the importance of addressing demographic issues in order to experience continued economic growth.

In further research, it would be beneficial to put additional focus on developing countries as well as the difference between developed and developing countries. Even though this research would be limited due to the lack of data, further examination of the implications of population aging on the economies of developing countries would be fortifying. The different rates at which mortality decreases in various countries will undoubtedly have consequences and affect both production and economic development within a country. It would be beneficial for developing countries to have a forecast of what this change might come to look like in order to properly utilize and harness their respective young populations.

In addition, it would also be beneficial to examine whether it is the existing rather than the emerging workforce that affects FDI. Furthermore, one could examine whether the age of the workforce affects FDI flows. It would be possible that a relatively young workforce is seen as more attractive, than a workforce that will soon retire. If the relationship between a large existing workforce and FDI inflows is positive, it could suggest that an emerging workforce, which has not yet begun contributing to economic growth, may have a dampening effect on the economy rather than a boosting one, while an established workforce can be directly linked to productivity and economic growth. This would then also be supported by the Demographic Dividend Theory.

Lastly, it is possible that the results vary between different time periods. It would therefore be interesting to examine shorter time periods, as well as compare different time periods with each other. It would also be interesting to include other control variables, controlling for human resources and technology. Incorporating technological advancements as control variables would be especially useful when facilitating drawing conclusions regarding whether the technological progress in developed countries helps compensate for the effects of their shrinking workforces.

6.2 Limitations

In this paper, we have been acting under a few limitations. A major one has been the lack of data and missing values. When comparing large numbers of countries, including both developed and developing ones, there is a limited amount of data available. Further complicating this are inherent discrepancies in the data, where certain control variables have data available for some countries but not for others, thereby making the comparative analysis more complex. Consequently, this shortage of data gives rise to missing values, which in turn can potentially undermine the reliability and robustness of the regressions. The missing values are mainly due to lack of data in developing countries and the problem intensifies when including political variables. As previously mentioned, this is the reason for the diminishing amount of observations in regression 2 and, thus making it less trustworthy. These limitations are important to take into consideration when interpreting and generalizing the results of our study, as they inevitably are affected by the inherent constraints of the available data sources.

Another factor that is affected by missing values is the explanatory power (R^2). As shown in the results, it takes on low values in both of the regressions, which is problematic. However, even though this is an important factor to take into consideration, since the aim of this paper is to gain an understanding about a relationship rather than predictive accuracy, a regression with low R^2 might still prove to be useful. Although the regressions don't explain much of the variation, they still give us valuable insights about the direction and strength between the dependent and independent variables.

Apart from this, the limited amount of data has also restricted the choice and number of control variables. If there was more data available, we would have liked to include additional variables concerning political stability, human capital as well as freedom of speech and expression, and infrastructure. These variables not only reflect the well-being of the inhabitants within a country but are also indicators of productivity as well as relationships with foreign nations, which may have a great effect on FDI. Thus, the inclusion of these variables would have provided a more nuanced understanding of the dynamics underlying FDI inflows.

Lastly, the paper is somewhat limited by the choice of the independent variable. For simplicity and because of time constraints all of the data has been collected from the same source, which restricted the choice of the independent variable. Since the aim has been to examine the relationship between an emerging workforce and FDI, population between ages 0-14 as the independent variable instead of working-age population aged 15-64. However, ideally, we would have liked to examine the younger part of the workforce as well. Productivity and future prosperity are not only controlled by the number of children but also by the young adults who still have many working years remaining. Therefore an independent variable with a larger age span would have been beneficial to our analysis.

7. Conclusion

This paper further develops the research concerning changing age demographics and FDI. Trends of declining mortality rates and fertility rates over the past few decades have drastically affected the age structure in those countries that have access to modern medicine and where the inhabitants have the opportunity to live comfortable and healthy lives. This in turn has generated a difference in age structures between countries with developed economies and developing countries. While developed countries face aging and diminishing workforces as well as increased retirement rates, developing countries have access to relatively larger workforces. The aim of this paper is to examine whether this affects FDI inflows. The theoretical framework used to analyze the results includes the Neoclassical Growth Theory, which states that the production of a country is directly linked to its workforce; Life Cycle Hypotheses/Overlapping Generations Model, which describes how individuals in different stages of their lives interact within a market; and Demographic Dividend Theory, which explains how changing mortality and fertility rates potentially can generate a boost of the workforce. Similar research has been conducted previously, reaching somewhat differing results, depending on which method and which variables are used when conducting their regressions.

The dependent variable used is FDI inflows as a percentage of GDP and the independent variable is the share of the population between ages 0-14 as well as some economic and political control variables. Two regressions were conducted, one using the fixed effects model and one using the random effects model.

In the results, regression 1, which solely includes economic control variables shows a negative relationship between an emerging workforce and FDI, which contradicts the predictions made in the initial sections of the paper. In regression 2, where both economic and political variables are used, nothing can be said about the relationship, due to lack of significant results. However, a positive relationship between trade openness and FDI was detected.

One cause for the negative relationship could be that as the workforce shrinks, the demand for capital increases in order to compensate for the loss of labor. This would indicate that the

demand for capital would increase in developed countries and that FDI would increase. Another possibility is that the technology available in developed countries helps keep the productivity of the labor force constant, even though the absolute amount of working-age individuals decreases. In addition, decreasing savings of the older parts of the population could lead to diminishing FDI outflows, which in turn affects the FDI inflows.

The results are significant for policymakers as well as investors and individual consumers. It can be used to properly adapt societal functions in order to adjust to the effects changing age demographics might come to have on a country. When it comes to investments it can help investors make more informed and well-versed decisions. Apart from this, it also contributes to making the picture of how age demographics affect FDI more nuanced. Further research includes comparing results between developed and developing countries, examining different time periods, and using different variables. Limitations of the paper include a shortage of data, a less-than-ideal number of control variables, and a slightly too restricted independent variable.

In summary, our analysis highlights the importance of considering demographic trends when assessing economic indicators such as FDI inflows. As countries navigate the challenges posed by aging populations and shifting workforce dynamics, policymakers and investors alike can benefit from a nuanced understanding of these factors and their implications for economic growth and development.

8. References

Boghean, C., & State, M. (2015). The Relation between Foreign Direct Investments (FDI) and Labour Productivity in the European Union Countries. *Procedia Economics and Finance*, *32*, 278–285. https://doi.org/10.1016/s2212-5671(15)01392-1

Breusch, T. S.; Pagan, A. R. (1979). "A Simple Test for Heteroskedasticity and Random Coefficient Variation". Econometrica. 47 (5): 1287–1294 https://www.jstor.org/stable/1911963?origin=crossref

M. Collins, S. (1991, January). Saving behavior in ten developing countries. *National Bureau of Economic Research*. http://www.nber.org/chapters/c5996

Daniel Kaufmann and Aart Kraay (2023). Worldwide Governance Indicators, 2023 Update (www.govindicators.org)

Dedrick, J., Kraemer, K. L., & Shih, E. (2013). Information technology and productivity in developed and developing countries. *Journal of Management Information Systems*, *30*(1), 97–122. https://doi.org/10.2753/mis0742-1222300103

ECON 251 - Lecture 12 - Overlapping Generations Models of the Economy | Open Yale Courses. (n.d.). Yale University https://oyc.yale.edu/economics/econ-251/lecture-12

Fisher, M, R. (2016) *Life Cycle Hypothesis.* Springer link. Life Cycle Hypothesis | SpringerLink

Fälth, J. (2021). *Aging Populations and FDI Outflows* [Bachelor's thesis, Lund University]. https://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=9068255&fileOId=9068257

Hahn, F.H. (2018). Neoclassical Growth Theory. In: The New Palgrave Dictionary of Economics. Palgrave Macmillan, London. https://doi.org/10.1057/978-1-349-95189-5_704

Hausman, J. A. (November 1978). "Specification Tests in Econometrics". Econometrica. 46 (6): 1251–1271 https://www.jstor.org/stable/1913827?origin=crossref

Kotschy, R., & Bloom, D. E. (2023, August). *Population Aging and Economic Growth: From Demographic Dividend to Demographic Drag?* Cesifo. Retrieved May 1, 2024, from https://www.cesifo.org/DocDL/cesifo1_wp10613.pdf#:~:text=Bloom%20et%20al.%20%282003%29%20label%20this%20growth%20take-off,dividend%20dissipates%20once%20countries%20complete%20the%20demographic%20transition.

Kurtishi-Kastrati, S., Phd. (2013). IMPACT OF FDI ON ECONOMIC GROWTH: AN OVERVIEW
OF THE MAIN THEORIES OF FDI AND EMPIRICAL RESEARCH. *European Scientific Journal*,
9(7). out_fdi-libre.pdf (d1wqtxts1xzle7.cloudfront.net)

Mankiw NG, Romer D, Weil D. A Contribution to the Empirics of Economic Growth. Quarterly Journal of Economics. 1992;107 (May) :407-437. A Contribution to the Empirics of Economic Growth | N. Gregory Mankiw (harvard.edu)

Mason, A. (1988). Saving, economic growth, and demographic change. *Population and Development*
Review, *14*(1). https://www.jstor.org/stable/1972502

Mitra, R., & Abedin, M. T. (2022). Does a shrinking labor force reduce FDI inflows in OECD countries? *Applied Economics Letters*, *29*(17), 1654–1658. https://doi.org/10.1080/13504851.2022.2025996

Mitra, R., and Abedin, M. T. (2020) "Population Ageing and FDI Inflows in Japan: ARDL Approach to Cointegration Analysis", Economics Bulletin, Volume 40, Issue 2, pages 1814-1825 Abstract (accessecon.com)

Mitra, R., & Abedin, M. T. (2020). Population ageing and FDI inflows in OECD countries: a dynamic panel cointegration analysis. *Applied Economics Letters*, *28*(13), 1071–1075. https://doi.org/10.1080/13504851.2020.1796914

Mitra, Rajarshi and Abedin, Md. Thasinul and Sen, Kanon Kumar, Does Population Ageing Affect FDI Flows in South Korea?. Available at SSRN: https://ssrn.com/abstract=4536756 or http://dx.doi.org/10.2139/ssrn.4536756

Narciso, A. (2010). *The impact of population ageing on international capital flows* [Dissertation, Copenhagen Business School]. https://mpra.ub.uni-muenchen.de/26457/1/MPRA_paper_26457.pdf

Ortiz-Ospina, E., Beltekian, D., & Roser, M. (2023, December 28). *Trade and globalization*. Our World in Data. https://ourworldindata.org/trade-and-globalization#trade-generates-efficiency-gains

Peters, D. H., Garg, A., Bloom, G., Walker, D., Brieger, W. R., & Rahman, M. (2008). Poverty and
access to health care in developing countries. *Annals of the New York Academy of Sciences*, *1136*(1),
161–171. https://doi.org/10.1196/annals.1425.011

Population Pyramids of the World from 1950 to 2100. (n.d.). PopulationPyramid.net. https://www.populationpyramid.net/

Pettinger, T. (2019, December 16). *Life-Cycle Hypothesis*. Economics Help. https://www.economicshelp.org/blog/27080/concepts/life-cycle-hypothesis/?trk=article-ssr-frontend-pulse_x-social-details_comments-action_comment-text

Population by age group. (n.d.). Our World in Data. https://ourworldindata.org/grapher/population-by-age-group

Tamplin, T. (2023, June 8). *Economic Growth | Definition, Factors, & Strategies*. Finance Strategies Economic Growth | Definition, Factors, & Strategies (financestrategists.com)

World Bank Open Data. (n.d.). Current account balance (% of GDP). Retrieved from https://data.worldbank.org/indicator/BN.CAB.XOKA.GD.ZS

World Bank Open Data. (n.d.). Death rate, crude (per 1000 people). Retrieved from Death rate, crude (per 1,000 people) | Data (worldbank.org)

World Bank Open Data. (n.d.). Fertility rate, total (births per woman- European Union). Retrieved from Fertility rate, total (births per woman) - European Union | Data (worldbank.org)

World Bank Open Data. (n.d.). Fertility rate, total (births per woman-Sub Saharan Africa). Retrieved from https://data.worldbank.org/indicator/SP.DYN.TFRT.IN?locations=ZG

World Bank Open Data. (n.d.). Foreign direct investment, net inflows (% of GDP). Retrieved from https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS

World Bank Open Data. (n.d.). Gross fixed capital formation (% of GDP). Retrieved from https://data.worldbank.org/indicator/NE.GDI.FTOT.ZS

World Bank Open Data. (n.d.). Population ages 0-14 (% of total population). Retrieved from https://data.worldbank.org/indicator/SP.POP.0014.TO.ZS

World Bank Open Data. (n.d.). School enrollment, primary (% net). Retrieved from https://data.worldbank.org/indicator/SE.PRM.NENR

World Bank Open Data. (n.d.). Trade (% of GDP). Retrieved from https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS

Zaman, Q. U., Donghui, Z., Yasin, G., Zaman, S., & M, I. (2018). Trade Openness and FDI Inflows: A Comparative Study of Asian Countries. *European Online Journal of Natural and Social Sciences*, *7*(2).https://www.researchgate.net/publication/333389066_Trade_Openness_and_FDI_Inflows_A_Comparative_Study_of_Asian_Countries

9. Appendix

9.1 Models

Model 1.

```
Fixed-effects (within) regression               Number of obs      =     5,809
Group variable: countryID                       Number of groups   =       171

R-squared:                                      Obs per group:
     Within  = 0.0192                                         min =         1
     Between = 0.3067                                         avg =      34.0
     Overall = 0.0578                                         max =        53

                                                F(4, 170)          =      8.11
corr(u_i, Xb) = -0.3002                         Prob > F           =    0.0000

                                    (Std. err. adjusted for 171 clusters in countryID)
------------------------------------------------------------------------------
             |               Robust
         fdi | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
      pop0014 |  -.2754997   .0980233    -2.81   0.006    -.4689993   -.0820002
        gfcf |   .0455437   .0611064     0.75   0.457    -.0750814    .1661688
         cab |  -.0498281   .0438858    -1.14   0.258    -.1364594    .0368032
         trd |   .0589661    .033095     1.78   0.077    -.0063639    .1242961
       _cons |   6.340912   4.746005     1.34   0.183    -3.027782    15.70961
-------------+----------------------------------------------------------------
     sigma_u |  4.7733882
     sigma_e |  13.710094
         rho |  .10811401   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Model 2

```
Random-effects GLS regression                   Number of obs     =      1,889
Group variable: countryID                       Number of groups  =        151

R-squared:                                      Obs per group:
     Within  = 0.0157                                         min =          1
     Between = 0.2847                                         avg =       12.5
     Overall = 0.0912                                         max =         20

                                                Wald chi2(6)      =      81.05
corr(u_i, X) = 0 (assumed)                      Prob > chi2       =     0.0000

                                (Std. err. adjusted for 151 clusters in countryID)
------------------------------------------------------------------------------
             |               Robust
         fdi | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
         trd |    .069421   .0095238     7.29   0.000     .0507546    .0880874
        gfcf |   .0784746   .1193936     0.66   0.511    -.1555326    .3124817
         cab |  -.0687477   .0457001    -1.50   0.132    -.1583184    .0208229
         rqr |   .0231582   .0187233     1.24   0.216    -.0135388    .0598552
      pop0014 |  -.101892   .1258482    -0.81   0.418    -.3485498    .1447658
     primary |  -.0014845   .0260322    -0.06   0.955    -.0525066    .0495376
       _cons |   -.973293   7.065853    -0.14   0.890    -14.82211    12.87552
-------------+----------------------------------------------------------------
     sigma_u |  5.8614823
     sigma_e |  11.126552
         rho |  .21723317   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

9.2 Breusch-Pagan tests

Test for model 1

```
Breusch–Pagan/Cook–Weisberg test for heteroskedasticity
Assumption: Normal error terms
Variables: pop0014 gfcf cab trd
```

H0: Constant variance

chi2(4) = 26686.30
Prob > chi2 = 0.0000

Test for model 2

Breusch–Pagan/Cook–Weisberg test for heteroskedasticity
Assumption: Normal error terms
Variables: trd gfcf cab rqr pop0014 primary
H0: Constant variance

chi2(6) = 1791.84
Prob > chi2 = 0.0000

9.3 Hausmann tests

Model 1

---- Coefficients ----

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fe	re	Difference	Std. err.
pop0014	-.2754997	-.1317793	-.1437204	.0395507
gfcf	.0455437	.009684	.0358597	.0177723
cab	-.0498281	-.0646251	.014797	.0105116
trd	.0589661	.0585305	.0004356	.0079911

b = Consistent under H0 and Ha; obtained from xtreg.
B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic
chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 18.67
Prob > chi2 = 0.0009

Model 2

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fe	re	Difference	Std. err.
trd	.0604003	.069421	-.0090208	.0165851
gfcf	.1449035	.0784746	.066429	.0342575
cab	-.0613753	-.0687477	.0073725	.0130052
rqr	-.0169553	.0231582	-.0401135	.0348394
pop0014	-.3393043	-.101892	-.2374123	.1185498
primary	-.0130978	-.0014845	-.0116133	.0402258

b = Consistent under H0 and Ha; obtained from xtreg.

B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 11.06

Prob > chi2 = 0.0864

9.4 Country List

Model 1

Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, The, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bermuda, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Comoros, Congo, Dem. Rep., Congo, Rep., Costa Rica, Cote d'Ivoire, Croatia, Curacao, Cyprus, Czechia, Denmark, Djibouti, Dominican Republic, Ecuador, Egypt, Arab Rep., El Salvador, Eritrea, Estonia, Eswatini, Ethiopia, Fiji, Finland, France, French Polynesia, Gabon, Gambia, The, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong SAR, China, Hungary, Iceland, India, Indonesia, Iran, Islamic Rep., Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Korea, Rep., Kosovo, Kuwait, Kyrgyz Republic, Lao PDR, Latvia, Lebanon, Lesotho, Libya, Lithuania, Luxembourg, Macao SAR, China, Madagascar, Malaysia, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Namibia, Nepal, Netherlands, New Caledonia, New Zealand, Nicaragua, Niger, North Macedonia, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Rwanda, Samoa, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Slovak Republic, Slovenia, Solomon Islands, South Africa, South Sudan, Spain, Sri Lanka, Sudan, Suriname, Sweden, Switzerland, Syrian Arab Republic, Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Tonga, Tunisia, Turkiye, Uganda, Ukraine, United Kingdom, United States, Uruguay, Uzbekistan, Vanuatu, Venezuela, RB, Viet Nam, West Bank and Gaza, Yemen, Rep., Zambia, Zimbabwe,

Model 2

Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, The, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bermuda, Bhutan, Bolivia, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Chile, China, Colombia, Comoros, Congo, Rep., Costa Rica, Croatia, Cyprus, Denmark, Djibouti, Dominican Republic, Ecuador, Egypt, Arab Rep., El Salvador, Eritrea, Estonia, Eswatini, Ethiopia, Fiji, Finland, France, Gambia, The, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Guinea-Bissau, Guyana, Honduras, Hong Kong SAR, China, Hungary, Iceland, India, Indonesia, Iran, Islamic Rep., Iraq, Ireland, Israel, Italy, Jamaica, Jordan, Kazakhstan, Kenya, Kiribati, Korea, Rep., Kyrgyz Republic, Lao PDR, Latvia, Lesotho, Lithuania, Luxembourg, Macao SAR, China, Madagascar, Malaysia, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, North Macedonia, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Rwanda, Samoa, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Slovak Republic, Slovenia, Solomon Islands, South Africa, South Sudan, Spain, Sri Lanka, Sudan, Suriname, Sweden, Switzerland, Syrian Arab Republic Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Tonga, Tunisia, Uganda, Ukraine, United Kingdom, United States, Uruguay, Uzbekistan, Vanuatu, Venezuela, RB, West Bank and Gaza, Yemen, Rep., Zambia, Zimbabwe,