

Not the Same Answers for the Rapid Aging Countries:  
The demographic and economic approaches matter.

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## **Abstract**

Increase in life expectancy combined with low fertility expedite a significant shift in the age structure of the world population. Relatively few studies integrated pace of aging into the association between pension and demographic determinants in the cross-national context. The purpose of this study is to identify how social spending correlates with aging outcomes; aging ratio, life expectancy, and total fertility rates. This study adopts the forty-most “aged countries,” and their demographic, macroeconomic, and social spending indicators by using the World Development Indicator (WDI) and Organization for Economic Cooperation and Development (OECD) data. First, a simple regression model describes how social spending correlates with the three aging-outcomes. Then, quantile-based multiple regression models examined the associations between aging and social spending by each pace of aging. The results support that pension spending overall has a positive association with the aging ratio whereas fertility rates limitedly correlate with public pension spending. Specifically, rapid aging societies show moderate public pension spending compared to slow-paced aging societies. Also, the rapid aging societies tend to show weak economic development; low GDP per capita, low female labor force participation, and low saving rates.

## 1. Introduction

According to UN 2017 World Population Prospects, life expectancy increased rapidly between 2005 and 2015; global life-expectancy at birth rose from 67.2 to 70.8 years. In 2017, about 13 percent of the global population aged over 60 in the world, 962 million people (UN, 2018). Increase in life expectancy combined with low fertility expedite a significant shift in the age structure of the worldwide population. According to the World Health Organization (WHO), a society where the proportion of people who age 65 years or older is over 7 percent is known as an “aging society,” where over 14 percent is defined as an “aged society,” and where 20 percent or higher is called a “post-aged society” (National Development Council, 2014)..

Many economists suggest that social expenditures influence individuals’ behaviors. Feldstein (1974) argues in his social security hypothesis that individuals’ efforts to reduce lifetime risks decline as the government provides social insurance more. Indeed, the public provision of old-age pensions exhibits an adverse impact on the old-age security motive for children (Boldrin et al., 2015) whereas reduction of social security benefits in the U.S. occurred with an increase in savings and fertility (Ehrlich & Kim, 2007). However, few studies integrated pace of aging into the association between pension and demographic determinants in the cross-national contexts.

The purpose of this study is to find policy implications for “aged societies” based on not only the level of aging but also the pace of aging. First, this paper describes the association between pension benefits and aging indices-aging ratio, life expectancy, and TFR- among the forty-most “aged countries.” Then, segmented paces of aging will be examined through demographic, economic, and social spending determinants in cross-national approach. This study uses more than 50 years of macroeconomic indices from the World Bank World Development Indicator (WDI) and Organization for Economic Cooperation and Development (OECD) data among the

forty-most “aged countries.” These cross-national datasets will be combined throughout the entirety of fertility transitions. A simple logistic regression model predicts the three dependents variables by using macro-level factors including demographic characteristics, macroeconomic indicators, and social policies. Then, quartile-based multiple regression models examined the association between aging and social policies by aging pace.

The results support the importance of an increase in public pension expenditure among the “aged societies.” On top of that, the analysis also reveals that different pace of aging may require different policy efforts. An increase in public pension expenditures is the ideal approach, but it is doubtful that public-pension oriented approach is the affordable response among the rapid aging societies as well. Also, the ramification of an adverse relationship between pension and children (Cigno, 2007; Boldrin, 2015) could eventually transform the population structure of a society into the one with a high dependency ratio. Therefore, not the same answers apply to rapid aging societies as a policy response to aging.

## 2. Literature Review

Many economists argue that social insurance benefits and contributions motivate individuals to change behaviors (Feldstein, 1974; Cigno, 1993; Boldrin et al., 2011)). The social security hypothesis postulates that welfare institutions affect the labor supply of individuals, which also provides a framework for analyzing the impact of pension insurance on the first demographic transition (Fenge & Scheubel, 2017). The life cycle hypothesis of saving argues that individuals consume and save from an early stage of lifecycle considering their lifetime earnings (Modigliani & Ando, 1963). Hock and Weil (2007) articulate an overlapping-generations model in which individuals pass through three life stages: dependent youth, working age, and the dependent elderly.

The children of baby boom generations shift to low fertility, transforming the population structure into high dependency shape (Bloom et al., 2011). Indeed, the exceptionally rapid population aging jeopardizes elderly's living with insufficient income source (Cigno & Werding, 2007). The economic pressure from aging such as a decline in retirement age and an increase in tax burden occur with having fewer children and increasing demand for public pension (Lee, 2003). On the other hand, retirees do not rely entirely on the labor of others such as social benefits and familial transfers. Instead, retirees depend more on private pension funds, personal savings, homes acquired during their working ages and other assets to finance some part of their retirement (Mason & Lee, 2007). Lindh and Malmberg (2007) argue that OECD countries show a high correlation between savings and investment because of development in the financial market and pricing system, based on the enormous pension and saving product markets.

In a Pay-As-You-Go (PAYGO) pension system which benefits are funded from the current taxpayers, the old generations of retirees become dependent on the young workers through payroll tax contributions (Clark et al. 2004). However, PAYGO pension programs faced to limitation amid population aging, unsustainable benefit promises, the trend toward early retirement, declining fertility, and fiscal challenges from market economy (World Bank, 1994; Williamsons, and Williams, 2003). Due to these challenges to existing PAYGO schemes, entirely new old-age pension schemes are under consideration in many countries (Watts-Roy & Williamson, 2009). More developed countries provide benefits for the elderly in a more consolidated way with three main approaches. The first pillar is that pension schemes are run directly by the government, while participation is mandatory for all citizens. The second pillar relies on employers' provision. The third pillar is the private sector such as insurance companies

or other types of financial markets, providing retirees with part of their pension (Cigno & Werding, 2007)

The population aging has proceeded rapidly in Southern Europe where is among the “oldest” areas in the world (Tomassini & Lamura, 2008). Italy provides recipients with several state care allowances, depending on severity, type of disability, and the income level (Principi, 2005). The UK national insurance plan provides a minimum level of universal pension from a uniform flat-rate contribution. Also, the Swedish pension system has two essential financial sources: general tax revenue and contributions by employers (Cigno & Werding, 2007). The Nordic countries were among the first countries to suffer rapid aging and which effectuated government mandates on pensions since the 1800s (Sundstrom, 2008). The social welfares of the Nordic countries support old parents to remain independent through the generous pension systems, also accessing to proper and inexpensive housing services, and health care, where also has been a gradual aging process (Sundstrom, 2008). Besides, Russia and Eastern European countries underwent other backgrounds of aging such as high out-migration of the young generation, a rapid decrease of mortality, which burdens the government with social welfare and health care needs: (Garvriova & Gavrilov, 2008).

Amid the demographic transition and rapid aging, Japan began universal health care and pension plans in 1961 and supported long-term care insurance and other customized schemes, such as employment insurance (Ogawa et al., 2007). The Japanese model is characterized as highly regulated by the government, enhancing a private provision with mandatory health insurance (Imai, 2002). South Korea is projected to be one of the highest old-age dependency ratios of any country in the world (Poston, 2008). Urasawa and Jones (2014) argue that the rapid population aging in Korea will increase elderly poverty more during the next decades because of

weak public and private support for elderly housing. In East Asian countries, the eldest son has been primarily responsible for caring for their aging parents and have co-resided with them (Lee, 2000; Mason, 1992; Skinner, 1997). What children support their aging parents was relatively less burdensome because the aging ratio was never as high as now (Kim & Choe 1992; Sung 1995).

### 3. Data and Method

World Development Indicator (WDI) is the World Bank's database collection of comparable cross-country data on development. The database includes more than 1400 time-series indicators for 217 economies and more than 40 country groups overarching more than 50 years. Since a cross-sectional analysis of national-level data has statistical limitations, this study used more than 50 years of national-level indicators of each "aged country," which identifies the proportion of pension expenditure through the level of aging. Social policies from OECD data are combined with WDI where lacks demographic and economic data. Also, not all WDI and OECD data provide 50 years of social spending because of the different onsets of welfare policies in rapid aging countries.

The first aim of this study is to describe the relationship between public pension contributions and the aging ratios among the "aged countries." Aging ratios measured by the share of the old over 65, life expectancy at birth, and the total fertility rates (TFR) serve as the three primary dependent variables. A simple logistic regression model is applied to the three dependents variables by using demographic characteristics, macroeconomic indicators, and social spending including public pension contributions, public health care expenditures, and the other social expenditures. This study adopts about 50 years of macroeconomic indicators of the forty-most "aged countries" to overcome a statistical limitation of using cross-sectional data of a country.

In general, population aging results from two factors: longer life expectancy and lower fertility rates. So, demographic, economic, and social spending are regressed to the three dependent variables separately: aging ratio, life expectancy, and fertility rates. The old aging ratio has defined the ratio of the old who ages over 65 in this study. Specifically, this study focuses on the forty-most “aged countries” where more than 14 percent of the population are the elderly who ages over 65 as of 2017, which are 50 years of cross-national data of the forty-most “aged countries” about 1928 samples.

The explanatory variables consist of demographic factors, economic factors, and social policies. The demographic factors consist of population growth, life expectancy, TFR, and aging pace which is measured by regression slopes of aging ratio during the recent five years. Also, life expectancy and TFR are tested in additional models separately because these two factors interactively influence aging ratios of each country. The economic conditions include GDP per capita (logarithm), unemployment rates, and female labor force participation (FLFP) at the national level. Finally, social policies include the proportion of public pension contributions, the proportion of public health expenditures, and the proportion of miscellaneous welfare expenditure compared to GDP. This study assumes that the policy responses of each “aged country” depend on the different aspects of aging: longer life expectancy and lower fertility rates. Also, the aging pace is assumed as a discrete factor to consider welfare policies intertwined with demographic and economic conditions.

The unique aspect of this study is to focus on the *pace* of aging and policy efforts among the “aged countries.” This paper assumes that aging pace provides a different perspective from the aging level regarding the relationship with the welfare policies. The following tests examine the association between each *pace* of aging and policy efforts other than demographic and economic



factors. The segmented pace of aging includes four models by quartile basis: slow aging, moderate aging, fast aging, and rapid aging. The subsequent tests include 482 samples for each quartile pace of aging consecutively. Then, this study examined how each quartile aging pace is associated with demographic, economic indicators and social spending. Like the previous test, the dependent variable is the aging ratio that is measured by the proportion of the old age over 65. The *pace*-oriented aging analysis aims to find implications of which the policy efforts against population aging should consider not only the *level* of aging but also the *pace* of aging.

#### 4. Result

Aging ratios, measured by the proportion of the old who age over 65, have increased during the recent 50 years among the “aged countries” in common (Figure 1). However, the pace of aging is a contrast between Northern European countries and East Asian Countries (Figure 2). The aging ratios in Norway and Sweden shows a steady increase during the recent 50 years whereas those of Japan, South Korea, and Hong Kong abruptly increased during the same period. Specifically, Japan shows the highest aging ratio as of 2017. Overall, the life expectancy has increased from the early 70s in 1960s to the early 80s in 2010s while TFR trend varies by countries. Northern European countries maintained similar fertility rates slightly below replacement level whereas Asian countries have reduced TFR precipitously to below 1.3 children per women. Figure 3 and 4 show that the background of aging is distinctive either an increase in life expectancy or a decrease in TFR.

[Figure 1,2,3,4 about here]

Table 1 describes how demographic, macroeconomic indicators and social expenditures correlate with the three aging components: aging ratio, life expectancy, and TFR. Overall, Table 1 illustrates the three associations with aging ratio and its components: high aging ratio, high life

expectancy, and low TFR. The recent demographic trend shows that population growth is closely related to an increase in life expectancy rather than TFR. On the other hand, the aging pace is negatively associated with life expectancy, which means there is a disconnection between the aging pace and the aging level in conforming aging ratio. Also, the aging ratio is correlated with high GDP per capita, low unemployment level, and lower saving rates. About the social spendings, public pension spending is positively associated with aging level among the forty-most “aged countries.”

[Table 1,2 about here]

Model 1 suggests how slow pace of aging, the lowest quartile measured by the recent five years of aging ratio regression slopes, is associated with the explanatory variables (Table 2). Model 4 exhibits how the most rapid quartile in aging pace correlates with demographic, macroeconomic indicators and social policies. Overall, the relationships are similar among the models other than the degree of associations. Public pension spending has a positive association with the aging ratio in common. However, the rapid aging of Model 4 has a moderate association with public pension spending compared to slow aging of Model 1. Also, the rapid aging societies have a negative relationship with population growth. Moreover, the savings rate shows the most negative association with the aging ratio in the rapid aging societies whereas GDP per capita finds a dubious relationship with the aging ratio in the rapid aging societies (Model 4). Overall, the rapid aging correlates with weak economic development indicators such as lower GDP per capita and the lower FLFP, and lower saving rates among the four paces of aging.

In sum, pension spending overall has a positive association with the aging ratio. In opposition to life expectancy, TFR barely correlates with public pension spending. More importantly, the aging pace plays a role in public spending on social policies. Rapid aging societies show a

limited contribution to social expenditure at the national level compared to the slow-paced aging societies. In the rapid aging societies, the results also identify weak economic development indicators; low GDP per capita, low FLFP, and low saving rates.

## 5. Discussion

Many European countries are spending a high proportion of GDP on social benefits. However, the policy approach to raise social benefits responding to aging needs to consider overall economic and demographic factors (Bloom, Canning, & Fink, 2010). Otherwise, the enormous burden may lead to an economic crisis of which Southern European countries faced in the early 2010s: Portugal, Italy, Greece, and Spain. Aging in Northern European countries was a relatively slow and long-term process more than one century whereas East Asian or East European countries' aging proceeded during the recent three decades precipitously (Sundstrom, 2008). Also, not high enough individuals' income and different labor market conditions endanger the sustainability of both social welfares systems and economic growth (Soubotina, 2004).

This study has limitations in that individuals also prepare for aging through private markets: private pension expenditures, private health care, and housing markets. Moreover, each country faces a different sociopolitical environment that affects either pro-welfare or anti-welfare policies. Also, economic downturns during the half-century could affect social spending policies: 1970s oil shocks, 1990s Asian economic crisis, the 2000s mortgage crisis, and the 2010s Southern European economic crisis. Notwithstanding these cyclical and political differences, this study suggests that the degree of social spending depends on the specific status of combinations among demographic, economic, and sociopolitical environment.

First, Northern European countries' population structure is less burdensome regarding dependency ratio compared to East Asian and East European countries. Indeed, fertility

recuperation and secure pension plans could be the matter of chickens and eggs. Thus, the massive proportion of social welfare spending in Northern European models may not be the best option for the rapid aging countries in East Asian and East European countries. Second, labor market policies including an increase in FLFP need to consider in rapid aging societies following the path of an increase in social spending. Therefore, future research should take into account not only the population structure but also the labor market conditions of each economy in the rapid aging trends.

## 6. Conclusion

This research aims to find evidence of what social policies have responded to aging during the recent 50 years among the current forty-most “aged countries.” This cross-national analysis focuses on the aging ratio, life expectancy at birth, and TFR with regards to the pace of aging. Currently, Europe has about 25 percent of the population ages over 65, and East Asian countries are expected to reach the same level within a decade. This study assumes that social spending correlates with not only the aging ratio but also the aging pace. Other than increasing social spending, rapid aging countries need to consider comprehensive policy efforts through population structure and labor market development.

This study suggests two important findings regarding the association between aging and social welfare policies. First, public pension spending overall has a positive association with the aging ratio. On the contrary to life expectancy, TFR limitedly correlates with public pension spending. Second, the aging pace plays a significant role in public spending as social policies. The most rapid aging societies show a limited association between aging level and social spending compared to the slow-paced aging societies. Also, the aging ratio in the most rapid

aging societies rarely correlates with the economic development indicators such as GDP per capita, FLFP, and saving rates.

Many Northern and Western European countries have experienced aging earlier even at a slower pace than other regions. On the contrary, rapid aging is a relatively new phenomenon in East Asian and East European countries. Indeed, the same policy efforts of the slow aging societies are hardly applicable to the rapid aging societies because both aging pace and the macroeconomic environments are different (Ferrera, 1996). Some countries are rapidly losing the labor force in their population because of rapid aging (Clark et al., 2007). Other than providing social welfare benefits for the aging population, the rapid aging societies need to consider whether existing pro-nalist policies could be applicable approaches for responding to aging societies. Simultaneously, rapid aging societies need to consider macroeconomic approaches such as higher FLFP, sustainable employment and saving rates.

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Figure 1.

Aging pace of aged countries countries

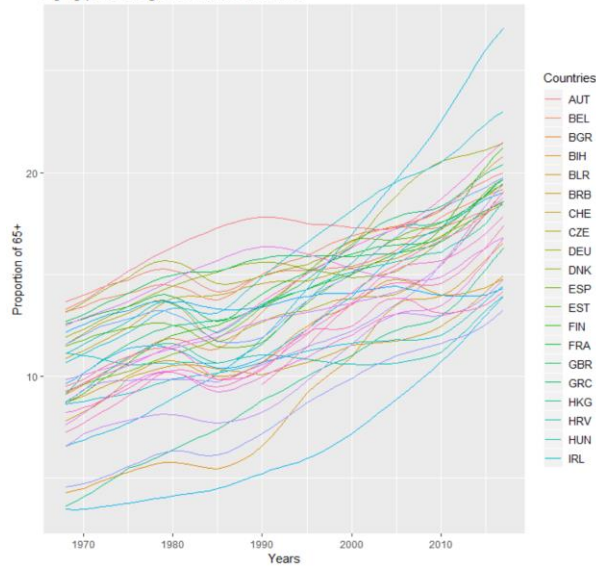


Figure 2.

Aging pace of Northern European and East Asian countries

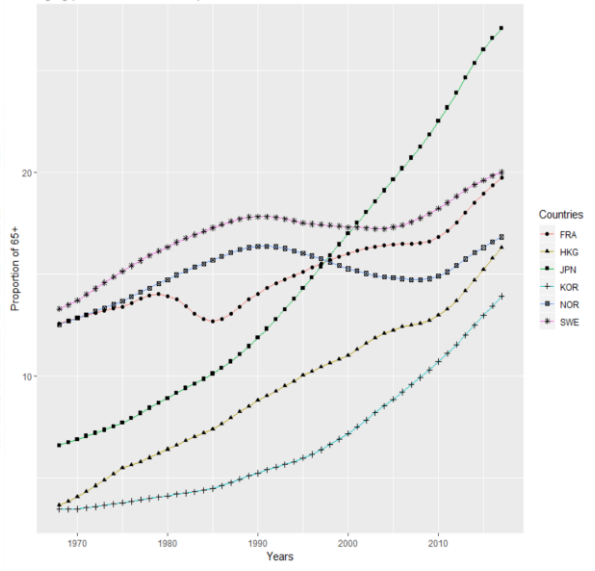


Figure 3.

Fertility of Northern European and Asian countries

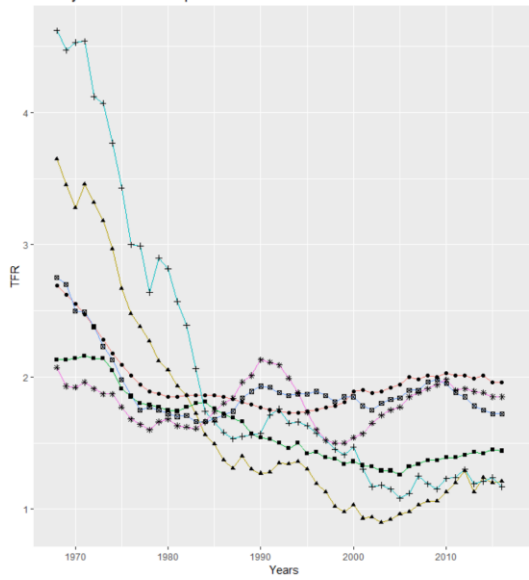
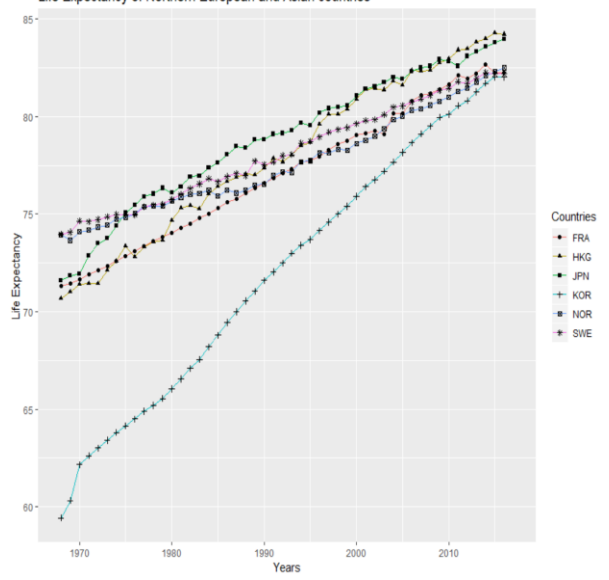


Figure 4.

Life Expectancy of Northern European and Asian countries



Source: WDI 2017, OECD 2017



Table 1. Log-odds of coefficients between three aging components and social policies among the forty aged countries

		Aging Ratio		Life expectancy			TFR	
		Log-odds	S.E	Log-odds	S.E		Log-odds	S.E
	Intercept	-12.50	(2.87) ***	44.26	(2.01) ***		1.14	***
Demographics	Population Growth	-2.09	(0.16) ***	1.42	0.15 ***		0.12	(0.02) ***
	Life Expectancy	0.01	(0.01)	-	-	-	-0.02	(0.01) **
	TFR	-0.13	(0.40)	-1.16	(0.39) **		-	-
	Aging Pace	2.25	(0.58) ***	-6.03	(0.51) ***		-0.31	(0.06) ***
Macro-Economics	GDP per capita	2.63	(0.24) ***	3.08	(0.19) ***		0.07	(0.03) **
	Unemployment Rate	-0.08	(0.02) ***	0.03	(0.02)		0.01	(0.00) ***
	Female Labor Force Participation	-0.04	(0.02) *	0.01	(0.02)		0.01	(0.00) ***
	Savings Rate	-0.08	(0.01) ***	-0.06	(0.01) ***		0.00	(0.00) **
Social Policies	Public Pension Spending % of GDP	0.43	(0.04) ***	0.08	(0.04) *		-0.01	(0.00) ***
	Public Health Spending % of GDP	0.01	(0.00) ***	0.01	(0.00) ***		0.00	(0.00) **
	Social Spending % of GDP	-0.07	(0.01) ***	-0.05	(0.01) ***		0.01	(0.00) ***
	n		1928		1928			1928

Signif. codes: \*\*\* 0.001, \*\* 0.01, \* 0.05, · 0.1

Source: WDI 2017, OECD 2017

Table 2. Log-odds of coefficients between the aging ratio and social policies by the aging pace

		Model 1 (Slow Aging)		Model 2 (Moderate )		Model 3 (Fast)		Model 4 (Rapid Aging)	
		Log-odds	S.E	Log-odds	S.E	Log-odds	S.E	Log-odds	S.E
	Intercept	4.63	(5.20)	-11.71	(6.08) ·	-20.15	(5.81) ***	-15.32	(7.50) *
Demographics	Population Growth	-0.80	(0.19) ***	-3.22	(0.55) ***	-2.72	(0.30) ***	-3.93	(0.44) ***
	Life Expectancy	-0.06	(0.07)	-0.03	(0.13)	-0.17	(0.11)	0.26	(0.10) **
	TFR	0.24	(0.56)	1.37	(0.83)	-0.49	(0.87)	1.34	(1.09)
Macro-Economics	GDP per capita	1.36	(0.28) ***	2.67	(0.61) ***	5.37	(0.73) ***	1.15	(0.93)
	Unemployment Rate	0.09	(0.05) ·	-0.06	(0.04)	-0.17	(0.04) ***	-0.07	(0.04) ·
	Female Labor Force Participation	-0.04	(0.02) ·	-0.04	(0.04)	-0.07	(0.03) ·	-0.08	(0.04) *
	Savings Rate	-0.04	(0.02) *	-0.06	(0.03) ·	-0.10	(0.02) ***	-0.15	(0.04) ***
Social Policies	Public Pension Spending % of GDP	0.45	(0.06) ***	0.62	(0.09) ***	0.45	(0.08) ***	0.21	(0.07) **
	Public Health Spending % of GDP	0.00	(0.00) *	0.00	(0.00)	0.00	(0.00)	0.01	(0.00) **
	Social Spending % of GDP	-0.09	(0.01) ***	-0.10	(0.02) ***	-0.11	(0.02) ***	-0.03	(0.02)
	n		482		482		482		480

Signif. codes: \*\*\* 0.001, \*\* 0.01, \* 0.05, · 0.1

Source: WDI 2017, OECD 2017