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Article

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The Effect of Public Debt on Income Inequality in Advanced Economies: Does Institutional Quality Matter?[1]

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Abstract

Global income inequality becomes one of the severe problems in most economies, while government spending financed by public debt can be a good instrument of fiscal policy to reduce this inequality in society. Does institutional quality affect the public debt – income inequality relationship in advanced economies? For the answer, the paper employs the system-GMM and PMG estimator to examine the effects of public debt, institutional quality, and their interaction on income inequality for a group of 30 advanced economies from 2002 through 2020. The paper finds some exciting results. Public debt and institutional quality narrow income inequality, but their interaction term widens. Furthermore, economic growth and unemployment increase income inequality, while education decreases it. The findings suggest some necessary policy implications to narrow income inequality through public debt and institutional quality.

Keywords: *institutional quality, public debt, income inequality, advanced economies*

JEL Classification: D31, E24, H63

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Introduction

Global income inequality in society is one of the severe challenges in most economies under increasing globalization because it may lead to social instability. Decreasing the income gap across countries becomes one of the eight MDGs (Millennium Development Goals) by the United Nations. Governments in advanced economies have several appropriate resources to achieve it. Public spending

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keeps a crucial role in the fiscal policy of governments. Compared with tax revenue, government spending is an active instrument of governments in running the economy and overcoming economic cyclicality. Governments actively spend more for a recession economy with high unemployment (an expansionary fiscal policy with increased government spending). However, they will spend less for a hot economy with high inflation (a contractionary fiscal policy with decreased government spending). In particular, governments can spend more to help low-income individuals access healthcare and education through social transfers to reduce the income difference between high-income individuals and low-income individuals, narrowing income inequality in society. However, rising public spending financed by borrowing leads to high public debt. Economic history shows that public debt crises often lead to economic crises: the European debt crisis in the second half of 2009 with high public debt in Portugal, Greece, Italy, Ireland, and Spain, the financial crisis in East Asia officially in 1997 with the collapse of the Thai baht, the Latin American debt crisis of the 1980s. These economies often have to enforce austerity policies and lose economic sovereignty to receive rescue packages from the IMF or World Bank. Their citizens face an unstable economy with more unemployment. Therefore, governments should control public debt with strict fiscal discipline to avoid a public debt crisis in the future. Despite its significant role in reducing inequality in society, the effect of government debt on wealth and income inequality remains a controversial topic. Since the birth of the GINI index in 1912, several related studies have tested the impact of public/government debt on inequality. However, no studies investigate the contribution of institutional quality to the public debt – income inequality relationship in advanced economies. Therefore, this paper will do it to contribute to the literature.

Global income inequality is one of the severe problems, while increasing public debt can lead to a debt crisis and social instability. In particular, institutional quality can significantly contribute to the public debt – income inequality relationship in advanced economies. Given these facts, the paper employs the system-GMM and PMG estimator to investigate the impacts of public debt, institutional quality, and their interaction on income inequality for a balanced panel dataset of 30 advanced economies during the period 2002 – 2020.

The paper shows the structure as follows. The introduction presents the introduction, while Section 1 gives an overview of global public debt as well as global income inequality. The theoretical framework and literature review in Section 2 focus on the impact of government debt on inequality, and Section 3 notes the methodology and research data. Meanwhile, Section 4 reports the results and discussion, and the last section provides a conclusion and some policy implications.

1. Overviews of the Global Public Debt and Global Income Inequality in Advanced Economies

1.1. Global Public Debt In Advanced Economies

Regarding the global public debt situation, International Monetary Fund (2021a) reports that in 2020, global public debt amounted to 88 trillion USD, which rose sharply because of the crisis. China and advanced economies captured more than 90 percent of the accumulation of worldwide debt. In 2021, public debt accounts for 97.8% of the world's GDP. Although it is 0.8% lower than one year ago, it still stands at record-high levels due to a massive fiscal response from governments to deal with the waves of the coronavirus pandemic. The statistical data from IMF note public debt in the coming years is still persistently higher than the levels projected before the coronavirus pandemic. It is expected to be near 20% higher in advanced economies through 2026. Public debt in the United States will decline by 0.6% to 133.3% in 2021 and stand at 133.5% in 2026. Japan's public debt will come to 256.9% of GDP this year, up 2.8% from one year ago, before decreasing to 251.9% in 2026. Likewise, International Monetary Fund (2021b) notes that the coronavirus pandemic has put a severe challenge to public finances. During the global financial crisis, the contraction in output and government revenues leads to public deficits and debts beyond levels. Notably, global public debt is forecast to increase further from 98% of GDP in 2020 to nearly 100% of GDP in 2021 driven by advanced and emerging economies.

1.2. Global Income Inequality in Advanced Economies

DESA (2020) says that many economies that experience high-income gaps have enjoyed a decrease in income inequality. Several economies and regions with low levels of income inequality in 1990 have seen increases in the income gap. Germany, many Eastern European economies, and Nordic economies have suffered rises in income inequality. Furthermore, some large middle-income economies have enjoyed rises in income inequality since 1990. Notably, China's income inequality increased in both urban and rural areas.

Notably, the income share by the top 1% increased in 59 out of 100 economies. In 2015, the richest 1% earned more than 20% of all income in 18 economies, including the United States, the United Arab Emirates, Turkey, Thailand, the Russian Federation, India, Chile, and Brazil. Although income inequality in Brazil has decreased, the income share of the top 1% before transfers and taxes increased to 28.3% in 2015 from 26.2% in 2001. In particular, the incomes of

the bottom 40% increased faster than average in France but slower than average in the United States, meaning that France moved towards decreasing income inequality while the United States did not.

Since the 2008 financial and economic crisis, the incomes of the top 10% and the top 1% have fallen in most high-income economies. In the meantime, the incomes of the bottom 10% have suffered a sustained decrease in around one-third of advanced economies. Among them are economies (Spain, Ireland, and Greece) that experienced the greatest income losses through the crisis.

2. Theoretical Framework and Literature Review

2.1. Theoretical Framework

Given the relevance, Chatzouz (2014) and Borissov and Kalk (2020) suggest theoretical frameworks to note the impact of public debt on income inequality. Chatzouz (2014) offers a simple analytical model to show how government debt affects wealth inequality with the presence of altruism. Meanwhile, Borissov and Kalk (2020) develop an economic growth model with government borrowing financed by income taxes and the presence of positional concerns. The analysis shows that policies focusing on narrowing initial inequality by government debt can widen wealth inequality in the long run. Notably, this paper discovers that institutional quality has a significant contribution to the public debt – income inequality relationship in advanced economies. According to Li and Filer (2007), advanced economies are those with rule-based governance (good institutional quality). These economies have enough appropriate resources to handle the income gap in society. They design, formulate and enforce regulations and policies (institutional quality) to narrow income inequality between the rich and the poor. They have higher levels of social spending and spend more on social protection (Ortiz-Ospina and Roser, 2016). They use public spending financed by debt to support the poor and low-income individuals through social transfers throughout economic development, reducing the income difference between low-income and high-income individuals. As a result, public debt and institutional quality decrease income inequality.

However, because high public debt can cause a public debt crisis and social instability, some regulations and policies (institutional quality) in these economies focus on controlling and managing strictly public debt. It leads to a decline in public debt. Therefore, the interaction between public debt and institutional quality can increase income inequality.

2.2. Literature Review

Most investigations on the income inequality and public debt relationship have been recently carried out. Notably, the number of studies on the impact of government debt on income inequality is not much.

Regarding the effect of income inequality on public debt, some studies (Arawatari and Ono, 2017; Röhrs and Winter, 2017; March and von Weizsäcker, 2020; Maebayashi and Konishi, 2021) develop theoretical models while others (Lee, 2005; Aksman, 2017; Luo, 2020; Carrera and de la Vega, 2021; Obiero and Topuz, 2021) carry out the empirical investigation. Arawatari and Ono (2017) develop a theoretical model to show the conflicts over fiscal policy across and within generations in which public debt and income inequality vary. The analysis notes that low-inequality economies implement contractionary fiscal policies with low government debt. However, high-inequality economies realize expansionary fiscal policies with high government debt. Similarly, Röhrs and Winter (2017) suggest a theoretical model indicating the effect of public debt reduction on wealth and income inequality. It shows that a decline in public debt leads to a good distribution of wealth and income. Recently, March and von Weizsäcker (2020) determine a theoretical model to highlight the mediating role of coordination in the effect of wealth inequality on government debt. More recently, Maebayashi and Konishi (2021) report an endogenous growth model focusing on the relationship between government debt sustainability and income inequality. The analytic results indicate that government debt sustainability affects both income inequality and the relative size of public debt. Meanwhile, Aksman (2017) does not find the impact of inequality on public debt using the bias-corrected LSDV estimator for all European Union countries from 1995 to 2015. Recently, Luo (2020) employs the fixed effects model for a sample of OECD members between 1970 and 2010. He finds that capital income inequality decreases public debt, but labor income inequality increases. Lately, Carrera and de la Vega (2021) apply the system-GMM (SGMM) estimator and the D-LSDVC estimator for a panel dataset of 158 countries from 2000 to 2019. They report a positive effect of inequality on government debt.

Regarding the effect of public debt on income inequality, Lee (2005) uses the fixed effects and random effects models for a group of 64 advanced and developing economies between 1970 and 1994. He notes public debt increases income and wealth inequality in limited democracies or nondemocracies but decreases it in fully institutionalized democracies. Similarly, Tung (2020) finds public debt narrows income inequality using the fixed-effects and random-effects models for 17 emerging and developing economies in the Asia and Pacific from 1980 to 2018. More recently, Biglaiser and McGauvran (2021) use the fixed effects

model for a group of 71 developing countries between 1986 and 2016. They find that debt restructurings widen income inequality. In the same vein, Obiero and Topuz (2021) employ the ARDL model for the data of time series in Kenya from 1970 through 2018. They note that both public and internal debt increase income inequality in the long term.

In short, the literature review shows: (i) no studies examine the contribution of institutional quality to the public debt – income inequality relationship in advanced economies, (ii) no studies employ the PMG estimator and the system-GMM estimator that can deal with serial autocorrelation and endogenous phenomena in the empirical models. Governance/institutional quality can significantly affect public debt. Tarek and Ahmed (2017) find that the three poor governance indicators lead to high public debt in the MENA countries. Plus, Asamoah (2021) discovers that institutional quality can narrow income inequality in developed and developing countries. Institutional improvement can change public debt, which can reduce/increase income inequality. Therefore, studying the impact of public debt on income inequality without the role of institutional quality can be a shortcoming. This paper focuses on these issues as a new contribution to the literature.

3. Methodology and Research Data

3.1. Methodology

Following the literature review, the paper uses the empirical equation as follows:

$$GIN_{it} = \gamma_0 + \gamma_1 GIN_{it-1} + \gamma_2 DEB_{it} + \gamma_3 GO_{it} + \gamma_2 \left(DEB \times GO\right)_{it} + X_{it}\gamma' + \sigma_i + \tau_{it} \quad (1)$$

where t and i are the time and country index. GIN_{it} is the Gini index, a proxy for income inequality. Its value ranges from 0 to 100 where 0 notes complete equality (everyone has the same income) and 100 reports the highest level of income inequality; GIN_{it-1} is the lagged dependent variable; DEB_{it} is public debt (% GDP); GO_{it} is one of the six governance indicator (control of corruption, political stability, government effectiveness, rule of law, regulatory quality, voice and accountability), a proxy for institutional quality; $\left(DEB \times GO\right)_{it}$ is the interaction between public debt and institutional quality. X_{it} contains some control variables as economic growth, education, and unemployment; σ_i is a country-specific, time-invariant, unobserved effect and τ_{it} is an observed error term; γ_0, γ_1, γ_2, and γ' are estimated parameters. Following Lee (2005) and Biglaiser and McGauvran (2021), the paper uses education and economic growth as control variables. Furthermore, it also uses unemployment in the empirical equations as unemployment can significantly contribute to income inequality.

The study applies Equation (1) to test the impacts of government debt, institutional quality, and their interaction on income inequality for a group of 30 advanced economies. It employs six governance indicators by the World Bank (with values ranging from –2.5 to 2.5) to proxy for institutional quality. Daniel et al. (2018) confirm that an "institutional void" can arise and impede policy efforts to decrease economic inequality through the operations of efficient markets. From the views of individuals and firms, the following six governance indicators have been suggested by World Bank (2021) to facilitate economic activities, improve welfare, and reduce poverty and economic inequality:

• *Control of corruption*: Corruption has adverse impacts on the economy. It is a constraint facing firms in developing economies (World Bank, 2021). Gupta et al. (2002) indicate that corruption leads a high-income inequality and poverty in several developing economies. Notably, higher corruption negatively affects efforts in income distribution conducted by governments (Gyimah-Brempong, 2002).

• *Government Effectiveness*: This indicator supports the government to design, issue, and enforce sound policies in which citizens are centric (Duho, 2020). Some poor institutional factors, i. e. government ineffectiveness, can lead to a deterioration in the income distributions of developing economies (Acemoglu et al., 2001).

• *Political Stability*: Political instability leads to uncertainty in the economy and impedes efforts in income distribution by governments. By contrast, political stability enhances welfare by improving income distribution and removing inequality from the economy (Shafique et al., 2006).

• *Regulatory Quality*: This indicator shows the government's capability to design, issue, and enforce sound regulations and policies that promote efficient economic activities (World Bank, 2021). Governments may achieve targets by increasing spending on regulatory measures like equitable income distribution (Shafique et al., 2006).

• *Rule of Law*: This indicator captures the independence and functioning of the judiciary, including contract enforcement quality, property rights protection, the police, and the likelihood of violence and crime (World Bank, 2021). Acemoglu et al., (2001) argue that the absence of the rule of law can the income distribution efforts in developing economies. By contrast, government effectiveness is necessary to eradicate poverty and narrow income inequality (Kraay and Dollar, 2003).

• *Voice and Accountability*: This indicator is the guarantee of stability and transparency of regulations and policies built by governments. It makes policymakers responsible for failures in implementing regulations and policies. Accountability in public officials contributes to efficient resource allocations (Farrington, 2009). Perera and Lee (2013) indicate democratic accountability reduces the income gap in some Asian countries.

Some severe problems in econometrics arise from estimating Equation (1). Firstly, public debt, economic growth, and unemployment can be endogenous. They may correlate with σ_i, which results in the endogenous phenomenon. Secondly, some unobserved effects such as culture, geography, customs, and anthropology (fixed effects) can correlate with the independent variables. These fixed effects exist in σ_i. Thirdly, a high autocorrelation comes from the presence of GIN_{it-1}. Finally, panel data contain a large unit of economies (M = 30) and a short length of observation (L = 19). These problems can make the OLS regression biased. The random-effects model (REM) and the fixed-effects model (FEM) could not handle serial autocorrelation as well as endogenous phenomena. The IV-2SLS estimator needs some suitable instruments out of independent variables in the empirical model. Following Judson and Owen (1999), we apply the system-GMM estimator and the PMG estimator for estimation and robustness check.

Holtz-Eakin et al. (1988) are the first to propose the general method of moments (GMM) Arellano and Bond (1991). Two kinds of GMM estimators are developed: the difference and the system. The past values of persistent regressors in the empirical models do not provide information for their changes, making their lags become weak instrumental variables in the difference GMM estimator. Therefore, the S-GMM (system-GMM estimator) is better than the D-GMM (difference-GMM estimator) (Arellano and Bover, 1995).

For estimation, the two-step S-GMM can be more efficient than the one-step S-GMM. However, employing the two-step S-GMM in small research samples like our sample has a problem (Roodman, 2009). It is the instrumental variable proliferation that quadratically rises as the dimension of time increases, which causes the number of instruments to be larger than the number of panel units. The solution is to employ the thumb rule to keep the number of panel units more than or equal to the number of instruments (Roodman, 2009). The study uses Arellano-Bond, Sargan, and Hansen statistics to test the instruments' validity in the S-GMM. The Arellano-Bond test AR(2) searches the serial autocorrelation of errors in the first difference while the Sargan and Hansen tests detect endogenous phenomena.

The study applies the PMG estimator by Pesaran et al. (1999) to check the robustness of the two-step S-GMM estimates. The PMG-based Error Correction Model is shown as follows:

$$\Delta Y_{it} = \psi X_{it-1} + \sum_{j=1}^{p} \pi_{ij} \Delta Z_{it-j} + \sigma_{it} + \tau_{it} \text{ where } X_{it-1} = Y_{it-1} - \lambda Z_{it-1} \qquad (2)$$

where Y is the Gini index, a proxy for income inequality; X_{it-1} is the deviation from long-run equilibrium for group i at any period t, and ψ is the error-correction

coefficient. The vector λ captures the long-run coefficients. They express the long-run elasticity of inequality corresponding with every variable in Z_{it-1}. Meanwhile, the vector π captures the short-run responses of the Z variables. σ_i is a fixed effect and τ_{it} is an error term. The study uses the value and significance level of the speed of adjustment ψ (negative, smaller than 1) to examine the validity of the PMG estimates.

3.2. Research Data

Data consist of the GINI index, public debt, governance indicators, real per capita GDP, primary school enrollment, and unemployment. The study extracts them from World Bank and International Monetary Fund databases. The sample contains 30 advanced economies[2] between 2002 and 2020.

The study presents the descriptive statistics in Table 1 and definition of the dataset and the matrix of correlation coefficients among variables in the Appendix (Table A, Table B, and Table C).

T a b l e 1

Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Income inequality (GIN)	570	31.612	4.252	23.6 (Slovenia, 2020)	42.5 (Israel, 2010)
Public debt (DEB)	570	63.456	35.240	3.765 (Estonia, 2007)	211.2 (Greece, 2020)
Economic growth (GDP)	570	40492.5	21573.0	8008.4 (Lithuania, 2002)	111968.4 (Luxembourg, 2007)
Education (EDU)	570	102.189	4.177	95.648 (Latvia, 2006)	126.575 (Latvia, 2017)
Unemployment (UNE)	570	7.648	4.134	2.01 (Czech, 2019)	27.466 (Ireland, 2013)
Regulatory Quality (IN1)	570	1.304	0.711	-0.189 (Greece, 2006)	2.469 (Denmark, 2012)
Rule of Law (IN2)	570	1.374	0.474	0.197 (Italy, 2007)	2.353 (Denmark, 2007)
Voice and Accountability (IN3)	570	.774	0.545	-1.626 (Israel, 2009)	1.755 (Finland, 2002)
Control of Corruption (IN4)	570	1.333	0.363	0.148 (Greece, 2016)	2.047 (Netherlands, 2017)
Government Effectiveness (IN5)	570	1.360	0.489	0.083 (Greece, 2017)	2.100 (Finland, 2014)
Political Stability (IN6)	570	1.224	0.286	0.570 (Israel, 2009)	1.800 (Denmark, 2004)

Source: Stata software's processing.

[2] Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Italy, Israel, Ireland, South Korea, Luxembourg, Lithuania, Latvia, Malta, Norway, Netherlands, Portugal, Switzerland, Slovak Republic, Spain, Slovenia, Sweden, United Kingdom, United States.

The results in Table B show that public debt, education, and unemployment are positively connected with income inequality, but economic growth is negatively associated with it. The value of correlation coefficients among control variables is low (lower than 0.8), so the study uses all in the empirical models. However, the value of all correlation coefficients among governance indicators in Table C is high (higher than 0.8), so the study uses them separately in the empirical equations.

4. Estimated Results and Discussion

4.1. Estimated Results

Table 2 and Table 3 show the two-step and one-step S-GMM estimates across all empirical models for the group of 30 advanced economies. Each column is the model corresponding with each governance indicator. The paper detects that public debt is endogenous in estimation procedures, thus it uses public debt as an instrumented variable in GMM style and income inequality, institutional quality, economic growth, education, and unemployment as instrumental variables in IV style.

The results in Table 2 and Table 3 indicate that public debt and institutional quality reduce income inequality, but their interaction increases it. The main result is that public debt narrows income inequality, and this negative effect is hindered by institutional quality. Notably, although governance indicators (control of corruption, political stability, government effectiveness, rule of law, regulatory quality, and voice and accountability) are separately applied in the empirical equations, the results note that the sign and significance level of their and interaction terms' estimated coefficients are completely consistent. Furthermore, economic growth and unemployment increase income inequality, but education decreases.

Advanced economies are those with good institutional quality that have enough appropriate resources to deal with the income gap in society. With rich resources and high levels of development, governments in these economies formulate and enforce policies and regulations (institutional quality) to reduce the income difference between high-income and low-income individuals. Concerning taxation, regulations and policies in these economies (which can be shown in terms of regulatory quality and government effectiveness) focus on taxing high-income people, not low-income people, and collect the tax revenue partly to support low-income people. Regarding the control and collection of taxes, regulations and policies (which can be expressed in terms of corruption control and

the rule of law) strictly control the income of the rich to eliminate the possibility of tax evasion, thereby ensuring fairness for tax payment between the rich and the poor. In particular, policies and regulations issued by the government are always publicly and transparently monitored (voice and accountability), thus ensuring a more equitable allocation of national resources in society, thus reducing the income gap between the rich and the poor, thus narrowing income inequality. The paper finds it in Richmond and Triplett (2018), Matallah (2019), and Law et al. (2020). Furthermore, they use high levels of public spending on social protection (Ortiz-Ospina and Roser, 2016). They use spending financed by public debt to support the poor and low-income individuals through social transfers throughout economic development. In addition to social transfer, public expenditures on health and education are allocated to help people improve their skills and knowledge so that they can find appropriate jobs with high incomes. In particular, these expenditures in developed countries are fairly distributed and mostly spent for low-income and jobless people (the poor), so narrowing the income difference between high-income and low-income individuals. The paper finds the same result in Tung (2020).

However, high government debt can cause a debt crisis and social instability. For example, the European debt crisis in the second half of 2009 with high public debt in Portugal, Greece, Italy, Ireland, and Spain (developed economies) led to economic and political instability in these economies. The number of poor and homeless in these economies increased rapidly during this crisis period, especially since the majority of the severely affected people were poor and low-skilled. To quickly get out of this crisis, these economies must accept the austerity solutions proposed by the IMF to receive bailouts. Accordingly, regulations and policies (institutional quality) must be changed and adjusted to cut government expenditure for retirees and jobless people, thereby focusing on reducing budget deficits and controlling and managing government debt. In particular, all these regulations and policies must reach a consensus among political parties (political stability), representing people's voices. In short, regulations and policies (institutional quality) that are issued and implemented to control public debt may reduce public debt. However, it leads to a decrease in public expenditures for the poor and low-income people, while the rich are almost unaffected by these regulations and policies, narrowing the income gap between the rich and the poor. As a result, the interaction between public debt and institutional quality widens income inequality.

This finding recommends that governments in advanced economies can use public debt to narrow income inequality in society. They should spend more on education and health to support the poor to improve their skills and knowledge,

decreasing the income difference between high-income and low-income individuals. Income inequality is one of the inherent social natures in human development, meaning that we can not eliminate income inequality but can reduce it. In particular, equality and efficiency are two opposite sides of the same coin, so when acting on one side, it affects the other side and vice versa. Governments should recognize it as the tradeoff between efficiency and equality throughout economic development. Increasing equality (or decreasing inequality) leads to decreasing efficiency and vice versa. It is important to have consensus among parties (representing people's voice) in determining and choosing a relative balance point between efficiency and equity to ensure social stability during economic development. Notably, they should control and manage public debt because rising public debt can lead to a public debt crisis and social instability. Governments in developed economies should note that policies and regulations (institutional quality) must be carefully considered in terms of their effectiveness in enforcement. Institutional quality includes political stability (consensus among political parties representing the people's voice), control of corruption, rule of law, government effectiveness (control of appropriate government revenues and spending), the rule of law, regulatory quality, voice and accountability (social equity with priority given to the poor and low-income people, regulations and policies are publicly and transparently implemented). In particular, when the economic crisis occurs, the majority of the poor and low-income people are the first and most severely affected, and its most obvious consequence is an increase in the income gap between the rich and the poor, widening income inequality.

In economic development, the outcomes may mainly benefit the rich while the poor do receive not much. The Kuznets (1955) curve argues that industrializing economies experience an increase and subsequent decrease in wealth and income inequality. Apergis (2021), Demir et al. (2020), Richmond and Triplett (2018), and Lee (2005) support this result. This finding indicates a challenge for governments in the appropriate allocation of the outcomes in economic development. Similarly, the high rate of unemployment often falls on the poor who lack the necessary knowledge and skills to get a high-income job, boosting the income gap in society. This finding implies that governments in advanced economies should pay more attention to the poor and support them to access education and healthcare to get high-income jobs. By contrast, education is a public good that governments supply for free, and students do not pay the money to attend public schools. Students from low-income families can improve their knowledge and skills from education to find a high-income job, which decreases the income gap between high-income and low-income individuals. This finding can be found in Lee (2005) and Obiero and Topuz (2021).

T a b l e 2

Institutional Quality, Public Debt and Income Inquality: Two-step S-GMM Estimates Dependent Variable: GINI Index (income inequality)

Variables	**IN1**	**IN2**	**IN3**	**IN4**	**IN5**	**IN6**
Gini index (–1)	0.930*** (0.023)	0.923*** (0.025)	0.908*** (0.021)	0.937*** (0.019)	0.922*** (0.025)	0.919*** (0.027)
Public debt	–0.020*** (0.007)	–0.039*** (0.015)	–0.016*** (0.005)	–0.041*** (0.015)	–0.028** (0.013)	–0.088*** (0.034)
Institutional quality	–1.177*** (0.353)	–2.615*** (0.911)	–1.642*** (0.367)	–2.659*** (0.909)	–2.138*** (0.739)	–5.403** (2.190)
Public debt*Ins. quality	0.013*** (0.004)	0.029*** (0.011)	0.016*** (0.004)	0.032*** (0.010)	0.020** (0.009)	0.073*** (0.028)
Economic growth	0.006*** (0.001)	0.007*** (0.002)	0.005*** (0.001)	0.005*** (0.001)	0.007*** (0.002)	0.010*** (0.003)
Education	–0.027** (0.013)	–0.026* (0.014)	–0.020* (0.010)	–0.004 (0.012)	–0.027** (0.013)	–0.028* (0.015)
Unemployment	0.055** (0.025)	0.061** (0.030)	0.064*** (0.016)	0.070** (0.028)	0.053* (0.027)	0.104** (0.041)
Instrument	11	13	13	12	12	11
Country/Observation	30/510	30/510	30/510	30/510	30/510	30/510
AR(2) test	0.216	0.233	0.279	0.114	0.186	0.269
Sargan test	0.578	0.564	0.266	0.741	0.452	0.720
Hansen test	0.647	0.805	0.660	0.838	0.689	0.867

Note: ***, **, * note significance level at 1%, 5%, 10% respectively.

Source: Stata software's processing.

T a b l e 3

Institutional Quality, Public Debt and Income Inquality: One-step S-GMM Estimates Dependent Variable: GINI Index (income inequality)

Variables	**IN1**	**IN2**	**IN3**	**IN4**	**IN5**	**IN6**
Gini index (–1)	0.925*** (0.011)	0.917*** (0.011)	0.905*** (0.013)	0.928*** (0.010)	0.919*** (0.011)	0.910*** (0.012)
Public debt	–0.021*** (0.005)	–0.038*** (0.010)	–0.010** (0.005)	–0.044*** (0.010)	–0.040*** (0.008)	–0.097*** (0.024)
Institutional quality	–1.240*** (0.287)	–2.610*** (0.686)	–1.003** (0.448)	–2.996*** (0.717)	–2.729*** (0.556)	–6.129*** (1.493)
Public debt*Ins. quality	0.013*** (0.003)	0.028*** (0.007)	0.008 (0.005)	0.033*** (0.007)	0.028*** (0.006)	0.080*** (0.020)
Economic growth	0.006*** (0.001)	0.008*** (0.001)	0.003*** (0.001)	0.006*** (0.001)	0.008*** (0.001)	0.012*** (0.002)
Education	–0.027*** (0.011)	–0.025** (0.012)	–0.001 (0.008)	–0.009 (0.008)	–0.032*** (0.011)	–0.030*** (0.011)
Unemployment	0.057*** (0.020)	0.056*** (0.021)	0.047*** (0.017)	0.074*** (0.019)	0.060*** (0.020)	0.121*** (0.028)
Instrument	12	13	17	12	12	11
Country/Observation	30/510	30/510	30/510	30/510	30/510	30/510
AR(2) test	0.255	0.248	0.291	0.107	0.216	0.299
Sargan test	0.374	0.564	0.178	0.741	0.307	0.253

Note: ***, **, * note significance level at 1%, 5%, 10% respectively.

Source: Stata software's processing.

4.2. Robustness Check

The paper employs the PMG estimator for Equation (2) to test the robustness of S-GMM estimates. It uses only economic growth as a control variable. The PMG estimator requires the co-integration between regressors and the dependent variable. So, the paper examines the stationary of all variables in the empirical model to ensure that they all have the same order of co-integration. Then, it performs the panel co-integration tests by Westerlund (2007).

The stationary tests in Table D (Appendix) report income inequality, public debt, institutional quality, and economic growth are stationary at a significance level of less than 10%, meaning that they have a co-integration of zero-order I(0). The Westerlund tests in Table 4 note that three of four tests deny the null hypothesis of no co-integration, suggesting that income inequality co-integrates with public debt, six governance indicators, and economic growth.

T a b l e 4

Westerlund Panel Co-integration Tests Normalized Variable: GINI Index (Income inequality)

Covariates	G_t	G_α	P_t	P_α
Public debt	–2.523**	–7.992	–12.728***	–7.318***
Institutional quality 1	–2.080**	–7.928	–11.238***	–7.526***
Institutional quality 2	–2.315***	–9.377***	–12.332***	–9.584***
Institutional quality 3	–2.371***	–9.326***	–13.408***	–8.422***
Institutional quality 4	–2.069**	–7.988	–10.887***	–7.243***
Institutional quality 5	–2.418***	–8.498*	–11.852***	–7.952***
Institutional quality 6	–4.342***	–8.914**	–10.725***	–5.622*
Economic growth	–2.624***	–8.234	–12.766***	–7.907***

Note: ***, **,* note significance level at 1%, 5%, 10% respectively.

Source: Stata software's processing.

T a b l e 5

Institutional Quality, Public Debt and Income Inequality: PMG Estimates Long Run Co-integrating Vectors Dependent Variable: GINI Index (income inequality)

Variables	**IN1**	**IN2**	**IN3**	**IN4**	**IN5**	**IN6**
Public debt	–0.041*** (0.016)	–0.045** (0.020)	–0.008 (0.007)	–0.047*** (0.010)	–0.271*** (0.050)	–0.027 (0.020)
Institutional quality	–1.301* (0.774)	–3.239*** (1.075)	–1.447** (0.687)	–2.892*** (0.663)	–13.38*** (2.151)	–1.327 (1.262)
Public debt*Ins. quality	0.029* (0.016)	0.032*** (0.012)	0.016** (0.007)	0.024*** (0.007)	0.002 (0.033)	0.010 (0.015)
Economic growth	0.042*** (0.011)	0.020** (0.010)	0.024** (0.010)	0.006 (0.007)	0.007 (0.004)	0.043*** (0.011)
Error correction	–0.522***	–0.542***	–0.557***	–0.552***	–0.339***	–0.523***
Observation	540	540	540	540	540	540
Log likelihood	–373.453	–375.424	–377.215	–367.568	–416.977	–373.162

Note: ***, **,* note significance level at 1%, 5%, 10% respectively.

Source: Stata software's processing.

The paper shows the results in Table 5. In line with the S-GMM estimates, public debt and institutional quality narrow income inequality, but their interaction term widens. Furthermore, economic growth enhances income inequality. The significance level and value of the speed of adjustment at the bottom of Table 5 report that PMG estimates are highly reliable.

Conclusion and Policy Implications

Public spending financed by debt keeps a crucial role in running the economy, while income inequality is one of the severe problems. Governments in these economies can use public debt to deal with the income gap in society. In particular, institutional quality can significantly contribute to the public debt – income inequality relationship. Given these facts, the paper investigates the impacts of public debt, institutional quality, and their interaction on income inequality for a group of 30 advanced economies from 2002 through 2020. It employs the S-GMM and PMG estimator for estimation and robustness check. The results show that public debt and institutional quality decrease income inequality, but their interaction increases it. The main result shows that public debt narrows income inequality in developed economies and this negative effect is impeded by institutional quality. Furthermore, economic growth and unemployment widen income inequality, but education narrows it.

The findings in the paper imply that governments in advanced economies can use public debt to deal with income inequality in society between the rich and the poor. They can design, formulate, and implement policies and regulations (institutional quality) to increase public spending financed by debt to support the poor and low-income individuals through social transfers. More importantly, they should spend more on health and education to improve the poor's skills and knowledge, which enhances the poor's income and reduces the income gap in society. However, they should be prudent in controlling and managing public debt to avoid a public debt crisis and social instability. Future research should focus on the contribution of institutional quality to the external/domestic public debt – income inequality relationship.

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Appendix

Table A

Data Description

Variable	Definition	Type	Source
Income inequality (GIN)	Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution.	value	World Bank
Public debt (DEB)	Gross debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future (% GDP)	%	IMF
Economic growth (GDP)	GDP per capita is gross domestic product divided by midyear population.	ln	World Bank
Education (EDU)	Gross primary school enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown.	%	World Bank
Unemployment (UNE)	Unemployment refers to the share of the labor force that is without work but available for and seeking employment.	%	World Bank
Regulatory Quality (IN1)	"Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.'	level	World Bank
Rule of Law (IN2)	"Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence."		
Voice and Accountability (IN3)	"Voice and Accountability captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media."		
Control of Corruption (IN4)	"Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests."		
Government Effectiveness (IN5)	"Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies."		
Political Stability (IN6)	"Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism."		

Source: Author.

T a b l e B

The Matrix of Correlation Coefficients between Variables

	GIN	DEB	GDP	EDU	UNE
GIN	1				
DEB	0.242***	1			
GDP	–0.134***	0.053	1		
EDU	0.173***	–0.011	–0.001	1	
UNE	0.270***	0.407***	–0.418***	0.024	1

Note: ***, **,* note significance level at 1%, 5%, 10% respectively.

Source: Author.

T a b l e C

The Matrix of Correlation Coefficients between Six Dimensions of Governance

	IN1	IN2	IN3	IN4	IN5	IN6
IN1	1					
IN2	0.929***	1				
IN3	0.448***	0.414***	1			
IN4	0.847***	0.827***	0.409***	1		
IN5	0.944***	0.923***	0.496***	0.858***	1	
IN6	0.883***	0.807***	0.651***	0.777***	0.856***	1

Note: ***, **,* note significance level at 1%, 5%, 10% respectively.

Source: Author.

T a b l e D

Fisher Type Unit Root Tests

Variables	**Augmented Dickey-Fuller test**		**Phillips-Perron test**	
	Prob > chi2		Prob > chi2	
	Without trend	*With trend*	*Without trend*	*With trend*
Income inequality	52.894	42.426	69.221	104.949***
Public debt	59.773	80.610**	26.197	24.853
Institutional quality 1	73.156	56.127	224.666***	157.362***
Institutional quality 2	96.673***	65.915	120.871***	105.612***
Institutional quality 3	95.006***	66.252	224.916***	157.084***
Institutional quality 4	61.690	67.764	77.742*	77.599*
Institutional quality 5	57.655	57.367	87.633***	83.252**
Institutional quality 6	121.610***	85.124**	114.410***	103.406***
Economic growth	83.006**	46.863	62.778	27.851

Note: ***, **,* note significance level at 1%, 5%, 10% respectively.

Source: Author.