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WEALTH INEQUALITY AND INSTITUTIONAL DEVELOPMENT: MACROECONOMETRIC EVIDENCE FROM A GLOBAL SAMPLE

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Abstract

This paper examines the empirical relationship between institutions, particularly financial institutions, and wealth inequality using a global panel data set for the period 2010–2016. We conduct a dynamic econometric analysis of these relationships based on the Credit Suisse and World Bank data. Our results reveal that control of corruption and government effectiveness do not have statistically significant effects on wealth inequality. However, the findings indicate an unfavourable effect of domestic credit on wealth inequality as measured by the Gini coefficient for wealth. The long-run effect of domestic credit is persistent and cumulates over time. We also find evidence of relationships between wealth inequality on one hand, and inflation rate, employment in agriculture and government expenditure on the other. The findings imply that policy makers need to re-examine the role and rules in the financial intermediation sector to address the issue of wealth inequality and equal opportunities.

Keywords: *wealth inequality, institutions, financial development, financial intermediation, dynamic panel data analysis.*

JEL classification: *C23, D02, D31.*

1. Introduction

It is the wealth that Adam Smith wrote about in his work that paved the way for the modern science of economics. Individual or family wealth is one of the most important determinants of human well-being, and the interest in its distribution is natural, especially from the perspective of economic science. The popularity of Piketty's (2014) work *Capital in the Twenty First Century* among laypeople and academics serves as evidence that the issue of wealth inequality remains unresolved, but recognition of wealth as an important independent dimension of social stratification is now widely accepted (Killewald 2017). Simultaneously, we witness an era of growing wealth inequality and for example in United States the period from 1980 to 2020 was a period with extraordinary wealth accumulation (Saez and Zucman 2020).

The wealth is what we own in the current value of assets that is generated by inheritance brought down from a previous period or generations, and what we earn as income minus all consumption and liabilities we service. The average wealth for the population

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may be the same in many different distributions, but different distributions may result in widely different social outcomes in terms of individual well-being, public health, poverty, social unrest, crime rate, and so forth. About 50% of the world adult population altogether own less than 1% of the total world wealth (Credit Suisse 2017). Even in the member countries of Organisation of Economic Co-operation and Development, real assets in the form of housing constitute the main form of wealth among individuals with both low and high levels of wealth, contributing to approximately 75% of the total value of assets on average. It is only at the top of the distribution that assets such as stocks and financial holdings appear as an important form of wealth (OECD 2015). Without understanding the patterns of distribution, we may not be able to fully understand the economic and social situation of any society.

As argued by Galbraith (2012), who investigated the link between inequality and financial stability since the Great Depression, there has been no serious work done on the macroeconomic effects of wealth inequality. Others, such as Stiglitz (2015), also argue that the inequality is the fact and discussions should be focused on its importance. Furthermore, according to the International Monetary Fund (2015), an increase in inequality may have a significant impact on the economic development, growth and stability. This is because the concentration of wealth may lead to the concentration of political power and induce crises, instability, reduce investment, and lead to suboptimal use of resources.

Institutions play a critical role in shaping the costs of production and operational efficiency of markets; they are the "rules of the game" in a society (Efendic and Pugh 2008). In this paper, we address the institutional and financial system, which is a man-made construct, and its impact on the level of wealth inequality, which is currently at extreme levels and may lead to poverty, destruction of civil liberties, and deterioration of the equality of opportunity with regard to education and politics. The main interest of this paper can be summarized in the claim that "economic inequality is largely the by-product of a system's structures and not the result of major differences in individual or group talents, characteristics, and motivations" (Hurst 1997, as cited by Boix 2010).

This research provides a nexus of institutions, finance, employment and growth relationships to wealth inequality. The aim of the paper is thus to determine the relationship between wealth inequality and the institutional development, in particular financial intermediation, and to reconsider and highlight the role of institutions in creating the wealth inequality in economic and social development. In order to achieve this, we consider and synthesize available theoretical and applied research and use newly available data and methods to analyse whether and to what extent institutions in general and financial intermediaries in particular affect wealth inequality. The main research question of this paper is whether institutional quality and development, with a focus on the development of financial intermediaries, are important explanatory factors of wealth inequality. Our findings challenge the existing assumptions and contribute to the knowledge and literature on the drivers of wealth inequality and its relationship to financial institutions. Moreover, our research provides novel insights that can inform policy interventions aimed at reducing the wealth inequality.

The data for this research were obtained from the Credit Suisse and World Bank publications and databases. The data on the wealth distribution as the dependent variable, measured by the Gini coefficient for wealth, is available from the Credit Suisse *Reports on Global Wealth* for the years 2010–2016. The data on the control of corruption is available from the Worldwide Governance Indicators prepared by Kaufmann, Kraay, and Mastruzzi (2010), whereas the data for all other variables are available from the World Bank (2022b) *World Development Indicators*. For empirical analysis, we employ the generalized method of moments (GMM), formalized by Hansen (1982), in order to estimate dynamic panel data models. The GMM does not require a complete knowledge of the distribution of the data, and is suitable to deal with potential problems, such as unobserved country specific effects or reverse causality, omitted variable bias, and institutional measurement error.

The structure of the paper is as follows. Section 2 provides the theoretical underpinnings of the wealth inequality determinants, whereas Section 3 summarizes empirical evidence on the introduced wealth inequality determinants. The two sections together provide a historical and theoretical overview with relevant theories. Section 4 provides a discussion of the methodology, with a focus on the estimation procedures and the model specifications. Section 5 addresses the data sources and the variables used in the model specifications. It also provides the descriptive statistics. Section 6 presents the empirical results of the research, with a focus on estimation results, model diagnostics and sensitivity analysis. Finally, Section 7 concludes the research with the key findings and policy recommendations.

2. Theoretical underpinnings of the wealth inequality determinants

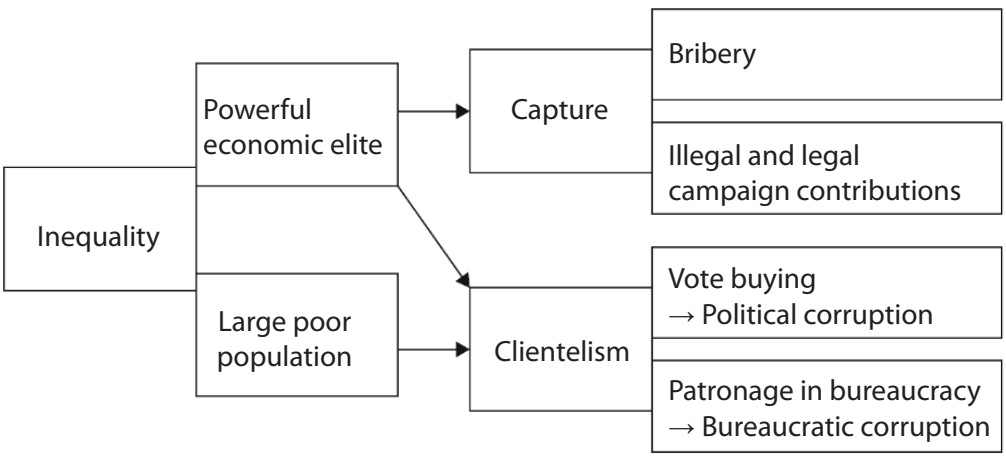
Wealth is defined as the "marketable value of financial assets plus non-financial assets (principally housing and land) less debts" (Credit Suisse 2018). The question of relationship between wealth inequality and institutions is explored in the political economy models. Do (2002) presents a model where the mechanism between the inequality and quality of institutions works through rent dissipation or competition among elites that makes them less effective at extracting rents. Other theoretical models critically relay on the saving motives of individuals, and put forward some factors that may explain wealth inequality, but without a single theoretical model or outline (Iftekhar, Horvath, and Mares 2020).

The theoretical framework of You (2015) for linking inequality and corruption in democracies is presented in Figure 1. He argues that corruption increases inequality, and points to the possible reverse causality issue, i.e., to the ambiguity in the literature of whether inequality increases corruption or corruption influences inequality or they have a mutual effect on each other. The model presents the mechanism that links inequality and corruption through the formation of a "powerful economic elite", which ensures "capture" that is linked to "bribery" and "illegal and legal campaign contributions". In addition to this channel, "powerful economic elite" also leads to "clientelism" and finally to "political corruption" and "bureaucratic corruption". According to Williams and Gashi (2022), corruption is often related to resource misallocation, and resource misallocation is usually related to the misuse of public office, state capture and preferential access to public goods and services (Efendic and Ledeneva 2020).

Piketty (2014) gave a historical overview of the works on inequality in the last couple of centuries, and he argues that David Ricardo and Karl Marx both believed that a small social group – landowners for Ricardo, industrial capitalists for Marx – would inevitably claim a steadily share of output and income. Furthermore, he argues that Marx's principal conclusion might be called "principle of infinite accumulation" or tendency of capital to accumulate and become concentrated in a few hands, with no natural limit to the process, which is for Marx a basis for the end of capitalism. His conclusion is that we should have diminishing returns on capital (killing the engine of accumulation) or an indefinite increase in capital's share in national income. Piketty (2014, p. 72-83) also introduces his idea of "the law of cumulative growth", which can bring significant results with very small rates of change (return on capital). Later, he put this idea as the central thesis of the book, where "apparently small gap between the return on capital and the rate of growth can in the long run have powerful and destabilizing effects on the structure and dynamics of social inequality".

In addition, a theoretically founded model presented by Kumhof and Rancière (2011) provides an explanation on the relationship between financial crisis and credit growth and inequality. The additional part of the income of high-income households and its transfer in the form of loans to poor population is the key mechanism of growth in the size of financial sector and latter crisis. If there is no growth and recovery of the economy and growth of the income of the middle and low-income groups, loans and size of the financial sector will grow up to the point of crisis. They find evidence in the periods of two crisis, 1920-1929 and 1983-2008, in which, due to the change in

Figure 1. Causal mechanism linking inequality to corruption



Source: You (2015).

bargaining powers, the income share of the wealthy increased. Low-income individuals and households take loans in order to sustain their consumption levels "at least for a while".

Furthermore, theoretical literature focuses on mechanisms behind the thick-tailed wealth distribution. Benhabib and Bisin (2018) present a model with wealth distribution induced by labour earnings, by individual wealth processes and random rate of return, and a model of expansive accumulation, with linear savings or savings rates that increase in wealth. Our focus is on "the principle of infinite accumulation" and "the law of cumulative growth" or on the last class of models where returns on savings may generate high levels of wealth inequality by multiplication or compounding over time through financial institutions. Formally, wealth at the time t is given by w_t, and can only be invested in an asset with return process r_{t+1}, whereas the earning process is given by y_{t+1}. Let c_{t+1} denote consumption at $t + 1$, so that the savings at $t + 1$ are given by $y_{t+1} - c_{t+1}$. The wealth accumulation equation is provided by the following expression:

$$w_{t+1} = r_{t+1}w_t + y_{t+1} - c_{t+1}.$$

If we assume that saving and consumption are linear in wealth, $c_{t+1} = \psi w_t + x_{t+1}$, and that $\psi, x_{t+1} \geq 0$, then the above expression transforms to:

$$w_{t+1} = (r_{t+1} - \psi)w_t + (y_{t+1} - \chi_{t+1}),$$

which is a framework of the wealth accumulation process. If we further assume the constant relative risk aversion (CRRA) preferences over consumption at any date t, we obtain the utility function:

$$u(c_t) = \frac{m_t^{1-\sigma}}{1-\sigma}.$$

This framework can be further reduced and according to Benhabib and Bisin (2018), wealth distribution is easily obtained with explosive wealth accumulation processes, but such processes do not converge to a stationary solution. For any (r_t, y_t), a skewed distribution can be obtained and w_{t+1} is non-stationary infinite explosive process, independent of the distribution of y_t, if $y > 0$ and $E(r_t) - \psi > 1$ for any $t \geq 0$.

The simplest representation of such explosive wealth accumulation equation can be given by:

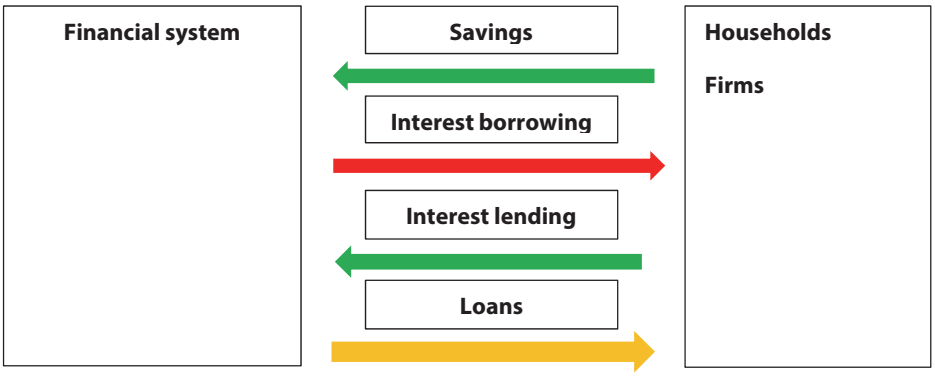
$$w_{t+1} = r_{t+1}w_t,$$

where there are no labour earnings, r_t is deterministic and $r_{t+1} = r > 1$, even if only for a sub-class of agents in the economy. This is also the case if r_{t+1} exhibits normal i.i.d. distribution and $E(r_t) > 1$. Returns to wealth follow Gibrat's law[1] that in finite time t a log-normal distribution is induced around its mean, with a mean and variance increasing and exploding in t:

$$ln\, w_t = ln\, w_0 + \sum_{j=0}^{t-1} ln\, r_j.$$

Non-stationarity is also induced in cases when saving is strictly convex, or consumption is strictly concave, and/or the rate of return on wealth is increasing in wealth. Within the given conditions, this process cannot exhibit stationarity, except if we are able to introduce another process that can slow down the expansion. According to Benhabib and Bisin (2018) these can be fiscal policies, decreasing returns on wealth, or birth and death processes with re-insertion at exogenous low level of initial wealth. The main channel of this accumulation is the institutional framework, in particular the financial sector. In essence, institutions of financial intermediation borrow short term

Figure 2. Simplified flow of funds in an economy



Source: Authors' representation.

and lend long term, with interest charged. The interest lending is higher than the interest borrowing and that is how the institutional system of financial intermediation is set.

Financial intermediaries channel this flow as those institutions "that acquire funds from one group of investors and make them available to another economic unit" (Kolb and Ricardo 1996, p. 269). In the well-functioning institutional framework, this flow between the elements of the system is continuous; the borrowing-landing process is not static in nature, meaning that every time banks borrow and land, the institutional system assumes and guarantees these flows. With even very small difference between lending and borrowing we may have the case of growth in size of financial intermediaries and infinite accumulation or tendency to accumulate wealth of individuals who save, with no natural limit to the process. Besides the fiscal policies, which are mentioned as a force to impact the process of infinite accumulation (Solow 1956, as cited by Piketty 2014, pp. 11-10), considers growth as counterbalance to the infinite accumulation argument that was also used by Marx. In an overview of the empirical determinants of wealth inequality in the next section we discuss some additional determinants that may impact inequality.

3. Empirical evidence on the wealth inequality determinants

The main task of the empirical work is to understand the thick-tailed distribution in the data. Benhabib and Bisin (2018) argue that the distribution of earnings cannot even partially contribute to the understanding of wealth inequality and that we should focus on stochastics return on wealth and on explosive wealth accumulation. Stochastic returns on wealth mainly relate to returns from residence ownership and unincorporated private business equity and investment in real estate. These returns are characterized by large standard deviations, as documented by Case and Shiller (1989) and Moskowitz and Vissing-Jorgensen (2002). Increasing savings in wealth may be the driver of explosive accumulation and the trigger for savings may be bequests (Cagetti and De Nardi 2008).

In addition, based on United States data, Saez and Zucman (2016) argue that a sudden increase in top incomes leads to a rise in wealth concentration. This is based on a cycle of high savings and the corresponding increase in capital income that lead to a snowballing effect over time. Their second finding is that the key driver of declining wealth of the bottom 90% of wealth owners lies in the plummeting of their savings rates, which may be due to the low rate of income growth, predatory lending or behavioural bias. For example, based on the US data, the top 1% of wealth-holders save 20-25% of their big incomes on average, while the 90% of wealth-holders save 3% of their income (Saez and Zucman 2016). Findings of Fagereng et al. (2019), based on a Norwegian panel data set, confirm the proposition that the savings are increasing in wealth when capital gains are included in the definition of saving, and that the wealthy accumulate more wealth through capital gains.

Tanzi (1998) identifies the fundamental determinants of income and wealth inequality as market forces, social norms, ownership of real and human capital, and the role of government. Ignoring temporary factors, such as natural catastrophes, the main "systematic" factors are social norms or institutions, broad economic change, and the role of government. Reuveny and Li (2003) further advocate that the key factors to reduce inequality are democracy and trade.

Glaeser, Scheinkman, and Shleifer (2003) find that in unequal societies the rich are enabled to subvert institutions in line with their interests, in terms of political, regulatory and legal aspects. Furthermore, inequality has adverse effects on ensuring property rights and growth. These issues are discussed in works on how those in power design institutions to stay in power by Acemoglu and Robinson (2002), Acemoglu and Robinson (2001), Glaeser and Shleifer (2002a) and (2002b) on efficient regulatory schemes and legal systems. This finding is also in line with Gupta, Davoodi, and Alonso-Terme (2002), who argue that corruption increases inequality and poverty. Additionally, Ali et al. (2021) find weak, though significant negative correlation between wealth inequality and institutional quality, while looking into the association between wealth inequality and socioeconomic outcomes.

According to Lee (2005), who examines the relationship between democracy, size of the public sector and inequality, public sector expansion reduces inequality. Lindert (1994; 2004) provided evidence on an implicit negative relationship between democracy and redistribution and on how spending on social needs, in particular on cash benefits and benefits in kind, such as spending on education and health, can reduce poverty and social exclusion. Benhabib, Bisin, and Zhu (2011) show that capital tax and estate tax, which are the source of latter spending, have an effect on inequality and wealth distribution. Namely, these taxes decrease the wealth inequality by affecting the top percentiles of the wealth distribution. The authors employed simulation and found that this effect is potentially very strong. Tax collection and expenditures relationship can reduce or increase inequality, and

generally, if the tax is proportional and the spending is flat per person, it reduces inequality (Saez and Zucman 2020). Government expenditure also tightly relates to the discussion on earnings and schooling. According to Hermann (2014), the public sector is a main factor that should address the issue of inequality. The government may impact the distribution of wealth by collecting the funds by taxation or borrowing and spending the funds on transfers, social services and providing public infrastructure. In addition, Kessler and Wolff (1991) attribute higher concentration of wealth in the United States (US), compared to France, to a lower share of capital in the public sector in the US.

Research done by Beck, Demirgüç-Kunt, and Levine (2007), where they used private sector credit as a measure for financial depth, suggests that financial depth contributes significantly to lowering income inequality. However, Jauch and Watzka (2012) find a positive effect of financial development on income inequality, verified by several robustness checks. Jaumotte, Lall, and Papageorgiou (2008) find positive and significant coefficients for financial development in different specifications and they confirm a positive relationship between income inequality and financial development. They used private credit over GDP as a control variable.

Piketty (2014, p. 103) concludes that inflation led to redistribution among social groups, often in a chaotic, uncontrolled manner. Spant (1987) finds that price changes accounted for a 20% increase in wealth for the wealthiest 0.2% of Swedish households between 1975 and 1983. In addition, Takayama (1991), Weicher (1995, pp. 14-15) and Wolff (1992) studied price effects on wealth inequality, with the conclusion that the long-run factors play the major role, such as saving, bequest behaviour and tax policy, while price changes play a role in short-term variations in inequality.

Robert Solow (1956) considers growth as a counterbalance to the notion of infinite accumulation argument and rise of inequality. However, if growth in population and productivity are low, the impact of accumulated wealth is more important (predominant). According to Mendes (2013), the theoretical relationship between inequality and growth is inconclusive and an unsettled topic. As explained by Aghion, García-Peñaloza, and Caroli (1999) a fundamental trade-off between productive efficiency (and/or growth) and social justice exists, and redistribution would reduce differences in income and wealth, but it also diminishes the incentives to accumulate wealth. According to Changkyu (2006) the relationship between growth of GDP per capita in real and nominal terms and income inequality is negative. Nonetheless, Barro (2008), in his work *Inequality and Growth Revisited*, which is an update of his previous work on inequality, confirms the evidence for Kuznets inverse U-shaped relationship between income inequality and GDP per capita.

Benhabib and Bisin (2018) claim that the distribution of earnings will not even partially contribute to the thickness of the tails of wealth distribution, and Boix (2010, p. 491) argues that famous Kuznets conjecture "does not contain a complete theory of the emergence and dynamics of inequality – it simply relies on some kind of exogenous technological shock that generates changes in factor sizes and incomes.". However, Jain-Chandra et al. (2018) find the movement from agriculture to industry as contributing to the decline in inequality. We take into consideration the theoretical argument of Kuznets (1955), who relates the increase in inequality to the size of agricultural sector and income growth. Kuznets' relationship between inequality and development has induced substantial empirical research, but with inconclusive results.

Reuveny and Li (2003) argue that democracy and trade reduce inequality. However, as presented in Easterly (2005), globalization and trade may somehow "naturally" benefit the rich, but with total gains for all. Another case is when, due to productivity differences, the richer countries can export labour intensive goods (productivity advantages offsets labour scarcity). Then trade would reduce inequality within the rich countries, but would increase inequality among the countries.

Hopkins (2004) underlines that there is no consensus in the economic theory on what are the most important determinants of inequality, despite the proposition of various underling mechanisms that sustain this high inequality levels. Different proposals of the underlining mechanisms are another sign of lack of robust research foundations on the causes of inequality. Furthermore, lack of consensus or a leading theory brings us to non-existence of the generally accepted empirical specification. Finally, he argues that this requires from the researcher a formal acknowledgment of the uncertainty involved in determining for the appropriate model specification.

4. Data

Our dataset consists of an unbalanced global panel data for the period 2010–2016. The data is provided by Credit Suisse and the World Bank. Not all the countries have available data for all years, thus the choice of countries as well as the selected time frame

is determined by the availability of data. The following countries are included in the final econometric estimation: Albania, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bangladesh, Belarus, Belgium, Belize, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Cabo Verde, Cambodia, Cameroon, Central African Republic, Chile, Colombia, Congo, Costa Rica, Cote d'Ivoire, Croatia, Cyprus, Czechia, Denmark, Egypt, El Salvador, Equatorial Guinea, Estonia, Fiji, Finland, France, Gabon, Georgia, Germany, Ghana, Greece, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Republic of Korea, Kyrgyz Republic, Latvia, Lebanon, Lesotho, Lithuania, Madagascar, Malaysia, Mali, Malta, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, Nicaragua, North Macedonia, Norway, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Russian Federation, Rwanda, Samoa, Saudi Arabia, Senegal, Serbia, Singapore, Slovak Republic, Slovenia, Solomon Islands, South Africa, Sri Lanka, Sudan, Sweden, Switzerland, Tanzania, Thailand, Togo, Tunisia, Türkiye, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Vanuatu, and Zambia.

Table 1 provides an overview of the definitions and sources for the variables used in model estimation. We use the Gini coefficient for wealth as a measure (proxy) of wealth inequality, the dependent variable of the model specifications. The data of the Gini coefficient for wealth is published by Credit Suisse in the Global Wealth Databook (authored by Davies, Lluberas, and Shorrocks 2017). Wealth is defined as the "marketable value of financial assets plus

Table 1. Description of the variables used in the empirical models

Variable	Description	Source
Dependent variable		
Gini coefficient for wealth	Measure of wealth inequality, based on the Lorenz curve, which plots the share of population against the share of wealth. By construction, it has a minimum value of zero (everybody has the same amount of wealth) and a maximum value of one (one person owns everything).	1
Variables of institutional quality and financial development (depth)		
Control of corruption	Capturing 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.	2
Government effectiveness	Reflects 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.	2
Domestic credit provided by the financial sector (% of GDP)	"Credit provided by the financial sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The financial sector includes monetary authorities and deposit money banks, as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other financial corporations are finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies" (World Bank 2017).	3
Control variables		
GDP growth (annual %)		3
Inflation rate, GDP deflator (annual %)		3
Employment in agriculture (% of total employment, modelled ILO estimate)		3
Government expenditure (% of GDP)		3
GDP per capita (constant 2015 US$)		3
Trade (% of GDP)		3

Sources: 1. Global Wealth Report (Credit Suisse 2017; 2018); 2. Worldwide Governance Indicators (World Bank 2022a); 3. World Bank Indicators (World Bank 2022a).

Table 2. Descriptive statistics of the main variables used in the empirical models

Variable	Mean	Std. dev.	Min	Max	Observations
Gini coefficient for wealth					
overall variability		0.07	0.45	0.99	$N = 1{,}130$
between variability	0.72	0.06	0.54	0.92	$n = 171$
within variability		0.04	0.49	0.93	$\bar{T} = 6.60$
Control of corruption					
overall variability		28.19	0.47	100	$N = 1{,}116$
between variability	49.40	28.33	1.42	99.72	$n = 169$
within variability		3.89	30.35	64.11	$\bar{T} = 6.60$
Domestic credit as % of GDP					
overall variability		60.75	–60.40	345.14	$N = 1{,}047$
between variability	74.15	60.58	–22.45	327.98	$n = 165$
within variability		10.98	–2.31	175.53	$\bar{T} = 6.35$

Source: Authors' calculations with the "xtsum" routine in Stata.

non-financial assets (principally housing and land) less debts" (Credit Suisse 2018). The explanatory variables are introduced and described in Table 1.

The period of analysis covers the years 2010 to 2016, during which the global economy experienced a slow recovery from the Great Recession with the global growth rate of around 3%, without significant growth in global trade, and with political turmoil, particularly evident in the Arab Spring protests in the Middle East and North Africa. The descriptive statistics of the main variables used in the dynamic panel-data models are presented in Table 2 for those years where data on the dependent variable of wealth inequality is available[2]. Wealth inequality refers to the distribution of wealth within nations and is related to different socio-economic outcomes.

The average Gini coefficient for wealth, a commonly used measure for inequality that ranges from 0 (perfect equality) to 1 (perfect inequality), exhibited a relatively high average and minimum values of 0.72 and 0.45, respectively. These high average and minimum values suggest that the wealth inequality is an important issue in the sample of countries being studied. The range of values for the Gini coefficient for wealth with the minimum of 0.45 and the maximum of almost perfect inequality (0.99) highlights a wide variation in the wealth inequality across countries. The within-country standard deviation amounted to 0.04 (deviations from the country average for each country) and the between-country standard deviation was 0.06 (deviations in terms of country averages). The average domestic credit as percentage of GDP amounted to 74.15, with between-country standard deviation of 60.58 and within-country standard deviation of only 10.98. The average value for control of corruption, represented on the scale from 0 to 100, was 49.40, with between-country standard deviation of 28.33 and within-country standard deviation of only 3.89. The variable with the lowest number of observations overall was the government expenditure as percentage of GDP, with 772 observations.

5. Methodology

Our estimation is based on a panel data set. According to Hsiao (2003) and Klevmarken (1989), as cited in Baltagi (2008), there are several advantages of using panel data compared to time series or cross-section data alone. In empirical estimation, we rely on the generalized method of moments (GMM), formalized by Hansen (1982). In particular, we employ the estimators that were developed for dynamic models of panel data by Holtz-Eakin, Newey, and Rosen (1990), Arellano and Bond (1991), Arellano and Bover (1995), Blundell and Bond (1998), and Roodman (2009). In this paper, we rely on the system GMM estimator, as implemented in the "xtabond2" routine in Stata, written by Roodman (2009).

The GMM does not require a complete knowledge of the distribution of the data, but rather derives only specified moments from an underlying model. It is suitable to deal with potential problems, such as unobserved country specific effects or reverse causality, omitted variable bias, and measurement error. Use of instrumental variables addresses potential endogeneity issues and can lead to consistent parameter estimates, even in the case of measurement errors or omitted explanatory variables that are constant over time. We shall control for endogeneity by using internal instruments based on lagged levels and lagged differences of the instrumented explanatory variables.

In addition, a dynamic model will allow us a separate analysis of the short-run and long-run effects of institutions on wealth inequality, which is not possible in a static model framework.

As stated by Leszczensky and Wolbring (2022), the Arellano-Bond approach accounts for reverse causality and is able to identify the true causal effects of both the lagged and the contemporaneous value of an explanatory variable. Furthermore, it provides a powerful toolbox to tackle endogeneity problems caused by both reverse causality and unobserved heterogeneity (Hsiao 2007). However, Leszczensky and Wolbring (2022) also address shortcomings of the approach in an empirical setting. These include requiring sufficient amount of within variation, unreliable inference in case of serial correlation, and issues with convergence (especially in a case of an unbalanced panel with missing values, such as ours). We perform a two-step estimation, where a weighting matrix of residuals is used in the second step to re-estimate the variance.

The empirical model of wealth inequality, proxied by the Gini coefficient for wealth, is constructed based on the theoretical underpinnings presented in Section 2 and existing empirical evidence presented in Section 3. There, we provided the relevant theoretical framework that links our estimation model with the main institutional variables of interest – control of corruption and financial development. Furthermore, we provided an overview of the empirical studies on the relationship between inequality and the variables that we use in our model. The relevant forces of the mentioned research efforts are examined in isolation, without an assessment of its relative importance. We thus evaluate hereinafter a concise model that includes these different determinants. We could not rely solely on the previous studies since, as pointed out by Iftekhar, Horvath, and Mares (2020, p. 4), only a few papers exist on this topic. The model is given by the following expression:

$$\log(WGINI_{it}) = \beta_0 + \beta_1 \log(WGINI_{it-1}) + \beta_2 \log(INST_{it}) + \beta_3 \log(FIN_{it}) + X_{it}'\beta + \Phi_t + u_{it},$$

where $\log(WGINI_{it})$ is the Gini coefficient for wealth in logarithms, $\log(INST_{it})$ is the control of corruption in logarithms (a proxy institutional variable), $\log(FIN_{it})$ is the domestic credit as percentage of GDP (a proxy variable for financial development), and x_{it} is a set of control variables. The latter include GDP growth, agricultural employment, GDP per capita, trade as a measure of openness, inflation as a measure of price change, and government expenditure as a measure of the government presence in the economy. Φt includes a full set of time dummy variables in order to prevent the presence of contemporaneous (cross-individual) correlation, whereas u_{it} represents a disturbance term.

The lagged Gini coefficient for wealth in logarithms, $\log(WGINI_{it\text{-}1})$, is treated as endogenous and thus instrumented, whereas the other explanatory variables are treated as exogenous. Roodman (2007) strongly recommends reporting the number of instruments used in the dynamic panel, since these models can generate an enormous number of potentially "weak" instruments that can cause biased estimates. In order to prevent "instrument proliferation", we employ option "collapsed" and restrict the number of lags for instruments to three. As a result, the number of instruments is much lower than the number of groups in all model specifications. As argued by Baltagi (2008), a small panel sample may produce a "downward bias of the estimated asymptotic standard errors" in the two-step procedure, thus we report the corrected estimates using the option "robust" that implements the Windmeijer correction (Windmeijer 2005, as cited in Baltagi 2008).

We also calculate the long-run effects of the explanatory variables on wealth inequality. The long-run regression coefficients $\hat{\beta}_{j,\,long}$ are being calculated based on the respective short-run regression coefficients $\hat{\beta}_{j,\,short}$ and the regression coefficient on the lagged dependent variable $\hat{\beta}_1$ in the following way (Efendic and Pugh 2015):

$$\hat{\beta}_{j,\,long} = \hat{\beta}_{j,\,short} \cdot \frac{1}{1-\hat{\beta}_1}, \qquad j > 1.$$

6. Empirical results

In this section, we present the empirical results of the research, with a focus on estimation results, model diagnostics and sensitivity analysis. The methodology of the GMM in dynamic panel data estimation framework is specially developed to address potential biases and endogeneity, as described in Section 4. The estimation is performed based on the Credit Suisse and World Bank data for a global sample of countries for the period 2010–2016, as presented in Section 5. In addition, we distinguish between short-run (contemporaneous) estimation results and long-run estimation results.

Table 3 presents the short-run (contemporaneous) results of the empirical estimation of four different model specifications, each with the Gini coefficient for wealth as the dependent variable. Each model specification consists of a given set of explanatory variables of institutional quality and financial development (depth), a given set of control explanatory variables,

Table 3. Results of the empirical estimation of the Gini coefficient for wealth

Explanatory variable	Model 1	Model 2	Model 3	Model 4
Constant term	–0.059342 (0.041666)	–0.076873 (0.040602)	–0.072035* (0.042303)	–0.125230 (–0.054054)
Lagged Gini coefficient for wealth (in logs)	0.817472*** (0.067560)	0.802587*** (0.076960)	0.811230*** (0.072004)	0.801782*** (0.072540)
Control of corruption (in logs)	–0.000194 (0.006666)	–	–0.000451 (0.007009)	–0.000627 (0.007130)
Government effectiveness	–	0.000185 (0.000230)	–	–
Total domestic credit as percentage of GDP (in logs)	0.012669*** (0.004190)	0.011148*** (0.004311)	0.012180*** (0.004111)	0.011402*** (0.004372)
GDP growth	0.000538 (0.000815)	0.000578 (0.000931)	0.000642 (0.000889)	0.000659 (0.000831)
GDP per capita (in logs)	–	–	–	0.006814 (0.004822)
Inflation rate	0.000996** (0.000497)	0.001103*** (0.000513)	0.001048** (0.000489)	0.001219** (0.000554)
Share of employment in agriculture (in logs)	0.005882** (0.002851)	0.007180*** (0.003291)	0.005095* (0.003041)	0.010606*** (0.003711)
Government expenditure as a share of GDP (in logs)	–0.012150** (0.006114)	–0.013940*** (0.006692)	–0.012341** (0.006219)	–0.014478** (0.007273)
Trade as percentage of GDP (in logs)	–0.004398 (0.005444)	–0.006197 (0.005852)	–0.005645 (0.005783)	–0.003782 (0.005711)
Dummy for year 2011	0.004436 (0.010233)	0.011372 (0.010591)	0.012698 (0.010716)	–0.004662 (0.010012)
Dummy for year 2012	0.016831*** (0.005091)	0.001328 (0.004934)	0.001820 (0.004857)	–0.016383*** (0.005067)
Dummy for year 2013	–0.029470*** (0.007230)	–0.011920 (0.006380)	–0.011620 (0.006430)	–0.029001*** (0.007130)
Dummy for year 2014	0.017350*** (0.004690)	0.016720*** (0.004686)	0.017350*** (0.004690)	–
Dummy for year 2015	–0.018650*** (0.004580)	–	–	–0.017780*** (0.004549)
Dummy for year 2016	–0.037860*** (0.008970)	0.057750*** (0.009520)	–0.072030*** (0.042300)	0.038500*** (0.008947)
Number of observations	581	583	583	581
Number of groups	110	111	111	110
Number of instruments	17	17	17	18
F–test of joint significance: H_0: Coefficients are jointly equal to zero.	$F = 2{,}933.5$ $p = 0.000$	$F = 3{,}090.0$ $p = 0.000$	$F = 3{,}280.7$ $p = 0.000$	$F = 2{,}345.8$ $p = 0.000$
Arellano–Bond test for AR(1): H_0: There is no first–order serial correlation.	$z = -3.59$ $p = 0.000$	$z = -3.56$ $p = 0.000$	$z = -2.51$ $p = 0.012$	$z = -3.59$ $p = 0.000$
Arellano–Bond test for AR(2): H_0: There is no second–order serial correlation.	$z = 0.55$ $p = 0.581$	$z = 0.56$ $p = 0.574$	$z = 0.55$ $p = 0.581$	$z = 0.56$ $p = 0.576$
Hansen *J*–test of overidentifying restrictions: H_0: Restrictions are valid.	$\chi^2 = 1.09$ $p = 0.780$	$\chi^2 = 4.50$ $p = 0.212$	$\chi^2 = 4.56$ $p = 0.207$	$\chi^2 = 0.92$ $p = 0.821$

Notes: Corrected standard errors are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.1$.

Source: Authors' calculations with the "xtabond2" routine in Stata.

and a set of time dummy variables for the analysed years. The latter capture the time-specific fixed effects that are common to all countries.

The first model specification (Model 1) includes the control of corruption as a variable representing the institutional quality. In the second model specification (Model 2), we replace the control of corruption with another variable representing institutional quality, i.e., the government effectiveness. The other explanatory variables are the same in both specifications. They are estimated by the system GMM estimator employing the first-differences transformation. The third model specification (Model 3) is similar to the first one, but employs the forward orthogonal deviations transformation instead of the first-differences transformation. In the fourth model specification (Model 4), we control for the level of development by including GDP per capita as a control variable. The other explanatory variables are the same as in the first and the third specification, whereas the first-differences transformation is employed again.

Let us address model diagnostics (lower part of Table 3) before transitioning to the interpretation of regression coefficients (upper part of Table 3), as the former is instrumental for consistency and unbiasedness of the latter. First, the GMM estimator implies first-order serial correlation, but requires that there is no second-order serial correlation in the disturbances (Arrelano and Bond 1991, as cited in Efendic and Pugh 2015). Our results in Table 3 indeed indicate the presence of first order auto-correlation and absence of second order auto-correlation in all four model specifications. Moreover, we perform the Hansen test of overidentifying restrictions, with the null hypothesis that these restrictions (orthogonality conditions) are valid. We find that the null hypothesis is not rejected in any of the model specifications, which gives us some confidence about instrument validity. In addition, according to Roodman (2007, p. 12, as cited in Efendic and Pugh 2015), the estimated coefficient on the lagged dependent variable in the model should indicate convergence by having a value less than one. As can be seen from Table 3, this is satisfied in all four model specifications.

Our model incorporates the long-term perspectives by taking into consideration the entire history of wealth inequality, institutional changes, as well as all relevant explanatory variables. Table 4 presents the long-run results of the empirical estimation of the first model specification (Model 1) only, focusing on the explanatory variables with statistically significant short-run effects.

We can now turn to the interpretation of regression coefficients, starting with the variables of institutional quality and financial development (depth). As can be seen from Table 3, control of corruption and government effectiveness are not statistically significant determinants of wealth inequality in any of the four model specifications. Conversely, the total domestic credit as percentage of GDP as a measure of financial development has a statistically significant "positive" contemporaneous effect on wealth inequality in all four model specifications (values between 0.011 and 0.013). This "positive" effect, even though relatively small, is unfavourable, as more credit as percentage of GDP leads on average, *ceteris paribus*, to more wealth inequality. As can be seen from Table 4, the long-run coefficient is also positive (0.069) and statistically significant. The long-run estimate, conditional on the entire history of the variable, thus demonstrates that the effect is persistent and cumulates over time.

In terms of control variables, we find no statistically significant effect of GDP on wealth inequality in any of the four model specifications, neither in terms of GDP per capita nor in terms of GDP growth. Likewise, trade as percentage of GDP also did not turn out to be a statistically significant determinant of wealth inequality. However, we find evidence of effects of the other control variables, such as the inflation rate, the share of employment in agriculture, and government expenditure as a share of GDP. These effects turned out to be statistically significant contemporaneously in all four model specifications, but not in the long run

Table 4. Long-run effects of determinants of the Gini coefficient for wealth

Explanatory variable	Long-run coefficient	Std. error	*z*–statistic	*p*–value
Total domestic credit as percentage of GDP (in logs)	0.06941	0.03228	2.15	0.032
Inflation rate	0.00546	0.00328	1.66	0.097
Share of employment in agriculture (in logs)	0.03223	0.02208	1.46	0.145
Government expenditure as a share of GDP (in logs)	–0.06656	0.03847	–1.73	0.084

Source: Authors' calculations with the "nlcom" routine in Stata based on Model 1.

(at least not at the 5% significance level).

Previous research is not clear about the sign and strength of the effect of prices on wealth inequality. For example, the Royal Commission on the Distribution of Income and Wealth (1979), which decomposed the impact of change in prices and quantities of wealth components, found that changes in prices of houses and shares in the period 1960–1972 in the United Kingdom cancelled out, or accordingly, prices had no strong effect on wealth inequality. Our findings suggest, as can be seen from Table 3, that the inflation rate has a statistically significant "positive" contemporaneous effect on wealth inequality (values around 0.001). This "positive" effect is again relatively small and unfavourable, as more inflation leads on average, *ceteris paribus*, to deepening the wealth inequality. These findings are in line with Spant (1987), who found that price changes account for an increase in wealth for the wealthiest households. Also, Takayama (1991), Weicher (1995), and Wolff (1992) concluded that the long-term factors play the major role, such as saving, bequest behaviour and tax policy, while price changes play a role in shorter-term variations in inequality.

Our findings from Table 3 also suggest that the share of employment in agriculture has a statistically significant "positive" effect on wealth inequality (values between 0.005 and 0.011). This "positive" effect is, once more, small and unfavourable, as more employment in agriculture leads on average, *ceteris paribus*, to more wealth inequality. However, this is a short-run effect only, since it does not accumulate into a statistically significant long-run effect. There is a cluster of literature that discuss the Kuznets theory and possible explanation may be in line with Llavador and Oxoby (2005), who argue that policies can be created to sustain abundant (and cheap) labour for the rural sector, where agrarian societies or land elite use explicit or implicit policies to prevent migration out of the rural sector. By doing this, the elites keep wages low and extract value from agricultural products with cheap labour inputs. This is the way of preventing rural people to move to the cities and to profit from the urban possibilities.

Hermann (2014) considers the public sector as the main factor that should address the issue of inequality. He provides evidence that the low-income, and we can assume also fewer wealthy residents benefit more from using public services, since the value provided represents a higher share of their income. The government may impact the distribution of wealth by collecting the funds by taxation or borrowing and spending these funds on transfers, social services, education and providing public infrastructure. This is a way to substitute the expenditure of the poor and to redistribute. This is congruent with our results in Table 3. Namely, we find that the government expenditure as a share of GDP has a statistically significant negative short-run effect on wealth inequality (values between –0.012 and –0.014). More government expenditure thus leads on average, *ceteris paribus*, to less wealth inequality.

We also performed a vast number of robustness checks. First, we changed (decreased to two and increased to four) the number of lags for instrumental variables in the GMM estimation, but found no substantial changes in terms of sign and statistical significance of the effects of key explanatory variables. Second, we allowed the variables of institutional quality and financial development, in particular the control of corruption, to have not only a contemporaneous effect, but also a lagged effect on wealth inequality (up to three years in length). It turned out that the lagged effects were not statistically significant, whereas the other results were fairly robust to the change. Third, we compared the dynamic panel estimates to ordinary least squares (OLS) estimates and fixed effects (FE) estimates, as proposed by Bond (2002). It turned out, as expected, that the estimated regression coefficient on the lagged dependent variable from the GMM estimation was between the values obtained from the other two estimators[3].

Lastly, we ran estimation with split sample into two groups. The first group consisted of countries with low and lower-middle income (up to 4,035 USD p.c.), whereas the second group consisted of countries of upper-middle and high income (above 4,035 USD p.c.). We found no substantial changes in terms of sign and statistical significance of the effects of the explanatory variables in the second group compared to the whole sample. Moreover, the coefficients for the variables representing domestic credit, inflation, employment in agriculture and government expenditure were significant at the 5% level in both the short run and the long-run. In the first group, however, we obtained statistically insignificant results for key explanatory variables. This was somewhat expected due to substantially decreased sample size in this group after sample splitting, as argued by Edelstein and Kilian (2007).

7. Concluding remarks

This paper examines the impact of institutional development on the inequality of wealth. More precisely, we consider the impact of quality of institutions represented by control of corruption and financial

development represented by domestic credit as percentage of GDP on the Gini coefficient for wealth. For this purpose, we construct a global panel data set for the period 2010–2016 and employ dynamic panel data models to conduct an econometric analysis of these relationships based on the Credit Suisse and World Bank data.

We do not find a statistically significant effect of control of corruption or government effectiveness on wealth inequality, but we do find unfavourable statistically significant contemporaneous and long-run effects of domestic credit as percentage of GDP on wealth inequality. The latter long-run estimate, conditional on the entire history of the variable, thus demonstrates that the effect is persistent and cumulates over time. We also find evidence of statistically significant relationships between wealth inequality on one hand, and inflation rate, employment in agriculture and government expenditure on the other. In the short-run, inflation and employment in agriculture have statistically significant unfavourable effects on wealth inequality. At the same time, government expenditure as a share of GDP has a favourable short-run effect on wealth inequality.

The deepening of wealth inequality through the financial institutional framework is a concerning trend. Our research provides policy-relevant findings and directions to decrease wealth inequality. Economic policy mechanisms, such as policies that target inflation, transition of labour to the industrial sector or changes in government expenditure, can have an impact on wealth inequality in the short run. However, to ensure a long-term impact, the capital should not have an institutionally guaranteed return, as this can lead to infinite accumulation or the so-called snowball effect. Specifically, as our findings suggest, redistribution policies are needed, but may not be effective in the long-run if applied in isolation, without addressing the root cause of expanding wealth gap. There is a need to re-examine the policies governing financial intermediation, as financial intermediaries can be both the source and the driver of an infinite accumulation process.

We performed various robustness checks and found that the results are robust. Nonetheless, we have encountered some constraints during our research, primarily related to issues with availability of high-quality data and endogeneity issues in dynamic panel data estimation. We need a longer time span in order to increase the number of observations. This will also improve the use of (internal) instrumental variables to deal with the endogeneity issue and enable additional robustness checking of particular determinants of wealth inequality.

Endnotes

1 The law of proportionate growth gives rise to a wealth distribution that is log-normal.

2 Before performing the empirical analysis, we adjusted the dataset by dropping outliers for GDP growth and inflation, defined by five standard deviations in both tails. In this process, we lost 14 observations for GDP growth and 5 observations for inflation.

3 In particular, based on Model 1, the estimated regression coefficient on the lagged dependent variable amounted to 0.827 in the case of OLS estimation and to 0.170 in the case of FE estimation.

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