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Public debt and inequality in Sub-Saharan Africa: the case of EMCCA and WAEMU countries

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Abstract

The paper investigates whether public debt explains income inequality in several Sub-Saharan African (SSA) countries. The core method employed is the Bayesian Model Averaging (BMA) estimator, which uses a dataset covering the period 1997–2019. The key findings reveal that public debt tends to reduce inequality among the poor but may harm the rich in the WAEMU region. Public debt generally has a neutral impact on inequality in EMCCA but can improve income distribution among the rich under stringent corruption control. In terms of contributions, the paper is one of the first works that examine how public debt impacts inequality in the Sub-Saharan African (SSA) countries across different levels of income. Moreover, it explores the intricate relationship among public debt, socio-economic characteristics, corruption, and inequality within the region.

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1 Introduction

Income inequality has garnered significant interest in recent decades as economic growth has not been uniformly distributed, leading to disparities in welfare among different groups. As a result, asymmetric effects are observed. Internationally, many countries have experienced varying degrees of inequality, influenced by factors such as corruption, economic structure and characteristics, education, and tax systems. Recently, a new strand of research has begun to introduce public debt as a relevant determinant of income inequality.

Unfortunately, the connection between inequality and public debt is not very clear even in modern macroeconomics, as many authors explain the transmission mechanisms in different ways. For example, the 'transfer approach', proposed by Andel (1969) and Gandenberger (1970), suggests that the 'public debt—inequality' interaction is mediated by the tax regime. Differently, Williamson (1985) shows that debt is transferred from low-saving to high-saving classes, affecting income distribution. In the same vein, Mankiw (2000) states that stabilized debt influences inequality through a pass-through effect of distortive taxes, which reduce the real interest rate, private capital, and labour productivity, ultimately affecting wages. Bilbiie et al. (2013) introduce the idea of 'sticky prices', arguing that public debt has redistributive effects under this price regime, stimulating growth as well.

Unlike previous theories, Jong and Dutt (1996) explain the theoretical transmission channel 'public debt—inequality' based on both the demand and supply sides. The demand approach, inspired by the post-Keynesian model, suggests that debt supports growth via aggregate demand and redistributes income from capitalists to workers. The supply approach posits that public debt exerts pressure on tax inputs, deteriorating income distribution. Herein, the poor are more likely to pay higher interest rates on public debt than the rich are.

Many regions in the world face large public debts accompanied by high inequality. In this context, African countries exhibit a particular feature in terms of income distribution. More precisely, many Africans seem to be more tolerant of inequality compared to people from developing and transition countries, with religious beliefs playing a crucial role in shaping this behaviour (Nel 2021). Among these, Sub-Saharan African (SSA) countries are strongly impacted, with two groups deserving particular investigation: the Economic and Monetary Community of Central Africa (EMCCA) and the West African Economic and Monetary Union (WAEMU). The EMCCA includes Cameroon, the Central African Republic, Chad, the Republic of Congo, Equatorial Guinea, and Gabon, while the WAEMU comprises Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo.

The EMCCA is an economic community established in 1964 targeting to achieve collective autonomy, improve the standard of living and ensure economic stability based on cooperation between its members, with a common currency (i.e. Central Africa CFA franc, connected to the Euro). According to its official status, the WAEMU is an organization founded in 1994 having its main aim to counterbalance the dominance of English-speaking economies, such as Nigeria and Ghana. The
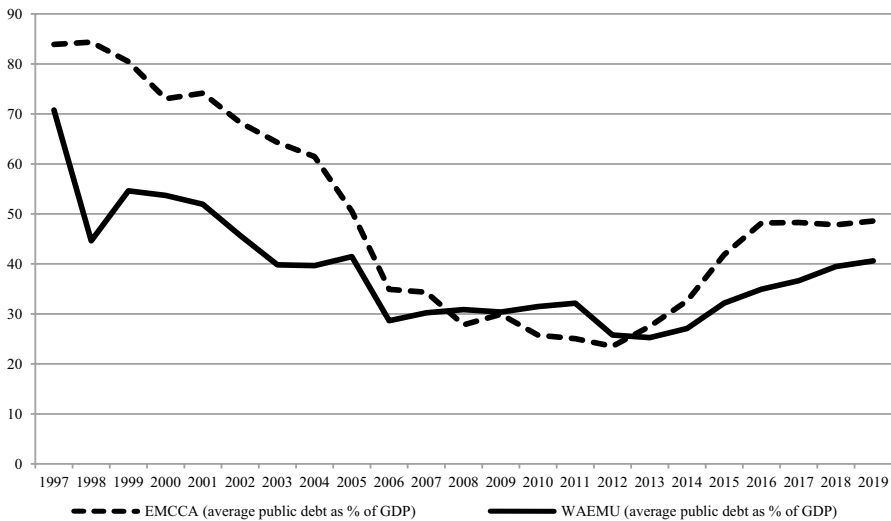
Fig. 1 Average public debt in EMCCA and WAEMU over 1997–2019. *Source*: Own calculus based on Government Finance Statistics (2021) online database

member countries of this organization admit both custom and currency union (i.e. a common currency is used, called the West Africa CFA franc, linked to Euro).

The EMCCA group is rich in natural resources, including oil and diamonds, whereas the WAEMU is characterized by economies where agriculture significantly contributes to the Gross Domestic Product (GDP).

These characteristics have significantly influenced inequality, resulting in some of the highest poverty levels in the world. Often, these countries have contracted international loans to stimulate their economies, which has exerted upward pressure on public debt, especially after 2013 (see Fig. 1).

Figure 1 shows three distinct periods regarding the average public debt in SSA. The first period reveals a downward trend (1997–2006), the second period shows a stable dynamic (2007–2013), and the third period clearly evidences a return to growth (2014–2019). Throughout the entire period, the average public debt in the EMCCA is generally higher than in the WAEMU group. Unfortunately, in many cases, public debt did not resolve socio-economic problems; on the contrary, it exacerbated poverty and income inequalities. Figure 2 illustrates that average income inequality is significantly higher at the top income levels in the EMCCA compared to the WAEMU, as well as the average public debt ratio.

The Congolese economy serves as an illustrative example of the EMCCA. The International Monetary Fund considers the country over indebted. Congo's debt ratio exceeds 70% of the community standard, reaching 86% of GDP in 2018 (AfDB 2019).

In this framework, the core objective of this paper is to analyse the impact of public debt on income inequality in both EMCCA and WAEMU regions by following the Bayesian Model Averaging (BMA) estimator. Additionally, a large set of control determinants is also considered to test the robustness of the results.
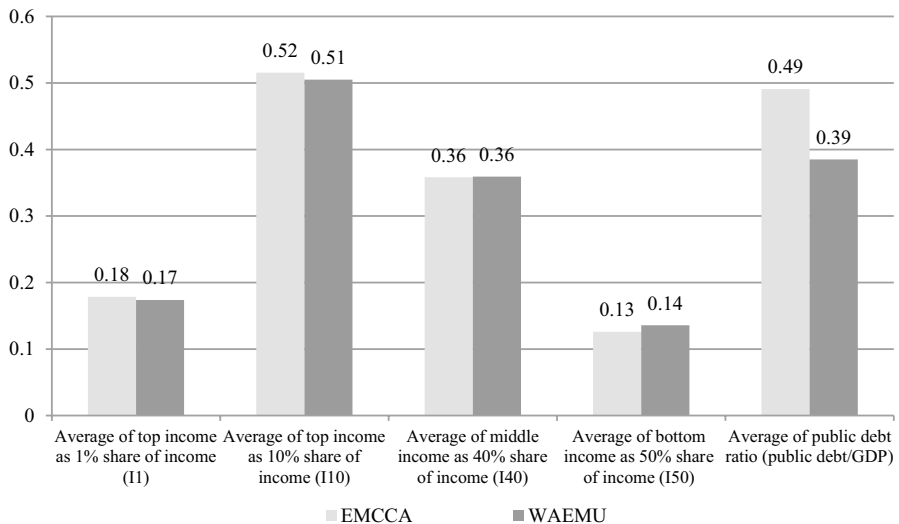
Fig. 2 Average income inequality and average public debt ratio in EMCCA and WAEMU (1997–2019). Source: Own calculus based on World Inequality Database (2021) and Government Finance Statistics (2021) online databases

The assumed hypothesis posits that there exists a significant relationship between public debt and income inequality, which varies across various income levels. The theoretical basis for this assumption is provided by Jong and Dutt's (1996) demand model, complemented by the supply-side approach, while also testing for various other determinants of inequality (Salti 2015). Among these determinants, corruption is separately explored, as it mediates the impact of public debt on inequality. From this perspective, Stiglitz (2002) argues that the loans offered by the International Monetary Fund (IMF) to Russia were not accompanied by a competitive institutional system. This led to corruption and state capture, which in turn increased income inequalities.

To this end, a sample of 14 countries, divided into two groups: EMCCA (comprising 6 countries) and WAEMU (comprising 8 countries), covering the period from 1997 to 2019, has been constructed to support the endeavour empirically.

Testing the hypothesis, the findings partially validate it. More precisely, the results suggest that in the WAEMU region, public debt tends to alleviate inequality among the poor while potentially imposing adverse effects on the wealthy. Conversely, in the EMCCA region, public debt generally does not significantly affect inequality, yet effective corruption control measures could facilitate improved income distribution among the affluent.

The contribution of the paper is threefold. First, to the best of our knowledge, this is one of the first studies to use various revenue quartiles to analyse the valence of public debt as a determinant of inequality in SSA countries. Unlike this study, existing contributions generally focus on a single inequality indicator, primarily the GINI index (Salti 2015; Arslan 2019; Tung 2020). Only Sayed (2020) considered three

levels of inequality in the case of Lebanon, whereas this paper examines four for different targeted countries.

Secondly, as a novelty, this study is one of the first to employ the Bayesian Model Averaging (BMA) estimator to distinguish between primary and auxiliary determinants of inequality. The rest of the papers follow either theoretical approaches (Jong and Dutt, 1996; Konishi and Maebayashi 2016; Borissov and Kalk 2020; Chatzouz 2020;) or econometric models by survey (Arslan 2019), cross-country (Salti 2015), panel (Tung 2020) or Autoregressive Distributed Lag (ARDL) approach and Error Correction Model (ECM) forms (Sayed 2020). As Hinne et al. (2020, p. 202) note, compared with the classical econometric tool, the BMA has several advantages: (1) "reduces the overconfidence (i.e. underestimated uncertainty) that emerges when model uncertainty is ignored"; (2) "results in optimal predictions under several loss functions, such as the logarithmic or the squared error loss"; (3) "avoids the all-or-nothing mentality that is associated with classical hypothesis testing, in which a model is either accepted or rejected wholesale. In contrast, BMA retains all model uncertainty until the final inference stage, which may or may not feature a discrete decision"; (4) "procedures based on the selection of a single best model may yield sudden changes in estimates when the observation of new data, or the repetition of an experiment, leads to the selection of a different best model"; (5) "is relatively robust to model misspecification."

Third, the paper provides a valuable comparison between the EMCCA and WAEMU groups, considering their socio-economic characteristics and corruption to mediate the 'public debt—inequality' nexus. The existing literature offers a more restrictive palette of controls as dictated by econometric methodology characteristics (Salti 2015; Arslan 2019; Sayed 2020; Tung 2020).

The remaining part of the study is organized as follows: Sect. 2 reviews the literature, Sect. 3 presents the methodology and data, Sect. 4 discusses the results, while Sect. 5 concludes by highlighting the main policy implications.

2 Literature review

Economic growth has been achieved in developing countries across Europe, Asia, and Africa in recent decades, and recent studies have analysed the most significant determinants of economic growth in these regions. For example, the bank capital-to-asset ratio is a prominent factor for growth in countries such as Bolivia, the Czech Republic, Estonia, Malaysia, Peru, Poland, and Thailand (Batrancea et al. 2022a), while exports, imports, foreign direct investment inflows and outflows, social contributions, and wages are the foundation of growth in 36 European economies (Batrancea et al. 2022b). Similar analyses consider various other factors, such as interest rates, business angels, bank support, and public support (Batrancea et al. 2022c); income, the rate of young employees, and educational attainment level (Batrancea 2023); or exports, gross capital formation, and gross domestic savings (Batrancea et al. 2021). Moreover, a recent paper claims that increased investments and green policies are essential for sustaining economic growth across the fifty nations analysed (Batrancea et al. 2023a).

However, many studies have demonstrated that economic growth leads to a more equitable distribution of income across the population (Soubbotina and Sheram 2000; Besley and Burgess 2003; Bourguignon et al. 2004). These papers also emphasize that better-targeted financial services for poor populations help reduce income inequalities among them (Bourguignon et al. 2004; Beck et al. 2007; McKenzie and Woodruff 2008).

The literature on the determinants of income inequality is extensive and continues to grow, covering economic context, structural factors, labour endowment, and institutional environment.

Economic context factors highlight the importance of the economic environment in shaping income inequality. Several studies identify country characteristics that influence inequality. For instance, Nandelenga and Oduor (2020) focus on sub-Saharan Africa, noting both short- and long-term asymmetric impacts of financial inclusion on income disparity (e.g. liquidity liabilities and credit to the private sector). They argue that GDP per capita stimulates the reduction in income inequality, a hypothesis supported by Sylwester (2002). Conversely, Salti (2015) argues that GDP per capita has positive effects on the Gini coefficient. Purba et al. (2019), focussing on the West Coast Region in North Sumatra, Indonesia, from 2012 to 2016, find that gross fixed capital formation positively impacts inequality. In contrast, Ames et al. (2002) demonstrate a positive link between inflation rate and inequality, whereas Nandelenga and Oduor (2020) claim a negative connection between trade openness and income distribution.

Tax burden is another crucial factor in assessing inequalities, as Lambert (1993) argues that a progressive tax schedule can reduce inequality. Poterba (2007), focussing on the USA, demonstrates that reducing the average tax burden for specific income quartiles increases the share of income in those groups, thereby addressing income distribution issues. Joumard et al. (2013), who suggest that reducing income inequality in OECD countries through tax burden and transfers depends on the size and progressivity of each tax, draw similar conclusions.

Economic structure determinants are also significant. For example, Moore (2009) emphasizes that the construction sector can reduce inequality, whereas the effects of the industry, manufacturing, and services sectors are mixed and depend on various factors. Additionally, Bourguignon and Morrisson (1998) argue that increasing productivity in traditional agriculture can alleviate inequality and poverty, but a decline in agricultural activity tends to increase inequality in developing countries (Anderson et al. 2009).

Labour endowment factors are also crucial. Sitthiyot and Holasut (2016), using a sample of sixty-nine countries, highlight that the relationship between inequality and population is nonlinear. According to Sulemana et al. (2019), there is a strong link between urbanization and income inequality in the SSA, covering 48 countries from 1996 to 2016. However, Chakravorty (1993) finds consistent results only for urban population and inequality. In contrast, Oyvat (2010) argues that urbanization does not increase income inequality but reduces it by narrowing the urban–rural income gap. Batrancea et al. (2023b) mention that the predictors with the strongest influence on economic growth in Western European regions are disposable household income, inter-regional mobility, housing indicators, and labour force participation.

In Eastern Europe, the main determinants are housing indicators, internet broadband access, and air pollution. Under the pressure of population growth, unemployment and its structural implications have been the focus of extensive research. For example, Saunders (2002) demonstrates that unemployment increases the risk of poverty, while Albrecht and Albrecht (2007) argue that high female unemployment rates exacerbate inequality. In contrast, Sylwester (2002) finds that education spending reduces income inequality in cross-sectional analysis. Similarly, Cardak (1999) asserts that education expenditure diminishes income inequality, though Artige and Cavenaile (2023) identify a U-shaped relationship. Celikay and Sengur (2016) propose that while an initial increase in education expenditure may raise inequality in the short-run, it reduces inequality in the long-run. Differently, health expenditure per capita shows a negative correlation with income inequality according to Torul (2020), while Jianu (2020) finds that both health and education expenditures reduce inequality in the EU. Doumbia and Kinda (2019) reinforce these findings in an 83-country study, highlighting that higher education and health spending decrease income inequality in the long-run. By analysing labour and capital inequality, Luo's (2019) investigations show that labour inequality increases debt, while capital inequality leads to a reduction in debt levels in these economies. Additionally, results obtained by Batrancea (2021), estimated using panel GMM, indicate that proxies for economic growth and inflation significantly influence economic sentiment, with positive implications for inequality reduction.

Finally, many authors also examine *institutional environment* determinants, with corruption being widely discussed. Gupta et al. (1998) conducted a cross-national analysis on how corruption adversely affects income distribution and poverty. They constructed an inequality model using the Gini coefficient to measure income inequality and various corruption indices. Their findings indicate that increasing income inequality due to corruption not only reduces economic growth but also exacerbates poverty. The authors also highlight that tax evasion, favouring wealthy elites, diminishes the tax base and contributes to greater income inequality. In contrast, Karstedt (2001) studied corruption's impact on income distribution across 35 OECD countries. The results reveal that countries with high income inequality tend to exhibit higher levels of corruption. Conversely, nations with higher secondary graduation rates and more women in government positions experience lower levels of corruption. The relationship between corruption and income inequality is nonlinear, suggesting that once a certain level of income equality is achieved, corruption declines exponentially. Using the Human Poverty Index (HPI) based on a sample of 97 developing countries from 1997 to 2006, Negin et al. (2010) propose that corruption and poverty are mutually reinforcing, with causality operating in both directions. Turning to other institutional factors, Chong and Grandstein (2007) present a study demonstrating that improvements in institutional quality reduce income inequality.

In the SSA countries, various determinants have been investigated, ranging from financial development (Zhang and Naceur 2019; Tchamyou et al. 2019) and endemic diseases (Soludo 2003) to net Foreign Direct Investments (FDI) (Gohou and Soumaré, 2012) and access to microfinance (Bangoura et al. 2016).

Despite its importance for income distribution, *public debt* has not been extensively explored among the factors influencing inequality. The literature presents two main strands of research on this topic.

The first strand suggests a positive effect of public debt on inequality. For instance, Tung (2020) examines 17 developing and emerging Asia–Pacific countries and finds that public debt has a negative impact on inequality. Similarly, Jong and Dutt (1996) present a theoretical model demonstrating that public debt can reduce income inequality under specific conditions. Conversely, Topuz (2021) identifies a beneficial impact of domestic public debt on income inequality in Turkey. In contrast, the second strand of literature argues that public debt exacerbates inequality through various channels. Konishi and Maebayashi (2016) theoretically show that increasing debt leads to higher inequality. Borissov and Kalk (2020) support this finding in their theoretical work, where they suggest that public debt exacerbates inequality. Chatzouz (2020) defends this view using a stylized Diamond model, highlighting that public debt increases income inequality. With a different methodology, Sayed (2020) obtains positive effects of public debt on inequality in Lebanon by following an ARDL analysis. Similarly, Arslan (2019) focuses on Turkey and concludes that reducing debt improves income inequality. Karlin (2018) examines OECD countries and indicates a negative impact of both external and internal debt on inequality, with external debt having a stronger effect in reducing income inequality compared to internal debt. Finally, Salti (2015) analyses data from 120 countries between 1990 and 2007 and observes that as as the share of public debt augments, the Gini coefficient has higher values.

Studies investigating the *influence of public debt on inequality in the SSA* region are limited. In this regard, we only have Cornia's (2016) contribution, which suggests that debt cancellation reduced the Gini coefficient in SSA between 1990 and 2011. In other words, an increase in external debt exacerbates inequality. Obiero and Topuz (2023) highlight a one-way causal relationship between public debt and inequality in Sub-Saharan African (SSA) countries, specifically from public debt to inequality. The increasing levels of inequality as public debt rises can be explained by the debt redistribution theory, which suggests that debt exacerbates the wealth gap by redistributing income from the poor to the rich. Furthermore, Obiero and Topuz (2022) find that both internal and public debt have a negative long-term impact on inequality in Kenya. They observe a one-way causality from internal debt to income inequality, whereas no causal relationship exists between public debt and income inequality. In a more recent study, Andoh et al. (2023) demonstrate that a 1% increase in public debt leads to approximately a 0.17% rise in inequality in Africa. Notably, this effect doubles when the public debt ratio reaches 57.47%.

It is noteworthy that there is a lack of literature considering public debt as a significant determinant of inequality in SSA countries. Moreover, no study examining inequality under debt pressure has investigated the revenue quartiles to ensure the robustness of the link. Additionally, despite the proliferation of corruption in the SSA region, no study has explored how public debt mediates its connection with inequality while accounting for this endemic phenomenon. In this context, we aim to fill the identified literature gaps related to SSA by addressing all these aspects.

3 Methodology and data

3.1 Methodology

In order to test if the revenues inequality is explained by public debt in the SSA, two important aspects arise: first, there is a large number of explanatory variables derived from literature, and second, the model specifications used in analyses are configured according to the researchers' visions.

This context induces a model selection problem related to the variable identification as the true statistical model is unknown. The BMA methodology is appealed to fix this issue by following the proposal of Magnus et al. (2010).

The core idea of the model-averaging method is that it estimates the parameters of interest conditional on each model, further calculating an unconditional estimate of their related weighted average. Having as ground the standard BMA, Magnus et al. (2010) offer a generalized framework by discriminating between focus and auxiliary regressors. The focus regressors refer to the classical determinants of income inequality as they are stated by literature, while the auxiliary regressors are derived from the new theory, being the subject of testing.

As Fragoso et al. (2018) note, the BMA is an extension of the Bayesian inference methods that suppose the model space $M = \{M_k, k = 1, 2, \ldots, K\}$, where k is the set of probability distributions related to the likelihood function $L(Y|\theta_k, M_k)$ of the observed data Y, θ_k being the vector of parameters in model M_k. The prior density of θ_k under M_k is $\Pi(\theta_k, M_k)$. In this case, the posterior distribution using Bayes' theorem is:

$$\Pi\big(\theta_k|Y, M_k\big) = \frac{L\big(Y|\theta_k, M_k\big)\Pi\big(\theta_k, M_k\big)}{\int L\big(Y|\theta_k, M_k\big)\Pi\big(\theta_k, M_k\big)}, \tag{1}$$

where the integral denotes the marginal distribution of the dataset regarding all the parameters in model M_k. Based on posterior distribution, the model's marginal likelihood can be calculated as:

$$\Pi(Y|M_k) = \int L(Y|\theta_k, M_k)\Pi\big(\theta_k, M_k\big)\mathrm{d}\theta_k, \tag{2}$$

Supposing there is a probability mass function $\Pi(M_k)$ related to all models, with $k = 1, 2, \ldots, K$, the posterior model probabilities obtained based on the Bayes' theorem is as follows:

$$\Pi\big(M_k|Y\big) = \frac{\Pi\big(Y|M_k\big)\Pi\big(M_k\big)}{\sum_{m=1}^{K} \Pi\big(Y|M_k\big)\Pi\big(M_k\big)}, \tag{3}$$

The connection between the above posterior model probabilities and use of Bayes' theorem can also be identified, the Bayes factor of model k against model m being:

$$\mathrm{BF_{km}} = \frac{\Pi(M_k|Y)}{\Pi(M_m|Y)}, \tag{4}$$

Further, Eq. (3) can be written as:

$$\Pi(M_k|Y) = \frac{\mathrm{BF_{km}}\Pi(M_k)}{\sum_{m=1}^{K} \mathrm{BF_{km}}\Pi(M_m)}, \tag{5}$$

Two directions depict the use of model probabilities. The first direction is related to the posterior probabilities as a straightforward model selection criterion, while the second supposes a quantity of interest Δ as the covariate or future observation, the marginal posterior distribution across all models being:

$$\Pi(\Delta|Y) = \sum_{k=1}^{K} \Pi(\Delta|Y, M_k)\Pi(M_k|Y). \tag{6}$$

The BMA methodology à la Magnus et al. (2010) is employed by considering three scenarios: the first scenario includes all SAA countries (i.e. 'whole sample'), while the second and third scenarios separately cover the EMCCA and WAEMU groups (Table A1, Appendix). All scenarios are computed by alternatively testing public debt, and the public debt interacted with corruption by following in this way Stiglitz (2002).

According to Camarero et al. (2021, p. 9), "One potential disadvantage of using such a large number of potential explanatory variables in a sample including heterogeneous countries is that the number of covariates with high inclusion probability increases". Considering more homogenous groups, we deal with such potential disadvantage in the BMA estimator.

The validations of coefficients and quality of estimations are indicated by estimated posterior means and their standard errors, *t*-ratios, posterior inclusion probabilities (i.e. PIP—the posterior probability that a variable is included in the model), and one-standard error bands (De Luca and Magnus 2011, pp. 532–533). The regressors are robustly correlated with the dependent variable if the *t*-ratios are greater than 1 in absolute value (i.e. one-standard error band does not include zero) or their posterior inclusion probabilities exceed 0.5 (Raftery 1995).

For robustness check reasons, the basic Instrumental Variable panel (IV panel) estimator is employed for each scenario: 'whole sample', EMCCA and WAEMU. Herein, the estimator is useful due to the impossibility of using the Generalized Method of Moments (GMM) when $N < T$ (Roodman 2009), untreated endogeneity in the Fixed- and Random-Effects panel models (Mutascu and Murgea 2020), and the inappropriateness of the Pooled Mean Group (PMG) approach when both N and T are small (Pesaran et al. 1999). Endogeneity due to reverse causality is primarily expected between inequality indicators and public debt. To address this, the lags of public debt are considered as the main instruments.

3.2 Data

A sample of 14 countries is employed to assess the robustness of public debt as a determinant of income inequality in SSA countries using the Bayesian Model Averaging (BMA) estimator from 1997 to 2019. Two sub-samples are also analysed: EMCCA (6 countries) and WAEMU (8 countries), considering their socio-economic characteristics.

The dependent variable, *income inequality*, is captured through four dimensions: top income as 10% share of income (I10), middle income as 40% share of income (I40), and bottom income as 50% share of income (I50). All three scenarios (i.e. whole sample, EMCCA and WAEMU) are computed by using those dimensions one by one.

The interest regressor is the *public debt*, representing an auxiliary determinant to be tested via the BMA methodology. It represents the central government debt as a percentage of GDP. An additional auxiliary determinant is also proposed, as *interacted public debt—control of corruption* variable (i.e. product between public debt and control of corruption). This variable examines how corruption influences the relationship between public debt and inequality, following insights from Stiglitz (2002).

A set of variables serves as focus regressors, being organized in four groups. The first group reflects the *economic context*, including: the GDP per capita, gross fixed capital formation, inflation rate, tax burden and trade openness. The second group stands for the *economic structure*, being related to the size of industry, agriculture, and services. The third group reveals the *labour endowment*, reflecting population, urban population, unemployment, female unemployment, education and health expenditures. Finally, the fourth group is related to the *institutional environment*, containing: corruption control, government effectiveness, political stability, regulatory quality, rule of law, voice and accountability, property rights and government integrity. Not at least, a *dummy-group* variable controlling for the EMCCA-WAEMU characteristics is also entered only in the scenario 'whole sample'.

All explanatory variables are inspired by literature, being widely used in empirical studies in the field. Moreover, in order to deal with endogeneity, several variables are considered in their lagged forms, especially to avoid simultaneity with respect to the outcome variable (Camarero et al. 2021).[1]

Both auxiliary and focus regressors are treated in logarithm forms or percentages, except for indexes and dummy. Their description, units of measurement, sources and expected signs are presented in Table A2 (Appendix), while the descriptive statistics of the sample are shown in Table A3 (Appendix).

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[1] There is a prolific literature devoted to the reverse link, running from inequality to: growth and unemployment (Yumna et al. 2015), investments (Carrera and De la Verga, 2019), inflation (Beetsma and Van Der Ploeg 1996), taxation (Islam et al. 2018), population and urbanization (Liddle 2017), female participation (Asongu and Odhiambo, 2020), education (Thorson and Gearhart 2018), health (Dorling et al. 2007) or institutions (Chong and Grandstein, 2007).

4 Results

The outputs of testing the public debt as a determinant of inequality are presented in Tables A4-A7 (Appendix) for each scenario by separately considering I1, I10, I40 and I50 dimensions. The robust determinants are highlighted in bold (i.e. PIP > 0.5 and posterior mean in absolute value greater than standard error $\approx$ t-ratio > 1), being retained for final interpretation only those regressors which are relevant in the 'whole sample' scenarios at least.

Dummy-group variable is robust in almost all cases, validating the existence of socio-economic heterogeneity between groups. The positive posterior mean value for both I1 and I10, and a negative mean value for I50 (i.e. I40 is not conclusive) reinforces the idea that the inequality is visibly higher in the EMCCA than in the WAEMU group but only for top incomes, while a lower inequality among poor people is observed in the WAEMU.

The most important finding is revealed by public debt estimations. For the 'whole sample', public debt seems to be a robust determinant of inequality. Its posterior positive mean in I1 and I10 cases, and negative in I40 and 150. In other words, I40 and I50 decrease to the detriment of I1 and I10 as debt extends, registering a wealth transfer from the rich to the poor. The results are not in line with Cornia's (2016), who states that an increase in external debt accentuates inequality. Curiously, public debt is not conclusive in the EMCCA but maintains its robustness in the WAEMU, except for I40 where the related PIP is near 0.5 threshold.

Regarding the focus regressors, gross fixed capital formation is a robust determinant of inequality only for the 'whole sample' and WAEMU. Its posterior mean has a negative sign for I1 and I10 cases, and a positive sign for I40 and 150. This shows that fixed capital investment represents a solution to reduce income inequality among the rich, especially in groups dominated by the agriculture sector. Fixed investments seem to attenuate inequality among rich people but accentuate inequality among the poor. This result confirms Purba et al. (2019), even though different samples and methodologies are applied.

Inequality is explained by the tax burden for the 'whole sample' and EMCCA. Its distortive effect runs from poor to rich people (i.e. the posterior mean is positive for I1 and I10, and negative for the rest), being more pronounced in economies dominated by natural resources. The output validates Lambert (1993) and Joumard et al. (2013), as under certain conditions, a higher tax burden can mitigate overall inequality, with beneficial effects for the poor.

Agriculture is a robust determinant of inequality in all scenarios, but with opposite effects across groups, partially confirming Anderson et al. (2009). In the 'whole sample' and EMCCA scenarios, the positive posterior mean in I1 and I10 cases, and negative in I40 and I50 show that the extension of this sector represents a solution to reduce inequality among the poor for economies dominated by natural resources. The effect is reversed in the WAEMU, challenging the role of agriculture as the dominant sector in combating inequality.

Unemployment strongly drives inequality in all scenarios, with the same effect. Here, its posterior mean is negative in I1 and I10 cases and positive for I40 and I50,

pointing out that joblessness is generally assimilated with high inequality among the poor. This finding fully confirms Saunders (2002), who sees unemployment as a main determinant of poverty.

Not least, health is a robust determinant for the 'whole sample' and WAEMU, but with different effects across them. The case of the 'whole sample' underlines the role of health to run inequality in the SSA, improving the income status for poor people as Torul (2020) or Jianu (2020) sustain. Interestingly, the effect is reversed in the WAEMU group and not conclusive in EMCCA, stating the idea that the health system is beneficial for poor people.

Finally, out of institutional regressors, only government effectiveness and political stability are robust to inequality. Inequality is explained by government effectiveness in the 'whole sample' and WAEMU, its related posterior mean being positive in I1 and I10 cases, and negative for the rest. The improvement of public services seems to be less beneficial for rich people, positively affecting the poor, especially in the WAEMU. Political stability is also robust to inequality in all scenarios, registering opposite effects only in the EMCCA compared with the 'whole sample' and WAEMU. Stable governance seems to preserve the income of the rich in the EMCCA as well as the income of the poor in the WAEMU. Both findings are partially in line with Chong and Grandstein (2007), additionally highlighting the importance of institutional factors for inequality.

The results of testing the interacted public debt—control of corruption as a determinant of inequality are shown in Tables A8-A11 (Appendix). I1, I10, I40 and I50 dimensions are separately treated in each of the three scenarios. Dummy-group focus regressor is still robust to inequality, with the exception of I40 case, supporting the idea of socio-economic heterogeneity in the SSA, with a higher inequality registered for top income in the EMCCA group.

Interestingly, contrary to the outputs strictly devoted to public debt, herein the effects of inequality are opposite when the public debt is impacted by corruption. For the 'whole sample', the posterior mean is negative for I1 and I10 and positive for I40 and I50, revealing that public debt is beneficial for the rich but only under good control of corruption. This finding is not in line with Stiglitz (2002), who emphasizes the major role of corruption in the 'public debt—inequality' nexus.

This effect remains robust in the EMCCA but only for I1 and I40, denoting that both I10 and I50 are rather not affected. Moreover, public debt accentuates inequality among poor people (i.e. the I50 group) despite good control of corruption in the WAEMU. The findings highlight that corruption via public debt has an asymmetrical effect on inequality, being more visible in the EMCCA at top inferior and middle incomes.

Out-of-focus regressors, tax burden, size of agriculture, unemployment, and political stability remain robust to inequality, as in the case of public debt panels, also maintaining their effect signs. Gross fixed capital formation and government effectiveness are not conclusive, indicating that many private investments and government services in the SSA are related to corruption phenomena.

It is noteworthy that trade openness becomes robust to inequality for the 'whole sample' and WAEMU. In both situations, the posterior mean is positive for I1 and I10, and negative for I40 and I50. This shows that international trade, where

agriculture makes a crucial contribution, is more beneficial for the poor than the rich. Two aspects also are important. First, there is a more pronounced diversification of exports for the WAEMU countries compared to those of the EMCCA (Carrère 2013). Second, there is a significant intra-regional trade supplement observed in the WAEMU but not in the EMCCA (Carrère 2013). Moreover, the EMCCA is strongly dependent on mining and petroleum sectors (e.g. petroleum, minerals), particularly making the group countries vulnerable to the volatility of related prices. Additionally, the specialization in natural resource extraction negatively affects economic growth as the weak intra-regional trade flow between the EMCCA countries has failed to contribute to their economic growth (Diaw and Lessoua 2013).

In both panels, the rest of regressors are either statistically insignificant or they are not conclusive in the 'whole sample' scenario by covering all I1, I10, I40 and I50 cases.

Summarizing, the findings show that public debt is a relevant determinant of inequality in the WAEMU group, characterized especially by the agriculture sector. Its effect on income distribution is rather neutral in the EMCCA. These findings partially confirm the overall positive (Tung 2020) or negative role of debt on inequality stressed by Salti (2015), Konishi and Maebayashi (2016), Arslan (2019), Chatzouz (2020), Borissov and Kalk (2020), and Sayed (2020). In contrast to their studies, this analysis incorporates various income levels and employs a different methodology and dataset.

The results of robustness check are presented in Table A12 (Appendix). IV panel estimations clearly shows that public debt remain robust to I1, I10, I40 and I50, generally maintaining their sign from BMA approach. More precisely, in the 'whole sample' scenario, public debt is significant and positively correlated with I1 and I10, and significant and negatively correlated with I40 and I50, fully confirming the BMA estimations. The same significant signs are registered for both EMCCA and WEAMU, with exception of I50 in EMCCA region, reinforcing the main validated correlations from BMA approach. Among validated controls in BMA estimations, all of them remain robust to I1, I10, I40 and I50 (i.e. gross fixed capital formation, tax burden, size of agriculture, health, government effectiveness and political stability), preponderantly maintaining the significance and signs over all scenarios, with exception of unemployment. Not least, dummy group variable in 'whole sample' scenario confirms its sign from BMA approach—positive for I1 and I10, and negative for I40 and I50. This confirms that inequality among top incomes is higher in the EMCCA compared to the WAEMU, while inequality among the poor is lower in the WAEMU region. Finally, Pagan-Hall tests indicate homoscedasticity of the disturbances in almost all cases, while Wu-Hausman F-tests affirm that the regressors are exogenous in all models. Both tests strongly prove the accuracy of performed estimations.

The study has several limitations, including the lack of data for a longer period of time, the inclusion of only widely used determinants of inequality as focus regressors, and the lack of alternative measures for targeted output.

5 Conclusion

In this paper, we analyse whether revenue inequality can be explained by public debt in the SSA, more precisely in the EMCCA and WEAMU regions. The core methodology is represented by the BMA estimator over the period 1997–2019. Although the two regions are both monetary unions, the public debt and inequality for top incomes are sensible higher in the EMCCA, endowed with natural resources, compared with WAEMU, dominated by agriculture.

The main findings show that public debt is a robust determinant in the WAEMU. As debt increases, inequality rises for the top incomes, and a wealth transfer from the rich to the poor is also observed under debt expansion. Both gross fixed capital formation and the size of agriculture are robust factors of inequality. Fixed capital investment has the potential to mitigate income inequality among the rich, particularly in groups dominated by the agriculture sector, while expanding agriculture appears to be a viable solution to reduce inequality among the poor in economies dominated by natural resources. Furthermore, inequality can be explained by health services, quality of governance, and political stability, which generally have positive effects on poor people. This denotes that the governance outputs are asymmetrically shared across the population, preponderantly advantaging the poor people. Interestingly, public debt can decrease inequality among the rich, exacerbating inequality among poor people, but only under strict control of corruption. Here, international trade is more beneficial for the poor in agrarian countries than for the rich, highlighting the protective effect of low price volatility in those economies compared to countries dominated by natural resources.

Public debt is generally a neutral determinant in the EMCCA, but it can be influenced by controlling corruption. In this case, debt has an asymmetrical influence on inequality, running from the very top to middle income. Without corruption's influence, the tax burden remains a negative factor only affecting the distribution of top incomes, which can be offset by stable governance. Unemployment in the whole SSA shows that occupation can significantly improve inequality among the poor.

In summary, high public debt in the WAEMU group is typically linked to low inequality among the poor, which harms the rich, while it tends to have a neutral impact on the EMCCA.

In the WAEMU countries, a higher public debt may lead to policies or investments that benefit the poorer segments of society, potentially reducing income inequality among them. Conversely, high public debt in the WAEMU group could potentially harm the wealthy, possibly by increasing taxes or reducing incentives for private investment. However, debt can induce a better distribution of income among the rich, especially in the EMCCA, but only under strict corruption control. This indicates that under transparent and accountable governance, public debt may fund projects or initiatives that benefit a broader segment of society, particularly those involved in agricultural businesses, including the wealthy.

As for policy implications, leveraging public debt effectively requires a nuanced approach tailored to the specific socio-economic context of each region. Policies should prioritize inclusive growth, mitigate inequality, and maintain fiscal prudence

under transparent governance to maximize the positive impact of public debt on societal welfare.

Concretely, given that high public debt in the WAEMU region is associated with low inequality among the poor, policymakers could consider leveraging public debt to fund targeted policies and investments. These adjustments should focus on enhancing education, healthcare, and infrastructure in poorer regions to uplift disadvantaged communities and reduce income inequality. Policymakers should be mindful of the potential negative impact of high public debt on the wealthy in WAEMU. Measures could include maintaining a balanced approach to taxation and ensuring incentives for private investment remain attractive to prevent economic slowdown and maintain wealth creation.

In EMCCA countries, where public debt tends to have a neutral impact on inequality but can benefit income distribution among the rich under strict corruption control, policymakers should prioritize strengthening anti-corruption measures. This includes enhancing transparency in public spending and improving governance to ensure that debt-funded projects effectively benefit all segments of society, including agricultural businesses and the wealthy. Under transparent governance, policies should aim to foster inclusive growth by supporting sectors that create employment opportunities and promote sustainable development.

Not least, effective oversight mechanisms, robust fiscal management, and stakeholder engagement to ensure that debt is used responsibly and equitably to benefit all societal segments are expected to be implemented in both WAEMU and EMCCA regions. Moreover, policymakers should consider sector-specific investments funded by public debt, particularly in sectors like agriculture, which can have multiplier effects on employment and income generation, benefiting both the poor and the wealthy.

Further research should consider extending the SSA panel to all African countries using a larger set of controls and different investigation periods. The inclusion of economic and pandemic shocks should also be considered to capture the behaviour of the 'debt-inequality' nexus under such turbulences.

Appendix

See Tables 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12.

Table 1 Sample of countries

Sample of countries	Countries included	Number of countries
Whole sample	Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Congo, Rep., Cote d'Ivoire, Equatorial Guinea, Gabon, Guinea-Bissau, Mali, Niger, Senegal, Togo	14
EMCCA	Cameroon, Central African Republic, Chad, Congo, Rep., Equatorial Guinea, Gabon	6
WAEMU	Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, Togo	8

Table 2 Description of variables

Variable	Explanation	U.M	Source	Expected sign
I1	Income inequality for top 1% share of income	%	World Inequality Database (2021)	
I10	Income inequality for top 10% share of income	%	World Inequality Database (2021)	
I40	Income inequality for middle 40% share of income	%	World Inequality Database (2021)	
I50	Income inequality for bottom 50% share of income	%	World Inequality Database (2021)	
Public debt	Central Government Debt as a percentage of GDP	%	Government Finance Statistics (2021)	±
Economic context				
GDP per capita	Gross Domestic Product per capita	Current US$	World Development Indicators (2021)	−
Gross fixed capital formation	Gross fixed capital formation as a percentage of GDP	%	World Development Indicators (2021)	+
Inflation	Inflation as annual percentage growth rate	%	World Development Indicators (2021)	+
Tax burden	Tax revenues as a percentage of GDP	%	International Monetary Fund (2021)	+
Trade openness	Imports plus exports as a percentage of GDP	%	World Development Indicators (2021)	−
Economic structure				
Size of industry	Industry (including construction) value-added as a percentage of GDP	%	World Development Indicators (2021)	±
Size of agriculture	Agriculture, forestry, and fishing value-added as a percentage of GDP	%	World Development Indicators (2021)	−
Size of services	Services value-added as a percentage of GDP	%	World Development Indicators (2021)	±
Labour endowment				
Population	Total population	Thousand persons	World Development Indicators (2021)	±
Urban population	Urban population as a percentage of the total population	%	United Nations Conference on Trade and Development (2021)	±
Unemployment	Unemployment as a percentage of total labour force	%	World Development Indicators (2021)	+

Table 2 (continued)

Variable	Explanation	U.M	Source	Expected sign
Female unemployment	Female unemployment as a percentage of female labour force	%	World Development Indicators (2021)	+
Education expenditures	Government expenditure on education as a percentage of GDP	%	World Development Indicators (2021)	−
Health expenditures	Current health expenditure as a percentage of GDP	%	World Development Indicators (2021)	−
Institutional environment				
Control of corruption	Reveals the perception of the extent to which public power is exercised for private gain, going from -2.5 (low control of corruption/high level of corruption) to+2.5 (high control of corruption/low level of corruption)	Index	Worldwide Governance Indicators (2021)	−
Government effectiveness	Reveals the perceptions of the quality of public services (−2.5 weak; 2.5 strong)	Index	Worldwide Governance Indicators (2021)	−
Political stability	Denotes the perception of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means (−2.5 weak; 2.5 strong)	Index	Worldwide Governance Indicators (2021)	−
Regulatory quality	Measures the perception of government ability to formulate and implement sound policies and regulations that permit and promote private sector development (−2.5 weak; 2.5 strong)	Index	Worldwide Governance Indicators (2021)	−
Rule of law	Illustrates the perception of agents' confidence regarding the rules of society, quality of contract enforcement, property rights, police and courts, and likelihood of crime and violence (−2.5 weak; 2.5 strong)	Index	Worldwide Governance Indicators (2021)	−
Voice and accountability	Reveals the perception the extent to which the citizens are able to participate in selection of government, plus freedom of expression and association, and free media (−2.5 weak; 2.5 strong)	Index	Worldwide Governance Indicators (2021)	−

Table 2 (continued)

Variable	Explanation	U.M	Source	Expected sign
Property rights	Captures the ability of individuals to accumulate private property media (0 weak; 100 strong)	Index	Heritage Foundation (2021)	–
Government integrity	Assesses the insecurity and uncertainty into economic relationships. (0 weak; 100 strong)	Index	Heritage Foundation (2021)	–
Dummy group	Dummy variable controlling for group characteristics (1—EMCCA, and 0—WAEMU)	Dummy	Constructed	+

Table 3 Descriptive statistics

Variable	Mean	Median	Maximum	Minimum	Std. Dev	Skewness	Kurtosis	Jarque–Bera	Probability	Sum Sq. Dev	Obs
I1	0.153131	0.1531	0.3086	0.0952	0.035106	1.63343	8.727739	288.0508	0	0.194726	159
I10	0.490168	0.4893	0.6463	0.4057	0.046098	0.664505	4.560656	27.83768	0.000001	0.335751	159
I40	0.372249	0.3733	0.418	0.2734	0.02749	−1.0662	5.345706	66.57767	0	0.1194	159
I50	0.137582	0.1364	0.1852	0.0803	0.021495	0.074361	2.998338	0.146551	0.929345	0.073002	159
Public debt	43.49415	35.92335	185.3096	6.272055	29.52727	1.986895	9.038496	346.1857	0	1.38E+05	159
GDP per capita	1154.411	688.2497	10,809.65	197.3414	1677.829	4.412704	22.93856	3149.751	0	4.45E+08	159
Gross fixed capital formation	22.62892	21.189	80.675	5.885	8.357107	2.736211	17.81738	1652.952	0	11,034.92	159
Inflation	3.967641	2.096075	80.89968	−21.1652	9.568164	4.430915	32.256	6190.702	0	14,464.86	159
Tax burden	19.15648	17.28	49.85	10.37	6.989356	1.660794	6.489692	153.7722	0	7718.473	159
Trade openness	61.14892	56.62101	135.5524	30.36824	23.41091	1.178522	4.038272	43.94803	0	86,595.18	159
Size of industry	28.21259	22.73405	78.06487	9.23916	16.28332	1.466999	3.993297	63.56679	0	41,893.16	159
Size of agriculture	26.71	26.52085	51.94562	3.329081	12.08865	−0.11858	2.287344	3.737301	0.154332	23,089.39	159
Size of services	40.75902	38.81635	57.02444	22.13152	8.594818	0.067392	1.940347	7.559331	0.02283	1.17E+04	159
Population	9910.793	9568.717	25,876.39	536.459	7394.28	0.347843	1.888369	11.39302	0.003358	8.64E+09	159
Urban population	43.76334	40.54287	89.36986	16.1861	19.93756	0.758351	2.884423	15.32855	0.000469	62,806.01	159
Unemployment	7.999119	4.59	29.04	0.22	8.015809	1.358728	3.860157	53.82439	0	10,152	159
Female unemployment	6.621761	4.44	20.41	0.32	5.892403	1.204606	3.340932	39.22354	0	5485.825	159
Education expenditures	3.445565	3.35602	6.22079	1.10792	1.006315	0.25586	2.787097	2.0351	0.36148	160.0019	159
Health expenditures	4.596023	4.396059	8.278856	1.875872	1.450267	0.307483	2.37478	5.095176	0.07827	332.3171	159
Control of corruption	−0.77381	−0.73016	0.176479	−1.77276	0.377616	0.084875	2.876719	0.291588	0.864336	22.52985	159
Government effectiveness	−0.84648	−0.79061	0.006617	−1.67962	0.379197	−0.24638	2.338619	4.506545	0.105055	22.71889	159
Political stability	−0.4169	−0.26409	0.820294	−2.07743	0.684342	−0.50918	2.452838	8.853952	0.011951	73.99523	159
Regulatory quality	−0.63118	−0.5826	−0.04779	−1.44463	0.354237	−0.39496	2.339459	7.024298	0.029833	19.82642	159
Rule of law	−0.7016	−0.64574	0.065605	−1.58555	0.400394	−0.31832	2.348513	5.496998	0.064024	25.32988	159

Table 3 (continued)

Variable	Mean	Median	Maximum	Minimum	Std. Dev	Skewness	Kurtosis	Jarque–Bera	Probability	Sum Sq. Dev	Obs
Voice and accountability	−0.53402	−0.49553	0.412923	−1.97654	0.601721	−0.13608	2.109469	5.744665	0.056567	57.20677	159
Property rights	29.69308	30	50	10	9.714377	−0.16581	3.312687	1.376277	0.502511	14,910.32	159
Government integrity	24.30881	26	43	10	8.602343	−0.31295	2.32891	5.578939	0.061454	11,692.05	159
Dummy-group	0.3522010	0	1	0	0.479165	0.61885	1.382975	27.47169	0.000001	36.27673	159

Table 4 Results of testing the public debt as determinant of inequality—I1

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
1. Focus regressors	Constant	0.000113	0.0685	1	−0.235963	0.102009	1	0.205004	0.054384	1
	Lagged log (GDP per capita)	0.030247	0.00934	1	0.0426702	0.010691	1	0.006141	0.009718	1
	Lagged Gross fixed capital formation	−0.14501	0.039746	1	0.0070644	0.0277075	1	−0.21411	0.046217	1
	Lagged Inflation	0.014697	0.024297	1	−0.014421	0.0128755	1	0.006412	0.054664	1
	Lagged Tax burden	0.075758	0.054967	1	0.1026393	0.0537842	1	0.009264	0.039507	1
	Trade openness	0.019001	0.01414	1	0.0274241	0.0221284	1	0.066412	0.013888	1
	Size of industry	0.087099	0.048343	1	0.032537	0.0555895	1	−0.18867	0.089357	1
	Size of agriculture	0.283111	0.048241	1	0.2908429	0.0485054	1	−1.92E-01	0.061148	1
	Size of services	−0.03694	0.047436	1	−0.161189	0.0909313	1	0.021715	0.039556	1
	Lagged log (Population)	−0.00227	0.002092	1	0.0038224	0.0015756	1	−0.00143	0.001548	1
	Lagged Urban population	−0.12346	0.03951	1	0.1945896	0.0672484	1	0.020063	0.043471	1
	Lagged Unemployment	−0.35213	0.323923	1	−1.868772	0.3391336	1	−0.44172	0.342837	1
	Lagged Female unemployment	0.006904	0.484577	1	1.505308	0.4905212	1	0.195839	0.451728	1
	Lagged Education expenditures	0.245704	0.327069	1	−0.019172	0.3488963	1	−0.8881	0.314897	1
	Lagged Health expenditures	−0.68334	0.244995	1	1.36625	0.4474875	1	0.659189	0.233249	1
	Lagged Control of corruption	0.022146	0.017096	1	0.0235638	0.0237399	1	−0.02088	0.01284	1
	Lagged Government effectiveness	0.024199	0.017485	1	0.02824	0.0257453	1	0.032627	0.014374	1
	Lagged Political stability	0.020237	0.005407	1	−0.025828	0.0116087	1	0.012119	0.003421	1

Table 4 (continued)

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
	Lagged Regulatory quality	−0.01093	0.018167	1	**−0.024893**	**0.021314**	**1**	0.01203	0.013116	1
	Lagged Rule of law	**−0.03204**	**0.020026**	**1**	−0.022078	0.0332305	1	0.005325	0.015955	1
	Lagged Voice and accountability	**0.020273**	**0.011349**	**1**	**0.0748702**	**0.0376989**	**1**	−0.00208	0.007149	1
	Property rights	0.001131	0.032501	1	**−0.091604**	**0.0468178**	**1**	**0.061093**	**0.035195**	**1**
	Government integrity	−0.04245	0.047496	1	0.0256618	0.0840484	1	−0.0229	0.033534	1
	Dummy group	**0.056211**	**0.012077**	**1**						
2. Auxiliary regressor	Public debt	**0.030247**	**0.00934**	**1**	0.0099125	0.0146322	0.41	**0.024096**	**0.01787**	**0.74**

Bold indicates that the regressor is robustly correlated with the outcome

PIP denotes the posterior inclusion probability

Table 5 Results of testing the public debt as determinant of inequality—110

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
1. Focus regressors	Constant	**0.247654**	**0.079153**	**1**	**0.218745**	**0.09693**	**1**	**0.38192**	**0.071269**	**1**
	Lagged log (GDP per capita)	**0.030138**	**0.010817**	**1**	**0.027466**	**0.009554**	**1**	**0.020704**	**0.012734**	**1**
	Lagged Gross fixed capital formation	−0.17149	0.046119	1	0.021914	0.026672	1	−0.24944	0.060562	1
	Lagged Inflation	0.017246	0.028199	1	−0.01317	0.012367	1	0.037756	0.071636	1
	Lagged Tax burden	**0.128736**	**0.063743**	**1**	**0.122354**	**0.050754**	**1**	**0.021937**	**0.051772**	**1**
	Trade openness	**0.041233**	**0.016411**	**1**	0.005163	0.021157	1	0.094329	0.018198	1
	Size of industry	**0.079493**	**0.055975**	**1**	**0.06143**	**0.052855**	**1**	−0.2487	0.117097	1
	Size of agriculture	**0.321356**	**0.055831**	**1**	**2.57E-01**	**0.045822**	**1**	−2.03E-01	0.080131	1
	Size of services	0.052389	0.055045	1	−0.16109	0.08204	1	**0.123573**	**0.051834**	**1**
	Lagged log (Population)	−0.00223	0.002428	1	**0.003316**	**0.001517**	**1**	−0.00136	0.002029	1
	Lagged Urban population	−0.04368	0.045821	1	**0.180358**	**0.063997**	**1**	0.186978	0.056968	1
	Lagged Unemployment	**−0.72339**	**0.372145**	**1**	**−1.9559**	**0.322957**	**1**	**−0.79894**	**0.449219**	**1**
	Lagged Female unemployment	0.376817	0.5555	1	**1.605507**	**0.453747**	**1**	**0.64429**	**0.591932**	**1**
	Lagged Education expenditures	−0.03534	0.379435	1	−0.03054	0.334754	1	**−1.75382**	**0.412656**	**1**
	Lagged Health expenditures	**−0.55538**	**0.284179**	**1**	**0.844231**	**0.42741**	**1**	**1.129702**	**0.305659**	**1**
	Lagged Control of corruption	**0.028913**	**0.019817**	**1**	−0.00153	0.022757	1	−0.01143	0.016826	1
	Lagged Government effectiveness	**0.058744**	**0.020276**	**1**	0.018932	0.023628	1	**0.080674**	**0.018834**	**1**

Table 5 (continued)

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
	Lagged Political stability	**0.032376**	**0.006274**	**1**	**−0.03605**	**0.010284**	**1**	**0.024139**	**0.004484**	**1**
	Lagged Regulatory quality	−0.01586	0.02104	1	**−0.02173**	**0.02047**	**1**	−0.00099	0.017188	1
	Lagged Rule of law	**−0.10394**	**0.023237**	**1**	−0.0098	0.031006	1	**−0.05073**	**0.020908**	**1**
	Lagged Voice and accountability	**0.014881**	**0.013165**	**1**	**0.074099**	**0.033147**	**1**	**−0.01244**	**0.009368**	**1**
	Property rights	−0.03317	0.037721	1	−0.08865	0.044155	1	0.015707	0.046112	1
	Government integrity	−0.02976	0.055041	1	0.043378	0.079782	1	**−0.06615**	**0.043945**	**1**
	Dummy group	**0.02268**	**0.013996**	**1**						
2. Auxiliary regressor	Public debt	**0.040361**	**0.018082**	**0.92**	0.002157	0.007186	0.17	**0.032498**	**0.023406**	**0.75**

Bold indicates that the regressor is robustly correlated with the outcome

PIP denotes the posterior inclusion probability

Table 6 Results of testing the public debt as determinant of inequality—I40

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
1. Focus regressors	Constant	**0.493054**	**0.054438**	**1**	**0.599515**	**0.070524**	**1**	**0.392982**	**0.047013**	**1**
	Lagged log (GDP per capita)	**−0.02115**	**0.007384**	**1**	**−0.02358**	**0.007275**	**1**	**−0.01193**	**0.008313**	**1**
	Lagged Gross fixed capital formation	**0.116362**	**0.031272**	**1**	−0.0107	0.019224	1	**0.185822**	**0.039438**	**1**
	Lagged Inflation	**−0.01928**	**0.019106**	**1**	**0.010267**	**0.008928**	**1**	−0.03054	0.047209	1
	Lagged Tax burden	**−0.05724**	**0.043309**	**1**	**−0.07177**	**0.037115**	**1**	0.016504	0.034049	1
	Trade openness	**−0.0149**	**0.011119**	**1**	−0.0108	0.015324	1	**−0.05115**	**0.011781**	**1**
	Size of industry	**−0.06046**	**0.038233**	**1**	−3.44E-02	0.038439	1	**0.113659**	**0.076912**	**1**
	Size of agriculture	**−0.18571**	**0.038195**	**1**	**−0.18612**	**0.033482**	**1**	**1.64E−01**	**0.052661**	**1**
	Size of services	−0.00997	0.037317	1	**0.124386**	**0.062021**	**1**	**−0.05762**	**0.03374**	**1**
	Lagged log (Population)	0.000902	0.001646	1	**−0.00255**	**0.001093**	**1**	0.000117	0.001339	1
	Lagged Urban population	**0.045932**	**0.031127**	**1**	**−0.13457**	**0.046511**	**1**	**−0.09246**	**0.037597**	**1**
	Lagged Unemployment	**0.49013**	**0.260912**	**1**	**1.428415**	**0.234601**	**1**	**0.575873**	**0.287041**	**1**
	Lagged Female unemployment	−0.37734	0.392255	1	**−1.20712**	**0.336711**	**1**	**−0.5943**	**0.383369**	**1**
	Lagged Education expenditures	0.114297	0.257465	1	0.04327	0.241849	1	**1.263854**	**0.270854**	**1**
	Lagged Health expenditures	**0.353926**	**0.192927**	**1**	**−0.87998**	**0.309807**	**1**	**−0.69303**	**0.200556**	**1**
	Lagged Control of corruption	**−0.02229**	**0.013484**	**1**	−0.00811	0.016452	1	0.004566	0.011108	1
	Lagged Government effectiveness	**−0.04964**	**0.013777**	**1**	**−0.02125**	**0.017636**	**1**	**−0.05958**	**0.012039**	**1**

Table 6 (continued)

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
	Lagged Political stability	**−0.01713**	**0.004255**	**1**	**0.019277**	**0.007882**	**1**	**−0.01119**	**0.002953**	**1**
	Lagged Regulatory quality	0.007569	0.01436	1	0.01334	0.014778	1	−0.00444	0.011337	1
	Lagged Rule of law	**0.069866**	**0.015755**	**1**	0.017607	0.022862	1	**0.039848**	**0.013803**	**1**
	Lagged Voice and accountability	−0.008	0.008937	1	**−0.05253**	**0.025551**	**1**	0.009077	0.006138	1
	Property rights	**0.038805**	**0.025558**	**1**	**0.065131**	**0.032302**	**1**	0.003027	0.028824	1
	Government integrity	0.01613	0.037488	1	−0.02435	0.058091	1	0.024741	0.02883	1
	Dummy group	−0.00553	0.00953	1						
2. Auxiliary regressor	Public debt	**−0.01577**	**0.013616**	**0.66**	−0.00525	0.009056	0.34	−0.01021	0.013277	0.46

Bold indicates that the regressor is robustly correlated with the outcome

PIP denotes the posterior inclusion probability

Table 7 Results of testing the public debt as determinant of inequality—I50

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
1. Focus regressors	Constant	0.252255	0.027807	1	0.179985	0.033502	1	0.224187	0.030053	1
	Lagged log (GDP per capita)	−0.0083	0.003846	1	−0.00305	0.003272	1	−0.00816	0.005344	1
	Lagged Gross fixed capital formation	0.05412	0.016572	1	−0.01107	0.009235	1	0.06045	0.025383	1
	Lagged Inflation	0.001819	0.010145	1	0.00267	0.004281	1	−0.00588	0.030194	1
	Lagged Tax burden	−0.069	0.022833	1	−0.05307	0.017525	1	−0.03708	0.021801	1
	Trade openness	−0.02625	0.005904	1	0.005054	0.007319	1	−0.04426	0.007607	1
	Size of industry	−0.01543	0.019885	1	−0.02545	0.01827	1	0.131435	0.049278	1
	Size of agriculture	−0.13166	0.019783	1	−7.34E-02	0.015825	1	4.12E-02	0.03373	1
	Size of services	−0.04342	0.019785	1	0.043581	0.028139	1	−0.06865	0.021721	1
	Lagged log (Population)	0.001375	0.000872	1	−0.00076	0.000525	1	0.001217	0.000856	1
	Lagged Urban population	−0.00401	0.016418	1	−0.04746	0.022124	1	−0.09501	0.024028	1
	Lagged Unemployment	0.283772	0.126432	1	0.515618	0.111659	1	0.257923	0.186635	1
	Lagged Female unemployment	−0.08248	0.186215	1	−0.36764	0.156227	1	−0.08542	0.247465	1
	Lagged Education expenditures	−0.09017	0.13619	1	−0.00506	0.115857	1	0.502637	0.1736	1
	Lagged Health expenditures	0.21065	0.10192	1	0.022638	0.147833	1	−0.44684	0.128567	1
	Lagged Control of corruption	−0.00758	0.007082	1	0.009138	0.007875	1	0.006858	0.007098	1
	Lagged Government effectiveness	−0.00831	0.007262	1	0.000568	0.008125	1	−0.01965	0.007826	1
	Lagged Political stability	−0.0151	0.002254	1	0.015776	0.003517	1	−0.01285	0.001889	1
	Lagged Regulatory quality	0.009604	0.007484	1	0.00871	0.007085	1	0.005226	0.007248	1
	Lagged Rule of law	0.033626	0.00835	1	−0.0061	0.010689	1	0.010913	0.00882	1
	Lagged Voice and accountability	−0.00648	0.004722	1	−0.01834	0.011322	1	0.003711	0.003938	1
	Property rights	−0.00538	0.01357	1	0.025182	0.015246	1	−0.02331	0.018968	1

Table 7 (continued)

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
	Government integrity	0.016591	0.019641	1	−0.02227	0.027571	1	**0.042992**	**0.018483**	**1**
	Dummy group	**−0.01642**	**0.004997**	**1**						
2. Auxiliary regressor	Public debt	**−0.02012**	**0.005207**	**0.99**	0.000393	0.001953	0.14	**−0.01855**	**0.00924**	**0.89**

Bold indicates that the regressor is robustly correlated with the outcome

PIP denotes the posterior inclusion probability

Table 8 Results of testing the interacted public debt—control of corruption as determinant of inequality—I1

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
1. Focus regressors	Constant	−0.0015361	0.068117	1	−0.18103	0.09828	1	0.209835	0.055609	1
	Lagged log (GDP per capita)	0.0313063	0.00942	1	0.034375	0.01057	1	0.00319	0.009659	1
	Lagged Gross fixed capital formation	−0.1425249	0.039577	1	0.011328	0.025532	1	−0.19397	0.044867	1
	Lagged Inflation	0.0139763	0.024262	1	−0.01244	0.011876	1	−0.00267	0.055674	1
	Lagged Tax burden	0.0690251	0.054398	1	0.109789	0.048747	1	0.002697	0.040167	1
	Trade openness	0.0238884	0.01435	1	0.035131	0.020745	1	7.21E-02	0.013443	1
	Size of industry	0.0904903	0.048481	1	0.01508	0.051723	1	−0.17386	0.091253	1
	Size of agriculture	0.2876856	0.048551	1	3.14E-01	0.046084	1	−0.20391	0.06188	1
	Size of services	−0.0358281	0.047299	1	−0.21072	0.085144	1	0.036007	0.038746	1
	Lagged log (Population)	−0.0023415	0.002085	1	0.003456	0.001458	1	−0.00133	0.001585	1
	Lagged Urban population	−0.1111215	0.038951	1	0.203838	0.061475	1	0.02298	0.044514	1
	Lagged Unemployment	−0.4138676	0.303135	1	−1.83637	0.309293	1	−0.63344	0.312769	1
	Lagged Female unemployment	0.0452393	0.462865	1	1.37151	0.443821	1	0.391666	0.433235	1
	Lagged Education expenditures	0.2473826	0.326124	1	−0.14087	0.327501	1	−0.95047	0.319328	1
	Lagged Health expenditures	−0.6450375	0.247209	1	1.366638	0.407571	1	0.721092	0.233746	1
	Lagged Control of corruption	0.0341783	0.016891	1	0.031408	0.02223	1	−0.01919	0.013482	1
	Lagged Government effectiveness	0.0203642	0.017242	1	0.035287	0.023133	1	0.026454	0.014179	1
	Lagged Political stability	0.0195663	0.005375	1	−0.01553	0.011801	1	0.011414	0.003478	1
	Lagged Regulatory quality	−0.0070394	0.018588	1	−0.02759	0.019627	1	0.014569	0.013536	1
	Lagged Rule of law	−0.0269498	0.019929	1	−0.02788	0.029913	1	0.005604	0.016361	1
	Lagged Voice and accountability	0.0207276	0.011346	1	0.046801	0.036631	1	−0.00365	0.007241	1
	Property rights	0.0036555	0.032493	1	−0.10777	0.043506	1	0.084915	0.0301	1

Table 8 (continued)

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
	Government integrity	**−0.0473417**	**0.046862**	**1**	0.037514	0.07667	1	−0.02906	0.034216	1
	Dummy group	**0.0572021**	**0.012125**	**1**						
2. Auxiliary regressor	Interacted debt—control of corruption	**−0.0346647**	**0.016016**	**0.91**	**−0.02853**	**0.014384**	**0.89**	−0.00857	0.015513	0.31

Bold indicates that the regressor is robustly correlated with the outcome

PIP denotes the posterior inclusion probability

Table 9 Results of testing the interacted public debt—control of corruption as determinant of inequality—I10

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
1. Focus regressors	Constant	**0.2437873**	**0.078344**	**1**	**0.24713**	**0.09917**	**1**	**0.388445**	**0.072953**	**1**
	Lagged log (GDP per capita)	**0.0316502**	**0.010861**	**1**	**0.022897**	**0.010609**	**1**	**0.016714**	**0.012674**	**1**
	Lagged Gross fixed capital formation	−0.1685875	0.045842	1	0.023734	0.025855	1	**−0.22229**	**0.05886**	**1**
	Lagged Inflation	0.0162918	0.028104	1	**−0.01208**	**0.012024**	**1**	0.025517	0.073037	1
	Lagged Tax burden	**0.120837**	**0.062987**	**1**	**0.127678**	**0.049332**	**1**	0.01305	0.052699	1
	Trade openness	**0.0474461**	**0.016594**	**1**	0.009205	0.020975	1	**0.101952**	**0.017642**	**1**
	Size of industry	**0.0847084**	**0.055908**	**1**	0.051734	0.052295	1	**−0.22861**	**0.119745**	**1**
	Size of agriculture	**0.3281547**	**0.055924**	**1**	**2.70E−01**	**0.046516**	**1**	**−2.19E−01**	**0.081185**	**1**
	Size of services	0.0535386	0.054783	1	**−0.18989**	**0.085723**	**1**	**0.142885**	**0.050838**	**1**
	Lagged log (Population)	−0.0023115	0.002415	1	**0.003156**	**0.001476**	**1**	−0.00123	0.00208	1
	Lagged Urban population	−0.0285009	0.045123	1	**0.186563**	**0.062224**	**1**	**0.190912**	**0.058396**	**1**
	Lagged Unemployment	**−0.7887753**	**0.346891**	**1**	**−1.93144**	**0.313121**	**1**	**−1.05793**	**0.410463**	**1**
	Lagged Female unemployment	0.4043358	0.526567	1	**1.518085**	**0.448478**	**1**	**0.908815**	**0.568453**	**1**
	Lagged Education expenditures	−0.0359623	0.377552	1	−0.0921	0.331191	1	**−1.83826**	**0.419**	**1**
	Lagged Health expenditures	**−0.5045362**	**0.285757**	**1**	**0.855244**	**0.412749**	**1**	**1.213262**	**0.306651**	**1**
	Lagged Control of corruption	**0.0439045**	**0.019546**	**1**	0.0025	0.022482	1	−0.00917	0.017694	1
	Lagged Government effectiveness	**0.0540913**	**0.019971**	**1**	**0.023654**	**0.02337**	**1**	**0.072309**	**0.01863**	**1**
	Lagged Political stability	**0.0315644**	**0.006226**	**1**	**−0.03045**	**0.011824**	**1**	**0.023189**	**0.004563**	**1**
	Lagged Regulatory quality	−0.0105992	0.021401	1	**−0.02327**	**0.019872**	**1**	0.00242	0.017761	1
	Lagged Rule of law	**−0.0976181**	**0.023085**	**1**	−0.01403	0.030256	1	**−0.05035**	**0.021464**	**1**

Table 9 (continued)

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
	Lagged Voice and accountability	**0.0155641**	**0.013129**	**1**	**0.058276**	**0.036755**	**1**	−0.01457	**0.009502**	**1**
	Property rights	−0.0299086	0.037634	1	**−0.09788**	**0.043962**	**1**	**0.047906**	**0.039532**	**1**
	Government integrity	−0.0352096	0.054211	1	0.051515	0.077598	1	**−0.07451**	**0.044902**	**1**
	Dummy group	**0.0241162**	**0.014002**	**1**						
2. Auxiliary regressor	Interacted debt—control of corruption	**−0.0438756**	**0.017508**	**0.94**	−0.01311	0.01412	0.56	−0.01145	0.020526	0.31

Bold indicates that the regressor is robustly correlated with the outcome

PIP denotes the posterior inclusion probability

Table 10 Results of testing the interacted public debt—control of corruption as determinant of inequality—I40

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
1. Focus regressors	Constant	0.4998335	0.054047	1	0.56133	0.068358	1	0.390811	0.047428	1
	Lagged log (GDP per capita)	−0.0223405	0.007442	1	−0.01766	0.007371	1	−0.01056	0.008169	1
	Lagged Gross fixed capital formation	0.1156874	0.030995	1	−0.01345	0.017729	1	0.177302	0.038276	1
	Lagged Inflation	−0.0187187	0.018998	1	0.008857	0.008248	1	−0.02677	0.047491	1
	Lagged Tax burden	−0.0552739	0.04263	1	−0.07764	0.03386	1	0.019643	0.034125	1
	Trade openness	−0.0178842	0.011273	1	−0.01619	0.014416	1	−0.05376	0.011305	1
	Size of industry	−0.0654848	0.03828	1	−0.02193	0.035942	1	0.106103	0.077045	1
	Size of agriculture	−0.1917095	0.038418	1	−2.02E−01	0.032049	1	1.69E−01	0.052631	1
	Size of services	−0.0097942	0.037046	1	0.160598	0.059284	1	−0.06412	0.032825	1
	Lagged log (Population)	0.0009049	0.001633	1	−0.00232	0.001012	1	7.42E−05	0.001352	1
	Lagged Urban population	0.0400291	0.030495	1	−0.14179	0.042697	1	−0.09369	0.037975	1
	Lagged Unemployment	0.485185	0.242703	1	1.401609	0.214796	1	0.662219	0.263087	1
	Lagged Female unemployment	−0.331622	0.374395	1	−1.10397	0.308493	1	−0.68232	0.366977	1
	Lagged Education expenditures	0.1222416	0.255648	1	0.127125	0.227559	1	1.294109	0.270367	1
	Lagged Health expenditures	0.3235008	0.194341	1	−0.88625	0.283004	1	−0.72012	0.199269	1
	Lagged Control of corruption	−0.0286496	0.013251	1	−0.01355	0.015446	1	0.004078	0.011323	1
	Lagged Government effectiveness	−0.0480235	0.013503	1	−0.02675	0.016081	1	−0.05649	0.011366	1
	Lagged Political stability	−0.0168549	0.004209	1	0.011965	0.008235	1	−0.0109	0.002966	1
	Lagged Regulatory quality	0.0041847	0.014721	1	0.015292	0.01363	1	−0.00536	0.011471	1
	Lagged Rule of law	0.0672407	0.015604	1	0.023325	0.020782	1	0.039759	0.013955	1
	Lagged Voice and accountability	−0.0086153	0.008902	1	−0.03228	0.025546	1	0.009847	0.006108	1
	Property rights	0.037098	0.025449	1	0.076852	0.03024	1	−0.00793	0.024542	1

Table 10 (continued)

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
	Government integrity	0.0166398	0.036788	1	−0.0337	0.053252	1	0.027883	0.028819	1
	Dummy group	−0.0067126	0.009548	1						
2. Auxiliary regressor	Interacted debt—control of corruption	**0.0205664**	**0.013775**	**0.78**	**0.018924**	**0.01013**	**0.87**	0.002403	0.007746	0.16

Bold indicates that the regressor is robustly correlated with the outcome

PIP denotes the posterior inclusion probability

Table 11 Results of testing the interacted public debt—control of corruption as determinant of inequality—I50

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
1. Focus regressors	Constant	**0.2514072**	**0.0278801**	**1**	**0.177015**	**0.03361**	**1**	**0.221146**	**0.0308**	**1**
	Lagged log (GDP per capita)	−0.008736	0.003887	**1**	−0.00285	0.00327	1	−0.00656	0.00542	**1**
	Lagged Gross fixed capital formation	0.0524294	0.0165866	**1**	−0.01107	0.009241	**1**	0.044867	0.02484	**1**
	Lagged Inflation	0.0021929	0.0101709	1	0.002623	0.004283	1	0.001536	0.030828	1
	Lagged Tax burden	−0.064469	0.0227719	**1**	−0.0535	0.017475	**1**	−0.03397	0.022384	**1**
	Trade openness	−0.029051	0.0059809	**1**	0.004906	0.007329	1	−0.04739	0.00761	**1**
	Size of industry	−0.016454	0.0200224	1	−2.50E−02	0.018273	1	0.12702	0.051349	**1**
	Size of agriculture	−0.133282	0.019973	**1**	−0.07394	0.015846	**1**	0.047914	0.034424	**1**
	Size of services	−0.044327	0.0198196	**1**	0.045072	0.027991	**1**	−0.07722	0.021688	**1**
	Lagged log (Population)	0.0014321	0.0008735	**1**	−0.00076	0.000526	**1**	0.001152	0.000878	**1**
	Lagged Urban population	−0.011592	0.0163328	1	−0.0479	0.022097	**1**	−0.09729	0.024644	**1**
	Lagged Unemployment	**0.3324307**	**0.1219267**	**1**	**0.513567**	**0.111509**	**1**	**0.377629**	**0.176992**	**1**
	Lagged Female unemployment	−0.125944	0.1823244	1	−0.36178	0.155384	**1**	−0.20868	0.242559	1
	Lagged Education expenditures	−0.093922	0.1364483	1	−0.00316	0.116075	1	**0.529752**	**0.178912**	**1**
	Lagged Health expenditures	**0.1908702**	**0.1029094**	**1**	0.020559	0.147667	1	**−0.48981**	**0.129555**	**1**
	Lagged Control of corruption	**−0.014785**	**0.0070574**	**1**	**0.009003**	**0.007887**	**1**	0.004291	0.007646	1
	Lagged Government effectiveness	−0.005887	0.0072262	1	0.000237	0.008069	1	**−0.01749**	**0.008559**	**1**

Table 11 (continued)

Category	Variables	Whole sample			EMCCA			WAEMU		
		Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP	Posterior mean	Standard errors	PIP
	Lagged Political stability	**−0.014675**	**0.0022533**	**1**	**0.015541**	**0.003523**	**1**	**−0.01225**	**0.001928**	**1**
	Lagged Regulatory quality	**0.0076829**	**0.0076353**	**1**	**0.008785**	**0.007088**	**1**	0.002441	0.007573	1
	Lagged Rule of law	**0.0305582**	**0.0083544**	**1**	−0.00576	0.010638	1	**0.010532**	**0.009061**	**1**
	Lagged Voice and accountability	**−0.006631**	**0.0047394**	**1**	**−0.01759**	**0.011271**	**1**	**0.00434**	**0.00408**	**1**
	Property rights	−0.006781	0.0136152	1	**0.025635**	**0.015233**	**1**	**−0.03692**	**0.017787**	**1**
	Government integrity	**0.0201638**	**0.0195572**	**1**	−0.02286	0.027525	1	**0.044827**	**0.019324**	**1**
	Dummy group	**−0.01681**	**0.0050315**	**1**						
2. Auxiliary regressor	Interacted debt—control of corruption	**0.020069**	**0.0053686**	**0.99**	0.00019	0.001491	0.12	**0.013316**	**0.012322**	**0.63**

Bold indicates that the regressor is robustly correlated with the outcome

PIP denotes the posterior inclusion probability

Table 12 Robustness check estimations (IV panel)

Region	Whole sample—dependent variable				EMCCA—dependent variable				WAEMU—dependent variable			
Regressor	I1	I10	I40	I50	I1	I10	I40	I50	I1	I10	I40	I50
Public debt	0.0473*** (−0.0129)	0.0574*** (−0.015)	−0.0299*** (−0.0101)	−0.0275*** (−0.00545)	0.0528** (−0.0255)	0.0457* (−0.0256)	−0.0383** (−0.0181)	−0.00738 (−0.00879)	0.0373*** (−0.0137)	0.0531*** (−0.0149)	−0.0286*** (−0.00996)	−0.0245*** (−0.00556)
log (GDP per capita)	0.0325*** (−0.00847)	0.0327*** (−0.00985)	−0.0233*** (−0.00663)	−0.00942*** (−0.00357)	0.0291*** (−0.011)	0.0137 (−0.0111)	−0.0131* (−0.00783)	−0.000586 (−0.0038)	0.0251*** (−0.00902)	0.0295*** (−0.0098)	−0.0223*** (−0.00654)	−0.00721** (−0.00365)
Gross fixed capital formation	−0.148*** (−0.0363)	−0.175*** (−0.0422)	0.119*** (−0.0284)	0.0557*** (−0.0153)	0.00457 (−0.0216)	0.0194 (−0.0218)	−0.00878 (−0.0154)	−0.0106 (−0.00746)	−0.110*** (−0.0385)	−0.159*** (−0.0418)	0.114*** (−0.0279)	0.0443*** (−0.0156)
Inflation	0.0141 (−0.0222)	0.0166 (−0.0258)	−0.0188 (−0.0174)	0.0021 (−0.00935)	−0.0113 (−0.0102)	−0.00999 (−0.0102)	0.00785 (−0.00722)	0.0021 (−0.00351)	0.0265 (−0.0239)	0.022 (−0.0259)	−0.0204 (−0.0173)	−0.00163 (−0.00966)
Tax burden	0.0838* (−0.0501)	0.138** (−0.0582)	−0.0650* (−0.0392)	−0.0731*** (−0.0211)	0.139*** (−0.0462)	0.159*** (−0.0464)	−0.0999*** (−0.0328)	−0.0597*** (−0.0159)	0.125** (−0.0536)	0.156*** (−0.0582)	−0.0705* (−0.0388)	−0.0855*** (−0.0217)
Trade openness	0.0193 (−0.0129)	0.0416*** (−0.015)	−0.0152 (−0.0101)	−0.0264*** (−0.00544)	0.0364** (−0.0179)	0.0143 (−0.018)	−0.0177 (−0.0127)	0.00343 (−0.00617)	0.0439*** (−0.0131)	0.0523*** (−0.0142)	−0.0185* (−0.00948)	−0.0338*** (−0.00529)
Size of industry	0.0990** (−0.0438)	0.0934* (−0.0509)	−0.0720** (−0.0343)	−0.0215 (−0.0185)	0.0254 (−0.0462)	0.031 (−0.0464)	−0.0113 (−0.0328)	−0.02 (−0.0159)	0.131*** (−0.047)	0.107** (−0.0511)	−0.0763** (−0.0341)	−0.0311 (−0.019)
Size of agriculture	0.296*** (−0.0437)	0.337*** (−0.0507)	−0.198*** (−0.0341)	−0.138*** (−0.0184)	0.323*** (−0.0415)	0.290*** (−0.0417)	−0.211*** (−0.0294)	−0.0792*** (−0.0143)	0.266*** (−0.0467)	0.324*** (−0.0508)	−0.194*** (−0.0339)	−0.129*** (−0.0189)
Size of services	−0.0402 (−0.0433)	0.0485 (−0.0504)	−0.00676 (−0.0339)	−0.0418** (−0.0182)	−0.270*** (0.0914)	−0.271*** (−0.0918)	0.208*** (−0.0648)	0.0632** (−0.0315)	−0.0227 (−0.0467)	0.0561 (−0.0507)	−0.0091 (−0.0339)	−0.0470** (−0.0189)
log(Population)	−0.0021 (−0.00191)	−0.00203 (−0.00222)	0.000739 (−0.00149)	0.00129 (−0.000805)	0.00397*** (−0.00123)	0.00346*** (−0.00124)	−0.00266*** (−0.000874)	−0.000788* (−0.000424)	−0.00298 (−0.00206)	−0.00242 (−0.00223)	0.000857 (−0.00149)	0.00156* (−0.000832)
Urban population	−0.129*** (−0.036)	−0.0502 (−0.0419)	0.0514* (−0.0282)	−0.00118 (−0.0152)	0.230*** (−0.0557)	0.216*** (−0.0559)	−0.162*** (−0.0395)	−0.0538*** (−0.0192)	−0.0546 (−0.0358)	−0.0179 (−0.0389)	0.0414 (−0.026)	−0.0236 (−0.0145)
Female unemployment	−0.263 (−0.423)	0.0596 (−0.492)	−0.114 (−0.331)	0.0546 (−0.178)	1.041** (−0.455)	1.134** (−0.458)	−0.849*** (−0.323)	−0.283* (−0.157)	−0.287 (−0.458)	0.0495 (−0.497)	−0.111 (−0.332)	0.0616 (−0.185)
Unemployment	−0.188 (−0.285)	−0.531 (−0.332)	0.33 (−0.223)	0.201* (−0.12)	−1.697*** (−0.28)	−1.782*** (−0.281)	1.296*** (−0.199)	0.485*** (−0.0964)	−0.184 (−0.308)	−0.529 (−0.335)	0.33 (−0.224)	0.199 (−0.125)

Table 12 (continued)

Region	Whole sample—dependent variable				EMCCA—dependent variable				WAEMU—dependent variable			
Regressor	I1	I10	I40	I50	I1	I10	I40	I50	I1	I10	I40	I50
Education expenditures	0.21 (−0.299)	−0.0768 (−0.347)	0.149 (−0.234)	−0.0723 (−0.126)	−0.12 (−0.277)	−0.133 (−0.279)	0.121 (−0.197)	0.0133 (−0.0955)	−0.238 (−0.31)	−0.272 (−0.337)	0.209 (−0.225)	0.0626 (−0.126)
Health expenditures	−0.653*** (−0.224)	−0.520** (−0.26)	0.324* (−0.175)	0.195** (−0.0941)	1.560*** (−0.364)	1.041*** (−0.366)	−1.029*** (−0.258)	−0.0125 (−0.125)	−0.630*** (−0.242)	−0.510* (−0.262)	0.321* (−0.175)	0.188* (−0.0977)
Control of corruption	0.0191 (−0.0156)	0.0253 (−0.0181)	−0.0193 (−0.0122)	−0.00602 (−0.00655)	0.0313* (−0.019)	0.00628 (−0.0191)	−0.014 (−0.0135)	0.00774 (−0.00653)	0.0138 (−0.0168)	0.023 (−0.0182)	−0.0186 (−0.0122)	−0.00443 (−0.00679)
Government effectiveness	0.0268* (−0.0159)	0.0618*** (−0.0185)	−0.0522*** (−0.0125)	−0.00962 (−0.00671)	0.0548** (−0.0246)	0.0459* (−0.0247)	−0.0417** (−0.0174)	−0.00425 (−0.00846)	0.0426** (−0.0169)	0.0687*** (−0.0184)	−0.0543*** (−0.0123)	−0.0144** (−0.00686)
Political stability	0.0207*** (−0.00494)	0.0329*** (−0.00574)	−0.0176*** (−0.00386)	−0.0153*** (−0.00208)	−0.0103 (−0.0122)	−0.0203* (−0.0123)	0.00733 (−0.00869)	0.0130*** (−0.00422)	0.0133*** (−0.00512)	0.0297*** (−0.00556)	−0.0166*** (−0.00371)	−0.0131*** (−0.00207)
Regulatory quality	−0.00669 (−0.0165)	−0.0109 (−0.0192)	0.00344 (−0.0129)	0.00745 (−0.00694)	−0.0302* (−0.0169)	−0.0271 (−0.0169)	0.0174 (−0.012)	0.00967* (−0.00581)	−0.0106 (−0.0178)	−0.0126 (−0.0193)	0.00397 (−0.0129)	0.00864 (−0.0072)
Rule of law	−0.0336* (−0.0183)	−0.106*** (−0.0213)	0.0714*** (−0.0143)	0.0344*** (−0.0077)	−0.0501* (−0.0299)	−0.0382 (−0.03)	0.0392* (−0.0212)	−0.00103 (−0.0103)	−0.0467** (−0.0196)	−0.111*** (−0.0213)	0.0731*** (−0.0142)	0.0384*** (−0.00793)
Voice and accountability	0.0216** (−0.0104)	0.0165 (−0.012)	−0.00934 (−0.0081)	−0.00717* (−0.00436)	0.0225 (−0.0405)	0.021 (−0.0407)	−0.0122 (−0.0287)	−0.00885 (−0.014)	0.0102 (−0.0109)	0.0115 (−0.0119)	−0.00782 (−0.00793)	−0.00374 (−0.00443)
Property rights	0.00196 (−0.0297)	−0.0322 (−0.0345)	0.038 (−0.0232)	−0.0058 (−0.0125)	−0.124*** (−0.0403)	−0.121*** (−0.0405)	0.0899*** (−0.0286)	0.0310** (−0.0139)	−0.0283 (−0.0315)	−0.0453 (−0.0342)	0.0420* (−0.0229)	0.0033 (−0.0128)
Government integrity	−0.033 (−0.0432)	−0.0187 (−0.0502)	0.00694 (−0.0338)	0.0118 (−0.0182)	0.0738 (−0.0704)	0.0922 (−0.0707)	−0.0615 (−0.0499)	−0.031 (−0.0242)	−0.0780* (−0.0457)	−0.0382 (−0.0497)	0.0129 (−0.0331)	0.0253 (−0.0185)
Dummy group	0.0585*** (−0.011)	0.0254** (−0.0128)	−0.00781 (−0.00859)	−0.0176*** (−0.00462)								

Table 12 (continued)

Region	Whole sample—dependent variable				EMCCA—dependent variable				WAEMU—dependent variable			
Regressor	I1	I10	I40	I50	I1	I10	I40	I50	I1	I10	I40	I50
Constant	−0.0228	0.221***	0.515***	0.264***	−0.180**	0.276***	0.556***	0.168***	0.0106	0.235***	0.511***	0.254***
	(−0.0617)	(−0.0716)	(−0.0482)	(−0.026)	(−0.085)	(−0.0854)	(−0.0603)	(−0.0293)	(−0.0662)	(−0.0719)	(−0.048)	(−0.0268)
Type of estimation	IV panel	IV panel	IV panel	IV panel	IV panel	IV panel	IV panel	IV panel	IV panel	IV panel	IV panel	IV panel
R-squared	0.592	0.673	0.586	0.797	0.959	0.968	0.961	0.973	0.834	0.878	0.853	0.899
Pagan-Hall test	50.180	36.364	38.096	28.973	11.404	9.042	10.286	8.339	20.384	19.845	22.876	16.216
	P-value=0.001	P-value=0.051	P-value=0.033	P-value=0.221	P-value=0.978	P-value=0.995	P-value=0.989	P-value=0.997	P-value=0.618	P-value=0.651	P-value=0.468	P-value=0.849
Wu-Hausman F-test	1.96346	2.35428	1.05724	5.53513	0.98837	1.42564	1.34240	1.12885	2.12873	1.65132	0.32910	4.75027
	P-value=0.163	P-value=0.127	P-value=0.305	P-value=0.021	P-value=0.327	P-value=0.241	P-value=0.254	P-value=0.295	P-value=0.202	P-value=0.148	P-value=0.567	P-value=0.032
Observations	161	161	161	161	58	58	58	58	103	103	103	103

(1) *, **, *** indicate significance at 10%, 5%, and 1% level; (2) standard errors are in (…); and (3) IV panel denotes Instrumental Variable panel

Declarations

Conflict of interest The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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