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Globalisation, inequality and redistribution: Theory and evidence

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1 | INTRODUCTION

A lot of empirical work has documented a significant rise in inequality across many countries over the last 35 years. Globalisation and skill-biased technological change have emerged as the key factors responsible for the rising inequality. If globalisation creates rising inequality, one would expect democratic societies to engage in redistribution to widely share the gains from trade. That is, one can expect globalisation to lead to greater redistribution as well. However, globalisation can also put constraints on the ability of the welfare state to redistribute. For example, a higher taxation could lead to a flight of mobile factors of production (skilled labour and capital), or increase distortion in the labour supply decision of higher earning factors such as skilled labour, which would reduce output and per capita income. This makes it interesting to study the relationship between globalisation and redistribution, which is the subject of this paper.

To motivate the empirical work, we present a simple theoretical model with one sector, two factors of production-skilled labour and unskilled labour, and an imported input. Globalisation is captured by a decrease in the price of the imported input. The policymaker chooses a tax-transfer scheme to maximise the sum of welfares of skilled and unskilled workers. Since skilled workers earn more, the optimal policy involves taxing skilled workers and transferring the proceeds to unskilled workers. The taxation of skilled workers distorts the supply of skilled labour, which acts as a constraint on the ability of the policymaker to redistribute. In this setting, it is shown that globalisation leads to an increase in inequality if the imported inputs can be easily substituted for unskilled labour and are complementary to skilled labour. More interestingly, the policymaker redistributes more in response to the inequality increasing forces of globalisation. It is further shown that the extent of redistribution can be measured by the difference between the pre-tax/transfer Gini coefficient of income and the post-tax/transfer Gini coefficient of income.

Our inequality and redistribution measures are obtained from The Standardized World Income Inequality Database (SWIID) of Solt (2014). The advantage of this data set, according to Solt (2014), is to provide researchers with data that maximise comparability for the broadest possible sample of countries and years. We use the Gini coefficient of income as our measure of inequality. Solt (2014) provides data on pre-tax/transfer inequality called "market" income inequality and post-tax/transfer income inequality called "net" income inequality. We use the Gini coefficient of

market income as our measure of inequality and the difference between the Gini coefficients of market income and net income as our measure of redistribution. An advantage of using this measure of redistribution is that it exactly corresponds to the share of redistributive taxation in total income in the theoretical model.

We use two alternative measures of globalisation. First, trade openness is a quantitative measure of trade openness, measured as the sum of exports and imports relative to real gross domestic product (GDP). We use both nominal trade openness and real trade openness.[1] Our main measure of globalisation; however, is the KOF index of globalisation which is a composite of three indexes: economic globalisation, social globalisation and political globalisation. Our main interest lies in the index of economic globalisation which consists of both outcome variables such as trade–GDP ratio, foreign direct investment (FDI), portfolio investment and the policy variables such as tariffs, non-tariff barriers, capital account restrictions. Also, it is conceivable that some components of the KOF index of social globalisation (telephone contacts, internet users etc.) may be capturing the cost of coordinating production chains across borders or buying from suppliers abroad. A fall in the communication cost would effectively reduce the cost of buying inputs from abroad. Therefore, we expect the index of social globalisation to have similar relationship with inequality and redistribution as the index of economic globalisation. To be consistent with the broader literature, we also use the index of political globalisation but we do not have a prior on how it should be related to inequality and redistribution. Broadly speaking, unlike trade openness, the KOF index of globalisation is multi-faceted and captures many different dimensions of globalisation that could affect inequality and redistribution.

We verify that market income inequality has been increasing with nominal openness and the KOF index of globalisation. The key result of the paper, however, is that the extent of redistribution has been increasing with globalisation as well. While all three of the KOF indexes of globalisation as well as the overall index are positively associated with redistribution, the relationship with the index of political globalisation is not statistically significant. The results are robust to the inclusion of many different controls and the exclusion of outliers. Our alternative measure of globalisation, both nominal and real trade openness, is positively (and statistically significantly) associated with redistribution as well. The results suggest that the redistributive policies by governments have ameliorated the impact of globalisation on inequality.

The rest of the paper is organised as follows. In the next section, we discuss the related literature. Section 3 presents the theoretical model. Section 4 describes the data used in the paper along with the empirical method used. Section 5 presents the empirical results. Section 6 provides various robustness checks. Section 7 provides concluding remarks.

2 | RELATED LITERATURE

The relationship between globalisation and welfare state is an active area of research. One prevailing view is that globalisation restricts the ability of governments to raise revenue and provide public goods due to increased tax competition. The idea is that mobile factors of production like capital and skilled labour look for high net returns and therefore, a government that keeps its taxes high is going to lose out in the international competition for these mobile factors. The tax competition literature therefore predicts a global tax race to the bottom (e.g., Bretschger & Hettich, 2002;

[1]The latter is measured as the real exports plus real imports divided by real GDP where each variable is deflated by its own PPP price index.

Devereux, Lockwood, & Redoano, 2008). This is termed as the "efficiency effect" by Schulze and Ursprung (1999) and Ursprung (2008). If the governments' ability to raise revenue is compromised, a decline in public spending follows.

As noted by Schulze and Ursprung (1999), while the above view captures the impact of globalisation on the supply side of the political market, it neglects the demand side which was made prominent in the literature by Rodrik (1998). Rodrik (1998) argued that globalisation makes economies more vulnerable to shocks, and therefore, if agents are risk averse and the markets for insurance are missing, they would demand compensation against risk. Therefore, there would be a greater role for governments to mitigate risk through greater spending. It follows that the size of government would be positively associated with globalisation. This implication known as the "compensation hypothesis" was tested by Rodrik (1998) and many follow up studies using the share of government consumption in GDP as a measure of the size of government.

Stabilising consumption or providing social insurance against risk is not the only role of government, however. The welfare state is deemed to have two key functions: social insurance and redistribution. While Rodrik (1998) focused on the former function of the welfare state in a globalised world, our focus is on the latter function. Therefore, while Rodrik (1998) showed that globalisation would increase the role of government as a provider of social insurance, we are arguing that if globalisation increases inequality then it increases the redistributive function of the welfare state. We show theoretically and verify empirically that if globalisation increases inequality in the distribution of income, then an inequality-averse government/policymaker (welfare state) redistributes more. It must be pointed out that while in our theoretical model, there is an efficiency cost of redistribution, globalisation does not directly influence this cost because there is no international tax competition or internationally mobile factor of production in our model. A full-fledged model incorporating both tax competition and efficiency cost of redistribution would be too complicated, but it is worth pointing out that in such a model the ability of a government to redistribute more will be compromised in a more globalised world. That is, while an increase in inequality will increase the redistributive role of the government, the fear of capital or skill flight will put a check on the ability of the government to engage in greater redistribution. At the end of the day, whether a government redistributes more or less in response to globalisation is an empirical question, which is what we attempt to answer in this paper.

In the empirical work of Rodrik (1998) the extent of social insurance was proxied by the share of government consumption in GDP, called government size, while globalisation was measured by nominal trade openness: the sum of imports and exports relative to GDP. He found trade openness to be positively associated with government size. Alesina and Wacziarg (1998) showed that country size (measured by population) was positively related to both government size and globalisation and, therefore, could possibly account for the positive association between government size and globalisation rather than there being a direct relationship between the two. Using country size as a control in the Rodrik (1998) regression framework, they found the result on the relationship between government size and globalisation to be sensitive to whether the ratio variables (government size, openness) were entered in levels or logs.[2] Both Rodrik (1998) and Alesina and Wacziarg (1998) used cross-sectional data. Ram (2009) revisited the question using a panel data set for 154 countries over 41 years. Using fixed effects estimation which relies upon within country variation, Ram (2009) found the results to be supportive of Rodrik (1998), that is, even after controlling for country size, government size was positively associated with globalisation.

[2]When government size and openness were entered in levels, the relationship between government size and openness became insignificant after controlling for country size.

All of these papers used the share of government consumption in GDP obtained from the Penn World Table (PWT) as a measure of the size of government. A recent paper by Jetter and Parmeter (2015) attempted to replicate the findings of Ram (2009) using more recent and different versions of the PWT data sets. They found the relationship between trade openness and government size to be sensitive to the choice of: (i) the version of the PWT data set; (ii) the time frame; (iii) the sample of countries; and (iv) the way the key variables were entered in the regression (level or log). Even though our focus is on redistribution, we also estimate the impact of globalisation on government size using our version of PWT which is 8.1. Both nominal and real openness are positively related to government size, but the former fails to be statistically significant. What is more interesting for our purposes is that the correlation between government size and our measure of redistribution is a mere −0.054. Clearly, our measure of redistribution is not just an alternative measure of government size.

Our main measure of globalisation, the KOF index of globalisation was developed by Dreher (2006a). Among the papers studying the impact of globalisation on government size, Meinhard and Potrafke (2012) is the only paper that uses the KOF index as a measure of globalisation. They found a positive relationship between the KOF index of social globalisation and government size. In the data set we use, government size was significantly correlated only with the KOF index of political globalisation, however, the sign was negative.

Among papers studying globalisation and inequality, Dreher and Gaston (2008) examined the effects of the KOF indexes on the measures of income and wage inequality in 100 countries over the period 1970–2000. Their income inequality measure was the Gini index from the University of Texas Inequality Project (UTIP). They found a positive and significant effect of globalisation on income inequality in the subsample of OECD countries. Bergh and Nilsson (2010) examined the impact of the KOF indexes on income inequality in 79 countries over the period 1970–2005 using the "net" income inequality measure from the Standardized World Income Inequality Database (SWIID) data set of Solt (2009). They found that social globalisation led to a higher income inequality and the effect was stronger in the low and middle income economies.[3]

Among other related research, some papers have studied the impact of some variables of interest on redistribution in addition to inequality. For instance, Morgan and Kelly (2013) examined how politics affected the market income inequality and redistribution in the Latin American and Caribbean countries. They used the same measure of redistribution that we use in this paper. They found that the market income inequality was more responsive to politics (left partisan power) than redistribution. Ostry, Berg, and Tsangarides (2014) also used the same measure of redistribution in their study of the inter-relationships among income inequality, redistribution and economic growth. They found a negative relationship between net income inequality and economic growth. They also found a positive association between market income inequality and redistribution, that is, societies with higher market income inequality tended to redistribute more. Dabla-Norris, Kochhar, Suphaphiphat, Ricka, and Tsounta (2015) confirmed the findings of Ostry et al. (2014) on the negative relationship between net income inequality and economic growth in a sample of 159 countries for the period 1980–2012. In addition, they also found there to be a negative but insignificant relationship between trade openness and income inequality (both market and net) in a subsample of 97 countries. They found the key drivers of inequality to be financial openness, financial development, less regulated labour markets and technological progress.

[3]There is a large literature on globalisation and inequality and here we mention papers that use the KOF index of globalisation. Among other related papers, Goldberg and Pavcnik (2007) investigated the distributional effects of globalisation in developing countries. Schulze and Ursprung (1999) and Dreher (2006b) examined the globalisation–welfare state nexus. See the recent survey article by Potrafke (2015) for these and several other related papers.

To the best of our knowledge, there is no previous paper that theoretically shows a relationship between globalisation and redistribution and empirically examines the effect of globalisation on a comprehensive measure of redistribution that we use in the current paper.

3 | THE THEORETICAL MODEL

We construct a simple one-sector model with an imported input that allows us to study the implications of globalisation for inequality and redistribution. While globalisation is normally studied in a multi-sector framework (e.g., the traditional two-sector Ricardian or Heckscher–Ohlin model), our aim is to write down the simplest possible model that will do the job. Given the rising importance of input trade in world trade, the model below captures important elements of reality and delivers important empirical implications which are taken to data. In subsection 3.1 below we discuss how our theoretical insights are more widely applicable and not confined to the simple model that we provide here.

Suppose the model economy produces a single final good using the following production function:

$$Z = A\left(\omega\left(L^{\frac{\sigma-1}{\sigma}} + M^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}\frac{\chi-1}{\chi}} + (1-\omega)H^{\frac{\chi-1}{\chi}}\right)^{\frac{\chi}{\chi-1}},$$

where L is unskilled labour, H is skilled labour and M is an imported input. The elasticity of substitution between unskilled labour and the imported input is σ while the elasticity of substitution between the composite of unskilled labour and imported input and skilled labour is χ. The price of the imported input is denoted by ϕ. Globalisation in the model is captured by a decline in ϕ. The single final good, which is also the numeraire, is exported in exchange for the import of inputs. Therefore, ϕ also captures the price of imports relative to the price of exports.

While unskilled workers supply one unit of labour inelastically, the supply of skilled labour is elastic. Denote the number of unskilled workers by L which also means that the total amount of unskilled labour in the economy is L. Suppose the number of skilled workers in the economy is N_h, and their utility function is given by:

$$u_h(c - \alpha h^2); u_h' > 0, u_h'' < 0,$$

where c is consumption of the single final good Z and h is the hours supplied by skilled workers. They get disutility from work which is captured by the convex cost of effort function αh^2 expressed in units of the consumption good, where $\alpha > 0$. Now, if the skilled wage is r and the tax on the hourly wage is T then the skilled workers choose their hours optimally as follows:

$$\underset{h}{Max}\{u_h((1-T)rh - \alpha h^2)\}.$$

The first-order condition for this maximisation implies:

$$h = \frac{(1-T)r}{2\alpha}. \tag{1}$$

That is, the higher the tax, T, the lower the supply of skilled labour. This acts as a constraint on the ability of the policymaker to tax skilled workers.[4]

[4]If human capital was internationally mobile, a tax on human capital in one country will lead to capital flight with similar consequences for the country imposing the tax.

The utility function of unskilled workers is $u_l(c)(u_l' > 0, u_l'' < 0)$ where $c = w + s$ where w is the unskilled wage and s is the amount of transfer they receive. The government runs a balanced budget and therefore, the transfer per unskilled worker is:

$$s = \frac{rhT}{L} N_h. \tag{2}$$

The policymaker's objective function is given by a utilitarian social welfare function of the following form:

$$SWF = N_h u_h(c - \alpha h^2) + L u_l(c). \tag{3}$$

That is, the policymaker simply maximises the sum of utilities of all agents.[5]

The firms, workers, as well as the policymaker take w and r as given in their maximisation. The policymaker announces a tax rate T and then skilled workers choose their hours optimally anticipating a skilled wage r. Therefore, the policymaker recognises the impact of its choice of T on the choice of h by skilled workers given by Equation (1). To keep the model realistic, we will focus on the case where parameters are such that in the absence of government intervention skilled workers have higher utility than unskilled workers so that the optimal redistributive policy involves $T > 0$, a redistribution in favour of unskilled workers. The policymaker solves the following maximisation problem:

$$\underset{T}{Max}\left\{ N_h u_h\left((1-T)r\frac{(1-T)r}{2\alpha} - \alpha\left(\frac{(1-T)r}{2\alpha}\right)^2 \right) + L u_l\left(w + N_h \frac{rT}{L}\frac{(1-T)r}{2\alpha} \right) \right\}.$$

Simplify the above to obtain:

$$\underset{T}{Max}\left\{ N_h u_h\left(\frac{((1-T)r)^2}{4\alpha} \right) + L u_l\left(w + \frac{N_h}{L}\frac{(1-T)Tr^2}{2\alpha} \right) \right\}.$$

The first-order condition from the above maximisation is given by:

$$-N_h u_h'(1-T)\frac{r^2}{2\alpha} + N_h u_l' \frac{r^2}{2\alpha}(1-2T) = 0. \tag{4}$$

The above implies:

$$\frac{(1-T)}{(1-2T)} = \frac{u_l'}{u_h'}. \tag{5}$$

As mentioned earlier, we are going to focus on the realistic case of $T > 0$. To rule out the possibility of $T \leq 0$, we assume that parameters are such that in the absence of any government

[5]Given the concave utility of agents ($u''(c) < 0$) the policymaker wants to engage in redistribution even with a utilitarian social welfare function. We could set up a generalised utilitarian social welfare function of the form: $N_h W(u_h(c - \alpha h^2)) + LW(u_l(c))$ where W is increasing and concave. This would make the policymaker even more egalitarian but will not change the qualitative results. For example, we could have a social welfare function of the CES form:

$$SWF = \begin{cases} \left(N_h (u_h(c-\alpha h^2))^{1-\rho} + L(u_l(c))^{1-\rho} \right)^{\frac{1}{1-\rho}} \text{ if } \rho \neq 1 \\ N_h \ln(u_h(c-\alpha h^2)) + L\ln(u_l(c)) \text{ if } \rho = 1 \end{cases},$$

where the parameter q captures inequality aversion. Our Equation (3) in the text corresponds to $\rho = 0$ and higher ρ captures greater inequality aversion.

intervention, skilled workers have higher utility than unskilled workers.[6] That is, unskilled workers are going to be poorer than skilled workers. Clearly, with $T > 0.5$, the left hand side will become negative which is not possible. Therefore, the relevant range of optimal T is $0 < T < 0.5$, in which case $u_l' > u_h'$. That is, the policymaker is not going to equalise the incomes of skilled and unskilled workers completely. Since the taxation causes a distortion in the supply of skilled labour, the optimal redistributive taxation will lead to $u_l' > u_h'$. It is also worth pointing out that since with policy intervention, we have $u_l' > u_h'$, no skilled worker has an incentive to pretend to be unskilled to take advantage of the redistributive taxation.

If the preferences of workers are logarithmic, then we get the following:

$$\frac{(1-T)}{(1-2T)} = \frac{((1-T)r)^2}{4\alpha\left(w + \frac{N_h}{L}\frac{(1-T)Tr^2}{2\alpha}\right)}. \tag{6}$$

The above gives T as a function of w and r. Re-write the above as:

$$\left(4\alpha w + 2\frac{N_h}{L}(1-T)Tr^2\right) = (1-2T)(1-T)r^2. \tag{7}$$

Since each skilled worker supplies h hours of labour given by Equation (1), the amount of skilled labour available for use in production is given by:

$$H = N_h h = N_h \frac{(1-T)r}{2\alpha}. \tag{8}$$

Recall that the price of the imported input is ϕ and we assume no taxation of firms. Therefore, firms undertake the following profit maximisation exercise:

$$\underset{L,M,H}{Max}\{Z - wL - \phi M - rH\}.$$

Using the definition $\Gamma \equiv A\left(\omega\left(L^{\frac{\sigma-1}{\sigma}} + M^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}\frac{\chi-1}{\chi}} + (1-\omega)H^{\frac{\chi-1}{\chi}}\right)^{\frac{\chi}{\chi-1}-1}$, the first-order conditions are given by:

$$L : \Gamma\omega\left(L^{\frac{\sigma-1}{\sigma}} + M^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma(\chi-1)}{(\sigma-1)\chi}-1} L^{\frac{-1}{\sigma}} = w, \tag{9}$$

$$M : \gamma\Gamma\omega\left(L^{\frac{\sigma-1}{\sigma}} + M^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma(\chi-1)}{(\sigma-1)\chi}-1} M^{\frac{-1}{\sigma}} = \phi, \tag{10}$$

$$H : \Gamma(1-\omega)H^{-\frac{1}{\chi}} = r. \tag{11}$$

The five Equations ((7)–(11)) determine the five endogenous variables of interest: w, r, T, M, and H.[7]

Since our aim lies in studying the impact of globalisation on inequality and redistribution, a natural question to ask is what is a good measure of inequality and redistribution. Given the

[6] It can be verified that in the absence of government intervention, $c - \alpha h^2 = r^2/4\alpha$. Therefore, a government intervention with $T > 0$ requires the parameters to be such that in the absence of intervention $r^2/4\alpha > w$. A small N_h/L ratio ensures that $r^2/4\alpha > w$.

[7] Note that to save on notation we are using H for both the firm choice of skilled labour and the supply of skilled labour. What really happens is that the firm's choice of skilled labour is given by Equation (11) which must equal the supply of skilled labour given in Equation (8) in a competitive equilibrium.

empirical focus of this paper, we are going to use empirically relevant measures of inequality and redistribution. Our measure of inequality is the Gini coefficient of income distribution. Since there are only two levels of income, the pre-tax Gini coefficient of income is given as follows:

$$G_g = \frac{rhN_h}{rhN_h + wL} - \frac{N_h}{N_h + L}. \tag{12}$$

It is easily verified that the Gini coefficient above is increasing in rh/w which is the relative income of skilled workers. Similarly, the post-tax Gini coefficient of income is given by:[8]

$$G_n = \frac{r(1-T)hN_h}{r(1-T)hN_h + (w+s)L} - \frac{N_h}{N_h + L}. \tag{13}$$

Since all taxation is redistributive in our model, a simple measure of redistribution, R, is the amount of tax revenue relative to factor income:

$$R = T\frac{rhN_h}{rhN_h + wL}. \tag{14}$$

The above corresponds to the tax–GDP ratio. Below we verify that the above measure of redistribution corresponds to the difference between the pre-tax Gini coefficient of income and the post-tax Gini coefficient of income. It is easily verified (upon using Equation (2)) that the difference between the two is given by:

$$R = G_g - G_n = T\frac{rhN_h}{rhN_h + wL}. \tag{15}$$

Next, we want to study the impact of globalisation on inequality, $dG_g/d\phi$, and redistribution, $dR/d\phi$. It is clear from the model that they, in turn, depend on the signs of $dr/d\phi$, $dh/d\phi$, $dw/d\phi$, and $dT/d\phi$. We can use the five Equations ((7)–(11)) to do these comparative statics, but doing so in the general model above is quite complicated. Therefore, we are going to solve it numerically, but to gain some intuitive insights about how globalisation affects inequality we are going to look at a special case of exogenous supply of skilled labour below.

3.1 | Special case

Suppose skilled workers also supply one unit of labour inelastically. In this case the amount of skilled labour available is given by $H = N_h$. The utility function of the two types of workers is identically given by $u(c)$ with $u'(c) > 0$, $u''(c) < 0$. In this special case, Equations ((9)–(11)) determine w, r, and M. Note that the pre-tax Gini in this special case is:

$$G_g = \frac{rN_h}{rN_h + wL} - \frac{N_h}{N_h + L}. \tag{16}$$

That is, G_g is an increasing function of r/w. In the appendix, we derive the following expression for the change in inequality with respect to offshoring:

[8]Note that Equations (13) and (14) are simply constructing pre-tax and post-tax measures of Gini coefficients. The pre-tax here does not mean that the tax rate $T = 0$, but it means that this Gini is based on the levels of factor income before deducting taxes and adding subsidies. Therefore, the amount of h is same in both expressions and is a function of T chosen by the government.

$$\frac{d\log\left(\frac{r}{w}\right)}{d\phi} = \frac{(\sigma-\chi)}{\phi\chi}\Omega\left(\varepsilon_{w\phi}-1\right), \tag{17}$$

where $0 < \Omega < 1$ and $\varepsilon_{w\phi}$ is the elasticity of wage with respect to ϕ. It is further verified that $\varepsilon_{w\phi} < 1$ which yields the following result.

Result 1: $d(r/w)/d\phi <(>)0$ and hence $dG_g/d\phi <(>)0$ if $\sigma >(<)\chi$.

That is, inequality increases with globalisation if unskilled labour and imported inputs are better substitutes for each other than their composite is for skilled labour: $\sigma > \chi$ In the opposite case, inequality decreases with globalisation. Intuitively, a higher σ implies that imported inputs can be easily substituted for unskilled labour and, therefore, the demand for unskilled labour decreases (or increases less) with globalisation. A high χ on the other hand implies that skilled labour can be easily substituted by the composite input, therefore, the demand for skilled labour decreases (or increases less) in response to globalisation. Clearly, while the former effect increases inequality, the latter reduces it, and hence, the net effect on inequality depends on their relative strengths which is captured by σ–χ.[9]

Since the taxation does not cause any distortion in the labour supply of skilled workers, in this case the policymaker simply equalises the incomes of the two types. That is T is such that:

$$r(1-T) = w + s. \tag{18}$$

From the balanced budget constraint, we get:

$$T = \frac{r/w-1}{r/w}\frac{L}{L+N_h}. \tag{19}$$

That is, T is increasing with inequality r/w and consequently G_g. It follows from *Result 1* that $\sigma >(<)\chi$ implies $dT/d\phi <(>)0$. That is, if globalisation increases inequality, then globalisation increases redistribution as well. The post-tax Gini is zero because the policymaker equalises the incomes of the two groups. Therefore, $R = G_g - G_n = G_g$, and hence, it follows from *Result 1* that $\sigma >(<)\chi$ implies $dR/d\phi <(>)0$.

3.2 | General case

Coming back to the general case with endogenous supply of skilled labour, an appropriate measure of pre-tax income inequality is rh/w. Note from Equation (12) that G_g is an increasing function of rh/w, and therefore what happens to h becomes important as well. We derive the following expression for the change in inequality with respect to ϕ:

$$\frac{d\log\left(\frac{rh}{w}\right)}{d\phi} = \frac{(\sigma-\chi)}{\phi\chi}\Omega\left(\varepsilon_{w\phi}-1\right) + \left(\frac{\chi-1}{\chi}\right)\frac{d\log h}{d\phi}. \tag{20}$$

The first term on the right-hand side of Equation (20) is the same as in Equation (17) while the second term arises due to the endogeneity of h. A rough intuition for the sign of the second term is as follows. A change in h in response to globalisation has two effects on inequality. Since rh is

[9]Note that a reduction in the price of the imported input has both scale and substitution effects on skilled and unskilled labour. The scale effect would tend to increase demand for skilled and unskilled labour, while the substitution effect would reduce demand for skilled and unskilled labour as they will be substituted by cheaper imported inputs. Since the scale and substitution effects go in opposite directions, whether the demand for these factors of production increases or decreases is ambiguous.

the income of the skilled, an increase in h increases inequality directly. However, an increase in h also increases the aggregate supply of skilled labour in the economy which reduces the relative reward of skilled labour and consequently reduces inequality. The strength of this latter effect depends on the degree of substitutability between skilled labour and the composite of imported inputs and unskilled labour, χ. The greater the substitutability, χ, the smaller the reduction in the relative reward of skilled labour and hence the smaller the reduction in inequality. When $\chi = 1$ these two effects cancel each other but for $\chi > 1$ the direct effect dominates, and therefore, an increase in h induced by globalisation increases inequality. In the opposite case of $\chi < 1$, the indirect effect dominates and hence inequality is reduced.

Assuming $\varepsilon_{w\phi} < 1$ and $dh/d\phi < 0$ in this more general case,[10] we observe the following pattern based on the intuition above. When $\sigma \geq \chi > 1$ then inequality increases in response to globalisation while when $\sigma \leq \chi < 1$ inequality decreases in response to globalisation. In these cases the two terms on the r.h.s in Equation (20) work in the same direction. When $\sigma > \chi$ but $\chi < 1$ or when $\sigma < \chi$ but $\chi > 1$ the two terms on the right-hand side in Equation (20) have opposite effects, rendering the net effect on inequality ambiguous. We verify these results numerically below:

Parameters for the Numerical Example: $A = 1$; $L = 1$; $N_h = 1/3$; $\alpha = .05$; $\omega = .5$; $\phi \varepsilon [0.5, 1.5]$.

Figure 1 plots our two measures of inequality, G_g (pre-tax/transfer inequality) and G_n (post-tax/transfer inequality) against a range of values of ϕ, the cost of imported inputs. The top border of the shaded area captures G_g while the bottom border captures G_n. The difference between G_g and G_n is our measure of redistribution, R, which is captured by the shaded area in each panel in Figure 1. Recall that a decrease in ϕ captures increased globalisation. We have chosen four parametric configurations of σ and χ to show various cases of interest. Figure 1a shows results for the case of $\sigma \geq \chi > 1$ ($\sigma = \chi = 2$ in the numerical example). As expected, globalisation increases inequality in this case which in turn also leads to increased redistribution. Note that the gap between the two lines increases as ϕ decreases in Figure 1a. Figure 1b shows a decrease in inequality and redistribution in the $\sigma \leq \chi < 1$ case ($\sigma = \chi = .8$ in the example). Figure 1c captures the parameter zone of $\sigma > \chi$ and $\chi < 1$ ($\sigma = 0.8$, $\chi = .75$ in the example). Note that the discussion above implied ambiguous effect of globalisation on inequality with this parametric configuration. Recall from the discussion of the special case earlier (when H is exogenous) that globalisation increases inequality when $\sigma > \chi$. However, with endogenous H we find that globalisation decreases inequality and redistribution for this parametric configuration. Finally, Figure 1d captures the case of $\sigma < \chi$ and $\chi > 1$ ($\sigma = 1.75$, $\chi = 2$ in the example). Again, in the special case (exogenous H) discussed earlier, globalisation would reduce inequality with this parametric configuration. But Figure 1d shows that with endogenous H both inequality and redistribution increase with globalisation.

The key results discussed above are summarised below.

Result 2: $dG_g/d\phi < 0$ and $dR/d\phi < 0$ if $\sigma \geq \chi > 1$ and $dG_g/d\phi > 0$ and $dR/d\phi > 0$ if $\sigma \leq \chi < 1$. The impact is ambiguous in other cases.

While we have attempted to identify the range of parameters under which globalisation in the form of trade in inputs increases or reduces inequality, can we say anything about which case is more plausible? It is difficult to find estimates of σ and χ in the literature. Since we think of two inputs as skilled and unskilled labour, we could look at the estimates of the elasticity of substitution between college graduates and high school graduates as a proxy for χ. The estimates by Katz and Murphy (1992) and Ciccone and Peri (2005) for this elasticity of substitution range between

[10]Proving it analytically is hard but in our extensive numerical exercise we find it to be true.

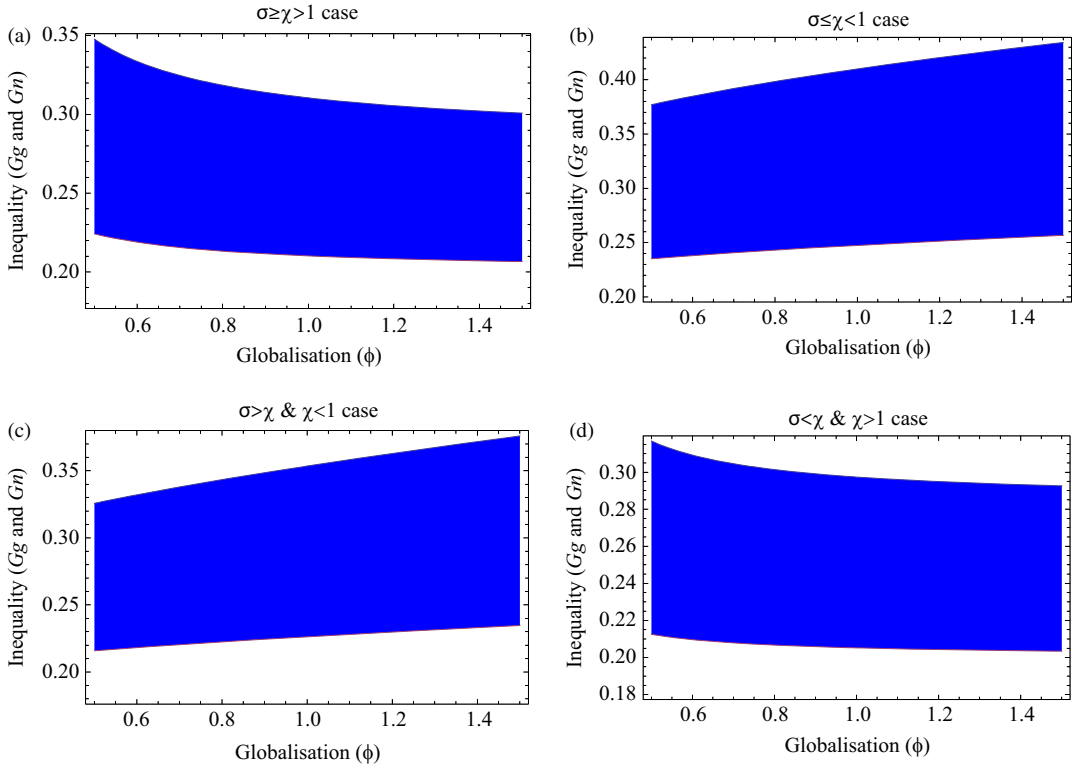

FIGURE 1 Globalisation, Inequality and Redistribution.
Notes: top line:Gg, bottom line:Gn, shaded area:R Other parameters: $A = 1$; $L = 1$; $N_h = 1/3$; $\alpha = .05$; $\omega = .5$

1.4 to 1.5. The estimates in a recent paper by Borjas, Grogger, and Hanson (2012) range between 1.67 and 3. It is much harder to find an estimate of σ in the literature. In the immigration literature, there are a number of estimates of the elasticity of substitution between native workers and immigrants (mainly with very low skills) for the United States. While Ottaviano and Peri (2012) find this to be about 20, the estimates in Borjas et al. (2012) are in the range of 48 to 500. If the elasticity of substitution between unskilled labour and imported inputs were similar to that between native workers and immigrants, then $\sigma > \chi > 1$ would seem to be the plausible parametric configuration. If, on the other hand, imported input is capital or a natural resource, it could very well be complementary to unskilled labour ($\sigma < 1$). In this case, since $\sigma < 1$ and $\chi > 1$ the impact of globalisation on inequality is theoretically ambiguous. However, since our paper mainly provides an empirical analysis on the relationship between globalisation, inequality and redistribution, we do not want to take a stand on the issue of plausible parameter range for σ and χ.

3.3 | Discussions

Our theoretical model can be viewed as one of a small country that imports inputs from rest of the world. The model does not answer how inequality will be affected in the country exporting inputs. To show the impact of input trade on inequality in both the importing and exporting countries we will have to extend the model to allow for a continuum of inputs. Feenstra and Hanson (1996) provide a model along those lines where they show that globalisation in such a model could increase inequality in both countries engaged in input trade. Here is a rough intuition for their results.

Suppose there is a continuum of inputs that are produced using skilled and unskilled labour. Now, arrange inputs according to their skill intensity. It will be the case that more skill-intensive inputs are produced in the skill-abundant North. Now, if it becomes cheaper to produce more inputs in the South (say due to a decline in trade barriers in the North or a decrease in communication/coordination cost), then the production of some inputs will shift to the South. This will increase relative demand for skill both in the North and South and consequently increase inequality. The point is that it is possible to show that globalisation increases inequality in both countries in a two-country model with input trade.

As is already clear from our simple one-sector model, the relationship between globalisation and inequality is not unambiguous. In the model discussed above, it depends on σ and χ, but in two-sector model of the Heckscher–Ohlin type, it will depend on whether a country has a comparative advantage in the skill-intensive good or in the unskilled-labour-intensive good. For example, in a Heckscher–Ohlin type model with skilled and unskilled labour, Moore and Ranjan (2005) show that inequality increases in the skill-abundant North but it decreases in the skill-scarce South. Extending this framework to allow for redistribution will imply greater redistribution in the North but a smaller one in the South upon globalisation. What this suggests is that globalisation could have different implications for inequality and redistribution in different groups of countries, something that we check in our empirical exercise.

While we have delineated one channel through which globalisation could affect inequality and redistribution, our measure of redistribution (difference between the pre-tax and post-tax Gini as shown in Equations ((12)–(15)) is independent of the underlying mechanism through which globalisation affects inequality. And, the theoretical framework suggests that if globalisation increases inequality, then it should increase redistribution as well.

Finally, in our theoretical model discussed above, globalisation is captured as a decrease in the price of the imported good. In the empirical work, we use the trade–GDP ratio from PWT and the KOF index of economic globalisation as our main measures of globalisation. Since a lot of international trade is in inputs or intermediate goods, increased the trade induced by a decline in the price of inputs (due to a decrease in trading costs including transportation costs, trade barriers, communication costs etc.) will be reflected in the trade–GDP ratio. As far as the KOF indexes are concerned, the index of economic globalisation is based on both "actual flows" and "restrictions" where the latter refer to various policy-induced restrictions on trade flows. These "restrictions" are more closely tied to the theoretical model in the paper because a removal of these restrictions will reduce the relative price of imports. Also, it is conceivable that some components of the KOF index of social globalisation (telephone contacts, internet users etc.) may be capturing the cost of coordinating production chains across borders or buying from suppliers abroad. A fall in the communication cost would effectively reduce the cost of buying inputs from abroad.

4 | EMPIRICAL MODEL, DATA AND ECONOMETRIC METHODOLOGY

4.1 | Empirical model

Our two key estimating equations are based on *Result 2* derived from the theoretical model. In particular, we estimate the following two equations:

$$Inequality_{it} = \alpha_0 + \alpha_1 Globalisation + \alpha_2 X + v_t + v_i + \varepsilon_{it},$$
$$Redistribution_{it} = \alpha_0 + \alpha_1 Globalisation + \alpha_2 X + v_t + v_i + \varepsilon_{it}.$$

$Inequality_{it}$ is the Gini index of market income and $Redistribution_{it}$ is the difference between the Gini index for market and the Gini index for net income. Globalisation is going to be captured by KOF index

of globalisation as well as the nominal and real trade openness defined earlier. X is a vector of controls and, v_t, v_i, and, ε_{it}, respectively, denote the "time effect", the "country effect" and the "error term".

Our choice of controls is informed by the existing literature on the subject. In our benchmark model, we use log real GDP per capita and the age dependency ratio as the controls. Later we assess the robustness of our results to some other controls used in the literature such as population, human capital, urbanisation, quality of institutions.

Our approach of running fixed effects regressions is standard in the literature (see, e.g., Bergh & Nilsson, 2010; Dreher & Gaston, 2008; Ostry et al., 2014). We use robust standard errors clustered at the country level and run the cluster-robust Hausman test of Kaiser (2015) to assess the validity of our fixed effects estimation. As pointed out by Kaiser (2015), when robust standard errors are clustered at the cross-sectional level in the fixed effects estimations, the classical Hausman test has size distortions. Therefore, we consider the recent Hausman test technique of Kaiser (2015). This technique corrects for the size distortion in the Hausman test when robust standard errors are considered.

4.2 | Data

The time period of our data is from 1970 to 2012. Our key measure of globalisation, the KOF index of globalisation, is obtained from the database of the Swiss Federal Institute of Technology, Zurich.[11] Among the three KOF indexes, the index of economic globalisation is available for the least number of countries. This is our main index of interest because it is closely tied with the motivating theoretical model and we have a better understanding of the implications of economic globalisation for inequality and redistribution than of social and political globalisation. Therefore, we restrict our empirical exercise to those country-year pairs for which the KOF index of economic globalisation is available.[12] We provide details on the KOF index of globalisation in Data Appendix I. The higher values indicate greater globalisation.[13] In our baseline regressions, we use 5-year averaged data. For example, for year 2012, the least globalised country according the KOF index of economic globalisation in the sample that we use was Bangladesh with a value of 32.59 while the most globalised country was Singapore with a value of 96.57.[14]

Our alternative measure of openness is the trade–GDP ratio. We use two variants of it: nominal openness and real openness. Nominal openness is the traditional variant which is constructed using nominal values of exports, imports and GDP. Alcala and Ciccone (2004) argued that the nominal openness overstates the importance of trade for poor countries compared to rich countries due to huge differences in the prices of non-traded goods. Following their reasoning, we use real trade openness

[11]The beginning date of KOF globalisation data set is 1970, and that is why the starting period of our empirical exercise is the year of 1970. The details of the construction of this index are given in Dreher (2006a) and Dreher et al. (2008). See Potrafke (2015) for a comprehensive survey of studies that use KOF index of globalisation.

[12]This allows us to have the same countries in the regressions involving different KOF indexes as well as the overall index facilitating comparison.

[13]In constructing the indexes of globalisation, each of the variables that go into the index described in Data Appendix I is transformed to an index on a scale of 1 to 100, where 1 is the minimum value for a specific variable over the 1970–2012 period, and 100 is the maximum value. The higher values indicate greater globalisation. Then they are combined into a higher level index by giving appropriate weights.

[14]Since we have 43 years of data, and we wanted to have last 5 years (2008–12) separate as the post-financial crisis years, our first two data points are 4-year averages and the rest are 5-year averages: 1970–73, 74–77, 78–82, 83–87, 88–92, 93–97, 98–02, 03–07, 08–12. Therefore, the KOF index of economic globalisation in Bangladesh and Singapore in 2012 refers to its average from 2008 to 2012.

measured as the sum of real exports and real imports relative to the real GDP as an alternative measure of trade openness.[15] The data for both nominal and real openness are obtained from PWT version 8.1 as are the data on government size (measured by the share of government consumption in GDP).

The data on income inequality and redistribution come from the SWIID (version 5.0) of Solt (2014). Looking at the inequality data, we find that between-country inequality as measured by the Gini coefficient of market income (pre-tax/transfer) has decreased over our sample period. For example, the standard deviation of market Gini index between countries was 9.26 in 1973, which decreased to 8.65 in 1992, and further to 7.07 in 2012. At the same time, within country inequality seems to have increased. If we look at the standard deviation of within and between-country inequality before and after 1990, we find that the former decreased from 8.78 to 7.15 while the latter increased from 2.55 to 3.08. As mentioned in the Introduction, the measure of redistribution is the difference between the Gini coefficient of pre-tax/transfer income and the Gini coefficient of post-tax/transfer income. An advantage of this derived measure of redistribution is that it is available for a much larger number of countries compared to the standard measures of redistribution used in literature. For example, information on subsidies and social expenditures tend to be available for mainly OECD countries. Also, as shown by Ostry et al. (2014), the correlation between this measure of redistribution and the ones used in the literature vary from 0.42 to 0.7 (see Table 1 in their paper). This may be due to the fact "that many presumptively redistributive transfers may not be so in particular cases" (Ostry et al., 2014). As well, this measure of redistribution is closely tied to the share of redistributive taxation in GDP in the theoretical model, and it is hard to get a direct empirical measure of the share of redistributive taxation in GDP.

The details on the other controls used in the paper as well as the descriptive statistics (five-year averaged data) on all variables are provided in Table 1. The correlation matrix (for five-year averaged data) for the key variables used in the regressions is provided in Table 2. The correlation between inequality and the KOF index of economic globalisation is small at 0.12 but the correlation between redistribution and the KOF index of economic globalisation is much stronger at 0.58. It also turns out that the correlation between inequality and the KOF index of economic globalisation is much stronger in the post-1990 period than in the pre-1990 period. Also, all our measures of globalisation are positively and significantly correlated with each other. Spain is one country that shows a very strong increase in the economic globalisation index, inequality and redistribution over the sample period from 1973 to 2012. The index of economic globalisation increased from 41.04 to 77.66, while inequality increased from 33.24 to 50.03 and redistribution increased from 1.12 to 16.89. Venezuela, on the other hand, is one of the few countries that show a decrease in all three variables over this period. The index of economic globalisation decreased from 44.76 to 41.5, inequality decreased from 41.49 to 39.73, while redistribution decreased from 2.92 to 2.84. Our regression framework below captures these relationships in a more general framework.

5 | EMPIRICAL RESULTS

5.1 | Results from benchmark regressions

Tables 3 and 4 present the results of the benchmark regressions with the Gini index of market income and redistribution as the dependent variables. Following Bergh and Nilsson (2010) and many others, the data are averaged over 5-year intervals to prevent short-term fluctuations affecting results.

[15]Note that Alcala and Ciccone (2004) actually use nominal exports plus imports over real GDP as their measure of real openness because they did not have access to price indexes for exports and imports. Since the introduction of PPP for exports and imports in PWT 8.0, it is possible to use real exports and real imports in constructing real openness which is what we do using the PWT version 8.1 of Feenstra, Inklaar, and Timmer (2015).

TABLE 1 Descriptive summary statistics

Variables	Definition	Data source	Mean	Standard deviation	Minimum	Maximum	Observations
Gini index of market income	Level of index	SWIID 5.0: Solt (2014)	44.56	8.002	18.88	70.30	933
Redistribution	Level of index	SWIID 5.0: Solt (2014)	6.551	6.492	−14.73	26.43	933
Economic globalisation	Level of index	KOF: Dreher (2006a)	52.58	18.65	10.06	97.40	884
Social globalisation	Level of index	KOF: Dreher (2006a)	43.95	21.93	6.674	92.97	884
Political globalisation	Level of index	KOF: Dreher (2006a)	63.01	21.36	7.572	97.78	884
Overall globalisation	Level of index	KOF: Dreher (2006a)	52.05	17.76	13.17	91.75	884
Actual flows	Level of Index	KOF: Dreher (2006a)	52.45	21.24	4.120	100.0	884
Restrictions	Level of index	KOF: Dreher (2006a)	53.18	22.02	4.410	96.25	870
Data on personal contact	Level of index	KOF: Dreher (2006a)	48.18	21.41	7.620	94.48	882
Data on information flows	Level of Index	KOF: Dreher (2006a)	52.75	22.81	3.860	97.85	884
Data on cultural proximity	Level of Index	KOF: Dreher (2006a)	30.43	29.76	1.000	96.74	884
Trade	Percentage of Gross Domestic Product (GDP)	World Bank, World Development Indicators	74.89	48.25	5.983	408.1	850
Stocks of foreign direct investments (inward flows)	Percentage of GDP	UNCTAD Statistics	25.71	61.58	0.000	1,533	769
Portfolio investments	Percentage of GDP	IMF, International Financial Statistics	121.4	833.0	0.006	10,757	428
Income payments to foreign nationals	Percentage of GDP	World Bank, World Development Indicators	6.887	20.83	0.068	365.3	734
Social expenditures	Percentage of GDP	OECD statistics	18.80	6.436	1.703	31.81	207
Real trade openness (real merchandise exports plus real imports relative to PPP GDP)	Level, ratio	Penn World Table (PWT) 8.1: Feenstra et al. (2015)	54.15	80.57	1.439	1,600	859

(Continues)

TABLE 1 (Continued)

Variables	Definition	Data source	Mean	Standard deviation	Minimum	Maximum	Observations
Nominal trade openness (merchandise exports plus imports relative to nominal GDP)	Level, ratio	PWT 8.1: Feenstra et al. (2015)	75.16	48.54	6.487	414.4	859
Government size (share of government consumption in GDP)	Level, ratio	PWT 8.1: Feenstra et al. (2015)	20.17	10.15	2.419	126.3	890
Population, total	Logarithmic form	PWT 8.1: Feenstra et al. (2015)	2.393	1.661	−2.669	7.181	890
Per capita GDP (PPPs, constant 2005US$)	Logarithmic form	PWT 8.1: Feenstra et al. (2015)	8.631	1.145	5.497	11.09	890
Age dependency ratio (% of Working–age population)	Level of index	World Bank, World Development Indicators	67.25	18.91	35.86	119.9	929
Urban population (% of total)	Level, ratio	World Bank, World Development Indicators	54.26	22.86	5.127	100.0	933
Population density (people per square km of land area)	Logarithmic form	World Bank, World Development Indicators	4.075	1.378	0.362	8.899	921
Diversification of exports index	Level of Index	International Monetary Fund	3.053	1.183	1.040	6.296	883
Inflation, consumer prices (annual %)	Percentage	World Bank, World Development Indicators	31.13	186.7	−11.44	3,330	819
Index of human capital per person	Level of index	PWT 8.1: Feenstra et al. (2015)	2.355	0.583	1.113	3.612	797
Institutional quality (executive constraints concept)	Index from 1 to 7	Polity IV Annual Time Series	5.002	2.049	1.000	7.000	875
Civil liberties ratings (1 representing the most free; 7 the least free)	Index from 1 to 7	Freedom House, Freedom in the World Database	3.316	1.728	1.000	7.000	905
Level of institutionalized democracy	Index from 0 to 10	Polity IV Annual Time Series	5.703	3.932	0.000	10.00	875

TABLE 2 Correlation matrix (five-year averaged data)

Regressors	Market Gini	Redistribution	Economic globalisation	Social globalisation	Political globalisation	Overall globalisation	Real trade openness	Nominal trade openness	Government size	Per capita Gross Domestic Product (GDP)	Age dependency ratio
Market Gini	1.000	—	—	—	—	—	—	—	—	—	—
Redistribution	.131	1.000	—	—	—	—	—	—	—	—	—
Economic globalisation	.120	.577	1.000	—	—	—	—	—	—	—	—
Social globalisation	.010	.702	.815	1.000	—	—	—	—	—	—	—
Political globalisation	.039	.485	.396	.538	1.000	—	—	—	—	—	—
Overall globalisation	.062	.698	.883	.944	.716	1.000	—	—	—	—	—
Real trade openness	.036	.205	.415	.356	.126	.363	1.000	—	—	—	—
Nominal trade openness	−.012	.111	.594	.384	−.117	.369	.423	1.000	—	—	—
Government size	−.128	−.054	−.019	−.054	−.248	−.109	.369	.129	1.000	—	—
Per capita GDP	−.014	.669	.699	.850	.479	.812	.141	.267	−.144	1.000	—
Age dependency ratio	.215	−.501	−.580	−.724	−.421	−.690	−.196	−.272	.061	−.770	1.000

TABLE 3 Benchmark regression: dependent variable market Gini (five-year averaged data)

Regressors	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	FE (6)
Constant term	12.89	10.49	14.09*	23.52***	10.41	16.86**
	(9.133)	(9.433)	(8.276)	(7.961)	(9.136)	(8.268)
Per capita gross domestic product	2.736***	3.307***	1.196	0.412	2.628***	0.602
	(0.976)	(0.937)	(0.906)	(0.850)	(0.955)	(0.922)
Age dependency ratio	0.089**	0.081***	0.155***	0.145***	0.117***	0.176***
	(0.033)	(0.035)	(0.033)	(0.034)	(0.035)	(0.033)
Nominal trade openness	0.029**	—	—	—	—	—
	(0.012)					
Real trade openness	—	0.0039	—	—	—	—
		(0.004)				
Economic globalisation	—	—	0.188***	—	—	—
			(0.030)			
Social globalisation	—	—	—	0.178***	—	—
				(0.032)		
Political globalisation	—	—	—	—	0.058**	—
					(0.025)	
Overall globalisation	—	—	—	—	—	0.206***
						(0.035)
Observations	859	859	859	859	859	859
Number of countries	140	140	140	140	140	140
Cluster–robust Hausman	10.8	9.68	6.47	12.9	8.07	7.80
	[0.013]	[0.021]	[0.090]	[0.005]	[0.044]	[0.050]
R–squared (within)	0.067	0.059	0.163	0.148	0.074	0.155

Notes: The dependent variable is the Gini index of market income. The cluster–robust Hausman test shows whether the results of the fixed effects or the random effects estimations are valid (null hypothesis: the difference in coefficients is not systematic, i.e., the fixed effects estimations are consistent). See Kaiser (2015) for details. We report the robust standard errors clustered at the country level. The standard errors are in parentheses and the *p*–values are in brackets. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The results for nominal and real trade openness are in columns (1) and (2), respectively, while the results for the KOF globalisation indexes (economic, social, political and overall) are reported in columns (3), (4), (5) and (6), respectively. All measures of globalisation increase inequality, but the coefficient of real trade openness is not statistically significant. More importantly, as shown in Table 4, all measures of globalisation increase redistribution, but the coefficient of the index of political globalisation is statistically insignificant. That is, greater globalisation is associated with higher redistribution in general. To get a sense of the magnitudes of these effects, looking at the economic globalisation index, we find that a one standard deviation increase in this index implies a 3.49 points increase (0.43 standard deviation) in market income inequality and a 1.36 points increase (0.21 standard deviation) in redistribution. The corresponding numbers for the overall KOF globalisation index are of similar order of magnitude. Let us make this more concrete with

TABLE 4 Benchmark regression: dependent variable redistribution (five-year averaged data)

Regressors	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	FE (6)
Constant term	−10.52***	−11.99***	−10.18***	−6.735*	−11.34***	−9.406**
	(4.108)	(4.342)	(3.787)	(3.515)	(4.311)	(3.838)
Per capita gross domestic product	1.633***	1.914***	1.082***	0.825**	1.816***	0.994**
	(0.434)	(0.452)	(0.393)	(0.371)	(0.452)	(0.402)
Age dependency ratio	0.034***	0.031***	0.056***	0.051***	0.030***	0.059***
	(0.011)	(0.011)	(0.012)	(0.013)	(0.014)	(0.014)
Nominal trade openness	0.013**	—	—	—	—	—
	(0.005)					
Real trade openness	—	0.0033**	—	—	—	—
		(0.0016)				
Economic globalisation	—	—	0.073***	—	—	—
			(0.017)			
Social globalisation	—	—	—	0.066***	—	—
				(0.018)		
Political globalisation	—	—	—	—	0.006	—
					(0.010)	
Overall globalisation	—	—	—	—	—	0.069***
						(0.019)
Observations	859	859	859	859	859	859
Number of countries	140	140	140	140	140	140
Cluster–robust Hausman	21.2	16.4	19.5	22.4	25.3	22.7
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]
R–squared (within)	0.093	0.090	0.149	0.136	0.084	0.129

Notes: The dependent variable is the redistribution. The cluster–robust Hausman test shows whether the results of the fixed effects or the random effects estimations are valid (null hypothesis: the difference in coefficients is not systematic, i.e., the fixed effects estimations are consistent). See Kaiser (2015) for details. We report the robust standard errors clustered at the country level. The standard errors are in parentheses and the *p*–values are in brackets. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

an example. In Indonesia, the economic globalisation index increased by 29.58 points over the period 1973–2012. Our regression coefficients predict that the inequality in Indonesia should have increased by 5.5 and redistribution should have increased by 2.15. The actual increase in inequality was 5.3, and in redistribution, it was 1.05.

Among the controls, both the per capita income and age dependency ratio are positively associated with both inequality and redistribution. Finally, the cluster–robust Hausman test (Kaiser, 2015) performed on the estimations in Tables 3 and 4 verify that the ordinary least squares fixed effects estimations are consistent.

Our result that economic and social globalisation indexes are positively associated with income inequality is consistent with the findings of Bergh and Nilsson (2010). The novel finding

of our paper is the positive relationship between globalisation and redistribution. While Rodrik (1998) showed that globalisation increases the role of state in providing insurance, here we are finding support for the view that globalisation increases the redistributive role of the government. The results are in line with the compensation hypothesis mentioned in Section 2.

While our measure of redistribution is the difference between market and net income inequality, we also examine the relationship between some other measures that may be related to the redistributive activities of governments. One such measure is the size of social expenditure relative to GDP. Unfortunately, this data is available only for OECD countries and the results for this smaller set of countries are provided in Table 5. We find a positive relationship between social expenditure and the KOF indexes of globalisation which is in line with previous studies (e.g., Potrafke, 2009).

We also examine the relationship between government size, which is available for a much larger set of countries, and globalisation, a much studied issue in the literature. As mentioned earlier, government size in these studies is measured by the share of government consumption in GDP.

TABLE 5 Social expenditures and globalisation in OECD countries (five-year averaged data)

Regressors	Social expenditures	Social expenditures	Social expenditures	Social expenditures	Social expenditures	Social expenditures
Constant term	−45.93***	−32.53**	−21.56*	2.462	−31.15***	6.455
	(16.32)	(14.50)	(12.66)	(11.83)	(11.38)	(9.598)
Per capita gross domestic product	6.727***	4.957***	3.041**	0.216	3.187***	1.416
	(1.498)	(1.318)	(1.303)	(1.386)	(1.095)	(1.151)
Age dependency ratio	−0.009	0.006	0.025	0.010	0.063	0.065
	(0.098)	(0.097)	(0.087)	(0.061)	(0.081)	(0.056)
Nominal trade openness	−0.023	–	—	—	—	—
	(0.016)					
Real trade openness	—	0.021	—	—	—	—
		(0.014)				
Economic globalisation	—	—	0.124***	—	—	—
			(0.045)			
Social globalisation	—	—	—	0.190***	—	—
				(0.043)		
Political globalisation	—	—	—	—	0.179***	—
					(0.047)	
Overall globalisation	—	—	—	—	—	0.313***
						(0.051)
Observations	207	207	207	207	207	207
Number of countries	34	34	34	34	34	34
R–squared (within)	0.329	0.333	0.375	0.460	0.466	0.522

Notes: The robust standard errors those are clustered at the country levels are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The results on the relationship between government size and globalisation are reported in Table 6. Government size is positively associated with nominal and real trade openness, but the coefficient of nominal openness fails to be statistically significant. As first noted by Alcala and Ciccone (2004), nominal trade openness overstates the extent of globalisation for poor countries, and if the relationship between globalisation and government size is stronger for rich countries, then we should expect a stronger relationship between real trade openness and government size than between nominal trade openness and government size. The result on the positive association between government size and openness is consistent with the result in Rodrik (1998) and Ram (2009). Among the KOF indexes of globalisation, only the index of political globalisation is significant but its sign is negative suggesting that greater political globalisation leads to smaller government size. These results are different from Meinhard and Potrafke (2012) who find a positive relationship between the KOF index of globalisation and government size. However, given the findings of Jetter and Parmeter (2015) regarding the sensitivity of the relationship between globalisation and government size, it is not surprising that our results based on a different data set differ from Meinhard and Potrafke (2012). More importantly, while government size may be a good proxy for capturing the extent of social insurance provided by the government, it is not likely to be good at capturing the extent of redistribution by the government. This is also borne out by the fact that the correlation between government size and our measure of redistribution is −0.054. This gives us confidence that our measure of redistribution is not simply a proxy for government size.

Having looked at the benchmark regressions and compared our results with the existing literature on government size and globalisation, we provide a host of robustness exercises below.

6 | ROBUSTNESS CHECKS

6.1 | Countries at different levels of economic development

Our first robustness exercise is to see if our results differ according to the level of development of countries. For this purpose, we divide our sample into two groups: high income and low income. We use the World Bank (2015) classification of the country and lending groups according to which our sample of high-income countries includes countries with per capita income greater than $4,125 in 2014 (84 countries) while low-income countries are those with per capita income below this amount (56 countries). The details of the classification are reported in the Data Appendix II.

Table 7a reports results for the low-income countries and Table 7b reports results for the high-income countries. We find that the positive relationship between globalisation and inequality as well as between globalisation and redistribution is driven primarily by the high-income countries. Even though the index of economic globalisation is positively associated with inequality in low-income countries, it does not lead to greater redistribution. The results suggest that governments in richer countries are more responsive to the issue of rising inequality associated with globalisation than in poorer countries.

Another way to divide countries by the level of development is to look at OECD versus non-OECD countries which is what we do in Table 8. Table 8a reports results for the non-OECD countries and Table 8b reports results for the-OECD countries. We observe that the positive relationship between globalisation and inequality as well as between globalisation and redistribution is much stronger for OECD countries than for non-OECD countries.

TABLE 6 Government size and globalisation (five-year averaged data)

Regressors	Government size (PWT 8.1)	Government size (PWT 8.1)	Government size (PWT 8.1)	Government size (PWT 8.1)	Government size (PWT 8.1)	Government size (PWT 8.1)
Constant term	35.55	18.18	32.53	33.35	35.57	30.41
	(27.28)	(17.11)	(27.65)	(29.81)	(26.10)	(28.60)
Per capita GDP	−2.989	−1.558	−1.658	−2.190	−0.565	−0.804
	(2.655)	(1.604)	(3.087)	(3.165)	(2.743)	(3.336)
Age dependency ratio	0.097	0.173**	0.056	0.076	−0.029	0.024
	(0.100)	(0.069)	(0.084)	(0.089)	(0.083)	(0.078)
Nominal trade openness	0.045	—	—	—	—	—
	(0.027)					
Real trade openness	—	0.062***	—	—	—	—
		(0.006)				
Economic globalisation	—	—	−0.044	—	—	—
			(0.076)			
Social globalisation	—	—	—	0.002	—	—
				(0.061)		
Political globalisation	—	—	—	—	−0.143**	—
					(0.055)	
Overall globalisation	—	—	—	—	—	−0.104
						(0.091)
Observations	859	859	859	859	859	859
Number of countries	140	140	140	140	140	140
R–squared (within)	0.042	0.247	0.034	0.033	0.070	0.041

Notes: The robust standard errors those are clustered at the country levels are in parentheses. *** and ** indicate statistical significance at the 1% and 5% levels, respectively.

6.2 | Sub-indexes of economic and social globalisation

Note that our results with the KOF indexes of economic and social globalisation are stronger than our results using nominal and real openness measures. To understand this better, we also look at the sub-indexes of the KOF index of economic globalisation which consists of "actual flows" and "restrictions". Table 9 reports results for the relationship between inequality and the sub-indexes of economic and social globalisation and Table 10 does the same for redistribution.[16]

Both the "actual flows" and "restrictions" turn out to be significantly related to inequality and redistribution. The result that "restrictions" are significantly correlated with inequality and redistribution gives us more confidence in our results because these restrictions affect the prices of traded goods directly and in that sense are more directly related to the mechanism outlined in the theoretical section of the paper. As far as the "actual flows" are concerned, we also separately used four of its sub-components: FDI stocks–GDP ratio, trade–GDP ratio, portfolio investment–GDP ratio

[16]These sub-indexes are available from the KOF website.

TABLE 7 (a) Benchmark regressions: low- and lower middle income economies. (b) benchmark regressions: upper middle- and high income economies

Regressors	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution
(a)												
Nominal trade openness	0.005	—	—	—	—	—	0.001	—	—	—	—	—
	(0.021)						(0.005)					
Real trade openness	—	—0.003	—	—	—	—	—	0.0012	—	—	—	—
		(0.002)						(0.005)				
Economic globalisation	—	—	0.134**	—	—	—	—	—	0.016	—	—	—
			(0.054)						(0.023)			
Social globalisation	—	—	—	0.103	—	—	—	—	—	0.013	—	—
				(0.080)						(0.031)		
Political globalisation	—	—	—	—	0.010	—	—	—	—	—	0.001	—
					(0.041)						(0.012)	
Overall globalisation	—	—	—	—	—	0.099	—	—	—	—	—	0.012
						(0.069)						(0.026)
Observations	286	286	286	286	286	286	286	286	286	286	286	286
Number of countries	56	56	56	56	56	56	56	56	56	56	56	56
R–squared (within)	0.011	0.015	0.048	0.020	0.011	0.025	0.001	0.001	0.006	0.002	0.001	0.003

(Continues)

TABLE 7 (Continued)

Regressors	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution
(b)												
Nominal trade openness	0.026*	—	—	—	—	—	0.013*	—	—	—	—	—
	(0.014)						(0.007)					
Real trade openness	—	0.026**	—	—	—	—	—	0.014**	—	—	—	—
		(0.010)						(0.006)				
Economic globalisation	—	—	0.187***	—	—	—	—	—	0.084***	—	—	—
			(0.034)						(0.020)			
Social globalisation	—	—	—	0.164***	—	—	—	—	—	0.061***	—	—
				(0.034)						(0.020)		
Political globalisation	—	—	—	—	0.076**	—	—	—	—	—	0.004	—
					(0.029)						(0.014)	
Overall globalisation	—	—	—	—	—	0.217***	—	—	—	—	—	0.075***
						(0.037)						(0.023)
Observations	573	573	573	573	573	573	573	573	573	573	573	573
Number of countries	84	84	84	84	84	84	84	84	84	84	84	84
R–squared (within)	0.159	0.168	0.267	0.250	0.178	0.270	0.147	0.156	0.213	0.183	0.139	0.184

Notes: The constant term, the per capita gross domestic product and the age dependency ratio are also estimated, but their coefficients are not reported. The robust standard errors those are clustered at the country levels are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 8 (a) Benchmark regressions: non-OECD countries (b) benchmark regressions: OECD countries

Regressors	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution
(a)												
Nominal trade openness	0.021	—	—	—	—	—	0.003	—	—	—	—	—
	(0.013)						(0.003)					
Real trade openness	—	—0.003	—	—	—	—	—	0.0006	—	—	—	—
		(0.021)						(0.0004)				
Economic globalisation	—	—	0.166***	—	—	—	—	—	0.018*	—	—	—
			(0.040)						(0.009)			
Social globalisation	—	—	—	0.192***	—	—	—	—	—	0.011	—	—
				(0.047)						(0.012)		
Political globalisation	—	—	—	—	0.050*	—	—	—	—	—	0.002	—
					(0.029)						(0.008)	
Overall globalisation	—	—	—	—	—	0.175***	—	—	—	—	—	0.014
						(0.048)						(0.014)
Observations	583	583	583	583	583	583	583	583	583	583	583	583
Number of countries	106	106	106	106	106	106	106	106	106	106	106	106
R–squared (within)	0.014	0.008	0.081	0.083	0.024	0.076	0.005	0.004	0.013	0.006	0.003	0.008

(Continues)

TABLE 8 (Continued)

Regressors	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution
(b)												
Nominal trade openness	0.014	—	—	—	—	—	0.013	—	—	—	—	—
	(0.023)						(0.016)					
Real trade openness	—	0.024	—	—	—	—	—	0.008	—	—	—	—
		(0.016)						(0.011)				
Economic globalisation	—	—	0.165***	—	—	—	—	—	0.097**	—	—	—
			(0.049)						(0.039)			
Social globalisation	—	—	—	0.108*	—	—	—	—	—	0.053	—	—
				(0.058)						(0.043)		
Political globalisation	—	—	—	—	0.057	—	—	—	—	—	0.006	—
					(0.045)						(0.031)	
Overall globalisation	—	—	—	—	—	0.192***	—	—	—	—	—	0.092*
						(0.063)						(0.053)
Observations	276	276	276	276	276	276	276	276	276	276	276	276
Number of countries	34	34	34	34	34	34	34	34	34	34	34	34
R–squared (within)	0.279	0.291	0.350	0.312	0.288	0.341	0.268	0.268	0.313	0.281	0.265	0.293

Notes: The constant term, the per capita gross domestic product and the age dependency ratio are also estimated, but their coefficients are not reported. The robust standard errors those are clustered at the country levels are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

and income payments to foreigners–GDP ratio.[17] We find two of these (trade–GDP ratio and portfolio investment–GDP ratio) to be significantly related to inequality and redistribution but the other two are not.[18] The trade–GDP ratio here is from the World Bank and is an alternative source of nominal openness that we used from the PWT in our regressions in Tables 3–8. The coefficients of trade–GDP ratio in Tables 9 and 10 are of similar orders of magnitude to the coefficients of nominal openness in Tables 3 and 4.

In Tables 9 and 10, we also use the three sub-indexes of the KOF index of social globalisation available from the KOF website. All three sub-indexes are positively and significantly correlated with inequality and redistribution.

6.3 | Results with balanced panel

Since our panel data set with 140 countries is unbalanced with only a few observations for some countries, Tables 11 and 12 present the results of the benchmark regression with a balanced panel. The sample size is much smaller with only 42 countries and 378 observations. The results with the KOF indexes of globalisation are similar to those for the benchmark regressions. All of the indexes are positively associated with inequality and the coefficients are statistically significant. As was the case in Table 4, the KOF indexes except for the index of political globalisation are positively associated with redistribution with the coefficients being statistically significant. Both the trade openness measures are positively associated with inequality and redistribution, but the coefficients are not statistically significant.

6.4 | Results with annual data

Our next robustness check involves running benchmark regressions with annual data and the results are reported in Tables 13 and 14. The only difference from the regressions reported in Tables 3 and 4 is that instead of using the current value of the globalisation variables we use one-year lagged value of it. This is to alleviate the problem of reverse causality affecting the estimates as is highlighted by Potrafke (2015). The results for the KOF indexes of globalisation are qualitatively similar to those obtained in the benchmark regressions in Tables 3 and 4. The results, however, are different for trade openness measures. Even though both measures of trade openness are positively associated with inequality and redistribution, the coefficients are not statistically significant.

6.5 | Robustness to the inclusion of other controls

Recall that our benchmark model includes the log real GDP per capita and the age dependency ratio as controls. Our next set of robustness checks involves adding other controls commonly used in the related literature. The results are reported in Table 15. Rather than adding all these controls at the same time, we first add the controls in such a way that our estimating

[17]Since the KOF website does not provide data on these four sub-indexes, we collected this data ourselves from the sources cited on the KOF website. Therefore, there could be some discrepancy between the data that went into the construction of the KOF index and the data that we use in running our regressions.

[18]Our finding of a positive correlation between inequality and portfolio investment to GDP ratio is consistent with similar evidence in the literature. Freeman (2010) finds a positive correlation between inequality and portfolio flows. Dabla-Norris et al. (2015) find a positive correlation between inequality and financial openness measured by the sum of foreign assets and liabilities relative to GDP. A possible explanation is the concentration of foreign assets in skill-intensive industries raising the relative demand for skilled labour.

TABLE 9 Benchmark regressions for market Gini: sub-indexes of economic and social globalisation (five-year averaged data)

Regressors	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini	Market Gini
Trade (% of GDP)	0.031***	—	—	—	—	—	—	—	—
	(0.011)								
Fdi stocks (% of GDP)	—	0.004	—	—	—	—	—	—	—
		(0.004)							
Portfolio investments (% of GDP)	—	—	0.002*	—	—	—	—	—	—
			(0.001)						
Income payments to foreign nationals (% of GDP)	—	—	—	0.029	—	—	—	—	—
				(0.031)					
Actual flows (index)	—	—	—	—	0.135***	—	—	—	—
					(0.019)				
Restrictions (index)	—	—	—	—	—	0.107***	—	—	—
						(0.029)			
Data on personal contact (index)	—	—	—	—	—	—	0.208***	—	—
							(0.059)		
Data on information flows (index)	—	—	—	—	—	—	—	0.084***	—
								(0.023)	
Data on cultural proximity (index)	—	—	—	—	—	—	—	—	0.077***
									(0.015)
Observations	749	830	425	717	859	845	859	859	859
Number of countries	140	140	115	139	140	136	140	140	140
R–squared (within)	0.042	0.062	0.183	0.041	0.157	0.099	0.096	0.092	0.133

Notes: The constant term, the per capita gross domestic product and the age dependency ratio are also estimated, but their coefficients are not reported. The robust standard errors those are clustered at the country levels are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 10 Benchmark regressions for redistribution: sub-indexes of economic and social globalisation (five-year averaged data)

Regressors	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution
Trade (% of GDP)	0.015***	—	—	—	—	—	—	—	—
	(0.005)								
FDI stocks (% of GDP)	—	0.001	—	—	—	—	—	—	—
		(0.001)							
Portfolio investments (% of GDP)	—	—	0.0012*	—	—	—	—	—	—
			(0.0006)						
Income payments to foreign nationals (% of GDP)	—	—	—	0.017	—	—	—	—	—
				(0.011)					
Actual flows (index)	—	—	—	—	0.054***	—	—	—	—
					(0.011)				
Restrictions (index)	—	—	—	—	—	0.038**	—	—	—
						(0.015)			
Data on personal contact (index)	—	—	—	—	—	—	0.057**	—	—
							(0.026)		

(Continues)

TABLE 10 (Continued)

Regressors	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution	Redistribution
Data on information flows (index)	—	—	—	—	—	—	—	0.023**	—
								(0.011)	
Data on cultural proximity (index)	—	—	—	—	—	—	—	—	0.032**
									(0.009)
Observations	749	749	425	717	859	845	859	859	859
Number of countries	140	140	115	139	140	136	140	140	140
R–squared (within)	0.071	0.071	0.123	0.043	0.150	0.105	0.096	0.094	0.140

Notes: The constant term, the per capita gross domestic product and the age dependency ratio are also estimated, but their coefficients are not reported. The robust standard errors those are clustered at the country levels are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 11 Benchmark regression: dependent variable market Gini (balanced panel and five-year averaged data)

Regressors	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	FE (6)
Constant term	−7.976	−5.529	6.938	16.06	−7.447	13.59
	(15.41)	(13.38)	(12.08)	(12.37)	(12.60)	(11.74)
Per capita gross domestic product	5.171***	4.783***	1.918	1.296	4.288***	0.564
	(1.738)	(1.416)	(1.414)	(1.502)	(1.325)	(1.450)
Age dependency ratio	0.063*	0.067*	0.116***	0.110**	0.106***	0.155***
	(0.037)	(0.039)	(0.038)	(0.041)	(0.036)	(0.038)
Nominal trade openness	0.005	—	—	—	—	—
	(0.021)					
Real trade openness	—	0.021	—	—	—	—
		(0.016)				
Economic globalisation	—	—	0.212***	—	—	—
			(0.046)			
Social globalisation	—	—	—	0.176***	—	—
				(0.052)		
Political globalisation	—	—	—	—	0.073*	—
					(0.040)	
Overall globalisation	—	—	—	—	—	0.263***
						(0.055)
Observations	378	378	378	378	378	378
Number of countries	42	42	42	42	42	42
R–squared (within)	0.217	0.228	0.336	0.312	0.237	0.343

Notes: The dependent variable is the Gini index of market income. We report the robust standard errors clustered at the country level. The standard errors are in parentheses and the *p*–values are in brackets. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

equation becomes comparable to the benchmark regression in another paper. When we add log population as a control to our benchmark regression, the estimating equation becomes the benchmark regression in Meinhard and Potrafke (2012). When we add the level of human capital to our benchmark regression, our estimating equation becomes the benchmark model of Bergh and Nilsson (2010). When we add the urbanisation rate to our benchmark regression, our estimating equation becomes the benchmark regression in Rodrik (1998). To facilitate comparison we also present the results of our benchmark regression at the top of Table 15. It is easily verified that the results for the KOF indexes of globalisation are robust to the inclusion of these controls. As was noted in the regressions with annual data and balanced panel, the coefficients of trade openness always have the positive sign but are not always statistically significant.

We also consider various measures of institutional quality which can affect the level of income inequality and redistribution. In particular, following Bergh and Nilsson (2010), we add the civil liberties index from the freedom in the world database; following Dreher and Gaston (2008) we add the democracy index from the Polity IV data set; following Rodrik (1998) we add an index of overall institutional quality based on the constraint on the executive power from the Polity IV data

TABLE 12 Benchmark regression: dependent variable redistribution (balanced panel and five-year averaged data)

Regressors	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	FE (6)
Constant term	−17.56**	−17.08**	−9.766	−6.150	−19.44***	−8.850
	(8.040)	(7.313)	(6.925)	(6.762)	(7.547)	(7.274)
Per capita gross domestic product	2.573***	2.505***	0.807	0.738	2.970***	0.647
	(0.858)	(0.741)	(0.802)	(0.792)	(0.791)	(0.935)
Age dependency ratio	0.044**	0.044**	0.073***	0.066***	0.036	0.084***
	(0.017)	(0.017)	(0.017)	(0.018)	(0.023)	(0.022)
Nominal trade openness	0.010	—	—	—	—	—
	(0.010)					
Real trade openness	—	0.014	—	—	—	—
		(0.009)				
Economic globalisation	—	—	0.128***	—	—	—
			(0.030)			
Social globalisation	—	—	—	0.093***	—	—
				(0.031)		
Political globalisation	—	—	—	—	−0.008	—
					(0.024)	
Overall globalisation	—	—	—	—	—	0.123***
						(0.042)
Observations	378	378	378	378	378	378
Number of countries	42	42	42	42	42	42
R–squared (within)	0.156	0.166	0.264	0.221	0.153	0.223

Notes: The dependent variable is the redistribution. We report the robust standard errors clustered at the country level. The standard errors are in parentheses and the *p*–values are in brackets. *** and ** indicate statistical significance at the 1% and 5% levels, respectively.

set. Following Rodrik (1998), we consider the consumer price-linked inflation rate as a potential control because inflation is like a tax and also has redistributive implications. Finally, following Rodrik (1998) we also use the diversification of exports as a control. The idea behind this control in Rodrik (1998) is that countries with more diversified export baskets are less vulnerable to external shocks and therefore, there is less need for governments to provide protection against external shocks. Note that this argument is less compelling for redistribution which is our focus, but we do this anyway as a robustness exercise. The results in all these cases show a pattern similar to the one observed in the previous paragraph. The results for the KOF indexes of globalisation are robust, but not for the measures of trade openness.

6.6 | Robustness to outliers

Our next set of robustness exercises involves excluding extreme observations for inequality, redistribution and measures of globalisation. Following Bergh and Nilsson (2010), we define the

TABLE 13 Regressions with annual data: dependent variable market Gini

Regressors	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	FE (6)
Constant term	8.347	8.439	13.49	19.47**	8.038	15.12*
	(9.715)	(9.747)	(8.649)	(8.018)	(9.361)	(8.494)
Per capita gross domestic product	3.625***	3.621***	1.542*	0.999	3.164***	1.017
	(0.973)	(0.969)	(0.922)	(0.820)	(0.973)	(0.933)
Age dependency ratio	0.071**	0.071**	0.136***	0.140***	0.100***	0.163***
	(0.035)	(0.035)	(0.031)	(0.034)	(0.035)	(0.033)
Lagged nominal trade openness	0.0017	—	—	—	—	—
	(0.007)					
Lagged real trade openness	—	0.0014	—	—	—	—
		(0.001)				
Lagged economic globalisation	—	—	0.165***	—	—	—
			(0.027)			
Lagged social globalisation	—	—	—	0.162***	—	—
				(0.031)		
Lagged political globalisation	—	—	—	—	0.039	—
					(0.025)	
Lagged overall globalisation	—	—	—	—	—	0.188***
						(0.036)
Observations	3,333	3,333	3,424	3,424	3,424	3,424
Number of countries	137	137	137	137	137	137
R–squared (within)	0.070	0.070	0.153	0.152	0.079	0.150

Notes: The dependent variable is the Gini index of market income. We report the robust standard errors clustered at the country level. The standard errors are in parentheses and the *p*–values are in brackets. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

extreme observations as those which are more than two standard deviations away from the average. Again, as shown in Table 16, the results are robust when globalisation is measured by the KOF indexes, but not necessarily for openness to trade.

Rodrik (1998) contends that the effect of globalisation on government size can be region-specific, and therefore, he uses the region-specific dummies for Latin America, East Asia and sub-Saharan Africa countries in his cross-sectional data estimations. Since we have panel data where we use country fixed effects, we cannot use regional dummies. Following the spirit of the exercise in Rodrik (1998), Bergh and Nilsson (2010) separately exclude the observations for the Latin America, developing East Asia and the sub-Saharan African countries to see the robustness of their

TABLE 14 Regressions with annual data: dependent variable redistribution

Regressors	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	FE (6)
Constant term	−11.53***	−11.44**	−9.691**	−7.496**	−11.96**	−9.346**
	(4.718)	(4.732)	(4.000)	(3.751)	(4.554)	(4.009)
Per capita GDP	1.894***	1.918***	1.082***	0.934**	1.914***	0.991**
	(0.493)	(0.498)	(0.434)	(0.387)	(0.475)	(0.425)
Age dependency ratio	0.029**	0.028**	0.056***	0.056***	0.033**	0.063***
	(0.012)	(0.012)	(0.012)	(0.013)	(0.015)	(0.015)
Lagged nominal trade openness	0.0037	—	—	—	—	—
	(0.0026)					
Lagged real trade openness	—	0.0005	—	—	—	—
		(0.0005)				
Lagged economic globalisation	—	—	0.071***	—	—	—
			(0.015)			
Lagged social globalisation	—	—	—	0.064***	—	—
				(0.017)		
Lagged political globalisation	—	—	—	—	0.005	—
					(0.011)	
Lagged overall globalisation	—	—	—	—	—	0.071***
						(0.019)
Observations	3,333	3,333	3,424	3,424	3,424	3,424
Number of countries	137	137	137	137	137	137
R–squared (within)	0.080	0.078	0.141	0.132	0.084	0.126

Notes: The dependent variable is the redistribution. We report the robust standard errors clustered at the country level. The standard errors are in parentheses and the *p*–values are in brackets. *** and ** indicate statistical significance at the 1% and 5% levels, respectively.

findings. We follow Bergh and Nilsson (2010) and re-estimate our benchmark regressions by excluding observations from Latin America and the Caribbean, East Asia and sub-Saharan Africa, one region at time. The results, shown in Table 16, are robust to the exclusion of these regions for the KOF indexes of globalisation but not necessarily for trade openness. In other words, our results in the benchmark regressions are not driven by the presence of observations from any one of these regions.

Finally, instead of having the age dependency ratio as the control as in our benchmark model, we consider the log population as the control as in the benchmark models of Ram (2009), and Jetter and Parmeter (2015), and report the results in Table 17. As well, following Ram (2009) we

TABLE 15 Sensitivity analysis: (including additional controls, five-year averaged data)

Sensitivity analysis	Coefficients	Market Gini	Redistribution
Results of the benchmark regressions	Nominal trade openness	0.029**	0.013**
		(0.012)	(0.005)
	Real trade openness	0.0039	0.0033**
		(0.004)	(0.0016)
	Economic globalisation	0.188***	0.073***
		(0.030)	(0.017)
	Social globalisation	0.178***	0.066***
		(0.032)	(0.018)
	Political globalisation	0.058**	0.006
		(0.025)	(0.010)
	Overall globalisation	0.206***	0.069***
		(0.035)	(0.019)
Including log population: benchmark model of Meinhard and Potrafke (2012)	Nominal trade openness	0.030**	0.013**
		(0.012)	(0.005)
	Real trade openness	0.0038	0.0034**
		(0.004)	(0.0017)
	Economic globalisation	0.192***	0.072***
		(0.032)	(0.016)
	Social globalisation	0.180***	0.066***
		(0.033)	(0.018)
	Political globalisation	0.073***	0.004
		(0.026)	(0.011)
	Overall globalisation	0.220***	0.069***
		(0.036)	(0.020)
Including human capital level: benchmark model of Bergh and Nilsson (2010)	Nominal trade openness	0.021*	0.010*
		(0.012)	(0.006)
	Real trade openness	0.0033	0.0020
		(0.003)	(0.0015)
	Economic globalisation	0.204***	0.070***
		(0.036)	(0.018)
	Social globalisation	0.204***	0.053***
		(0.039)	(0.020)
	Political globalisation	0.052**	−0.010
		(0.026)	(0.011)
	Overall globalisation	0.249***	0.057***
		(0.043)	(0.021)

(Continues)

TABLE 15 (Continued)

Sensitivity analysis	Coefficients	Market Gini	Redistribution
Including urbanisation rate: benchmark model of Rodrik (1998)	Nominal trade openness	0.029**	0.014***
		(0.011)	(0.005)
	Real trade openness	0.004	0.0036**
		(0.004)	(0.0017)
	Economic globalisation	0.197***	0.080***
		(0.031)	(0.016)
	Social globalisation	0.189***	0.074***
		(0.033)	(0.018)
	Political globalisation	0.060**	0.009
		(0.024)	(0.010)
	Overall globalisation	0.222***	0.079***
		(0.036)	(0.019)
Including civil liberties (index)	Nominal trade openness	0.027**	0.013**
		(0.011)	(0.005)
	Real trade openness	0.003	0.0031**
		(0.0035)	(0.0015)
	Economic globalisation	0.191***	0.075***
		(0.031)	(0.016)
	Social globalisation	0.178***	0.069***
		(0.033)	(0.018)
	Political globalisation	0.054**	−0.001
		(0.024)	(0.009)
	Overall globalisation	0.212***	0.070***
		(0.036)	(0.018)
Including democracy (index)	Nominal trade openness	0.025**	0.012**
		(0.012)	(0.005)
	Real trade openness	0.0035	0.0031*
		(0.003)	(0.0016)
	Economic globalisation	0.188***	0.071***
		(0.032)	(0.016)
	Social globalisation	0.178***	0.063***
		(0.033)	(0.017)
	Political globalisation	0.059**	0.004
		(0.025)	(0.010)
	Overall globalisation	0.211***	0.066***
		(0.036)	(0.018)
Including institutional quality	Nominal trade openness	0.026**	0.012**

(Continues)

TABLE 15 (Continued)

Sensitivity analysis	Coefficients	Market Gini	Redistribution
		(0.012)	(0.005)
	Real trade openness	0.0038	0.0033**
		(0.0035)	(0.0016)
	Economic globalisation	0.191***	0.074***
		(0.031)	(0.016)
	Social globalisation	0.180***	0.066***
		(0.033)	(0.018)
	Political globalisation	0.062**	0.006
		(0.024)	(0.010)
	Overall globalisation	0.213***	0.070***
		(0.035)	(0.018)
Including inflation rate	Nominal trade openness	0.027**	0.014**
		(0.013)	(0.006)
	Real trade openness	0.0042	0.0034**
		(0.0036)	(0.0015)
	Economic globalisation	0.185***	0.079***
		(0.033)	(0.018)
	Social globalisation	0.162***	0.069***
		(0.035)	(0.020)
	Political globalisation	0.041	0.009
		(0.030)	(0.013)
	Overall globalisation	0.203***	0.082***
		(0.043)	(0.024)
Including diversification of exports	Nominal trade openness	0.032**	0.014**
		(0.014)	(0.006)
	Real trade openness	0.0041	0.0035**
		(0.004)	(0.0017)
	Economic globalisation	0.197***	0.077***
		(0.030)	(0.016)
	Social globalisation	0.183***	0.070***
		(0.032)	(0.018)
	Political globalisation	0.060**	0.007
		(0.026)	(0.010)
	Overall globalisation	0.216***	0.074***
		(0.035)	(0.019)

Notes: The constant term, per capita gross domestic product and the age dependency ratio are also estimated, but their coefficients are not reported. The robust standard errors those are clustered at the country levels are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 16 Sensitivity analysis: (different cases, five-year averaged data)

Sensitivity analysis	Coefficients	Market Gini	Redistribution
Results of the benchmark regressions	Nominal trade openness	0.029**	0.013**
		(0.012)	(0.005)
	Real trade openness	0.0039	0.0033**
		(0.004)	(0.0016)
	Economic globalisation	0.188***	0.073***
		(0.030)	(0.017)
	Social globalisation	0.178***	0.066***
		(0.032)	(0.018)
	Political globalisation	0.058**	0.006
		(0.025)	(0.010)
	Overall globalisation	0.206***	0.069***
		(0.035)	(0.019)
Excluding extreme units of inequality and redistribution measures	Nominal trade openness	0.027**	0.0076**
		(0.011)	(0.0038)
	Real trade openness	0.0031	0.0024**
		(0.0033)	(0.0012)
	Economic globalisation	0.181***	0.048***
		(0.030)	(0.017)
	Social globalisation	0.173***	0.051***
		(0.033)	(0.018)
	Political globalisation	0.069***	−0.003
		(0.023)	(0.008)
	Overall globalisation	0.209***	0.043**
		(0.035)	(0.018)
Excluding extreme units of globalisation measures	Nominal trade openness	0.039***	0.015**
		(0.014)	(0.006)
	Real trade openness	0.041***	0.021***
		(0.010)	(0.005)
	Economic globalisation	0.194***	0.082***
		(0.030)	(0.016)
	Social globalisation	0.181***	0.067***
		(0.032)	(0.018)
	Political globalisation	0.040	0.005
		(0.028)	(0.011)
	Overall globalisation	0.210***	0.072***
		(0.036)	(0.019)

(Continues)

TABLE 16 (Continued)

Sensitivity analysis	Coefficients	Market Gini	Redistribution
Excluding sub-Saharan Africa countries	Nominal trade openness	0.032**	0.015**
		(0.013)	(0.006)
	Real trade openness	0.0041	0.0035**
		(0.0035)	(0.0016)
	Economic globalisation	0.198***	0.089***
		(0.030)	(0.018)
	Social globalisation	0.186***	0.070***
		(0.033)	(0.019)
	Political globalisation	0.095***	0.010
		(0.025)	(0.012)
	Overall globalisation	0.237***	0.082***
		(0.034)	(0.021)
Excluding Latin American and Caribbean countries	Nominal trade openness	0.031**	0.014**
		(0.013)	(0.006)
	Real trade openness	0.032***	0.015**
		(0.011)	(0.006)
	Economic globalisation	0.197***	0.072***
		(0.033)	(0.017)
	Social globalisation	0.173***	0.065***
		(0.034)	(0.019)
	Political globalisation	0.058**	0.006
		(0.027)	(0.011)
	Overall globalisation	0.212***	0.068***
		(0.038)	(0.020)
Excluding developing east Asian countries	Nominal trade openness	0.035***	0.017***
		(0.012)	(0.006)
	Real trade openness	0.0041	0.0033*
		(0.004)	(0.0017)
	Economic globalisation	0.197***	0.073***
		(0.031)	(0.017)
	Social globalisation	0.183***	0.070***
		(0.033)	(0.019)
	Political globalisation	0.057**	0.007
		(0.025)	(0.010)
	Overall globalisation	0.211***	0.071***
		(0.036)	(0.019)

Notes: The constant term, per capita gross domestic product and the age dependency ratio are also estimated, but their coefficients are not reported. The robust standard errors those are clustered at the country levels are in parentheses. *** and ** indicate statistical significance at the 1% and 5% levels, respectively.

also add the urbanisation rate and the log population density as additional controls. Again, the results with the KOF indexes of globalisation are similar to those for the benchmark regressions but not necessarily for the measures of trade openness.

To sum up, our robustness exercises reveal that the KOF indexes of economic and social globalisation as well as the overall index are positively associated with inequality and redistribution as is the case in the benchmark regressions in Tables 3 and 4. As far as the nominal and real trade openness are concerned, they are always positively associated with inequality and redistribution, but their coefficients are not always statistically significant.

Why do we get stronger results for the KOF index of economic globalisation than the standard measure of openness, trade–GDP ratio? It is possible that the KOF index captures some aspects of globalisation that are missing from the traditional trade–GDP ratio. Recall that trade–GDP ratio is one component of KOF index of economic globalisation, (it gets about 11% weight in this index) but it has several other components and we found some of them to be individually significant in explaining inequality and redistribution (Tables 9 and 10). There is also reason to believe that trade–GDP ratio may be understating the growing importance of trade in the world economy. For example, Feenstra and Hanson (2003, p. 149) say: "But the ratio of trade to GDP does not tell the whole story. All industrial countries have had increasing shares of their economies devoted to services rather than merchandise (i.e., manufacturing, mining and agriculture). To make a better comparison of trade with overall production, we should measure merchandise goods in both the numerator and the denominator—that is compare merchandise trade to merchandise value-added." Feenstra (1998) computes merchandise trade to merchandise value-added ratio for some rich countries and shows this to be much higher (both in levels and growth rates) than the trade–GDP ratio. It is conceivable that this downward bias in the trade–GDP ratio has something to do with us obtaining a smaller coefficient for this variable than for the KOF index of economic globalisation.

Even though we have provided a battery of robustness exercises to show that the relationship between globalisation, inequality and redistribution is robust, we have not addressed the endogeneity issue in the paper and therefore cannot claim causality running from globalisation to inequality and redistribution. Our estimates provide a conditional correlation between globalisation, inequality and redistribution which is consistent with the theoretical model. It is hard to find an instrument for globalisation index that satisfies the exclusion restrictions. However, as pointed out by the survey of Potrafke (2015), some recent studies have attempted to address the issue of endogeneity of the KOF index of globalisation.[19]

Before ending this section it is also worth pointing out that empirical analysis based on cross-country data is fraught with comparability issues which is particularly relevant for inequality data. Even though we have tried to use a high-quality inequality data, the results in the paper are subject to the standard caveat of data quality and measurement errors applicable to any cross-country study.

7 | CONCLUSION

We have theoretically and empirically studied the implications of globalisation for inequality and redistribution. Using a comprehensive measure of the extent of redistribution, we find that as economies become more globalised they redistribute more. Our measure of redistribution is the difference between pre-tax/transfer Gini and post-tax/transfer Gini, which is a novel approach to

[19]See, e.g., Potrafke (2013), Vadlamannati (2015), and Eppinger and Potrafke (2016).

TABLE 17 Comparison with Ram (2009) and Jetter and Parmeter (2015)

Models	Coefficients	Market Gini	Redistribution
Benchmark regression of Ram (2009) and Jetter and Parmeter (2015): (per capita GDP plus log population)	Nominal trade openness	0.025*	0.011*
		(0.012)	(0.005)
	Real trade openness	0.0022	0.0025*
		(0.0034)	(0.0015)
	Economic globalisation	0.162***	0.059***
		(0.036)	(0.017)
	Social globalisation	0.150***	0.052***
		(0.033)	(0.018)
	Political globalisation	0.057**	−0.002
		(0.025)	(0.011)
	Overall globalisation	0.176***	0.051***
		(0.040)	(0.019)
Including urbanisation rate	Nominal trade openness	0.026**	0.012**
		(0.011)	(0.005)
	Real trade openness	0.0027	0.0034**
		(0.0036)	(0.0016)
	Economic globalisation	0.180***	0.073***
		(0.031)	(0.016)
	Social globalisation	0.172***	0.068***
		(0.031)	(0.018)
	Political globalisation	0.061**	0.002
		(0.024)	(0.011)
	Overall globalisation	0.201***	0.068***
		(0.035)	(0.019)
Including (urbanisation rate plus log population density)	Nominal trade openness	0.027**	0.014**
		(0.012)	(0.006)
	Real trade openness	0.0025	0.0038**
		(0.0037)	(0.0018)
	Economic globalisation	0.195***	0.075***
		(0.031)	(0.016)
	Social globalisation	0.188***	0.075***
		(0.032)	(0.018)
	Political globalisation	0.064***	0.001

(Continues)

TABLE 17 (Continued)

Models	Coefficients	Market Gini	Redistribution
		(0.024)	(0.011)
	Overall globalisation	0.216***	0.071***
		(0.035)	(0.019)

Notes: The constant term, per capita gross domestic product and the log population are also estimated, but their coefficients are not reported. The robust standard errors those are clustered at the country levels are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

measuring redistribution. The results, particularly with respect to the KOF index of economic globalisation, are robust to the inclusion of a variety of controls and to the exclusion of outliers. The result that the positive relationship between globalisation and redistribution is stronger for richer countries is in line with the earlier findings in the literature of a positive association between globalisation and social expenditure for OECD countries. An implication is that in the absence of redistributive measures by the government, particularly in welfare states where governments may be more responsive to the needs of their subjects, globalisation would have raised the effective inequality even more. The results in this paper are consistent with the compensation hypothesis which suggests a positive relationship between globalisation and the size of government in contrast to the efficiency effect which suggests the opposite. While the compensation hypothesis, as expounded by Rodrik (1998) was based on the idea of government providing greater welfare expenditure to mitigate the additional risk arising from greater volatility associated with globalisation, here we broaden the compensation hypothesis to include additional redistributive expenditure arising in response to greater inequality.

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THEORETICAL APPENDIX

PROOF OF RESULT 1

Using the definition:

$$Z = A\left(\omega\left(L^{\frac{\sigma-1}{\sigma}} + M^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}\frac{\chi-1}{\chi}} + (1-\omega)H^{\frac{\chi-1}{\chi}}\right)^{\frac{\chi}{\chi-1}},$$

the first-order conditions are given by:

$$L : \Gamma\omega\left(L^{\frac{\sigma-1}{\sigma}} + M^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}\frac{\chi-1}{\chi}-1} L^{\frac{-1}{\sigma}} = w, \tag{A1}$$

$$M : \Gamma\omega\left(L^{\frac{\sigma-1}{\sigma}} + M^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}\frac{\chi-1}{\chi}-1} M^{\frac{-1}{\sigma}} = \phi, \tag{A2}$$

$$H : \Gamma(1-\omega)H^{-\frac{1}{\chi}} = r. \tag{A3}$$

where we use the compact notation: $\Gamma \equiv A\left(\omega\left(L^{\frac{\sigma-1}{\sigma}} + M^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}\frac{\chi-1}{\chi}} + (1-\omega)H^{\frac{\chi-1}{\chi}}\right)^{\frac{\chi}{\chi-1}-1}$.

From Equation (A1) and (A2) we obtain:

$$M = L\left(\frac{w}{\phi}\right)^{\sigma}. \tag{A4}$$

Next, using Equation (A4) re-write Equations (A1) and (A3) as:

$$\Gamma\omega\left(1 + \left(\frac{w}{\phi}\right)^{\sigma-1}\right)^{\frac{\sigma}{\sigma-1}\frac{\chi-1}{\chi}-1} L^{-\frac{1}{\chi}} = w, \tag{A5}$$

$$\Gamma(1-\omega)H^{-\frac{1}{\chi}} = r. \tag{A6}$$

Therefore:

$$\frac{r}{w}=\frac{(1-\omega)}{\omega}\left(1+\left(\frac{w}{\phi}\right)^{\sigma-1}\right)^{\frac{\sigma-\chi}{(\sigma-1)\chi}}\left(\frac{H}{L}\right)^{-\frac{1}{\chi}}. \tag{A7}$$

Take the log of both sides of Equation (A7) and then differentiate with respect to ϕ to obtain:

$$\frac{\mathrm{d}\log\left(\frac{r}{w}\right)}{\mathrm{d}\phi}=\frac{(\sigma-\chi)}{\phi\chi}\frac{\left(\frac{w}{\phi}\right)^{\sigma-1}\left(\frac{\phi}{w}\frac{\mathrm{d}w}{\mathrm{d}\phi}-1\right)}{\left(1+\left(\frac{w}{\phi}\right)^{\sigma-1}\right)}. \tag{A8}$$

Re-write the above as:

$$\frac{\mathrm{d}\log\left(\frac{r}{w}\right)}{\mathrm{d}\phi}=\frac{(\sigma-\chi)}{\phi\chi}\Omega\left(\varepsilon_{w\phi}-1\right). \tag{A9}$$

where we use the compact notation: $\Omega\equiv(w/\phi)^{\sigma-1}/1+(w/\phi)^{\sigma-1}$; $\varepsilon_{w\phi}\equiv\phi/w\cdot\mathrm{d}w/\mathrm{d}\phi$. Clearly, $0<\Omega<1$. Therefore, the sign depends on $(\sigma-\chi)$ and the elasticity of wage with respect to ϕ : $\varepsilon_{w\phi}$.

Next, we obtain the expression for $\varepsilon_{w\phi}$ as follows. Substituting out M in Equation (A5) using Equation (A4) we obtain:

$$\omega A\left(1+\left(\frac{w}{\phi}\right)^{\sigma-1}\right)^{\frac{\sigma}{\sigma-1}\frac{\chi-1}{\chi}-1}\left(\omega\left(1+\left(\frac{w}{\phi}\right)^{\sigma-1}\right)^{\frac{\sigma}{\sigma-1}\frac{\chi-1}{\chi}}L^{\frac{\chi-1}{\chi}}+(1-\omega)H^{\frac{\chi-1}{\chi}}\right)^{\frac{\chi}{\chi-1}-1}L^{-\frac{1}{\chi}}=w. \tag{A10}$$

Take the log of both sides and obtain:

$$\log w=\left(\frac{\chi-\sigma}{(\sigma-1)\chi}\right)\log\left(1+\left(\frac{w}{\phi}\right)^{\sigma-1}\right)+\left(\frac{1}{\chi-1}\right)\log\left(\omega\left(1+\left(\frac{w}{\phi}\right)^{\sigma-1}\right)^{\frac{\sigma}{\sigma-1}\frac{\chi-1}{\chi}}L^{\frac{\chi-1}{\chi}}+(1-\omega)H^{\frac{\chi-1}{\chi}}\right)+\text{constant}. \tag{A11}$$

It follows that:

$$\varepsilon_{w\phi}=\left(\varepsilon_{w\phi}-1\right)\left(\frac{\chi-\sigma(1-\Psi)}{\chi}\right)\Omega, \tag{A12}$$

where:

$$\Psi\equiv\frac{\omega\left(1+\left(\frac{w}{\phi}\right)^{\sigma-1}\right)^{\frac{\sigma}{\sigma-1}\frac{\chi-1}{\chi}}L^{\frac{\chi-1}{\chi}}}{\left(\omega\left(1+\left(\frac{w}{\phi}\right)^{\sigma-1}\right)^{\frac{\sigma}{\sigma-1}\frac{\chi-1}{\chi}}L^{\frac{\chi-1}{\chi}}+(1-\omega)H^{\frac{\chi-1}{\chi}}\right)}<1.$$

Next, re-arranging Equation (A12) we obtain:

$$\varepsilon_{w\phi} = \frac{\Omega\left(\frac{\chi-\sigma(1-\Psi)}{\chi}\right)}{\Omega\left(\frac{\chi-\sigma(1-\Psi)}{\chi}\right)-1}. \tag{A13}$$

Therefore:

$$\varepsilon_{w\phi} - 1 = \frac{1}{\Omega\left(\frac{\chi-\sigma(1-\Psi)}{\chi}\right)-1}. \tag{A14}$$

Verify that $\Omega\ (\chi - \sigma\ (1 - \psi)/\chi) < 1$. A sufficient condition is $(\chi - \sigma\ (1 - \psi)/\chi) < 1$ which is true because $\psi < 1$. Therefore, $\varepsilon_{w\phi}$-1 < 0.

Hence, Equation (A9) implies that the sign of $\mathrm{d}(r/w)/\mathrm{d}\phi$ is the opposite of the sign of $\sigma - \chi$.

In the general case, an appropriate measure of inequality is rh/w.

Therefore:

$$\frac{\mathrm{d}\log\left(\frac{rh}{w}\right)}{\mathrm{d}\phi} = \frac{\mathrm{d}\log\left(\frac{r}{w}\right)}{\mathrm{d}\phi} + \frac{\mathrm{d}\log h}{\mathrm{d}\phi}. \tag{A15}$$

Next, note that the derivative of Equation (A7) with respect to ϕ when H is endogenous is:

$$\frac{\mathrm{d}\log\left(\frac{r}{w}\right)}{\mathrm{d}\phi} = \frac{(\sigma-\chi)}{\phi\chi}\Omega\left(\varepsilon_{w\phi}-1\right) - \frac{1}{\chi}\frac{\mathrm{d}\log\left(\frac{H}{L}\right)}{\mathrm{d}\phi}, \tag{A16}$$

where the last term captures the endogenous response of endowments to globalisation. Using (Equation (8)) to substitute out H in the above, we can re-write the expression in Equation (A15) as:

$$\frac{\mathrm{d}\log\left(\frac{rh}{w}\right)}{\mathrm{d}\phi} = \frac{(\sigma-\chi)}{\phi\chi}\Omega\left(\varepsilon_{w\phi}-1\right) + \left(\frac{\chi-1}{\chi}\right)\frac{\mathrm{d}\log h}{\mathrm{d}\phi}. \tag{A17}$$

It is very difficult to sign the expressions for $\varepsilon_{w\phi}$ and $\mathrm{d}\log h/\mathrm{d}\phi$ in the general case so we provide numerical examples instead.

DATA APPENDIX I

Details of the KOF Index of Globalisation Data Set

Globalisation indices and variables	Weights, %
Economic globalisation	[36%]
i) Actual flows	*50.00*
Trade (percent of GDP)	21.77
Foreign direct investment, stocks (percent of GDP)	26.62
Portfolio investment (percent of GDP)	24.31
Income payments to foreign nationals (percent of GDP)	27.30
ii) Restrictions	*50.00*
Hidden import barriers	23.59
Mean tariff rate	27.80

(Continues)

TABLE (Continued)

Globalisation indices and variables	Weights, %
Taxes on international trade (percent of current revenue)	25.90
Capital account restrictions	22.71
Social globalisation	[38%]
i) Data on personal contact	*33.03*
Telephone traffic	25.13
Transfers (percentage of GDP)	2.99
International tourism	26.25
Foreign population (percentage of total population)	20.95
International letters (per capita)	24.69
ii) Data on information Flows	*35.25*
Internet users (per 1,000 people)	36.05
Television (per 1,000 people)	37.63
Trade in newspapers (percent of GDP)	26.32
iii) Data on cultural proximity	*31.72*
Number of McDonald's Restaurants (per capita)	44.28
Number of IKEA (per capita)	44.49
Trade in books (percentage of GDP)	11.23
Political globalisation	[26%]
Embassies in country	24.93
Membership in international organizations	27.21
Participation in UN Security Council Missions	22.32
International treaties	25.55

DATA APPENDIX II

List of Countries in the Panel Data Set (Country and Lending Groups Classification of the World Bank in 2015)

Low-income group in our sample consists of countries with GNI per capita of less than $4,125 in 2015. (This group is comprised of countries deemed to be low income with GNI of $1,045 or less and lower middle income with GNI between $1,046 and $4,125 in 2015, according to the World Bank classification.) High income group consists of countries with GNI per capita of $12,736 or more. (This group is comprised of countries deemed to be upper-middle income with GNI per capita between $4,125 and $12,736, and high income with GNI per capita above $12,736 in 2015 according to the World Bank classification).

Fifty-six Low Income Countries (GNI of $4,125 or less)

Benin, Burkina Faso, Burundi, Cambodia, the Central African Republic, Chad, Congo Democratic Republic, Ethiopia, the Gambia, Guinea, Guinea–Bissau, Madagascar, Malawi, Mali, Mozambique, Nepal, Niger, Rwanda, Sierra Leone, Tanzania, Togo, Uganda, Zimbabwe.

Armenia, Bangladesh, Bolivia, Cameroon, Cape Verde, Congo Republic, Egypt, El Salvador, Georgia, Ghana, Guatemala, Honduras, India, Indonesia, Ivory Coast, Kenya, Kyrgyz Republic, Lesotho, Mauritania, Morocco, Nigeria, Pakistan, the Philippines, Senegal, Sri Lanka, Sudan, Swaziland, Syria, Tajikistan, Ukraine, Vietnam, Yemen, Zambia.

Eighty-four High Income Countries (GNI of $4,126 or more)

Albania, Angola, Azerbaijan, Belarus, Belize, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, China, Colombia, Costa Rica, the Dominican Republic, Ecuador, Fiji, Gabon, Iran, Jamaica, Jordan, Kazakhstan, Lebanon, Macedonia FYR, Malaysia, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Namibia, Panama, Paraguay, Peru, Romania, Serbia, South Africa, Suriname, Thailand, Tunisia, Turkey.

Argentina, Australia, Austria, the Bahamas, Barbados, Belgium, Canada, Chile, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea Republic, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, the United Kingdom, the United States, Uruguay, Venezuela.