ifo WORKING PAPERS

247
2018

January 2018

Globalization and Income Inequality Revisited

Florian Dorn, Clemens Fuest, Niklas Potrafke

ifo INSTITUTE

Leibniz Institute for Economic Research
at the University of Munich

Impressum:

ifo Working Papers
Publisher and distributor: ifo Institute – Leibniz Institute for Economic Research at the University of Munich
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49(0)89 9224 0, Telefax +49(0)89 985369, email ifo@ifo.de
www.cesifo-group.de

An electronic version of the paper may be downloaded from the ifo website:
www.cesifo-group.de

Globalization and Income Inequality Revisited

Abstract

This paper re-examines the link between globalization and income inequality. We use data for 140 countries over the period 1970–2014 and employ an IV approach to deal with the endogeneity of globalization measures. We find that the link between globalization and income inequality differs across different groups of countries. There is a robust positive relationship between globalization and inequality in the transition countries including China and most countries of Middle and Eastern Europe. In the sample of the most advanced economies, neither OLS nor 2SLS results show any significant positive relationship between globalization and inequality. We conclude that institutions providing income insurance and education, which characterize most advanced economies but are less developed in transition economies, may have moderated effects of globalization on income inequality.

JEL Classification: D31, D63, F02, F60, C26, H11, H20.
Keywords: Globalization, income inequality, redistribution, instrumental variable estimation, panel econometrics, development levels, transition economies, China.

Florian Dorn, ifo Institute Munich, University of Munich (LMU), dorn@ifo.de;
Clemens Fuest, ifo Institute Munich, University of Munich (LMU), fuest@ifo.de;
Niklas Potrafke, ifo Institute Munich, University of Munich (LMU), potrafke@ifo.de.

December 2017

Acknowledgements: We would like to thank Matteo Cervellati, Debora Di Gioacchino, Gabriel Felbermayr, Jasmin Gröschl, Bernd Hayo, Andreas Peichl, Jukka Pirttilä, Uwe Sunde and the participants of the European Commission DG ECFIN Annual Research Conference 2016, the participants of the 2017 meeting of the European Public Choice Society (EPCS), the participants of the seventh meeting of the Society for the Study of Economic Inequality (ECINEQ), and the participants of the International Institute of Public Finance (IIPF) Annual Conference 2017 and IIPF Doctoral School on "Dynamics on Inequality" for helpful comments. A previous version was prepared as discussion paper in the context of the European Commission DG ECFIN's fellowship initiative 2016/17. We would like to thank Antonia Kremheller, Garry Poluschkin, and Alexander van Roessel for research assistance. Florian Dorn is grateful for support from the Hanns-Seidel-Foundation.

1 INTRODUCTION

The link between globalization and income inequality plays a key role in the international policy debate. The view is widespread that inequality caused by globalization is an important driver of growing support for populism. The Brexit referendum in the United Kingdom in 2016 or the victory of Donald Trump in the United States in 2016 are widely seen as reflecting the growing anger of globalization losers.

At a global scale, globalization rather seems to give rise to income convergence. International trade has allowed many emerging countries, especially China, to catch up with the developed world. But a large part of the debate focuses on income inequality within countries, in particular within advanced economies. The United States, for example, is widely seen as the country that has experienced the most pronounced increase in income inequality, partly because competition from emerging economies has destroyed jobs for medium and low skilled labor. But other industrialized countries also report growing divergence between rich and poor citizens.

How should economic policy respond to the development of inequality? Clearly, the answer to this question should be based on a sound understanding of the key factors driving inequality trends. Various factors are likely to play a role. These include globalization, skill biased technological change, economic reforms such as deregulation in financial markets, rolling back the welfare state or reforms of the tax system, the growing role of telecommunication and the mass media, growing regional disparities within countries and many more.

In this paper we revisit the question of how globalization influences income inequality within countries. We distinguish between the impact of globalization on i) market income inequality and ii) net income inequality, that is income inequality after taxes and transfers. As measures of income inequality we employ the pre tax/transfer and the post tax/transfer Gini indices taken from Solt's (2016) Standardized World Income Inequality Database (V 5.1).

Globalization is a multifaceted concept. Measuring globalization is therefore challenging, and any measure will inevitably be controversial. We use the KOF index of globalization (Dreher 2006a, and Dreher et al. 2008) to measure globalization. Since summary measures like the KOF index do not allow to distinguish between different ways in which globalization affects inequality we also employ indicators for trade openness, financial openness, political and social globalization.

The Stolper-Samuelson mechanism predicts that global integration increases income inequality within developed countries and decreases inequality within developing countries. However, various theories of international trade and investment have described other channels how globalization may influence income inequality. Overall, economic theory does not lead to unambiguous predictions about how globalization affects inequality. The link between globalization and income inequality has been examined in many empirical studies during the 1990s (Wood 1995; Cragg and Eppelbaum 1996; Borjas et al. 1997; Edwards 1997; Feenstra and Hanson 1996, 1997, 1999; Barham and Boucher 1998; Leamer 1998), and has been revisited by several scholars in the last decade (Goldberg and Pavcnik 2007; Dreher and Gaston 2008; Roine et al. 2009; Bergh and Nilsson 2010; Figini and Görg 2011; Jaumotte et al. 2013; Dabla-Norris et al. 2015; Gozgor and Ranjan 2017; Dorn and Schinke 2018). The results differ depending on the measures of globalization and income inequality used and the sample of countries examined. The majority of studies using Gini indices as inequality measure, however, report

a positive relationship between globalization and income inequality (see Bergh and Nilsson 2010; Jaumotte et al. 2013; Dabla-Norris et al. 2015; Gozgor and Ranjan 2017).

Our sample includes up to 140 countries over the period 1970-2014. Ordinary Least Squares (OLS) results confirm the findings of previous studies, indicating a positive relationship between globalization and income inequality. The results are sensitive to the sample of countries though. The relationship between overall globalization and income inequality is positive within the full sample of countries, within the sample of emerging and developing countries, and in our benchmark sample. The latter excludes low-income countries, where the available data is often poor. However, the relationship within our benchmark sample of countries lacks statistical significance when we exclude transition countries from Eastern Europe and China. The OLS results, moreover, do not show that globalization and income inequality are positively correlated within the sample of the most advanced economies.

Examining the causal effect of globalization on income inequality is challenging. We control for many variables, but other unobserved omitted variables may still cause biased estimates by influencing both, globalization and income inequality. Moreover, reverse causality may occur because changes in income inequality are likely to influence policies which, in turn, affect globalization. Previous studies do little to deal with the endogeneity of globalization and therefore mostly provide descriptive evidence on the link between globalization and inequality. This descriptive evidence is useful but it is important to ask whether there is a causal effect running from globalization to inequality. We deal with the endogeneity problem of globalization by using an instrumental variable (IV) approach. Our IV is predicted openness based on a gravity equation using a time-varying interaction of geography and natural disasters as proposed by Felbermayr and Gröschl (2013). Predicted openness has been used as an IV for trade openness (Frankel and Romer 1999, Felbermayr and Gröschl 2013) and the KOF index of globalization (Potrafke 2013, Eppinger and Potrafke 2016). Another new study dealing with the endogeneity problem between globalization and inequality is Lang and Tavares (2018). The authors use another instrument that exploits the geographically diffusive character of globalization to examine the effect of the KOF subindex of economic globalization on income inequality.

Our Two Stage Least Squares (2SLS) results do not support the view that globalization influences income inequality for the full country sample and the sample of emerging and developing countries. Within our benchmark sample of countries, which includes transition countries, we do find a positive effect of globalization on income inequality. The coefficient of the 2SLS estimator is indeed larger than the OLS estimator indicating that OLS results underestimate the effect of globalization on income inequality. However, the positive effect of globalization on income inequality is driven by China and transition countries from Eastern Europe. These countries have experienced a particularly fast change towards globalization accompanied by a simultaneous privatization and economic transition process. There was a huge impact on the income distribution which was hardly cushioned by either labor market institutions or welfare states which characterize most advanced economies in the rest of the world. 2SLS results within the most advanced economies do not suggest that globalization increased income inequality.

Examining sub-indicators of globalization shows that effects of trade, political and social globalization on income inequality are driven by globalization and rising income inequality in China. The results suggest foreign direct investments (FDI) are the main driver of inequality enhancing effects of globalization.

2 THEORETICAL PREDICTIONS

Globalization has been shown to give rise to many benefits. Globalization has, in fact, brought hundreds of million people out of poverty.[1] It is, however, not guaranteed that everyone within each country is better off when globalization is proceeding rapidly. Many studies have examined the effect of globalization on income distribution within countries.

The classical theoretical framework for analyzing the relationship between globalization and distributional market outcomes is the Heckscher-Ohlin (HO) model (Ohlin 1933). It explains the inequality effect of globalization as a result of productivity differences and the relative factor endowment of countries, and the extent to which individuals depend on labor or capital income. Countries specialize in production in their relatively abundant factor and export these goods when they open up to trade. The Stolper-Samuelson theorem (Stolper and Samuelson 1941) shows that the subsequent trade-induced relative changes in product prices increase the real return to the factors used intensively in the production of the factor-abundant export goods and decrease the returns to the other factors. As a consequence, the country's abundant production factors gain from openness, while scarce factors lose. Most theories distinguish between the production factors labor and capital, or between unskilled and skilled labor. Because capital and skilled labor are relatively abundant in advanced economies, income inequality and income concentration towards the top incomes is expected to increase. In developing countries, unskilled labor, which is intensively used in local production, would benefit from economic openness by increasing wages. In developed countries income inequality would therefore expected to decrease. Based on the HO-model assumptions, how globalization influences income inequality depends on a country's development level.

Since the 1990s, many studies have pointed to limitations of the standard HO-model implications and suggested different ways in which globalization may affect income inequality.[2] For instance, the Heckscher-Ohlin-model relies on between sector reallocations and neglects within-sector shifts in production and vertical specializations across countries. While offshoring and outsourcing of less-skilled production within a sector decreases wages and bargaining power of less skilled workers in advanced economies, the offshored and outsourced activities along the value chain may be relatively skill-intensive from the perspective of the developing countries (see Feenstra and Hanson 1996, 1999). Along the same lines Feenstra and Hanson (1997), for example, describe that FDI increases the relative demand for skilled labor and the skill premium due to capital-skill-complementarities in the developing world. In addition, as a response to the rising exposure to import competition, occupations in traded sectors of the developing world may become more skill-intensive so that relative wages of low-skilled workers decline (Cragg and Eppelbaum 1996). Income inequality may also rise because of heterogeneous firms within sectors and countries and resulting wage premia for workers in firms participating in international trade. Exporting firms are more productive than non-exporting firms and pay higher wages to hire higher-skilled labor (see Manasse and Turrini 2001; Yeaple 2005; Munch and Skaksen 2008; Verhoogen 2008; Egger and Kreickemeier 2009; Frias et al. 2012; Egger et al. 2013; Sampson 2014). Helpman et al. (2010, 2017) predict a non-monotonic relationship between trade

[1] Since the pioneering work of Samuelson (1939) about the gains of trade, several studies confirm that trade is welfare improving compared to autarky because of productivity gains and a new variety of products. See Arkolakis et al. (2012) and Costinot and Rodríguez-Clare (2014) for surveys on the welfare gains released from new trade models. For empirical evidence on globalization and poverty see Bergh and Nilsson (2015).

[2] Many empirical studies have shown poor performance of the factor bias assumption of the Heckscher-Ohlin model. Leamer (1998), for example, has found evidence for the Stolper-Samuelson mechanism in the 1970s only, while there is a lack of evidence in other decades. Goldberg and Pavcnik (2007) show also poor performance of the model predictions in a large literature review about the relationship of trade and earnings in developing countries.

openness and wage inequality, where trade liberalization at first raises and later reduces wage inequality.

Skill biased technological change is discussed as one of the main alternative explanations of the rising skill premium and income inequality within countries. A large number of studies discusses how innovations and new labor-saving technologies have eliminated low-skilled jobs through automation or by upgrading the required skill levels (see Berman et al. 1994, 1998; Machin and van Reenen 1998; Acemoglu 1998, 2002; Krusell et al. 2000; Card and DiNardo 2002). While technological innovations primarily occurs in advanced economies, globalization may facilitate technology transfer across borders, so that skill biased technological change also takes place in less developed countries (see Berman and Machin 2000; Burstein et al. 2013). Rising import competition may also induce investments in new technologies and accelerate technological shifts which decrease employment of relatively unskilled workers (Bloom et al. 2016).

Political and social globalization are likely to influence income inequality as well. Political globalization may lead countries to set common minimum standards and therefore enhance equality within countries (Dreher 2006b). International migration may have diverse effects on the income distribution in both the sending and destination country. Standard models of immigration suggest, for example, that factors for which immigration is a good substitute will lose relatively to factors that are complementary. If immigration increases the labor supply of unskilled workers, the wage gap between high-skilled and low-skilled labor and income inequality is expected to increase (see Borjas et al. 1997). Changing social norms, which results from more interaction and integration around the world, may also change the social acceptance of income inequality and therefore affect the behavior of people, for example the wage bargaining of unions (Atkinson 1997).

Governments are likely to influence market outcomes by setting agreements, regulations and tariffs; and design taxation and social policies to redistribute income from the rich to the poor. There are two competing views on the relationship between globalization, welfare state policies and the impact on income inequality: the race to the bottom hypothesis and the compensation hypothesis.

The “race-to-the-bottom” theory (e.g., Sinn 2003) describes that globalization puts a downward pressure on tax rates and regulations for mobile factors such as tax rates on capital. Large welfare states, moreover, attract unskilled and poor immigrants who want to benefit from redistribution. This together gives rise to lower public spending and less redistribution. Globalization is thus expected to increase income inequality after taxes and transfers. Experts emphasizing the ‘dark side of globalization’ such as Stiglitz (2002) believe that globalization is responsible for diminishing redistribution activities and shrinking social security systems.

In contrast, the compensation hypothesis (Rodrik 1998) predicts an expansion of the welfare state, providing insurance against growing risks associated with globalization. A variant of this argument is that losers from globalization may demand compensation. This theory predicts that globalization will increase the size and scope of government. In a similar vein, Gozgor and Ranjan (2017) suggest that when globalization raises market income inequality, policymakers who are interested in maximizing the sum of welfare of all agents would increase redistribution. Meltzer and Richard (1981) describe that higher inequality tends to increase redistribution, because the median voter would favor more redistribution. The available empirical evidence on the globalization-welfare state nexus is mixed (e.g., Schulze and Ursprung 1999, Milanovic 2000, Ursprung 2008, Meinhard and Potrafke 2012, Kauder and Potrafke 2015, Potrafke 2015).

3 DATA AND DESCRIPTIVE STATISTICS

3.1. VARIABLES

Income Inequality: Income inequality is measured by the Gini index. Gini indices are often based on different sources and welfare definitons, and are therefore calculated in manifold ways (see Dorn 2016 for a discussion of income inequality databases). Many scholars consider the Luxembourg Income Study (LIS) to be the best datasource for comparable data across countries. The LIS data are based on microdata from national household income surveys and use a harmonized set of assumptions and definitions to maximize its comparability. LIS data, however, are not collected every year and are available for a small number of country-year observations only. Secondary source datasets[3], as an alternative, combine several data sources and data quality to achieve a higher coverage. The Gini observations, however, are rarely comparable across countries and over time within a single country. Scholars who use secondary source datasets often apply constant adjustment procedures to standardize different Gini measures. Differences of Gini measures are likely to vary across countries and within countries over time depending on the extent of taxation and transfer policies, patterns of consumption and savings, family structure, and other factors. Constant adjustment procedures are therefore likely to produce systematic errors in the data and estimation results. On the one hand, secondary source datasets have a high coverage at the expense of comparability; on the other hand, harmonized microdata sets such as LIS are more comparable, but at the expense of coverage over time and countries: this reflects the trade-off between greater comparability and broader coverage of income inequality datasets.

We use the Gini household income inequality indices of Solt's (2016) Standardized World Income Inequality Database (SWIID, v5.1).[4] SWIID provides standardized Gini income inequality measures for market and net outcomes based on the same concept, and thus allows comparing income inequality before and after redistribution by taxation and transfers over time. We use both, the market and net income Gini indices. Both Gini indices are quite strongly correlated (see Appendix Table B).

The high coverage across countries and time and the adjustment procedure for achieving a possible comparability is the major reason for preferring SWIID to other secondary source datasets: SWIID uses the LIS series as baseline. To predict missing observations in the LIS series, data from other secondary data sources and statistical offices is standardized to LIS by using systematic relationships of different Gini types and model-based multiple imputation estimates.[5] When estimating missing observations Solt (2016) considers that adjustments cannot be constant across countries and time by relying on available information from proximate years in the same country as best solution, and on information on countries in the same region and with similar development level as second best solution. There are, however, concerns to the reliability of SWIID's imputed estimates in data-poor regions (see Ferreira et al. 2015, Jenkins 2015). We address these concerns in our benchmark sample selection (see section 3.2).

[3] The World Income Inequality Database (WIID) of UNU-WIDER and Branko Milanovic's All-the-Ginis (ATG) database are, for example, large collections of secondary data sources and are often used in empirical research.
[4] SWIID has been used in several empircal studies before (see Bergh and Nilsson 2010; Acemoglu et al. 2015).
[5] The ratios of different Gini types are estimated by systematic relationships on the basis of eleven different combinations of welfare definitions and income scales (see Solt 2016).

Globalization: We measure globalization by the KOF globalization index 2016 (Dreher 2006a and Dreher et al. 2008). The KOF index aggregates 23 variables to an overall index on a scale of one to hundred, where higher values describe greater globalization. The index encompasses economic, social, and political dimensions of globalization and has been used in some hundreds of studies (see Potrafke 2015 for a survey on the consequences of globalization as measured by the KOF index). Examples of countries with very low levels of globalization include Afghanistan, Ethiopia, Tanzania and many other African countries (values below 40 in our sample). Globalization is pronounced in EU member states. The most globalized countries are small EU member states such as Belgium, Ireland or the Netherlands. Outside Europe, especially the small country of Singapore belongs to the group of the most globalized countries.

We also employ sub-indicators of globalization for trade, financial, social and political globalization to investigate whether various channels of globalization are differently related to inequality outcomes. Data on trade are provided by the World Development Indicators (World Bank 2017).[6] Trade openness is measured as the sum of exports and imports of goods and services as a share of the gross domestic product (GDP), import openness as imports as percentage of GDP; and export openness as exports as share of GDP. We use data for financial, social and political globalization based on the KOF index 2016.[7] As proxy for financial globalization, we use the KOF index on the inward and outward stock of FDI as a percentage of GDP based on data of UNCTAD. The KOF sub-index of social globalization includes eleven variables encompassing data on migration and tourism, and the spread of ideas, information and culture. The political KOF sub-index includes four individual variables to proxy the degree of the diffusion of government policies.[8]

Covariates: We follow previous studies by including the following control variables: real GDP per capita[9] of the new released Penn-World-Table version 9.0 by Feenstra et al. (2015), to control for any distributional effect due to different income levels. Studies show that economic growth and the GDP per capita level are related to globalization (see Dreher 2006a; Dreher et al. 2008) and to the development of the income distribution over time (see Barro 2000; Forbes 2000; Berg et al. 2012). Demographic changes and shifts in the size of population are also likely to influence both globalization and the income distribution (OECD 2008). We therefore add the age dependency ratio by the World Development Indicators (World Bank 2017) and the logarithm of total population of the Penn-World-Table (Feenstra et al. 2015). The dependency ratio measures the proportion of dependents per 100 of the working age population, where citizens younger than 15 or older than 64 are defined as the dependent (typically non-productive) part. A higher share of dependent citizens is usually associated with higher income inequality and higher redistribution activities within countries. Shifts in the size of the population affect the dependency ratio as well as a country's labor and skill endowment.

Covariates for robustness checks: The skill biased technological change is discussed as alternative factor for explaining the rising skill premium and income inequality within countries. New technologies, such as information and communication technologies, have given rise to improvements in productivity and a disproportionately increase in the demand for capital and skilled-labor by eliminating unskilled jobs through automation or upgrading the required skill level of jobs (see

[6] Trade data released from the World Development Indicators is used as variable in the overall KOF index of globalization.
[7] The KOF globalization index includes a sub-index for economic globalization, encompassing variables on trade and financial openness. Empirical literature has shown that trade openness and financial openness might have different impacts on income inequality (see Jaumotte et al. 2013; Dabla-Norris et al. 2015). We consider potential differences in the impact of various economic sub-indicators by using indicators for trade openness and financial openness separately.
[8] Summary statistics and correlations are reported in the Appendix. In the cross section, globalization indicators are positively related to each other (see Appendix Table B). Political globalization and trade indicators, however, are negatively correlated in the cross section.
[9] We use the expenditure-side real GDP at chained PPPs to compare relative living standards across countries and over time.

Berman et al. 1994, 1998; Machin and van Reenen 1998; Acemoglu 1998, 2002; Krusell et al. 2000; Card and DiNardo 2002). The technological spread around the world is closely related to globalization (Berman and Machin 2000; Burstein et al. 2013; Bloom et al. 2016). Neglecting the skill biased technological change in empirical estimations, therefore, may give rise to an omitted variable bias. Many empirical studies investigating the globalization-inequality-nexus do not take the technology mechanism into account. Others use investments in Information and Communication Technologies (ICT) as proxy for technology. Investments in new technologies, however, may be induced by globalization shocks (see Bloom et al. 2016). We control for the skill biased technological progress by using ICT capital stock estimates of Jorgenson and Vu (2017)[10] as a proxy for the technological change which is driven by information and communication technologies (section 5.5.3). The ICT capital stock has already been used by Jaumotte et al. (2013) and Dabla-Norris et al. (2015) and is widely accepted in the technology-growth empirical literature. We also include capital intensity, as measured by the capital stock in relation to the labor employed within a country, to consider effects of capital-skill complementarities on globalization and inequality (Krusell et al. 2000). The capital stock of structures and equipment and the number of persons engaged are taken from the Penn-World-Table 9.0 (Feenstra et al. 2015). To deal with the effect of varying human capital endowments of the population on globalization and skill premia, we include the human capital index of the Penn-World-Table 9.0, based on an assumed rate of return to education and the average years of schooling. We include the ICT capital stock and the human capital index in the robustness section as these covariates are not available for the full sample of 140 countries.

We also include institutional variables, which might influence globalization and income inequality. We use the real output-share of government consumption to deal with simultaneous effects of government expenditures on globalization and the income distribution of a country (Feenstra et al. 2015). From the Economic Freedom Index by Gwartney et al. (2015) we use the overall index of economic freedom, the subindex of overall regulation (including business, credit and labor market regulation) and the sub-index on the regulation in the labor market itself (including indicators such as minimum wages, collective bargaining centralization, or hiring, firing and hours regulations). More market-oriented policies are, for example, expected to be correlated with globalization and inequality. Higher regulated labor markets might promote equality at the expense of globalization and growth. The data on economic freedom and labor market institutions is not available for the full set of 140 countries.

3.2. DATA AND SUBSAMPLES

We use an unbalanced panel for up to 140 countries over the period 1970-2014. The data is averaged over five years in nine periods between 1970 and 2014. We use five year averages to reduce the possibility that outliers, measurement errors, missing observations in individual years and short term movements in the business cycle influence the inferences.

Next to our FULL SAMPLE of 140 countries, we use a sample for high and middle income countries as our BENCHMARK SAMPLE. High and middle income countries are classified by the criterion of the World Bank as of 2015, including 82 countries having a GNI per capita of USD 4,126 or more. The 58 countries in our dataset below the GNI per capita of USD 4,126 threshold are classified as lower income countries. Lower income countries are more likely to have few period-observations per

[10] We thank Dale Jorgenson and Khuong Vu for providing their ICT capital stock estimates.

country due to a lack of data availability than high and middle income countries (see Appendix, Figure A). Data in lower income countries are, moreover, more likely to be subject of measurement errors. There are serious concerns about the quality of the income inequality data from less developed countries.[11] Jenkins (2015), for example, shows that source data on inequality with high quality, in which the income concept and the survey can be verified, is rare in less developed and in particular in Subsaharan African countries. The lack of data quality is also reflected in the imputed Gini estimates in SWIID as the imputation variability of imputed country-period observations is large in some countries, especially in lower income countries (see Ferreira et al. 2015, Jenkins 2015). To address potential biases in the estimates because of measurement error, our benchmark sample excludes the 58 lower income countries compared to the full sample. 30 of the 58 excluded countries are Subsaharan African countries.

Development levels: Some theories predict different outcomes on the globalization income inequality nexus depending on the development level of countries. Next to our full and benchmark sample of our baseline regressions, we therefore use additional subsamples for the most ADVANCED ECONOMIES, as well as EMERGING MARKETS & DEVELOPING ECONOMIES (EMD).[12] To distinguish between advanced economies and emerging markets and developing economies we apply the classification of the International Monetary Fund (IMF 2016). The IMF-classification is based on per capita income level, export diversification and the degree of integration into the global financial system.[13] The 34 countries fulfilling the criterion of the advanced economies sample are also included in our benchmark sample (high and middle income countries). The subsample of emerging markets and developing economies includes 106 countries released from both income groups, high and middle income countries and lower income countries.

Transition economies: Transition economies have experienced a large shift in globalization since the Fall of the Iron Curtain. During the simultaneous period of transition toward market economies, however, transition countries have also experienced many structural and institutional changes in political institutions and their economy, such as privatizations of state owned enterprises, deindustrialization, shrinking and reforming of the public sector, or institutional liberalizations. The systemic change and restructuring of the economy and governance may also have influenced the speed of globalization and the rise of income inequality (see Milanovic 1999; Milanovic and Ersado 2011; Aristei and Perugini 2014). We therefore use a sample of the (new) European Union member states from Central and Eastern Europe (EAST EU) and other transition countries such as China.

Unbalanced panel: The overall panel of 140 countries is unbalanced: the number of country-period observations varies across countries and 5-year-periods (see Appendix, Figure A shows the distribution of country-period observations). Some countries have observations for many periods; some have observations for just two periods. There are, for example, fewer observations in periods before the 1990s and the period 2010-2014. The lack of observations in these periods is, however, primarily based on the lack of data availability within the sample of lower income countries and

[11] There are several reasons for poor inequality and poverty measures in low-income countries. On the one hand, official statistical data of good quality on income distribution is often rare in developing countries as they have high shares of informal working participants and self-employed in business and agriculture. On the other hand, reliable survey data on income or consumption is also rare. Surveys in developing countries might have a sample bias when some parts of the population are systematically not surveyed, for example unskilled people because of literacy problems or people who live in rural regions. Responders, moreover, might not report the truth as they might fear that information is provided to government authorities, for example tax institutions. The lack of political will, unskilled staff, and high turnover in statistical offices are also reasons why data are not collected consistently and continually (see, for example, Deaton 2005).

[12] See Appendix for the classification of countries by development levels.

[13] Oil exporters that have high per capita GDP, for example, would not make the advanced classification because around 70% of its exports are oil.

countries such as members of the former Republic of Yugoslavia, for example Croatia and Slovenia, or successor states of the former Soviet Union such as the Russian Federation or the Baltic countries. We investigate the robustness of the relationship between globalization and income inequality using different samples. In our robustness checks (section 5.5.2), we focus on three subsamples requiring a minimum of period observations by each country. By doing so we make sure that the estimates measuring how globalization influences income inequality are based on several within variations by each country. We use a LARGE sample of 117 countries having at least four period observations for each country, an INTERMEDIATE sample of 70 countries having at least six period observations, and a SMALL sample of 56 countries having at least seven period observations. The intermediate and small samples primarily include high and middle income countries (of our benchmark sample) as lower income countries are more likely to have a lack of data availability.

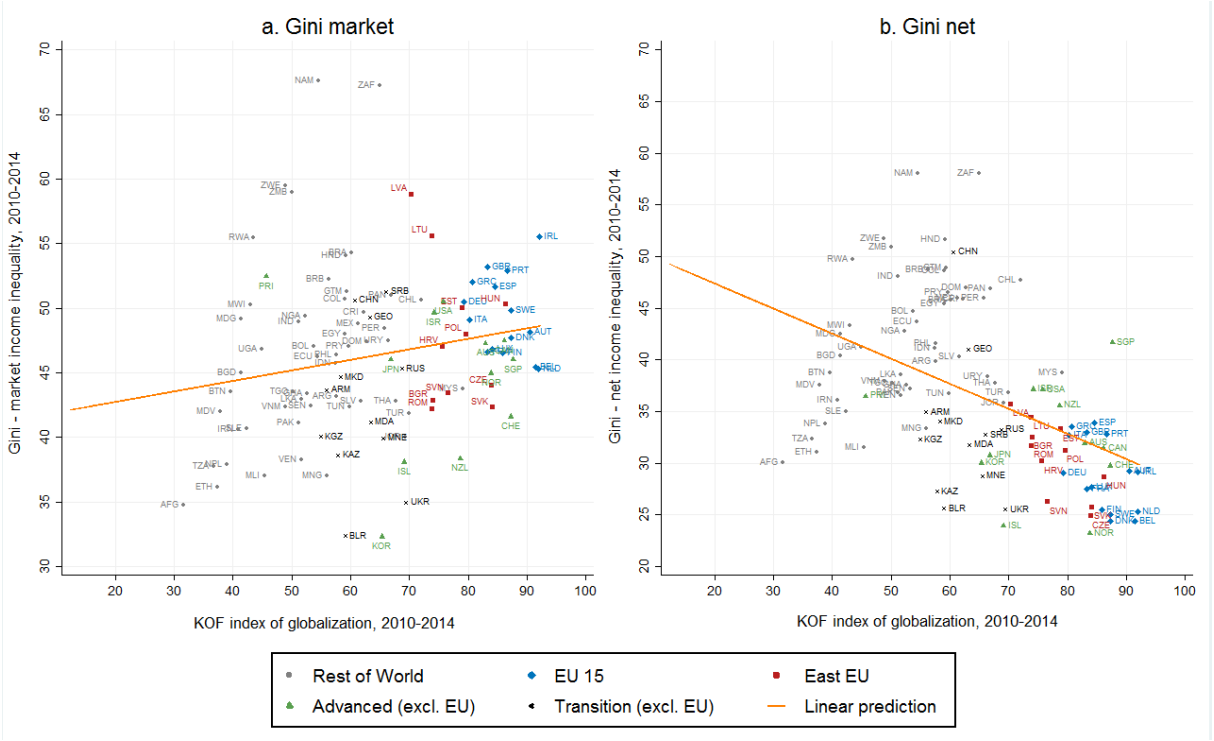
3.3. GLOBALIZATION AND INCOME INEQUALITY ACROSS COUNTRIES

We examine the correlation between globalization and income inequality across countries: income inequality before taxes and transfers is hardly correlated with globalization (see Figure 1a for the five year period 2010-2014). More globalized countries tend to have somewhat larger market inequality outcomes in the last period of observation 2010-2014. The coefficient of correlation is 0.08.

Net income inequality in highly globalized countries is lower than in less globalized countries. The correlation coefficient between the KOF globalization index and the Gini market index is -0.24, indicating that more developed countries have larger welfare states. EU member states and other advanced economies belong to the most globalized countries and have the lowest levels of income inequality after redistribution around the world. This suggests why there is a negative relationship between globalization and after taxation and transfer income inequality across countries (see Figure 1b for the five year period 2010-2014).[14]

[14] For cross country correlations of all periods, see Appendix Table B.

Figure 1: **Cross-section of Gini income inequality and globalization around the world, averaged by country in period 2010-2014**



Source: SWIID 5.1, KOF 2016, own calculations

Note: Figures 2a and 2b relate to the full country sample within the period 2010-2014. Transition (excl. EU) relate to former members of the Soviet Union (FSU, non-EU), Western Balkan (non-EU) states, and China.

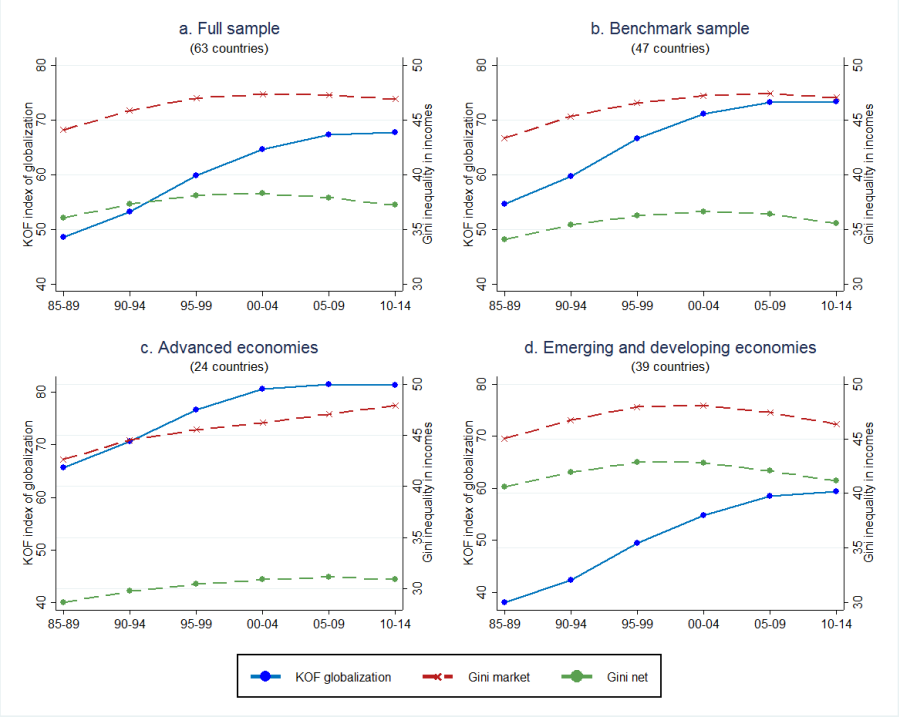
3.4 TRENDS WITHIN COUNTRIES

Globalization and income inequality both proceeded quite rapidly between the late 1980s and the late 1990s; that is the first decade after the Fall of the Berlin wall in 1989 (Figure 2). Since 2000, globalization within advanced economies remained relatively stable around an index level of 81, but increased by 4.6 index points to a level of 59.4 in EMD economies.[15] The pre tax/transfer and post tax/transfer Gini indices decreased since the early 2000s in EMD economies.[16] In a similar vein, income inequality has also not increased on average in the full and benchmark samples since its peak in the late 1990s. The pre tax/transfer Gini is around an index value of 47 in both, the full and the benchmark sample. The post tax/transfer Gini index has even decreased since 2000. In the period 2010-2014, the Gini net indices in the full sample (37.2) and the benchmark sample (35.5) are about the same as in the period 20 years before. In advanced economies, the Gini net index is around 31 since 2000, while market income inequality has increased in the same period of time. The differing trends of the mean values of the Gini indices before and after taxation and transfers indicate a rise of redistribution in the sample of advanced economies since the early 2000s. Before taxation and transfers, income inequality is at a similar level in advanced and EMD economies. After taxation and transfers, inequality is much lower in advanced economies than in the emerging and developing world.

[15] The mean level of globalization in advanced economies, for example, increased by 15 index points and the level in EMD economies by 16.8 index points between 1985-1989 and 2000 2004.

[16] In the period 2010-2014, both the mean values of Gini market (46.3) and Gini net (41.1) are even lower in EMD economies than the mean values (46.7 and 41.9) of the period 1990-1994.

Figure 2: **Global trends of Gini income inequality and globalization between 1985-1989 and 2010-2014 (unweighted mean of balanced samples)**



Source: SWIID 5.1, KOF 2016, own calculations.
Note: In the full sample, 63 of 140 countries have observations in all six periods, in the benchmark sample 47 of 82 countries, 24 of 34 countries within the sample of advanced economies, and 39 of 106 countries in the sample of emerging and developing economies (EMD).

Figure 3 shows how income inequality and globalization proceeded across regions between the periods 1985-1989 and 2010-2014. Globalization proceeded in all regions since the late 1980s, but to different degrees across regions. Advanced economies such as the countries of the western offshores (Australia, Canada, New Zealand, and United States) and the EU15 already enjoyed a quite high level of globalization in the 1980s. During the 1990s, globalization and income inequality slightly increased in both groups (see Figures 3a-b). Since 2000, the level of globalization remained relatively stable at a high level in the countries of the western offshores and the EU15. In the western offshores, income inequality further increased on average in the 2000s, but slightly decreased in the period after the financial crisis in 2009. In the EU15, the Gini net index remained relatively stable on average, although the Gini market index increased further since the turn of the millennium.[17] The majority of the EU15 countries are well-established welfare states. In the EU15, post tax/transfer inequality is lower and redistribution higher than in other advanced regions such as the western offshores. The trends in inequality reflect that countries of the western offshores such as the United States do have more market-oriented economic systems and less generous welfare states than their Scandinavian and continental European counterparts (see Fuest et al. 2010; Doerrenberg and Peichl 2014; Dorn and Schinke 2018). Post-communist countries from Central and Eastern Europe (East EU) and the former Soviet Union (FSU) had relative low levels in globalization and income inequality before 1990 (Figures 3c and 3f). During their first stage of transition from centrally planned to market-based economies in the 1990s, both groups have experienced a large rise in globalization and income inequality. While globalization proceeded in both groups during the 2000s, inequality increased in new

[17] Empirical research have shown how inequality dynamics also differ among advanced economies during the last wave of globalization, with larger increases in income inequality in Anglo-Saxon countries such as the United States and a less pronounced trends in Continental Europe (see Atkinson and Piketty 2007; Dorn 2016; Dorn and Schinke 2018).

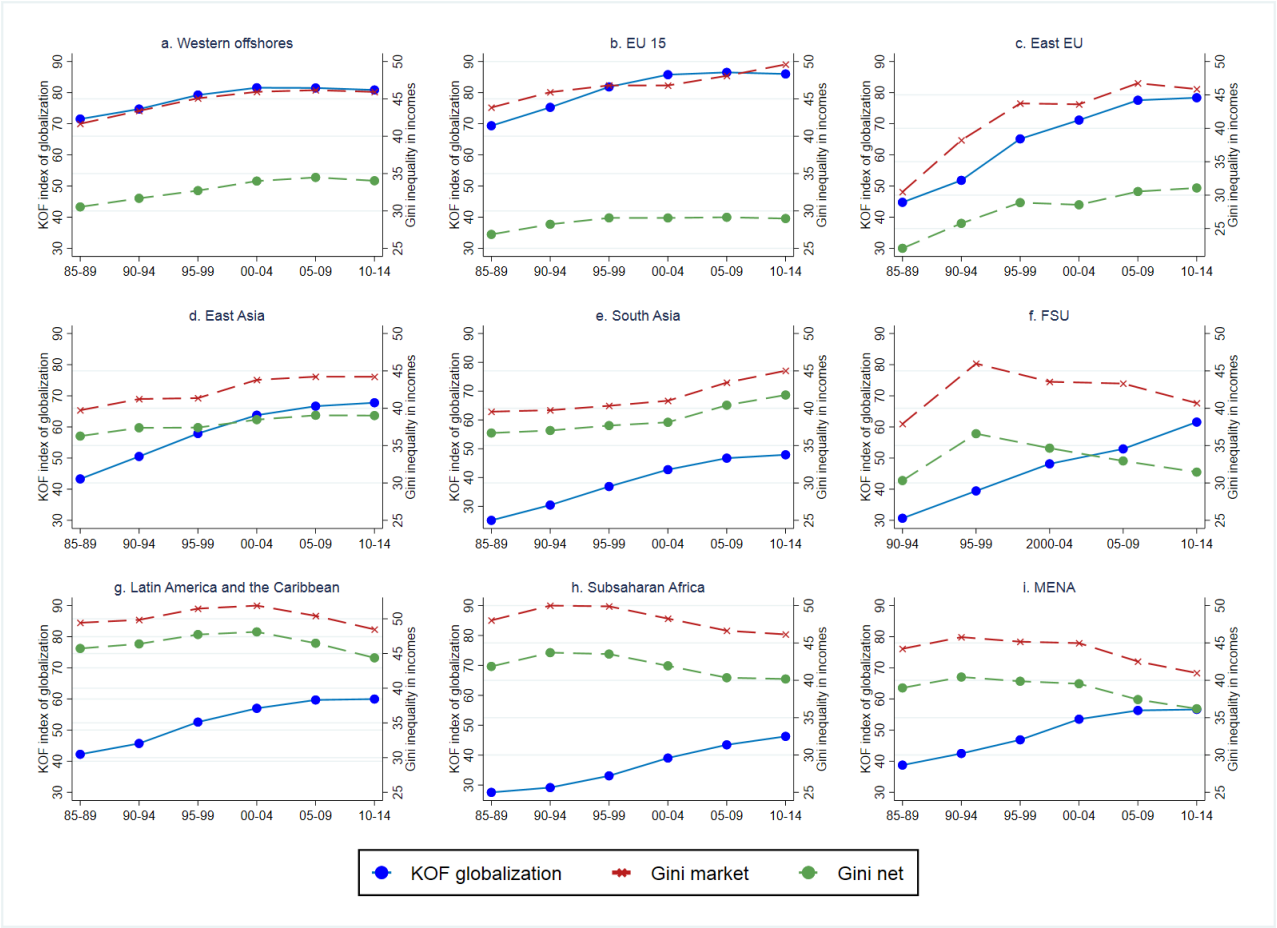
EU member countries from Central and Eastern Europe[18], but decreased in the other countries of the former Soviet Union such as the Russian Federation (see Gorodnichenko et al. 2010; Aristei and Perugini 2014). Countries from East and South Asia have, on average, experienced a relative constant rise in globalization and income inequality between the periods 1985-1989 and 2010-2014 (Figures 3d and 3e). The rise in Gini inequality, however, is more pronounced in South Asian countries such as India since the 2000s. The Asian subsamples do have higher mean Gini indices than advanced economies from Europe or the western offshores. Country samples from Latin America and the Caribbean, Subsaharan Africa, and the Middle East and North Africa (MENA) also belong to regions with high Gini inequality indices. Globalization and income inequality are negatively related in Latin America and the Caribbean, Subsaharan Africa, and the MENA countries since the mid-1990s - income inequality was decreasing, while globalization was still on the rise (Figures 3g-i).

Examining trends in the levels of globalization and income inequality in the full and benchmark sample of countries, and across development levels and regions do not show a clear relationship over the full period from the Fall of the Berlin wall till the period after the great recession. In Figure 4 we focus on changes in income inequality and globalization in individual countries of our benchmark sample between the periods 1985-1989 and 2005-2009 (based on 52 countries of high and middle income countries having observations in both periods 1985-1989 and 2005-2009). The unconditional correlation between the changes in the globalization index and the market and net income inequality is positive and statistically significant.[19] The coefficients of correlation are 0.22 and 0.14. There is, however, a group of countries being the key driver of the linear relationship between the late 1980s and late 2000s: the transition countries in Eastern Europe and China have experienced a huge opening process (globalization shift) and a huge rise in income inequality. The other countries of the benchmark sample have also enjoyed rapidly proceeding globalization, but experienced less pronounced increases in income inequality than Eastern European countries and China. When we exclude the transition countries, the unconditional correlation between the change in globalization and income inequality lacks statistical significance and is rather negative. The coefficients of correlation are -0.12 and 0.07 when we exclude transition countries from the sample of high and middle income countries. Within the sample of EU15 countries and other advanced economies (without transition countries), the changes in the globalization index and income inequality outcomes are hardly correlated. The coefficients of correlation are -0.06 and 0.01.

[18] The trend of the balanced East-EU sample is based on an unweighted average of Bulgaria, Hungary, Poland and Romania. Individual trends of all new Central and Eastern European EU members are shown in Figure 5.

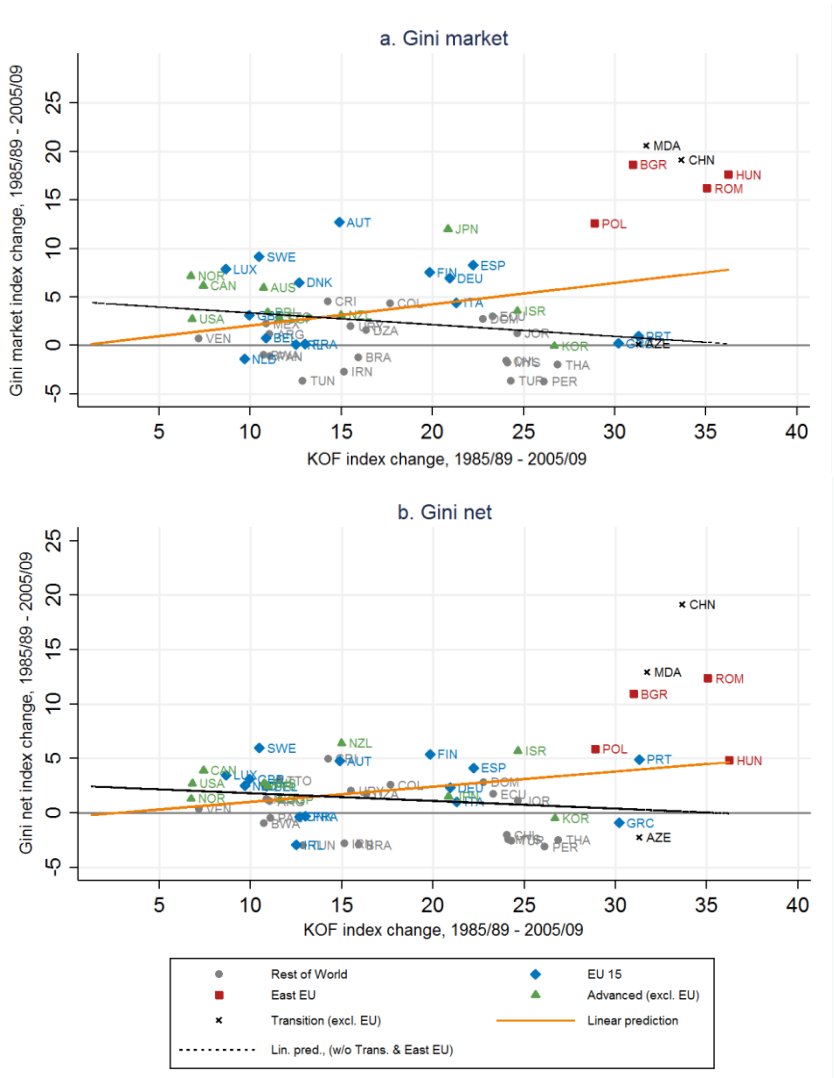
[19] See Appendix III (supplementary material) for figures comparing the changes within the benchmark sample between the periods 1990-1994 and 2005-2009; and within the full sample between the periods 1985-1989 and 2005-2009. Inferences do not change.

Figure 3: **Regional trends of Gini income inequality and globalization between 1985-1989 and 2010-2014 (unweighted mean of balanced samples)**



Source: SWIID 5.1, KOF 2016, own calculations.
Note: The figures only include countries with balanced panels between the periods 1985-1989 and 2010-2014. The western offshores include Australia, Canada, New Zealand, and the United States; in the EU15, 14 countries have observations in all six periods (Austria, Belgium, Germany, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom); 4 of 11 countries in East EU (Bulgaria, Hungary, Poland, Romania); East Asia includes 8 countries (China, Indonesia, Japan, Rep. Korea, Malaysia, Philippines, Singapore, Thailand); South Asia includes 3 countries (Bangladesh, India, Pakistan); former Soviet Union (FSU) includes 12 countries, which are not members of the EU (Armenia, Belarus, Georgia, Kazakhstan, Kyrgyz Republic, Moldova, Russian Federation, Ukraine; and Azerbaijan, Tajikistan, Turkmenistan, and Uzbekistan - the latter 4 countries do not have observations in the period 2010-2014); the group Latin America and the Caribbean includes 17 countries (Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Panama, Peru, Puerto Rico, Uruguay, Venezuela); Subsaharan Afrcia includes 7 countries (Ghana, Malawi, Mali, Nigeria, Rwanda, Sierra Leone, Uganda); and MENA includes 3 Middle East and North African countries with muslim majority (Iran, Jordan, Tunisia).

Figure 4: **Changes in Gini income inequality and globalization, between 1985-1989 and 2005-2009 (benchmark sample, N=52)**



Source: SWIID 5.1, KOF 2016, own calculations

Note: Figures 4a and 4b describe countries within the benchmark sample including high and middle income countries having observations in periods 1985-1989 and 2005-2009. Classification as high and middle income country if GNI per capita of USD 4.126 or more (World Bank, 2015). Transition (excl. EU) captures former members of the Soviet Union, Western Balkan (Non-EU) states, and China. The unconditional linear predictors in the benchmark sample are $\hat{\beta}_{market} = 0.22^{**}, \hat{\beta}_{net} = 0.14^{**}$; ,** $p < 0.05$.

4 EMPIRICAL ANALYSIS

4.1. OLS PANEL FIXED EFFECTS MODEL

We estimate the baseline panel model by OLS, where countries are described by $\boldsymbol{i}$ and 5-year-periods by τ:

$$y_{i,\tau} = \beta_1 \times GLOB_{i,\tau} + \boldsymbol{\Theta}' \times \boldsymbol{\chi_{i,\tau}} + \upsilon_i + \upsilon_\tau + \varepsilon_{i,\tau} . \quad \textbf{(1)}$$

$y_{i,\tau}$ describes the Gini index value of country i in period τ. The explanatory variable $GLOB_{i,\tau}$ describes the KOF index of globalization of country i in period τ. For robustness tests, the overall KOF index is replaced by sub-indicators of globalization in equation (1). The vector $\boldsymbol{\chi_{i,\tau}}$ includes control variables as described in section 3.1, υ_i describes the country fixed effects, υ_τ describes the fixed period effects, and $\varepsilon_{i,\tau}$ is the error term. All variables are included as averages in each of the nine periods (t = 1,...,9).

By estimating OLS in a fixed effects (FE) model we exploit the within-country variation over time, eliminating any observable and unobservable country-specific time-invariant effects. We also include fixed time effects to control for other confounding factors (e.g. period specific shocks) that influence multiple countries simultaneously. We use standard errors robust to heteroscedasticity.

4.2. 2SLS PANEL IV MODEL

4.2.1 Endogeneity problem and IV approach

There are two reasons for potential endogeneity of the globalization variable in our model: omitted variable bias and reverse causality.

We have included many control variables, but other unobserved omitted variables may give rise to biased estimates. The omitted variable bias indicates that there is still a third (or more) variable(s) which both influence(s) globalization and income inequality. For example, increasing mobility may induce countries to reduce (capital) taxes and cut welfare benefits, which in turn, will influence disposable income and probably also employment. If competition from countries with cheap labor induces companies in high income countries to specialize in the production of high tech goods and services, which requires highly skilled labor, this will have an impact on the skill premium. It is difficult to disentangle these effects from the 'direct' influence of globalization on income inequality, that is the influence of globalization, given other factors.

Secondly, reverse causality may occur because changes in income inequality are likely to influence policies which affect globalization. The debate on the Transatlantic Trade and Investment Partnership (TTIP), for instance, is also influenced by the perception that gains from trade may be distributed

rather unevenly. Shifts in the income distribution within a country may also have direct effects on the globalization level of the country, for example if more or less people are able to travel, to buy more expensive import-goods or to make international investments and savings.

To deal with the endogeneity problem of globalization, we use predicted openness based on a gravity equation as an IV. Frankel and Romer (1999) apply predicted openness in a cross-sectional approach. We would like to exploit exogenous time variation in predicted openness using the IV in a panel model and controlling for unobserved country effects (see Feyrer 2009; Felbermayr and Gröschl 2013). We employ the exogenous component of variations in openness predicted by geography and time-varying natural disasters in foreign countries, as proposed by Felbermayr and Gröschl (2013) for a panel data model, as an IV for globalization. Based on a modified gravity framework, Felbermayr and Gröschl (2013) show that the incidence of natural disasters such as earthquakes, hurricanes or volcanic eruptions in one country influences openness of its trading partners, depending on the two countries' geographic proximity.[20] An earthquake hitting Mexico, for example, will increase international trade and financial flows of other countries with Mexico and immigration from Mexico. The rise in a country's globalization level will be larger, the closer a country is located to Mexico. Gravity model based predicted openness variables have been shown to be a relevant IV for the KOF globalization index (Potrafke 2013; Eppinger and Potrafke 2016) and trade openness (see Frankel and Romer 1999; Felbermayr and Gröschl 2013).

4.2.2 IV

The predicted openness by Felbermayr and Gröschl is constructed in two steps:

First, bilateral openness is predicted by a reduced[21] gravity model using Poisson Pseudo Maximum Likelihood (PPML) estimation and standard errors clustered by country pairs. Bilateral openness is regressed on variables exogenous to income inequality such as large scale natural disasters in foreign countries j, interactions of the incidence of natural disasters in foreign countries j and bilateral geographic variables, or population. Felbermayr and Gröschl (2013) estimate

$$\widehat{\omega}_t^{ij} = \exp\left[\delta_1 \times D_t^j + \boldsymbol{\gamma}' \times \mathbf{Z_t^{ij}} + \boldsymbol{\lambda}' \times \left(\mathbf{\Phi_t^{ij}} \times D_t^j\right) + v^i + v^j + v_t\right] + \varepsilon_t^{ij}, \qquad \textbf{(2)}$$

where $\mathbf{Z_t^{ij}} = \left[\ln POP_t^i ; \ln POP_t^j ; \ln DIST^{ij}; BOR^{ij}\right]$ includes exogenous controls such as population (*POP*) in countries i and j in year t, and the bilateral geographic variables distance *DIST*, and a common border dummy *BOR*, based on Frankel and Romer (1999). D_t^j denotes exogenous large scale natural disasters in country j, while $\mathbf{\Phi_t^{ij}} = \left[\ln FINDIST_t^j; \ln AREA^j; \ln POP_t^j; BOR^{ij}\right]$ describes the exogenous variables interacted with D_t^j, such as the international financial remoteness *FINDIST*, the surface area *AREA*, or population *POP* of country j.[22] Country and time fixed effects[23] are captured by v^i, v^j, v_t, while ε_t^{ij} accounts for the idiosyncratic error.

[20] For example, the effect of an earthquake in Mexico will be stronger for international transactions of Honduras or the United States than for India.

[21] The reduced form of the gravity model differs from standard (trade) gravity models by excluding variables that would be correlated to income inequality such as GDP per capita.

[22] As large scale natural disasters may hit both bordering countries, an interaction of disasters and the common border dummy is included. Interactions of the disaster variable with surface area and population in country j consider the fact that economic and population density matters for the aggregate damage caused by large scale natural disasters. The interaction of disasters with financial remoteness is motivated by related literature (see Felbermayr and Gröschl 2013).

We follow the preferred approach by Felbermayr and Gröschl (2013) and use truly exogenous "large" scale natural disasters (as D_t^j) to make sure that a disaster is of a sufficiently large dimension and not caused by local determinants or the development level of the country, but rather by exogenous global phenomena. This classification of natural disasters includes "large" earthquakes, droughts, storms, storm floods, and volcanic erruptions that (i) caused 1,000 or more deaths; or (ii) injured 1,000 or more people; or (iii) affected 100,000 or more people. In our robustness checks, we use alternative definitions of disasters to construct the instrument, such as a broader specification of disasters that includes all kinds of natural disasters[24] or counting all sizes of disasters (see section 5.5.3).

We use an exogenous proxy for multilateral openness $\Omega_{\mathrm{i,t}}$ by aggregating the obtained predicted openness values $\widehat{\omega}_t^{ij}$ of country i over all bilateral country-pairs and years t:

$$\Omega_{\mathrm{i,t}} = \sum_{i \neq j} \widehat{\omega}_t^{ij} \ . \qquad \textbf{(3)}^{25}$$

Based on our underlying data[26] we obtain values from 1966 to 2008. Averaging over nine periods τ and using one period lags of predicted openness $\Omega_{\mathrm{i},\tau-1}$, we obtain our instrument for $GLOB_i, \tau$ in equation (1).

Relevance of the instrument: The relevance of the IV predicted openness $\Omega_{\mathrm{i},\tau-1}$ depends on its conditional correlation with the KOF globalization index values $GLOB_i, \tau$. The first stage regression has the following form:

$$GLOB_i, \tau \ = \ \alpha_1 \times \Omega_{\mathrm{i},\,\tau-1} + \boldsymbol{\varphi}' \times \boldsymbol{\chi}_{i,\tau} + \upsilon_i + \upsilon_\tau + \varepsilon_{i,\tau} \ . \qquad \textbf{(4)}$$

The model is estimated by applying the FE estimator, controlling for any time-invariant country characteristics, and using robust standard errors. The first stage also includes period dummies to control for common period effects.

The first stage regression results in Table 1 show that the IV is relevant. Our predicted openness variable is qualitatively good and correlates positively and significantly with the overall KOF globalization index (GLOB) and the sub-indicators of globalization (Trade, Exports, Imports, FDI, social and political openness). The F-statistics on the excluded instrument are well above Staiger and Stock's (1997) rule of thumb (F≥10) and the 10 % critical value (F≥16.38) of the weak instrument test by Stock and Yogo (2005) for the overall KOF index and four out of six other specifications of sub-indicators (trade openness, export openness, import openness, and political globalization). In the specifications for FDI and the social globalization index, the F-statistic is above the 15% (F≥8.96) and 25% (F≥5.53) critical values. The partial R^2 of lagged predicted openness ranges between 1.1% in the specification for FDI and 16.9% in the specification for export openness.

---

[23] Time fixed effects also account for improved reporting of natural disasters and its consequences (see Felbermayr and Gröschl 2013).

[24] Natural disasters caused by extreme temperature, floods, (mud)slides, or wildfires are also included in this extended definition of natural disasters. Epidemics are not included in any of our classifications.

[25] The instrument in equation 3 is constructed based on all available trade partners in the raw data following Felbermayr and Gröschl (2013). The sample includes more countries than our full sample of 140 countries.

[26] The trade data originally comes from the IMF's Direction of Trade Statistics (DoTS), nominal GDPs and populations are taken from Word Development Indicators (WDI) and Barbieri (2002), and the geographic variables are from the CEPII's Geographic and Bilateral Distance Database. Data on natural disasters is taken from the Emergency Events database (EM-DAT), and data on financial centers is based on Rose and Spiegel (2009).

Table 1: **First stage regression results (2SLS), based on nine periods using 5-year averages and FE estimates**

a) Full sample

Instrumented var.	(1) GLOB	(2) Trade	(3) Export	(4) Import	(5) FDI	(6) Social	(7) Political
$\Omega^i_{\tau-1}$	0.075***	0.450***	0.258***	0.192***	0.129***	0.068**	0.184***
	(0.015)	(0.088)	(0.050)	(0.043)	(0.038)	(0.028)	(0.038)
Partial R^2	0.029	0.075	0.081	0.048	0.011	0.014	0.055
F-Test, excl. IV	24.40	25.93	26.13	20.31	11.24	5.94	23.44
F-Test, p-value	0.000	0.000	0.000	0.000	0.001	0.015	0.000
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects							
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	140	139	139	139	140	140	140
Observations	815	800	800	800	821	815	815

b) Benchmark sample (high and middle income countries)

Instrumented var.	(1) GLOB	(2) Trade	(3) Export	(4) Import	(5) FDI	(6) Social	(7) Political
$\Omega^i_{\tau-1}$	0.087***	0.561***	0.339***	0.222***	0.122***	0.097***	0.180***
	(0.017)	(0.096)	(0.053)	(0.048)	(0.038)	(0.027)	(0.043)
Partial R^2	0.043	0.142	0.169	0.087	0.014	0.029	0.067
F-Test, excl. IV	25.93	33.89	41.54	21.97	10.18	12.66	17.37
F-Test, p-value	0.000	0.000	0.000	0.000	0.002	0.000	0.000
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects							
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	82	82	82	82	82	82	82
Observations	529	517	517	517	530	529	529

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All specifications include baseline control variables: GDP per capita, ln population, and dependency ratio.Stock and Yogo (2005) weak identification test – critical values: 16.38 (10%); 8.96 (15%); 6.66 (20%); 5.53 (25%).

Exclusion restriction: Income inequality does not influence predicted openness because the instrument is constructed from exogenous components only, such as large scale natural disasters and bilateral geographic components. We do not think that predicted openness influences income inequality directly or through other explanatory variables that we did not include in our model. Predicted trade openness is an arguably excludable instrument. Foreign natural disasters are expected to have no effect on income inequality other than through international transactions and migration, i.e., the extent of globalization. One may want to maintain that the exclusion restriction is not fulfilled because natural disasters that occur in the trading partner countries (which are often direct geographical neighbors) give rise to migration. For example, when a natural disaster occurs in Mexico, especially poor Mexican citizens are likely to leave Mexico and migrate to a neighboring country such

as Honduras.[27] If this is true, the natural disaster that hit Mexico (and gave rise to the exogenous variation in our instrumental variable trade openness) influenced globalization and income inequality in Honduras. Migration is, however, included in the KOF globalization index.[28]

Large scale natural disasters may give rise to changes in the income distribution. Felbermayr and Gröschl (2013, 2014), for example, have shown that natural disasters influence overall per capita income. Some natural disasters are registered across borders. Registered natural disasters in the home country might have a direct impact on the home country's income distribution. To mitigate a potential omitted variable bias because of cross-border natural disasters we directly control for the effect of large scale natural disasters of the home country as a robustness test in section 5.5.1.[29]

5 RESULTS

5.1. BASELINE MODEL

OLS results in Table 2 confirm the findings of previous empirical studies indicating a positive relationship between globalization and income inequality (columns 1 to 4). The coefficient of the globalization index is larger when we use the Gini market index (before taxation and transfers) than when we use the Gini net inequality index (after taxation and transfers) as the dependent variable. When we estimate the model by 2SLS, the coefficient of the globalization index lacks statistical significance for the full sample (columns 5 and 6), but has a positive sign and is statistically significant at the 10% and 5% level for the benchmark sample (columns 7 and 8). The effect of globalization on income inequality is positive in both specifications, before and after redistribution. The coefficient of the 2SLS estimator is larger than the OLS estimator in our benchmark sample indicating that OLS results underestimate the effect of globalization on income inequality. The numerical meaning of the effects is that a ten unit increase in the KOF globalization index gives rise to a 3.11 higher Gini market index value and a 3.83 higher Gini net index value. In other words, an increase of the KOF globalization index by one standard deviation (about 16.8 points on the scale from 1 to 100) gives rise to an increase in the Gini market index value by around 0.74 standard deviations (about 5.2 Gini index points) and an increase in the Gini net index value by around 0.70 standard deviations (about 6.4 Gini index points).

[27] Empirical studies show, however, that natural hazards give hardly rise to international migration in the medium and long term (see Gröschl and Steinwachs 2017).

[28] We acknowledge that citizens in Honduras may become depressive when they observe the consequences of a natural disaster that occurred in Mexico. When poor citizens in Honduras are more likely to become depressive than rich citizens and depressions give rise, for example, to decreasing incomes, income inequality in Honduras will increase. We are not aware of variables that measure how citizens with high and low incomes emotionally respond to natural disasters in neighboring countries. We do, however, not expect a significant effect of emotional and personal reactions on income inequality because of foreign natural disasters.

[29] The gravity model also includes population growth to construct predicted openness. We already control for population growth as baseline control in the OLS and IV regressions.

Table 2: **Baseline: OLS and 2SLS panel fixed effects estimates, based on nine periods using 5-year averages between 1970 and 2014**

	OLS				2SLS			
	Full sample		Benchmark sample		Full sample		Benchmark sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Gini market	Gini net	Gini market	Gini net	Gini market	Gini net	Gini market	Gini net
GLOB	0.234***	0.162***	0.213**	0.136**	-0.031	0.122	0.311*	0.383**
	(0.071)	(0.058)	(0.084)	(0.067)	(0.249)	(0.206)	(0.177)	(0.169)
GDP pc	0.065	-0.004	0.039	-0.045	0.034	-0.009	0.047	-0.024
	(0.066)	(0.055)	(0.066)	(0.055)	(0.049)	(0.039)	(0.041)	(0.035)
ln POP	-8.925***	-4.201**	-7.762**	-1.505	-12.164***	-4.680*	-6.223	2.378
	(2.486)	(2.104)	(3.644)	(3.148)	(3.469)	(2.835)	(3.865)	(3.390)
Dependency	0.140***	0.070*	0.185***	0.127**	0.106**	0.065*	0.202***	0.170***
	(0.049)	(0.041)	(0.066)	(0.056)	(0.047)	(0.039)	(0.055)	(0.048)
Fixed Effects								
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	140	140	82	82	140	140	82	82
Observations	815	815	529	529	815	815	529	529
R^2(within)	0.2526	0.1187	0.3611	0.1782	0.2083	0.1170	0.3540	0.0835

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

5.2. GLOBALIZATION SUB-INDICATORS

Table 3 shows regression results for the individual globalization indicators using equations (1) and (4). Trade openness as measured by imports and exports as a share of GDP hardly influenced income inequality. The coefficient of trade openness is statistically significant at the 10% level in columns (2) and (8) but lacks statistical significance in the other specifications. Export openness (exports as a share of GDP) was positively related with income inequality in the full sample (columns 1 and 2), but does not turn out to be statistically significant in columns (3) to (7). The coefficient of export openness is positive and statistically significant at the 10% level in column (8) indicating that export openness somewhat increased the Gini net index. Import openness (imports as a share of GDP) does not turn out to be statistically significant in columns (1) to (8).

By contrast, the OLS-results suggest that actual inflows and outflows of FDI (our proxy for financial globalization) as measured as a share of GDP was positively associated with income inequality (columns 1 to 4). The 2SLS results corroborate that FDI had a positive effect on income inequality in the benchmark sample (columns 7 and 8) but do not suggest that FDI influenced income inequality in the full sample (columns 5 and 6).

The social globalization index was positively associated with the Gini market index (columns 1 and 3). The 2SLS results show that social globalization had a positive effect both on the Gini market and net index in the benchmark sample, but do not suggest an effect of social globalization in the full sample (columns 5 to 8). The coefficient of the political globalization index lacks statistical significance in columns (1) to (7) and has positive effect on Gini next index in the benchmark sample (column 8).

Table 3: **Sub-indicators of globalization: OLS and 2SLS – panel fixed effects estimates, based on nine periods using 5-year averages between 1970 and 2014**

a) Sub-indicators: Trade opennes, export openness, and import openness

	OLS				2SLS			
	Full sample		Benchmark sample		Full sample		Benchmark sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Gini market	Gini net	Gini market	Gini net	Gini market	Gini net	Gini market	Gini net
Trade openness	0.019	0.020*	-0.001	0.007	-0.029	-0.001	0.033	0.044*
	(0.013)	(0.012)	(0.015)	(0.013)	(0.046)	(0.038)	(0.030)	(0.027)
Countries	140	140	82	82	139	139	82	82
Observations	801	801	517	517	800	800	517	517
R^2(within)	0.1829	0.0764	0.279	0.115	0.1629	0.0700	0.267	0.089
Export openness	0.048*	0.045**	0.010	0.016	-0.050	-0.002	0.055	0.073*
	(0.026)	(0.023)	(0.030)	(0.026)	(0.081)	(0.066)	(0.053)	(0.044)
Countries	140	140	82	82	139	139	82	82
Observations	801	801	517	517	800	800	517	517
R^2(within)	0.1858	0.0798	0.2788	0.1154	0.1603	0.0699	0.2730	0.0968
Import openness	0.016	0.022	-0.016	0.007	-0.068	-0.002	0.084	0.111
	(0.027)	(0.023)	(0.028)	(0.024)	(0.108)	(0.088)	(0.077)	(0.069)
Countries	140	140	82	82	139	139	82	82
Observations	801	801	517	517	800	800	517	517
R^2(within)	0.1804	0.0725	0.2792	0.1142	0.1632	0.0702	0.2549	0.0617
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

b) Sub-indicators: Foreign direct investments, social, and political globalization

	OLS				2SLS			
	Full sample		Benchmark sample		Full sample		Benchmark sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Gini market	Gini net	Gini market	Gini net	Gini market	Gini net	Gini market	Gini net
FDI	0.083***	0.051***	0.099***	0.057***	-0.015	0.077	0.226*	0.279**
	(0.020)	(0.015)	(0.025)	(0.015)	(0.143)	(0.120)	(0.124)	(0.123)
Countries	140	140	82	82	140	140	82	82
Observations	821	821	530	530	821	821	530	530
R^2(within)	0.2544	0.1147	0.3741	0.1817	0.2051	0.1086	0.2989	-0.2974
Social Glob.	0.129**	0.078	0.132*	0.070	-0.034	0.135	0.280**	0.345**
	(0.062)	(0.052)	(0.070)	(0.056)	(0.278)	(0.226)	(0.170)	(0.175)
Countries	140	140	82	82	140	140	82	82
Observations	815	815	529	529	815	815	529	529
R^2(within)	0.2364	0.1013	0.3514	0.1637	0.2071	0.0949	0.3211	-0.0531
Political Glob.	0.023	0.033	0.052	0.061	-0.013	0.050	0.151	0.185**
	(0.039)	(0.035)	(0.050)	(0.045)	(0.100)	(0.086)	(0.092)	(0.085)
Countries	140	140	82	82	140	140	82	82
Observations	815	815	529	529	815	815	529	529
R^2(within)	0.2192	0.0935	0.3328	0.1658	0.2166	0.0925	0.3129	0.1000
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. First-stage results and F-statistics on the excluded instrument are reported in Table 1. All specifications include baseline control variables: GDP per capita, ln population, and dependency ratio.

*** p<0.01, ** p<0.05, * p<0.1.

The estimated coefficients of the globalization sub-indicators are larger when we estimate the model by 2SLS than by OLS in all specifications of our benchmark sample. The result supports the finding in our baseline model (see 5.1), indicating that OLS results underestimate the effect of globalization on income inequality.

5.3. THE ROLE OF DEVELOPMENT LEVELS

The effect of globalization on income inequality is likely to differ depending on the development and income level of countries. We therefore examine subsamples depending on the development level of countries.

OLS estimates in Table 4 show a positive correlation between globalization and income inequality within the sample of the 106 emerging markets and developing economies (columns 3 and 4), but no statistically significant correlation within the 34 most advanced economies (columns 1 and 2). OLS estimates show, however, a positive correlation between globalization and income inequality for all 82 countries in our benchmark sample (columns 5 and 6). The benchmark sample of high and middle income countries includes the advanced economies sample and the 48 emerging economies having a per capita income level above a minimum threshold. The subsample-results confirm the baseline results indicating that the relationship between globalization and income inequality is somewhat larger when we use the Gini market index (before taxation and transfers) than when we use the Gini net index (after taxation and transfers) as the dependent variable. The results also suggest that the relationship between globalization and income inequality is larger for less developed countries than for more advanced economies: an increase of ten KOF globalization index points is associated with a 3.23 higher Gini market and a 2.49 higher Gini net inequality index within the sample of emerging and developing countries. Within the benchmark sample, which does not include developing countries having a GNI per capita below 4,126 USD (World Bank 2015), the estimated coefficient becomes smaller. An increase of the globalization by 10 index points is associated with a 2.12 higher Gini market and a 1.36 higher Gini net index value. Within the sample of 34 advanced economies around the world, the estimators are even below 0.1 and 0.01 (and statistically not different from zero).

When we exclude the 58 poorest countries, 2SLS estimates show that globalization influences income inequality within the remaining 82 high and middle income countries of the benchmark sample (Table 4, columns 5 and 6). 2SLS results do, however, not show that globalization influences income inequality within the most advanced economies and within the sample of emerging markets and developing economies (columns 1-4). The coefficients do not turn out to be statistically significant. The instrument is relevant within both sub-samples. The F-statistic on the excluded instrument is well above the 20% and 15% critical values.

We also examine the relationship between the globalization sub-indicators (trade openness, export openness, import openness, FDI, social and political globalization) and income inequality within the subsamples.[30] Within advanced economies, neither the OLS nor 2SLS results suggest any statistically significant effects. Within the emerging and developing economies, the OLS results suggest that export openness, FDI and social globalization are positively associated with income inequality (Gini market and Gini net indices). The import share and political globalization is not significantly related to

[30] Estimation results for globalization sub-indicators are not reported in the table.

inequality. 2SLS results do, however, not show that any sub-indicator influences income inequality within this sub-sample of countries. The results based on the development level sub-samples do not suggest that overall globalization or any sub-indicator influences income inequality within countries. While we cannot confirm any significant relationship within advanced economies, our findings suggest that globalization influences income inequality within our benchmark sample of high and middle income economies. As 41.5 percent of countries in the benchmark sample are advanced economies, other countries within the benchmark sample might be the drivers of the effects of globalization on income inequality.

Table 4: **Development levels: OLS and 2SLS panel fixed effects estimates, based on nine periods using 5-year averages between 1970 and 2014**

	Advanced Economies		Emerging and Developing		Benchmark sample	
	(1) Gini market	(2) Gini net	(3) Gini market	(4) Gini net	(5) Gini market	(6) Gini net
OLS-results						
GLOB	0.086	0.009	0.323***	0.249***	0.213**	0.136**
	(0.116)	(0.053)	(0.085)	(0.079)	(0.084)	(0.068)
2SLS-results						
GLOB	-0.254	-0.025	-0.449	-0.416	0.311*	0.383**
	(0.258)	(0.181)	(0.425)	(0.365)	(0.177)	(0.169)
F-Test excl. IV	7.64		10.27		25.93	
F-Test, p-value	0.0062		0.0014		0.000	
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
Countries	34	34	106	106	82	82
Observations	244	244	571	571	529	529

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. All specifications include baseline control variables: GDP per capita, ln population, and dependency ratio. Stock and Yogo (2005) weak identification test – critical values:16.38 (10%); 8.96 (15%); 6.66 (20%); 5.53 (25%).

5.4. THE ROLE OF CHINA AND TRANSITION COUNTRIES

5.4.1 Estimation results

The unconditional relationship between the change in globalization and income inequality seems to be driven by China and the Eastern European countries (East-EU). We therefore exclude China (columns 3 and 4) and China and the eleven Eastern European EU member countries (columns 5 and 6) from the benchmark sample of high and middle income countries. The results in Table 5 show that the coefficient estimates of the globalization index becomes smaller compared to the baseline sample (columns 1 and 2) when we exclude China (columns 3 and 4). The coefficient of the globalization variable becomes smaller and does not turn out to be statistically significant when we exclude China and the Eastern European countries, estimating the model by OLS or 2SLS notwithstanding (columns 5 and 6).

The results in Table 6 show that excluding China also renders the effects of the sub-indicators trade and export openness, and political and social globalization to lack statistical significance. The coefficient of the FDI variable, however, remains statistically significant at the 10% (1%) level when China is excluded and the model is estimated by 2SLS (OLS).

Table 5: **Baseline, excluding China and transition economies: OLS and 2SLS panel fixed effects estimates, based on nine periods using 5-year averages between 1970 and 2014**

	Benchmark sample (all)		Benchmark sample (excl. China)		Benchmark sample (excl. China and East-EU)	
	(1) Gini market	(2) Gini net	(3) Gini market	(4) Gini net	(5) Gini market	(6) Gini net
OLS-results						
GLOB	0.213**	0.136**	0.168**	0.084*	0.101	0.031
	(0.084)	(0.068)	(0.075)	(0.049)	(0.082)	(0.052)
2SLS-results						
GLOB	0.311*	0.383**	0.218	0.294*	-0.348	-0.103
	(0.177)	(0.169)	(0.184)	(0.171)	(0.316)	(0.244)
F-Test excl. IV	25.93		24.22		10.40	
F-Test, p-value	0.000		0.000		0.0014	
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
Countries	82	82	81	81	70	70
Observations	529	529	520	520	459	459

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. All specifications include baseline control variables: GDP per capita, ln population, and dependency ratio. Stock and Yogo (2005) weak identification test – critical values:16.38 (10%); 8.96 (15%); 6.66 (20%); 5.53 (25%).

Table 6: **Sub-indicators of globalization, benchmark sample excluding China: OLS and 2SLS panel fixed effects estimates, based on nine periods using 5-year averages between 1970 and 2014**

a) Sub-indicators: Trade openness, export openness, and import openness

	OLS				2SLS			
	Benchmark sample (all)		Benchmark sample (excl. China)		Benchmark sample (all)		Benchmark sample (excl. China)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Gini market	Gini net	Gini market	Gini net	Gini market	Gini net	Gini market	Gini net
Trade openness	-0.001	0.007	-0.006	0.002	0.033	0.044*	0.011	0.021
	(0.015)	(0.013)	(0.014)	(0.011)	(0.030)	(0.027)	(0.030)	(0.026)
Countries	82		81		82		81	
Observations	517		508		517		508	
F-Test excl. IV					33.89		32.25	
F-Test, p-value					0.000		0.000	
Export openness	0.010	0.016	0.001	0.007	0.055	0.073*	0.017	0.035
	(0.030)	(0.026)	(0.028)	(0.023)	(0.053)	(0.044)	(0.048)	(0.042)
Countries	82		81		82		81	
Observations	517		508		517		508	
F-Test excl. IV					41.54		39.68	
F-Test, p-value					0.000		0.000	
Import openness	-0.016	0.007	-0.024	-0.001	0.084	0.111	0.027	0.054
	(0.028)	(0.024)	(0.026)	(0.022)	(0.077)	(0.069)	(0.077)	(0.065)
Countries	82		81		82		81	
Observations	517		508		517		508	
F-Test excl. IV					21.97		20.72	
F-Test, p-value					0.000		0.000	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

b) Sub-indicators: Foreign direct investments, social and political globalization

	OLS				2SLS			
	Benchmark sample (all)		Benchmark sample (excl. China)		Benchmark sample (all)		Benchmark sample (excl. China)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Gini market	Gini net	Gini market	Gini net	Gini market	Gini net	Gini market	Gini net
FDI	0.099***	0.057***	0.098***	0.055***	0.226*	0.279**	0.171	0.231*
	(0.025)	(0.015)	(0.026)	(0.015)	(0.124)	(0.123)	(0.136)	(0.130)
Countries	82		81		82		81	
Observations	530		521		530		521	
F-Test excl. IV					10.18		9.00	
F-Test, p-value					0.002		0.003	
Social Glob.	0.132*	0.070	0.094	0.026	0.280**	0.345**	0.195	0.262
	(0.070)	(0.056)	(0.058)	(0.039)	(0.170)	(0.175)	(0.163)	(0.159)
Countries	82		81		82		81	
Observations	529		520		529		520	
F-Test excl. IV					12.66		11.02	
F-Test, p-value					0.000		0.001	
Political Glob.	0.052	0.061	0.020	0.027	0.151	0.185**	0.105	0.142
	(0.050)	(0.045)	(0.041)	(0.033)	(0.092)	(0.085)	(0.095)	(0.087)
Countries	82		81		82		81	
Observations	529		520		529		520	
F-Test excl. IV					17.37		16.80	
F-Test, p-value					0.000		0.000	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. All specifications include baseline control variables: GDP per capita, ln population, and dependency ratio. Stock and Yogo (2005) weak identification test – critical values: 16.38 (10%); 8.96 (15%); 6.66 (20%); 5.53 (25%).

5.4.2 Income inequality during transition

Transition countries have experienced a large shift in globalization, in particular since the Fall of the Berlin wall, which coincides with an increase in income inequality in almost all of the countries during the 1990s (see Figure 5). The countries have experienced many massive structural and institutional changes, such as privatizations of state owned enterprises, deindustrialization, price liberalizations, financial development, labor and product market deregulation, new models of corporate governance, or shrinking and reforming of the public sector during their transformation from centrally planned to market-based economies. One of the most visible outcomes of the systematic change and complex interplay of several forces is a remarkable increase in income inequality (see Perugini and Pompei 2015). The market-oriented reforms, moreover, promoted the inflow of FDI and the integration in the global market. The transition toward market economies therefore might be an omitted driver of globalization and inequality in transition countries.

Transition in Central and Eastern European countries: Transition countries from Central and Eastern Europe have experienced a fundamental and systematic change toward a market economy since the outset of transition in the late 1980s and particularly the early 1990s.[31] Speed, sequence and inequality outcomes, however, even had various patterns within Eastern European transition countries (see Aristei and Perugini 2014). The Visegrád countries (Czech Republic, Hungary, Slovakia, and Poland) and the Baltic countries (Estonia, Latvia and Lithuania) had, for example, a relative fast transition and joined the EU in 2004. Poland, in particular, is an example of a country which implemented a shock-therapy approach, the "Balcerowicza plan", with a fast systematic change from a centrally planned to a pure market economy in almost all fields. Hungary, as another example, followed a more gradual transformation process at the beginning, but implemented some radical reforms in the mid-1990s, especially large-scale privatizations. Bulgaria and Romania, the two countries who joined the EU in 2007, had a gradual and less coordinated transition over a longer time period than other new EU members from Central and Eastern Europe.

The first years of transition were characterized by macroeconomic imbalances such as a large output drop and hyperinflation in the majority of the post-communist transition countries from Central and Eastern Europe. Unemployment and wage dispersion rapidly increased because of the introduction of (international) market competition and new plants with new technologies, and large scale privatizations, infrastructure reforms, and deindustrialization (see Milanovic 1999; Campos and Coricelli 2002; Ivaschenko 2002; Ivanova 2007; Milanovic and Ersado 2011). As a consequence of their transition pattern, income inequality increased in the Visegrád countries and the Baltic countries mainly in the first stage of the transition period and maintained during the 1990s (see Figure 5). Poland and Hungary, in particular, experienced a steep rise in unemployment and income inequality. The Czech and the Slovak Republics and the two EU members of the former Yugoslavia (Croatia and Slovenia)[32], however, were already able to keep their inequality growth at a minimum in the 1990s.

Reforms of the East-EU member countries during transition coincided with a rise in globalization. Large-scale privatizations, for example in Hungary in the mid-1990s, often attracted large inflows of FDI (Sinn and Weichenrieder 1997; Campos and Coricelli 2002). Globalization, the acceleration of new technologies, deregulation, and privatizations of state-owned net industries decreased the labor

[31] Several countries from the former Soviet Union have also experienced a substantial transition process (see Figure 3f). We have not excluded former Soviet Union countries other than the Baltic states from the regressions in section 5.4.1.

[32] The Gini indices in Croatia were higher than in many other transition countries in the period 1990-1994. One reason might be that the former Republic of Yugoslavia already implemented some inequality rising reforms during the late 1980s. During the war in the 1990s, inequality even decreased in Croatia. The country has proceeded its transition process in the 2000s and joined the EU in 2013.

share in advanced market economies during the same time (see Azmat et al. 2012; Karababounis and Neiman 2014). Changes in established market economies were, however, smaller and moderated by stable political institutions, established transfer systems, and manifold opportunities for education, which have moderated adverse effects on income inequality. Figure 3b shows, for example, that income inequality after taxation and transfers hardly increased in the generous welfare states of the EU15, while globalization proceeded. High redistribution and inequality outcomes at a relative low level remained pronounced in the Scandinavian countries and the Western continental Europe (see Fuest et al. 2010 for the redistributive effects of tax-benefit systems in Europe; and Doerrenberg and Peichl 2014 for trends in inequality by welfare state types). In Central and Eastern European countries social transfers played a minor countervailing role during transition. Policies like the removal of price subsidies, the reduction of social in-kind benefits, and the privatization of public sector housing rather increased inequality in the first transition stage (see Milanovic 1999; Flemming and Micklewright 2000; Ivanova 2007). The transition countries, moreover, had limited capabilities in the education system and higher labor market frictions at the beginning of their transition. The transition to an open and competitive market economy, FDI induced new technologies and equipment, and the overall skill-biased technological shift in the 1990s suddenly required other and higher skill-requirements than the working age population and the education systems were prepared for (see Aghion and Commander 1999).

While globalization proceeded in the transition countries from Central and Eastern Europe since the end of its transformation into market economies, income inequality did not increase (or even decreased) in many countries in the 2000s (see Figure 5).[33] Exceptions are, for example, the Baltic countries Latvia and Lithuania. In Bulgaria and Romania, income inequality was incrementally on the rise during the 1990s and 2000s, in a similar vein as their gradual transition process. At the beginning of their transition toward a market economy, the new EU member countries from Central and Eastern Europe had a lower globalization and Gini inequality level on average than other advanced economies in the world. After transition, they are at about the same level in both, globalization and income inequality (see Figures 2 and 3 for the trends in the level averages of advanced economies and the EU15 countries).

Transition in China: In China, the transition to a marked-based economic system was more gradual than in Central and Eastern Europe and proceeded in several sequences over a long time period (see Roland 2000). In the 1970s, globalization and income inequality were less pronounced, but poverty rates were high (Figure 5).[34] After the death of Mao and decades of communist economics, China decided to partially implement market elements in its economy from 1978 onwards. The government started, for example, with agrarian reforms and to introduce free prices with a dual price quota system, which allowed selling parts of the output at free market prices. Decentralization occurred by shifting power to regional authorities. The first joint-venture-law was passed in 1979 and the first special economic zones were created in the early 1980s. FDI, at first, were only allowed in special economic zones. The inflow of FDI and established market elements in the economy contributed to a large economic, employment and globalization growth in the special economic zones. During the 1980s, China implemented several more special economic zones, free trade zones, and technological development zones. Moreover, contract responsibility reforms in state-owned and collective

[33] Egger and Stehrer (2003) rather suggest that FDI and outsourcing of intermediate goods production to Eastern Europe resulted in a reduction of wage inequality in the affected transition countries.
[34] Communist programs such as "The Great Leap Forward", the "Cultural Revolution" and collective farming (with weak incentives for work) had left a pervasive poverty in China by the mid-1970s.

enterprises and the effective development of new private companies and joint-ventures occurred. Since the mid-1990s, privatizations of small-medium sized enterprises are proceeding.

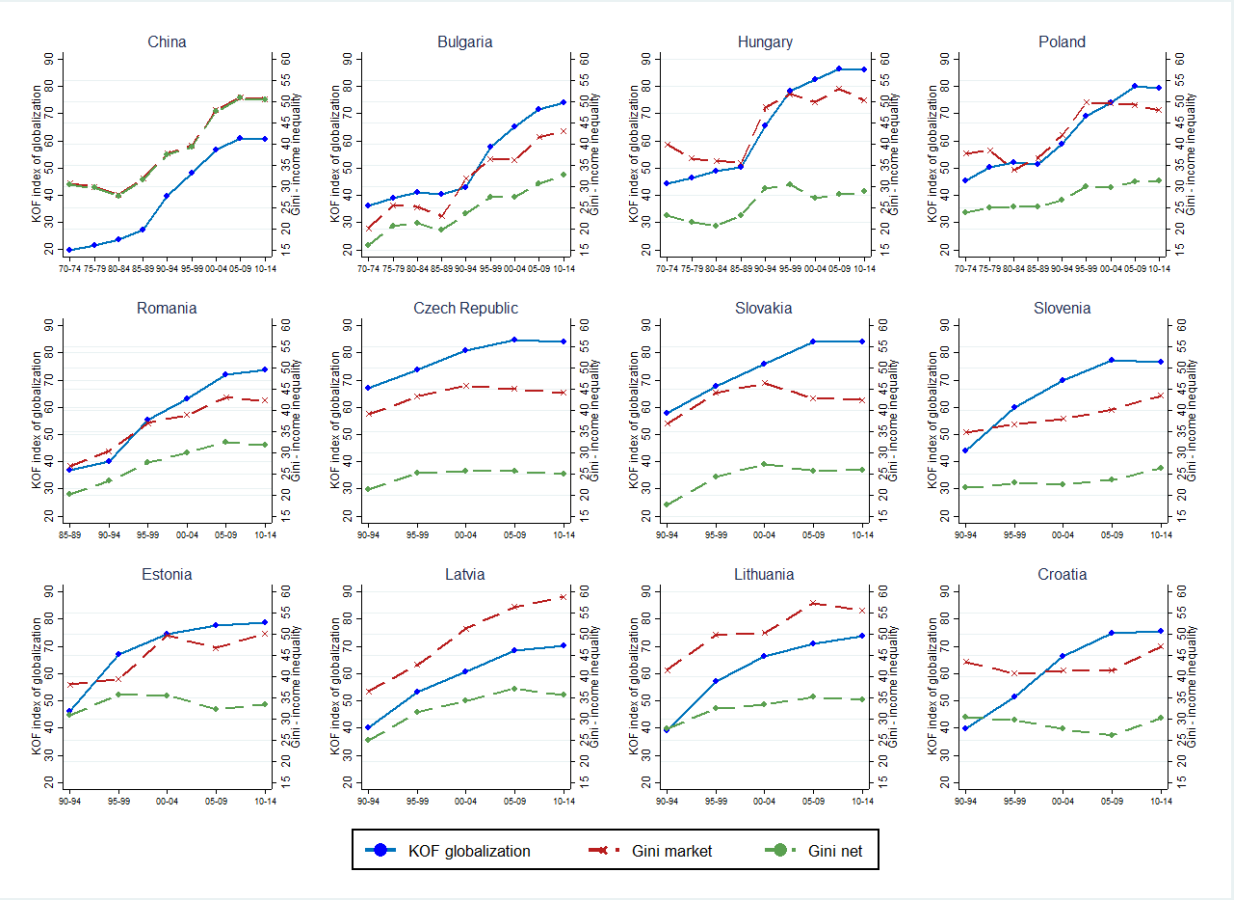
Globalization and economic growth in China has been increasing since the beginning of the Chinese gradual reform programs in the late 1970s. China has made a large progress against absolute poverty ever since (see Ravaillon and Chen 2007). Participation in the Chinese income growth, however, was unequally distributed between and within regions (see Ravaillon and Chen 2007). Income growth has been remarkably larger at the top of the Chinese income distribution (Lakner and Milanovic 2015). While Central and Eastern European transition countries mainly had a fast transition period or even a big-bang approach of transition and its income inequality only increased to a large amount within that period of time, China has implemented a gradualism approach of reforms which all have increased inequality sequentially. Political and economic reforms were concentrated on growth that has not been moderated by large taxation and transfer programs.[35] China has started some redistribution programs to promote a "harmonious society" during the 2000s, but nation-wide direct income taxation and transfers are still on a low level (see Knight 2014). As a consequence, both income inequality pre and post taxation and transfers are increasing in China since the early 1980s.

The gradual economic reforms in China have simultaneously produced a large increase of its globalization and income inequality levels (see Figure 5). As shown in section 5.4.1, China is a main driver of the positive relationship between globalization and income inequality. The global interpersonal inequality, however, has declined as the Chinese population has increased its income across all deciles in the course of its globalization and transition process (Lakner and Milanovic 2015). The Chinese example of economic growth suggests that large income increases of the rich may be a precondition for the poor to also experience increases in income when a country is emerging rapidly.[36] The Chinese rise in income inequality is, moreover, consistent with predictions of the inverted-U hypothesis of the Kuznets curve relating inequality to the development level (see Kuznets 1955). Following the predictions of Kuznets, China might be able to reduce its inequality level if its income level proceeds to increase in the future.

[35] Ravaillon and Chen (2007) have shown that public spending between 1980 and 2001 has reduced poverty, but not income inequality.

[36] While inequality might be a precondition to create incentives and economic growth in an equalized society, high inequality might be problematic for sustainable growth (see Dorn 2016 for a discussion of the relationship between income inequality and economic growth). Ravaillon and Chen (2007) have, for example, shown that Chinese provinces starting with higher income inequality experienced slower growth than less unequal provinces.

Figure 5: **Trend of Gini income inequality and globalization in China and East-EU transition countries**



Source: SWIID 5.1, KOF 2016, own calculations.
Note: Data for Czech Republik, Slovakia, Slovenia, Estonia, Latvia, Lithuania and Croatia is avalable since the period 1990-1994; data for Romania since the period 1985-1989.

5.5. ROBUSTNESS CHECKS

5.5.1 Accounting for direct effects of natural disasters

Our instrument predicted openness is constructed by using exogenous large scale natural disasters. Natural disasters itself are shown to influence trade openness and the per capita income level of countries (see Felbermayr and Gröschl 2013, 2014). To make sure that our estimated relationship between globalization and inequality is not driven by the correlation between disasters and income inequality, we directly control for the effect of large scale natural disasters on the income distribution within countries. Table 7 shows results for including contemporaneous and one period lagged large scale natural disasters in our OLS and 2SLS baseline equations. Inferences do not change compared to the baseline results in Table 2.

Table 7: **Direct effect of natural disasters: OLS and 2SLS panel fixed effects estimates, based on periods using 5-year averages between 1970 and 2014**

	Gini market				Gini net			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OLS-results								
GLOB	0.249***	0.208***	0.197***	0.196***	0.169**	0.126**	0.115**	0.122***
	(3.10)	(2.82)	(2.65)	(3.05)	(2.56)	(2.38)	(2.17)	(2.75)
Disaster		1.758***	1.013***			1.838***	1.127***	
		(5.39)	(3.83)			(4.70)	(4.73)	
L. Disaster ($\tau - 1$)			1.197***	1.927***			1.145***	1.996***
			(4.70)	(5.78)			(5.28)	(4.55)
2SLS-results								
GLOB	-0.055	-0.152	-0.139	-0.070	0.068	-0.018	-0.007	0.088
	(-0.18)	(-0.44)	(-0.41)	(-0.28)	(0.28)	(-0.07)	(-0.03)	(0.43)
Disaster		2.342***	1.306***			2.072***	1.233***	
		(3.50)	(2.76)			(3.71)	(3.35)	
L. Disaster ($\tau - 1$)			1.591***	2.330***			1.288***	2.048***
			(2.85)	(4.91)			(2.82)	(4.86)
F-Test excl. IV	15.14	12.92	13.40	23.82	15.14	12.92	13.40	23.82
F-Test, p-value	0.0001	0.0004	0.0003	0.0000	0.0001	0.0004	0.0003	0.0000
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects								
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	140	140	140	140	140	140	140	140
Observations	716	716	716	815	716	716	716	815

Estimates use robust standard errors; t- statistics in OLS and z-statistics in 2SLS in parentheses; *** p<0.01, ** p<0.05, * p<0.1. All specifications include baseline control variables: GDP per capita, ln population, and dependency ratio. Stock and Yogo (2005) weak identification test – critical values: 16.38 (10%); 8.96 (15%); 6.66 (20%); 5.53 (25%).

Columns (1) – (4) in Table 7 show the results using the Gini market index as the dependent variable; columns (5) – (8) show the results using Gini net. As we do not take into account natural disasters in the period 2011-14, columns (1) – (3) and (5) – (6) have less observations than our baseline results of Table 2. Columns (1) and (5) show baseline results without observations of the last period and before including the disasters variable as an explanatory variable. The size of the coefficient of the globalization variable hardly changes when excluding the period 2011-2014. By including natural disasters as covariate, the coefficient estimates of the globalization index becomes smaller. Both, contemporaneous and lagged disasters are positively correlated with market and net income inequality. When we control for contemporaneous and lagged disasters simultaneously (see columns 3 and 7), the results suggest that an average of one large scale natural disaster per year in the contemporaneous period increases the level of Gini inequality between 1.01 and 1.31 index points, and additionally by 1.15 to 1.59 index points for an average of one large scale natural disaster per year in the previous 5-year-period.

5.5.2 Variations in country-period observations

Our data on country-period observations varies across countries and time. We test the robustness of the baseline results by controlling for effects of the unequal distribution of observations. We use subsamples of countries, which have a minimum number of period-observations. Results are shown in Table 8. Inferences do not change.

OLS results among all specifications in Table 8 confirm the positive relationship between globalization and income inequality for the full and benchmark country samples in Table 2. The size of the coefficient of the globalization index decreases when increasing the minimum number of period-observations per country, and even lacks statistical significance in the most stringent sample of 56 countries having at least seven period observations. The small sample contains mainly advanced economies and other high and middle income countries.

The 2SLS results of the large sample of 117 countries (columns 1a,b in Table 8), which have at least four period-observations per country, do not suggest that globalization influences income inequality. The large sample result confirms the findings of the full sample in Table 2. The coefficient of the globalization index is, however, positive and statistically significant in the smaller samples when we use the Gini index as dependent variable (columns 2b, and 3a,b). The smaller samples mainly include high and middle income countries of our benchmark sample. The results are therefore driven by the income level of different subsamples. The F-statistic on the excluded instrument is well above the 10% critical value of the weak IV-test of Stock and Yogo (2005) in all three subsamples. Predicted openness remains a strong and relevant instrument for globalization.

The results among the subsamples are not driven by the individual country-period observations but rather by the development levels within the subsamples of countries, as developed and high and middle income countries are more likely to have more period-observations per country (see Figure 1). Results depending on the development levels are shown in section 5.3.

Table 8: **Variations in country-period observations: OLS and 2SLS panel fixed effects estimates, based on nine periods using 5-year averages between 1970 and 2014**

	Large		Intermediate		Small	
	(1a) Gini market	(1b) Gini net	(2a) Gini market	(2b) Gini net	(3a) Gini market	(3b) Gini net
OLS-results						
GLOB	0.233***	0.158***	0.198**	0.144*	0.172	0.120
	(3.22)	(2.70)	(2.23)	(1.92)	(1.64)	(1.34)
2SLS-results						
GLOB	-0.001	0.145	0.223	0.317*	0.415**	0.485***
	(-0.00)	(0.77)	(1.16)	(1.84)	(2.40)	(2.92)
F-Test excl. IV	27.10		30.74		28.24	
F-Test, p-value	0.000		0.000		0.000	
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
Countries	117	117	70	70	56	56
Observations	753	753	549	549	465	465
Period-obs. by country	$\succeq$ 4(9)	$\succeq$ 4(9)	$\succeq$ 6(9)	$\succeq$ 6(9)	$\succeq$ 7(9)	$\succeq$ 7(9)

Estimates use robust standard errors; t- statistics in OLS and z-statistics in 2SLS in parentheses; *** p<0.01, ** p<0.05, * p<0.1. All specifications include baseline control variables: GDP per capita, ln population, and dependency ratio. Stock and Yogo (2005) weak identification test – critical values:16.38 (10%); 8.96 (15%); 6.66 (20%); 5.53 (25%). The large sample requires at least four period-observations per country (columns 1a-1b). The intermediate sample requires six periods (columns 2a-2b), the small sample requires seven out of nine periods (columns 3a-3b).

5.5.3 Sensitivity tests on baseline specification

We have tested the sensitivity of the OLS FE and 2SLS baseline panel data models in many ways.

First, we have included several other covariates: including the human capital index shows that a higher human capital endowment is associated with a lower Gini index value. The coefficient of the human capital index is, however, only statistically significant in the OLS model when we use Gini market as the dependent variable. Inferences regarding the relationship of globalization and income inequality do not change when we control for the human capital endowment. When we control for the regulation in the labor market, inferences of our baseline models do not change. A higher labor market regulation is, however, related to a lower level of income inequality. The coefficient of labor market regulation is statistically significant at the 1% level when we use Gini income inequality after redistribution. While the ICT capital stock is positively related to changes of the Gini inequality outcomes in all OLS and 2SLS models, inferences about the relationship of globalization and income inequality do not change when we control for the technological change. We have also included capital intensity, an index on economic freedom, an index of overall regulation, and the share of government consumption as percent of GDP as additional explanatory variable in the baseline OLS and 2SLS models. All of these control variables do not turn out to be statistically significant in any model, notwithstanding using the Gini market or the Gini net index as the dependent variable. Inferences regarding the relationship of globalization and income inequality do not change.

Second, we have used robust standard errors clustered by country and classical standard errors. Inferences do not change.

Third, we have used alternative definitions of natural disasters by constructing the instrument predicted openness in the panel model, such as broader specifications that includes all kinds of natural disasters or counting all sizes of disasters (small and large), as suggested by Felbermayr and Gröschl (2013). Using the alternative instruments, inferences do not change.

6 CONCLUSION

We have re-examined the nexus between globalization and income inequality. OLS results confirm previous findings that income inequality and globalization are positively correlated. We have used several sub-samples: the relationship is positive within our benchmark sample of high and middle income countries, the full sample of countries and the sample of emerging markets and developing economies. For the most advanced economies, however, the results do not suggest that globalization and income inequality are positively correlated.

We use predicted openness as an IV for globalization. Within our benchmark sample of high and middle income countries the 2SLS results confirm that globalization indeed influences income inequality. But again this effect is driven by the transition countries. In particular, in the subsample of advanced countries, our results do not show a systematic effect of globalization on income inequality, neither positive nor negative. The same is true for the group of emerging and developing countries.

How can we explain the finding that there seems to be a robust and positive relationship between globalization and inequality in the transition countries including China and the countries of Eastern Europe but not in the group of advanced economies or developing countries?

The transition countries from Eastern Europe and China have experienced a rapid process of globalization while the welfare states and labor market institutions in these countries were less developed than in advanced countries in the rest of the world – in particular in Western Europe. Chinese reform programs were, for example, concentrated on economic growth that has not been moderated by redistribution programs. Participation in the Chinese rise to a global economic power, therefore, is unequally distributed within the country. Transition countries from Central and Eastern Europe have also experienced systematic structural and institutional changes towards market economies which might be the omitted drivers of rising globalization levels and inequality outcomes in our results.

Advanced economies do predominantly have higher levels of globalization, while less developed economies do have lower levels of globalization on average in our dataset. The relationship between globalization and income inequality might thus be non-monotonic, where inequality first rises and later declines in the course of globalization, as predicted by Helpman et al. (2010, 2017). This would follow Kuznet's (1955) hypothesis predicting a non-linear relationship where income inequality first increases and later decreases when the overall income level of a country is increasing.

In advanced economies established transfer systems, stable political and democratic institutions, and manifold opportunities for education may have moderated adverse effects of globalization on income inequality. The role of institutions and the coordination of the economy and welfare system, however, even seem to be relevant for different inequality rising effects of globalization among advanced economies. Dorn and Schinke (2018), for example, have shown that globalization gave rise to the income shares of the rich in the more market-oriented systems of Anglo-Saxon countries, but not in other advanced economies. This would suggest that the establishment and the design of institutions matter for the development of income inequality in times of growing globalization.

There are many issues that should be addressed in future research such as non-linear relationships between globalization and income inequality and using other measures for income inequality. The shortcoming of Gini indices is that they do not consider, for example, whether income inequality changes because of the rich becoming richer, the poor becoming poorer (or both). In particular, income inequality increases, when both the poor and rich become richer, but the income-increases are just larger for the rich. Moreover, income increases of the rich may well be a precondition for the poor to also experience increases in income.

REFERENCES

Acemoglu, D. (1998). "Why do New Technologies Complement Skills? Directed Technical Change and Wage Inequality." *Quarterly Journal of Economics*, 113(4), pp. 1055-1090.

Acemoglu, D. (2002). "Technical Change, Inequality, and the Labor Market." *Journal of Economic Literature*, 40(1), pp. 7-72.

Acemoglu, D., S. Naidu, P. Restrepo, and J. Robinson (2015). "Democracy, Redistribution and Inequality." In A. Atkinson, and F. Bourguignon, eds., *Handbook of Income Distribution*, Vol. 2B, Amsterdam: Elsevier, pp. 1885–1966.

Aghion, P., and S. Commander (1999). "On the Dynamics of Inequality in the Transition." *Economics of Transition*, 7(2), pp. 275-298.

Aristei, D., and C. Perugini (2014). "Speed and Sequencing of Transition Reforms and Income Inequality: A Panel Data Analysis." *Review of Income and Wealth*, 60(3), pp. 542-570.

Arkolakis, C., A. Costinot, and A. Rodríguez-Clare (2012). ''New Trade Models, Same Old Gains?'', *American Economic Review*, 102(1), pp. 94–130.

Atkinson, A. (1997). Bringing Income Distribution in from the Cold. *Economic Journal,* 107, pp. 297-321.

Atkinson, A., and T. Piketty (2007). *Top Incomes over the 20th Century. A Contrast between Continental European and English-Speaking Countries*. Oxford: Oxford University Press.

Azmat, G., A. Manning, and J. van Reenen (2012). "Privatization and the Decline of Labour's Share: International Evidence from Network Industries." *Economica*, 79(315), pp. 470-492.

Barbieri, K. (2002). *The Liberal Illusion: Does Trade Promote Peace?* University of Michigan Press.

Barham, B., and S. Boucher (1998). "Migration, Remittances, and Inequality: Estimating the Net Effects of Migration on Income Distribution." *Journal of Development Economics*, 55(2), pp. 307-331.

Barro, R. (2000). "Inequality and Growth in a Panel of Countries." *Journal of Economic Growth*, 5(1), pp. 5-32.

Berg, A., J. Ostry, and J. Zettelmeyer (2012). "What Makes Growth Sustained." *Journal of Development Economics,* 98(2), pp. 149-166.

Bergh, A., and T. Nilsson (2010). "Do Liberalization and Globalization Increase Income Inequality?" *European Journal of Political Economy*, 26, pp. 488-505.

Bergh, A., and T. Nilsson (2014). "Is Globalization reducing Absolute Poverty?" *World Development*, 62, pp. 42-61.

Berman, E., J. Bound, and Z. Griliches (1994). "Changes in the Demand for Skilled Labor within U.S. Manufacturing: Evidence from the Annual Survey of Manufactures." *Quarterly Journal of Economics*, 109(2), pp. 367–97.

Berman, E., J. Bound, and S. Machin (1998). "Implications of Skill-Biased Technological Change: International Evidence." *Quarterly Journal of Economics*, 113(4), pp. 1245–79.

Berman, E., and S. Machin (2000). "Skill-Biased Technology Transfer around the World." *Oxford Review of Economic Policy*, 16(3), pp. 12-22.

Bloom, N., M. Draca, and J. Van Reenen (2016). "Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity." *Review of Economic Studies*, 83(1), pp. 87-117.

Borjas, G., R. Freeman, and L. Katz (1997). "How Much Do Immigration and Trade Affect Labor Market Outcomes?" *Brookings Papers on Economic Activity*, 1, pp. 1-90.

Burstein, A., J. Cravino, and J. Vogel (2013). ''Importing Skill-Biased Technology.'' *American Economic Journal: Macroeconomics*, 5, pp. 32–71.

Campos, N., and F. Coricelli (2002). "Growth in Transition: What We Know, What We Don't, and What We Should." *Journal of Economic Literature*, XL(3), pp. 793-836.

Card, D., and J. DiNardo (2002). "Skill Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles." *Journal of Labor Economics,* 20(4), pp. 733-783.

Costinot, A., and A. Rodríguez-Clare (2014). ''Trade Theory with Numbers: Quantifying the Consequences of Globalization.'' In E. Gita Gopinath and K. Rogoff, eds., *Handbook of International Economics*, Vol. 4, Amsterdam: Elsevier, pp. 197-261

Cragg, M., and M. Epelbaum (1996). "Why Has Wage Dispersion Grown in Mexico? Is it the Incidence of Reforms of the Growing Demand for Skills?" *Journal of Development Economics*, 51(1), pp. 99–116.

Dabla-Norris, E., K. Kochhar, N. Suphaphiphat, F. Ricka, and E. Tsounta (2015). "Causes and Consequences of Income Inequality: A Global Perspective." *IMF Staff Discussion Note*, No. 15/13.

Deaton, A. (2005). "Measuring Poverty in a Growing World (or Measuring Growth in a Poor World)." *Review of Economics and Statistics*, 87, pp. 1‐19.

Doerrenberg, P., and A. Peichl (2014). "The Impact of Redistributive Policies on Inequality in OECD Countries." *Applied Economics*, 46(17), pp. 2006-2086.

Dorn, F. (2016). "On Data and Trends in Income Inequality around the World." *CESifo DICE Report - Journal of Institutional Comparisons*, 14(4), pp. 54-64.

Dorn, F., and C. Schinke (2018). "Top Income Shares in OECD Countries: The Role of Government Ideology and Globalization." *World Economy*, forthcoming.

Dreher, A. (2006a). "Does Globalization Affect Growth? Empirical Evidence from a new index." *Applied Economics,* 38, pp. 1091-1110.

Dreher, A. (2006b). "The Influence of Globalization on Taxes and Social Policy - an Empirical Analysis for OECD Countries." *European Journal of Political Economy,* 22, pp. 179-201.

Dreher, A., and N. Gaston (2008). "Has Globalisation Increased Inequality?" *Review of International Economics,* 16, pp. 516-536.

Dreher, A., N. Gaston, and P. Martens (2008*). Measuring globalization - Gauging its consequences.* Berlin: Springer.

Edwards, S. (1997). "Trade Policy, Growth, and Income Distribution." *American Economic Review*, 87, pp. 205-210.

Egger, H., and U. Kreickemeier (2009). "Firm Heterogeneity and the Labor Market Effects of Trade Liberalization." *International Economic Review*, 50(1), pp. 187–216.

Egger, H., P. Egger, and U. Kreickemeier (2013). "Trade, Wages, and Profits." *European Economic Review*, 64, pp. 332‐350.

Egger, P., and R. Stehrer (2003). "International Outsourcing and the Skill Specific Wage Bill in Eastern Europe." *World Economy*, 26(1), pp. 61-72.

Eppinger, P., and N. Potrafke (2016). "Did Globalization Influence Credit Market Deregulation?" *World Economy*, 39(3), pp. 444-473.

Feenstra, R., and G. Hanson (1996). "Globalization, Outsourcing, and Wage Inequality." *American Economic Review*, 86 (2), pp. 240–45.

Feenstra, R., and G. Hanson (1997). "Foreign direct Investment and Relative Wages, Evidence from Mexico's Maquiladoras." *Journal of International Economics*, 42, pp. 371-393.

Feenstra, R., and G. Hanson (1999). "The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States, 1979–1990." *Quarterly Journal of Economics,* 114(3), pp. 907–40.

Feenstra, R., R. Inklaar, and M. Timmer (2015). "The Next Generation of the Penn World Table." *American Economic Review*, 105(10), pp. 3150-82.

Felbermayr, G., and J. Gröschl (2013). "Natural Disasters and the Effect of Trade on Income: A New Panel IV Approach." *European Economic Review*, 58, pp. 18-30.

Felbermayr, G., and J. Gröschl (2014). "Naturally Negative: The Growth Effects of Natural Disasters." *Journal of Development Economics* 111, pp. 92–106.

Ferreira, F. H., N. Lustig, and D. Teles (2015), "Appraising Cross-National Income Inequality Databases: An Introduction." *Journal of Economic Inequality*, 13, pp. 497-526.

Feyrer, J. (2009). "Trade and Income - Exploiting Time Series in Geography." *NBER Working Paper,* No. 14910.

Figini, P., and H. Görg (2011). "Does Foreign Direct Investment Affect Wage Inequality? An Empirical Investigation." *World Economy*, 34 (9), pp. 1455–75.

Flemming, J., and J. Micklewright (2000). "Income Distribution, Economic Systems and Transition." In: A. Atkinson, and F. Bourguignon, eds., *Handbook of Income Distribution*, Amsterdam: Elsevier, pp. 843-918.

Forbes, K. (2000). "A Reassessment of the Relationship between Inequality and Growth." *American Economic Review*, 90(4), pp. 869-887.

Frankel, J., and D. Romer (1999). "Does Trade cause Growth?" *American Economic Review*, 89(3), pp. 379-399.

Frias, J., D. Kaplan, and E. Verhoogen (2012). ‘‘Exports and Within-Plant Wage Distributions: Evidence from Mexico,” *American Economic Review*, 102, pp. 435–440.

Fuest, C., J. Niehues, and A. Peichl (2010). “The Redistributive Effects of Tax Benefit Systems in the Enlarged EU.” *Public Finance Review,* 38(4), pp. 473–500.

Goldberg, P., and N. Pavcnik (2007). ‘‘Distributional Effects of Globalization in Developing Countries.” *Journal of Economic Literature*, 45, pp. 39–82.

Gorodnichenko, Y., K. Sabirianova Peter, and D. Stolyarov (2010). “Inequality and Volatility Moderation in Russia: Evidence from Micro-Level Panel Data on Consumption and Income.” *Review of Economic Dynamics*, 13(1), pp. 209-237.

Gozgor, G., and P. Ranjan (2017). “Globalization, Inequality, and Redistribution: Theory and Evidence.” *World Economy*, 40(12), pp. 2704-2751.

Gröschl, J., and T. Steinwachs (2017). “Do Natural Hazards Cause International Migration?” *CESifo Economic Studies*, 63, forthcoming.

Gwartney, J., R. Lawson, R., and J. Hall (2015). *2015 Economic Freedom Dataset.* Economic Freedom of the World: 2015 Annual Report. Fraser Institute.

Helpman, E., O. Itskhoki, and S. Redding (2010). “Inequality and Unemployment in a Global Economy,” *Econometrica*, 78(4), pp. 1239–1283.

Helpman, E., O. Itskhoki, M.-A. Muendler, and S. Redding (2017). ‘‘Trade and Inequality: From Theory to Estimation,” *Review of Economic Studies*, 84(1), pp. 357-405.

IMF (2016). *World Economic Outlook*. October 2016. Washington, DC : International Monetary Fund.

Ivanova, M. (2007). “Inequality and Government Policies in Central and Eastern Europe.” *East European Quarterly*, 41(2), pp. 167-204.

Jaumotte, F., S. Lall, and C. Papageorgiou (2013). Rising Income Inequality: Technology, or Trade and Financial Globalization? *IMF Economic Rev*iew, 61(2), pp. 271-309.

Jenkins, S. (2015). “World Income Inequality Databases: an Assessment of WIID and SWIID.” *Journal of Economic Inequality*, 13, pp. 629-671.

Jorgenson, D., and K. Vu (2017). “The Outlook for Advanced Economies.” *Journal of Policy Modelling* 39 (3), pp. 660-672.

Karabarbounis, L., and B. Neiman (2014). “The Global Decline of the Labor Share.” *Quarterly Journal of Economics*, 61, pp. 61-103.

Kauder, B., and N. Potrafke (2015). “Globalization and Social Justice in OECD Countries.” *Review of World Economics /Weltwirtschaftliches Archiv* , 151(2), 353-376.

Knight, J. (2014). “Inequality in China: An Overview.” *World Bank Research Observer*, 29(1), pp. 1–19.

Krusell, P., L. Ohanian, L. Giovanni, J.-V. Rios-Rull, and G. Violante (2000). “Capital-skill complementarity and inequality, a macroeconomic analysis.” *Econometrica,* 68, pp. 1029–1053.

Kuznets, S. (1955). “Economic Growth and Income Inequality.” *American Economic Review*, 45, pp. 1-28.

Lakner, C., and B. Milanovic (2016). “Global Income Distribution: From the Fall of the Berlin Wall to the Great Recession.” *World Bank Economic Review*, 30(2), pp. 203-232.

Lang, V., and M. Tavares (2018). “The Distribution of Gains from Globalization.” *IMF Working Paper*, forthcoming.

Leamer, E. (1998). “In Search of Stolper–Samuelson Linkages between International Trade and Lower Wages.” In S. Collins, ed., *Imports, Exports and the American Worker*, Washington, D.C.: Brookings, pp. 141–202.

Machin, S., and J. van Reenen (1998). “Technology and Changes in Skill Structure: Evidence from Seven OECD Countries.” *Quarterly Journal of Economics*, 113(4), pp. 1215-1244.

Manasse, P., and A. Turrini (2001). “Trade, Wages, and ‘Superstars’.” *Journal of International Economics*, 54(1), pp. 97-117.

Meinhard, S., and N. Potrafke (2012). “The Globalization-Welfare State Nexus reconsidered.” *Review of International Economics* 20(2), pp. 271-87.

Meltzer, A., and S. Richard (1981). “A rational Theory of the Size of Government.” *Journal of Political Economy*, 89(5), pp. 914-927.

Milanovic, B. (1999). “Explaining the Increase in Inequality During Transition.” *Economics of Transition*, 7(2), pp.299-341.

Milanovic, B. (2000). "The Median-Voter Hypothesis, Income Inequality, and Income Redistribution: An Empirical Test with Required Data." *European Journal of Political Economy*, 16(3), pp. 367-410.

Milanovic, B., and L. Ersado (2011). "Reform and Inequality During the Transition. An Analysis Using Panel Household Survey Data, 1990-2005." In G. Roland, ed., *Economies in Transition. The Long Run View*, London: Palgrave Macmillan, pp. 84-108.

Munch, J., and R. Skaksen (2008). "Human Capital and Wages in Exporting Firms." *Journal of International Economics*, 75(2), pp. 363-372.

OECD. (2008). *Growing Unequal? Income Distribution and Poverty in OECD Countries.* Paris:OECD.

Ohlin, B. (1933). *Interregional and International Trade*. Cambridge: Harvard University Press.

Perugini, C., and F. Pompei (2015). "Income Distribution." In J. Hölscher, and H. Tomann, eds., *Palgrave Dictionary of Emerging Markets and Transition Economics*, London: Palgrave Macmillan, pp. 458-476.

Potrafke, N. (2013). "Globalization and Labor Market Institutions: International Empirical Evidence." *Journal of Comparative Economics*, 41(3), pp. 829-842.

Potrafke, N. (2015). "The Evidence on Globalisation." *World Economy*, 38(3), pp. 509-552.

Ravallion, M., and S. Chen (2007). "China's (uneven) Progress against Poverty." *Journal of Development Economics*, 82, pp. 1– 42.

Rodrik, D. (1997). *Has Globalization Gone Too Far?* Washington D.C.: Instutute for International Economics.

Rodrik, D. (1998). "Why Do more open Economies have bigger Governments?" *Journal of Political Economy*, 106(5), pp. 997-1032.

Roine, J., Vlachos, J., and Waldenström, D. (2009). "The Long-Run Determinants of Inequality: What Can We Learn from Top Income Data?" *Journal of Public Economics,* 93(7-8), S. 974-988.

Roland, G. (2000). *Transition and Economics. Politics, Markets, and Firms*. Cambridge, Massachusetts: MIT Press.

Rose, A., and M. Spiegel (2009). "International Financial Remoteness and Macroeconomic Volatility." *Journal of Development Economics,* 89(2), pp. 250-257.

Sampson, T. (2014): "Selection into Trade and Wage Inequality." *American Economic Journal: Microeconomics*, 6(3), pp. 157–202.

Samuelson, P. (1939). "The Gains from International Trade." *Canadian Journal of Economics,* 5(2), pp. 195–205.

Schulze, G., and H. W. Ursprung (1999). "Globalisation of the Economy and the Nation State." *World Economy,* 22(3), pp. 295–352.

Sinn, H.-W., and A. Weichenrieder (1997). "Foreign Direct Investment, Political Resentment and the Privatization Process in Eastern Europe." *Economic Policy*, 12(24), pp. 177-210.

Sinn, H.-W. (2003). *The New Systems Competition*. Oxford: Blackwell.

Solt, F. (2016). "The Standardized World Income Inequality Database." *Social Science Quarterly,* 97(5), pp. 1267-1281.

Staiger, D., and J. Stock (1997). "Instrumental Variables Regression with Weak Instruments." *Econometrica*, 65(3), pp. 557–586.

Stiglitz, J. (2002). *Globalization and its Discontents.* London: Penguin Books.

Stock, J., and M. Yogo (2005). "Testing for Weak Instruments in Linear IV Regression." In D. Andrews, and J. Stock, ed*., Identification and Inference for Econometric Models: Essays in Honour of Thomas Rothenberg,* Cambridge: Cambridge University Press, pp. 80-108.

Stolper, W., and P. Samuelson (1941). "Protection and Real Wages." *Review of Economic Studies*, 9, pp. 58-73.

Ursprung, H. (2008). "Globalisation and the Welfare State." In S. Durlauf, and L. Blume, ed., *The New Palgrave Dictionary of Economics*, Second edition. Köln: Palgrave Macmillan.

Verhoogen, E, (2008). "Trade, Quality Upgrading and Wage Inequality in the Mexican Manufacturing Sector." *Quarterly Journal of Economics*, 123(2), pp. 489–530.

World Bank (2017). *World Development Indicators (WDI).* Washington D.C.: The World Bank. *Last update: 29 March 2017.*

Wood, A. (1995). "How Trade hurt unskilled Workers." *Journal of Economic Perspectives*, 9, pp. 57-80.

Yeaple, S. (2005). "A Simple Model of Firm Heterogeneity, International Trade, and Wages." *Journal of International Economics*, 65(1), pp. 1–20.

APPENDIX I

Summary statistics

Table A: **Summary statistics and data sources, based on nine 5-year averaged periods between 1970 and 2014**

Variable	Mean	Std. Dev.	Min.	Max.	N	Source	Definition
Dependent variables							
Gini market	45.71	7.24	20.13	74.46	821	Solt (2016), SWIID v5.1	Gini inc. inequality, pre tax & transfers
Gini net	37.50	8.98	16.11	61.84	821		Gini inc. inequality, post tax & transfers
Globalization variables							
GLOB	53.62	18.15	14.73	92.18	815	Dreher (2006a),	KOF index of globalization 2016
FDI	58.86	24.31	1	100	821	update KOF 2016	KOF index of total FDI-to-GDP ratio 2016
Social GLOB	45.34	22.86	6.55	93.00	815		KOF index of social globalization 2016
Political GLOB	65.85	20.03	18.55	97.67	815		KOF index of political globalization 2016
Trade openness	74.50	48.94	6.79	410.25	801	World Bank(2017), WDI	Exports & imports as share of GDP
Export openness	35.22	25.77	3.54	218.62	801		Exports as share of GDP
Import openness	39.28	24.28	3.25	191.63	801		Imports as share of GDP
Instrument							
Ω^i_τ	58.04	34.69	0.93	322.62	722	Felbermayr & Gröschl (2013)	Predicted openness
$\Omega^i_{\tau-1}$	54.96	33.64	0.83	322.62	821		One period lag of predicted openness
Baseline controls							
GDP pc	12.46	12.90	0.44	90.50	821	Feenstra et al.(2015),	Real GDP per capita, in billions USD
ln POP	2.53	1.62	-1.89	7.21	821	PWT v9.0	Log of total population, in millions
Dependency	65.96	18.95	34.96	112.84	821	World Bank (2017), WDI	Age dependency ratio, young & old
Robustness test controls							
ICT capital stock	0.19	0.8	0	12.71	583	Jorgenson and Vu (2017)	ICT capital stock, in 100'000 USD
Capital intensity (K/L)	88.99	97.18	94.17	510.41	819	Feenstra et al. (2015), PWT v9.0	Capital stock of structures & equipment in 1'000 USD / numb. of persons engaged
Human capital index	2.34	0.71	1.04	3.72	769		Index based on the rate of return to education & average years of schooling
Gov. expenditures	0.19	0.08	0.04	0.85	821		Share of government consumption at current PPPs
Economic freedom	6.24	1.25	2.47	8.88	717	Gwartney et al. (2015)	Index of economic freedom
Regulations (overall)	6.15	1.27	1.00	8.86	709		Index of overall regulations
Labor market regulation	4.33	1.51	0.60	8.16	491		Index of labor market regulations
Disaster	0.21	0.66	0	7.8	722	Felbermayr & Gröschl (2013)	Large scale natual disasters
L.Disaster$_{\tau-1}$	0.20	0.63	0	7.8	821		One period lag of large scale natural disasters

Correlation matrix

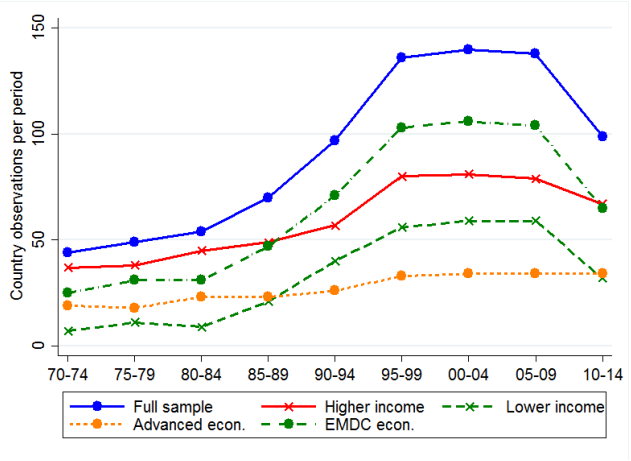
Table B: **Cross country correlation coefficients between selected variables, based on periods using 5 - year averages between 1970 and 2014**

Variables	Gini market	Gini net	GLOB	Trade	Exports	Imports	FDI	Social	Political
Gini market	1								
Gini net	0.74***	1							
GLOB	-0.03	-0.45***	1						
Trade	-0.01	-0.11***	0.35***	1					
Exports	-0.02	-0.14***	0.41***	0.98***	1				
Imports	0.00	-0.08**	0.28***	0.98***	0.91***	1			
FDI	0.24***	-0.02	0.65***	0.49***	0.50***	0.46***	1		
Social	-0.05	-0.47***	0.95***	0.38***	0.42***	0.31***	0.50***	1	
Political	-0.07**	-0.34***	0.72***	-0.11***	-0.03***	-0.18***	0.32***	0.56***	1

*** p<0.01, ** p<0.05, * p<0.1.

Distribution of country-period observations

Figure A: **Distribution of country-period observations**



Source: SWIID 5.1, KOF 2016, own calculations

APPENDIX II

List of countries (140)

Advanced Economies*:

Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Republic of Korea, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States

Emerging and Developing Economies:

Albania*, Algeria*, Angola*, Argentina*, Armenia, Azerbaijan*, Bangladesh, Barbados*, Belarus*, Belize*, Benin, Bolivia, Bosnia and Herzegovina*, Brazil*, Bulgaria*, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Chile*, China*, Colombia*, Comoros, Costa Rica*, Cote d'Ivoire, Croatia*, Djibouti, Dominican Republic*, Ecuador*, Egypt, El Salvador, Ethiopia, Fiji*, Gabon*, Gambia, Georgia, Ghana, Guatemala, Guinea, Guinea-Bissau, Haiti, Honduras, Hungary*, India, Indonesia, Iran*, Jamaica*, Jordan*, Kazakhstan*, Kenya, Kyrgyz Republic, Lao, Lebanon*, Macedonia (FYR)*, Madagascar, Malawi, Malaysia*, Maldives*, Mali, Mauritania, Mauritius*, Mexico*, Moldova,, Mongolia*, Morocco, Mozambique, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Panama*, Paraguay*, Peru*, Philippines, Poland*, Romania*, Russian Federation*, Rwanda, Senegal, Sierra Leone, South Africa*, Sri Lanka, St. Lucia*, Suriname*, Syria, Tajikistan, Tanzania, Thailand*, Togo, Trinidad and Tobago*, Tunisia*, Turkey*, Turkmenistan*, Uganda, Ukraine, Uruguay*, Uzbekistan, Venezuela*, Viet Nam, Republic of Yemen, Zambia, Zimbabwe

Central and Eastern European EU Members*: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia

Former Members of the Soviet Union: Armenia, Azerbaijan*, Belarus*, Georgia, Kazakhstan*, Kyrgyz Republic, Moldova, Russian Federation*, Tajikistan, Turkmenistan*, Ukraine, Uzbekistan

Western Balkan*: Albania, Bosnia and Herzegovina, Macedonia (FYR)

EU 15*: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom

*Countries and samples marked with * are high and middle income countries and included in our benchmark sample. The World Bank (2015) classified countries having a GNI per capita of.4,126 USD or more as high and middle income countries.*

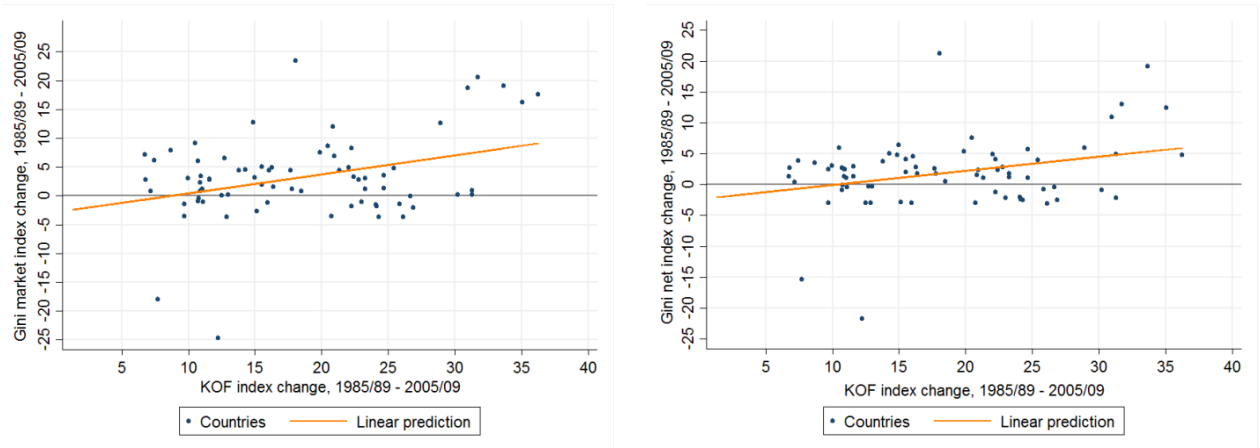
APPENDIX III

SUPLEMENTARY MATERIAL

Additional figures

Figure A1: **Changes in Gini income inequality and globalization, between 1985-1989 and 2005-2009 (full sample, N=73)**

a) Gini market *b) Gini net*



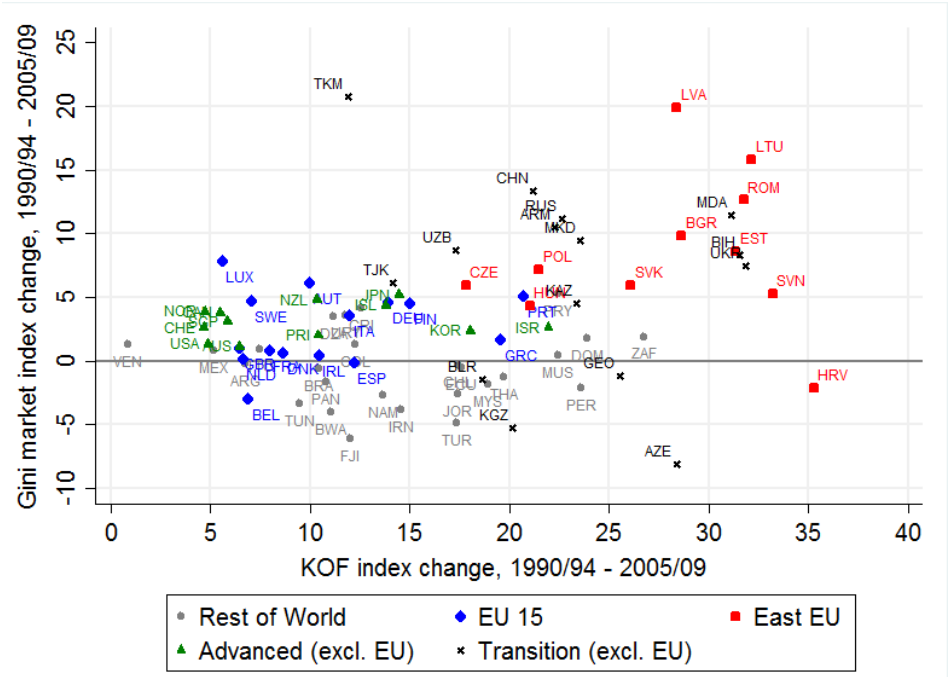
Source: SWIID 5.1, KOF 2016, own calculations

Note: Figures 3a and 3b relate to countries within the full sample having observations in periods 1985-1989 and 2005-2009. The unconditional linear predictors are $\hat{\beta}_{market} = 0.33^{***}, \hat{\beta}_{net} = 0.23^{***}$; *** $p < 0.01$.

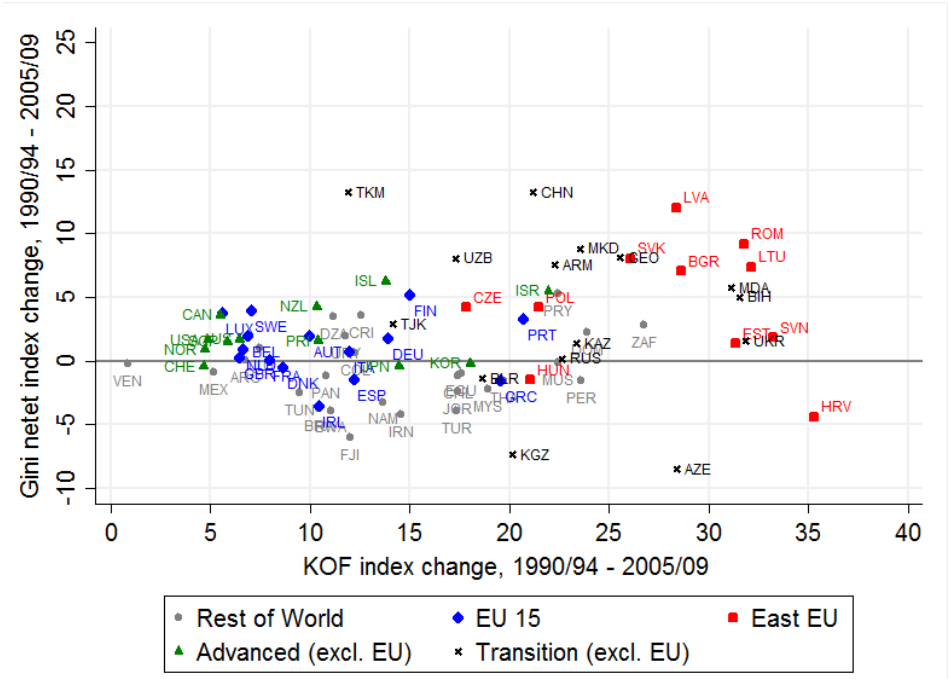
Figure A1 shows changes in income inequality and globalization between the periods 1985-1989 and 2005-2009 (based on 73 countries of all income levels having observations in both periods). Globalization and income inequality both proceeded quite rapidly in many countries. The coefficients of correlation between the change in the KOF globalization index and the change in the pre/post taxation and transfer GINI index are 0.33 and 0.23.

Figure A2: **Changes in Gini income inequality and globalization, between 1990/94 – 2005/09 (benchmark sample, N=52)**

a) Gini market



b) Gini net



Source: SWIID 5.1, KOF 2016, own calculations

Note: Figures 4a and 4b describe countries within the benchmark sample (high and middle income countries) having observations in periods 1990-94 and 2005-09. Classification as high and middle income country if GNI per capita of USD 4.126 or more (World Bank, 2015). Transition (excl. EU) captures former members of the Soviet Union, Western Balkan (Non-EU) states, and China.

ifo Working Papers

No. 246 Dorn, F. and C. Schinke, Top Income Shares in OECD Countries: The Role of Government Ideology and Globalization, January 2018.

No. 245 Burmann, M., M. Drometer and R. Méango, The Political Economy of European Asylum Policies, December 2017.

No. 244 Edo, A., Y. Giesing, J. Öztunc and P. Poutvaara, Immigration and Electoral Support for the Far Left and the Far Right, December 2017.

No. 243 Enzi, B., The Effect of Pre-Service Cognitive and Pedagogical Teacher Skills on Student Achievement Gains: Evidence from German Entry Screening Exams, December 2017.

No. 242 Doerrenberg, P. and A. Peichl, Tax morale and the role of social norms and reciprocity. Evidence from a randomized survey experiment, November 2017.

No. 241 Fuest, C., A. Peichl and S. Siegloch, Do Higher Corporate Taxes Reduce Wages? Micro Evidence from Germany, September 2017.

No. 240 Ochsner, C., Dismantled once, diverged forever? A quasi-natural experiment of Red Army misdeeds in post-WWII Europe, August 2017.

No. 239 Drometer, M. and R. Méango, Electoral Cycles, Effects and U.S. Naturalization Policies, August 2017.

No. 238 Sen, S. and M.-T. von Schickfus, Will Assets be Stranded or Bailed Out? Expectations of Investors in the Face of Climate Policy, August 2017.

No. 237 Giesing, Y. and A. Music, Household behaviour in times of political change: Evidence from Egypt, July 2017.

No. 236 Hayo, B. and F. Neumeier, Explaining Central Bank Trust in an Inflation Targeting Country: The Case of the Reserve Bank of New Zealand, June 2017.

No. 235 Buettner, T. und M. Krause, Föderalismus im Wunderland: Zur Steuerautonomie bei der Grunderwerbsteuer, März 2017.

No. 234 Blesse, S. und F. Rösel, Gebietsreformen: Hoffnungen, Risiken und Alternativen, Januar 2017.

No. 233 Hayo, B. and F. Neumeier, The (In)Validity of the Ricardian Equivalence Theorem – Findings from a Representative German Population Survey, December 2016.

No. 232 Fritzsche, C. and L. Vandrei, The German Real Estate Transfer Tax: Evidence for Single-Family Home Transactions, November 2016.

No. 231 Nagl, W. and M. Weber, Stuck in a trap? Long-term unemployment under two-tier unemployment compensation schemes, November 2016.

No. 230 Neumeier, F., Do Businessmen Make Good Governors?, November 2016.

No. 229 Gutmann, J., M. Neuenkirch and F. Neumeier, Precision-Guided or Blunt? The Effects of US Economic Sanctions on Human Rights, November 2016.

No. 228 Felbermayr, G., R. Aichele, I. Heiland, A. Melchior and M. Steininger, TTIP – Potential Effects on Norway, (November 2016) revised version December 2016.

No. 227 Schueler, R., Educational inputs and economic development in end-of-nineteenth-century Prussia, October 2016.

No. 226 Riem, M., Does political uncertainty influence firm owners‘ business perceptions?, October 2016.

No. 225 Enzi, B. and B. Siegler, The Impact of the Bologna Reform on Student Outcomes – Evidence from Exogenous Variation in Regional Supply of Bachelor Programs in Germany, October 2016.

No. 224 Roesel, F., Do mergers of large local governments reduce expenditures? – Evidence