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The KOF Globalisation Index – Revisited*

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Abstract: In this paper we present and describe the revised version of the KOF Globalisation Index, a composite index measuring globalisation for every country in the world along the economic, social and political dimension. The original index was introduced by Dreher (2006) and updated in Dreher et al. (2008). This second revision of the index introduces the differentiation between de facto and de jure measures along the different dimensions of globalisation, the differentiation between trade and financial globalisation within the economic dimension of globalisation and time-varying weighting of the variables entering the index. Finally, the revised version incorporates several additional variables in the construction process. At the aggregate level, we show that a bi-directional relationship between de facto and de jure globalisation exists.

The KOF Globalisation Index can be downloaded from <http://www.kof.ethz.ch/globalisation/>.

JEL classification: F15, F36, F43, F53, F60, F62, O19, O24, O57, Y10.

Keywords: Globalisation, composite indicators, Granger causality, economic growth

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1. Introduction

The impact of globalisation on different aspects of our daily lives is still a very hotly debated topic. In order to analyse questions related to globalisation more analytically, we need to measure globalisation. Single indicators, often reflecting openness, such as trade as a percentage of GDP, are frequently used as a proxy for globalisation. However, if we understand globalisation as a multifaceted concept, it encompasses much more than trade openness and movements of capital. It can also manifest itself in citizens of different countries communicating with each other and exchanging ideas and information or governments working together to tackle political problems of global reach. Consequently, we have to find ways to account for various manifestations of globalisation. Composite indicators, such as the KOF Globalisation Index, present themselves as straightforward solutions because they allow to combine different variables, measuring different aspects of globalisation, into one final index. Several composite indicators measuring globalisation have been proposed in recent years. The KOF Globalisation Index, introduced by Dreher (2006) and updated in Dreher et al. (2008), measures globalisation along the economic, social and political dimension for almost every country in the world since 1970. It has become the most widely used globalisation index in the literature (Potrafke, 2015).

Inherent to composite indicators is the danger of oversimplification, which could result in misinterpretation of globalisation. Rather than finding one composite indicator based on the widest definition possible, we propose an index that allows for flexible aggregation of different dimensions and characteristics of globalisation. The revised version of the KOF Globalisation Index introduces a clear distinction between *de facto* and *de jure* measures of globalisation. While *de facto* measures of globalisation include variables that *represent* flows and activities, *de jure* measures include variables that represent policies that, in principle, *enable* flows and activities. Quinn et al. (2011) for example show that the decision to use either *de facto* or *de jure* measures of financial openness results in systematically different findings in the financial openness-economic growth nexus. We do not only propose a separate *de facto* and *de jure* globalisation index, the distinction between *de facto* and *de jure* is also maintained in every dimension and sub-dimension of the index. The overall KOF Globalisation Index is calculated by combining *de facto* and *de jure* indices. The wide set of globalisation indices of different dimensions and aggregation levels makes the index applicable in a large number of different settings. At the same time, researchers still have the possibility to use an overall index of globalisation in which all dimensions and characteristics play their role. For an overview of the structure of the revised KOF Globalisation Index, see Table 1.

[Insert *Table 1: Structure of the KOF Globalisation Index* about here]

Besides distinguishing between *de facto* and *de jure* indices of globalisation, the revision of the KOF Globalisation Index includes the following components: We introduce the differentiation

between trade and financial globalisation within the economic dimension of globalisation, we allow the weights of the underlying variables to vary over time and we define cultural globalisation in a broader way. While some variables from the 2007 version of the KOF Globalisation Index are replaced, many new variables, especially measuring de jure characteristics of globalisation, are introduced. The total number of underlying variables increases from 23 to 42 compared to the previous version of the index.

This paper is structured as follows. In Section 2, we define globalisation as we want to measure it and review the literature that has evolved around the measurement of globalisation by the means of composite indicators. In Section 3, we describe the methodology of the revisited KOF Globalisation Index, which includes the content of the current revision, the selection of variables and the method of calculation. In Section 4, we discuss first results, which includes the comparison between the previous and the revisited version of the index and the empirical relationship between de facto and de jure globalisation indices. Finally, Section 5 concludes.

2. Measuring globalisation

2.1 Defining globalisation

In order to construct a composite indicator measuring globalisation, a clear definition of globalisation is needed. Our definition of globalisation stems from Dreher (2006) and is based on Clark (2000) and Norris (2000). The definition states that globalisation *describes the process of creating networks of connections among actors at intra- or multi-continental distances, mediated through a variety of flows including people, information and ideas, capital, and goods. Globalisation is a process that erodes national boundaries, integrates national economies, cultures, technologies and governance, and produces complex relations of mutual interdependence.* To guide our decision in terms of structuring the KOF Globalisation Index, we draw on the work of Nye and Keohane (2000) who divide globalisation in three different dimensions. Economic globalisation characterises long distance flows of goods, capital and services as well as information and perceptions that accompany market exchanges. Social globalisation expresses the spread of ideas, information, images and people. Political globalisation characterises the diffusion of government policies.

According to Scholte (2008) and Caselli (2012) globalisation is distinct to similar concepts such as internationalisation, liberalisation, universalisation or Westernisation. These concepts are however close to each other and sometimes used interchangeably. A clear distinction is therefore needed but sometimes difficult to achieve. Based on Scholte (2008) internationalisation refers to an increase in transactions and interdependencies between countries. Liberalisation denotes the process of removing officially imposed restrictions on movements of resources between countries. Universalisation describes the process of dispersing various objects and experiences to people at all inhabited parts of the earth.

Westernisation is interpreted as a particular type of universalisation, in which social structures of Western societies are spread across the earth. According to Scholte (2008) globalisation is the spread of trans-planetary or supra-territorial connections between people. What distinguishes it from the aforementioned concepts is the relation to space. Globalisation is a supra-territorial or a multi-continental concept, as it is defined in Clark (2000) and Norris (2000). While Scholte (2008) perceives the differentiation as essential, Figge and Martens (2014), on the contrary, argue that a distinction of all these concepts is not needed, when a pluralistic and multiscale definition of globalisation is employed.

2.2 Literature and critique

Previous measures of globalisation

The construction of comprehensive composite indicators measuring a multifaceted concept of globalisation has flourished during the last two decades (for an overview of some of the most popular globalisation indices, see Table 2). The A.T. Kearney/Foreign Policy Globalisation Index (ATK/FP) was one of the first globalisation index, launched in 2001 and continued until 2006, and has served as a prototype for many later indices. Influenced by the ATK/FP Index, the KOF Globalisation Index followed in 2002 and was updated in 2007 (Dreher, 2006 and Dreher et al, 2008). The Center for the Study of Globalisation and Regionalisation (CSGR) at the University of Warwick produced a globalisation index for the years 1982-2004, measuring the economic, social and political dimension of globalisation using 16 different variables and determining the weights by the means of principal components (Lockwood and Redoano, 2005). A distinguishing feature of the CSGR is that variables measuring openness are adjusted for country characteristics such as initial population size, land area and whether a country is landlocked or not. The GlobalIndex attempted to better include the sociological concept of globalisation by extending the cultural dimension of globalisation with variables related to the international convergence of norms and values (Raab et al., 2008). The Maastricht Globalisation Index (MGI) included the environmental dimension in their index, represented by the ecological footprint of exports and imports as a share of bio capacity (Figge and Martens, 2014). The New Globalisation Index (NGI) introduced distance weighting of some of the variables to better distinguish globalisation from regionalisation (Vujakovic, 2010). More recently, the DHL Connectedness Index, measuring connectedness rather than globalisation, has been proposed (Ghemawat and Altman, 2016). It distinguishes between depth and breadth of integration along the different dimensions of globalisation.

[Insert *Table 2: Globalisation Indices - Overview and main characteristics* about here]

The KOF Globalisation Index is the most heavily adopted and cited globalisation index in the literature. It encompasses a large panel dataset including over 200 countries and territories and spans from 1970-2015. The data is easily accessible and a yearly update includes adding an

additional year.¹ Potrafke (2015) reviews 120 more recent empirical studies that use the 2007 version of the KOF Globalisation Index in their empirical specifications.

As the number of globalisation measures has flourished in the last two decades, so did the literature discussing the appropriate definition of globalisation and features that have to be accounted for when measuring globalisation.² In the following, we discuss different topics concerning the measurement of globalisation defined by Martens et al. (2015), which guides us in the construction of the revised KOF Globalisation Index: (i) the focus of measurement, (ii) the unit of measurement, (iii) the dimensions of globalisation, (v) the differentiation between globalisation and regionalisation, (vi) the transformation of variables in the light of country specific factors and (vii) the comparison of countries with different development status.

Focus of measurement: Activities or policies

Globalisation indices and similar composite indicators can be distinguished by their focus of measurement, which can be de facto or de jure measures, also labelled as activities and policies or output and input measures. While de facto measures include variables that represent actual flows or activities, de jure measures include variables representing policies, resources or institutions enabling or facilitating actual flows and activities. According to Lombaerde and Iapadre (2008) and Martens et al. (2015) it is advisable that a composite index only consists of variables from one focus of measurement to maintain a clear distinction between the de facto and de jure globalisation. When analysing the relationship between financial openness and economic growth, Quinn et al. (2011) show that the choice of financial openness indicators has a crucial impact on the results. The findings especially depend on whether a de facto or de jure measure of financial openness is chosen. As Kose et al., 2009 point out, de facto and de jure measures can differ substantially, when for example a policy is strict on paper, but toothless in practice.

Most globalisation indices focus on de facto globalisation. Exceptions are the 2007 version of the KOF Globalisation Index and the GlobalIndex by Raab et al. (2008) which combines variables representing de facto and de jure measures within the economic dimension, making them hybrid indices. The 2007 version of the KOF Globalisation Index for example, includes the sub-dimension actual flows, a de facto measure, which contains variables of trade and capital flows and the sub-dimension restrictions, a de jure measure, which contains variables on hidden import barriers and tariff rates. In the revised KOF Globalisation Index, we propose a rigorous distinction between de facto and de jure measures of globalisation in all dimensions

¹ The KOF Globalisation Index can be downloaded from <http://www.kof.ethz.ch/globalisation>.

² See among others: Dreher et al. (2008), Dreher et al. (2010), OECD (2010), Caselli (2012) and Martens et al. (2015).

and sub-dimensions of the index. This allows researchers to compare different outcomes of de facto and de jure globalisation and the relationship between the two measures.

Unit of measurement: National, subnational, individual

The KOF Globalisation Index focuses, as most other globalisation indices, on measuring globalisation at the international level. Caselli (2012) advocates extending this perspective by considering further units of measurement as exchanges at multi-continental distances not only take place at the national level. Moreover, concentrating on the national perspective conflicts with the notion that globalisation erodes national borders, reducing the importance of nation states. Given the distinct feature of globalisation being its supra-territoriality, as opposed to internationalisation, Scholte (2008) raises the question on how we can justify the use of the nation state as the main unit of measurement. In the light of this discussion, indices that depart from the perspective of nation states have been proposed, such as the Person-Based Globalisation Index (PBGI) by Caselli (2012) and the Global Cities Index (GCI) by A.T. Kearney. They provide new perspectives and additional insights to the multidimensional concept of globalisation. However, no index so far reasonably combines different units of measurement. Caselli (2013) concludes that composited indices with different unit of measurement should be used side by side rather than be combined.

Dimensions of Globalisation: Economic, social and political dimensions

The KOF Globalisation Index identifies three dimensions of globalisation: Economic, social and political. Economic globalisation is subdivided into trade and financial globalisation. Social globalisation is subdivided into interpersonal, information and cultural globalisation. Figge and Martens (2014) propose two additional dimensions in the Maastricht Globalisation Index, which are technological and ecological globalisation. While technological globalisation includes measures of communication technology that overlap with the social dimension of the KOF Globalisation Index, the ecological dimension is a distinct feature of the Maastricht Globalisation Index.

The definition of cultural globalisation in the KOF Globalisation Index goes back to Saich (2000) and Rosendorf (2000), stating that cultural globalisation can be understood as the dispersion of American values. However, Raab et al. (2008), Dreher et al. (2010) and Martens et al. (2015) perceive current attempts to measure cultural globalisation as being too much focused on Western cultural peculiarities and its global spread. Raab et al. (2008) take a more refined look at cultural globalisation, trying to abstain from focusing too much on Western culture. Following the literature in sociology on international cultural diffusion, Raab et al. (2008) include additional variables measuring the spread of values and standards of rationalism around the world. They interpret the diffusion of such values as clear signs of globalisation in cultural affairs. Kluver and Fu (2004) use as proxy for cultural globalisation three media related

variables, which they combine to one composite index, in form of a Herfindahl-Hirschman index. They justify the usage of those variables by pointing out that the international media has a more lasting impact on citizens thinking than the presence of fast food restaurants or international brands.

Transmission of cultural values is closely related to sharing cultural goods and services such as movies and TV series, music and other works of art across borders. Studies analysing cultural assimilation and its consequences therefore use direct measures of these cultural goods and services to proxy cultural proximity. Disdier et al. (2010) analyse bilateral trade in cultural goods and use it as a proxy for countries' cultural proximity. UNESCO (2009) has classified cultural goods for such purposes. In recent years, many cultural goods such as music recordings and movies initially provided physically have become digital, which has shifted the focus to trade in cultural services. Hellmanzik and Schmitz (2015) study trade in audio-visual services and relate it to a new proxy for cultural proximity based on bilateral hyperlinks and bilateral website visits.

Globalisation versus Regionalism: Accounting for distances, intensities and networks

When measuring globalisation, most indices do not account for distances, intensities or network sizes, which leads to the criticism that globalisation cannot be distinguished from concepts such as openness or regionalism (Vujakovic, 2010; Martens et al., 2015). A typical example is the variable trade, which usually is employed as sum of total exports and imports in percent of GDP. According to Vujakovic (2010), trade that encompasses global distances and trade that takes place between neighbouring countries cannot be treated equally. While the former is an indication of globalisation, the second rather depicts regionalism. Vujakovic (2010) proposes to weight trade data with the bilateral distance between the capital cities to correct for these shortcomings. Greater distances lead to higher weighted trade, which indicates a higher degree of globalisation. The DHL Connectedness Index is a more recent attempt to account for the notion of creating networks in the definition of globalisation (Ghemawat and Altman, 2016). The DHL Connectedness Index defines globalisation as the concentration of relationships across borders. Countries maintaining smaller numbers of international connections are assigned lower levels of globalisation than countries that maintain connections with many partners, independent of locations or distances.

Babones and Farabee-siers (2008), Lombaerde and Iapadre (2008) and OECD (2010) propose another concept, which is to include variables that indicate a country's trade partner concentration as a proxy for the trade partner network. In this line, we include the inverse of the Herfindahl-Hirschmann concentration index for a country's exports and imports as additional variable in the revised KOF Globalisation Index. A country is assigned higher values

if its trade is more equally distributed across trade partners. On the contrary, countries whose trade structure is heavily skewed towards a few trade partners, an indication of regional integration, are assigned lower values in this variable.

Transformation of variables: Shall we account for country specific factors?

The outcome of many variables, in particular most de facto variables, is influenced by a variety of exogenous and country specific factors. Larger countries for example exhibit higher trade volumes in absolute terms. Landlocked countries are less integrated in world markets than countries with access to the sea due to higher transport costs. Hence, constructing a globalisation index includes deciding on how to deal with the influence of such exogenous factors. The 2007 version of the KOF Globalisation Index accounts for the size of an economy or a country by dividing variables by GDP or population size. This procedure is maintained in the revised version of our index. Lockwood (2004) proposes a more rigorous way of controlling for geographical characteristics of a country. His correction consists of regressing each variable on a set of exogenous factors such as population, land area and whether a country is landlocked or not. The residuals of such regressions, which describe the difference between the predicted value based on geographical characteristics and the actual value of the variable, are included in the index. Lockwood and Redoano (2005) use this technique to transform all economic variables related to openness in the CSGR Globalisation Index. Vujakovic (2010) goes even further and transforms the majority of variables included in her globalisation index in such a way. She shows that this procedure favours bigger countries, giving them higher levels of globalisation than they would have had otherwise. However, it goes beyond the treatment of variables that is suggested by the definition of globalisation in Clark (2000), Norris (2000) and Nye and Keohane (2000). These authors describe globalisation as a process that connects actors, which does not call for more than a correction of size effects.

Comparison of countries of different development status

Ebenthal (2007) worries about the ability of single indices to assess globalisation appropriately for all countries in the world at the same time. Disregarding completely any level of development is, from his point of view, handicapping less developed countries. Ebenthal (2007) points out that one should not focus too much on variables that measure recent technological developments. Instead, one should continue considering variables that measure older technologies because they are still heavily used in developing countries. An additional criticism of his concerns the procedure with which the weights of the different variables are determined. By not considering differences in development status, developing countries once more start from a suboptimal position. He speaks in favour of performing more than one principle component analysis for different groups of countries, which are formed according to their development status.

3. The KOF Globalisation Index revisited

3.1 Content of revision

Distinction between de facto and de jure globalisation

The revisited KOF Globalisation Index introduces a rigorous distinction between de facto and de jure measures of globalisation. As aforementioned, Martens et al. (2015) do not recommend combining both de facto and de jure measures of economic globalisation within one index, due to its potential distorting effects in later applications. Quinn et al. (2011) show that de jure and de facto indicators yield systematically different results when the effect of financial globalisation on GDP growth is analysed. This is because de jure indices of financial globalisation do not reflect the extent to which actual capital flows evolve in response to legal restrictions. We propose a new structure for the revised KOF Globalisation Index, which introduces the differentiation between de facto and de jure globalisation at every dimension and at every level of the index. In this structure, we calculate a separate index for de facto and de jure economic, social and political globalisation. On the sub-dimensional level a separate index for de facto and de jure trade, financial, interpersonal, informational and cultural globalisation is calculated. All of those indices are published, which makes the index and its sub-indices applicable in a wide range of empirical settings. We acknowledge that some variables in the 2007 version of the KOF Globalisation Index do not measure international flows but rather the possibility for information exchange between international actors. These variables include access to television and internet and are reclassified as de jure indicators in the revised KOF Globalisation Index. Besides reclassifying some variables from the 2007 version of the index, many new variables, especially measuring de jure globalisation, are introduced.

Differentiation between trade and financial globalisation

The economic dimension of the revised KOF Globalisation Index consists of the two sub-dimensions, trade globalisation and financial globalisation. Differentiating between these two dimensions of economic globalisation is a key advantage over the 2007 version of the KOF Globalisation Index and other globalisation indices. The distinction between trade and financial liberalisation has already been exploited in the literature. Jaumotte et al. (2013) for example study the effect of trade and financial globalisation on the income distribution within a country and find that whereas trade globalisation is associated with a reduction in inequality, financial globalisation is associated with an increase in inequality. In a study on the negative relationship between output volatility and growth, Kose et al. (2009) find that both trade and financial globalisation reduces this negative relationship, although the effect tends to be stronger for trade globalisation. Several strands of literature have also documented that trade and financial

globalisation go hand in hand (see, for example, Lane and Milesi-Ferretti, 2008).

Measuring cultural globalisation more broadly

Another feature of the revised KOF Globalisation Index is an attempt to define and measure cultural globalisation more broadly. This is done by including more variables that do not rely on particular value concepts. The original selection of variables in the 2002 version of the KOF Globalisation Index built on an understanding of cultural globalisation based on Saich (2000), which defines modern cultural globalisation largely as the dispersion of American values. It was measured by including the number of McDonald's restaurants in a country. The focus on American values was somewhat relaxed in the 2007 version of the index by including the number of IKEA stores and trade in books as additional variables to the index. Nevertheless, as discussed above, the KOF Globalisation Index is still subject to the critique that it rather measures Westernisation than cultural globalisation in general. In the revised version of the KOF Globalisation Index, we include three additional de facto variables measuring cultural globalisation, of which none relies on a particular value concept. These variables measure trade in cultural goods, trademark applications of non-residents and trade in personal services. The variables McDonald's restaurants and IKEA stores are still included in the index.

Time-varying weights for the aggregation

The revised KOF Globalisation Index includes time-varying weighting of the individual variables in the aggregation process. As in the 2007 version of the KOF Globalisation Index, we use principle component analysis to determine the weights of the individual variables for the lowest aggregation level of the index. However, we no longer use all years to determine the weights, but apply principal component analysis on rolling windows of 10 years instead to calculate time-varying weights. This procedure has the advantage of letting the weights adjust over the years to account for changes in the role of certain variables in serving as proxies for globalisation.

Reevaluate variables

In order to emphasize globalisation as being a process of creating global networks, we include two additional variables that do not only measure the manifestation of an outcome of globalisation itself, but also quantify the creation of networks. Those variables measure trade partner diversification in the sub-dimension trade globalisation and number of partners in investment treaties in the dimension political globalisation. In this way, we account for the point of view that globalisation also has a spatial dimension as put forward by Babones and Farabee-siers (2008), Vujakovic (2010) and Ghemawat and Altman (2016).

A final part of the revision consists of reassessing the ability of some variables contained in the 2007 version of the KOF Globalisation Index to measure flows of information and

communication over the entire time span. In particular, variables in the 2007 version of the index such as international letters, trade in newspapers and trade in books are heavily affected by the digitalisation and the internet and are gradually replaced by different channels of information exchanges. Ideally, we would include variables measuring those new channels alongside with the variables measuring the traditional channels to capture some of the substitution between the two variables over the time span. However, in cases where no measures for those new means of communication are readily available for a large number of countries, we remove some of the old variables from the index. Keeping them in the index delivers the impression, that social globalisation is decreasing, while in fact only the means of communication are changing.

3.2 Data selection

KOF *de facto* Economic Globalisation

KOF Trade Globalisation. The sub-dimension trade globalisation includes variables that measure the exchange of goods and services over long distances. We use the sum of exports and imports of goods as a share of GDP, the sum of exports and imports of services as a share of GDP and a variable that measures trade partner diversification in goods trade. Trade partner diversification is computed as the inverse of the average Herfindahl-Hirschmann trade partner concentration index for exports and imports of goods. Herfindahl-Hirschmann trade partner concentration index is computed as the sum of squares of trade partner shares in exports and imports respectively for a given country. The more dispersed the trade of a country over different trade partner is, the higher the value in the variable. The variable therefore favours countries whose export and import structure is globally oriented as compared to countries that primarily trade regionally.

KOF Financial Globalisation. Financial globalisation is measured by capital flows and stocks of foreign assets and liabilities. We thereby apply a quantity-based measure as opposed to a price-based or news-based measure of financial globalisation (see Baele et al., 2004). As Kose et al. (2009) point out, it is preferable to focus on the sum of stocks of foreign assets and liabilities as opposed to flows, because it can mitigate the problem of volatility and measurement errors in the flow variables. Based on the work of Lane and Milesi-Ferretti (2007) we include the following variables: The sum of stocks of assets and liabilities of foreign direct investments as a share of GDP, the sum of assets and liabilities of international equity portfolio investments as a share of GDP, the sum of inward and outward stocks of international portfolio debt securities and bank loans and deposits as share of GDP and international reserves excluding gold as a share of GDP. As only flow variable, we include the sum of primary income payments and receipts as a share of GDP. It comprises earnings and payments arising mainly from the cross-border provision of labour and capital. For the historical values for all variables,

we rely on the updated and extended dataset External Wealth of Nations of Lane and Milesi-Ferretti (2007), which comprises information about the composition of the international financial position of a large sample of countries from 1970-2011. Additionally, the dataset accounts for valuation changes.

KOF *de facto* Social Globalisation

KOF Interpersonal Globalisation. We measure *de facto* interpersonal globalisation using four variables: International voice traffic, international financial transfers, international tourism and the share of foreign-born persons. In the revised version international calls not only includes incoming and outgoing calls from fixed telephone lines but also from mobile phones. All of the variables are measured in relation to domestic population. In contrast to the 2007 version of the KOF Globalisation Index, international transfers is divided by population instead of GDP. By following this approach, we still account for differences in country size as in Dreher et al. (2008), but it has the advantage of not carrying over movements in GDP that are not directly relevant for personal contacts. In that sense and in line with our definition of globalisation, the role of actors is better highlighted in the process of creating connections.

KOF Informational Globalisation. Informational globalisation is measured by three variables. The first two are the stock of patent applications made by non-residents and the sum of in- and outbound international students. Both variables are proposed by OECD (2010) to represent international flows of technology, scientific knowledge and related information and are used in a similar fashion in Vujakovic (2010). We divide both variables by population size, to stress the influence that foreign information has on national actors. As the variable patent applications by non-residents proxies the inflow of information, we choose the third variable to be export of high technology products divided by population. It serves as representation of outward flows of technological and scientific information. Using this variable is in accordance with the proposal of the OECD (2010) to use it as an approximation for outward directed flow of information.

KOF Cultural Globalisation. The revised sub-dimension measuring cultural globalisation contains the number of McDonald's restaurants and the number of IKEA stores, as in the 2007 version. Additionally, we include the stock of trademark applications by non-residents. It is conceptually very close to the number of McDonald's Restaurants or IKEA stores, for they are both registered trademarks. Yet, trademark applications do not focus on American or any other particular culture, as all non-residents in principle have equal opportunities to register trademarks. Following Disdier et al. (2010) and Hellmanzik and Schmitz (2015), we include trade in cultural goods and trade in personal, cultural and recreational services as two distinct additional variables. Both variables contain the sum of exports and imports and are calculated in per capita terms. For the first, we employ the definition based on UNESCO (2009), which

identifies eleven groups of cultural goods. The latter is a subcomponent of the Balance of Payments and includes for example services related to provision of cultural goods such as production of motion pictures or musical records, organisation of sport events or operation of museums. A substantial part of this subcomponent represents financial flows related to audio-visual services which includes purchases and sales of mass produced recordings and manuscripts that were downloaded.

KOF *de facto* Political Globalisation

Political globalisation is measured using the variables participation in UN Peacekeeping missions and number of embassies. The presence of embassies implies foreigners acting in their home countries' interest. Hence, it is an indication of how much a government accepts foreign sovereign governmental influence and resources. Additionally, we include the variable number of NGO active in a country. Similar to an embassy, the presence of NGOs involves presence of foreigners with political or social motives in one's own territory, which can be interpreted as political influence from abroad. We focus on NGOs that are declared as internationally oriented NGOs by the Union of International Organisations.

KOF *de jure* Economic Globalisation

KOF Trade Globalisation. We argue that *de jure* trade globalisation includes policies that impede or promote trade flows between countries. The dimension relates closely to the sub-dimension economic restriction of the 2007 version of the KOF Globalisation Index (Dreher et al., 2008). The first variable is called trade regulation and includes the average over two subcomponents. The prevalence of non-tariff trade barriers, which is based on the WEF Global Competitiveness Reports survey question: In your country, tariff and non-tariff barriers significantly reduce the ability of imported goods to compete in the domestic market. And the sub-component compliance costs, which is based on the World Bank's Doing Business report. The second variable measuring *de jure* trade globalisation is trade taxes, which measures the income of taxes on international trade as a share of total income. The variables measures the unweighted mean of tariff rates. All variables are taken from Gwartney et al. (2016).

KOF Financial Globalisation. The IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) is the primary source for most measures of *de jure* financial globalisation (see for example Quinn et al., 2011). The most widely used index based on the AREAER reports is the Chinn-Ito index, which we include as a variable measuring *de jure* financial globalisation. The Chinn-Ito index is the first principle component of the four IMF binary variables foreign exchange regime, export proceeds, capital account and current account, but does not bear information on the prevalence of capital controls on specific types of flows nor information on the direction or residency. To account for additional information in the AREAER that became available since 1995, we also include the index of Jahan and

Wang (2016) that is based on the same source, but includes a broader set of variables in the construction. The third variable measures investment restrictions and includes measures of the prevalence of foreign ownership and regulations to international capital flows. It is based on the WEF Global Competitiveness Report and taken from Gwartney et al. (2016).

KOF *de jure* Social Globalisation

KOF Interpersonal Globalisation. Measuring *de jure* interpersonal globalisation, we choose variables that are conceptually close to the ones we use for *de facto* interpersonal globalisation. The first variable is the sum of mobile phone and telephones subscriptions per 100 people. Movement of people across borders count for a substantial amount of *de facto* personal contact. Including a measure that facilitate these movements, helps create a more complete picture of *de jure* interpersonal globalisation. We include the number of airports hosting international flights, published by the International Civil Aviation Organization (ICAO). Additionally, the variable freedom of foreigners to visit is included. It is measured by the percentage of countries for which a country requires a visa for foreign visitors and is taken from Gwartney et al. (2016).

KOF Informational Globalisation. *De jure* informational globalisation is measured by the number of televisions by household and internet access per household. Furthermore, we measure the relevance of the internet in enabling exchange of information through electronic channels by using the maximum international internet bandwidth. It captures the maximum capacity with which users can access information from abroad. Additionally, the press freedom index captures the availability of news related information.³ The index aims at portraying media independence and assessing the degree of print, broadcast, and digital media freedom.⁴

KOF Cultural Globalisation. Our choice of variables for this sub-dimension is inspired by the GlobalIndex. Raab et al. (2008) justify their choice of variables by highlighting their key role in quantifying the spread of common values of rationalism and hence cultural assimilation across the world. With respect to our attempts to discriminate *de facto* and *de jure* globalisation, we classify them as factors shaping openness towards other cultures. Three factors are of particular relevance to us when it comes to the ability of understanding and accepting foreign cultural values. We use the general government expenditure on education expressed as a percentage of GDP as an indication of the importance of education. Schools in many countries

³ In the KOF Globalisation Index based on Dreher et al. (2008), the variable trade in newspapers was used to proxy information flows. Although we will not include this variable in the *de facto* sub index on informational globalisation, we can proxy the availability of news related information in the *de jure* part.

⁴ This index does not distinguish between national and international press. Hence, the validity of including the indicator rest on the assumption that national and international media is not treated differently when it comes to censoring.

teach foreign languages, which are needed to make international culture understandable. A great part of today's international culture is influenced by an egalitarian view on the role of woman in society. Consequently, we assume that having an equally egalitarian view intensifies cultural assimilation. As an approximation of such views, we use the gender parity index on gross primary school enrolment. It is an indication of parity of boys and girls and as such a strong indicator of the equality of men and women. Third, we include the civil freedom index, an assessment of civil liberties published in the freedom of the world report. It quantifies aspects of civil freedom such as expression and belief, associational and organisational rights, rule of law and personal autonomy and individual rights. These and other cultural elements determine whether citizens of a country have the possibility to get in touch with values and beliefs, essential elements of culture, from abroad.

KOF *de jure* Political Globalisation

We include the number of multilateral treaties signed since 1945 and number of memberships in international organisations as two out of three variables in the dimension of *de jure* political globalisation. Both variables represent cross-border communication and meetings of negotiators. Nevertheless, the actual intention of such actions is to influence future relationships and therefore rather characterises the willingness of creating networks than actual manifestation of flows. Next to the number of treaties, partner constellations are also informative when examining the impact of a country in global politics. Having the same number of treaties with a smaller number of partners rather reveals strong individual relationships than willingness to create global political networks. Contrary to the first treaty related variable, we restrict ourselves to bilateral treaties.⁵ There exists no conclusive collection of bilateral treaties, however the United Nation Conference on Trade and Development publishes data on bilateral investment treaties.⁶

Table 3 gives an overview of all variables that are used to construct the different dimensions of the KOF Globalisation Index, as well as their definitions and sources.

[Insert *Table 3: Overview of all variables used to construct the KOF Globalisation Indices* about here]

⁵ We do so to not unwillingly reward free-rider behaviour. We assume that the successful negotiation of a bilateral treaty tells us that each party was actively involved, whereas the same cannot be assumed to be necessary in case of multilateral treaties.

⁶ Since each pair of countries only forms one contract, we can simply count the number of bilateral investment treaties a country has to arrive at the equivalent of a concentration measure.

3.3 Method of calculation

The revised version of the KOF Globalisation Index is based on 42 individual variables, which are aggregated to a de facto and a de jure index of five sub-dimensions (trade, financial, interpersonal, informational and cultural globalisation), three dimensions (economic, social and political globalisation) and one total index. We can thus differentiate between as many as eighteen different indices if we maintain the distinction between de facto and de jure. We also report an overall index for the total and each of the three dimensions, which is calculated as the average of the de facto and the de jure index. This increases the total number of indices to twenty-two. Besides the selection of variables, which is described in Section 3.2, the construction of the KOF Globalisation Index includes the following steps.

Imputation of missing data

The KOF Globalisation Index is calculated on a yearly basis from 1970 to 2015 and for a maximum number of 209 countries and territories. The selection of countries and territories relies on the definitions by the World Bank. However, not all variables are available for all countries and years. Missing observations within a series are imputed using linear interpolation. Missing observations at the beginning or the end of a series are substituted by the closest observation available. Specifically, this implies that we carry the last non-missing observation backwards in the case of missing observations at the beginning of a series and forward in the case of missing observations at the end of a series. Table 4 displays the data coverage for the different variables and selected years before imputation by displaying the share of non-missing observations in percent. Data coverage increases for most variables over the time horizon from on average of 34 percent in 1970 to 71.3 percent in 2015.

[Insert *Table 4: Coverage ratios of variables for selected years (in percent)* about here]

Normalisation of the data

Normalising the data implies that each variable is transformed to an index with a scale from one to one hundred, where one hundred is assigned to the observation with the highest value of the whole sample of countries and the entire period of time. The remaining observations are ranked according to the percentiles of the distribution. This procedure is called panel normalisation, which is different to annual normalisation, where observations are normalised over given year only. The resulting data is well-behaved in terms of sensitivity to outliers, which is a clear advantage over the original series. The downside is that changes in the data in any year possibly affect the index value of countries in all years.

Determining the weights

We perform principal components analysis on a 10-year rolling window to determine time-varying weights for the individual variables. This means that we use observations for $t-10$ until $t-1$ to compute the weights for time t . The weights for the years 1970 to 1979 are set equal the weights of the year 1980, given the shorter time window. Principal components analysis partitions the variance of the variables used in each sub-group and the weights are determined in a way that maximises the variation of the resulting principal component. We calculate the weights using the entire sample of countries at the same time. By applying time-varying weights as opposed to fixed weights determined over all years, we are able to adapt to changes in the relevance of certain variables to capture globalisation over time. Table 5 displays time-varying weights of the variables in the lowest aggregation level for selected years.

While the weights of individual variables vary over years, the weights of the sub-indices are determined by giving equal weights to each component and are held fixed over the time horizon. Economic globalisation is sub-divided into trade and financial globalisation, both of which receive a weight of 50 percent within the economic dimension. Social globalisation consists of interpersonal, informational and cultural globalisation, each of them contributing a third to the social globalisation index. Economic, social and political globalisation are aggregated to the Globalisation Index using again equal weights. The overall globalisation indices are calculated as the average of the de facto and the de jure indices. Table 1 shows the weights of the different levels of the indices in the aggregation process.

Aggregation to indices

Once the weights are determined, the aggregation consists of adding up individual weighted variables to the desired level of aggregation. Each aggregation level is calculated from the individual variables instead of using the aggregated lower-level indices. This procedure has the advantage that variables can be used in higher aggregation levels of the index, even if the value of a sub-index is not reported due to missing data. Observations of indices are reported as missing if more than 40 percent of the underlying variables are missing or at least two out of three sub-indices cannot be calculated.

4. Resulting KOF Globalisation Indices

4.1 World averages

Since there is no reference series with which we can assess the appropriateness of the revised KOF Globalisation Index, we compare the revised 2018 version with the 2007 version of the KOF Globalisation Index. For that purpose, we recalculate the 2007 version with the most recent data. Ultimately, our perception of globalisation did not change and the outcome of the

two indices should therefore be comparable.

Figure 1 is a combination of four graphs, where each of them allows comparing the evolution of world globalisation and its dimensions according to the 2018 and 2007 version of the KOF Globalisation Index. We calculate the world globalisation and its dimension as the unweighted average over all countries. The upper left panel shows the overall KOF Globalisation Index computed by the two different versions. Both lines represent the evolution of worldwide globalisation over time. While the 2018 version shows a much higher level of globalisation than the 2007 version, the two series exhibit very similar movements over time. According to both measures, globalisation increases most strongly between 1990 and 2007, but levels off afterwards.

[Insert *Figure 1: KOF Globalisation Index - 2007 Version vs. 2018 Version* about here]

The remaining three panels show the evolution of economic, social and political globalisation respectively, measured by the two different versions of the KOF Globalisation Index. We observe that, at least at the world level, there are no fundamental differences in the measurement of globalisation arising between the two versions. There are however some smaller differences, arising from the revised calculation method and new variables.

Measuring economic globalisation, the increase in globalisation between 1990 until the onset of the financial crisis 2007 is less pronounced in the 2018 version than in the 2007 version of the KOF Globalisation Index. The reason being that economic globalisation in the 2018 version contains more variables reflecting de jure economic globalisation than in the previous version. In particular, de jure financial globalisation did not keep up with progresses in de facto financial globalisation. Measuring social globalisation, the revised version exhibits much higher levels of globalisation on the world level, after all, social globalisation is the dimension where the KOF Globalisation Index has been modified the most. Additionally, compared to the revised version of the index, social globalisation remains flat after 2000 in the 2007 version. Given many numerous modern channels of international communication, some older variables are dropped or replaced from the index. Political globalisation shows the smallest differences between the two versions.

To see how the two versions compare in individual years, we examine overlap statistics of the rankings of countries in our index. These statistics are an indication of similarity in the sense that they specify the share of identical countries within the same range in both rankings.⁷ It does however not make a statement about the similarity of the exact ordering of the countries. The overlap statistics of the comparison of the country rankings of the 2007 and the 2018

⁷ For each comparison, we concentrate on the subsample of countries that are present in both rankings and have positive index values.

version of the KOF Globalisation Index are shown in Figure 2. For each Index, we display the similarity of country composition in the different quintiles of the ranking for five selected years. The first panel displays the overlap statistics of the two different versions of the overall KOF Globalisation Index. Overlap in the first quintile is equal or greater than 80 percent in all years, which means that 80 percent of countries in the top quintiles of the index are the same in both versions. The overlap is also high in the bottom quintile with values around 80 percent. In the middle quintiles, overlap is lower because countries in the middle of the rankings have index values that lie much closer together. Consequently, any changes from the 2007 to the 2018 version are likely to have the greatest impact on the position of countries that are in the middle part of the ranking.

[Insert *Figure 2: Overlap statistics of the 2007 and 2018 versions of the KOF Globalisation Index and its dimensions* about here]

To analyse the revised KOF Globalisation Index, we compare *de facto* with *de jure* globalisation indices. Figure 3 depicts both indices for the KOF Globalisation Index and its dimensions. Overall, developments of *de facto* and *de jure* globalisation are quite distinct over time. Until 1995 the world average of *de facto* and *de jure* globalisation evolve fairly similar but start to diverge afterwards, where *de jure* globalisation grows considerable faster than the *de facto* globalisation.

[Insert *Figure 3: KOF Globalisation Index - de facto versus de jure globalisation* about here]

For economic globalisation, both indices measure a steeper increase in *de facto* than in *de jure* globalisation. We find that, while in the sub-dimension trade globalisation both *de facto* and *de jure* indices increase hand-in-hand over our sample period, in the sub-dimension financial globalisation we observe a steep increase in *de facto* globalisation but only a muted development in *de jure* globalisation. For social and political globalisation, *de jure* globalisation increases much more compared to *de facto* globalisation, especially after 1990 and 1995, respectively.

The overlap statistics between the *de jure* and *de facto* indices, depicted in Figure 4, confirm that both differ substantially and produce distinct country rankings. The highest overlap is achieved in the top quintiles: Countries that are most globalised in the *de facto* indices also tend to be most globalised in the *de jure* indices. On the contrary, overlap in the middle quintiles is low. With value below 50 percent, overlap tend to be lowest for social and economic globalisation. Overall, the low overlap statistics do confirm the notion that *de facto* and *de jure* globalisation feature different characteristics of globalisation resulting in distinct country rankings.

[Insert *Figure 4: Overlap statistics of de facto and de jure measures of the KOF Globalisation Index and its dimensions* about here]

4.2 Regional differences

Departing from the world view, we can look at regional averages which reveal interesting features of globalisation as measured with our indices. We compute regional globalisation as country averages based on the regional classification of the World Bank.⁸

The left panel of Figure 5 shows de facto globalisation of different regions. North America is the most globalised region during the first half of the sample period, but is overtaken by Europe & Central Asia in the year 2005. The breakdown of the Soviet Union leads to a drop in the index value for Europe & Central Asia in the early 1990ies. This is because we cannot compute the index value for many former soviet countries for the years prior to the fall of the iron curtain and including them afterwards lowers the regional average. Middle East & North Africa, East Asia & Pacific and Latin America and Caribbean form the middle field of globalised regions. South Asia and Sub-Saharan Africa are considered the least globalised regions, whereby the former manages to catch up substantially over the sample period.

[Insert *Figure 5: KOF de facto and de jure Globalisation Indices - Regional differences* about here]

The right panel of Figure 5 shows that North America leads the comparison of regional averages when looking at de jure globalisation. Europe & Central Asia follows with the second highest average value. Although the gap clearly decreases after Europe & Central Asia's plunge in the nineties, they did so far not manage to take over the leading role of North America as they already have regarding de facto globalisation. Further below, the Middle East & North Africa, East Asia & Pacific and Latin America form the middle group and South Asia and Sub-Saharan Africa forming the group with the lowest de jure globalisation average.

Diving deeper into the different dimensions, we can identify de facto economic globalisation as the main driver of Europe & Central Asia's catch up in terms of de facto globalisation (see Figure 6). From being second in the seventies to being sixth after the breakdown of the Soviet Union in the nineties, the region experiences a remarkable comeback in terms of de facto economic globalisation and takes over the leading role in 2000. North America is considered the most globalised region in terms of de jure economic as well as de jure social globalisation.

[Insert *Figure 6: KOF de facto and de jure Economic Globalisation Indices - Regional differences* about here]

During the first half of the sample, de jure social globalisation evolves equally sluggish,

⁸ We use the classification from 2017 for the entire sample from 1970 to 2015. Country classifications from World Bank can be found here: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>

however for six out of seven regions these flat trends turn into much steeper growth paths in the second half of the period (see Figure 7). Only North America continues to grow at a similar pace as before, the region started off from an already high level.

[Insert *Figure 7: KOF de facto and de jure Social Globalisation Indices - Regional differences* about here]

De facto political globalisation grows steadily for the majority of the regions (see Figure 8). There are only two exceptions to this: North America and Latin America & Caribbean. North America exhibits the most interesting evolution of de jure political globalisation. While it experiences the strongest increase in the early nineties, the evolution almost completely flattens out shortly afterwards.

[Insert *Figure 8: KOF de facto and de jure Political Globalisation Indices - Regional differences* about here]

4.3 Income group differences

We use the World Bank classification of 2017 to compare the evolution of globalisation across four different income groups.⁹ Figure 9 shows that de facto and de jure globalisation evolve remarkably similar across income groups and the differences across groups remain constant. High-income countries are by far more globalised than middle and low-income countries. However, more variation becomes apparent in individual dimensions.

[Insert *Figure 9: KOF de facto and de jure Globalisation Indices – Income group differences* about here]

Figure 10 displays de facto and de jure economic globalisation for the same four income groups. De facto globalisation increases considerably in all income groups over the sample period, but only remains subdued for low-income countries since the 1990s. Interestingly, de facto economic globalisation recovers in the years after the great recessions for high-income countries but deteriorates in middle income countries. Compared to the remarkable increase of de facto economic globalisation from 1970 to 2015 the evolution of de jure economic globalisation is perceived as modest across all different income groups. High-income countries are by far the most globalised countries in terms of de jure economic globalisation.

[Insert *Figure 10: KOF de facto and de jure Economic Globalisation Indices – Income group differences* about here]

⁹ We use the classification from 2017 for the entire sample from 1970 to 2015. Country classifications from World Bank can be found here: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>

Figure 11 shows that high income countries are the most globalised countries when social globalisation is analysed. This holds for both de facto and de jure social globalisation. In de facto social globalisation, the gap to the remaining countries appears particularly large. Low-income countries especially, record only modest developments in de facto social globalisation. De jure social globalisation appears to develop very dynamically since the 1990s in all income groups. Especially middle-income countries are able to catch up with the high-income countries, at least to some extent.

[Insert *Figure 11: KOF de facto and de jure Social Globalisation Indices – Income group differences* about here]

Contrary to economic and social globalisation, the income groups lie much closer together in political globalisation and upper-middle income countries appear to be even more globalised than high-income countries (see Figure 12). In de facto political globalisation, this is characterized by strong catch-up since the end of the 1990s. In de jure political globalisation, the difference between the country groups is smallest over the whole sample period. Overall, political globalisation seems to be more independent from the income level than the other two dimensions.

[Insert *Figure 12: KOF de facto and de jure Political Globalisation Indices – Income group differences* about here]

4.4 Testing for Granger non-causality between de facto and de jure globalisation

To end, we empirically examine the interaction between de facto and de jure globalisation. We are interested in identifying the direction of transmission from de facto globalisation to de jure globalisation and vice versa. To do so, we apply a panel vector autoregression (panel VAR) on a balanced panel of de facto and de jure globalisation indices, which includes 144 countries over the period 1985-2015.¹⁰ We first test for Granger non-causality between de facto and de jure measures of globalisation and then estimate Impulse Response Functions (IRF) for different shocks to identify the direction of transmission across the two measures. We apply this approach to different dimensions and sub-dimensions of globalisation and for different sub-samples. To do so, we estimate a homogeneous panel VAR of order ρ with panel-specific fixed effects in a General Methods of Moments (GMM) framework following Abrigo and Love (2016). The model consists of the following system of linear equations:

$$Y_{i,t} = Y_{i,t-1}A_1 + Y_{i,t-2}A_2 + \dots + Y_{i,t-\rho}A_\rho + u_i + e_{i,t} \quad (1)$$

¹⁰ To attain a balanced panel for all measures of globalisation, 65 countries out of the full sample of 209 countries are dropped and years prior to 1985 omitted.

where Y_{it} is the vector of endogenous variables and u_i and $e_{i,t}$ are vectors of the dependent variable-specific panel-fixed effects and idiosyncratic errors, respectively. It is assumed, that countries share the same underlying data generating process, which means that the reduced-form parameters A_1, A_2, \dots, A_ρ are the same across countries. Systematic cross-sectional heterogeneity is thus only modelled through panel-specific fixed effects, for which forward orthogonal deviation, as proposed by Arellano and Bover (1995), is applied.

Applying the CD-test as described in Pesaran (2004 and 2015), cross-sectional independence is rejected in our panel, but substantially mitigated if we use first-differenced variables. Panel unit roots are rejected in all tests of stationarity, such as the Levin-Lin-Chu test, the Im-Pesaran-Shin test and the CIPS test of Pesaran (2007) that allows testing for panel unit roots in the presence of cross-sectional dependence. The optimal lag-length is determined to be $\rho = 5$.

After fitting the reduced-form panel VAR where $Y_{i,t} = (dindex.df_{i,t}, dindex.dj_{i,t})$ in which $dindex.df$ is the first difference of our de facto globalisation measure and $dindex.dj$ is the first difference of our de jure globalisation measure, we test for panel Granger non-causality, i.e., we want to know whether past values of one of our variables is useful in predicting the values of the other variable conditional on the past values of that variable. The Granger non-causality test consists of a Wald tests for each equation of the underlying panel VAR model with the null hypothesis that the coefficients of the endogenous variable are jointly equal to zero. We run the test for the overall globalisation index, as well as for sub-indices of the economic, social and political dimensions and trade, financial, interpersonal, informational and cultural sub-dimensions of globalisation. Table 6 reports the resulting values of the χ^2 distribution and the corresponding p-values. The results show, that a bi-directional relationship exists between de facto and de jure measures of globalisation at the aggregated level. We can reject the null hypothesis that de jure globalisation does not Granger-cause de facto globalisation (left panel) and that de facto globalisation does not Granger-cause de jure globalisation (right panel) at the 95 percent confidence level.

[Insert Table 6: Granger causality tests about here]

Shocks in de jure globalisation appear to have a direct effect on contemporaneous de facto globalisation, while shocks to de facto globalisation affects de jure globalisation only with some delay. However, we do not find support for this presumptions from the Granger non-causality test. For that, we calculate the IRFs that are depicted in Figure 13. Confidence intervals are computed using 200 Monte Carlo draws from the distribution of the fitted reduced-form panel VAR. The results suggest that shocks to de jure globalisation have a somewhat stronger effect on de facto globalisation than vice versa. However, the differences are small and not statistically significant. In both directions, the effect is strongest after one year and then successively dies out.

[Insert *Figure 13: Impulse response functions de facto vs. de jure – KOF Globalisation Index* about here]

For economic globalisation, there does not appear to be a transmission of a shock from de jure economic globalisation to de facto globalisation and vice versa (see **Error! Reference source not found.14**). However, there appears to be a heterogeneous effect among the two sub-dimension of the economic dimension, trade and financial globalisation. While we find a bi-directional Granger-causality in trade globalisation, no relationship exists between de jure and de facto measures of financial globalisation. For social globalisation, the transmission appears to be bi-directional, with a somewhat stronger effect from de jure social globalisation to de facto social globalisation (see **Error! Reference source not found.15**). Granger-causality tests reveal that a bi-directional relationship exists in the measures of interpersonal and informational globalisation. For cultural globalisation, we find that de facto cultural globalisation Granger-cause de jure cultural globalisation, but the reverse is not true. For political globalisation, the transmission appears to be only from de facto political globalisation to de jure political globalisation (see **Error! Reference source not found.16**).

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Finally, we test the model for different income groups within our data. Using the same specification, we find that the bi-directional relationship between de facto and de jure globalisation is mostly driven by high income and lower-middle income countries. Overall, we find evidence for interaction effects across de facto and de jure globalisation. These are mostly bi-directional.

5. Conclusions

This paper has introduced the third version of the KOF Globalisation Index, a composite index measuring globalisation for every country in the world since 1970. In line with its previous two versions, it distinguishes economic, social and political globalisation. Besides increasing the number of underlying variables, the major innovations have this time been to distinguish between de jure and de facto versions of the different indices and create a separate index within the dimension of economic globalisation reflecting financial globalisation. We furthermore also allow the weights of the underlying variables to slowly change over time by incorporating time-varying weights in the aggregation procedure.

We empirically show that the relationship between our de facto and de jure overall index is

largely bi-directional. This appears to be driven by the social dimension of globalisation – only there the transmission of shocks appears to be bi-directional. For the economic dimension we do not find any significant links between the de jure and de facto parts and for political globalisation it is the de facto part that runs ahead of the de jure part. The on the aggregate found bi-directional relationship between de facto and de jure globalisation appears to be mostly driven by high-income and middle-income countries. For low-income countries no relationship appears to exist.

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Tables and Figures

Table 1: Structure of the KOF Globalisation Index

Globalisation Index, de facto	Weights	Globalisation Index, de jure	Weights
<i>Economic Globalisation, de facto</i>	33.3	<i>Economic Globalisation, de jure</i>	33.3
<i>Trade Globalisation, de facto</i>	50.0	<i>Trade Globalisation, de jure</i>	50.0
Trade in goods	40.9	Trade regulations	32.5
Trade in services	45.0	Trade taxes	34.5
Trade partner diversification	14.1	Tariffs	33.0
<i>Financial Globalisation, de facto</i>	50.0	<i>Financial Globalisation, de jure</i>	50.0
Foreign direct investment	27.5	Investment restrictions	21.7
Portfolio investment	13.3	Capital account openness 1	39.1
International debt	27.2	Capital account openness 2	39.2
International reserves	2.4		
International income payments	29.6		
<i>Social Globalisation, de facto</i>	33.3	<i>Social Globalisation, de jure</i>	33.3
<i>Interpersonal Globalisation, de facto</i>	33.3	<i>Interpersonal Globalisation, de jure</i>	33.3
International voice traffic	22.9	Telephone subscriptions	38.2
Transfers	27.6	Freedom to visit	31.2
International tourism	28.1	International airports	30.6
Migration	21.4		
<i>Informational Globalisation, de facto</i>	33.3	<i>Informational Globalisation, de jure</i>	33.3
Patent applications	35.1	Television	25.2
International students	31.2	Internet user	31.9
High technology exports	33.7	Press freedom	13.2
		Internet bandwidth	29.7
<i>Cultural Globalisation, de facto</i>	33.3	<i>Cultural Globalisation, de jure</i>	33.3
Trade in cultural goods	22.6	Gender parity	31.1
Trademark applications	13.3	Expenditure on education	30.9
Trade in personal services	25.6	Civil freedom	38.0
McDonald's restaurant	23.2		
IKEA stores	15.3		
<i>Political Globalisation, de facto</i>	33.3	<i>Political Globalisation, de jure</i>	33.3
Embassies	35.7	International organisations	37.0
UN peace keeping missions	27.3	International treaties	33.0
International NGOs	37.0	Number of partners in investment treaties	30.0

Notes: Weights in percent. Weights for the individual variables are time variant. Depicted are the weights for the year 2015. Overall indices for each aggregation level are calculated by the average of the respective de facto and de jure indices.

Table 2: Globalisation Indices - Overview and main characteristics

Measure	Countries/ Years/ Variables	Description	Characteristics
KOF Globalisation Index - 2018 Version	209 / 1970-2015/ 42	Comprehensive indicator covering the economic, social and political aspects of Globalisation distinguishing between <i>de facto</i> and <i>de jure</i> .	Clear distinction between <i>de facto</i> and <i>de jure</i> Globalisation for each dimension and sub-dimension of the index.
KOF Globalisation Index - 2007 Version	209 / 1970-2015/ 23	Comprehensive indicator covering the economic, social and political aspects of Globalisation.	Wide coverage in terms of countries and years. Hybrid-measure. No clear distinction between trade and financial Globalisation.
Maastricht Globalisation Index (MGI) – 2012 Edition	117/ 2000, 2008, 2012/ 11	Comprehensive indicator covering the political, economic, social & cultural, technological and environmental domain of Globalisation.	Includes environmental dimension. Only three years.
A.T. Kearney/ Foreign Policy Globalisation Index (ATK/ FP)	62/ 2002-2007/ 14	First composite indicator measuring Globalisation. Covers political engagement, technology, personal contact and economic integration on a global scale.	Used as benchmark by many alternative indices.
GlobalIndex	97/ 1970-2002/ 31	Sociological index of Globalisation covering the economic, sociotechnical, cultural and political dimensions of Globalisation.	Extends existing indices by additional dimensions and indicators representing a sociological concept of Globalisation.
Center for the Study of Globalisation and Regionalisation (CSGR)	119 / 1982-2004/ 16	Composite index measuring the economic, political and social aspects of Globalisation. Weights of variables are determined by principal components analysis.	Variables measuring openness are corrected for by fixed country characteristics (initial population size, land area and if a country is landlocked).
New Globalisation Index (NGI)	70/ 1995-2005/ 21	Comprehensive indicator measuring the economic, political and social aspects of Globalisation controlling partly for geographical distances between countries.	Controlling for geographical distance helps to some extent to distinguish Globalisation from regionalization.
DHL Connectedness Indicator (GCI)	140/ 2005-2015/ 12	Composite indicator measuring depth and breadth of country's integration with the rest of the world. Covers international flows of goods and services, capital, information and people.	Distinction between depth and breadth of integration.

Table 3: Overview of all variables used to construct the KOF Globalisation Indices

<u>Indices and variables</u>	<u>Sources</u>	<u>Definitions</u>
Economic Globalisation (KOFecGI)		
<i>Economic Globalisation, de facto (KOFecGldf)</i>		
<i>Trade Globalisation, de facto (KOFTrGldf)</i>		
Trade in goods	World Bank WDI (2017)	Sum of exports and imports in goods as share of GDP.
Trade in services	World Bank WDI (2017)	Sum of exports and imports in services as share of GDP.
Trade partner diversification	Own calculations based on IMF DOTS (2017)	Herfindahl-Hirschman concentration index for trade in goods. Constructed as the average of the sum of squares of trade partner shares in total exports and imports (inverted).
<i>Financial Globalisation, de facto (KOFFIGldf)</i>		
Foreign direct investment	IMF IIP (2017) / historical data from EWN	Sum of stocks of assets and liabilities of foreign direct investments (% of GDP).
Portfolio investment	IMF IIP (2017) / historical data from EWN	Sum of stocks of assets and liabilities of international equity portfolio investments (% of GDP).
International debt	IMF IIP (2017) / historical data from EWN	Sum of inward and outward stocks of international portfolio debt securities and international bank loans and deposits (% of GDP)
International reserves	IMF IIP (2017) / historical data from EWN	Includes foreign exchange, SDR holdings and reserve position in the IMF (% of GDP)
International income payments	IMF IIP (2017) / historical data from EWN	Sum of capital and labour income to foreign nationals and from abroad (% of GDP)
<i>Economic Globalisation, de jure (KOFecGldj)</i>		
<i>Trade Globalisation, de jure (KOFTrGldj)</i>		
Trade regulations	Gwartney et al. (2017)	Average of two subcomponents: Prevalence of non-tariff trade barriers and compliance costs of importing and exporting.
Trade taxes	World Bank WDI (2017)	Income from taxes on international trade as percentage of revenue (inverted).
Tariffs	Gwartney et al. (2017)	Unweighted mean of tariff rates.
<i>Financial Globalisation, de jure (KOFFIGldj)</i>		
Investment restrictions	Gwartney et al. (2017)	Prevalence of foreign ownership and regulations to international capital flows.
Capital account openness 1	Chinn, Ito (2017)	Chinn-Ito index of financial openness.
Capital account openness 2	Jahan, Wang (2016)	Jahan-Wang index of openness of the capital account.
Social Globalisation (KOFSoGI)		
<i>Social Globalisation, de facto (KOFSoGldf)</i>		
<i>Interpersonal Globalisation, de facto (KOFIpGldf)</i>		
International voice traffic	ITU (2017)	Sum of international incoming and outgoing fixed and mobile telephone traffic in minutes per capita.
Transfers	World Bank WDI (2017)	Sum of gross inflows and outflows of goods, services, income or financial items without a quid pro quo per capita.
International tourism	World Bank WDI (2017)	Sum of arrivals and departures of international tourists as a share of population.
Migration	World Bank WDI (2017)	Number of foreign or foreign-born residents as percentage of total population.
<i>Informational Globalisation, de facto (KOFInGldf)</i>		
Patent applications	Own calculations based on World Bank WDI (2017)	Patent applications by non residents filed through the Patent Cooperation Treaty procedure or with a national patent office (stocks as % of population)
International students	UNESCO (2017)	Sum of inbound and outbound number of tertiary students (% of population)
High technology exports	World Bank WDI (2017)	Exports of products with high R&D intensity as share of total merchandise exports.

<i>Cultural Globalisation, de facto (KOFCuGldf)</i>		
Trade in cultural goods	UN Comtrade (2017)	Sum of exports and imports of cultural goods as defined in UNESCO (2009).
Trademark applications	World Bank WDI (2017)	Applications to register a trademark with a national or regional Intellectual Property (IP) office by non residents in percent of all applications.
Trade in personal services	IMF BOPS (2017)	Sum of exports and imports in personal services.
McDonald's restaurant	Various sources.	Number of McDonald's restaurants (per capita).
IKEA stores	IKEA	Number of IKEA stores (per capita)
Social Globalisation, de jure (KOFSoGldj)		
<i>Interpersonal Globalisation, de jure (KOFIpGldj)</i>		
Telephone subscriptions	World Bank WDI (2017)	Fixed telephone and mobile subscriptions as percentage of population.
Freedom to visit	Gwartney et al. (2017)	Percentage of countries for which a country requires a visa from foreign visitors.
International airports	ICAO (2017)	Number of airports that offers at least one international flight connection (per capita).
<i>Informational Globalisation, de jure (KOFInGldj)</i>		
Television	World Bank WDI (2017)	Share of households with a television set.
Internet user	World Bank WDI (2017)	Individuals using the internet (as % of population). Internet users are individuals who have used the internet in the last three months.
Press freedom	Gwartney et al. (2017)	Numerical scores evaluating the legal environment for the media, political pressure that influence reporting and economic factor that affect access to news and information.
Internet bandwidth	ITU (2017)	Total used capacity of international internet bandwidth in bits per second per capita.
<i>Cultural Globalisation, de jure (KOFKuGldj)</i>		
Gender parity	UNESCO (2017)	Ratio of girls to boys enrolled in primary education level in public and private schools.
Expenditure on education	UNESCO (2017)	General government expenditure on education (current, capital and transfers) per capita.
Civil freedom	Gwartney et al. (2017)	Quantification of aspects on freedom of expression and belief, associational and organizational rights, rule of law and personal autonomy and individual rights.
Political Globalisation (KOFPoGI)		
<i>Political Globalisation, de facto (KOFPoGldf)</i>		
Embassies	Europe World Yearbook (various years)	Absolute number of embassies in a country.
UN peace keeping missions	Department of Peacekeeping Operations, UN	Personnel contributed to U.N. Security Council Missions per capita.
International NGOs	Union of International Association (various	Number of international oriented nongovernmental organisations (NGO) with members in that country or territory.
<i>Political Globalisation, de jure (KOFPoGldj)</i>		
International organisations	CIA World Factbook (various years).	Number of international inter-governmental organisations in which a country is member.
International treaties	United Nations Treaty Collection.	Internationall treaties signed between two or more states and ratified by the highest legislative body of each country since 1945.
Number of partners in investment treaties	UNCTAD (2017)	Number of distinct treaty partners of a country with bilateral investment treaties.

Table 4: Coverage ratios of variables for selected years (in percent)

Variable	1975	1985	1995	2005	2015
Trade in goods	57.4	70.3	87.1	90.0	84.7
Trade in services	23.4	57.9	68.4	81.3	69.4
Trade partner diversification	61.7	73.7	85.2	87.1	86.6
Trade regulations	0.0	0.0	24.4	66.0	75.6
Trade taxes	22.0	24.4	46.4	57.4	38.3
Tariffs	13.4	45.0	46.9	67.0	75.1
Foreign direct investment	48.3	64.6	82.3	86.6	50.2
Portfolio investment	46.9	62.7	81.8	86.6	42.6
International debt	48.8	64.1	81.8	87.1	45.9
International reserves	50.7	65.1	83.3	87.1	42.1
International income payments	23.4	57.9	68.4	81.3	69.4
Investment restrictions	0.0	0.0	24.4	56.5	71.8
Capital account openness 1	52.6	67.5	73.2	85.6	83.3
Capital account openness 2	0.0	0.0	0.0	65.6	0.0
Voice traffic (Fixed calls outgoing)	4.8	13.9	78.5	44.5	48.3
Voice traffic (Fixed calls incoming)	15.8	58.4	89.0	86.1	59.8
Voice traffic (Mobile calls outgoing)	0.0	0.0	0.0	20.1	52.2
Voice traffic (Mobile calls incoming)	0.0	0.0	0.0	26.3	62.2
Transfers	24.9	59.3	71.8	78.9	65.1
International tourism	0.0	0.0	42.6	48.8	44.0
Migration	87.1	87.1	98.6	99.0	98.6
Telephone subscriptions	95.2	95.7	96.2	98.1	98.1
Freedom to visit	0.0	0.0	0.0	67.5	75.1
International airports	0.0	0.0	0.0	95.2	98.6
Patent applications	36.4	40.2	49.8	47.8	51.2
International students	98.1	98.1	99.0	99.0	98.6
High-tech exports	0.0	0.0	54.1	76.6	64.6
Television	13.4	23.4	64.6	83.7	11.5
Internet user	0.0	0.0	60.8	93.8	95.7
Press freedom	0.0	0.0	87.6	90.4	91.4
Internet bandwidth	0.0	0.0	18.2	88.5	91.9
McDonald's restaurants	55.5	58.9	58.9	99.0	98.1
Ikea stores	98.1	98.1	99.0	99.0	98.6
Trade in cultural goods	0.0	0.0	99.0	99.0	98.6
Trademark applications	37.8	40.7	54.5	60.8	62.2
Trade in personal services	0.0	0.0	0.0	42.6	55.5
Gender parity	59.8	61.7	67.9	80.4	62.7
Expenditure on education	25.8	25.8	38.8	53.6	20.1
Civil freedom	70.3	74.2	89.5	90.0	90.9
Embassies	64.1	86.1	98.1	99.0	90.4
UN peace keeping missions	97.6	97.6	98.6	98.6	98.1
International NGOs	0.0	0.0	0.0	99.5	100.0
International organizations	2.4	2.4	95.2	97.6	98.1
International treaties	92.3	92.3	92.3	92.3	92.3
Partners in investment treaties	100.0	100.0	100.0	100.0	100.0
<i>Mean</i>	<i>34.0</i>	<i>41.5</i>	<i>61.2</i>	<i>78.7</i>	<i>71.3</i>
<i>Std</i>	<i>34.8</i>	<i>36.6</i>	<i>34.2</i>	<i>20.9</i>	<i>25.8</i>

Table 5: Weights of variables for selected years

Globalisation Index, de facto						Globalisation Index, de jure					
Economic Globalisation, de facto	1975	1985	1995	2005	2015	Economic Globalisation, de jure	1975	1985	1995	2005	2015
<i>Trade Globalisation, de facto</i>						<i>Trade Globalisation, de jure</i>					
Trade in goods	42.5	42.0	40.4	38.7	40.9	Trade regulations	28.3	28.5	28.3	30.3	32.5
Trade in services	46.4	44.9	42.3	42.6	45.0	Trade taxes	35.8	35.5	35.6	35.9	34.5
Trade partner diversification	11.1	13.1	17.3	18.7	14.1	Tariffs	35.9	36.0	36.1	33.8	33.0
<i>Financial Globalisation, de facto</i>						<i>Financial Globalisation, de jure</i>					
Foreign direct investment	16.1	17.1	21.5	29.5	27.5	Investment restrictions	30.2	29.7	30.1	23.8	21.7
Portfolio investment	4.1	5.2	4.1	9.4	13.3	Capital account openness 1	26.6	28.1	30.0	37.3	39.0
International debt	28.5	26.5	25.2	23.4	27.2	Capital account openness 2	43.1	42.1	39.9	38.9	39.2
International reserves	13.1	13.4	12.8	0.1	2.4						
International income payments	38.2	37.8	36.4	37.5	29.6						
Social Globalisation, de facto						Social Globalisation, de jure					
<i>Interpersonal Globalisation, de facto</i>						<i>Interpersonal Globalisation, de jure</i>					
International voice traffic	25.4	25.3	26.6	26.6	22.9	Telephone subscriptions	39.0	39.4	40.0	39.7	38.2
Transfers	28.7	28.8	27.7	26.9	27.6	Freedom to visit	27.6	28.1	28.2	30.6	31.1
International tourism	28.8	28.3	28.5	27.6	28.1	International airports	33.5	32.6	31.8	29.7	30.6
Migration	17.1	17.6	17.1	18.8	21.4						
<i>Informational Globalisation, de facto</i>						<i>Informational Globalisation, de jure</i>					
Patent applications	40.9	70.8	39.8	38.8	35.1	Television	23.7	24.5	25.7	23.0	25.2
International students	28.2	28.3	29.1	27.6	31.2	Internet user	29.2	28.6	28.1	29.3	31.9
High technology exports	30.9	30.9	31.1	33.6	33.7	Press freedom	21.3	31.3	20.8	17.7	13.2
						Internet bandwidth	25.8	25.6	25.4	29.9	29.7
<i>Cultural Globalisation, de facto</i>						<i>Cultural Globalisation, de jure</i>					
Trade in cultural goods	17.0	15.0	13.0	17.7	22.6	Gender parity	36.5	37.2	39.8	34.7	31.1
Trademark applications	20.6	16.2	17.8	17.7	13.3	Expenditure on education	25.2	23.2	21.9	25.7	30.9
Trade in personal services	30.4	24.6	24.7	23.9	25.6	Civil freedom	38.3	39.6	38.3	39.6	38.0
McDonald's restaurant	11.7	19.1	22.7	23.9	23.2						
IKEA stores	20.2	25.1	21.8	16.7	15.3						
Political Globalisation, de facto						Political Globalisation, de jure					
Embassies	38.3	38.2	36.0	34.3	35.7	International organisations	39.8	40.5	37.7	37.1	37.0
UN peace keeping missions	22.6	22.2	27.1	29.5	27.3	International treaties	39.8	40.5	37.7	37.0	33.0
International NGOs	39.1	39.6	36.9	36.2	37.0	Partners in investment treaties	20.4	20.2	24.2	28.4	30.0

Notes: Weights in percent.

Figure 1: KOF Globalisation Index - 2007 Version vs. 2018 Version

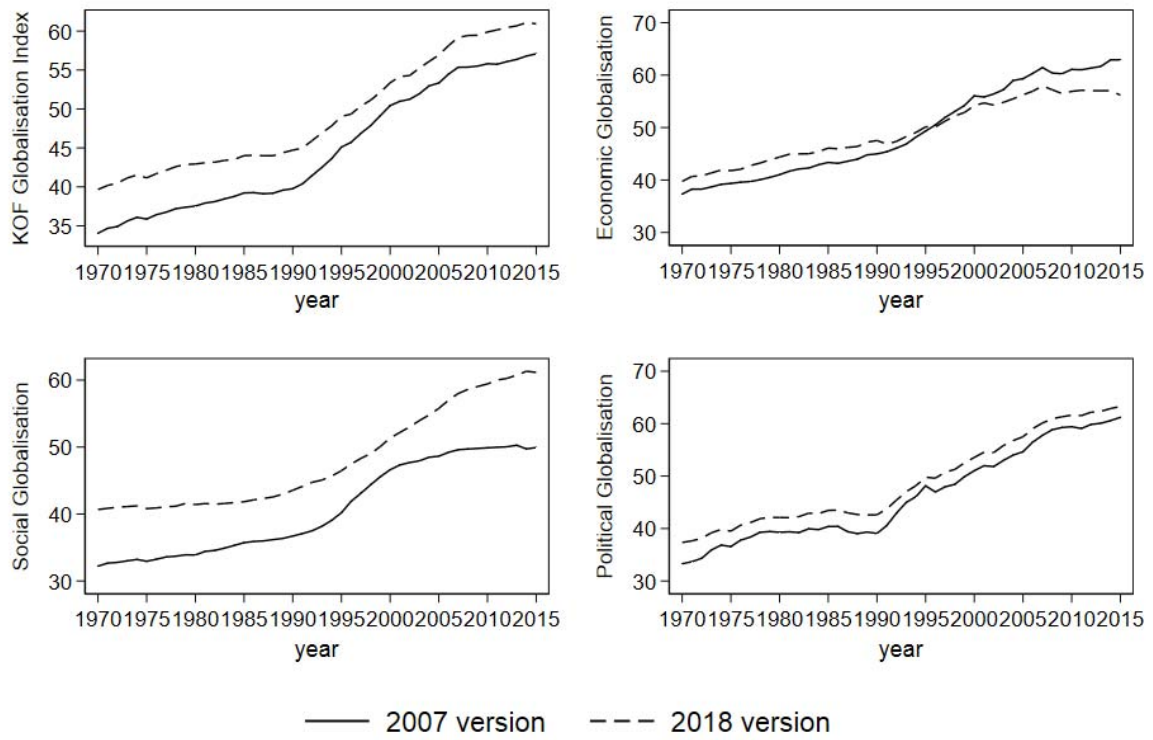


Figure 2: *Overlap statistics of the 2007 and 2018 versions of the KOF Globalisation Index and its dimensions*

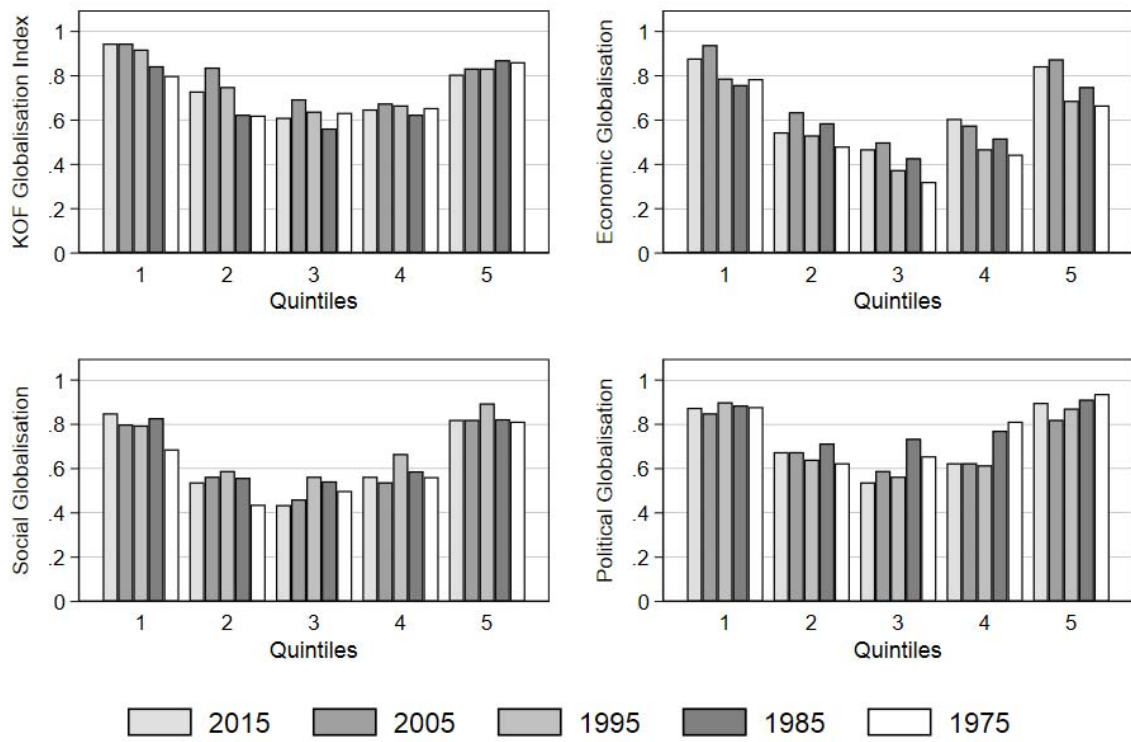


Figure 3: KOF Globalisation Index - de facto versus de jure globalisation

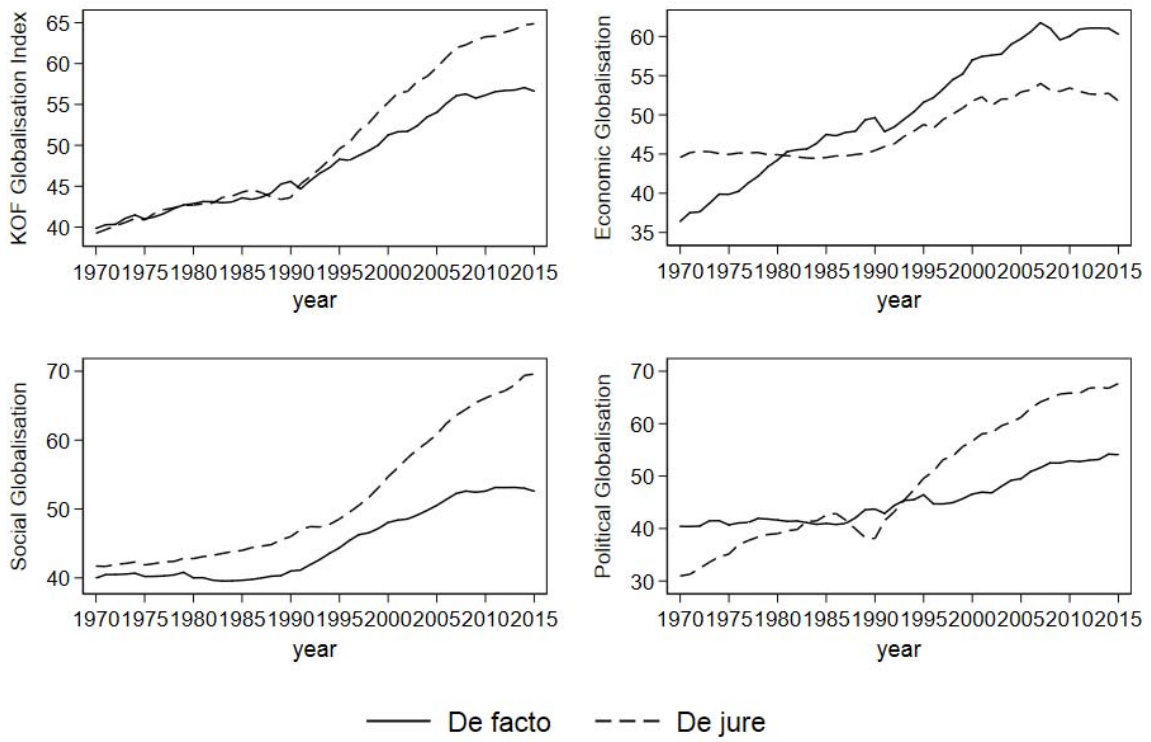


Figure 4: *Overlap statistics of de facto and de jure measures of the KOF Globalisation Index and its dimensions*

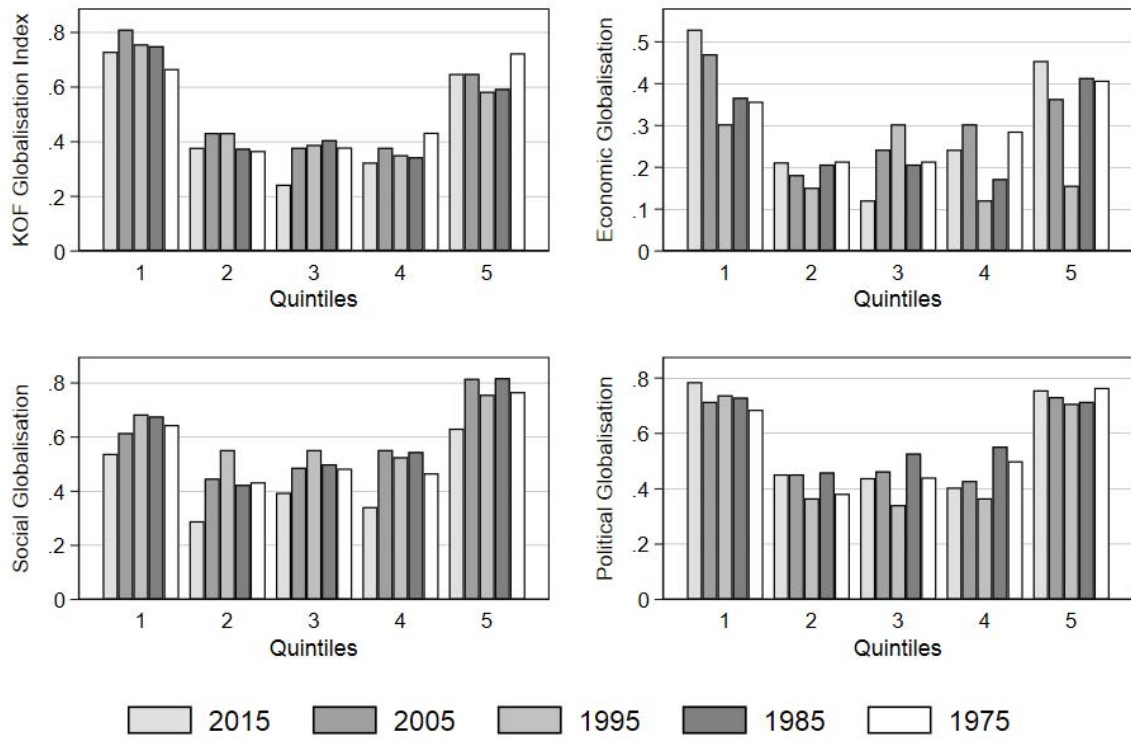


Figure 5: KOF de facto and de jure Globalisation Indices - Regional differences

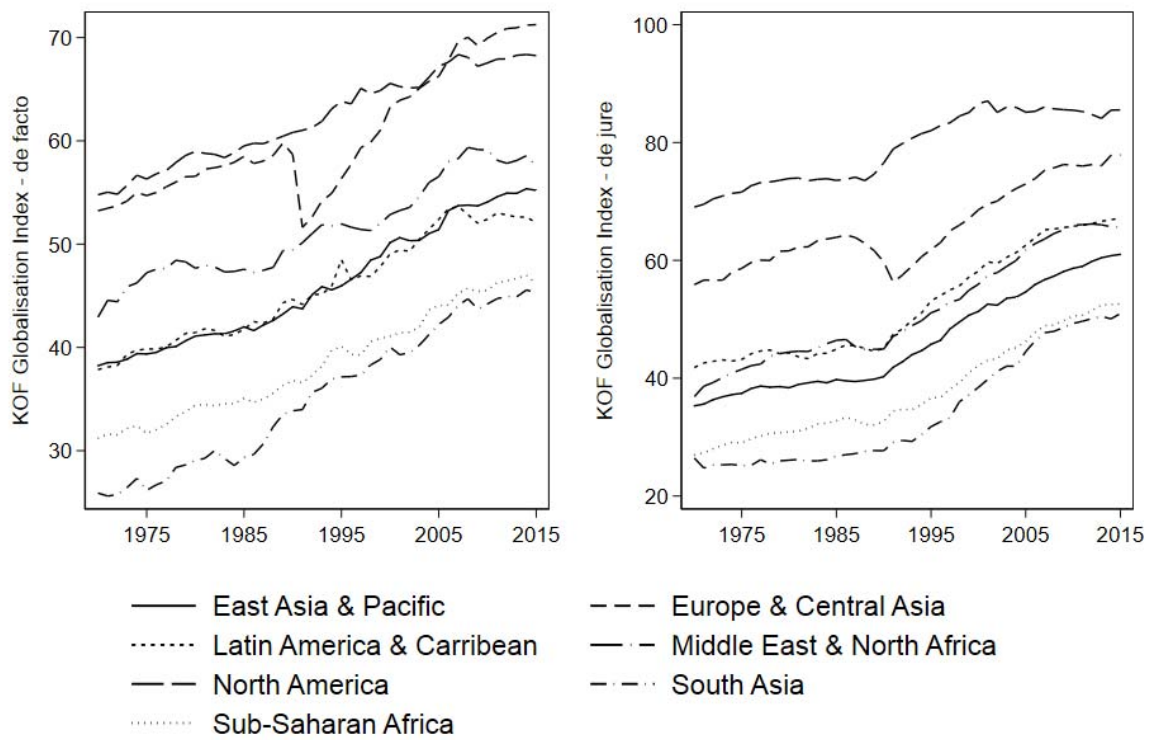


Figure 6: KOF de facto and de jure Economic Globalisation Indices - Regional differences

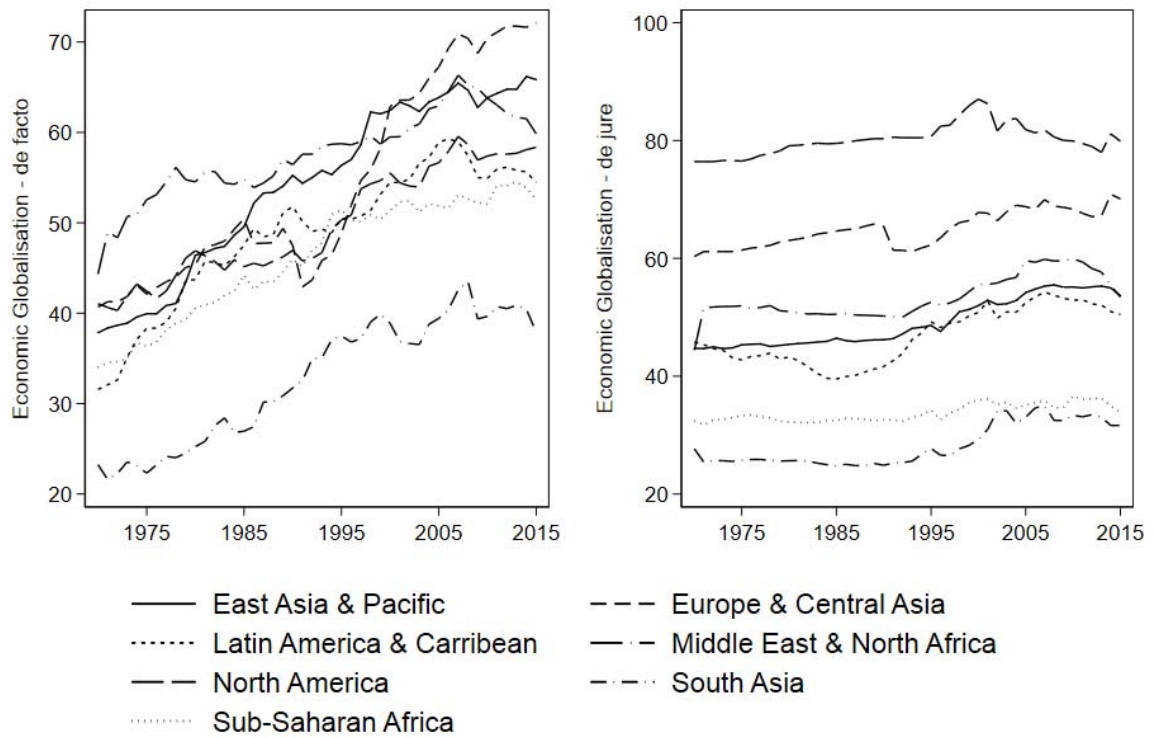


Figure 7: KOF de facto and de jure Social Globalisation Indices - Regional differences

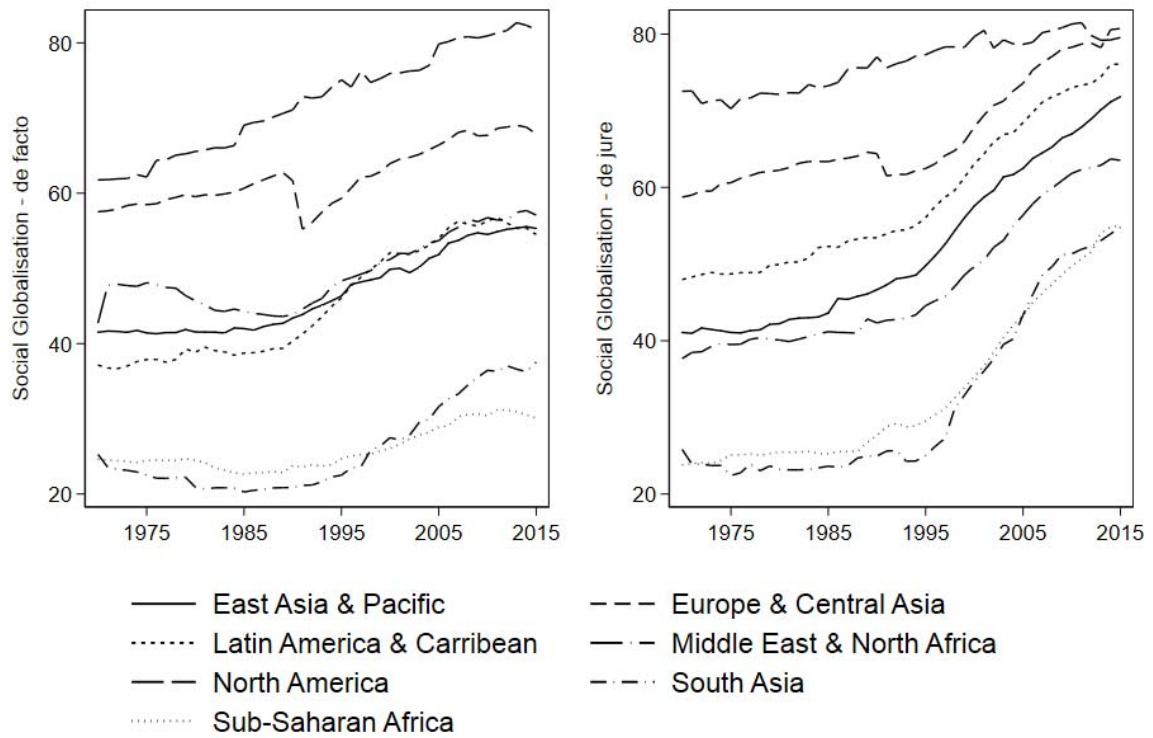


Figure 8: KOF de facto and de jure Political Globalisation Indices - Regional differences

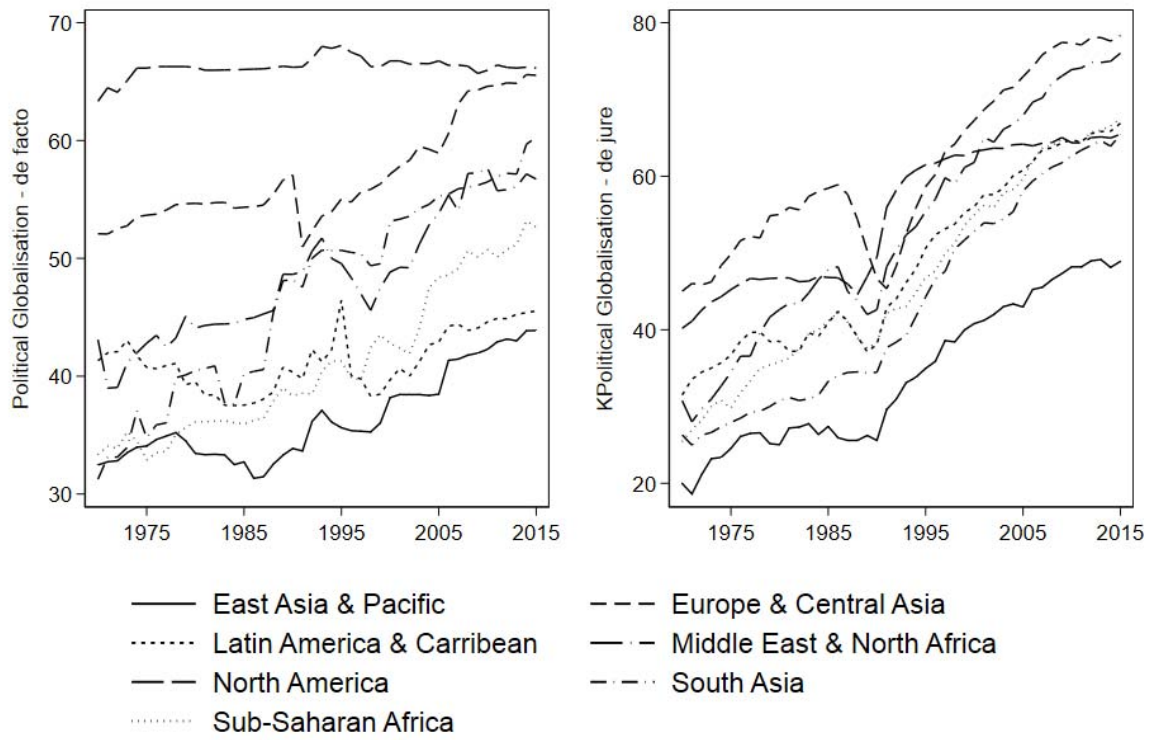


Figure 9: KOF de facto and de jure Globalisation Indices – Income group differences

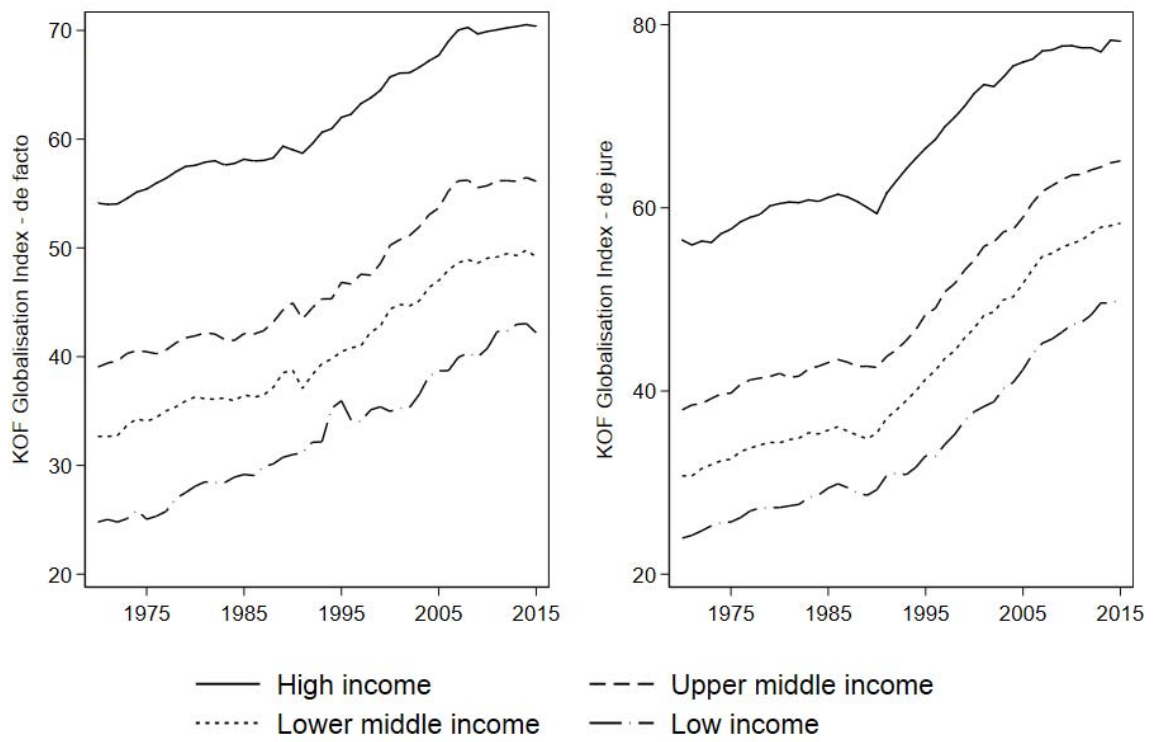


Figure 10: KOF de facto and de jure Economic Globalisation Indices – Income group differences

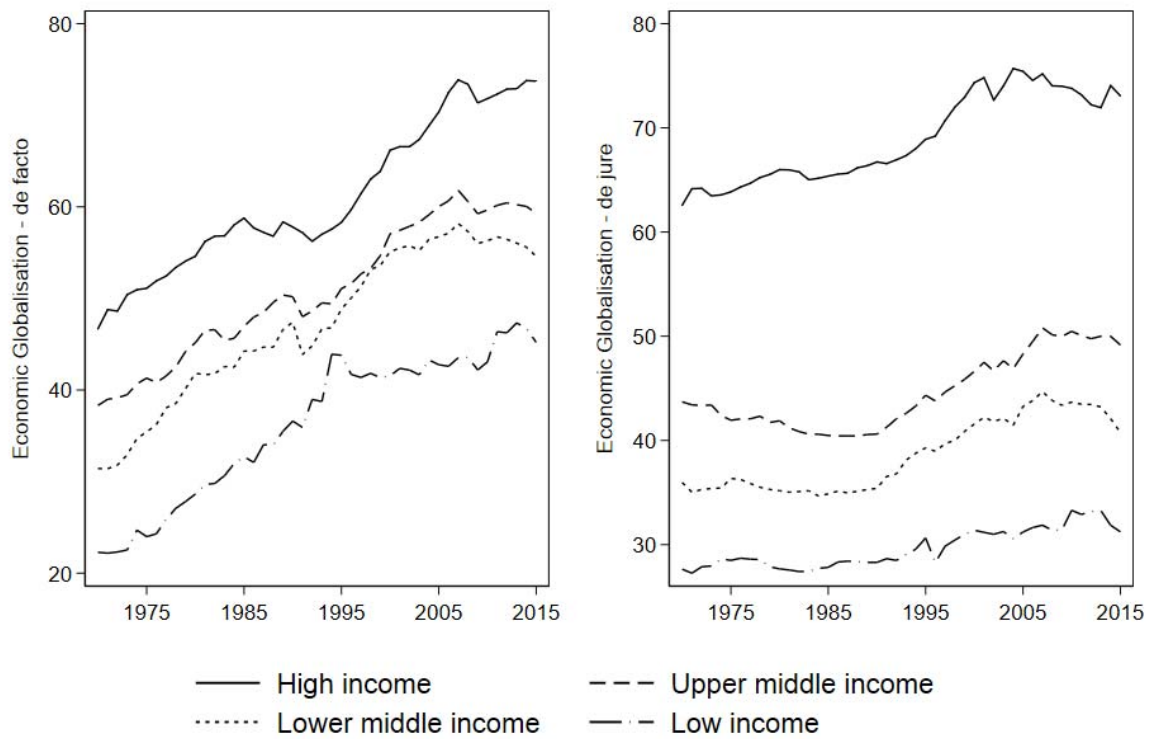


Figure 11: KOF de facto and de jure Social Globalisation Indices – Income group differences

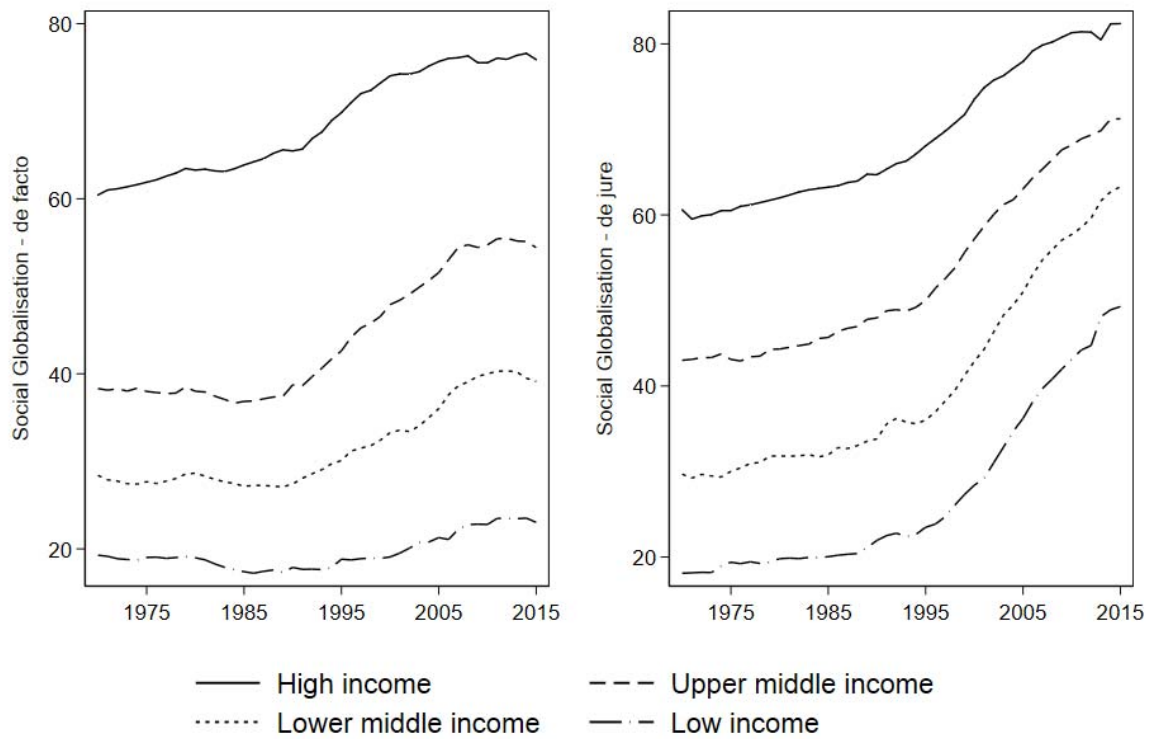


Figure 12: KOF de facto and de jure Political Globalisation Indices – Income group differences

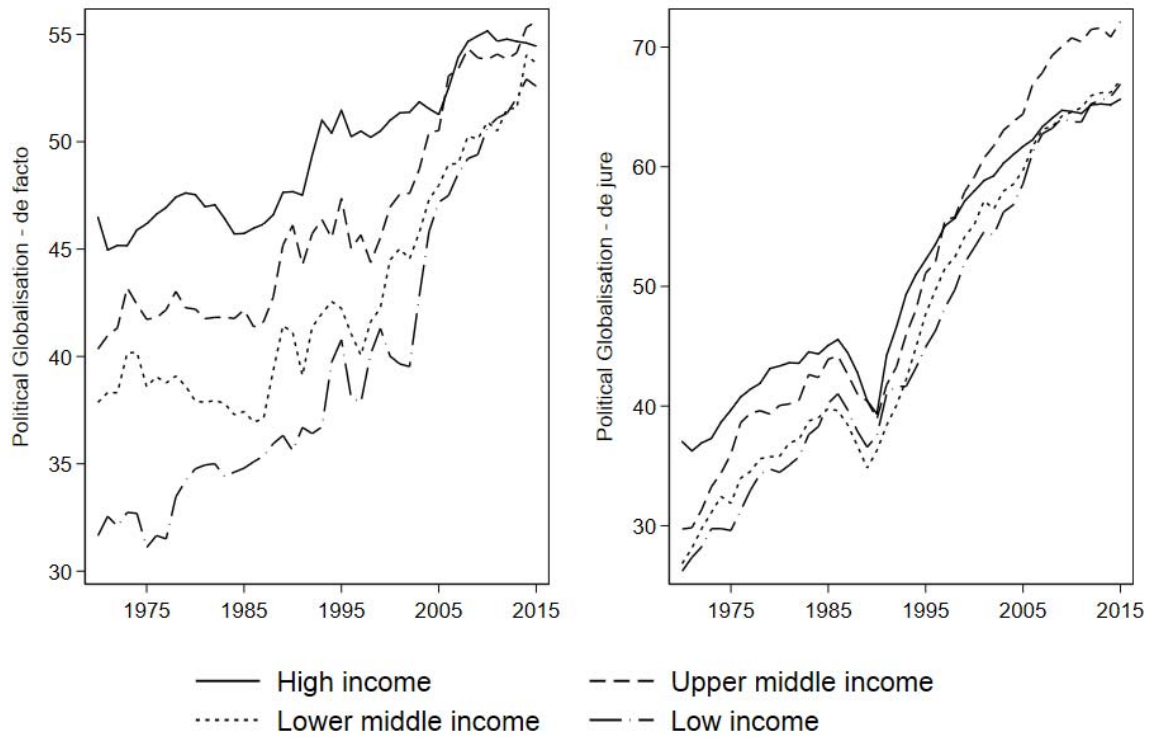
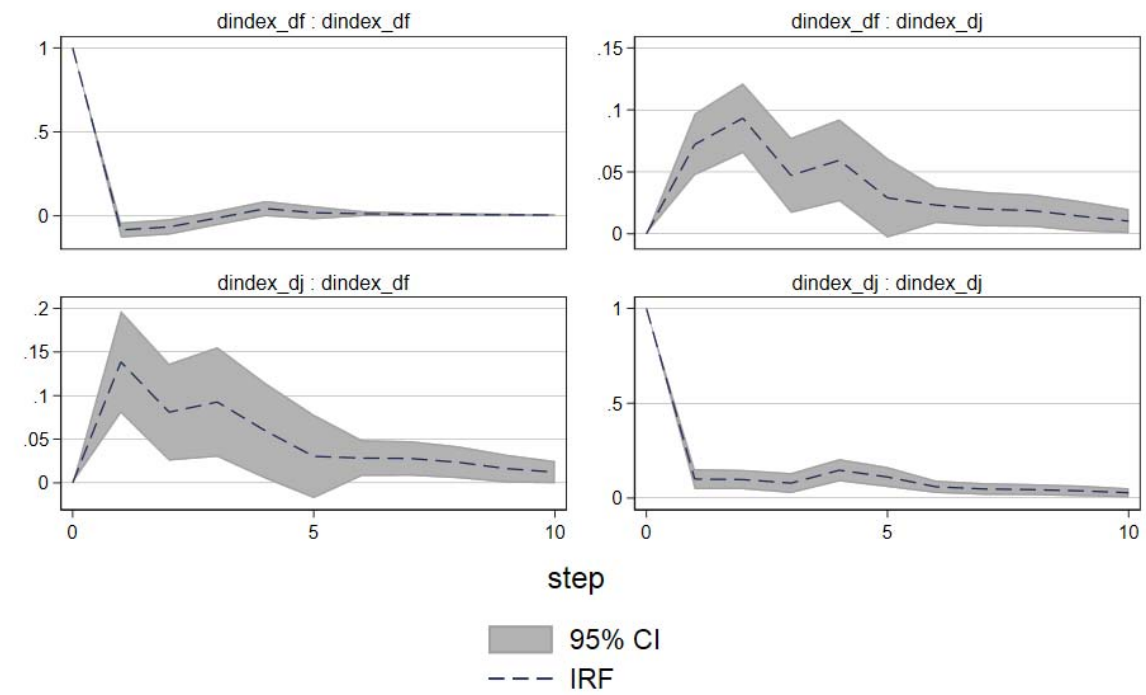


Table 6: Granger causality tests

Variable	de jure granger-cause de facto		de facto granger-cause de jure	
	χ^2 -value	p-value	χ^2 -value	p-value
<i>KOF Globalisation Index</i>	32.96	0.00	60.26	0.00
<i>Economic Globalisation</i>	1.76	0.88	5.04	0.41
Trade Globalisation	19.03	0.00	23.54	0.00
Financial Globalisation	3.74	0.59	7.01	0.22
<i>Social Globalisation</i>	55.87	0.00	20.15	0.00
Interpersonal Globalisation	18.80	0.00	17.22	0.00
Informational Globalisation	15.31	0.01	18.18	0.00
Cultural Globalisation	1.14	0.95	12.81	0.03
<i>Political Globalisation</i>	12.83	0.03	39.59	0.00

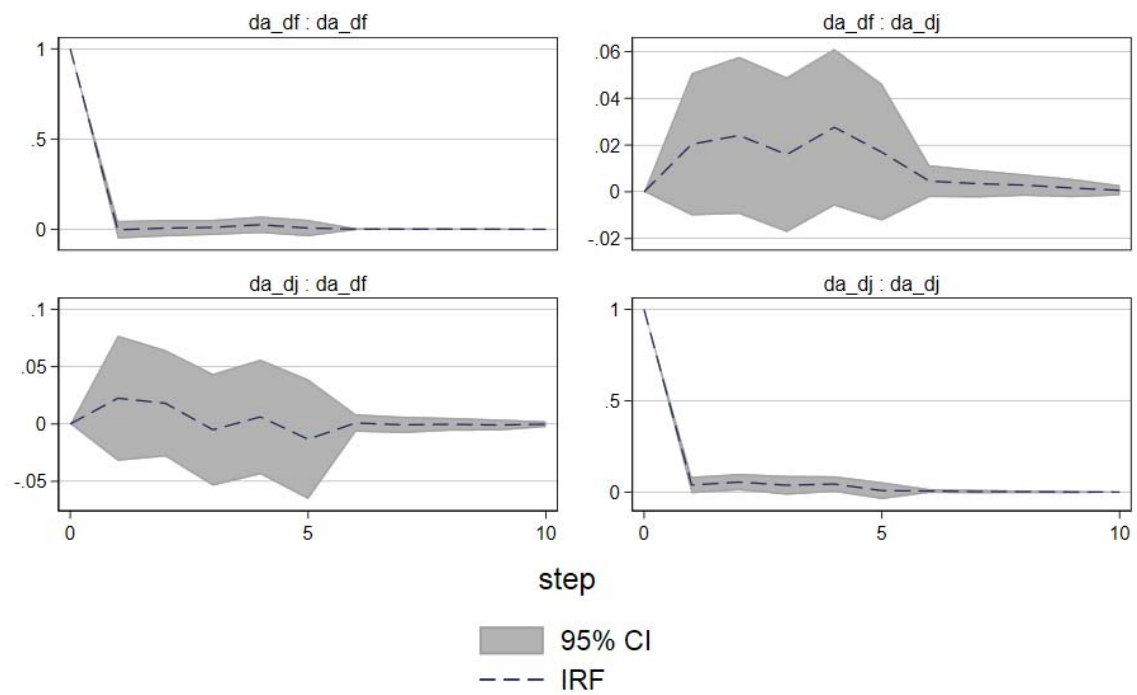
Figure 13: Impulse response functions de facto vs. de jure – KOF Globalisation Index



impulse : response

Note: the headers of each graph indicate “impulse : response”, whereby df stands for de facto and dj for de jure.

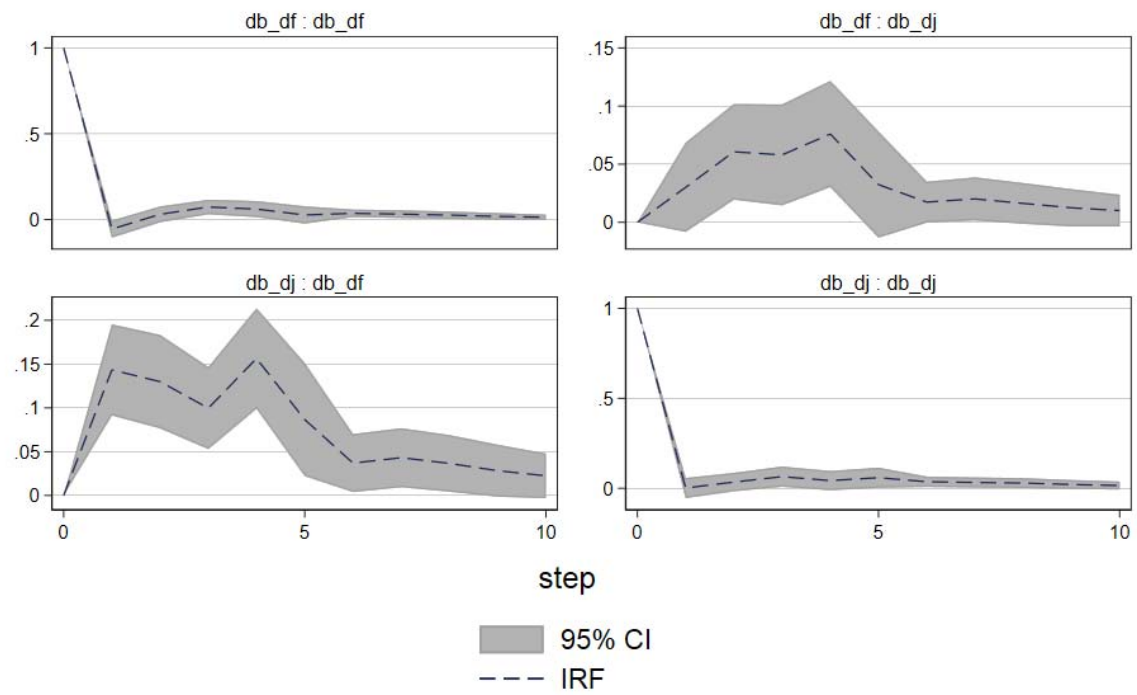
Figure 14: Impulse response functions de facto vs. de jure – KOF Economic Globalisation Index



impulse : response

Note: the headers of each graph indicate “impulse : response”, whereby df stands for de facto and dj for de jure.

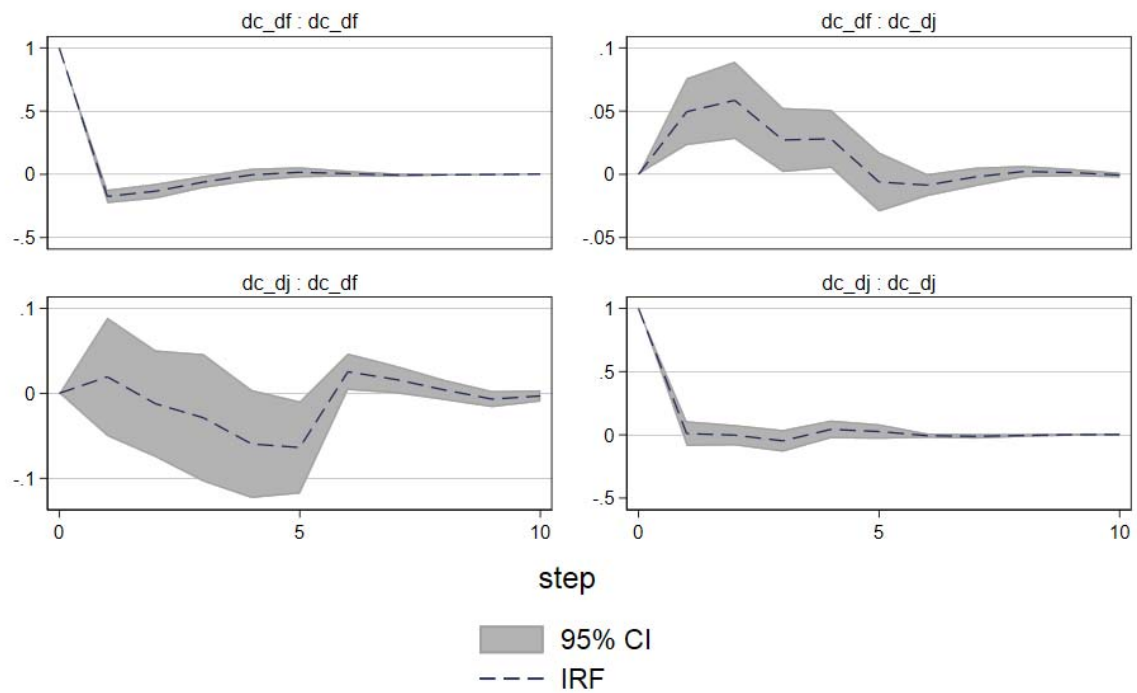
Figure 15: Impulse response functions de facto vs. de jure – KOF Social Globalisation Index



impulse : response

Note: the headers of each graph indicate “impulse : response”, whereby df stands for de facto and dj for de jure.

Figure 16: Impulse response functions de facto vs. de jure – KOF Political Globalisation Index



impulse : response

Note: the headers of each graph indicate “impulse : response”, whereby df stands for de facto and dj for de jure.