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Working Paper Measuring Economic Openness: A review of existing measures and empirical practices

ICAE Working Paper Series, No. 84

Provided in Cooperation with: Johannes Kepler University Linz, Institute for Comprehensive Analysis of the Economy (ICAE)

Suggested Citation: Gräbner, Claudius; Heimberger, Philipp; Kapeller, Jakob; Springholz, Florian (2018) : Measuring Economic Openness: A review of existing measures and empirical practices, ICAE Working Paper Series, No. 84, Johannes Kepler University Linz, Institute for Comprehensive Analysis of the Economy (ICAE), Linz

This Version is available at: https://hdl.handle.net/10419/193623

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ICAE Working Paper Series - No. 84 - August 2018

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Measuring Economic Openness: A review of existing measures and empirical practices

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Abstract

This paper surveys existing measures of economic openness understood as the degree to which non-domestic actors can or do participate in a domestic economy. We introduce a typology of openness indicators, which distinguishes between 'real' and 'financial' openness as well as between 'de facto' and 'de jure' measures of openness, and show that this classification indeed captures different dimensions of economic openness. The main contribution of the paper is to supply a comprehensive and novel data set of openness indicators available for interested researchers. Based on this effort, we analyze some trends in economic openness over time and provide a correlation analysis across indicators. Finally, we explore the practical implications of choosing among different openness measures within a growth regression framework and highlight that researchers should make the choice of the indicator based on explicit theoretical justifications that correspond to their specific research questions.

Keywords: Economic openness, Trade openness, financial openness, globalization. **JEL codes:** F00, F40, F60.

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1. Introduction

The impact of global economic integration and increased economic openness of domestic economies has been a prime area of interest within both the scientific community as well as the wider public. The relevant debates, however, use a great diversity of concepts to describe the extent of international economic integration: terms like 'trade openness', 'economic integration', 'trade liberalization' and 'globalization' are widely used when the general increase in economic openness during the last decades is addressed. The same observation holds true for the financial dimension, where terms like 'financial openness', 'financial integration' and 'financial globalization' are used regularly and often interchangeably (e.g., Kose et al. 2009; De Nicolo and Juvenal 2014; Saadma and Steiner 2016). In analogy to this variety of terms and concepts, a large variety of *measures* of economic openness have been developed, which typically emphasize different aspects of economic integration. Thus, not only the definition, but also the measurement of openness has varied considerably over the past three decades (Squalli and Wilson 2011).

While a lack of consensus on how to best measure economic openness has been widely acknowledged (e.g. Yanikkaya 2003; Busse and Koeniger 2012; Huchet-Bourdon et al. 2014), most econometric works discount the underlying debate on the measurement of economic openness by simply employing the most popular measures without providing in-depth explanations or justifications for doing so. Against this backdrop, this paper contributes to the literature by providing a systematic collection, categorization and evaluation of the most prominent openness indicators used in the recent literature. Hence, the main purpose of our work is threefold: first, we provide applied researchers with the relevant information to make an informed choice on the use of different openness indicators, which eventually depends on the specific questions and methods employed in their empirical work. Second, we want to highlight the practical implications of choosing some openness indicator by showing how empirical outcomes change when different openness indicators are used. Third, we supply a novel and comprehensive data set on openness indicators to be used in further research.

In this context we will restrict ourselves to direct measures of economic openness. As a consequence, we exclude instrumental variables that are sometimes developed to substitute openness indicators whenever one expects endogeneity problems (e.g. Frankel and Romer 1999, who use predictions from a gravity equation, or Felbermayr and Gröschl 2013, who use the effects of natural disasters) as well as indicators based on extensive models of domestic

economies (such as Waugh and Ravikumar 2016). While these approaches deserve their own assessment, we confine ourselves to direct measures of economic openness for two main reasons: first, finding a suitable instrument or model capturing trade openness is heavily context-dependent and requires of additional theoretical assumptions (e.g. exclusion restrictions). Thus, a *general* assessment of such instruments seems difficult to undertake. Second, the direct openness measures discussed below currently dominate much of the applied literature (e.g. Dreher et al. 2010; Martens et al. 2015; Potrafke 2015), which is why we are convinced they deserve a proper treatment on their own.

The paper proceeds as follows: the next section introduces a typology for openness indicators by discussing the distinction between 'trade' and 'financial' openness, which have a 'de facto' and 'de jure' dimension, respectively. We classify the most commonly used openness measures according to this typology. Section 3 provides descriptive trends of the most relevant openness indicators, while section 4 analyzes the mutual relationship of these indicators by inspecting the correlations of different openness measures. Section 5 highlights the practical implications of choosing among different measures within a growth regression framework. Section 6 summarizes and concludes the paper.

2. Measures of economic openness

Existing measures of economic openness, generally understood as the degree to which non-domestic actors can or do participate in a domestic economy, can be grouped in two ways: first, according to the type of openness – 'real' or 'financial' – they aim to measure, and, second, according to the sources utilized in composing the openness measure. These sources are either aggregate economic statistics (de-facto measures) or assessments of the institutional foundations of economic openness, i.e. the legally established barriers to trade and financial transactions (dejure measures).

In addition, 'hybrid' measures aim to incorporate information on both, real and financial aspects, while "combined" measures also strive to integrate information on de-facto as well as dejure aspects of economic openness (see Table 1).

	Evaluation of openness with regard to real flows (goods and services)	Evaluation of openness with regard to financial flows	Combined measures
Evaluation of outcomes: De-facto measures of economic openness	De facto measures of trade openness, for example: <i>total</i> <i>imports</i> or <i>total exports (relative to</i> <i>GDP)</i>	De facto measures of financial openness, for example: FDI inward/outward or foreign financial assets/liabilities	ing real and pects
Evaluation of legal framework: De-jure measures of economic openness	De jure measures of trade openness, for example: <i>tariff</i> <i>rates</i> or <i>non-tariff trade barriers</i> Hybrid measures	De jure measures of financial openness, for example: FDI restrictions or capital account restrictions	Measures integrat financial as

Table 1: Types of openness indicators.

De-facto measures are outcome-oriented indicators, reflecting a country's actual degree of integration into the world economy. De-jure measures, on the other hand, are based upon an evaluation of a country's legal framework: they reflect a country's willingness to be open as expressed by the prevailing regulatory environment. Typically, de-jure measures on trade are based on tariff rates (such as duties and surcharges), information on non-tariff trade barriers (such as licensing rules and quotas) or tax revenues emerging from trade activities relative to GDP. Financial de-jure measures indicate the extent to which a country imposes legal restrictions on its cross-border capital transactions. As de-jure indicators evaluate a country's regulatory environment, it is important to keep in mind that this environment is influenced not only by national policies; they are also shaped by the impact of supranational institutions like the European Union or the World Trade Organization.

The above construction and interpretation of the two main types of indicators, de-facto and de-jure, reveals that these types do indeed measure different facets of openness, which need not be consistent for a given country. For instance, a country could have a defensive legal stance in terms of openness, but still play an important role in the world trading system e.g. due to its special position as a trade hub (e.g. China) or as a financial hub (e.g. Malta). At the same time, a country may be open to trade in terms of institutions and policy, but nonetheless lag behind in terms of its relative integration in international trade due its geographic remoteness (e.g. Canada) or technological inferiority (e.g. Uganda).⁵

⁵ In the appendix we provide a more complete analysis of countries with regard to the discrepancy between de-jure and de-facto openness.

Hence, implications drawn from de-jure indicators can differ strongly from those derived from de-facto indicators: while the former are mostly based on a single, yet prominent, factor in shaping actual economic integration – a country's regulatory environment – de-facto indicators are focused on overall outcomes. Hence, they capture the *total* impact of a series of different factors, such as the level of technology, geographical location, the existence of natural resources, legal regulations and tax policies, political and historical relationships, multi- and bilateral agreements or the quality of institutions. Therefore, de-facto measures can be seen as a way to capture the overall impact of all relevant factors without any ambition to delineate their relative contribution to the chosen outcome dimension. It is for these reasons, that any "combined measure" (Table 1) has to be received with great care as it lumps together two qualitatively different approaches towards economic openness and can, hence, lead to ambiguous results with unclear interpretations (Martens et al. 2015).

2.1 Trade openness measures

De-facto openness to trade in goods and services is a prime subject of interest in discussions on economic openness. These discussions are strongly coined by one core measure of trade openness, namely *Trade volume relative to GDP*. As Table 1 shows, alternatives to Trade to GDP do indeed exist and are mostly based on sub-components and variations of the Trade/GDP approach.

Name	Components	Scale Type		Time	Countries	Source	
Export share	Exports (X)	9/ of	Co-Ra				
Import share	Imports (M)	70 OI	Co-Ra	1960-	200	World Bank, 2017	
Trade share	Trade Volume = Exports (X)	GDP	Co-Ra	2016	200	(publicly available)	
	+ Imports (M)	0.01	00 10				
	The Index represents the trade						
Generalized	volume as a share of a						
Trade Openness	country's GDP factor, defined	0-100	Co-Int	1970- 2014	145	Tang (2011)	
Index	by a CES-function of its own	0 100	C0-III			(own calculations)	
Index	GDP and the GDP of the rest						
	of the world						
Composite	Trade Volume (X+M) in %			1077		Squalli & Wilson	
Trade Share	GDP, adjusted by the World	arbitrary	Co-Int	2016	187	(2011)	
Trade Share	Trade Share (WTS)			2010		(own calculations)	
	Trade Volume (X+M) in % of	% of real		1960-	173	Alcala & Ciccone	
Real trade share	GDP at PPP	GDP	Co-Ra	2015		(2004)	
		ODI		2015		(own calculations)	
Adjusted trade	Imports divided by GDP,			1960-		Lietal (2004)	
	adjusted for the nation's share	arbitrary	Co-Ra	2016	187	(own calculations)	
share	in world production			2010		(Own calculations)	
Frankel	Trade volume adjusted for the	arbitrary	Co Int	2000) 22	Frankel (2000)	
Frankei	nation's share of world GDP	aibitiary	CO-IIIt	2000	23	(own calculations)	
Notes: In the type colum	n "Co" corresponds to "continuous", "D	i" corresponds i	to "discrete",	"Bi" corres	ponds to ''binary	", "Int" corresponds to	
"interval" and "Ra" corresponds to "Ratio"							

Table 2: De facto trade openness measures.

Notwithstanding the fact that the popularity of Trade to GDP as a central measure of reference stems from its intuitive interpretation and its seemingly close alignment to the question at stake, it has to be used with caution for a series of reasons. First, it is typically defined as including all goods and services, which is why variations in the calculation of Trade/GDP might be appropriate (e.g. focusing solely on trade in goods or excluding exports in primary sectors). Prominent examples are Exports/GDP or Imports/GDP, which can be worthwhile substitutes if one wants to focus on openness understood in either a more 'outward' (Exports) or a more 'inward' sense (Imports).

Second, by taking GDP as a reference point, Trade/GDP incorporates a specific size bias as small economies typically show higher trade volumes relative to GDP than large economies – a fact well-known from the estimation of gravity equations (e.g. Feenstra 2015). Although one might argue that this aspect of the Trade/GDP measure is actually a strength – as small economies may depend more strongly on international exchange relations due to a lack of endowments, institutions or technology – it effectively implies a definition of 'openness' in terms of the relative importance of cross-border versus domestic exchange. Against this backdrop, it does not come as a surprise that strong domestic economies, which also happen to be major players in international trade (like the U.S., Japan, Germany or China), find themselves at the lower end of any country-ranking composed out of Trade/GDP. It is for these reasons that Tang (2011), Squalli and Wilson (2011), Alcala and Ciccone, Frankel (2000) and Li et al. (2004) not only suggest more specific labels for Trade/GDP, such as *trade dependency ratio, trade openness index*,

trade share or *trade ratio*, but also provide alternative indicators, which aim to account for the sizebias inherent in taking Trade/GDP as a straightforward measure of economic openness (see Table 1). Additional strategies for addressing this size-bias include the incorporation of an inversed Herfindahl-Index of the relative shares of all trading partners (to account for the diversity of exchange relations; e.g. OECD 2010) or regression-based strategies where Trade/GDP is first regressed on a series of demographical and geographical variables and only the residuals of these regressions are interpreted as a for of 'net openness' conditional on some country characteristics (Lockwood 2004, Vujakovic 2010). Whether such a corrective measures are appropriate eventually depends on one's research question and empirical setup. Alternatively, the size-bias of Trade/GDP can be addressed by substituting the Trade/GDP variable with one of the alternatives listed above or by adding additional regressors aiming to control for country size.

Finally, the inclusion of Trade/GDP in regression approaches has also been the target of endogeneity concerns (e.g. Frankel & Romer 1999). Hence, empirical researchers are well-advised to think critically about possible endogeneity problems, especially when coupling Trade/GDP with other GDP-related variables in applied work.

Name	Components	Scale	Type	Time	Countries	Source
Sachs-Warner index	Binary variable based on Sachs & Warner (1995) criterion (see text for more details)	0-1	Di-Bi	1960-2010	118	Sachs and Warner, 1995 Extended by Wacziarg & Welch, 2008, and Dollar et. al., 2016 (publicly available)
IMF Tariff Rates (Tariff_RES)	100 – Average of the effective rate (=tariff revenue/import value) and the average unweighted tariff rates	0-100	Co-Int	1980-2004	44	Jaumotte et. al., 2013, based on IMF database (publicly available)
Trade Freedom (HF_trade)	Trade-weighted average tariff rate – Nontariff trade barriers (NTBs)	0-100	Di-Int	1995-2017	186	Miller et. al., 2018: Index of Economic Freedom. Heritage Foundation (publicly available)
Freedom to Trade Internationally (FTI_Index)	 Tariffs: Revenue from trade taxes (% of trade sector) Mean tariff rate Standard deviation of tariff rates Regulatory trade barriers: Non-tariff trade barriers Compliance costs of importing and exporting 	0-10	Co-Int	5-year measure: 1970-2000 Yearly data: 2000-2015	159	Gwartney et. al, 2017: Economic Freedom of the World: 2017 Annual Report. Fraser Institute. (publicly available)
	Additional	variable w	vith improv	ved coverage		
WITS Tariff Rates (Tariff_WITS)	100 – Mean of Effectively Applied (AHS) and Most- Favored Nation (MFN) weighted average tariff rates	0-100	Co-Int	1988-2016	168	Based on tariff data of WITS databank (own calculations)

Notes: In the type column "Co" corresponds to "continuous", "Di" corresponds to "discrete", "Bi" corresponds to "binary", "Int" corresponds to "interval", and "Ra" corresponds to "Ratio".

Table 3: De jure trade openness measures.

In contrast to the outcome-orientation of de-facto measures, the focus of de-jure measures typically lies on tariff rates and other institutional forms of trade-barriers (see Table 3). Unfortunately, there is a lack of de-jure indices that are both methodologically sound and widely available.

One of the earliest and most influential de-jure measures for trade openness is the index by Sachs & Warner (1995). It is a binary index that classifies a country as closed if it meets at least one out of five criteria relating to tariff rates, non-tariff trade barriers, socialist governance in trade relations and the difference between black market exchange rates and official exchange rates. When used in growth regressions, the index mostly suggests a positive relationship between openness and trade (e.g. Harrison 1996; Wacziarg & Welch 2008; Dollar et al. 2016), yet it has been strongly criticized for its ambiguous criterions and its dichotomous output dimension, which classifies countries as either 'open' or 'closed' and, hence, does not allow for a more nuanced analysis (Rodriguez & Rodrik 2001).

An alternative to the Sachs-Warner-index is the tariff-based measure as used in an influential paper by Jaumotte *et al.* (2013), who employ a continuous index based on (1) the ratio of tariff revenue to import value and (2) average unweighted tariff rates. Thus, it seeks to directly measure the changes in the regulatory framework of countries, which is preferable to the rather crude binary index of Sachs and Warner. Unfortunately, the coverage of the dataset provided by Jaumotte *et al.* (2013) is limited and the authors base their index on internal data of the IMF implying that replicating or expanding their dataset is a non-trivial exercise.

Two further alternatives are provided by two partisan think-tanks: the *Trade Freedom Index*, based on the *Economic Freedom Index* of the Heritage Foundation, covers 186 countries from 1995 until 2017, and the *Freedom to Trade Internationally Index*, which is based on the *Economic Freedom of the World Index* of the Fraser Institute. The latter covers the period between 1970-2000 in 5-year intervals and contains yearly data over the period 2000-2014 for 159 countries. Both approaches are composite indices that merge several tariff and non-tariff related variables into a final measure (for details see Table 4). Due to the partisan orientation of these two institutions – which promote a free-market agenda – and the opacity of data sources and aggregation methods, neither of the indicators makes a strong case for being considered in serious research on the role of economic openness.

Trade	Freedom	index
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	Trade Freedom = $100 \cdot \frac{\text{Tariff}_{max} - \text{Tariff}_{max}}{\text{Tariff}_{max} - \text{Tariff}_{max}}$	$\frac{f_x}{nin} - NTB$				
Variable	Description	Source and further details				
Tariff _X	Weighted average tariff rate in country X					
Tariff _{max} , Tariff _{min}	Upper and lower bounds for tariff rates;	Miller et al. (2018)				
NTB	Minimum tariff is zero, the upper bound is set to					
	50 percent. Depending on the use of NTBs a penalty is subtracted from the base score.					
Freedom to Trade Internationally Index						
$FTI = \frac{1}{5} \sum_{n=1}^{5} \delta_i$						
	Tariff dimension					

Variable	Description	Source
δ_1	Revenue from trade taxes	
δ_2	Mean tariff rate	
δ_3	Standard deviation of tariff rates	Fraser Institute (2018)
Regulato	ory trade barriers (included since 1995)	Taser Institute (2010)
δ_4	Non-tariff trade barriers	
δε	Compliance costs of importing and exporting	

Table 4. Components of the Trade Freedom and the Freedom to Trade Internationally Index.

Given this unsatisfactory state of affairs we developed an additional alternative indicator that closely follows the methodological approach of the tariff-based measures of Jaumotte et al. (2013), but is based on the publicly available World Integrated Trade Solution (WITS) databank of the World Bank. Thus, it is easy to replicate and available for 168 countries in the period between 1988-2016. We calculate the index as 100 minus the average of (1) the effectively applied tariff rates and (2) the weighted average of the most-favored nation tariff rates. The resulting index is strongly correlated with the measure of Jaumotte (with a Pearson coefficient of 0.78 for the joint data points) and, thus, preserves the methodological advantages of the original indicator, while at the same time remedying its drawbacks in terms of coverage and replicability.

2.2. Financial openness measures

The most popular de-facto measure of financial openness comes from the dataset compiled and continuously updated by Philip Lane and Gian Maria Milesi-Ferretti (2003, 2007, 2017). It is now typically referred to as the "*financial openness index*" and defined as the volume of a country's foreign assets and liabilities relative to GDP (Baltagi et al. 2009). The Lane and Milesi-

Ferretti (henceforth LMF) database is publicly available⁶ and currently contains data for 211 countries for the period 1970-2015. The LMF database is considered the most comprehensive source of information in terms of financial capital stocks. In addition to the financial openness index, this dataset also contains three more specific indicators focusing on FDI and equity markets that are widely applied in empirical analyses. A comparable set of indicators on FDI can also be obtained from UNCTAD⁷ (see Table 5).

Name	Components	Scale	Туре	Time	Countries	Source
Financial Openness Index (LMF_OPEN)	LMF_OPEN represents the sum of Total Foreign Assests and Total Foreign Liabilities in % GDP	% of GDP	Co-Ra	1970- 2015	211	"LMF": Lane & Milesi-Ferretti
Equity-based Financial Integration (LMF_EQ)	LMF_EQ represents the sum of Portfolio Equity Assets and Liabilities (stocks)	% of GDP	Co-Ra	1970- 2015	211	(2017) (publicly available)
Private Financial Openness Index (OPEN_pv)	OPEN_pv makes a distinction between private and official financial openness by subtracting official development aid from foreign liabilities and international reserves from foreign assets.	% of GDP	Co-Ra	1970- 2014	190	Saadma & Steiner (2016)
FDI liabilities (LMF)		% of GDP	Co-Ra	1970-	202	Lane & Miles- Ferretti (2017)
(LMF_in_GDP, LMF_FDI_in)	The inward FDI stock represents the value of foreign investors' equity in and	USD	Co-Int	2015		(publicly available)
FDI liabilities (UNCTAD)	net loans to enterprises resident in the reporting economy.	% of GDP	Co-Ra	1980-	196	UNCTAD (2017)
(UNC_in_GDP, UNC_FDI_in)		USD	Co-Int	2016		(publicly available)
FDI asset stock (LMF)		% of GDP	Co-Ra	1970-	202	Lane & Miles- Ferretti (2017)
(LMF_out_GDP, LMF_FDI_out,)	The outward FDI stock represents the value of the resident investors' equity in	USD	Co-Int	2015	202	(publicly available)
FDI asset stock (UNCTAD)	and net loans to enterprises in foreign economies.	% of GDP	Co-Ra	1980-	106	UNCTAD (2017)
(UNC_out_GDP, UNC_FDI_in)		USD	Co-Int	2010	190	(publicly available)

Notes: In the type column: "Co" corresponds to "continuous", "Di" corresponds to "discrete", "Bi" corresponds to "binary", "Int" corresponds to "interval", and "Ra" corresponds to "Ratio".

Table 5: De facto financial openness measures.

Saadma & Steiner (2016) build on the data provided by Lane & Milesi-Ferretti to create an index for private financial openness (OPEN_pv), which can be seen as further development of the financial openness index. It distinguishes between private and state-led financial openness by subtracting development aid (DA) from foreign liabilities (FL) and international reserves (IR) from foreign assets (FA). The motivation of Saadma & Steiner (2016) is to show that correlations

 $^{^{6} \} The \ latest \ LMF \ dataset \ is \ available \ here: \ https://www.imf.org/en/Publications/WP/Issues/2017/05/10/International-Financial-Integration-in-the-Aftermath-of-the-Global-Financial-Crisis-44906$

⁷ Existing differences between the FDI time series provided by Lane and Milesi-Ferretti (2017) in comparison to UNCTAD (2017) can be traced back to a partly different usage of balance of payment manuals: for some countries, the two sources treat reverse investment (between affiliates and parent companies) differently, which leads to deviations in the reported FDI assets and liabilities.

between growth and financial openness lead to less ambiguous results when the factors underlying actual capital flows are accounted for in the data.

Name	Components	Scale	Туре	Time	Countries	Source
Chinn-Ito-Index (KAOPEN)	Table-based AREAER* measure: - presence of multiple exchange rates - restrictions on current account transactions - restrictions on capital account transactions - the requirement of the surrender of export proceeds	arbitrary	Co-I	1970- 2015	182	Chinn and Ito (2006) update in 2015, (publicly available)
Financial Current Account (FIN_CURRENT)	Text-based AREAER* measure FIN_CURRENT is based on how compliant a government is with its obligations under the IMF's Article VIII to free from government restriction the proceeds from international trade of goods and services	0-100	Di-O	1950- 2004	94	Quinn & Toyoda (2008) (publicly available)
Capital Account Liberalization (CAPITAL)	Text-based AREAER* measure CAPITAL is based on restrictions on capital outflows and inflows, with a distinction between residents and non- residents	0 – 100	Di-O	1950- 2004	94	Quinn & Toyoda (2008) (publicly available)
Capital Account Restrictions (KA_Index)	Text-based AREAER* measure Similar than CAPITAL and FIN_CURRENT but includes finer- graned sub-categories and information about different types of restrictions, asset categories, direction of flows and residency of agents.	0-1	Di-O	1995- 2005	91	Schindler (2009) (publicly available)
Financial Current and Capital Account (FOI)	Table and text-based AREAER* measure The most comprehensive AREAER* measure. The FOI includes information on twelve categories of current and capital account transactions (more see text)	0-12	Di-O	1965- 2004	187	Brune (2006) (not available)
Investment Freedom (HF_fin)	Non-AREAER* measure Index starts from 100 and then points are deducted due to a penalty catalogue. Information based on official country publications, the Economist and US government agencies, but exact coding/methodology remains unclear.	0-100	Di-O	1995- 2017	186	Miller et al. (2018) (publicly available)
Equity market liberalization indicator	Non-AREAER* measure This binary liberalization index corresponds to a date of formal regulatory change after which foreign investors officially have the opportunity to invest in domestic equity securities.	0-1	Di-Bi	1980- 2006	96	Bekaert et al. (2013) (not available)
FDI regulatory restrictiveness index (FDI_Restrictions)	Non-AREAER* measure Based on four types of restrictions on FDI: - Foreign equity limitations - Discriminatory screening mechanisms - Restrictions on the employment of foreigners - Other operational restrictions n: "Co" corresponds to "continuous". "Di" correston	0-1 ads to ''discrete	Co ", "Bi" corr	1997, 2003, 2006, 2010- 2016	62 (binary", "Int" a	Kalinova et al. (2010), update 2018, (publicly available)

"interval", and "Ra" corresponds to "Ratio".

Table 6: Classification of financial de-jure measures.

Finally, Table 6 collects the most prominent de jure indicators in the financial dimension. Two aspects are of particular importance. First, the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAR) obtains a prominent role as these reports serve as a key source for deriving de-jure indicators regarding trade openness (IMF 2016).⁸ Existing de-jure indicators can be broken down into three sub-categories: (i) de-jure indicators that are based on the AREAER Categorical Table of Restrictions, (ii) de-jure indicators that are based on the actual text of the AREAER and (iii) de-jure indicators that are not based on the AREAER report (Quinn et al. 2011). Table-based indicators provide comprised data and come with the advantage that they are relatively easy to replicate. In contrast, text-based indicators contain finer-grained information on regulatory restrictions of capital flows. As a consequence text-coded indicators can only be replicated if the authors provide a detailed description of their coding-methodology.

Second, the Chinn-Ito index (KAOPEN) is most widely used in the literature on the impacts of financial openness. It focuses on regulatory restrictions of capital account transactions, is publicly available and covers 181 countries in the period 1970–2015.⁹ This comparably huge coverage of the Chinn-Ito Index is a major asset partly explaining its popularity. The index is based on information about the restrictions on cross-border financial transactions, as provided in the summary tables of the IMF AREAER report (Chinn and Ito, 2006, 2008). To compose the index, Chinn and Ito (2008) codify binary variables for the four major categories reported in the AREAR, i.e., (1) the presence of multiple exchange rates, (2) restrictions on current account transactions, (3) restrictions on capital account transactions and (4) the requirement of the surrender of export proceeds. Eventually the KAOPEN index (short for capital account openness index) is constructed by conducting a principal component analysis on these four variables.¹⁰

2.3. Hybrid and combined measures for economic openness

While there exist a series of different indicators for assessing the intensity of globalization in general (see Gygli et al. 2018, Table 2, for an overview), indices that focus specifically on *economic* globalization (as distinguished from e.g. social, political or cultural aspects of globalization) are comparably rare. To derive such more specific measures of economic globalization requires researchers first isolate the relevant economic dimensions and then identify

⁸ The IMF's AREAER report draws on information from official sources and has been prepared in close consultation with national authorities. For more information visit:

https://www.imf.org/~/media/Files/Publications/AREAER/AREAER_2016_Overview.ashx

⁹ Note that the covered time period is shorter for some countries due to data availability.

¹⁰ The Chinn-Ito-Index has been criticized for measuring more the *extensity* than the *intensity* of capital controls. In response, Chinn & Ito (2008) compare their index with de-jure indices that focus on the intensity of capital controls (e.g. CAPITAL in Table 6) and find a high correlation between CAPITAL and KAOPEN suggesting that KAOPEN is a valid proxy for the *intensity* of capital controls.

suitable variables for measuring these dimensions. Among those globalization indicators, that could serve as a starting point for assessing the economic dimension of globalization – such as the DHL Connectedness index (Ghemawat and Altman 2016), the New Globalization index (Vujakovic 2010), or the Maastricht Globalization index (Figge and Martens 2014) – the KOF Globalization index (Dreher 2006, Gygli et al. 2018) occupies an exceptional position in terms of coverage, conceptual clarity and transparency. The index is supplied by the Swiss Economic Institute (KOF) and is by far the most widely applied index of economic openness in the economics literature (Potrafke 2015). Most recently, the KOF introduced a series of methodological improvements as well as additional variables to revise and extend the basic methodology for constructing the KOF globalization index (Gygli et al. 2018). In doing so, the KOF also introduced a series of novel sub-indices based on a modular structure, which allows for inspecting different dimensions of economic openness in a disaggregated form.

Name	Components ¹¹	Scale	Туре	Time	Countries	Source
KOF	Trade in goods (40.9%)					
trade	Trade in services (45%)					
de-facto	Trade partner diversification (14.1%)	_				
	Foreign direct investment (27.5%)					
KOF	Portfolio investment (13.3%)					
finance	International debt (27.2%)					
de-facto	International reserves (2.4%)					
	International income payments (29.6%)	_				Cli -+ -l
KOF	KOF trade de-facto (50%)	_				Gygli et al.
de-facto	KOF finance de-facto (50%)	0.100	C - Lut	1970-	221	(2018),
KOF	Trade regulations (32.5%)	- 0-100	Co-Int	2015	221	publicly
trade	Trade taxes (34.5%)					available
de-jure	Tariffs (33%)	_				
KOF	Investment restrictions (21.7%)	_				
finance	Capital account oppoppose (78.3%)					
de-jure	Capital account openness (78.578)	_				
KOF	KOF trade de-jure (50%)					
de-jure	KOF finance de-jure (50%)	_				
KOF	KOF de-facto (50%)	_				
econ	KOF de-jure (50%)					

Notes: In the type column: "Co" corresponds to "continuous", "Di" corresponds to "discrete", "Bi" corresponds to "binary", 'Iint" corresponds to "interval", and "Ra" corresponds to "Ratio".

Table 7: The KOF economic globalization index as an example for a hybrid measure.

¹¹ For more details see: <u>https://www.ethz.ch/content/dam/ethz/special-interest/dual/kof-dam/documents/Globalization/2018/Variables_2018.pdf</u> (accessed July 20, 2018).

3. General trends for the openness indicators

This section illustrates some of the general trends and properties exhibited by the indicators presented so far.

3.1. Trade openness

Panels A and B in Figure 1 show trends of selected trade indicators. We classify countries according to their economic complexity (Hidalgo and Hausmann 2009), a proxy for the level of their technological capabilities. This is motivated by recent findings according to which countries with high economic complexity tend to benefit more from trade (e.g. Carlin et al. 2001; Hausmann et al. 2007; Huchet-Bourdon et al. 2017). And indeed, we observe some substantial differences in de-facto trade openness when considering technological capabilities. Specifically, we find that the export share of high complexity countries started to decouple from the moderate and low complexity countries in the early 1980s.¹² While some convergence is observable in the late 1980s and the 1990s, from 2000 onwards the export share disparities have again increased substantially. This finding suggests that countries, which tend to benefit more from trade, also tend to record higher *de facto* openness to trade.

With regard to the *de-jure* openness to trade, the differences among country groups are less pronounced and converging since the late 1980s (Figure 1, panel D). The latter observation suggests that countries of moderate and low complexity have opened their regimes in terms of trade policy in the past decades and all countries approach very high openness degrees. Several factors have been discussed in the literature to explain this change in de jure trade policy (especially in developing countries), ranging from the policy-makers' intention to increase trade volumes to the effects of trade agreements within the WTO and policy prescriptions advocated by the IMF and the World Bank (e.g. Baldwin 2016; Rodrik 2018).

¹² The classification into complexity groups and basic information on the data are provided in detail in the appendix.



Figure 1. Trends of trade indicators (panels A to C show de-facto measures; panel D a de-jure measure).

3.2. Financial openness

Measures of financial openness show similar trends than those of trade openness (see Figure 2, panels A-D). De-facto measures of the high complexity group started to decouple from the other groups between 1995 and 2000, that is, after the foundation of the WTO in 1994. Since then, the gap between the former and the latter two groups has enlarged substantially, which implies that the integration of financial markets among high complexity countries has proceeded faster than in the rest of the world. Also, a comparison of in- and outflows of FDIs (panels A and B in Figure 2), indicates that a large part of FDI in medium- and low complexity countries, where inflows are much greater than outflows, stems from the high complexity country group. With regard to the high complexity countries we find that, on average, larger countries play a relatively greater role in terms of outflows than inflows and vice versa. Eventually, we observe that the financial crisis of 07-08 had only a minor impact on financial openness: after a sharp

reduction, the level of financial de-facto openness recovered rapidly and continued to grow across all country groups.

In terms of financial de-jure openness we find that high complexity countries have kept the high level of financial de-jure openness established during the 1990s constant over the past two decades. In contrast, countries with moderate and low complexity have seen their de-jure openness increase till the advent of the financial crisis in 2007/2008 – since then, the Chinn-Ito index (Figure 2, panel D), which is the only index covering the relevant time-span, indicates that financial openness in medium complexity countries has decreased, while it has sharply increased in low complexity countries.



Figure 2: Trends in indicators for financial openness (panels A to C show de-facto measures; panel D a de-jure measure).



Figure 3: The KOF globalization index as a hybrid measure.

The KOF index provides a more complete view on the increase of economic openness in the previous decades. As can be seen from Figure 3, the index captures the overall trend of increasing openness (plot A) and the somehow different dynamics in the de facto and de jure dimension (plots B and C). In the de facto dimension the KOF-index clearly mimics the on-going divergence in terms of economic openness between high complexity countries and the rest of the world, which has already been visible in Figure 1 and 2. Similarly, the weak but persistent trend for a convergence in terms of the de-jure openness is picked up by the KOF-index. From a global perspective, the main increase in de-jure openness had happened in the 1990s, in which all three country-groups, on average, experienced a significant increase in the de-jure openness. Defacto openness on the other hand is rising steadily over time, which, again, suggests that de-facto developments are not primarily driven by de-jure (policy) changes.

4. Do different measures of openness measure the same? A correlation analysis

After introducing the most prominent indicators for economic openness and discussing their conceptual differences, we will now examine the empirical relationship between these openness indicators. Given the previous discussion, we would expect that indicators within the same group (e.g. de-facto trade openness) measure similar aspects of economic openness and, therefore, are strongly correlated with each other. To corroborate this hypothesis and to study the relationship between indicators belonging to different types, we now conduct a comprehensive correlation analysis of the 32 indices of economic openness presented so far. Since many papers use the first difference of these indicators, we pay attention to both correlations of the variables in levels as well as across the time-series in first differences.¹³ This exercise is useful for answering a variety of questions: for instance, whether indicators that were built to measure the same type of openness are consistent with each other or to what extent financial and trade indicators do behave similarly. In addition, such an approach allows for clarifying the degree of alignment between one-dimensional indicators on the one hand and hybrid and combined indicators on the other hand. Finally, studying the relationship between different indicators is a relevant preliminary exercise for examining the question whether the choice of indicators matters for empirical applications. In our analysis, we use the Spearman rank coefficient since it requires only few assumptions on the scale and distribution of the compared time-series (e.g. Weaver et al. 2017). We report and discuss the results using the Pearson coefficient, which are qualitatively equivalent, in the accompanying appendix. While Figure 4 illustrates the correlation of the various measures in levels, Figure 5 depicts correlations among the time series of the various indicators in first differences.

When inspecting Figures 4 and 5, we can identify clusters of closely related openness measures: we generally find stronger associations among the indicators within each type (trade de-facto; trade de-jure; financial de-facto; financial de-jure), but only weak to moderate correlations of indicators can be established across different types (e.g. trade de-facto vis-à-vis financial de-facto) – with some notable exceptions to be discussed below. Thereby, correlations are consistently lower whenever one compares the differenced indicator (Figure 5), with indicators of different types now being almost completely uncorrelated. Furthermore, these correlated than its de-facto counterparts, while the correlation between de-facto and de-jure in both dimensions (trade and finance) is weaker. This result implies that economic policy in terms of trade and finance tends to be more convergent than de-facto outcomes; furthermore, countries that decide to reduce institutional obstacles to trade generally do it simultaneously for real and financial flows. Our findings lend support to the argument that de-facto indicators generally represent more than just the outcome of economic policy, while de-jure indicators measure the legal foundations of economic policy.

¹³ Unit roots tests for the individual time series are provided in the appendix. The Sachs-Warner as an index is excluded from this analysis.

Across the four major types of openness, the cluster relating to de-facto financial openness measures is the least visible cluster, which indicates that this dimension exhibits the greatest diversity in terms of indicators with different conceptual underpinnings. Notably, we find that the KOF economic globalization index is correlated with almost all other indices, which illustrates its ability to integrate different aspects of economic openness.



Figure 4: Spearman correlation coefficients for the levels of the openness indicators discussed in this paper.



Figure 5: Spearman correlation coefficients for the first differences of the openness indicators discussed in this paper

Summing up, the correlation analysis suggests that the concept of 'economic openness' has many facets, and various measures capture quite different aspects of this 'openness'.

5. Application: The choice of economic openness measures makes a difference in growth regressions

We continue by posing a question that is of particular interest to empirical researchers: what do the findings from the correlation analysis in the previous section imply for the choice of openness variables in regression specifications? For illustration purposes, we run growth regressions based on a data set for 144 countries over the time period 1960-2014. There is a large literature on the determinants of economic growth (e.g. Barro, 1991; Barro, Sala-i-martin 1995; Aghion and Howitt, 2008), which has partly focused on the impact of increasing economic

openness (e.g. Dollar 1992; Sachs and Warner 1995; Frankel and Romer 2000; Arora and Vamvadikis 2005; Menyah et al. 2014). While this literature has produced mixed results regarding the link between openness and growth (e.g. Edwards, 1993; Rodriguez and Rodrik 2001; Bekaert et al. 2005; Bussiere and Fratzscher 2008), a number of studies has highlighted that the choice of the openness indicator can have a pronounced impact on the obtained regression results (e.g. Rodriguez and Rodrik, 2001; Yanikkaya 2003; Aribaz Fernandez et al. 2007; Quinn et al. 2011). Against this background, we apply the trade and financial openness indicators analyzed in the first sections of this paper in a standard growth regression framework; by doing so, we illustrate how the choice of the openness variable matters.

Our regression equation closely follows standard specifications as used in the existing literature (Barro, Sala-i-martin 1995; Arora and Vamvadikis 2005) and can be summarized as follows:

$GDPg_{i,t} = \alpha open_{i,t} + \delta Z_{i,t} + FE_i + \epsilon_{i,t}, \qquad (1)$

where $GDPg_{i,t}$ represents the growth rate of Gross Domestic product at PPP per capita for country i in period t. $open_{i,t}$ is the main explanatory variable of interest, defined as the natural logarithm of one of several (trade or financial) openness indicators, which we introduce below. $Z_{i,t}$ represents a vector of additional explanatory variables, which are explained in Table 8 (Data sources and summary statistics are available in the accompanying appendix). FE_i are country-fixed effects, which we include to account for unobservable, time-invariant countryspecific characteristics that may influence $GDPg_{i,t}$. In this setup, we express all variables as fiveyear averages (except for the initial level of GDP per capita) to dampen the effects of short-run business cycle fluctuations on GDP per capita growth (e.g. Arora and Vamvadikis 2005). Additionally, and to account for the correlation structure found for the times series in first differences (compare Figures 4 and 5), we also estimate a corresponding version of equation (1) in first differences:¹⁴

$$\Delta GDPg_{i} = \Delta open_{i,t}\alpha + \Delta Z_{i,t}\delta + \epsilon_{i,t}$$
(2)

The results on the sign and statistical significance of the estimated coefficients are summarized in Table 8¹⁵. Despite the obvious remark that our specifications may contain misspecifications, most notably due to endogeneity issues, the outcomes reveal interesting patterns, both within and between the various dimensions of openness. Within the cluster of de-

¹⁴ Notably, we use annual data (and not 5-year averages as in equation (1)) to estimate the first difference specification in equation (2).

¹⁵ More detailed results regarding coefficients, standard errors and test statistics can be obtained from the appendix.

facto trade openness measures, and for the case of 5-year averages in levels, the real trade share suggests a negative relationship between openness and growth. The remaining indicators, on the other hand, suggest a positive relationship, with Trade/GDP and the TOI indicator (Tang 2011) being significant at the 5% level. The picture is more ambiguous when we consider the first-difference estimations based on annual data: in this case, both the TOI and the real trade share are highly significant and suggest a negative relationship, while the remaining three indicators are positively correlated with growth, and trade to GDP is moderately significant. These marked differences in how openness indicators correlate with GDP growth can be traced back to the methodological approach underlying the construction of different openness indicators, which is why our comparison of growth regressions results provides an illustration for the theory-ladenness of observation (Hanson 1958) in the context of measuring economic openness. The fact that moving from one measure for de facto openness to another has such profound effects on the estimation results emphasizes our point that the choice of the indicator is important and requires both a case-based theoretical justification as well as thorough robustness checks.

Dependent variable: GDP per capita growth							
		Direction of relationship		Significance		Controls	
		5-year averages	FD yearly	5-year- averages	FD yearly		
	Trade to GDP	+	+	**	**		
to	Real trade share	-	-	0	***		
le fac	Adjusted trade share	+	+	0	0		
de c	Composite trade share	+	+	0	0		
Trac	Generalized Trade Openness Index	+	-	**	***	log(human capital),	
	KOF de-facto	+	-	0	***	population growth,	
	KOF_de-jure	+	+	0	*	log(investment share)	
e de	Tariff_WITS	-	-	0	*	log(investment share)	
Trade jure	FTI_Index	+	+	***	0	For 5-year estimations	
	HF_trade	+	-	0	0	additionally:	
	LMF_open	-	-	**	***	loc/initial CDD)	
ial to	LMF_EQ	+	-	*	**	log(initial GDP),	
inanc lefact	FDI inflows (% of GDP)	+	-	**	***		
щч	FDI outflows (% of GDP)	+	-	0	0		
л. re	KAOPEN	+	+	0	0		
inai e ju:	HF_fin	-	-	0	0		
H de	CAPITAL	+	+	0	***		

Table 8: The results from estimating equations (1) and (2) with different measures for economic openness. We use 5-year averages when estimating equation (1) and annual data when estimating equation (2). The dependent variable is GDP per capita growth and the openness measures were transformed into natural logarithms. Statistical inference is based on clustered (heteroskedasticity-robust) standard errors. "FD yearly" denotes First Differences based on annual observations.

The results within the cluster of trade de jure measures are also mixed: in case of the fiveyear averages, three of the indicators (KOF_dejure, HF_trade and the FTI index) are positively correlated with growth and the latter variable even shows a statistical significance. However, the estimate for Tariff_WITS has a negative sign and is significant at the 10% level. The result for the FD-specification is similar, although HF_trade now switches sign but remains insignificant, the KOF de-jure index turns significant at the 10% level, and the FTI index ceases to be significant.

The conclusion for measures of de-facto financial openness is also ambiguous: in case of the five-year averages, three of the four de-facto measures suggest a positive relationship (LMF_EQ, FDI inflows, FDI outflows), with two of them being significant at the 5 and 10% level, while the LMF openness indicator (LMF_open) suggests a negative relationship, significant at the 5% level. The results are more straightforward when the FD estimator is used: here all indicators suggest a negative relationship and all these correlations, except for the FDI outflows, are considered as statistically significant at the 5% or 1% percent level.

Finally, we also observe ambiguous patterns for the financial de-jure measures with KAOPEN and CAPITEL being positively, and HF_fin being negatively associated with growth, for both the estimations based on first differences and five-year averages. All of these relationships remain insignificant, with CAPITAL in the FD case being the exception: it is significant at the 1% level.

These exercises reveal that there is not only considerable variation in outcomes when different types of economic openness are considered, but that results may also vary within a certain conceptual dimension as different indicators are constructed in different ways. To arrive at a fuller picture of the empirical assessment of economic openness, we estimate a more complete regression equation in the next step. In doing so, we augment the baseline specification by including measures for different types of economic openness (all measured in logs):

 $GDPg_{i,t} = \alpha KOF_{defacto} + \beta KOF_{defure} + \gamma KAOPEN + \eta LMF_{open} + \delta Z_{i,t} + FE_i + \epsilon_{i,t}$ (3)

as well as a first difference specification:

$\Delta GDPg_{i,t} = \Delta KOF_{defacto}\alpha + \Delta KOF_{dejure}\beta + \Delta KAOPEN\gamma + \Delta LMF_{open}\eta + \Delta Z_{i,t}\delta + \epsilon_{i,t}$ (4)

The results on the determinants of GDP per capita growth obtained from estimating equations (3) and (4) are again sensitive to both the dimensions of economic openness actually considered as well as the set of openness indicators chosen to represent different dimensions of openness (see Table 9): if we do not include de-facto measures for financial openness, the estimate for the KOF de-facto indicator has a negative sign; but once LMF_open is included in

the model, the estimate switches its sign and, for the FD specification, becomes highly significant. If we use FDI inflows instead of LMF_open, KOF_defacto remains insignificant, but switches its sign in the FD case. KAOPEN and KOF_dejure remain insignificant in all specifications, but consistently show a positive association with growth. LMF_open is always highly significant and negatively associated with growth; in case of FDI inflows, sign and significance depend on the estimation technique: for the FD case we estimate a significantly negative relationship with growth (at the 5% level), for the five-year averages case, the relationship is, however, positive and insignificant.

While we do not claim that we provide a fully-fledged estimation framework or to provide a definite answer on the relationship between economic openness and growth – which would require a much more careful consideration of possible endogeneity and reverse causality issues –, we can nevertheless use the standard regression framework to derive some general conclusions on the use of openness indicators. The results indicate that operationalizing economic openness for econometric research is not a straightforward task. Rather, explicit theoretical justifications are necessary to make an informed choice on the relevant dimensions as well as the available indicators within these dimensions: we find that differences in how openness indicators correlate with economic growth are due to the theory-ladenness of observation (Hanson 1958), i.e. the methodological approach underlying the construction of different openness indicators makes an important difference. At the same time, specifying growth regressions with more than one openness indicator, or running extensive robustness checks with different indicators, can provide hints regarding how different types of economic openness relate to GDP growth.

		Ful	l specification					
	Dependent variable: GDP per capita growth							
	(1) 5-year averages	(2) FD	(3) 5-year averages	(4) FD	(5) 5-year averages	(6) FD		
log(KOF_dejure)	1.212 (1.306)	1.871 (2.398)	1.126 (1.514)	2.618 (2.456)	1.504 (1.338)	1.657 (2.204)		
log(KOF_defacto)	-0.675 (0.737)	-1.245 (1.901)	-1.433 (0.956)	0.099 (2.296)	0.839 (0.729)	7.318 ^{***} (1.641)		
log(KAOPEN)	0.201 (0.255)	0.458 (0.285)	0.094 (0.284)	0.505 (0.314)	0.292 (0.246)	0.386 (0.245)		
log(UNC_in_GDP)			0.436 (0.286)	-2.196 ^{***} (0.733)				
log(LMF_open)					-1.259 ^{***} (0.306)	-8.399 ^{***} (0.894)		
log(initial_GDP_pc)	-2.180 ^{***} (0.514)		-2.385 ^{***} (0.588)		-2.218 ^{***} (0.508)			
log(hc)	4.734 ^{***} (1.755)	-0.207 (5.630)	8.534 ^{***} (2.105)	13.724 ^{**} (6.239)	6.363 ^{***} (1.784)	4.404 (10.411)		
pop_growth	-0.457 ^{**} (0.190)	-0.600^{*} (0.323)	-0.311 (0.202)	-0.454 (0.296)	-0.446^{**} (0.178)	-0.634 ^{**} (0.313)		
inflation	-0.002 ^{***} (0.0003)	0.001 (0.0005)	-0.002 ^{***} (0.0003)	0.001 (0.0005)	-0.001 ^{***} (0.0003)	0.001**** (0.0002)		
log(inv_share)	1.746 ^{***} (0.602)	0.005 (1.587)	1.155 (0.725)	-0.516 (1.741)	1.179 ^{**} (0.572)	-0.177 (0.684)		
Observations	1,105	4,797	934	3,929	1,074	4,670		
R ²	0.091	0.004	0.110	0.010	0.115	0.023		
F Statistic	11.946 ^{***} (df = 8; 960)	3.266 ^{***} (df = 6; 4790)	10.859 ^{***} (df = 9; 788)	5.591 ^{***} (df = 7; 3921)	13.407 ^{***} (df = 9; 928)	15.614 ^{***} (df = 7; 4662)		
Note:					*p<0.1; **p<0.	05; ****p<0.01		

Table 9: Results based on estimating equations (2) and (3). Models (1), (3) and (5) build upon 5-year averages (equation 3), models (2), (4) and (6) on yearly data and FD estimation (equation 4). Statistical inference based on clustered (beteroskedasticity-robust) standard errors.

6. Conclusions

This paper has reviewed existing measurements and empirical practices on economic openness, which we can generally understand as the degree to which non-domestic actors can or do participate in the domestic economy. We have compiled a comprehensive set of openness indicators from the existing literature – the data set is published together with this article – and have categorized the indicators using a typology of economic openness, which distinguishes

between 'real' and 'financial' openness, as well as a 'de facto' dimension (based on aggregate economic statistics) and a 'de jure' dimension (focusing on institutional foundations of openness), respectively.

We have used this data set to analyze the correlation across indicators, both in levels and in first differences. We find that indicators that belong to the same category of openness measures tend to be correlated more strongly. Correlations among openness indicators are, however, in general much weaker in the case of first differences. By using a standard growth regression framework, we have shown how different types of economic openness as well as different indicators capture the impact of openness on economic growth in different ways. From this finding, it follows that applied researchers are well advised to motivate their choice of openness indicator rigorously, since different research questions might also entails different conceptions of economic openness. At the same time, it can be argued that the identification of reasons for why different measures of economic openness yield different results is an important and rewarding research activity.

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Appendix: Measuring Economic Openness A review of existing measures and empirical practices

Supplementary material*

August 17, 2018

Abstract

We provide the descriptive statistics for all data used in the paper in section \underline{A} . Section \underline{B} gives a more detailed analysis of the individual time series, including a test for their stationarity. We then rank countries according to their openness in selected indicators, as well as the discrepancy between their *de facto* and *de jure* openness in section \underline{C} . In section \underline{D} we describe how we grouped countries for the analysis in section 3 in the main paper, and provide for the figures with countries grouped according to their level of income (section \underline{E}). In section \underline{F} we replicate the correlation analysis of section 4 in the main paper using the Pearson instead of the Spearman correlation coefficient.

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^{*}The authors acknowledge funds of the Oesterreichische Nationalbank (OeNB, Anniversary Fund, project number: 17383).

A Descriptive statistics and country set

Table 1 provides the descriptive statistics for the variables used in the paper. For data sources as well as detailed descriptions of the variables see the meta data file that comes with the data set 1

For the regressions in section 5 we have used the following set of 144 countries:

[1] Angola [2] Albania [3] United Arab Emirates [4] Argentina [5] Armenia [6] Australia [7] Austria [8] Burundi [9] Belgium [10] Benin [11] Burkina Faso [12] Bangladesh [13] Bulgaria [14] Bahrain [15] Belize [16] Bolivia [17] Brazil [18] Barbados [19] Brunei Darussalam [20] Botswana [21] Central African Republic [22] Canada [23] Switzerland [24] Chile [25] China [26] Cote D'Ivoire [27] Cameroon [28] Democratic Republic of the Congo [29] Congo [30] Colombia [31] Costa Rica [32] Cyprus [33] Czech Republic [34] Germany [35] Denmark [36] Dominican Republic [37] Algeria [38] Ecuador [39] Egypt [40] Spain [41] Estonia [42] Ethiopia [43] Finland [44] Fiji [45] France [46] Gabon [47] United Kingdom of Great Britain and Northern Ireland [48] Ghana [49] Gambia [50] Greece [51] Guatemala [52] Hong Kong [53] Honduras [54] Croatia [55] Haiti [56] Hungary [57] Indonesia [58] India [59] Ireland [60] Ira [61] Iraq [62] Iceland [63] Israel [64] Italy [65] Jamaica [66] Jordan [67] Japan [68] Kazakhstan [69] Kenya [70] Kyrgyzstan [71] Cambodia [72] Republic of Korea [73] Kuwait [74] Lao People's Democratic Republic [75] Liberia [76] Sri Lanka [77] Lesotho [78] Lithuania [79] Luxembourg [80] Latvia [81] Macao [82] Morocco [83] Republic of Moldova [84] Madagascar [85] Maldives [86] Mexico [87] Mali [88] Malta [89] Myanmar [90] Mongolia [91] Mozambique [92] Mauritania [93] Mauritius [94] Malawi [95] Malaysia [96] Namibia [97] Niger [98] Nigeria [99] Nicaragua [100] Netherlands [101] Norway [102] Nepal [103] New Zealand [104] Pakistan [105] Panama [106] Peru [107] Philippines [108] Poland [109] Portugal [110] Paraguay [111] Qatar [112] Romania [113] Russian Federation [114] Rwanda [115] Saudi Arabia [116] Sudan [117] Senegal [118] Singapore [119] Sierra Leone [120] El Salvador [121] Serbia [122] Slovakia [123] Slovenia [124] Sweden [125] Swaziland [126] Syrian Arab Republic [127] Togo [128] Thailand [129] Tajikistan [130] Trinidad and Tobago [131] Tunisia [132] Turkey [133] Taiwan, Province of China [134] United Republic of Tanzania [135] Uganda [136] Ukraine [137] Uruguay [138] United States of America [139] Venezuela, Bolivarian Republic of [140] Viet Nam [141] Yemen [142] South Africa [143] Zambia [144] Zimbabwe

¹The data, as well as the code to reproduce the estimation results and figures is available online: https: //github.com/graebnerc/econ-openness.

Further information about the data used is provided below.

Variable	Observations	Mean	Standard deviation
Alcala	5446	386557.61	461690.6800
CAPITAL	3858	56.40	28.2800
CTS	7090	551.24	1693.9500
EXP_to_GDP	8254	36.61	27.7100
FIN_CUR	3858	60.06	28.0300
Frankel	5821	-17.20	52.7000
FTI_Index	2859	6.69	1.7500
FTI_Index_ipo	5370	61.55	21.3700
FTI_trade	3323	5.69	2.8100
FTI_trade_ipo	6698	5.10	3.1300
GDP_pc_growth	8221	2.29	7.4800
hc	7224	2.06	0.7200
HF_fin	3543	52.57	21.0900
HF_trade	3535	68.15	16.3900
IMP to GDP	8254	42.53	29.1000
inflation	7591	33.43	474.5300
inv share	8684	21.58	21.0500
KA Index	1001	66.38	355500
KAOPEN	6887	45.46	35.8400
KOF defacto	8544	51.28	19 4000
KOF dejure	7637	48.54	20 5700
KOF econ	8130	40.04	20.5700
KOF finance df	8350	51 49	21 6100
KOF finance di	7820	17 36	21.0100 24.0100
KOF trade df	8631	41.50 50 52	24.0100
KOF trade di	7975	50.52 50.51	21.5100
Liotal	7441	0.46	0.2700
I ME EO	7441 7065	53.85	537 0500
I ME EDI in	7650	50480.34	308868 8600
I ME EDI out	7630	59469.54 60206 62	360124 4600
I ME EDI total stocks CDP	7594	82 70	652 7200
IME in CDD	7030	02.70 140.02	1872 6000
	7020	140.02	2202 7200
LMF _open	7030	450.00	3292.7200
LMF_OUT_GDP	1081	100.08	3213.4800
In_F 11_Index_ipo	0539	4.03	0.5400
Penn_GDP_PPP	8001	0.00	0.0000
Penn_GDP_PPP_log	8001	-12.10	1.2800
pop_growtn	11820	1.((0.0500
pop_log	12035	14.82	2.3900 100751000 C400
population	12035	24245522.79	100751022.6400
rgdpo	8684	263742.63	1026442.3100
Tariff_RES	3057	85.60	11.4500
Tariff_WITS	2084	91.35	5.8000
Tariff_WITS_ipo	2611	90.70	6.6500
	4782	15.97	16.8700
Trade_to_GDP	8232	78.42	53.6500
UNC_FDI_in	6450	52887.28	240838.3700
UNC_FDL_out	4693	73631.72	337692.5900
UNC_FDI_total_stocks_GDP	4448	64.42	193.3800
UNC_in_GDP	6173	114.41	1635.6200
UNC_out_GDP	4516	158.57	2523.5600

Table 1: Descriptive statistics for the data used in the paper.

Variable name	Description	\mathbf{Unit}	Source
Alcala	Real trade share (Alcala and Ciccone, 2004).	% of GDP at PPP	The World Bank
			(2018), own
			calculations
CAPITAL	Text-based index for de jure financial openness	index $0-100$	Quinn and Toyoda
			(2008)
ccode	Iso3c code of Country	NA	NA
Country	Country name	NA	NA
CTS	Composite Trade Share (CTS).	Index	Squalli and Wilson
			(2011)
EXP_to_GDP	Exports / GDP	% of GDP	The World Bank (2018)
FIN_CUR	The Financial Current Account, a text-based AREAR measure; based on	index $0-100$	Quinn and Toyoda
	compliance with IMF's Article VIII obligations.		(2008)
Frankel	Adjusted trade share, alternative method for outlier handling (Frankel, 2000)	% of 2. GDP	The World Bank
			(2018); own
			calculations
FTI_Index	Freedom to trade international index, sub-index of the Economic Freedom	index 0-10	The Fraser Institute
	Index provided of the Fraser Institute		(2016)
FTI_Index_ipo	FTLIndex with interpolated values (linear interpolation)	index $0-10$	The Fraser Institute
			(2016), own calc

FTI_trade	Freedom to trade international index, with score for "Black Market Exchange	index 0-10	The Fraser Institute
	Rates" and "controls of the movement of capital and people" being excluded.		(2016)
FTI_trade_ipo	FTL-trade with interpolated values (linear interpolation)	index 0-10	The Fraser Institute
			(2016), own
			calculation.
GDP_pc_growth	Growth in GDP per capita	Percent	$\operatorname{Pen}(2018)$
hc	Human capital index, based on years of schooling and returns to education;	Index, 1-5	$\operatorname{Pen}(2018)$
	see Human capital in PWT9.		
HF_econ	Economic Freedom Index of the Heritage Foundation (average of 12	Index, 0-100	Miller et al. (2018)
	sub-indices).		
HF_fin	Financial Investment Freedom Index, subset of Economic Freedom Index	Index, 0-100	Miller et al. (2018)
HF_trade	Trade-weighted average tariff rate D Nontariff trade barriers (NTBs), subset	Index, 0-100	Miller et al. (2018)
	of Economic Freedom Index.		
IMP_to_GDP	Imports / GDP	% of GDP	The World Bank (2018
inflation	Inflation, consumer prices (annual)	annual growth in $\%$	The World Bank (2018
$initial_GDP_pc$	GDP per capita at PPP in starting year of periods (for 5-year average	Output-side real	Pen (2018); own
	dataset only).	GDP at chained	calculation
		PPPs (in mil.	
		2011US\$)	
inv_share	Share of gross capital formation	at current PPPs	Pen (2018)

KA_Index	Capital Account Restrictions, a Text-based AREAER measur; similar to	Index, 0-1	Schindler (2009)
	CAPITAL and $\ensuremath{FIN_C}\ensuremath{C}\ensuremath{R}\ensuremath{E}\ensuremath{N}\xspace$ but includes finer-graned sub-categories and		
	information about different types of restrictions, asset categories, direction of		
	flows and residency of agents.		
KAOPEN	Chinn-Ito-Index, a table-based AREAER measure	index from -1.90 to	Chinn and Ito (2008),
		2.37	data update 2015
KOF_defacto	De facto part of the KOF Economic Globalization index	index 0-100	Gygli et al. (2018)
KOF_dejure	De jure part of the KOF Economic Globalization index	index 0-100	Gygli et al. (2018)
KOF_econ	The Economic Globalization index of the Swiss Economic Institute (KOF);	index 0-100	Gygli et al. (2018)
	de facto and de jure weighted equally		
Lietal	Adjusted trade share, modification to Frankel and Romer (1999) approach,	% of GDP	The World Bank
	suggested by Li et al. (2004)	(adjusted)	(2018); own
			calculations
LMF_EQ	Total for eign assets and liabilities (stocks) in $\%~{\rm GDP}$	% of GDP	Lane and
			Milesi-Ferretti (2017)
LMF_FDI_total_stocks_GDP	Sum of inward and outwarf FDI stocks in $\%$ of GDP.	% of GDP	Lane and
			Milesi-Ferretti (2017)
LMF_in_GDP	FDI inward stocks in $\%$ of GDP in USD.	% of GDP	Lane and
			Milesi-Ferretti (2017)

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LMF_open	Portfolio equity assets and liabilities (stocks) in $\%~{\rm GDP}$	% of GDP	Lane and
			Milesi-Ferretti (2017)
LMF_open_pv	Private Financial Openness Index: by subtracting official development aid	% of GDP	Lane and
	(DA) from foreign liablities (FL) and international reserves (IR) from foreign		Milesi-Ferretti (2017)
	assets (FA), private financial openness represents private agents Ő willingness		
	and ability to invest abroad and to incur foreign debt.		
LMF_out_GDP	FDI outward stocks in $\%$ of GDP in USD.	% of GDP	Lane and
			Milesi-Ferretti (2017)
ln_FTI_Index_ipo	Log of FTL_trade_ipo HOW	\log	Lane and
			Milesi-Ferretti (2017)
Penn_GDP_PPP			Pen (2018)
Penn_GDP_PPP_log	Log of Penn_GDP_PPP	log	Pen (2018)
period	Periods used for calculation of 5 year averages	NA	Own calculation
pop_growth	Growth of pop_{growth}	Percent	Own calculation
pop_log	Log of population	Log	Own calculation
population	Total de facto population, inluding both Sexesas of 1 July of the year	1000 people	UNPD (2015 Revision)
	indicated.		
rgdpo	Output-side real GDP	chained PPPs (in	Pen (2018)
		mil. 2011USD)	

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Tariff_RES	100 minus the tariff rate, which is based upon the average of (1) the effective	Index, 0-100	Jaumotte et al. (2013)
	(i.e. tariff revenue divided by import value) and (2) the unweighted tariff		
	rates		
$Tariff_WITS$	100 minus Mean of Effectively Applied (AHS) and Most-Favored Nation	index $0-100$	Own calculations, 2017
	(MFN) weighted average tariff rates		(based on tariff data of
			WITS databank)
Tariff_WITS_ipo	Tariff_WITS with interpolated values (linear interpolation)	index $0-100$	Own calculation
TOI	Generalized Trade Openness Index	index 0-100 (top	$\operatorname{Tang}(2011)$
		value= 100 , others	
		relative to this)	
Trade_to_GDP	(Imports+Exports) / GDP	Percent	World Bank
UNC_FDI_in	Inward Foreign Direct Investment stocks (value of foreign investors' equity in	% of GDP	UNCTAD Database
	and net loans to enterprises resident in the reporting economy) in $\%$ of GDP		(01/2018)
UNC_FDI_out	Outward FDI stocks (value of the resident investors' equity in and net loans	% of GDP	UNCTAD Database
	to enterprises in foreign economies) in $\%~\mathrm{GDP}$		(01/2018)
UNC_FDI_total_stocks_GDP	Sum of inward and outwarf FDI stocks in $\%$ of GDP.	% of GDP	UNCTAD Database
			(01/2018)
UNC_in_GDP	Outward FDI stocks in $\%$ GDP in USD	% of GDP	UNCTAD Database
			(01/2018)

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UNC_out_GDP	Outward FDI stocks in $\%$ GDP in USD	% of GDP	UNCTAD Database
			(01/2018)
Year	Year of observation	NA	NA

B Further information on individual time series

Here we provide more specific information on the individual time series of the openness measures considered. Columns 'start' and 'end' indicate the first and last data point for the time series. Column 'share_na' gives the share of missing data points in percent. Column 'adf_pval' provides the p value of an augmented Dickey Fuller test with trend for stationarity, and the last columns illustrates the significance level on which the Null of a stationary time series has to be rejected.

country	var_name	data_start	data_end	share_na	adf_pval	sig
Albania	Lietal	1984	2016	0.000	0.088	*
Australia	Lietal	1989	2016	0.000	0.543	
Austria	Lietal	2005	2016	0.000	0.223	
Belgium	Lietal	2002	2016	0.000	0.139	
Bulgaria	Lietal	1980	2016	0.000	0.100	
Canada	Lietal	1960	2016	0.000	0.563	
Croatia	Lietal	1995	2016	0.000	0.345	
Cyprus	Lietal	1976	2016	0.000	0.356	
Czech Republic	Lietal	1993	2016	0.000	0.038	**
Denmark	Lietal	1975	2016	0.000	0.454	
Estonia	Lietal	1995	2016	0.000	0.033	**
Finland	Lietal	1975	2016	0.000	0.541	
France	Lietal	1975	2016	0.000	0.341	•
Germany	Lietal	1971	2016	0.000	0.550	
Greece	Lietal	1976	2016	0.024	0.382	
Hungary	Lietal	1991	2016	0.000	0.703	
Iceland	Lietal	1976	2016	0.000	0.547	
Ireland	Lietal	2005	2016	0.000	0.608	
Italy	Lietal	1970	2016	0.000	0.264	
Japan	Lietal	1996	2016	0.000	0.061	*
Korea	Lietal	1976	2016	0.000	0.685	
Latvia	Lietal	1995	2016	0.000	0.053	*
Lithuania	Lietal	1995	2016	0.000	0.151	
Luxembourg	Lietal	1999	2016	0.000	0.100	*
Macedonia FYR	Lietal	1996	2016	0.000	0.232	

Malta	Lietal	1971	2016	0.000	0.699	
Mexico	Lietal	1979	2016	0.000	0.165	•
Montenegro	Lietal	2007	2016	0.000	0.001	***
Netherlands	Lietal	1967	2016	0.000	0.530	
New Zealand	Lietal	2000	2016	0.000	0.247	
Norway	Lietal	1975	2016	0.000	0.309	
Poland	Lietal	1990	2016	0.000	0.094	*
Portugal	Lietal	1975	2016	0.000	0.023	**
Romania	Lietal	1987	2016	0.000	0.262	
Serbia	Lietal	2007	2016	0.000	0.001	***
Slovakia	Lietal	1993	2016	0.000	0.167	
Slovenia	Lietal	1995	2016	0.000	0.083	*
Spain	Lietal	1975	2016	0.000	0.255	
Sweden	Lietal	1970	2016	0.000	0.331	
Switzerland	Lietal	1980	2016	0.000	0.402	
Turkey	Lietal	1974	2016	0.000	0.038	**
United Kingdom	Lietal	1970	2016	0.000	0.143	
United States	Lietal	1970	2016	0.000	0.174	
Albania	$Trade_{to}GDP$	1996	2016	0.000	0.837	
Australia	$Trade_to_GDP$	1960	2016	0.000	0.304	
Austria	$Trade_to_GDP$	1960	2016	0.000	0.179	
Belgium	${\rm Trade_to_GDP}$	1960	2016	0.000	0.049	**
Bulgaria	$Trade_to_GDP$	1991	2016	0.000	0.079	*
Canada	${\rm Trade_to_GDP}$	1960	2016	0.000	0.683	
Croatia	$Trade_to_GDP$	1995	2016	0.000	0.481	
Cyprus	${\rm Trade_to_GDP}$	1960	2016	0.000	0.671	
Czech Republic	$Trade_to_GDP$	1990	2016	0.000	0.054	*
Denmark	${\rm Trade_to_GDP}$	1960	2016	0.000	0.263	
Estonia	$Trade_to_GDP$	1993	2016	0.000	0.264	
Finland	${\rm Trade_to_GDP}$	1960	2016	0.000	0.326	
France	$Trade_to_GDP$	1960	2016	0.000	0.249	
Germany	Trade_to_GDP	1960	2016	0.000	0.645	
Greece	$Trade_to_GDP$	1960	2016	0.000	0.028	**

Hungary	$Trade_to_GDP$	1978	2016	0.000	0.383	
Iceland	$Trade_to_GDP$	1960	2016	0.000	0.495	
Ireland	Trade_to_GDP	1960	2016	0.000	0.324	
Italy	$Trade_to_GDP$	1960	2016	0.000	0.379	
Japan	$Trade_to_GDP$	1960	2016	0.000	0.434	
Korea	Trade_to_GDP	1970	2016	0.000	0.522	•
Latvia	Trade_to_GDP	1990	2016	0.000	0.015	**
Lithuania	$Trade_to_GDP$	1990	2016	0.000	0.030	**
Luxembourg	Trade_to_GDP	1960	2016	0.000	0.958	
Macedonia FYR	Trade_to_GDP	1995	2016	0.000	0.022	**
Malta	Trade_to_GDP	1960	2016	0.000	0.195	
Mexico	Trade_to_GDP	1960	2016	0.000	0.253	
Montenegro	Trade_to_GDP	2000	2016	0.000	0.544	
Netherlands	Trade_to_GDP	1960	2016	0.000	0.120	
New Zealand	Trade_to_GDP	1960	2016	0.000	0.424	
Norway	Trade_to_GDP	1960	2016	0.000	0.015	**
Poland	Trade_to_GDP	1980	2016	0.000	0.003	***
Portugal	Trade_to_GDP	1960	2016	0.000	0.089	*
Romania	Trade_to_GDP	1980	2016	0.000	0.193	
Serbia	Trade_to_GDP	1995	2016	0.000	0.132	
Slovakia	Trade_to_GDP	1990	2016	0.000	0.034	**
Slovenia	Trade_to_GDP	1990	2016	0.000	0.001	***
Spain	Trade_to_GDP	1960	2016	0.000	0.070	*
Sweden	Trade_to_GDP	1960	2016	0.000	0.170	
Switzerland	Trade_to_GDP	1960	2016	0.000	0.302	
Turkey	Trade_to_GDP	1980	2016	0.000	0.476	
United Kingdom	Trade_to_GDP	1960	2016	0.000	0.282	
United States	${\rm Trade_to_GDP}$	1960	2016	0.000	0.091	*
Albania	Alcala	1980	2014	0.000	0.659	
Australia	Alcala	1989	2014	0.000	0.660	
Austria	Alcala	2005	2014	0.000	0.048	**
Belgium	Alcala	2002	2014	0.000	0.490	
Bulgaria	Alcala	1980	2014	0.000	0.743	

Canada	Alcala	1960	2014	0.000	0.082	*
Croatia	Alcala	1993	2014	0.000	0.669	
Cyprus	Alcala	1976	2014	0.000	0.364	
Czech Republic	Alcala	1993	2014	0.000	0.699	
Denmark	Alcala	1975	2014	0.000	0.339	
Estonia	Alcala	1992	2014	0.000	0.293	
Finland	Alcala	1975	2014	0.000	0.318	
France	Alcala	1975	2014	0.000	0.216	
Germany	Alcala	1971	2014	0.000	0.574	
Greece	Alcala	1976	2014	0.026	0.799	
Hungary	Alcala	1982	2014	0.000	0.523	
Iceland	Alcala	1976	2014	0.000	0.094	*
Ireland	Alcala	2005	2014	0.000	0.449	
Italy	Alcala	1970	2014	0.000	0.260	
Japan	Alcala	1996	2014	0.000	0.114	
Korea	Alcala	1976	2014	0.000	0.785	
Latvia	Alcala	1992	2014	0.000	0.479	
Lithuania	Alcala	1993	2014	0.000	0.639	
Luxembourg	Alcala	1999	2014	0.000	0.853	
Macedonia FYR	Alcala	1996	2014	0.000	0.214	
Malta	Alcala	1971	2014	0.000	0.965	
Mexico	Alcala	1979	2014	0.000	0.322	
Montenegro	Alcala	2007	2014	0.000	0.009	***
Netherlands	Alcala	1967	2014	0.000	0.383	
New Zealand	Alcala	2000	2014	0.000	0.442	
Norway	Alcala	1975	2014	0.000	0.209	
Poland	Alcala	1976	2014	0.000	0.779	
Portugal	Alcala	1975	2014	0.000	0.140	
Romania	Alcala	1971	2014	0.000	0.911	
Serbia	Alcala	2007	2014	0.000	0.106	
Slovakia	Alcala	1993	2014	0.000	0.516	
Slovenia	Alcala	1992	2014	0.000	0.542	
Spain	Alcala	1975	2014	0.000	0.034	**

Sweden	Alcala	1970	2014	0.000	0.293	
Switzerland	Alcala	1977	2014	0.000	0.653	
Turkey	Alcala	1974	2014	0.000	0.455	
United Kingdom	Alcala	1970	2014	0.000	0.109	
United States	Alcala	1970	2014	0.000	0.599	
Albania	CTS	1984	2016	0.000	0.473	
Australia	CTS	1989	2016	0.000	0.324	
Austria	CTS	2005	2016	0.000	0.179	
Belgium	CTS	2002	2016	0.000	0.015	**
Bulgaria	CTS	1980	2016	0.000	0.707	
Canada	CTS	1977	2016	0.000	0.732	
Croatia	CTS	1995	2016	0.000	0.330	
Cyprus	CTS	1977	2016	0.000	0.057	*
Czech Republic	CTS	1993	2016	0.000	0.600	
Denmark	CTS	1977	2016	0.000	0.292	
Estonia	CTS	1995	2016	0.000	0.064	*
Finland	CTS	1977	2016	0.000	0.511	
France	CTS	1977	2016	0.000	0.061	*
Germany	CTS	1977	2016	0.000	0.463	
Greece	CTS	1977	2016	0.025	0.885	
Hungary	CTS	1991	2016	0.000	0.875	
Iceland	CTS	1977	2016	0.000	0.743	
Ireland	CTS	2005	2016	0.000	0.661	
Italy	CTS	1977	2016	0.000	0.518	
Japan	CTS	1996	2016	0.000	0.179	
Korea	CTS	1977	2016	0.000	0.465	
Latvia	CTS	1995	2016	0.000	0.079	*
Lithuania	CTS	1995	2016	0.000	0.233	
Luxembourg	CTS	1999	2016	0.000	0.031	**
Macedonia FYR	CTS	1996	2016	0.000	0.172	
Malta	CTS	1977	2016	0.000	0.634	
Mexico	CTS	1979	2016	0.000	0.496	
Montenegro	CTS	2007	2016	0.000	0.059	*

Netherlands	CTS	1977	2016	0.000	0.405	•
New Zealand	CTS	2000	2016	0.000	0.032	**
Norway	CTS	1977	2016	0.000	0.137	
Poland	CTS	1990	2016	0.000	0.165	•
Portugal	CTS	1977	2016	0.000	0.519	•
Romania	CTS	1987	2016	0.000	0.052	*
Serbia	CTS	2007	2016	0.000	0.085	*
Slovakia	CTS	1993	2016	0.000	0.397	•
Slovenia	CTS	1995	2016	0.000	0.567	
Spain	CTS	1977	2016	0.000	0.864	
Sweden	CTS	1977	2016	0.000	0.327	
Switzerland	CTS	1980	2016	0.000	0.790	
Turkey	CTS	1977	2016	0.000	0.017	**
United Kingdom	CTS	1977	2016	0.000	0.418	
United States	CTS	1977	2016	0.000	0.491	
Albania	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.131	
Australia	KOF_defacto	1970	2015	0.000	0.832	
Austria	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.619	
Belgium	KOF_defacto	1970	2015	0.000	0.555	
Bulgaria	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.420	
Canada	KOF_defacto	1970	2015	0.000	0.261	
Croatia	$\mathrm{KOF}_{-}\mathrm{defacto}$	1991	2015	0.000	0.965	
Cyprus	KOF_defacto	1970	2015	0.000	0.553	
Czech Republic	$\mathrm{KOF}_{-}\mathrm{defacto}$	1993	2015	0.000	0.343	
Denmark	KOF_defacto	1970	2015	0.000	0.669	
Estonia	$\mathrm{KOF}_{-}\mathrm{defacto}$	1991	2015	0.000	0.888	
Finland	KOF_defacto	1970	2015	0.000	0.362	
France	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.214	•
Germany	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.637	
Greece	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.334	•
Hungary	KOF_defacto	1970	2015	0.000	0.511	
Iceland	KOF_defacto	1970	2015	0.000	0.916	
Ireland	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.458	

Italy	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.583	
Japan	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.542	•
Korea	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.734	•
Latvia	${\rm KOF_defacto}$	1990	2015	0.000	0.305	
Lithuania	$\mathrm{KOF}_{-}\mathrm{defacto}$	1990	2015	0.000	0.182	
Luxembourg	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.686	
Macedonia FYR	$\mathrm{KOF}_{-}\mathrm{defacto}$	1991	2015	0.000	0.448	
Malta	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.803	
Mexico	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.168	
Montenegro	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.640	
Netherlands	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.294	
New Zealand	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.916	
Norway	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.307	
Poland	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.955	
Portugal	$\mathrm{KOF}_{-}\mathrm{defacto}$	1970	2015	0.000	0.102	

C Rankings

Here we first rank countries according to selected openness measures (see table 4) and, second, illustrate the fact that a high degree of *de jure* openness does not necessarily implies a high degree of *de facto* openness: figure 1 illustrates this difference and highlights those countries with the strongest discrepancy between *de facto* and *de jure* openness.



(a) Differences in the ranks of trade-to-GDP (trade *de facto*) and the WITS-based index (trade *de jure*).



Figure 1: Comparisons of *de facto* and *de jure* openness.

Country	Rank	Country	Rank
Luxembourg	1	Singapore	1
Hong Kong	2	Mauritius	2
Singapore	3	Georgia	3
Malta	4	Peru	4
Ireland	5	New Zealand	5
Slovakia	6	Switzerland	6
Viet Nam	7	Ukraine	7
United Arab Emirates	8	USA	8
Hungary	9	Australia	9
Congo	10	Albania	10
Sint Maarten (Dutch part)	207	Turkmenistan	207
Seychelles	208	Timor-Leste	208
Syrian Arab Republic	209	Tonga	209
Turks and Caicos Islands	210	Trinidad and Tobago	210
Turkmenistan	211	Tuvalu	211
Trinidad and Tobago	212	Taiwan, Province of China	212
Tuvalu	213	Uzbekistan	213
Taiwan	214	Venezuela	214
Venezuela	215	Virgin Islands, British	215
Virgin Islands, British	216	Virgin Islands, U.S.	216
Vanuatu	217	Vanuatu	217

(a) Rank according to trade-to-GDP (trade de (b) Rank according to the WITS-based index facto). (trade de jure).

Country	Rank	Country	Rank
Singapore	1	Hong Kong	1
Belgium	2	Singapore	2
Netherlands	3	Netherlands	3
Malta	4	Ireland	4
Hong Kong	5	Belgium	5
Marshall Islands	6	France	6
Seychelles	7	Czech Republic	7
Luxembourg	8	Finland	8
Ireland	9	United Kingdom	9
Mauritius	10	Luxembourg	10
Romania	207	Sint Maarten (Dutch part)	207
San Marino	208	Turks and Caicos Islands	208
Somalia	209	Turkmenistan	209
South Sudan	210	Timor-Leste	210
Sint Maarten (Dutch part)	211	Tonga	211
Turks and Caicos Islands	212	Tuvalu	212
Timor-Leste	213	Taiwan, Province of China	213
Tuvalu	214	Uzbekistan	214
Taiwan, Province of China	215	Virgin Islands, British	215
Virgin Islands, British	216	Virgin Islands, U.S.	216
Virgin Islands, U.S.	217	Vanuatu	217

(c) Rank according to the KOF de facto index. (d) Rank according to the KOF de jure index.

Table 4: The most and least open countries according to selected openness measures.

D Country groups according to economic complexity

We classified countries according to their complexity as defined by Hidalgo and Hausmann. We decided to set thresholds such that the three groups (*high, medium, and low* complexity) consist of approximately the same number of countries. This yields to the following classification, according to which we classify countries every year anew (i.e. countries can in principle switch between groups):

High complexity	ECI > 0.5
Medium complexity	$0.5 \geq ECI \geq -0.5$
Low complexity	ECI < -0.5

E Trends in openness based on income groups

In the main paper we classified countries according to their complexity as defined by Hidalgo and Hausmann and as explicated in section **D**. Here we complement this presentation by providing the same kind of visualization, but according to the income groups as provided by the World Bank. The World Bank assigns countries into four income groups – high, upper-middle, lower-middle, and low. The assignment is based on the GNI per capita in current US dollars calculated using the Atlas method. The threshold levels are determined at the start of the Bank's fiscal year in July and remain fixed for 12 months regardless of subsequent revisions to estimates. Thus, as for the classification into complexity groups, countries may move among income groups over the years. Currently, the following classification scheme is used:

	GNI p.c. in current USD
High income	> 12235
Upper middle income	3956 - 12235
Lower middle income	1006 - 3955
Low income	< 1005

The figures of section 3 in the main text are replicated in figures 2 (for figure 1 in the main text), 3 (for figure 2 in the main text), and 4 (for figure 3 in the main text) using the World Bank classification. Note that since our sample is restricted to European countries only high and upper medium income countries show up.



Figure 2: Replication of figure 1 in the main text: the dynamics of trade openness measures.

F Correlation analysis with alternative correlation measures

Here we replicate the correlation matrix of section 4 in the main paper with the Pearson correlation coefficient (see figure 5a for correlations among levels and 5b for correlations among differences). The assumptions for this measure are somehow more restrictive than for the Spearman coefficient, yet the results are more pronounced, and the clusters of trade vs. financial, and de facto vs. de jure measures are easier to spot.



Figure 3: Replication of figure 2 in the main text: the dynamics of financial openness measures.



Figure 4: Replication of figure 3 in the main text: the dynamics of the KOF hybrid measure.



(b) The correlation analysis for differenced using the Pearson correlation coefficient.

G More detailed regression results

Here we provide the detailed results for the regressions summarized in table 7 in the main paper.

Table 5 provides the results for de facto trade openness measures, table 6 for de jure trade openness measures, table 7a for de facto financial openness measures, and, finally, table 7b for de jure financial openness measures.

		Depende	nt variable: C	DP per capit	a growth	
	(1)	(2)	(3)	(4)	(5)	(6)
$\log(\text{Trade_to_GDP})$	1.229^{**} (0.570)					
$\log(Alcala)$	· · · ·	-0.081 (0.591)				
$\log(\text{Lietal})$		× /	$0.136 \\ (0.889)$			
$\log(\mathrm{TOI})$				1.261^{**} (0.544)		
$\log(\text{KOF_defacto})$				· · ·	0.402 (0.523)	
$\log(\text{CTS})$					(0.020)	1.849 (3.939)
$\log(initial_GDP_pc)$	-2.316^{***} (0.452)	-2.699^{***} (0.610)	-2.812^{***} (0.590)	-2.352^{***} (0.562)	-2.399^{***} (-4.848)	-3.536^{***} (-4.759)
$\log(hc)$	(0.132) 4.081^{***} (1.214)	9.812^{***} (2.389)	9.868^{***} (1.941)	9.713^{***} (1.935)	5.442 (3.775)	(5.812)
$pop_{-}growth$	(0.231) (0.231)	(0.370)	(0.331) (0.385)	-0.380 (0.366)	-0.398^{***} (-2.059)	-0.280^{***} (-0.716)
inflation	-0.002^{***} (0.0004)	-0.003^{***} (0.0005)	-0.003^{***} (0.0005)	-0.003^{***} (0.0005)	(-0.002^{***}) (-3.788)	(-0.002^{***}) (-6.531)
log(inv_share)	(0.0001) 0.972^{**} (0.495)	(0.6000) 1.394^{**} (0.695)	(0.0000) 1.319^{*} (0.706)	(0.0000) 1.263^{*} (0.753)	(2.883)	$\begin{array}{c} 0.001)\\ 0.417\\ (0.550)\end{array}$
Observations R ²	1,186 0.092	978 0.133	947 0.134	867 0.133	1,173 0.102	895 0.167
R ² F Statistic	$0.092 \\ 17.445^{***}$	$0.133 \\ 21.164^{***}$	$0.134 \\ 20.665^{***}$	$0.133 \\ 18.790^{***}$	$0.102 \\ 19.359^{***}$	0.167 25.009^{**}

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 5: Detailed regression results for de facto trade openness measures.

	Depende	nt variable: C	DP per capit	a growth
	(1)	(2)	(3)	(4)
$\log(\text{KOF}_{dejure})$	1.510			
- ()	(1.053)			
log(Tariff_WITS_ipo)		-0.660		
		(1.390)		
ln_F"TI_Index_ipo			1.451***	
			(0.414)	
$\log(\text{HF}_{\text{trade}})$				0.546
				(1.719)
$\log(\text{initial}_GDP_pc)$	-2.498^{***}	-4.054^{***}	-2.230^{***}	-3.948^{***}
	(0.514)	(1.089)	(0.559)	(0.840)
$\log(hc)$	5.337^{***}	17.283^{***}	3.449^{**}	18.972^{***}
	(1.374)	(4.826)	(1.441)	(5.188)
pop_growth	-0.373^{*}	-0.392^{*}	-0.368^{*}	-0.009
	(0.196)	(0.202)	(0.221)	(0.285)
inflation	-0.002^{***}	-0.001^{***}	-0.002^{***}	-0.002^{***}
	(0.001)	(0.0002)	(0.0003)	(0.0004)
log(inv_share)	1.637^{***}	2.070	1.219^{*}	1.105
	(0.608)	(1.444)	(0.686)	(1.078)
Observations	1,160	484	1,047	640
\mathbb{R}^2	0.104	0.114	0.112	0.119
F Statistic	19.588***	7.626***	18.992***	11.079***
Note:		*p<	0.1; **p<0.05	5; ***p<0.01

Table 6: Detailed regression results for de jure trade openness measures.

	Depende	nt variable: C	GDP per capit	a growth
	(1)	(2)	(3)	(4)
$\log(\text{LMF_open})$	-0.673^{**} (0.332)			
$\log(\text{LMF}_\text{EQ})$		0.444^{*} (0.233)		
$\log(\text{UNC_in_GDP})$		()	0.530^{**} (0.240)	
$\log(\text{UNC_out_GDP})$			()	0.091 (0.192)
$\log(\mathrm{initial_GDP_pc})$	-2.308^{***} (0.481)	-2.744^{***} (0.496)	-2.516^{***} (0.557)	-2.922^{***} (0.653)
$\log(hc)$	(0.101) 7.965^{***} (1.575)	4.761^{***} (1.378)	8.964^{***} (1.943)	(2.254)
pop_growth	(0.1010) -0.431^{**} (0.198)	(1.010) -0.431^{**} (0.197)	(1.013) -0.222 (0.211)	(2.231) 0.183 (0.286)
inflation	-0.002^{***} (0.0004)	-0.002^{***} (0.0004)	-0.002^{***} (0.0004)	-0.002^{***} (0.0004)
log(inv_share)	1.271^{**} (0.554)	1.581^{***} (0.565)	0.931 (0.678)	0.201 (0.871)
Observations	1,144	$1,\!146$	992	828
\mathbb{R}^2	0.108	0.107	0.136	0.104
F Statistic	20.100***	19.850***	22.111***	13.391***
Note:		*p<	(0.1; **p<0.05	5; ***p<0.01

*p<0.1; **p<0.05; ***p<0.01

(a) Detailed regression results for de facto financial openness measures.

$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		Dependent	variable: GDF	P per capita growth
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		(1)	(2)	(3)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	log(KAOPEN)	0.302		
$\begin{array}{cccc} \log(\mathrm{HF_fin}) & & -0.998 \\ & & (0.719) \\ \\ \log(\mathrm{CAPITAL}) & & 1.512^{***} \\ & & (0.443) \\ \log(\mathrm{initial_GDP_pc}) & -2.069^{***} & -3.775^{***} & -2.649^{***} \\ & & (0.463) & (0.892) & (0.697) \\ \log(\mathrm{hc}) & & 4.170^{***} & 19.083^{***} & -0.321 \\ & & (1.193) & (4.136) & (1.670) \\ pop_growth & -0.464^{**} & -0.021 & -0.934^{***} \\ & & (0.187) & (0.310) & (0.350) \\ \mathrm{inflation} & & -0.002^{***} & -0.002^{***} & -0.002^{***} \\ & & (0.0002) & (0.0004) & (0.0005) \\ \end{array}$		(0.203)		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\log(\text{HF}_{fin})$		-0.998	
$\begin{array}{llllllllllllllllllllllllllllllllllll$			(0.719)	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\log(CAPITAL)$			1.512^{***}
$\begin{array}{llllllllllllllllllllllllllllllllllll$				(0.443)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	log(initial_GDP_pc)	-2.069^{***}	-3.775^{***}	-2.649^{***}
$\begin{array}{llllllllllllllllllllllllllllllllllll$		(0.463)	(0.892)	(0.697)
$\begin{array}{ccccccc} (1.193) & (4.136) & (1.670) \\ \text{pop-growth} & -0.464^{**} & -0.021 & -0.934^{***} \\ (0.187) & (0.310) & (0.350) \\ \text{inflation} & -0.002^{***} & -0.002^{***} & -0.002^{***} \\ (0.0002) & (0.0004) & (0.0005) \end{array}$	$\log(hc)$	4.170^{***}	19.083^{***}	-0.321
pop_growth -0.464^{**} -0.021 -0.934^{***} (0.187) (0.310) (0.350) inflation -0.002^{***} -0.002^{***} (0.0002) (0.0004) (0.0005)		(1.193)	(4.136)	(1.670)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	pop_growth	-0.464^{**}	-0.021	-0.934^{***}
inflation $\begin{array}{c} -0.002^{***} & -0.002^{***} & -0.002^{***} \\ (0.0002) & (0.0004) & (0.0005) \end{array}$		(0.187)	(0.310)	(0.350)
$(0.0002) \qquad (0.0004) \qquad (0.0005)$	inflation	-0.002^{***}	-0.002^{***}	-0.002^{***}
		(0.0002)	(0.0004)	(0.0005)
$\log(\text{inv_share})$ 1.652*** 1.149 0.800	$log(inv_share)$	1.652^{***}	1.149	0.800
(0.577) (1.040) (0.581)		(0.577)	(1.040)	(0.581)
Observations 1,128 641 697	Observations	$1,\!128$	641	697
R^2 0.089 0.128 0.111	\mathbb{R}^2	0.089	0.128	0.111
F Statistic 15.927*** 12.057*** 12.433***	F Statistic	15.927***	12.057***	12.433***

Note:

*p<0.1; **p<0.05; ***p<0.01

(b) Detailed regression results for de jure financial openness measures.

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