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Financial Inclusion, Globalization and Structural Transformation in Developing Countries: A Finite Mixture-of-Regressions Approach

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Abstract Industrialization plays a key role in job creation and economic development. We extend the abundant literature on the determinants of industrialization by exploring the potential effects of financial inclusion in 64 developing countries over the period 2000-2020. Using a finite mixture regression model, we find that our sample is best described by a model with three classes of countries. We then incorporate the potential presence of hidden heterogeneity and, we explain the class membership of countries based on globalization. We find that the impact of financial inclusion on industrialization differs across these three classes of countries. Specifically, financial inclusion is negatively associated with industrialization in the first class of countries where the level of industrialization is low, while it positively affects industrialization in relatively more industrialized countries (class 2 and class 3). We also show that better-integrated countries into the global economy are more likely to be in the class where financial inclusion promotes industrialization. Our results are robust to several robustness checks. Our findings suggest that developing countries could reap more benefits from financial inclusion by strengthening their integration into the global economy.

Keywords: financial inclusion, globalization, industrialization, finite mixture regression, developing countries

JEL Classifications: G21, F63, O14, C13

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I. Introduction

Recently, weak macroeconomic conditions in developing countries have been driven by supply chain disruptions caused by the COVID-19 pandemic and exacerbated by the outbreak of the war in Ukraine. These supply chain disruptions and the related protectionist policies have highlighted the potential costs of reliance on certain staple goods imports and revealed the importance of structural transformation in many countries. Indeed, they have reduced developing countries access to key agricultural commodities such as fertilizers and leading to dramatic

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price increases[1]. The associated reduction in fertilizer use could negatively affect crop yields and threaten food security in developing countries which are net fertilizer-importing countries. This could also, set back living standards for millions of people in a context of limited fiscal space and limited safety nets across the region. Furthermore, youth do not have stable economic opportunities in developing countries (Hilson & Osei, 2014; Kingdon & Knight, 2004).

The growing adoption of financial technology has increased financial inclusion-FI thereafter (Yang & Zhang, 2022) of households, and firms, and reshaped their economic activity (Philippon, 2016). Following the World Bank, « FI means that individuals and businesses have access to useful and affordable financial products and services that meet their needs-transactions, payments, savings, credit and insurance-delivered responsibly and sustainably». It simply represents the access to and use of formal financial services by households and firms (Sahay et al., 2015). As suggested by the literature, FI is an important driver of strong macroeconomic conditions. Consequently, FI positively affects saving and provides resources for large-scale investment projects (Allen et al., 2016; Aportela, 1999; Demirguc-Kunt et al., 2015; Demirgüç-Kunt et al., 2020), enhances tax revenue collection (Oz-Yalaman, 2019), reduces inequality (Aslan et al., 2017; Swamy, 2014), boosts economic growth and closes the gender gap (Sahay et al., 2015; Sanyal, 2014), alleviates energy poverty and reduces carbon emissions (Shahbaz et al., 2020); and ensures financial stability (Demirgüç-Kunt & Huizinga, 2010; Hauswald & Marquez, 2006; Petersen et al., 1995). Nonetheless, the impact of FI[2] in ensuring financial stability depends on the quality of banking supervision (Cihak et al., 2016; Dabla-Norris et al., 2015; Han & Melecky, 2013).

By improving macroeconomic conditions, FI could promote industrialization. Our paper contributes to the abundant literature on the determinants of industrialization (e.g., Chenery, 1960, 1975, 1980; Chenery et al., 1986; Dasgupta & Singh, 2007) by exploring the potential effects of FI. To the best of our knowledge, existing studies only focused on the effects of financial development on industrialization (Carlin & Mayer, 2003; Gerschenkron, 1963; Stiglitz & Uy, 1996) or used the traditional econometric models to examine this relationship. Indeed, these models disregard the possibility that heterogeneity may exist along the distribution of the outcome itself. What are the effects of FI on industrialization in developing countries controlling for the globalization level? Answering this question could help provide some policy options to boost industrialization in developing countries.

This paper aims to explore the relationship between FI and industrialization in developing

1) For instance, fertilizer exports from Belarus and Russia have been disrupted, reflecting the economic sanctions and disruptions in Black Sea trading routes. In addition, China imposed export restrictions to ensure domestic availability.

2) Financial stability could be threatened especially if there is weak banking supervision and higher access to credit given that non-performing loans may increase (Dabla-Norris et al., 2015; Han and Melecky, 2013; Čihák and Melecky, 2016).

countries, depending on the level of globalization. It differs from previous studies in many ways. First, previous studies employed traditional OLS fixed effects and GMM methods, which impose a single model in the sample. We use a finite mixture model, which assumes that there are multiple industrialization classes (or regimes) and that the impact of FI on industrialization differs across these classes. The finite mixture model incorporates a latent variable to classify countries into different classes and enables any possible unobserved heterogeneity that may exist to be taken into account (Flachaire et al., 2014; Konte, 2016; Ouédraogo et al., 2021). Therefore, countries are grouped into classes based on the similarity of the conditional distribution of their industrialization given all the observed explanatory variables (Deb & Gregory, 2016; Flachaire et al., 2014). Second, we explore the role of economic and social globalization in explaining the different effects of FI on industrialization between classes. This is very important given that the effect of external factors on industrialization in developing countries has become a controversial subject in recent decades. Third, the originality of this paper resides in the fact that it extends the existing studies by empirically investigating the macroeconomic effects of FI on industrialization in SSA. The objective of this paper is in line with the 2030 Agenda for Sustainable Development (SDGs, 2015)[3]. Accordingly, the tenth target of the 8th goal aims to "*Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all.*". The second target of the 9th goal aims to "*Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in the least developed countries*."

Drawing upon a finite mixture regression model, we cover a sample of 64 developing countries, over the period 2000-2020. Our sample is best described by a model with three classes of countries. Our results demonstrate that FI is negatively associated with industrialization in the first class of countries where the industrialization level is low, while it positively affects industrialization in more industrialized countries (second and third-class countries). The extent of our results is meaningful because a 0.1% increase in FI is associated with a decrease in industrialization by up to 1.286% in the first class of countries, while it increases industrialization by up to 2.306% and 2.188% in countries belonging to the second and third class respectively. These findings are robust to alternative specifications and the addition of control variables as well. They also hold when we use an alternative measure for industrialization. Our findings highlight that there is an unobserved heterogeneity in the effect of FI on industrialization, which the previous studies have failed to incorporate. Moreover, we find that the level of economic, and social globalization explains class membership. More precisely, countries with high levels

3) The 8th SDG goal aspires to "*Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.*" and the 9th SDG goal aims to "*Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation*."

of economic and social globalization are more likely to be in the class where FI increases industrialization. Our results corroborate previous investigations on the importance of financial development in the industrialization process (Heblich & Trew, 2019; Kothakapa et al., 2021; Rajan, Raghuram G. and Zingales, 1998). We reveal that developing countries could foster their economic structural transformation by designing and effectively implementing financial policies that include their citizens.

The remainder of this paper is organized as follows. Section 2 presents the literature review. Section 3 describes the data. Section 4 reports the underlying model. Section 5 discusses the results. Section 6 concludes and discusses policy implications.

II. Literature Review

There is evidence that financial development promotes industrialization. In this study, we assume that the financial system affects industrialization and FI influences industrialization by increasing access to financial services and deepening the financial system. We also emphasize the role of globalization in the relationship between FI and industrialization.

According to the traditional approach (Cameron, 1967; Gerschenkron, 1963), the financial system promotes industrialization through three mechanisms. First, the financial system can increase resource mobilization for industrialization. The mobilization of resources can be facilitated by financial intermediaries that connect agents with financing capacity and those with financing needs (Levine, 1997). According to Gerschenkron, (1963), a financial system is a fundamental prerequisite to mobilize resources for industrialization as it allows firms to go beyond the indivisibility of their investment projects and to exploit economies of scale. Without access to a minimum amount of financing, many firms would be constrained to operate at an inefficient scale. In the same vein, Stiglitz & Uy, (1996) underscore the fundamental role of financial development on industrial growth in East Asian countries. Second, the financial system provides information about firms and improves capital allocation. Indeed, before investing in firms (e.g., industries), it is important to evaluate them (their managers and the market conditions). Unlike savers who are not able, financial intermediaries can select the most promising firms and managers and allow efficient capital use (Greenwood & Jovanovic, 1990). Some researchers (Pang & Wu, (2009), Wurgler, (2000)) find that financial development improves the allocation of industrial capital. Pang & Wu, (2009) also show that countries with better financial markets increase investments in growing industries. Finally, the financial system contributes to fostering innovative activities (Schumpeter & Nichol, 1934), by identifying potential successful entrepreneurs in the production processes (King & Levine, 1993). It provides financial services (information on risk management and acquisition) which, reduce transaction costs and facilitate

investment in innovative activities.

Using data for 27 industries in 14 countries over the period 1970-1995, Carlin & Mayer, (2003) show that financial markets foster capital investment or R&D investment in industries that depend more on external funding. While the traditional approach argues that the financial system positively affects industrialization, the modern approach supports a non-monotonic effect of the financial system on industrialization. Several authors including Cecchetti & Kharroubi, (2012, 2019) and Kothakapa et al., (2021) find a non-linear relationship between the financial system and industrialization. Cecchetti and Kharroubi (2012) show that financial development has a U-inverted-shaped effect on productivity growth. According to them, a financial boom generates competition between the financial sector and the real economy for scarce resources (skilled workers, physical capital). This overdevelopment of finance will benefit the financial sectors and reflect on the collateral of loans to the detriment of R&D-intensive sectors. Using 33 manufacturing industries from 17 developed countries, Cecchetti and Kharroubi (2019) conclude that credit growth negatively affects industries that either have low asset tangibility or are R&D-intensive. However, Kothakapa et al., (2021) highlight a U-shaped relationship between financial development and industrialization in many developing countries. They show that financial development hurts the growth of the manufacturing sector up to a certain threshold beyond which the effect is positive. These results can be explained by the fact that when financial development is low, capital accumulation tends to be associated with low allocative efficiency (Marconi & Upper, 2017) which can be outright corporate fraud or capital outflows (Györy, 2020). In addition, the industrialization process requires significant resources for industries to benefit from economies of scale. These resources can be mobilized in the presence of a large financial system.

Financial could affect industrialization by increasing access to financial services and deepening the financial system. First, in developing countries, people have low access to the financial system (around 20 percent) and firms have low access to credit. Due to market constraints, most of the population is excluded from the financial system, which creates a potential loss of savings and investable funds. In this line, Aportela (1999) and Allen et al. (2016) show that financial increases the saving of poor people in developing countries. The mobilization of additional resources by the financial system can be used to finance the development of industrialization. In addition, FI enables households and firms to have more access to investable resources. Consequently, FI allows agents to participate in long-term investment activities, and facilitate an efficient allocation of productive resources through a reduction in the cost of capital and informal sources of credit (Demirguc-Kunt et al., 2015; Demirgüç-Kunt et al., 2020). Moreover, by accessing financial services (saving, credit), households may engage in riskier high-yielding activities (Banerjee et al., 2013; Guiso et al., 2004; Klapper et al., 2006; Rewilak, 2013), and create new microenterprises and firms in the industrial sector. For example, Nizam

et al. (2020) demonstrate that FI affects manufacturing firms' growth in three selected ASEAN countries (Malaysia, Philippines, and Vietnam). Second, FI can spur industrialization by improving financial system stability. Indeed, Demirgüç-Kunt & Huizinga, (2010) defend that in an inclusive financial sector, by involving out to more people, financial institutions can garner ample cheap retail deposits whilst decreasing reliance on volatile wholesale funding. In addition, an inclusive financial sector helps financial institutions (for instance banks, and microfinance) to decrease asymmetric information problems by increasing relationships with customers (Petersen et al., 1995). When the distance between customers and financial institutions is reduced (through more bank branches for example), financial institutions have precise information on customer quality (Hauswald & Marquez, 2006). By improving lending conditions, an inclusive financial sector contributes to stabilizing the financial system.

However, these studies did not take into account the role of globalization. Indeed, Frôbel et al. (1980) argue that the global reorganization of manufacturing, called the new international division of labor, is the defining characteristic of the latest generation of globalization. Moreover, Gereffi et al. (2005) claim that the manufacturing industry is currently organized through complex networks of companies, sometimes referred to as global commodity chains or global value chains. Gereffi (2001) and Kaplinsky, (2000) also indicate that within these networks created by globalization, companies from developed countries relocate their manufacturing activities to developing countries by investing or subcontracting, while focusing on higher-value activities such as research and development and marketing. All this should therefore increase manufacturing exports and FDI, thus accelerating the development of the manufacturing industry in developing countries.

This paper bridges this gap and analyzes the potential role of globalization in the relationship between FI and industrialization. Globalization is considered a concomitant factor to explain class membership and explore the relationship between FI and industrialization development.

III. Data and Descriptive Statistics

Driven by data availability, our sample covers 64 developing countries from 2000 to 2020[4]. We averaged our sample of 21 years into 3-year non-overlapping periods to mitigate short-term fluctuations (2000-2002, 2003-2005, 2006-2008, 2009-2011, 2012-2014, 2015-2017, 2018-2020). Following the empirical literature (Kang & Lee, 2011) Gui-Diby & Renard, (2015), and Haraguchi et al., (2019)), we use manufacture value added as a share of GDP to proxy industrialization. We also use per capita manufacture value-added as the alternative variable for industrialization

4) The list of countries is presented in Table A1 in the Appendix.

to assess the robustness of our results. As for the interest variable, we use the FI index developed by Svirydzenka (2016)[5]. This index has the advantage of providing indicators that consider the multidimensional nature of FI. It is calculated based on nine indices that summarize the degree of development of financial institutions and financial markets in terms of depth, access, and efficiency. Finally, these indices are then grouped into a composite financial development index which better reflects the inclusive nature of financial development (see Svirydzenka (2016) for more details). Our control variables include the main determinants of industrialization. For instance, we include the following variables as a share of GDP: Agriculture, forestry, and fishing value added, total of investment, government revenue, trade, remittances, FDI net inflows, and natural resources rents. We also include inflation, urbanization rate, access to mobile phones, and an electoral democracy index. Our data stem from five main sources, namely the World Development Indicators (WDI), the World Economic Outlook (WEO) database, the International Country Risk Guide (ICRG) and the Varieties of Democracy (V-Dem)[6]. Table 1 presents the descriptive statistics.

Table 1. *Descriptive Statistics*

Variables	Obs	Mean	SD	Min	Max
Manufacture VA (% of GDP)	443	13.594	6.482	1.732	48.878
log(Manufacture VA per Capita)	443	9.681	2.541	3.111	16.290
Financial inclusion index	448	0.215	0.143	0.029	0.718
Agriculture, VA (% of GDP)	448	14.950	10.273	1.480	59.037
Urban population (% of total)	448	51.556	17.742	15.204	91.990
Inflation	433	8.057	18.598	-7.1705	301.788
Investment (% of GDP)	448	23.918	8.010	5.446	63.562
General government revenue (% of GDP)	448	22.099	9.299	2.838	62.699
Trade (% of GDP)	447	69.879	30.345	22.800	207.709
Remittances (% of GDP)	443	4.422	5.242	0	33.188
FDI inflows (% of GDP)	446	3.646	4.382	-7.781	47.744
Natural resources rents (% of GDP)	448	8.705	10.308	0.074	63.239
Mobile cellular subscriptions (per 100 people)	447	66.951	47.299	0	174.116
Internet users (% of the population)	441	20.953	22.240	0.036	84.981
Access to electricity (% of population)	448	68.691	31.727	1.279	100
Terms of trade adjustment	431	1.48e+12	3.13e+13	-2.28e+14	4.10e+14
Composite country risk	446	65.315	6.356	43.640	83.604
Electoral democracy index	448	0.479	0.188	0.072	0.911

5) The index is constructed by Svirydzenka (2016) using a standard three-step approach to reduce multidimensional data into a single summary index: (i) standardization of variables; (ii) aggregation of standardized variables into sub-indexes representing a particular functional dimension; and (iii) aggregation of sub-indexes into the final index. A total of nine indices covering financial institutions and financial markets have been aggregated to obtain a single index of financial inclusion.

6) The detailed description of the variables in Table A2 in the Appendix

IV. Econometric Specifications

Previous work on the determinants of industrialization has used standard regression models that restrict homogeneous parameters (Asongu & Odhiambo, 2020; Efobi et al., 2019; Haraguchi et al., 2019; Kothakapa et al., 2021). Indeed, the implicit hypothesis imposed by its standard approaches is too restrictive and does not allow us to identify the impact of the explanatory factor. These regressions assume that all individuals in the sample face similar constraints and behave identically. Thus, the assumption that all observations can be characterized by a single pattern may mask critical features of the data (Morduch & Stern, 1997). In particular, these traditional modeling techniques assume that countries follow the same process of industrialization and do not capture the presence of heterogeneities within subgroups or classes (Di Vaio & Enflo, 2011; Flachaire et al., 2014; Heckman & Singer, 1984; Ouedraogo et al., 2021).

To overcome these shortcomings, we rely on a finite mixture regression model. Finite mixture regressions are semi-parametric methods to model unobserved heterogeneity in the population. They allow us to relax the assumption of a structural transformation model and to assume that there can be several trajectories of industrialization in developing countries, i.e., different classes so that the determinants of industrialization can have different marginal effects depending on the classes. To illustrate the approach, consider the simple case of two industrialization trajectories in developing countries. A finite mixture of linear regressions assumes that an observation belonging to the first class and an observation belonging to the second class would not be generated by the same data generation process (Flachaire et al., 2014). The finite mixture model can be written as follows:

$$\begin{aligned} Class1 \ : \quad & Y = X\beta_1 + \epsilon_1, \ \epsilon_1 \sim N(0, \ \sigma_1^2) \\ Class2 : \quad & Y = X\beta_2 + \epsilon_2, \ \epsilon_2 \sim N(0, \ \sigma_2^2) \end{aligned} \tag{1}$$

Where YY is the dependent variable, XX is a set of covariables, and $\epsilon_1\epsilon_1$ and $\epsilon_2\epsilon_2$ are independent and identically normally distributed (iind) error terms within each group, with variance of ${\sigma_1}^2{\sigma_1}^2$ and ${\sigma_2}^2{\sigma_2}^2$ respectively. Since the sets of coefficients $\beta_1\beta_1$ and $\beta_2\beta_2$ are not (necessarily) equal, independent variables XX do not explain in the same way differences in YY between observations belonging to the first group and between observations belonging to the second group.

In the context of industrialization regressions, the finite mixture model assumes that countries can be classified into two (or more) classes, associated with two different structural transformation trajectories i.e., of different industrialization, and that at least one covariate (in our case FI) does not explain the industrialization gaps within the two groups in the same way. It should

be noted that such an assumption can be accounted for in standard regressions if one includes additional covariates calculated as cross-products of the FI variable with a dummy variable that specifies class membership. In this case, the classes must be defined a priori based on a prior belief, such as the assumption that the convergence coefficient is different for countries in developing countries. In contrast, in a finite mixture model, class membership is not imposed but rather estimated to create homogeneous classes in terms of the relationship between YY and XX Moreover, the number of classes is not fixed but determined endogenously according to a criterion or an econometric test.

A general finite mixture regression model can be written as follows:

$$f(y|x,\gamma;\Theta)=\sum_{c=1}^{C}\pi_c(\gamma,\ \alpha_c)\phi(y|x;\beta_c,\sigma_c) \tag{2}$$

Where C is the number of classes, $\pi_c(\gamma,\ \alpha_c)$ is the probability of belonging to class C with a set of specific concomitant variables γ and $\phi(y|x;\beta_c,\sigma_c)$ is the distribution of industrialization conditional on belonging to class C and on covariates x. The parameters α_c, β_c, and σ_c are unknown and hence estimated. If we consider $\phi(y|x;\beta_c,\sigma_c)$ as Gaussian distributions with conditional expectations equal to $E(y|x)=x\beta_c$, for $C=1$ this model reduces to $class1:$ $y=x\beta_1+\epsilon_1$ and for $C=2$ this model reduces to class2: $y=x\beta_2+\epsilon_2$.

The probability of belonging to a given class c' is:

$$\pi_{c'}=\frac{\exp\left(\alpha_{c'}+\gamma\alpha_{c'}\right)}{\sum_{c=1}^{C}\exp\left(\alpha_{c'}+\gamma\alpha_{c'}\right)},\ with\ 0\langle\pi_{c'}\langle 1\ \text{and}\ \sum_{c=1}^{C}\pi_{c'}=1 \tag{3}$$

The estimation can be carried out using maximum likelihood with the Expectation-Maximization (EM) algorithm of Dempster, Laird, & Rubin (1977) and this is the procedure we will follow.

$$\max_{\pi,\Theta}\log\ L=\sum_{i=1}^{N}\left(\log\left(\sum_{c=1}^{C}\pi_c f_c(y|\Theta_c)\right)\right) \tag{4}$$

Furthermore, as recommended by Hawkins, Allen, & Stromberg (2001) in the case of a finite mixture of linear regression, the Bayesian Information Criterion (BIC) or the Akaike Information Criterion (AIC) are the criteria for choosing the components. We use the BIC (Schwarz (1978)) to choose the number of components. More specifically, the BIC is defined as:

$$BIC = -2\log(L) + K\ \log(N) \tag{5}$$

Where log (L) is the estimated value of the log-likelihood estimated in (3), L is the number of free parameters and N is the number of observations.

V. Empirical Results

We first present how we determine the appropriate number of classes for the finite mixture regression model, then we analyze the relationship between FI and industrialization concerning the different classes. Finally, we perform some robustness tests to assess the stability of the results.

A. Baseline results

We select the number of classes using the BIC (Bayesian Information Criterion). Table 2 reports the BIC values for different number of classes. Usually, the optimal model is the one that has the lowest values of BIC. Given that the BIC values' trend change (declining from C=1 to C=3 and increasing from C=3 to C=4), the BIC values are minimized in C=3. The value for this criteria is minimal in C=5 but they become non-concave beyond C=6, excluding any possibility for this class to be the optimal class that minimizes the BIC. To sum up, we select the finite mixture model with three classes given that the BIC value is minimal when the number of classes is 3.

Table 2. *Selection of the Number of Classes*

Number of class	C=1	C=2	C=3	C=4	C=5	C=6
BIC	2665.755	2547.11	2439.601	2458.373	2475.252	Not Concave

Table 3 below shows the descriptive statistics of our dependent and interest variables across different classes. On average, the level of industrialization differs across the three classes. The first class includes countries with the lowest level of industrialization, followed by the second class and the third class, respectively (relatively high levels of industrialization). This already suggests that the three classes of countries do not have the same industrialization trajectories and confirms our choice of the finite mixture regression model.

Table 3. *Descriptive Statistics of the Dependent and Interest Variables in Each Class*

Variables	Obs	Mean	Std. dev.	Min	Max
Class 1					
Manufacture VA (% of GDP)	172	12.872	4.779	1.732	26.537
Log (Manufacture VA per Capita)	172	9.468	2.725	3.111	15.877
Financial inclusion index	172	0.199	0.13	0.033	0.634
Class 2					
Manufacture VA (% of GDP)	173	12.726	5.710	2.980	29.815
Log (Manufacture VA per Capita)	173	9.717	2.304	4.803	16.290
Financial inclusion index	173	0.246	0.158	0.029	0.714
Class 3					
Manufacture VA (% of GDP)	98	16.391	9.12	2.648	48.878
Log (Manufacture VA per Capita)	98	9.990	2.595	3.184	15.734
Financial inclusion index	103	0.191	0.124	0.032	0.718

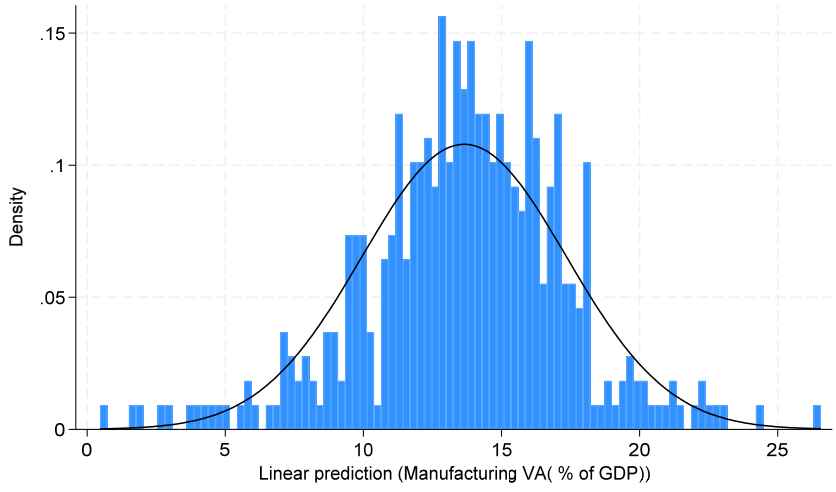
We aim to test the hypothesis that the effect of FI on industrialization depends on the class in which countries belong. We relax the hypothesis of one industrialization class and assume C different homogeneous industrialization classes such that the determinants of industrialization have different marginal impacts across class. This allows us to test the hypothesis that the marginal impact of the FI on industrialization differs across classes.

Table 4 presents the baseline results from generalized least squares (GLS), system generalized method of moments (GMM-sys) regressions, and Finite Mixtures Models (FMM) with three classes. The results show that the coefficient associated with the FI index is statistically significant when we use the GLS estimator for a single model while it is not significant when with GMM estimator is used.

Thus, the coefficient associated with FI is statistically significant at a 1% level with the GLS estimator. An increase in FI by 0.1 point percentage is associated with an increase in manufactured value added to GDP by 9.591 %.

Figure 1 presents the predicted values of manufacturing value added to GDP obtained through the GLS model. Thus, the figure clearly shows that the distribution does not seem to be normal, which already portends a certain heterogeneity that is not considered in traditional regressions. Therefore, as pointed out above, these traditional econometric models (GLS and GMM) do capture the potential differential effects between countries. We overcome the shortcomings of these traditional models by using a finite mixture regression model.

Figure 1. Distribution of predicted manufacturing VA (% of GDP) using GLS



(Source) Authors calculations.

Table 4. *The Effects of FI on Industrialization*

VARIABLES	GLS	GMM-system	GLS-FMM		
			Class 1	Class 2	Class 3
Manufacture VA (% of GDP), t-1		0.849*** (12.98)			
Financial inclusion index	9.591*** (3.73)	0.418 (0.16)	-12.865*** (-3.49)	23.068*** (11.06)	21.886*** (15.17)
Agriculture, VA (% of GDP)	-0.170*** (-4.27)	-0.032 (-1.08)	-0.276*** (-8.95)	-0.062 (-1.20)	-0.559*** (-25.43)
Urban population (% of total)	0.067*** (2.82)	0.007 (0.26)	0.075** (2.41)	0.024 (0.85)	-0.032* (-1.89)
Inflation	-0.038 (-1.00)	-0.025 (-1.06)	0.145*** (4.36)	-0.193*** (-2.78)	-0.232*** (-14.37)
Investment (% of GDP)	0.153*** (3.87)	0.008 (0.16)	0.171*** (3.15)	-0.191*** (-2.78)	-0.017* (-1.75)
General government revenue (% of GDP)	-0.155*** (-3.94)	-0.087*** (-3.50)	-0.074** (-2.04)	-0.360*** (-8.47)	0.280*** (18.63)
Trade (% of GDP)	0.047*** (4.33)	0.040* (1.74)	-0.031 (-1.57)	0.055*** (4.18)	0.015*** (2.87)
Remittances (% of GDP)	-0.058 (-1.01)	-0.025 (-0.44)	-0.091** (-2.03)	0.058 (0.99)	-0.050** (-2.40)
FDI inflows (% of GDP)	-0.390*** (-5.65)	-0.103 (-0.86)	-0.108 (-1.21)	0.059 (0.37)	-0.941*** (-33.56)
Natural resources rents (% of GDP)	-0.175*** (-4.55)	-0.000 (-0.01)	-0.285*** (-10.45)	-0.081** (-2.02)	0.534*** (34.52)
Mobile cellular subscriptions (per 100 people)	-0.013 (-1.45)	-0.008 (-1.64)	0.025** (2.13)	-0.016* (-1.74)	-0.046*** (-12.62)

Table 4. *Continued*

VARIABLES	GLS	GMM-system	GLS-FMM		
			Class 1	Class 2	Class 3
Internet users (% of the population)	-0.042** (-1.99)	0.005 (0.28)	-0.024 (-0.70)	-0.056*** (-3.08)	-0.120*** (-13.54)
Composite country risk	-0.097 (-1.61)	-0.012 (-0.31)	0.083 (1.43)	-0.092 (-0.82)	0.208*** (7.67)
Electoral democracy index	-5.791*** (-3.49)	-2.172 (-0.60)	-3.746*** (-2.86)	-8.032*** (-3.48)	-0.050 (-0.10)
Constant	21.454*** (5.23)	3.886 (1.30)	13.082*** (4.09)	29.640*** (6.54)	11.458*** (6.43)
Observations	417	363	156	201	60
Number of id	64	63	24	31	9
P-value AR1		0.034			
P-value AR2		0.354			
Number of instruments		52			
Hansen test. p-value		0.356			
Posterior probability			0.374	0.483	0.143
Log-likelihood	-1284.613			-1068.973	

z-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1

The results of the finite mixture models with three classes (i.e., C=3) using manufactured value added as a dependent variable indicate that the impact of FI on industrialization differs across the three classes of countries. FI significantly reduces manufactured value added in the first class of countries. Conversely, FI significantly increases the manufactured value added in the second and third classes of countries. The coefficient associated with FI is negative and statistically significant in the first class which contains countries with a low level of industrialization. In contrast, the coefficient associated with FI is positively and significantly associated with manufactured value added in the second and third classes of countries. Specifically, a 0.1 percentage point increase in the FI index leads to a reduction in manufactured value added to GDP by 1.286% in the first class, while, a 0.1 percentage point increase in the FI index leads to an increase in manufactured value added to GDP by 2.306% and 2.188% respectively in the second class and third class of countries.

This finding is consistent with previous studies that underscore the importance of financial development in the industrialization process (Heblich & Trew, 2019; Kothakapa et al., 2021; Rajan, Raghuram G. and Zingales, 1998). For instance, Heblich & Trew (2019) highlight that access to banking services is an underlying growth mechanism through increased industrial employment and the inter-industrial transition towards sub-sectors with high technical factor productivity and high capital intensity. Kothakapa et al., (2021) also find that inadequate financial development harms the growth of the manufacturing sector.

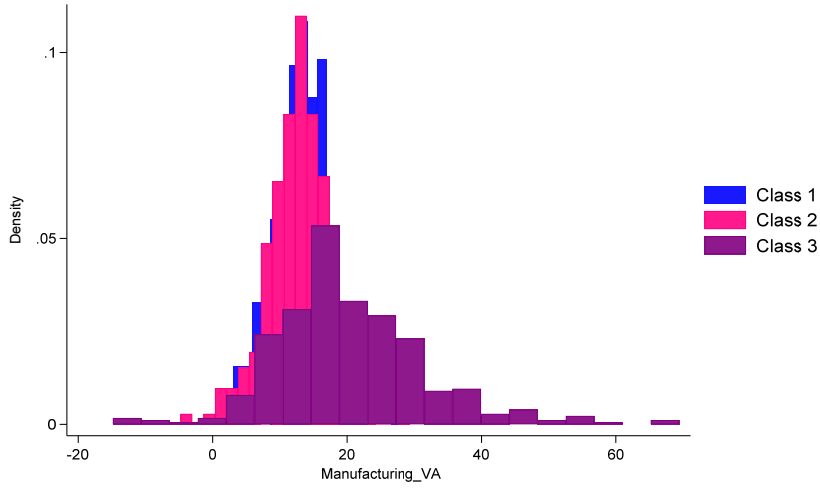
We also present the posterior probability for each class. It shows that about 37.37% of the observations are in class 1 and about 48.27% and 14.36% are in class 2 and class 3 respectively (Table 4). However, to obtain the associated levels of industrialization and FI for each class of countries, we calculate their marginal means. Table 5 shows the results. As we can observe, the first class corresponds to the lowest levels of industrialization and FI while the second and third classes are associated with relatively high levels of industrialization and FI. We also observe that FI has a positive effect on industrialization in countries where the level of FI is high (second-class countries). The negative effect in the first class of countries can be explained by the fact higher FI might lead to financial instability if there is weak banking supervision (Cihak et al., 2016; Dabla-Norris et al., 2015; Han & Melecky, 2013) and significantly reduces industrialization.

Table 5. *Latent Class Marginal Means*

	Class 1	Class 2	Class 3
Manufacture VA (% of GDP)	12.872	12.726	16.391
Financial inclusion index	0.199	0.246	0.191
Observations		417	

Figure 2 presents the distribution of the predicted level of manufacture value added by class, showing that the three classes differ in terms of manufacture value added. Countries in class 3 are at the left and right ends of the distribution and more pronounced on the right, suggesting that they are more likely to have a high level of manufacturing value added. This finding is consistent with Table 4 which shows that on average manufacturing value added is higher in Class 3 compared to the two classes. However, countries in class 1 and 2 seem to have similar characteristics.

Figure 2. Distribution of the predicted level of manufacture value added by class



We analyze the composition of the three classes of countries based on the posterior probability. The posterior probability that a specific country belongs to a given class can be calculated using the Bayes rule. The posterior probability that country i belongs to class c is equal to:

$$\hat{\pi}_{ic'} = \frac{\hat{\pi}_{c'}\left(\gamma_i + \hat{\alpha}_{c'}\right)\phi_{c'}\left(y_i|x_i, \hat{\beta}_k, \hat{\sigma}_k\right)}{\sum_{c=1}^{C}\pi_c\left(\gamma_i, \hat{\alpha}_{c'}\right)\phi_c\left(y_i|x_i;\beta_c, \sigma_c\right)} \tag{6}$$

Our baseline model (Table 4) allows us to calculate the posterior probabilities. We assign country i to class 1 if and only if the probability of belonging to this class is greater than that of belonging to classes 2 and 3. Table A3 in the appendix shows the class membership of countries and the associated posterior probabilities. For example, Bangladesh, Ecuador, and Mali remained in class 1 during the period 2000-2020, Angola Burkina Faso, Botswana, and Zambia remained in class 2 and Alegria and the Philippines remained in class 3 during the same period. On the other hand, other countries have moved from one class to another. For instance, Cote d'Ivoire, Congo, Egypt, Guinea-Bissau have moved from class 1, 2 and 3 during the period 2000-2020. This result could be explained by the instability of economic policies' implementation following political turmoils in these countries.

B. Robustness analysis

To assess the robustness of our results, we (i) use an alternative measure of industrialization and (ii) include additional control variables in our baseline model.

1. Alternative measure of industrialization

We estimate our baseline model using an alternative measure for industrialization, namely *manufacturing value added per capita*[7]. As shown in Table 6, FI is positively and significantly associated with industrialization in the second class of countries. This finding is consistent with our baseline results. The coefficient associated with FI remains negative and statistically significant in class 1 and positively significant in classes 2 and 3. Consequently, our results remain unchanged despite the use of alternative indicators to measure industrialization.

7) This variable is defined as the average amount that each inhabitant spends on the manufacturing sector.

Table 6. *The Effects of FI on an Alternative Measure of Industrialization*

Log(Manufacturing, VA per Capita)	GLS-FMM		
	Class 1	Class 2	Class 3
Financial inclusion index	-4.896*** (-5.42)	11.687*** (3.99)	2.776*** (3.41)
Agriculture, VA (% of GDP)	-0.192*** (-17.27)	0.106* (1.79)	0.034*** (3.32)
Urban population (% of total)	-0.066*** (-6.45)	0.111*** (4.38)	-0.072*** (-10.46)
Inflation	-0.109*** (-9.40)	-0.161 (-1.33)	0.034*** (4.36)
Investment (% of GDP)	-0.011 (-1.32)	0.063 (1.33)	0.061*** (3.25)
General government revenue (% of GDP)	-0.053*** (-4.57)	-0.031 (-0.64)	-0.068*** (-4.25)
Trade (% of GDP)	0.001 (0.22)	0.061*** (6.97)	0.001 (0.17)
Remittances (% of GDP)	0.016 (0.68)	-0.268*** (-5.68)	-0.023 (-1.11)
FDI inflows (% of GDP)	-0.178*** (-13.17)	-0.251*** (-3.68)	0.106*** (3.99)
Natural resources rents (% of GDP)	0.093*** (7.83)	-0.157*** (-3.53)	0.056*** (3.84)
Mobile cellular subscriptions (per 100 people)	0.008* (1.94)	0.002 (0.26)	0.002 (0.78)
Internet users (% of the population)	0.013* (1.86)	-0.030 (-1.50)	0.020** (2.12)
Composite country risk	-0.069*** (-3.03)	-0.113* (-1.88)	0.005 (0.22)
Electoral democracy index	-1.383* (-1.81)	1.047 (0.75)	0.392 (0.84)
Constant	23.888*** (23.48)	8.426* (1.83)	9.458*** (6.43)
Observations	126	111	180
Number of id	19	17	28
Posterior probability	0.302	0.266	0.431
Log-likelihood		-790.3	

z-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1

2. Additional control variables

In this robustness check, we introduce more control variables. These variables include *access to electricity* and *a term of trade adjustment.* Access to electricity captures the production cost in the process of industrialization. Rosenberg, (2015) underscores the important role of electricity in the industrial process over the last century in America. However, he shows that industrialization

does not necessarily imply an increase in energy intensity given the emergence of other forms of energy. The terms of trade can influence the development of manufacturing either through the intensification of the costs of acquiring equipment or by increasing the costs of large quantities of consumer goods. For example, if a country specializes in manufacturing exports, an increase in terms of trade leads to an increase in exports and therefore industrialization (Lee, 2023). Table 7 shows that our results are not sensitive to the addition of control variables. The inclusion of additional determinants of industrialization does not alter our results.

Table 7. *The Inclusion of Additional Control Variables*

	GLS-FMM		
	Class 1	Class 2	Class 3
Financial inclusion index	-14.215***	6.126***	14.297***
	(-5.18)	(2.86)	(6.79)
Agriculture, VA (% of GDP)	-0.561***	-0.149***	0.520***
	(-8.51)	(-5.35)	(5.33)
Urban population (% of total)	-0.265***	0.133***	-0.160***
	(-8.34)	(7.34)	(-3.32)
Inflation	-0.048**	0.006	0.006
	(-2.10)	(0.27)	(0.43)
Investment (% of GDP)	-0.072**	0.132***	-0.152***
	(-1.98)	(2.63)	(-3.67)
General government revenue (% of GDP)	-0.185***	-0.296***	0.341***
	(-2.77)	(-15.00)	(11.16)
Trade (% of GDP)	-0.038**	0.101***	-0.059***
	(-2.27)	(12.48)	(-6.35)
Remittances (% of GDP)	-0.192	-0.038	-0.289***
	(-1.53)	(-1.12)	(-6.99)
FDI inflows (% of GDP)	0.168**	-0.781***	-0.672***
	(2.53)	(-7.22)	(-25.59)
Natural resources rents (% of GDP)	-0.103**	0.002	0.364***
	(-1.98)	(0.04)	(9.92)
Mobile cellular subscriptions (per 100 people)	-0.002	-0.013**	-0.044***
	(-0.21)	(-2.26)	(-4.88)
Internet users (% of the population)	0.058	-0.060***	-0.145***
	(1.58)	(-5.03)	(-8.72)
Composite country risk	0.314***	-0.277***	0.440***
	(4.86)	(-7.18)	(8.68)
Electoral democracy index	3.885***	-3.739**	-17.493***
	(3.08)	(-2.24)	(-11.60)
Access to electricity (% of population)	0.056***	0.022**	0.312***
	(3.16)	(2.15)	(23.68)
Terms of trade adjustment	0.000***	0.000***	-0.000
	(4.83)	(3.71)	(-1.60)
Constant	19.707***	27.550***	-19.404***
	(5.82)	(7.80)	(-3.55)

Table 7. *Continued*

	GLS-FMM		
	Class 1	Class 2	Class 3
Observations	159	198	60
Number of id	24	30	9
Posterior probability	0.382	0.474	0.143
Log-likelihood		-1024	

Z statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

3. Explaining class membership: The role of globalization

After examining the classification of countries, it is necessary to identify the factors that contribute to explaining membership in a class. We extend our basic model by incorporating concomitant variables to analyze the determinants of the classification of countries in the different manufacturing value-added classes. Given that the probability of being in class 2 is high and that in this class FI positively influences manufacturing value-added, we will focus our analysis on this class. Thus, we define a dummy variable taking the value one if the country is in class 2 and 0 otherwise. The Mundlak model with random effects (Mundlak, 1978) is then used to estimate the correlations of membership in class 2. The advantage of the Mundlak model with random effects is that it takes into account countries that are not in class 2, while the fixed effects model leaves these countries aside and addresses the question of accessory parameters. Furthermore, the RE-Mundlak approach controls for all unexplained differences between countries, taking into account all country-specific and time-invariant characteristics that may affect the probability of belonging to class 2. In this context, we examine the role of globalization in the relationship between FI and industrialization. We seek to understand the factors that explain membership in a class. To this end, we focus on the different components of globalization as concomitant variables to estimate whether the level of globalization makes a country more likely to belong to a class. Indeed, previous work (Gereffi et al., 2005; Kaya, 2010) has argued that manufacturing is now organized through complex networks of firms, sometimes referred to as global commodity chains or global value chains. As a result, within these networks, companies from developed economies relocate their manufacturing activities to developing countries by investing or subcontracting, while focusing on higher-value activities such as research and development and marketing (Gereffi et al., 2005; Kaplinsky, 2000). Therefore, translates into an increase in manufacturing exports and FDI, as well as an expansion of manufacturing employment in developing countries. Therefore, globalization simply decreases the cost of manufacturing goods.

For this, we use the different components of globalization by Gygli et al. (2018, 2019) which provides an assessment of the political and social dimensions of countries. We estimate the following equation:

$$MVA\_Po_{i,t} = \phi_i + \omega Globalization_{i,t} + \vartheta_{i,t} \quad (7)$$

Where $MVA\_Po_{i,t}$ is a binary variable taking the value 1 if country i is in group 2 and therefore experiences a positive effect at time t. $Globalization_{,t}$ represents the globalization variable KOF, is $\vartheta_{i,}$ the error term. Regarding the globalization variables, we consider the following : (i) Economic globalization which includes commercial and financial globalization. Indeed, it characterizes the long-distance flows of goods, capital, and services as well as the information and perceptions that accompany market exchanges, ii) Social globalization includes interpersonal, informational, and cultural globalization. It expresses the diffusion of ideas, information, images, and people, and, iii) Political globalization which is characterized by the diffusion of government policies through the establishment of embassies, participation in United Nations peacekeeping missions, affiliation with international organizations, signing of international treaties, etc. The globalization index is approximated by KOF Globalization Index, compiled by Gygli et al., (2019)[8].

The results are reported in Table 8. We see that all the coefficients associated with the different dimensions of globalization are positive and statistically significant except that of political globalization. This means that an increase in economic globalization and social globalization index by 1 percent increases the probability that a country from one of the other classes moves to class 2 by 0.021003 percent and 0.021033 percent, respectively. The results suggest that countries with a low level of globalization are likely to be in class 2. Therefore, developing countries with a high level of globalization, specifically the high level of economic globalization and social globalization are more likely to be part of the class in countries where financial inclusion significantly increases manufacturing value added. This result is consistent with previous studies which have shown that globalization increases the industrialization development in countries (Kaya, 2010).

Table 8. *The Role of Globalization in the Relationship between FI and Industrialization*

Variables	Marginal effect of variables		
Economic Globalisation	0.021*** (7.21)		
Social Globalisation		0.021*** (14.13)	
Political Globalisation			-0.001 (-0.37)
Observations	412	412	412
Log pseudolikelihood	-1049.040	-1045.988	-1071.741

Z statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

8) For more information on the calculation of globalization indicators, see the following link: https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html

VI. Conclusion and Policy Implications

Our paper extends the literature by exploring the impact of FI on industrialization in developing countries. Considering the possibility that countries might be grouped into different classes, we used a finite mixture model that allows us to relax the single model featured in traditional estimators. Our approach consists of determining endogenously if our data is better generated by multiple hidden classes of similar countries (so that the effect of FI on industrialization differs across these classes). This produces more adaptable results, which fit the data better. Using a sample of 64 developing countries over the period 2000-2020, we find that this sample is best described by a model with three classes of countries. We also find that the impact of FI on industrialization differs across these three classes of countries. Specifically, FI is negatively associated with industrialization in the first class of countries, while it positively affects industrialization in the second and third class of countries. These results are robust to alternative specifications with the addition of control variables. They also hold when we use an alternative measure for industrialization. Furthermore, the analyses show that countries characterized by high levels of globalization are likely to be in the class where the FI increases manufacturing value added.

Our results lend support to previous investigations on the importance of financial development in the industrialization process (Heblich & Trew, 2019; Kothakapa et al., 2021; Rajan, and Zingales, 1998). These results partly confirm previous studies on the effect of FI in increasing industrialization in countries with high economic and social globalization. Our results suggest that developing countries could reap more benefits from FI and foster the industrialization process by improving their integration (economic, social, and political) into the global economy. They should design and implement sound policies that improve their participation in the global economy.

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Appendix

Table A1. *Sample of Countries*

Number	Country	Number	Country
1	Albania	33	Kenya
2	Algeria	34	Libya
3	Angola	35	Madagascar
4	Argentina	36	Malaysia
5	Azerbaijan	37	Mali
6	Bangladesh	38	Mexico
7	Belarus	39	Moldova
8	Bolivia	40	Mongolia
9	Botswana	41	Morocco
10	Burkina Faso	42	Mozambique
11	Cameroon	43	Namibia
12	Colombia	44	Nicaragua
13	Congo, Dem. Rep.	45	Niger
14	Congo, Rep.	46	Nigeria
15	Costa Rica	47	Pakistan
16	Cote d'Ivoire	48	Paraguay
17	Dominican Republic	49	Peru
18	Ecuador	50	Philippines
19	Egypt, Arab Rep.	51	Russian Federation
20	El Salvador	52	Senegal
21	Gabon	53	Serbia
22	Gambia, The	54	Sierra Leone
23	Ghana	55	South Africa
24	Guatemala	56	Sri Lanka
25	Guinea	57	Tanzania
26	Guinea-Bissau	58	Thailand
27	Haiti	59	Togo
28	Honduras	60	Tunisia
29	India	61	Turkiye
30	Indonesia	62	Uganda
31	Jamaica	63	Vietnam
32	Kazakhstan	64	Zambia

Table A2. *Description of Variables, and Sources*

Variables	Descriptions	Sources
Financial inclusion index	The composite index ranges from zero (0) to one (1) and is a multidimensional measure of financial and stock market development using eight variables. It considers the accessibility, efficiency, and depth of financial markets. For more details see Svirydzenka, (2016).	International Monetary Fund (IMF)
General government revenue (% GDP)	Revenue consists of taxes, social contributions, grants receivable, and other revenue.	
Total investment (% of GDP)	Investment or gross capital formation is measured by the total value of the gross fixed capital formation and changes in inventories and acquisitions less disposals of valuables for a unit or sector.	
Manufacture Value added (%GDP)	The value added of the manufacturing sector as a percentage of the GDP (constant prices).	World Development Indicators (WDI)
Agriculture. Value added (% of GDP)	Sum of Agriculture, forestry, and fishing, value added divided by GDP).	
Urban population (% of total)	Urban population refers to the ratio between the urban population and the total population.	
Inflation	Annual percentage change of consumer price index.	
Trade (%GDP)	Trade is the sum of exports and imports of goods and services measured as a share of GDP.	
Remittances (% of GDP)	Personal remittances received (% of GDP).	
FDI inflows (%GDP)	Net inflows in a given economy from foreign investors, divided by GDP.	
Natural resources rents (%GDP)	Total natural resources rents are the sum of natural resources rents as a share of GDP.	
Mobile cellular subscriptions	Number of postpaid subscriptions, and the number of active prepaid accounts (i.e. that have been used during the last three months per 100 people.	
Access to electricity (% population)	Access to electricity is the percentage of the population with access to electricity.	
Terms of trade adjustment	The terms of trade effect equal capacity to import less exports of goods and services in constant price	
Composite country risk	The composite scores, ranging from zero to 100, are then broken into categories from Very Low Risk (80 to 100 points) to Very High Risk (zero to 49.9 points).	ICRG
Electoral democracy index	This index represents the average of: (i) the weighted average of the indices measuring freedom of association, clean elections, freedom of expression, elected officials, and suffrage and (ii) the five-way multiplicative interaction between those indices.	Varieties of Democracy (V-Dem)
Economic globalization index	Economic globalization (scale of 1 to 100) covers both trade flows as well as financial flows. De facto trade is determined with reference to the trade in goods and services. De jure trade covers customs duties, taxes and restrictions on trade	The KOF Globalization Index - revisited
Political globalization index	Political globalization (scale of 1 to 100) regards the de facto segment measured with reference to the number of embassies and international non-governmental organisations (NGOs), along with partici-pation in UN peacekeeping missions. The de jure segment contains variables focussing on the membership of international organisations and international treaties.	
Social globalization index	Social globalization (scale of 1 to 100) is comprised of three segments, each with its own de facto and de jure segment. Interpersonal contact is measured within the de facto segment with reference to international telephone connections, tourist numbers and migration. Within the de jure segment, it is measured with reference to telephone subscriptions, international airports and visa restrictions	

Table A3. *Group Membership*

country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3	country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3
Azerbaijan	1	1	0.73	0.27	0.00	Congo. Dem. Rep.	6	2	0.00	1.00	0.00
Azerbaijan	2	1	0.71	0.29	0.00	Congo. Dem. Rep.	4	2	0.00	1.00	0.00
Bangladesh	5	1	0.55	0.43	0.03	Congo. Dem. Rep.	5	2	0.00	1.00	0.00
Bangladesh	1	1	0.56	0.44	0.00	Congo. Rep.	5	2	0.00	1.00	0.00
Bangladesh	6	1	0.57	0.43	0.00	Congo. Rep.	4	2	0.03	0.97	0.00
Bangladesh	2	1	0.60	0.40	0.00	Colombia	7	2	0.01	0.99	0.00
Bangladesh	7	1	0.85	0.15	0.00	Colombia	5	2	0.27	0.73	0.00
Belarus	6	1	1.00	0.00	0.00	Colombia	6	2	0.02	0.98	0.00
Belarus	1	1	1.00	0.00	0.00	Colombia	4	2	0.48	0.52	0.00
Belarus	7	1	1.00	0.00	0.00	Colombia	1	2	0.44	0.56	0.00
Belarus	4	1	1.00	0.00	0.00	Costa Rica	6	2	0.00	0.55	0.45
Belarus	5	1	1.00	0.00	0.00	Costa Rica	4	2	0.23	0.77	0.00
Bolivia	5	1	0.66	0.34	0.00	Dominican Republic	7	2	0.00	1.00	0.00
Bolivia	4	1	0.72	0.28	0.00	Dominican Republic	5	2	0.00	0.54	0.46
Bolivia	3	1	0.78	0.22	0.00	Egypt. Arab Rep.	2	2	0.00	1.00	0.00
Bolivia	2	1	0.59	0.41	0.00	Egypt. Arab Rep.	5	2	0.21	0.79	0.00
Bolivia	1	1	0.67	0.33	0.00	Egypt. Arab Rep.	4	2	0.12	0.88	0.00
Cote d'Ivoire	3	1	0.99	0.01	0.00	Egypt. Arab Rep.	3	2	0.00	1.00	0.00
Cote d'Ivoire	4	1	1.00	0.00	0.00	Egypt. Arab Rep.	1	2	0.00	1.00	0.00
Cote d'Ivoire	1	1	1.00	0.00	0.00	Gabon	2	2	0.00	1.00	0.00
Cote d'Ivoire	2	1	1.00	0.00	0.00	Gabon	1	2	0.00	1.00	0.00
Cameroon	2	1	0.52	0.48	0.00	Ghana	7	2	0.23	0.74	0.03
Cameroon	4	1	0.53	0.47	0.00	Ghana	6	2	0.23	0.77	0.00
Cameroon	5	1	0.56	0.44	0.00	Ghana	5	2	0.12	0.78	0.09
Cameroon	3	1	0.79	0.21	0.00	Guinea	5	2	0.40	0.60	0.00
Congo. Rep.	3	1	0.77	0.23	0.00	Guinea	2	2	0.13	0.87	0.00
Congo. Rep.	2	1	0.95	0.05	0.00	Guinea-Bissau	4	2	0.00	1.00	0.00

Table A3. *Continued*

country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3	country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3
Congo. Rep.	1	1	1.00	0.00	0.00	Guinea-Bissau	2	2	0.00	1.00	0.00
Colombia	2	1	0.53	0.47	0.00	Guinea-Bissau	3	2	0.00	1.00	0.00
Colombia	3	1	0.82	0.18	0.00	Guinea-Bissau	6	2	0.00	1.00	0.00
Costa Rica	1	1	0.64	0.36	0.00	Guinea-Bissau	5	2	0.00	1.00	0.00
Costa Rica	3	1	0.47	0.19	0.34	Guatemala	4	2	0.12	0.88	0.00
Dominican Republic	2	1	1.00	0.00	0.00	Guatemala	1	2	0.39	0.61	0.00
Dominican Republic	1	1	0.63	0.07	0.30	Guatemala	3	2	0.28	0.55	0.17
Ecuador	1	1	1.00	0.00	0.00	Guatemala	2	2	0.09	0.73	0.19
Ecuador	5	1	1.00	0.00	0.00	Honduras	6	2	0.06	0.49	0.45
Ecuador	7	1	1.00	0.00	0.00	Honduras	3	2	0.03	0.96	0.01
Ecuador	4	1	1.00	0.00	0.00	Honduras	5	2	0.03	0.97	0.00
Ecuador	6	1	1.00	0.00	0.00	Haiti	4	2	0.49	0.51	0.00
Ecuador	2	1	0.83	0.17	0.00	Haiti	5	2	0.49	0.51	0.00
Ecuador	3	1	0.95	0.05	0.00	Haiti	3	2	0.41	0.59	0.00
Egypt. Arab Rep.	6	1	0.63	0.37	0.00	India	6	2	0.37	0.63	0.00
Gabon	3	1	0.80	0.20	0.00	India	5	2	0.34	0.66	0.00
Gabon	7	1	1.00	0.00	0.00	India	7	2	0.48	0.52	0.00
Gabon	5	1	1.00	0.00	0.00	India	4	2	0.07	0.93	0.00
Gabon	4	1	0.96	0.04	0.00	India	2	2	0.00	1.00	0.00
Ghana	2	1	0.46	0.37	0.17	India	3	2	0.00	1.00	0.00
Ghana	1	1	0.55	0.45	0.00	India	1	2	0.00	1.00	0.00
Guinea	4	1	0.96	0.04	0.00	Jamaica	1	2	0.00	1.00	0.00
Guinea	3	1	0.77	0.23	0.00	Jamaica	5	2	0.00	1.00	0.00
Guinea	7	1	0.76	0.24	0.00	Jamaica	7	2	0.16	0.84	0.00
Guinea-Bissau	7	1	0.40	0.22	0.38	Jamaica	4	2	0.00	1.00	0.00
Guatemala	6	1	0.54	0.46	0.00	Jamaica	2	2	0.00	1.00	0.00
Haiti	2	1	0.67	0.33	0.00	Jamaica	6	2	0.04	0.96	0.00

Table A3. *Continued*

country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3	country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3
Haiti	6	1	0.53	0.47	0.00	Jamaica	3	2	0.00	1.00	0.00
Haiti	7	1	0.71	0.29	0.00	Kazakhstan	6	2	0.00	1.00	0.00
Indonesia	6	1	0.97	0.03	0.00	Kazakhstan	2	2	0.14	0.86	0.00
Indonesia	7	1	0.92	0.08	0.00	Kazakhstan	5	2	0.03	0.97	0.00
Kazakhstan	3	1	0.58	0.42	0.00	Kazakhstan	1	2	0.01	0.99	0.00
Kenya	1	1	0.91	0.09	0.00	Kazakhstan	7	2	0.16	0.84	0.00
Kenya	2	1	0.74	0.26	0.00	Kazakhstan	4	2	0.50	0.50	0.00
Kenya	3	1	0.55	0.45	0.00	Kenya	7	2	0.00	1.00	0.00
Libya	2	1	0.93	0.07	0.00	Kenya	5	2	0.26	0.74	0.00
Libya	3	1	0.99	0.01	0.00	Kenya	6	2	0.11	0.89	0.00
Sri Lanka	7	1	0.49	0.30	0.21	Kenya	4	2	0.37	0.63	0.00
Morocco	2	1	0.56	0.44	0.00	Libya	5	2	0.01	0.99	0.00
Morocco	4	1	0.51	0.49	0.00	Libya	4	2	0.01	0.99	0.00
Morocco	1	1	0.71	0.29	0.00	Libya	1	2	0.00	1.00	0.00
Morocco	5	1	0.52	0.48	0.00	Sri Lanka	2	2	0.00	1.00	0.00
Moldova	4	1	0.57	0.43	0.00	Sri Lanka	1	2	0.02	0.98	0.00
Moldova	3	1	0.59	0.41	0.00	Sri Lanka	6	2	0.44	0.56	0.00
Moldova	5	1	0.51	0.49	0.00	Morocco	7	2	0.41	0.41	0.18
Madagascar	7	1	0.55	0.34	0.10	Morocco	3	2	0.28	0.72	0.00
Madagascar	6	1	0.93	0.07	0.00	Morocco	6	2	0.43	0.57	0.00
Madagascar	4	1	0.78	0.22	0.00	Moldova	2	2	0.01	0.99	0.00
Madagascar	3	1	0.70	0.30	0.00	Moldova	1	2	0.00	1.00	0.00
Mexico	3	1	0.57	0.43	0.00	Moldova	7	2	0.14	0.86	0.00
Mexico	2	1	0.53	0.47	0.00	Moldova	6	2	0.23	0.77	0.00
Mexico	6	1	0.63	0.37	0.00	Mexico	4	2	0.45	0.55	0.00
Mexico	5	1	0.59	0.41	0.00	Mongolia	6	2	0.30	0.70	0.00
Mexico	1	1	0.61	0.39	0.00	Mongolia	5	2	0.03	0.97	0.00

Table A3. *Continued*

country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3	country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3
Mexico	7	1	0.52	0.48	0.00	Mozambique	3	2	0.31	0.69	0.00
Mali	7	1	0.86	0.14	0.00	Mozambique	4	2	0.29	0.71	0.00
Mali	3	1	0.54	0.46	0.00	Mozambique	2	2	0.13	0.87	0.00
Mali	6	1	0.74	0.22	0.04	Malaysia	6	2	0.00	1.00	0.00
Mali	2	1	0.88	0.12	0.00	Malaysia	1	2	0.00	1.00	0.00
Mali	4	1	0.80	0.20	0.00	Malaysia	4	2	0.00	1.00	0.00
Mongolia	3	1	0.58	0.42	0.00	Malaysia	3	2	0.00	1.00	0.00
Mongolia	4	1	0.56	0.44	0.00	Malaysia	5	2	0.00	1.00	0.00
Mongolia	7	1	0.56	0.44	0.00	Malaysia	2	2	0.00	1.00	0.00
Mongolia	1	1	0.70	0.30	0.00	Malaysia	7	2	0.00	1.00	0.00
Mozambique	5	1	0.55	0.45	0.00	Niger	3	2	0.16	0.84	0.00
Mozambique	6	1	0.55	0.45	0.00	Niger	5	2	0.20	0.50	0.30
Mozambique	7	1	0.53	0.47	0.00	Nigeria	1	2	0.00	1.00	0.00
Namibia	6	1	0.68	0.32	0.00	Nigeria	7	2	0.26	0.74	0.00
Namibia	5	1	0.65	0.35	0.00	Nigeria	2	2	0.01	0.99	0.00
Namibia	2	1	0.78	0.22	0.00	Nicaragua	6	2	0.30	0.70	0.00
Namibia	7	1	0.64	0.36	0.00	Nicaragua	3	2	0.24	0.47	0.29
Namibia	4	1	0.74	0.26	0.00	Pakistan	5	2	0.48	0.52	0.00
Namibia	3	1	0.55	0.45	0.00	Peru	7	2	0.13	0.87	0.00
Niger	6	1	0.37	0.32	0.31	Peru	6	2	0.17	0.83	0.00
Niger	7	1	0.52	0.48	0.00	Peru	1	2	0.49	0.51	0.00
Niger	4	1	0.95	0.05	0.00	Russian Federation	2	2	0.27	0.73	0.00
Nigeria	4	1	0.96	0.04	0.00	Russian Federation	7	2	0.47	0.53	0.00
Nigeria	3	1	0.84	0.16	0.00	Russian Federation	4	2	0.43	0.57	0.00
Nigeria	5	1	0.85	0.15	0.00	Russian Federation	1	2	0.03	0.97	0.00
Nicaragua	1	1	0.56	0.42	0.02	Russian Federation	6	2	0.04	0.96	0.00
Nicaragua	2	1	0.60	0.40	0.00	Russian Federation	5	2	0.06	0.94	0.00

Table A3. *Continued*

country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3	country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3
Nicaragua	5	1	0.56	0.44	0.00	El Salvador	1	2	0.35	0.65	0.00
Nicaragua	7	1	0.55	0.45	0.00	Togo	7	2	0.31	0.69	0.00
Nicaragua	4	1	0.55	0.45	0.00	Thailand	2	2	0.00	1.00	0.00
Pakistan	1	1	1.00	0.00	0.00	Thailand	5	2	0.00	0.95	0.05
Pakistan	2	1	1.00	0.00	0.00	Thailand	1	2	0.00	1.00	0.00
Pakistan	7	1	0.57	0.10	0.33	Thailand	6	2	0.00	0.99	0.01
Pakistan	6	1	0.89	0.11	0.00	Tunisia	2	2	0.41	0.59	0.00
Pakistan	4	1	0.61	0.39	0.00	Tanzania	2	2	0.40	0.60	0.00
Peru	3	1	0.61	0.39	0.00	Tanzania	4	2	0.01	0.98	0.01
Peru	2	1	0.58	0.42	0.00	Tanzania	3	2	0.01	0.99	0.00
Peru	5	1	0.76	0.24	0.00	Tanzania	6	2	0.00	0.73	0.27
Peru	4	1	0.82	0.18	0.00	Uganda	5	2	0.01	0.99	0.00
Paraguay	6	1	1.00	0.00	0.00	Uganda	6	2	0.03	0.86	0.12
Paraguay	4	1	0.96	0.04	0.00	Uganda	7	2	0.25	0.75	0.00
Paraguay	2	1	0.77	0.22	0.00	Uganda	4	2	0.00	1.00	0.00
Paraguay	7	1	0.99	0.01	0.00	Vietnam	6	2	0.00	1.00	0.00
Paraguay	3	1	0.96	0.04	0.00	Vietnam	7	2	0.00	1.00	0.00
Paraguay	1	1	0.60	0.40	0.00	Vietnam	2	2	0.00	1.00	0.00
Paraguay	5	1	0.98	0.02	0.00	Vietnam	3	2	0.00	1.00	0.00
Russian Federation	3	1	0.54	0.46	0.00	Vietnam	5	2	0.00	1.00	0.00
Senegal	7	1	0.99	0.01	0.00	South Africa	2	2	0.04	0.96	0.00
Senegal	6	1	0.99	0.01	0.00	South Africa	3	2	0.33	0.67	0.00
Senegal	4	1	0.41	0.37	0.22	South Africa	1	2	0.00	1.00	0.00
Sierra Leone	6	1	0.98	0.02	0.00	Zambia	6	2	0.00	1.00	0.00
Sierra Leone	7	1	0.94	0.06	0.00	Zambia	4	2	0.01	0.99	0.00
Sierra Leone	4	1	0.98	0.02	0.00	Zambia	2	2	0.16	0.84	0.00
Sierra Leone	5	1	1.00	0.00	0.00	Zambia	3	2	0.28	0.72	0.00

Table A3. *Continued*

country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3	country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3
Sierra Leone	3	1	0.92	0.07	0.00	Zambia	5	2	0.00	1.00	0.00
El Salvador	7	1	0.54	0.45	0.01	Zambia	7	2	0.00	1.00	0.00
El Salvador	5	1	0.61	0.39	0.00	Albania	5	3	0.00	0.24	0.76
El Salvador	3	1	0.56	0.44	0.00	Albania	7	3	0.00	0.30	0.70
El Salvador	4	1	0.52	0.48	0.00	Bangladesh	3	3	0.36	0.25	0.39
El Salvador	6	1	0.68	0.32	0.00	Bangladesh	4	3	0.31	0.28	0.40
El Salvador	2	1	0.52	0.48	0.00	Belarus	3	3	0.00	0.00	1.00
Serbia	6	1	0.91	0.09	0.00	Cote d'Ivoire	6	3	0.09	0.37	0.55
Serbia	4	1	0.79	0.00	0.21	Cameroon	6	3	0.17	0.35	0.48
Serbia	7	1	0.94	0.06	0.00	Congo. Dem. Rep.	3	3	0.00	0.37	0.63
Serbia	5	1	0.98	0.02	0.00	Congo. Dem. Rep.	2	3	0.00	0.44	0.56
Togo	4	1	1.00	0.00	0.00	Congo. Rep.	6	3	0.00	0.40	0.60
Togo	6	1	0.75	0.25	0.00	Costa Rica	5	3	0.00	0.50	0.50
Togo	1	1	1.00	0.00	0.00	Costa Rica	7	3	0.00	0.47	0.53
Togo	5	1	1.00	0.00	0.00	Costa Rica	2	3	0.38	0.23	0.39
Togo	2	1	1.00	0.00	0.00	Dominican Republic	4	3	0.00	0.47	0.53
Togo	3	1	1.00	0.00	0.00	Dominican Republic	3	3	0.04	0.11	0.85
Tunisia	4	1	0.51	0.49	0.00	Dominican Republic	6	3	0.00	0.35	0.65
Tunisia	5	1	0.85	0.15	0.00	Algeria	5	3	0.00	0.00	1.00
Tunisia	6	1	0.51	0.49	0.00	Algeria	6	3	0.23	0.00	0.77
Tunisia	3	1	0.55	0.45	0.00	Algeria	4	3	0.00	0.00	1.00
Tunisia	7	1	0.46	0.14	0.40	Algeria	2	3	0.00	0.00	1.00
Tunisia	1	1	0.52	0.48	0.00	Algeria	1	3	0.00	0.00	1.00
Turkiye	2	1	0.93	0.07	0.00	Algeria	3	3	0.00	0.00	1.00
Turkiye	5	1	0.71	0.29	0.00	Algeria	7	3	0.00	0.00	1.00
Turkiye	7	1	0.80	0.19	0.01	Egypt. Arab Rep.	7	3	0.19	0.34	0.47
Turkiye	3	1	0.92	0.08	0.00	Gabon	6	3	0.07	0.01	0.91

Table A3. *Continued*

country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3	country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3
Turkiye	4	1	0.68	0.32	0.00	Ghana	3	3	0.00	0.42	0.58
Turkiye	6	1	0.69	0.31	0.00	Ghana	4	3	0.00	0.38	0.62
Tanzania	1	1	0.65	0.35	0.00	Guinea	6	3	0.19	0.13	0.68
Uganda	1	1	0.97	0.03	0.00	Gambia. The	5	3	0.00	0.01	0.99
Uganda	2	1	0.91	0.09	0.00	Gambia. The	7	3	0.00	0.01	0.99
Uganda	3	1	0.93	0.07	0.00	Gambia. The	6	3	0.00	0.01	0.99
South Africa	5	1	0.74	0.26	0.00	Gambia. The	3	3	0.00	0.00	1.00
South Africa	7	1	0.88	0.12	0.00	Gambia. The	4	3	0.00	0.00	1.00
South Africa	6	1	0.82	0.18	0.00	Gambia. The	2	3	0.00	0.00	1.00
South Africa	4	1	0.82	0.18	0.00	Guatemala	5	3	0.35	0.25	0.40
Angola	2	2	0.00	1.00	0.00	Guatemala	7	3	0.22	0.35	0.43
Angola	3	2	0.17	0.83	0.00	Honduras	7	3	0.10	0.38	0.52
Angola	4	2	0.00	1.00	0.00	Honduras	2	3	0.00	0.33	0.67
Angola	5	2	0.00	1.00	0.00	Honduras	4	3	0.15	0.39	0.46
Angola	6	2	0.00	1.00	0.00	Honduras	1	3	0.00	0.08	0.92
Angola	7	2	0.00	1.00	0.00	Haiti	1	3	0.45	0.02	0.53
Albania	4	2	0.00	0.96	0.04	Indonesia	2	3	0.00	0.00	1.00
Albania	3	2	0.00	1.00	0.00	Indonesia	1	3	0.00	0.00	1.00
Albania	2	2	0.00	1.00	0.00	Indonesia	3	3	0.00	0.00	1.00
Albania	1	2	0.00	1.00	0.00	Indonesia	5	3	0.11	0.01	0.87
Albania	6	2	0.00	0.86	0.14	Indonesia	4	3	0.00	0.00	1.00
Azerbaijan	3	2	0.47	0.53	0.00	Sri Lanka	3	3	0.15	0.26	0.59
Azerbaijan	4	2	0.02	0.98	0.00	Madagascar	5	3	0.34	0.00	0.66
Azerbaijan	5	2	0.00	1.00	0.00	Mali	5	3	0.37	0.01	0.62
Azerbaijan	6	2	0.00	1.00	0.00	Niger	2	3	0.01	0.26	0.73
Azerbaijan	7	2	0.00	1.00	0.00	Niger	1	3	0.02	0.25	0.73

Table A3. *Continued*

country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3	country	year	Class membership	ProbClass 1	ProbClass 2	ProbClass 3
Burkina Faso	4	2	0.09	0.91	0.00	Nigeria	6	3	0.02	0.04	0.94
Burkina Faso	1	2	0.00	1.00	0.00	Pakistan	3	3	0.14	0.04	0.82
Burkina Faso	3	2	0.13	0.87	0.00	Philippines	6	3	0.01	0.23	0.77
Burkina Faso	6	2	0.42	0.58	0.00	Philippines	3	3	0.00	0.17	0.83
Burkina Faso	7	2	0.43	0.57	0.00	Philippines	4	3	0.00	0.38	0.62
Burkina Faso	5	2	0.37	0.63	0.00	Philippines	2	3	0.00	0.24	0.76
Burkina Faso	2	2	0.00	1.00	0.00	Philippines	5	3	0.00	0.13	0.87
Bolivia	7	2	0.18	0.82	0.00	Philippines	1	3	0.00	0.20	0.80
Bolivia	6	2	0.11	0.89	0.00	Philippines	7	3	0.13	0.27	0.60
Botswana	2	2	0.00	1.00	0.00	Senegal	2	3	0.00	0.01	0.99
Botswana	5	2	0.00	1.00	0.00	Senegal	5	3	0.29	0.02	0.69
Botswana	6	2	0.00	1.00	0.00	Senegal	1	3	0.00	0.02	0.98
Botswana	1	2	0.00	1.00	0.00	Senegal	3	3	0.05	0.01	0.93
Botswana	3	2	0.00	1.00	0.00	Serbia	3	3	0.18	0.00	0.82
Botswana	4	2	0.00	1.00	0.00	Thailand	3	3	0.00	0.27	0.73
Botswana	7	2	0.00	1.00	0.00	Thailand	7	3	0.00	0.47	0.53
Cote d'Ivoire	7	2	0.09	0.91	0.00	Thailand	4	3	0.00	0.27	0.73
Cote d'Ivoire	5	2	0.30	0.70	0.00	Turkiye	1	3	0.18	0.00	0.82
Cameroon	1	2	0.44	0.56	0.00	Tanzania	7	3	0.00	0.43	0.57
Cameroon	7	2	0.24	0.76	0.00	Tanzania	5	3	0.00	0.40	0.59
						Vietnam	4	3	0.00	0.48	0.52