Mapping hawala risks around the world: the use of a composite indicator

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ABSTRACT

The aim of this study is to map the landscape of risk faced by each country with respect to the presence and prosperity of informal fund transfer (IFT) systems. This study constructed a composite indicator to assess IFT risks of the 121 countries. The IFT risk that this study intended to gauge is not crime risk(s) that IFT systems cause but risk that IFT systems operate and prosper in given countries. The IFT risk indicator was developed with eleven variables extracted from public domain datasets regarding migration, access to formal financial institutions, AML/CFT measures, and societal attitudes towards informality. Routine activity theory was used to derive the factors associated with IFT risk. This study found that the level of IFT risk is associated with their levels of economic development. The main advantage of the IFT risk indicator is that it can gauge 'nuanced' differences in IFT risks among countries.

1. Introduction

It has been argued that the attacks of 11 September 2001 are one of the three major shocks[1] to the global systems in the 21st century (Summers, 2020). This tragic event also gave rise to significant changes in criminal policy and research (Aas, 2010; LaFree & Freilich, 2017; McCulloch & Pickering, 2009; Morrison, 2013; Schuilenburg et al., 2014). One of the issues that drew the attention of crime scholars as well as the general public was an allegation that the *Al-Qaeda* terrorists' attacks were funded through unauthorised remittance networks, so-called *hawala*. Even after suspicions were laid to rest through the discovery of *Al-Qaeda* accounts with formal financial institutions that appeared to have funded the terrorist attacks (Van de Bunt, 2008), many law enforcement professionals and crime scholars continue to regard the connection between unauthorised remittance networks and transnational organised crime and terrorism as highly probable (Cooper & Walker, 2016; Levi, 2010; McCusker, 2005; United States General Accounting Office, 2003). Some scholars, on the other hand, focused on the contribution of unauthorised remittance networks to economic development in developing countries (El-Qorchi et al., 2003; Todoroki et al., 2014). This illegal cross-border remittance channel was first called an

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underground banking system and later termed as an informal value transfer system (Passas, 1999) or an informal fund transfer (IFT) system (Hernandez-Coss, 2005; World Bank, 2006).

IFT systems exist in nearly every economy. There is scant information available about the prevalence and distribution of IFT activities worldwide, despite mounting concerns about them. When it comes to the global landscape of IFT businesses, it is challenging to measure the impact and success IFT systems have, especially because they are illegal in most countries. Several studies attempted to gauge the amounts of remittances transferred via IFT systems using a multitude of methods (El-Qorchi et al., 2003; Schaeffer, 2008). However, the reliability of the estimates was often doubted (Ferriani & Oddo, 2019; Financial Action Task Force [FATF], 2013c). In addition, given that such efforts were limited to some countries, they could not meet the demands for a global perspective on IFT systems.

As IFT activities are factually illegal activities, it is not feasible to capture their prevalence with existing research instruments. This study did not seek to measure the prevalence of IFT activities across the world, instead focusing on assessing the IFT 'risk' of each country, as it is feasible to derive the likelihood that IFT systems as an illegal remittance channel operate and prosper from factors related to IFT systems. Each country has its own, unique, cross-border fund transfer environment. A cross-sectional comparison of countries, which looks at factors that are likely to contribute to the survival, expansion, or shrinkage of IFT systems, can help map a nuanced landscape of IFT risk faced by each country. The global landscape of IFT risk can thus discern and demonstrate which countries are more susceptible to the risk that IFT systems operate and prosper and need more assistance from the international community. In mapping the IFT risk of each country, this study drew on a composite indicator, which is often used to capture immeasurable, complex subjects (e.g. corruption, organised crime, or sustainability; Bohringer & Jochem, 2007; Dugato et al., 2020; Galtung, 2006). This study constructed this indicator by combining separate indicators theoretically associated with IFT activities. A similar approach was adopted with respect to the measurement of corruption. Instead of measuring actual corruption, efforts were made to track countries' institutional loopholes associated with opportunities or incentives for corruption (e.g. the Public Integrity Index of Global Integrity and the Corruption Perceptions Index of Transparency International; Kaufmann et al., 2007; Ko & Samajdar, 2010). Before delving into the construction of a composite indicator to gauge the global landscape of IFT risk, this study first succinctly illustrates the basic mechanisms and features of IFT systems given that they are not a popular research topic among crime scholars. This study also briefly touches upon the concept of a composite indicator as composite indicators have barely been developed or discussed in the field of crime science. To conclude, IFT risks captured by the indicator are analysed.

2. Informal fund transfer systems

IFT transactions refer to cross-border fund transfers made by an entity that is not permitted or authorised to do so. The basic mechanism of IFT transactions is similar to that of formal remittances by formal financial institutions (Schaeffer, 2008). The differences between IFT systems and formal financial institutions are mainly linked to IFT

brokers who carry out cross-border payment transactions without being subject to government control (Soudijn, 2015). Similar to formal remittance transfers, IFT transactions rarely involve the physical transfer of funds between IFT brokers and are characterised as exchanging credits and debts. IFT brokers in sending and receiving countries do not settle their debts and credits every time (Schaeffer, 2008). IFT transactions thus always involve settlement issues (Figure 1). There are several ways to settle outstanding debts in IFT systems: Simple reverse IFT transactions, financial settlement, physical transfers of cash, trade in goods or services, and international asset transactions (El-Qorchi et al., 2003).

Many studies on IFT systems consider the fast, efficient, and low-threshold services of IFT systems to be more advantageous for their customers than formal financial institutions (El-Qorchi et al., 2003; Hernandez-Coss, 2005; Kosse & Vermeulen, 2014). These advantages are mainly attributed to the absence of government control. IFT systems are competitive in terms of dealing with the small amounts of remittances (e.g. less than 200 USD) that IFT users usually send (Irving et al., 2010; Maimbo et al., 2005). When transferring small remittance amounts, formal financial institutions typically charge flat fees of 10 to 15 USD per transfer (equivalent to 10 to 20% of a remittance of 200 USD). This is more expensive than a transfer conducted via IFT systems that charge 2 to 5% of the total remittance amount (Freund & Spatafora, 2008). When it comes to the speed of transferring funds, IFT systems can send remittances within 24 hours. Formal financial institutions, on the other hand, take about four days to transfer funds between major international cities (Bank for International Settlements [BIS] and World Bank, 2007; Holmes et al., 2007; State Secretariat for Economic Affairs [SECO], 2009). IFT systems have the advantage of accessibility over formal financial institutions in certain regions. IFT systems operate not only in unprofitable areas where formal financial institutions are reluctant to open branches, but also in situations of political or economic crisis, such as civil wars, conflicts, or economic sanctions (Maimbo & Passas, 2005).

The absence of government control brings with it some additional features: anonymity and secrecy. IFT brokers do not need to check their customers' identities, record transactions, or endeavour to discover unusual transactions. Illegal migrants thus can send remittances via IFT systems to their home countries without worrying about being detected
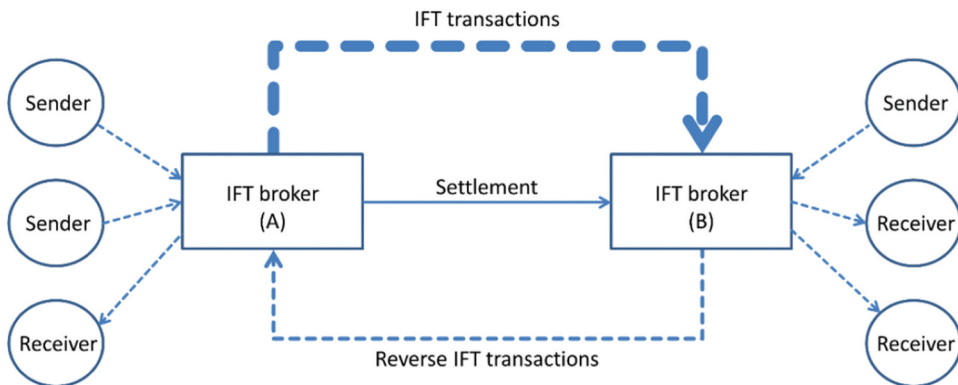

Figure 1. Settlement of debts between IFT brokers.

by law enforcement authorities. The anonymity of IFT systems is an attractive characteristic for prospective remitters who want to send funds without government scrutiny, because IFT systems leave few audit trails for law enforcement authorities (El-Qorchi et al., 2003). Organised crime groups may make use of IFT systems to elude investigations of law enforcement authorities into connections between their criminal activities and the proceeds that result from those activities. Some businesses endeavouring to evade taxes also take advantage of the anonymity offered by IFT systems (Maimbo & Passas, 2005).

There is a prospect that the fast, efficient, and low-threshold services of IFT systems may lose their competitive edge because of technology-driven financial (Fintech) services that emerged after the global financial crisis of 2008 (Metzger et al., 2019; Narain et al., 2019). Fintech services, such as mobile money and crypto assets[2], have the potential to facilitate cheaper and more efficient remittances (Bersch et al., 2021; Cortina & Schmukler, 2018). In particular, mobile money keeps gaining importance in developing countries with weak banking infrastructure. Fintech is expected to curtail the demands for IFT services. Nevertheless, according to some studies on mobile money (Waweru & Kamau, 2017; World Bank, 2017), IFT systems still play a primary role in receiving international remittances.

3. Research method

Research on IFT systems has proven IFT systems somewhat elusive, even though IFT systems in some developing countries are less than clandestine[3] (Razavy, 2005; Van de Bunt, 2008). IFT brokers and IFT users are socially invisible, and their activities are concealed from the view of mainstream society. Instead of attempting to capture the complex networks of IFT systems, this study assessed the level of risk faced by each country with respect to the prosperity of IFT systems, using a composite indicator. A composite indicator refers to a single index compiled from individual indicators (or variables) that are linked around a multi-dimensional concept to be measured (Organization for Economic Co-operation and Development [OECD] and Joint of Research Centre [JRC] of the European Commission, 2008). Once the OECD and the UN commissioned studies on social indicators in 1970, composite indicators became increasingly recognised as a useful tool for policy analysis and public communications (Noll, 2004). Their popularity seems to stem from their ability to summarise complex or multi-dimensional issues into a simple format, thereby making it possible for policymakers to obtain a tractable and representative sense of the phenomena of interest in a given country, and to make comparisons with other countries (Saisana & Saltelli, 2011). The construction process of a composite indicator consists of several steps: Identification of a theoretical framework, data selection or selection of variables, data treatment, weighting, aggregation, and testing for robustness (Freudenberg, 2003).

4. Construction of an IFT risk indicator

4.1. Variables

The construct that this study aimed to measure with a composite indicator is IFT risk. The term risk[4] here technically refers to the (undesirable) consequences of a set of events and associated uncertainties (Aven and Thekdi, 2022). This study defined IFT risk as the

likelihood of the presence and prosperity of IFT systems. IFT risk is not necessarily associated with what sources of funds are transferred via IFT systems. Many scholars and professionals concur that IFT transactions to conceal and launder criminal proceeds are harmful. Most of them may not concede that transfers of remittances of expatriate workers via IFT systems are risky. IFT risk means more than whether transactions or funds via IFT systems are harmful or risky. In the remittance market, the regulatory authorities of both developed and developing countries seek to ensure safety, soundness, and compliance with consumer protection and AML/CFT laws through licensure, registration, and supervision. In particular, developing countries attend to monitoring the inward and outward flows of remittances, using these regulatory schemes, to maintain adequate liquidity of foreign exchange reserve (BIS and World Bank, 2006). With respect to economic development with remittances, formal remittance systems have a stronger potential for economic development in receiving countries, compared to IFT systems, by improving the earnings of the domestic financial sector and by increasing resources to finance economic activities (Kosse & Vermeulen, 2014). The presence and prosperity of IFT systems pose challenges to achieving these policy objectives (El-Qorchi,). IFT systems in receiving countries pose concerns to sending countries as well. The expansion and prosperity of IFT systems in receiving countries not merely hinder the development of formal remittance systems but promote the use of IFT systems in sending countries.

Given that legality and legitimacy are distinguished (Mayntz, 2016), this study attended to IFT systems *per se*, or illegality – not being licenced or registered – of IFT systems, rather than how IFT systems are perceived or whether IFT systems are acceptable. What use of IFT systems is (il)legitimate depends on the perceptions of stakeholders. Legitimacy of IFT systems is situational and contextual[5]. It would be challenging to assess legitimacies of IFT systems across countries as they may even differ within a country according to the distribution of socio-economic circumstances. The IFT risk that this study intended to gauge is not crime risk(s) (e.g. money laundering or financing of terrorism) that IFT systems cause but risk that IFT systems operate and prosper in given countries. This study sought to measure how susceptible the countries within its scope are to IFT systems, and to present the extent of their IFT risk in the form of an IFT risk indicator.

The quality of a composite indicator depends largely on the quality of the underlying individual variables. A theoretical framework provides a basis for selecting the individual variables to be integrated into a composite indicator (Freudenberg, 2003). As this study aimed at depicting the landscape of IFT risk across countries rather than at identifying the criminality or motivation of those involved in IFT activities, it drew on routine activity theory in constructing an IFT risk indicator. According to Cohen and Felson (1979), crime is likely to occur when a motivated offender and a suitable target or victim converge in space and time in the absence of a capable guardian. Even though routine activity theory often explains crime occurrence at the micro level, it embraces macro-level social and economic changes in explaining crime rates (Eck, 1995; Pratt et al., 2010). Routine activity theory has primarily explained predatory crimes. This theory has rarely been applied to illegal markets where targets (or victims) are not distinct. Nevertheless, this theory can encompass IFT activities if properly tweaked.

The review of previous studies on IFT systems from the perspective of routine activity theory shows that IFT activities are generally associated with four factors: Migration (offenders), access to formal financial institutions (targets), AML/CFT systems in place

(guardians), and societal attitudes towards the informal economy (motivation and capability; FATF, 2013c; Freund & Spatafora, 2008; Todoroki et al., 2014). According to many studies on IFT systems, the primary customers of IFT systems are expatriate workers[6], and IFT brokers are compatriots of IFT users. The number of IFT users and IFT brokers can be estimated with the number of immigrants (in sending countries) and emigrants (in receiving countries). Thus, the more immigrants a (remittance sending) country has, the more IFT risk the country faces; the more emigrants a (remittance receiving) country has, the more IFT risk the country faces. The victims[7] of IFT transactions are formal remittance operators given that they are the competitor of IFT systems. The damage imposed by IFT systems is not the loss of what they possessed but the loss of the anticipated revenues of formal remittance operators by IFT businesses. As IFT systems emerge to fill the niche market that formal remittance operators cannot address, the suitability for IFT businesses can be determined by the extent of access to formal remittance operators. The guardianship against IFT activities can be measured by the level of AML/CFT measures given that AML/CFT measures normally address the illegality of IFT systems as well as their engagement in money laundering and financing of terrorism (Passas, 2005b). The mere association among the three variables may not be sufficient to explain the prosperity and decline of IFT systems. This study examined one more variable to take into account the level of motivation of IFT brokers and IFT users and the level of capability of AML/CFT measures. The variable is societal attitudes towards informality. It reflects the degree of tolerance for informal arrangements in a society. For instance, the more favourable societal attitudes are towards informality, the more likely remitters are to use IFT services and the less likely AML/CFT measures are to be implemented effectively. In sum, a large number of migrants, low access to formal financial institutions, weak AML/CFT measures, and a tolerant societal attitude towards informality are likely to encourage IFT activities.

The main difference between the original routine activity theory and this variant one is the role of changes in the legitimate opportunity structure in explaining crime occurrence. The original routine activity theory posits that technological advances designed for legitimate purposes increased criminal opportunities. This variant theory assumes that IFT activities take place because of the blockage in accessing institutional means (i.e. formal remittance operators).

4.2. Data

The designers of composite indicators must decide which variables – and how many variables – to select when constructing a composite indicator, taking into account not only the selected theoretical framework, but also data availability (Freudenberg, 2003). This study used the following five datasets (Table 1) to construct an IFT risk indicator.

This study first extracted data on the cumulative numbers of emigrants and immigrants from the migration and remittance dataset of 2013[8] released by the World Bank in 2016 (World Bank, 2016). The use of this dataset was based on the notion that the demand – or the market size – for IFT services is strongly associated with the number of remittance senders and recipients, and expatriate workers and their relatives in home countries account for the majority of users of IFT systems. The size of the demand for IFT services in a country can therefore be gauged by summing up the cumulative numbers of emigrants (i.e. senders from foreign countries) and immigrants (i.e. senders in the country

Table 1. Dimensions and measurements of IFT risk.

Dimension	Measurement	Dataset	Source
Migration	Cumulative stock of immigrants (thousands); Cumulative stock of emigrants (thousands)	Migration and remittances factbook	World Bank
Access to formal financial institutions	Account at formal financial institutions (%); Debit card (%)	The Little Data Book on Financial Inclusion	World Bank
	ATMs per 100,000 adults	Financial Access Survey	International Monetary Fund (IMF)
AML/CFT system	Compliance score with 48 recommendations; Compliance score with special Recommendation VI	Mutual evaluation reports	FATF
Societal attitudes towards Informality	Protection of property rights; Protection of intellectual property; Reliance of police services; Strength of auditing and reporting	Executive opinion survey	World Economic Forum (WEF)

itself). In this study, the 2014 financial inclusion dataset of the World Bank and the 2014 financial access survey dataset of the IMF were used to reflect the level of access to formal financial institutions in assessing IFT risks across countries. This is because limited access to formal financial institutions implies a higher likelihood of recourse to IFT systems. The two datasets include numerous variables regarding the use of financial services (Demirguc-Kunt & Klapper, 2012) but do not contain variables directly associated with 'cross-border' remittances. Thus, this study selected three proxy variables, based on the assumption that access to formal financial institutions is positively associated with cross-border remittance transfers via formal financial institutions. These are: The percentage of possession of an account at a formal financial institution, the percentage of possession of a debit card, and the number of automated teller machines (ATMs) per 100,000 adults.

This study analysed the mutual evaluation reports of the FATF and its eight regional partner organisations to reflect the level of AML/CFT enforcement of each country in gauging IFT risk. This analysis is based on the assumption that IFT activities may thrive to a lesser extent in countries where AML/CFT systems are fully compliant with the FATF's 49 Recommendations. Mutual evaluation reports include the assessment of the level of compliance of member countries' AML/CFT systems with its 49 Recommendations (FATF, 2004, 2009). This study analysed the third round of mutual evaluation reports, because the fourth round (initiated in October 2014) of mutual evaluations is still ongoing. According to the methodology for the third round of mutual evaluations, the technical compliance of each member country's AML/CFT system with the FATF 49 Recommendations, was assessed with a four-point ordinal scale[9] (FATF, 2013a). The mutual evaluation report of each jurisdiction contains 49 assessment results corresponding to the 49 recommendations but does not include the overall compliance level. This study presented separately the overall compliance level, which averaged the 48 assessment results, and a specific compliance level regarding IFT systems – a recommendation applicable to money or value transfer services (MVTS).

In putting together an IFT risk indicator, this study also used data from the Executive Opinion Survey 2013 of the WEF, among several other publicly available domain datasets that deal with informality at a global level. In this survey, four variables were selected that are closely linked to societal attitudes towards informality: Protection of property rights, protection of intellectual property, reliability of police services, and strength of auditing and reporting standards. This is because the four variables reify the degree of compliance with formality (or tolerance of informality). The inverse transformation of these measurements – the perception of the level of 'threat' to the formal economy – represents the attitude towards 'informality'. They can reflect the expansion and shrinkage of the level of informality. The four variables in the opinion survey are measured according to a seven-point ordinal scale. As score 1 and score 7 indicate the most negative and the most positive perception respectively, the lower the scores of each variable, the less strict the attitudes towards informality in a given country.

4.3. IFT risk dataset

This study developed a new dataset by combining the five datasets to construct an IFT risk indicator, thereby assessing the IFT risk of each country. The unit of analysis is a country. Before developing the combined dataset, the original five datasets had different numbers of countries and each dataset included missing data. This study adopted a case-by-case deletion approach in managing missing values in the combined dataset. This approach was chosen because the number of cases with missing values was not substantial and the imputation method may distort the data on the level of IFT risk faced by each country. In the end, the subjects selected for this study were 121 countries[10].

When it comes to the composition of the subjects (Table 2), from a geographical perspective, Europe and Central Asia account for the largest share (36.4%) of the subjects, whereas the North American countries account for the smallest share (1.7%). When the countries are classified by their national income levels, the high-income countries account for the largest part (36.4%) of the subjects and the share of the low-income countries is the smallest (12.4%).

This study first examined the variations of the IFT risk variables, considering their geographical regions and national income levels (Table 3). The market size of IFT services in North America was greater than those in other regions. The region with the highest access to formal financial institutions was also North America. The levels of access to

Table 2. Composition of the 121 selected countries.

	National income level				
	High	Upper middle	Lower middle	Low	Total (%)
Region					
Europe & Central Asia	28	11	5	-	44 (36.4)
Middle East & North Africa	5	4	2	-	11 (9.1)
Sub-Saharan Africa	-	5	7	10	22 (18.2)
North America	2	-	-	-	2 (1.7)
L. America & the Caribbean	3	12	5	1	21 (17.4)
East Asia & the Pacific	6	3	3	2	14 (11.6)
South Asia	-	-	5	2	7 (5.8)
Total	44 (36.4)	35 (28.9)	27 (22.3)	15 (12.4)	121

formal financial institutions in Sub-Saharan Africa and South Asia were quite low and comparable. As for compliance with the FATF Recommendations, the compliance levels of North America and Europe and Central Asia were assessed as higher than those of other regions. Compliance with the MVTS recommendation was highest in Europe and Central Asia. The compliance levels of South Asia and Sub-Saharan Africa were lower than those of other regions. Countries in North America were assessed to have a more unfavourable attitude towards informality than other regions. The Latin American and Caribbean region appears to have had an equally favourable environment for informality as South Asia and Sub-Saharan Africa. National income levels are also useful in gaining insight into the variations of IFT risk variables. The market size of IFT services was greatest in the high-income countries, and smallest in the low-income countries. The level of access to formal financial institutions in the high-income countries was greater than in other income groups. In the low-income countries, compliance with FAFT Recommendations was lower than in countries that fall under other income groups. Societal attitudes towards informality were more favourable in the low-income countries than in countries that fall under other income groups.

4.4. Putting together of an IFT risk indicator

When an IFT risk indicator is constructed with the 11 variables, normalisation of the variables is required prior to their aggregation given that they are based on the three different measurement units (i.e. number, percentage, and ordinal scale). Faced with the choice between several normalisation methods, this study adopted the z-score method because z-score standardisation can achieve normalisation without losing information regarding the performance level of each subject (OECD and JRC, 2008).

Before the eleven z-scores were aggregated, weights were applied to the eleven variables. Irrespective of the method selected from the available weighting techniques, weights are essentially products of value judgements (OECD and JRC, 2008). This study adopted two methods – an equal weighting and a statistical method – to apply weights to the variables alternately, thereby producing two IFT risk assessment models for an IFT risk indicator. A statistical method is usually employed to avoid multiple counting by individual variables and to weight variables in a less arbitrary manner (Nardo et al., 2005). In this study, the statistical method used for weighting is principal component analysis (PCA). Since PCA examines redundancies between observed variables – while reducing a number of observed variables into a small number of principal components – weights to be applied to each variable are derived from the extent to which variables overlap (O'Rourke & Hatcher, 2013). Although they are not a measure of the importance of the associated variables, weights used for composite indicators are often derived from PCA, as weights derived from PCA reflect statistical quality of data (Nardo et al., 2005).

In order to derive weights to be applied to each variable, PCA reduced the eleven variables to 'three' principal components, given that the principal components with eigenvalues greater than 1.00 were the first three (Figure 2)[11]. After rotating these components, individually they constituted more than 10% of the total variance (46.68%, 16.59% and 14.56% respectively). The cumulative variance of the three principal components accounted for approximately 77.83% of the total variance of the data collected from the 121 countries (Table 4). Weights to be applied to each variable were derived from

Table 3. Centrality measure of IFT risk variables by region and national income level.

	Market size of IFT services		Access to formal financial institutions			Compliance with FATF Recommendations		Attitude towards informality			
	Stock of emigrants (thousands)	Stock of immigrants (thousands)	Bank account (%)	Debit card (%)	ATMs per 100,000 adults	MVTS compliance (0–4)	Overall AML compliance (0–4)	Property rights (1–7)	Intellectual property (1–7)	Police services (1–7)	Auditing and reporting (1–7)
Region											
Europe & Central Asia (44)	1,573.6	1,856.8	(86.65)	(64.65)	76.46	2.45	2.61	4.55	4.15	4.76	4.85
MENA (11)	900.0	3,108.3	(50.50)	(32.40)	41.06	2.18	2.26	4.53	3.77	4.30	4.55
Sub-Saharan Africa (22)	543.3	536.8	(19.70)	(12.75)	14.57	1.32	1.76	3.83	3.33	3.77	4.21
North America (2)	2,251.5	26,670.3	(96.35)	(84.70)	197.67	2.0	2.85	5.60	5.40	5.85	5.65
Latin America & the Caribbean (21)	1,570.0	387.1	(43.30)	(25.60)	44.52	1.86	2.21	3.73	3.17	3.43	4.49
East Asia & the Pacific (14)	2,337.7	1,834.5	(86.25)	(60.25)	79.58	1.79	2.28	4.70	4.32	4.73	4.89
South Asia (7)	5,041.0	1,743.2	(30.90)	(6.70)	14.21	1.43	1.86	3.77	3.23	3.59	4.13
National Income level											
High (44)	1,242.7	3,761.0	(95.40)	(79.80)	92.34	2.43	2.64	5.15	4.79	5.28	5.26
Upper middle (35)	1,783.1	927.4	(54.00)	(35.10)	51.99	2.06	2.29	4.04	3.39	3.85	4.59
Lower middle (27)	2,153.6	832.7	(30.00)	(15.80)	26.90	1.59	2.04	3.63	3.13	3.53	4.09
Low (15)	1,423.1	455.4	(17.20)	(5.20)	4.79	1.13	1.59	3.33	2.93	3.49	3.78
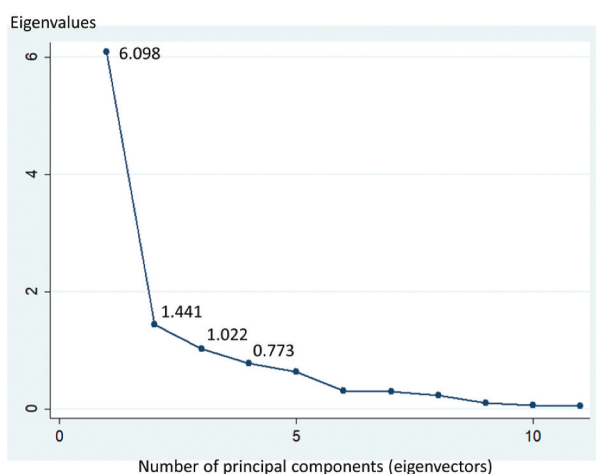
Eigenvalues

Figure 2. Scree plot of eigenvalues after PCA of the IFT risk data.

Table 4. Component loadings of an IFT risk indicator from PCA with varimax rotation with Kaiser normalisation.

	Component loading				Squared component loading (scaled to unity sum)		
	1	2	3	Cronbach's alpha	1	2	3
Market size							
Stock of emigrants	.252	−.138	.580	.885	.012	.010	**.210**
Stock of immigrants	−.053	.163	.668	.908	.001	.015	**.279**
Access to formal financial institutions							
Account at formal financial institutions	.317	.140	−.100	.833	**.020**	.011	.006
Debit card	.340	.133	−.055	.831	**.023**	.010	.002
ATMs per 100,000 adults	.163	.053	−.434	.858	.005	.002	**.118**
AML-systems							
MVTS recommendation	−.027	.732	.085	.859	.000	**.294**	.005
48 recommendations	.053	.600	−.800	.849	.001	.197	**.400**
Perception of Informality							
Protection of property rights	.432	−.058	.017	.834	**.036**	.002	.000
Protection of intellectual property	.434	−.071	−.019	.833	**.037**	.003	.000
Reliability of police services	.425	−.078	.015	.836	**.035**	.003	.000
Strength of auditing and reporting standards	.363	.060	.030	.838	**.026**	.002	.001
Variance explained	5.135	1.825	1.601				
% of total variance (Cumulative %)	46.68	16.59 (63.27)	14.56 (77.83)				
Overall Cronbach's alpha				.865			

squared component loadings obtained from PCA. Among the three principal components, the highest squared component loading[12] for each original variable became the weight for each variable (OECD and JRC, 2008).

Once the weights for variables are determined, the weighted values of the variables are aggregated. Among several aggregation methods (Saisana & Saltelli, 2011), this study employed the linear aggregation method[13], given the fact that negative values and a low score in one IFT risk element (e.g. access to formal financial institutions) are offset by high values in other risk elements (e.g. AML/CFT systems). The two different weights produced 'two IFT risk assessment models' for an IFT risk indicator. This resulted in two sets of IFT

Table 5. Correlations between the IFT risk rankings by exclusion of individual variables and different weighting and aggregation methods.

Variables excluded from the full model	Equal weights	PCA-derived weights
Market size	0.975	0.885
Stock of emigrants	0.988	0.964
Stock of immigrants	0.993	0.937
Access to formal financial institutions	0.963	0.987
Account at formal financial institutions	0.996	0.999
Debit card	0.997	0.999
ATMs per 100,000 adults	0.993	0.992
AML-systems	0.971	0.706
MVTS recommendation	0.991	0.958
48 recommendations	0.992	0.939
Perception of Informality	0.924	0.990
Protection of property rights	0.996	0.999
Protection of intellectual property	0.997	0.999
Reliability of police services	0.996	0.999
Strength of auditing and reporting standards	0.994	0.999
Full model		
Between arithmetic and geometric aggregations	0.926	0.912
In arithmetic aggregation	0.864	
In geometric aggregation	0.992	

risk values and ranks for the 121 countries (Appendix A). The higher a country's IFT risk ranking, the higher the IFT risk it faces. For instance, Myanmar (the equal weighted score) and Bangladesh (the PCA weighted score) face a higher IFT risk than other countries. Switzerland (the equal weighted score) and Belgium (the PCA weighted score) face a lower IFT risk than other countries.

4.5. Robustness of the IFT risk indicator

While constructing the IFT risk indicator, several decisions were made, especially on the selection of individual variables, data normalisation, and weighing and aggregation methods (Dugato et al., 2020; Ferwerda & Kleeman, 2019). The indicator may produce different IFT risk rankings according to these decisions. This study conducted a simple sensitivity analysis to assess the robustness of the indicator in terms of exclusion or inclusion of individual variables and weighting and aggregation methods. The sensitivity analysis (Table 5) showed that the two IFT risk assessment models are quite robust against the selection of individual variables ($R_{equal} \geq 0.993$ and $R_{pca} \geq 0.937$)[14]. The choice of aggregation methods made little difference in the IFT risk rankings irrespective of weighting methods ($R_{equal} = 0.926$ and $R_{pca} = 0.912$). The different weighting methods also made negligible differences in the rankings ($R_{arithmetic} = 0.864$ and $R_{geometric} = 0.992$)[15].

5. Analysis of IFT risk values

5.1. IFT risk values by different weighting methods

Given that the impact of uncertainty from weighting methods looked greater than those from exclusion of individual variables and aggregation methods, this study focused on examining differences in the IFT risk rankings with respect to different weighting methods. As the correlation between the two IFT risk assessment models ($R_{arithmetic} = 0.864$)

shows, most countries had few differences between their ranks, despite the different weights. However, there were relatively large gaps between the ranks of some countries. Changes in ranks that exceeded a quartile merited further examination to identify the factors that explain the large gaps. The countries with a ranking difference of more than 30 are listed (Table 6).

The large differences between the IFT risk rankings of the same countries may have resulted from several factors. One plausible reason is that the PCA weights amplified the differences in the variables associated with market size of IFT systems and compliance with the FATF Recommendations, and reduced the variations of the variables regarding access to formal financial institutions and societal attitude towards informality (Table 7)[16]. For instance, the countries with relatively large markets for IFT systems (e.g. the U.S., the U.A.E., and Canada) were assessed as having higher IFT risks in the PCA weighted indicator than in the equal weighted indicator. The countries with relatively high levels of compliance with the FATF Recommendations (e.g. Colombia, Egypt, Guatemala, and Bulgaria) were assessed as having lower IFT risks in the PCA weighted model than in the equal weighted model. Despite lingering doubts about the validity of this composite indicator, it is unrealistic to expect to find a weighting method that can satisfy all stakeholders (Mazziotta & Pareto, 2017). Studies on composite indicators (OECD and JRC, 2008) emphasise that the lack of a definitive way to determine weights and an aggregation method does not necessarily lead to a rejection of the validity of a composite indicator, as long as the process of constructing it is transparent and fully elaborated.

Table 6. Countries with more than 30 rank difference by the two weighting methods.

Country	Region	Nat'l income level	Market size		Financial inclusion		AML-systems		Informality		Overall rank		Difference
			E	S	E	S	E	S	E	S	E	S	
U.S.	North America	High	1	1	118	119	113	114	99	99	74	2	72
U.A.E.	MENA	High	21	18	89	90	39	49	106	106	91	49	42
Colombia	L. America & Carib.	U. middle	30	36	46	47	119	119	50	49	71	112	41
Canada	North America	High	16	14	120	120	51	65	113	114	113	75	38
Egypt	MENA	L. middle	23	24	13	19	98	95	24	27	37	73	36
New Zealand	E. Asia & the Pacific	High	59	55	105	97	40	52	119	119	108	72	36
Guatemala	L. America & the Carib.	L. middle	72	74	39	42	103	102	36	36	56	91	35
Mauritania	S. Saharan Africa	L. middle	116	116	17	17	45	40	6	6	10	43	33
Angola	S. Saharan Africa	U. middle	97	99	32	28	47	41	4	4	13	46	33
Bulgaria	Europe & C. Asia	U. middle	54	60	83	98	116	115	39	38	81	114	33
Namibia	S. Saharan Africa	U. middle	118	118	62	62	14	15	87	86	70	38	32
Luxembourg	Europe & C. Asia	High	117	115	109	107	53	47	117	116	111	80	31

Table 7. Standard deviation values of IFT risk elements.

	Equal weighted	PCA weighted
Market size	1.56	0.38
Financial Inclusion	2.74	0.15
AML-systems	1.86	0.39
Informality	3.74	0.13
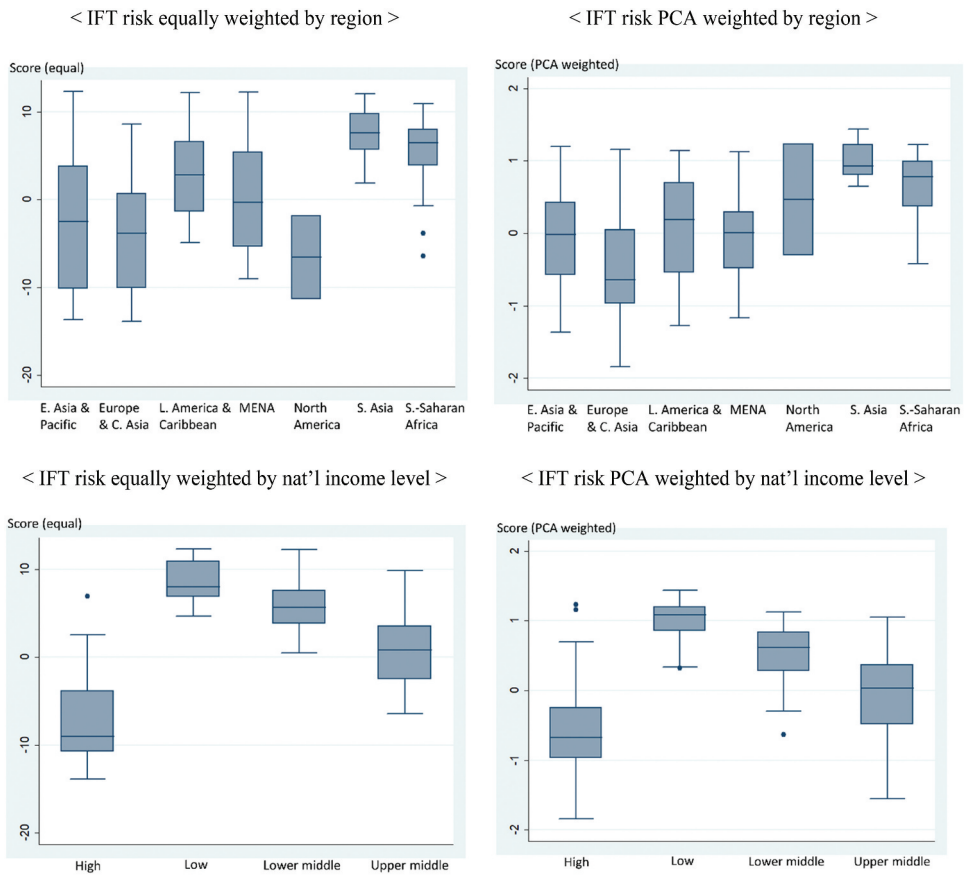
Figure 3. Overall IFT risk values by region and national income level.

5.2. IFT risk values by region and national income level

This study categorised the IFT risk values of the 121 countries by region and national income level (Figure 3). Southern Asian countries and Sub-Saharan African countries were rated as having greater IFT risk than other countries. Countries in Europe and the Central Asia region seem to have been more immune to IFT risk than those in other regions. The overall IFT risk levels faced by Northern American countries differed according to the weighting methods employed. Except for Northern American countries, the two different weights made little difference in the regional IFT risk patterns. When the IFT risk values of the 121 countries were also arranged by national income level, the findings confirmed the general assumption that the national income levels of countries are likely to be negatively related to their IFT risk levels. The level of IFT risk of the high-income group was lower than that of countries that fall under other income categories. The IFT risk faced by the countries that fall under the low-income group was the largest. The two different weighting methods made little difference in the IFT risk pattern with respect to national income levels.

Table 8. 10 countries with the highest IFT risk.

Country	Region	Nat'l Income level	Market size	Financial accessibility	AML-Systems	Perception of Informality	Overall
Equally weighted							
Myanmar	E. Asia & Pacific	Low	27	12	25	3	1
Yemen	MENA	L. middle	57	2	11	5	2
Haiti	L. America & Carib.	Low	58	8	11	2	3
Bangladesh	S. Asia	Low	9	18	29	13	4
Guinea	S.-Saharan Africa	Low	95	1	16	7	5
Mali	S.-Saharan Africa	Low	76	6	2	14	6
Paraguay	L. America & Carib.	U. middle	75	24	9	10	7
Pakistan	S. Asia	L. middle	10	3	59	23	8
Cambodia	E. Asia	Low	69	11	1	32	9
Mauritania	S.-Saharan Africa	L. middle	116	17	45	6	10
PCA weighted							
Bangladesh	S. Asia	Low	11	15	29	13	1
United States	N. America	High	1	119	114	99	2
Nepal	S. Asia	Low	33	20	5	31	3
Mali	S.-Saharan Africa	Low	78	7	2	14	4
Cambodia	E. Asia & Pacific	Low	71	16	1	34	5
Russia	Europe & C. Asia	High	2	116	70	15	6
Haiti	L. America & Carib.	Low	63	3	12	2	7
Yemen	MENA	L. middle	59	6	12	5	8
Sierra Leone	S.-Saharan Africa	Low	106	2	3	43	9
Burkina Faso	S.-Saharan Africa	Low	42	4	9	44	10

5.3. Highest and lowest at-risk countries

When listing the ten countries with the highest IFT risk at the top of Table 8, it becomes apparent that most of them are from the low-income group. The ten countries identified as being exposed to the lowest IFT risk (Table 9) are mostly from the high-income group and are concentrated in Europe and Central Asia. Although there are differences between the 10 countries with the highest IFT risk (or with the lowest IFT risk) according to the different weighting methods, several countries are classified within the same groups. Regardless of the weighting methods applied, Bangladesh, Cambodia and Haiti were identified as the countries with the highest IFT risk, whereas Switzerland, Belgium and Malta were identified as those with the lowest IFT risk. Given that the level of IFT risk faced by developed countries is low, and that of developing countries is high, a controversial argument could be made that, despite various factors being considered and complex procedures used to gauge IFT risk levels, national income level is ultimately the decisive factor in determining IFT risk levels. This finding is consistent with studies on the

Table 9. 10 countries with the least IFT risk.

Country	Region	Nat'l Income level	Market size	Financial accessibility	AML Systems	Perception of Informality	Overall
Equally weighted							
Switzerland	Europe & C. Asia	High	44	107	115	116	121
Singapore	E. Asia & Pacific	High	56	98	110	120	120
Belgium	Europe & C. Asia	High	61	111	121	100	119
Finland	Europe & C. Asia	High	101	96	72	121	118
Austria	Europe & C. Asia	High	67	112	101	110	117
Netherlands	Europe & C. Asia	High	41	103	102	115	116
Malta	Europe & C. Asia	High	120	94	117	102	115
Norway	Europe & C. Asia	High	98	100	88	114	114
Canada	North America	High	16	120	51	113	113
United Kingdom	Europe & C. Asia	High	7	117	114	112	112
PCA weighted							
Belgium	Europe & C. Asia	High	53	102	121	102	121
Malta	Europe & C. Asia	High	120	88	117	100	120
Slovenia	Europe & C. Asia	High	104	104	118	82	119
Hungary	Europe & C. Asia	U. middle	84	75	119	67	118
Switzerland	Europe & C. Asia	High	40	103	111	117	117
Singapore	E. Asia & Pacific	High	48	93	112	120	116
Portugal	Europe & C. Asia	High	35	118	110	90	115
Bulgaria	Europe & C. Asia	U. middle	60	98	115	38	114
Cyprus	Europe & C. Asia	High	113	73	113	88	113
Colombia	L. America & Carib.	U. middle	110	47	119	49	112

relationship between economic growth and informality, proving that the level of informality within a country decreases with development (Loayza & Rigolini, 2006; La Porta & Shleifer, 2014).

In order to identify the nuanced landscape of IFT risks, this study examined the differences in IFT risks faced by high-income countries in Europe and Central Asia. The 'high-income' countries in this region were assessed as having low IFT risk levels, compared to other groups of countries. However, some of those countries fall outside the lower quartile (i.e. ranked higher than 90th) and may need more careful monitoring of their remittance markets (Table 10). The relatively high IFT risks of Russia, Poland, and Italy seem to be affected by their market sizes for informal remittance. The worrisome IFT risks faced by Czechia, Croatia, and Greece seem to be attributed to their societal attitudes towards informality and their AML systems' compliance with the FATF Recommendations.

Table 10. The differences in IFT risks faced by high income countries in Europe and Central Asia.

	Market size		Financial inclusion		AML-systems		Informality		Overall rank	
Country	E	S	E	S	E	S	E	S	E	S
Switzerland	44	40	107	103	115	111	116	117	121	117
Belgium	61	53	111	102	121	121	100	102	119	121
Finland	101	102	96	72	72	72	121	121	118	96
Austria	67	61	112	111	101	99	110	110	117	109
Netherland	41	39	103	92	102	101	115	115	116	108
Malta	120	120	94	88	117	117	102	100	115	120
Norway	98	94	100	87	88	100	114	113	114	106
United Kingdom	7	7	117	115	114	116	112	112	112	103
Luxembourg	117	115	109	107	53	47	117	116	111	80
Estonia	111	110	104	99	106	107	96	96	109	111
Sweden	73	67	97	79	77	77	111	111	107	93
Denmark	99	98	101	91	93	87	101	103	104	105
Ireland	68	69	106	105	85	93	103	104	103	104
France	13	12	108	109	108	109	105	105	102	102
Slovenia	107	104	110	104	118	118	82	82	101	119
Portugal	32	35	115	118	109	110	89	90	99	115
Germany	6	5	116	113	94	88	109	109	98	71
Spain	17	17	113	112	104	105	86	87	97	101
Cyprus	113	113	78	73	111	113	88	88	96	113
Latvia	100	100	95	94	82	85	79	80	89	92
Lithuania	86	87	79	71	104	105	69	68	85	107
Italy	14	13	93	100	107	108	65	70	83	89
Slovakia	90	89	86	83	96	91	56	56	82	98
Czechia	81	79	82	70	79	79	61	60	75	79
Croatia	65	65	102	110	34	37	57	58	73	59
Greece	53	54	85	82	52	45	52	55	69	60
Poland	20	21	73	81	38	48	72	71	62	44
Russia	3	2	99	116	56	70	15	15	24	6

6. Discussion

It is often said that the construction of composite indicators is an art rather than an exact science (Grupp & Schubert, 2010; Nardo et al., 2005; OECD and JRC, 2008). As for the validity issue of a composite indicator, Vertesy (2016) argues that a comparative assessment of multiple indicators for the same phenomenon (e.g. corruption) can be beneficial in assessing the validity of a composite indicator. However, given the absence of an instrument to measure IFT activities, there may be limited ways to examine the validity of the IFT risk indicator. After all, taking into account Vertesy's suggestion, the assessments of the validity of the IFT risk indicator may rely on the professional consensus of relevant experts. The experts' professional opinions may include subjective judgements that reflect what is known about IFT risk and how IFT risk levels are perceived (Greco et al., 2019). This study may be the first attempt to construct an IFT risk indicator. There has not yet been an opportunity to subject this indicator to expert review. This study therefore examined congruence between the outcomes from the two IFT risk assessment models and the findings from previous studies on IFT systems. As a result, the IFT risk levels derived from the equal weighting aggregation method are likely to be more in line with a normal perception of IFT risk levels for the countries of interest. This is especially the case given the outcome from the equal weighted IFT risk assessment model whereby the 10 countries with the largest IFT risk are all developing countries and the 10 countries with the smallest IFT risk are all developed countries. According to the PCA weighted IFT risk

assessment model, Colombia, which is known as the origin of one of many trade-based money laundering schemes (i.e. Black Market Peso Exchange), falls under the category of countries that are faced with the lowest level of risk. The result of examining the relationships between the IFT risk levels assessed and the IFT risk levels perceived implies that the equal weighted IFT risk indicator is slightly more convincing than the indicator developed with weights derived from PCA. However, this does not mean that the PCA weighted IFT risk indicator merits little attention. The PCA weighted indicator adequately reflects the impact of migration and AML systems on IFT risks. This IFT risk indicator suggests that high-income countries, such as Russia, the U.A.E[17]., and the U.S., can also be exposed to high levels of IFT risk.

7. Conclusion

The aim of this study was to map the landscape of IFT risk worldwide by means of the composite indicator methodology. As a theoretical framework for the IFT risk indicator, this study drew on routine activity theory, thereby extracting the four factors that are associated with the expansion and shrinkage of IFT systems: The market size of IFT services, access to formal financial institutions, compliance with international AML/CFT standards, and societal attitudes towards informality. These four IFT risk elements comprise 11 variables, extracted from five public domain datasets, and underlie the IFT risk indicator. In the course of composing the IFT risk indicator, this study adopted two weighting methods alternately – equal weighting and PCA weighting – thereby producing two IFT risk assessment models. There is no gold standard to evaluate the two models given that even experts thoroughly acquainted with the phenomenon of interest rarely reach consent on weights (Grupp & Schubert, 2010).

The main findings of the study confirmed those of previous studies on IFT systems. Most of the developed countries analysed were rated as having low IFT risk, mainly because of a high level of access to formal financial institutions and a high level of compliance with international AML/CFT standards. However, among the developed countries, some – considered popular destinations for immigrants – were rated as having a high level of IFT risk. On the other hand, most of the developing countries were rated as being exposed to a high level of IFT risk because of a large number of emigrants, poor formal financial systems, low compliance levels with international AML/CFT standards, and lenient attitudes towards illegality. The finding that the level of IFT risk is associated with the level of economic development appears to be a foregone conclusion.

The main advantage of the IFT risk indicator is, however, that it can gauge 'nuanced' differences in IFT risks among countries. The IFT risk indicator therefore merits to be adopted as a key indicator to monitor IFT risks across countries. IFT systems may not be considered illegitimate in some developing countries given their economic and social impact. Nevertheless, the benefits of IFT systems are unlikely to outweigh the need for global governance of IFT risks, given the cross-border impact of IFT systems. The IFT risk indicator will play a role in providing each country with warning signals regarding IFT systems, even though the extent of IFT risks for certain countries in this indicator may different from the actual IFT risks in those countries. The countries that are assessed with having higher IFT risk

than normally conceived may need to monitor their remittance markets more in-depth instead of simply disregarding the IFT risks. As for the countries that are assessed as having lower IFT risks than normally known, researchers should check the composition and validity of the underlying variables used to construct this indicator. The IFT risk indicator should interact with the governments of each country and field researchers to improve its validity, thereby approaching the prevalence of IFT activities more closely. Particularly if the IFT risk indicator is used to monitor IFT risk levels over a period of several years, policy makers and scholars will be able to monitor not only changes in IFT risk levels faced by countries, but also the potential impact of AML/CFT programmes implemented against IFT systems. The global AML/CFT community – including the FATF – could therefore benefit from this IFT risk indicator to create benchmarks that countries with high levels of IFT risk should endeavour to meet. This study examined the IFT risks faced by only 121 countries due to the limited data used to construct this indicator. Some countries well known for the prevalence of IFT systems, such as Somalia[18] (Hesse, 2010; Omer, 2002), were missed out. Future studies are expected to address this limitation.

Notes

1. Former U.S. Treasury secretary Larry Summers in his Financial Times article pointed out three events that gave major shocks to the global system in the 21 century: the 2001 terror attacks, the 2008 financial crisis, and the COVID-19 crisis.
2. Crypto assets are used as a remittance vehicle not only by remitters themselves but also by IFT brokers (Metzger et al., 2019).
3. IFT systems overtly operate in some countries, such as China, Somalia, and the U.A.E (Passas & Maimbo, 2008; Varese et al., 2019).
4. Financial Action Task Force (FATF) provides the definition of risk – a function of threat, vulnerabilities, and consequences – for the purposes of assessing national money laundering and terrorist financing risk (FATF, 2013b). This study did not adopt the FATF's definition of risk as it is somewhat narrow given that it focuses on money laundering and terrorist financing risk. Nevertheless, among the eleven variables analysed with respect to IFT risk in this study, most of them relate to vulnerabilities to IFT risk. The variables regarding 'migrants' can be construed as 'threat' that leads to IFT activities.
5. With respect to the legitimacy of IFT systems, many studies on IFT systems discern legitimate use from illegitimate use of IFT systems. This study, however, did not seek to distinguish between them as it is nearly impossible to capture whether IFT brokers stick to 'clean' remittances and separate criminal proceeds from the funds that they take from their customers (El-Qorchi et al., 2003; Passas, 2005a).
6. Given that IFT systems emerged in ancient times to avoid the inconvenience and risk incurred from physically transporting money between merchants from different regions of MENA and South Asia, their then primary customers of IFT systems were merchants engaging in long distance trade (Schaeffer, 2008). Most of the current users are migrants, even though some merchants still use IFT systems to transfer payments abroad (FATF, 2013c). Many studies (Razavy, 2005; Thompson, 2008) show that migrants from MENA and South Asia are more familiar with IFT systems because of the historical and cultural context.
7. IFT systems may pose a threat to the governments as well as formal remittance systems. As IFT systems are illegal businesses in most countries, the governments of each country may miss out on taxes on remittances and the illegal businesses (El-Qorchi,). Some IFT systems may help tax evasion of traders who undervalue their imported goods by transferring payments for imported goods to exporters without traces. However, the damage to the government coffers caused by IFT systems may not be significant. Even remittances via

formal remittance systems are not normally taxed in receiving countries. Many professionals express concern over some sending countries' attempts to tax outward remittances (Ratha et al., 2017). IFT systems are normally small businesses that are exempted from taxation. Traders' tax evasion via IFT systems tends to be addressed in light of AML efforts.

8. Although more recent datasets for migration, financial inclusion, and attitude towards informality were available, this study had to use the datasets of 2013 or 2014. When the data analysis for this study was conducted in 2018, the FATF's fourth round mutual evaluations which started in 2014 were still ongoing. This study thus analysed 135 countries' mutual evaluation reports of the third round which ended in 2014.

9. In the coding process, this study assigned 4 to 'compliant', 3 to 'largely compliant', 2 to 'partially compliant', 1 to 'non-complaint', and 0 to 'not applicable'.

10. The 121 countries were not randomly selected samples but the study population *per se*. This study did not conduct a significance test given that 'significance tests presuppose that the units being studied are sampled randomly from the populations to which they belong' (Cowger, 1984, p. 365). Although some studies have conducted significance tests with populations (Leahey, 2006), this study holds the view that 'significance tests are not only inappropriate when applied to a total population but are unnecessary since the probable relation of a sample and a population is defined as unity when they are the same' (Berk et al., 1995; Cowger, 1984, p. 366).

11. Figure 2

12. Squared component loadings used as weights are produced by dividing squared component loadings by the variances of the original data explained by each principal component (OECD and JRC, 2008). For instance, $0.023 = (0.340 ^ 2) / 5.135$, which is the proportion of the variance of the first principal component explained by the variable percentage of possession of a debit card.

13. PCA weighted IFT risk indicator = 0.210 z_emigrant + 0.279 z_immigrant + 0.020 z_account + 0.023 z_debit + 0.118 z_atm + 0.294 z_MVTSrecommedation + 0.400 z_overallrecommendation + 0.036 z_propertyrights + 0.037 z_IPR + 0.035 z_policing + 0.026 z_auditing.

14. In order to examine the impacts of individual variables on a composite indicator, the robustness of the indicator is assessed in a way of excluding each variable one by one. This study assessed the robustness of the IFT risk indicator by excluding not only individual variables but also each group of variables (e.g. variables regarding financial inclusion) from the IFT risk assessment models ($R_{equal} \geq 0.963$ and $R_{pca} \geq 0.706$).

15. The IFT risk rankings according to different weighting and aggregation methods are graphed in Annexe 2.

16. Table 7.

17. The U.A.E. is known as a *hawala* settlement hub (Ballard, 2005; Malit et al., 2005; accordingly ranked 49 by the PCA weighted indicator). Nevertheless, the U.A.E. was assessed as having a relatively low IFT risk level (i.e. ranked 91 by the equal weighted indicator). This counter intuitive assessment outcome seems to result from the underestimation of the U.A.E.'s level of informality and an (relative) overweight on it in the equal weighted indicator. The U.A.E.'s business friendly environments seem to have a positive impact on the assessment of its level of informality (Gatti et al., 2014; Loayza et al., 2005).

18. The two of the five datasets used to construct this indicator – the financial inclusion dataset of the IMF and the AML/CFT dataset of the FATF and its associates – unfortunately did not include data of some developing countries, including Somalia. This may imply that such countries do not have competence to collect and share financial inclusion data with international organisations and do not have instruments regarding AML/CFT; as a result, they may have high IFT risks.

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Disclosure statement

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Appendix A. Ranks from IFT-risk element values

Country	Rank from equal weighted IFT-risk element values					Rank from PCA weighted IFT-risk element values				
	Market size	Financial accessibility	AML Compliance	Informality	Total	Market size	Financial accessibility	AML Compliance	Informality	Total
Albania	62	40	66	18	38	66	43	64	18	64
Algeria	43	37	26	11	15	45	25	27	12	21
Angola	97	32	47	4	13	99	28	41	4	46
Argentina	37	59	18	8	21	38	63	19	7	19
Armenia	78	33	94	62	64	80	50	88	63	90
Australia	22	119	75	107	110	20	117	75	107	88
Austria	67	112	101	110	117	61	111	99	110	109
Azerbaijan	55	35	82	58	57	58	40	85	59	77
Bahrain	102	80	112	97	100	101	57	103	97	110
Bangladesh	9	18	29	13	4	11	15	29	13	1
Belgium	61	111	121	100	119	53	102	121	102	121
Benin	94	9	16	40	22	97	9	17	40	23
Bolivia	79	42	24	21	29	81	45	25	21	30
Bosnia and Herzegovina	46	56	57	46	54	52	54	53	47	61
Botswana	119	50	20	84	61	119	44	21	84	37
Brazil	39	91	89	81	86	41	106	80	79	97
Bulgaria	54	83	116	39	81	60	98	115	38	114
Burkina Faso	40	5	9	44	18	42	4	9	44	10
Cambodia	69	11	1	32	9	71	16	1	34	5
Canada	16	120	51	113	113	14	120	65	114	75
Chile	84	67	75	93	87	83	68	75	93	85
China	5	70	92	74	63	6	67	83	75	56
Colombia	30	46	119	50	71	36	47	119	49	112
Costa Rica	108	74	43	83	78	105	95	36	83	67
Côte d'Ivoire	34	10	20	27	11	32	11	21	26	15
Croatia	65	102	34	57	73	65	110	37	58	59

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Country	Rank from equal weighted IFT-risk element values					Rank from PCA weighted IFT-risk element values				
	Market size	Financial accessibility	AML Compliance	Informality	Total	Market size	Financial accessibility	AML Compliance	Informality	Total
Cyprus	113	78	111	88	96	113	73	113	88	113
Czech Republic	81	82	79	61	75	79	70	79	60	79
Denmark	99	101	93	101	104	98	91	87	103	105
Dominican Republic	47	49	70	33	48	50	46	50	29	62
Ecuador	63	52	60	45	53	64	55	56	45	65
Egypt	23	13	98	24	37	24	19	95	27	73
El Salvador	51	38	48	20	34	56	41	63	20	54
Estonia	111	104	106	96	109	110	99	107	96	111
Finland	101	96	72	121	118	102	72	72	121	96
France	13	108	108	105	102	12	109	109	105	102
Georgia	83	54	71	49	60	85	66	71	48	74
Germany	6	116	94	109	98	5	113	88	109	71
Ghana	77	26	18	68	41	77	21	19	72	29
Greece	53	85	52	52	69	54	82	45	55	60
Guatemala	72	39	103	36	56	74	42	102	36	91
Guinea	95	1	16	7	5	96	1	17	9	17
Haiti	58	8	11	2	3	63	3	12	2	7
Honduras	89	30	31	26	28	93	30	31	23	35
Hong Kong	36	88	84	118	105	31	78	90	118	95
Hungary	85	75	119	71	92	84	75	119	67	118
India	2	43	98	70	36	3	35	95	69	28
Indonesia	19	45	33	64	42	22	51	35	62	33
Ireland	68	106	85	103	103	69	105	93	104	104
Israel	60	90	85	92	93	51	108	93	92	100
Italy	14	93	107	65	83	13	100	108	70	89
Jamaica	71	63	97	66	79	72	49	92	65	94
Japan	35	114	68	108	106	34	114	67	108	83
Jordan	31	31	55	94	68	29	34	51	95	57

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Country	Rank from equal weighted IFT-risk element values					Rank from PCA weighted IFT-risk element values				
	Market size	Financial accessibility	AML Compliance	Informality	Total	Market size	Financial accessibility	AML Compliance	Informality	Total
Kazakhstan	15	58	32	60	46	16	77	32	61	26
Kenya	80	47	6	47	39	76	31	6	46	16
Korea	26	121	64	77	95	26	121	61	78	87
Kuwait	49	84	41	85	76	43	76	33	85	52
Kyrgyz, Rep.	82	21	34	12	14	82	27	37	11	36
Lao PDR	64	22	4	48	27	68	26	4	52	12
Latvia	100	95	82	79	89	100	94	85	80	92
Lebanon	50	51	67	28	47	47	48	66	28	66
Lesotho	109	19	14	25	19	109	22	15	30	22
Lithuania	86	79	104	69	85	87	71	105	68	107
Luxembourg	117	109	53	117	111	115	107	47	116	80
Malawi	104	14	37	51	40	103	12	46	51	48
Malaysia	28	68	87	95	88	27	64	98	94	84
Mali	76	6	2	14	6	78	7	2	14	4
Malta	120	94	117	102	115	120	88	117	100	120
Mauritania	116	17	45	6	10	116	17	40	6	43
Mauritius	115	77	46	90	84	117	65	60	89	70
Mexico	4	48	74	55	30	4	52	74	53	25
Moldova	74	29	49	16	31	73	38	43	16	51
Mongolia	121	87	30	17	51	121	85	30	19	41
Montenegro	110	61	80	63	72	111	80	82	64	86
Myanmar	27	12	25	3	1	28	5	26	3	11
Namibia	118	62	14	87	70	118	62	15	86	38
Nepal	33	23	5	29	12	33	20	5	31	3
Netherlands	41	103	102	115	116	39	92	101	115	108
New Zealand	59	105	40	119	108	55	97	52	119	72
Nicaragua	92	20	36	41	35	95	24	42	41	45
Nigeria	45	44	42	19	33	46	36	34	17	39

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	Rank from equal weighted IFT-risk element values					Rank from PCA weighted IFT-risk element values				
Country	Market size	Financial accessibility	AML Compliance	Informality	Total	Market size	Financial accessibility	AML Compliance	Informality	Total
North Macedonia	87	69	77	78	80	88	69	77	77	82
Norway	98	100	88	114	114	94	87	100	113	106
Pakistan	10	3	59	23	8	10	10	55	22	20
Panama	114	53	22	91	67	114	60	23	91	40
Paraguay	75	24	9	10	7	75	29	9	10	13
Peru	52	41	81	38	50	57	53	84	35	76
Philippines	12	34	64	67	45	15	33	61	66	42
Poland	20	73	38	72	62	21	81	48	71	44
Portugal	32	115	109	89	99	35	118	110	90	115
Romania	24	64	54	37	49	25	74	69	39	58
Russian Federation	3	99	56	15	24	2	116	70	15	6
Saudi Arabia	11	81	98	98	90	8	89	95	98	69
Senegal	93	7	63	59	44	92	8	59	57	63
Serbia	48	76	69	30	59	49	61	68	32	68
Sierra Leone	105	4	3	42	17	106	2	3	43	9
Singapore	56	98	110	120	120	48	93	112	120	116
Slovak Republic	90	86	96	56	82	89	83	91	56	98
Slovenia	107	110	118	82	101	104	104	118	82	119
South Africa	38	71	73	104	94	37	84	73	101	78
Spain	17	113	104	86	97	17	112	105	87	101
Sri Lanka	42	57	26	73	55	44	39	27	73	34
Sweden	73	97	77	111	107	67	79	77	111	93
Switzerland	44	107	115	116	121	40	103	111	117	117
Tanzania	96	15	6	35	16	91	14	6	37	14
Thailand	25	92	44	54	66	23	101	39	50	50
Trinidad and Tobago	103	72	13	43	52	107	59	14	42	31
Tunisia	88	27	90	53	58	90	32	81	54	81
Turkey	18	65	57	75	65	19	86	53	74	53

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Country	Rank from equal weighted IFT-risk element values					Rank from PCA weighted IFT-risk element values				
	Market size	Financial accessibility	AML Compliance	Informality	Total	Market size	Financial accessibility	AML Compliance	Informality	Total
Uganda	91	25	28	31	25	86	18	11	33	27
Ukraine	8	66	62	9	23	9	96	58	8	32
United Arab Emirates	21	89	39	106	91	18	90	49	106	49
United Kingdom	7	117	114	112	112	7	115	116	112	103
United States	1	118	113	99	74	1	119	114	99	2
Uruguay	106	55	91	80	77	108	58	104	81	99
Venezuela	66	60	61	1	26	62	56	57	1	55
Vietnam	29	36	23	22	20	30	37	24	24	18
Yemen, Rep.	57	2	11	5	2	59	6	12	5	8
Zambia	112	28	8	76	43	112	23	8	76	24
Zimbabwe	70	16	49	34	32	70	13	43	25	47

Annex2. Rankings of countries by weighting and aggregation methods