GSMA Intelligence

Exploring the relationship between mobile money regulation and usage

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GSMA

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1. Introduction and key findings

Mobile money has helped reduce the financial exclusion gap in low- and middle-income countries, with more than 1 billion registered accounts at the end of 2019.[1] In Sub-Saharan Africa, almost half of mobile money users are reliant solely on mobile money to access financial services.[2] The positive impacts that mobile money enables for individuals, households and businesses has been demonstrated by a burgeoning body of research and empirical evidence. Mobile money reduces transaction costs for users and helps households to better manage their cash-flows, enabling them to smooth consumption, manage risk and build working capital. It also allows firms to invest and build capital over time, fostering the creation and expansion of business, and facilitates faster and more efficient government transfers. These benefits allow many mobile money users to realise significant quality of life improvements.[3]

As important players in the provision of basic transactional financial services to populations largely underserved by formal financial institutions, mobile money services are subjected to a range of regulations. It has generally been accepted by regulators, mobile money providers and investors that regulation has a material impact on mobile money adoption and usage.[4] Regulation affects the ease with which new customers can enrol to a mobile money service and the range of services offered, as well as the commercial and operating environment for providers and investors.

The link between an enabling regulatory framework and a successful mobile money market has been supported by previous research, though many of these studies have been qualitative or focused on case studies. Furthermore, very few studies have explored the different aspects of a regulatory framework and how these can potentially impact the provision and usage of mobile money services. This paper contributes to the literature by leveraging the GSMA Mobile Money Regulatory Index (MMRI)[5], which benchmarks mobile money regulation based on 26 individual indicators. This is combined with data from the 2017 World Bank Findex survey to assess the relevance and importance of the different components of mobile money regulation. The analysis covers almost 50,000 individuals across 46 countries.

[1] GSMA (2020)
[2] Demirguc-Kunt et al (2018)
[3] See Aron (2018)
[4] See for example GSMA (2016)
[5] https://www.gsma.com/mobilemoneymetrics/#regulatory-index

Overall, we find compelling evidence that an enabling regulatory framework – as measured by the MMRI – is strongly associated with higher mobile money usage. On average, when a country's Index score increases by 10 points, the use of mobile money increases by 3.2 percentage points. This relationship also becomes stronger as the Index score increases, for example an increase from 80 to 90 points is associated with a larger increase in mobile money usage than an increase from 50 to 60 points.

There are a number of components within a regulatory framework that are linked to increased usage of mobile money, including: allowing non-banks to issue mobile money; permitting international money transfers; a comprehensive consumer protection framework; giving mobile money providers flexibility to appoint individual agents; not imposing strict transaction limits, taxes or price controls on mobile money transactions; allowing non-banks to have direct access to retail payment settlement infrastructure, and; allowing providers to distribute interest earnings on trust accounts.

We find evidence that a more enabling regulatory framework has a stronger association with mobile money usage amongst women compared to men. There is also some evidence to suggest that enabling regulation is more closely linked to mobile money usage amongst the poorest 40% of a country's population compared to richer individuals. Some of the factors that are particularly linked to higher usage amongst women and the poor include: regulations that permit agents to register customers and carry out other activities (i.e. not just cash-in and cash-out), and; less strict KYC requirements, where prospective users can access entry-level mobile money accounts with just an ID and mobile number and where documents beyond Government-issued IDs can be used. However, further work is required to be conclusive on which specific regulatory factors are important to drive usage amongst under-served populations. The next phase of research on this topic should also look to isolate the causal impact of regulation (and the different aspects of regulation) on mobile money adoption and usage.

The remainder of this paper is organized as follows. Section 2 provides explains the research questions we explore, framing them in the relevant empirical literature., Section 3 describes the data and Section 4 details the empirical strategy that we use. Section 5 provides results, and Section 6 summarizes key conclusions and implications, as well as suggestions for further research.

2. Research scope

Many demand- and supply-side factors determine the level of mobile money adoption in a given country. These include (amongst other things) income, financial literacy, access to other financial services, mobile phone adoption, pricing and competition. The regulatory framework that applies to mobile money impacts both demand and supply drivers. Poorly-crafted or overly restrictive regulation can hinder access to mobile money by disincentivising investors or restricting the breadth and scope of prospective services. Regulation also affects the commercial and operating environment, for instance, onerous enrolment requirements can slow the pace of customer acquisition and may result in prohibitive cost barriers for providers. An uncertain legal framework and a lack of consumer protection rules can also deter individuals from using mobile money if they do not have complete confidence and trust in the service.

Previous studies have found that enabling regulatory frameworks are associated with successful mobile money markets. A relevant paper on this topic is Gutierrez & Singh (2013), which was one of the first studies to attempt to explain statistically what features of a regulatory framework contribute to mobile banking usage. The authors constructed an index measuring the existence of laws and regulation that support mobile banking activity in 35 countries. The index was based on six principles outlined in Porteous (2006, 2009). Using variations in regulatory environments across these countries and combining it with data from the 2011 World Bank Findex survey, the study found that a supporting regulatory framework is associated with higher usage of mobile banking for the general population as well as for the unbanked.

Another relevant study is Allen et al (2016), which also leverages the 2011 World Bank Findex survey and explores the key foundations and drivers of financial inclusion. While not focused specifically on mobile money, the paper finds that greater financial inclusion is associated with stronger legal rights, and more politically stable environments. Other studies are narrower in scope but also find that enabling regulation is an important predictor of success in mobile money services (GSMA, 2016) and that heavy regulation – particularly an insistence that banks play a central role in mobile money schemes and burdensome KYC and agent restrictions – is generally fatal to igniting mobile money schemes (Evans and Pirchio, 2015).

This study builds on the existing literature in two ways. First, the analysis looks at a more recent period in 2017, whereas most previous studies assessed mobile money regulation and usage during the earlier stages of market development. In 2011, there were 83 mobile money services being offered in 52 countries, with 73 million registered mobile money accounts globally. By 2017, there were 261 mobile money services being offered in 91 countries, with more than 750 million accounts (i.e. at ten-fold increase in adoption over six years).6

Second, we leverage the GSMA Mobile Money Regulatory Index, the most comprehensive assessment of mobile money regulation developed in the literature thus far. It is built using 26 individual metrics (or indicators), which are aggregated into six dimensions and an overall index score. By contrast, the index developed in Gutierrez & Singh (2013) was based on nine metrics (or components), while other studies assessing the impact of mobile money regulation have either considered a narrower range of regulatory principles or they have carried out a detailed review of a much smaller number of countries.

We therefore assess the relationship between mobile money regulation and usage in more countries and measure regulation more comprehensively than in previous studies. We do not aim to find a causal link (this will be considered in future research) but instead focus on the relationship when other relevant factors are controlled for. Given the scope of the data, this will provide evidence as to whether regulation could have a significant impact and if so what specific aspects of regulation are important to make mobile money successful.

[6] GSMA Mobile Money Metrics and Deployment Tracker: https://www.gsma.com/mobilemoneymetrics

3. Data

3.1 GSMA Mobile Money Regulatory Index

The extent to which a country's regulatory framework is enabling (or not) is measured by the GSMA Mobile Money Regulatory Index (MMRI), which covers 90 countries.[7] In 2013, the GSMA identified six principles that define enabling regulatory frameworks[8], building on previous work such as Porteous (2006, 2009). An enabling regulatory framework can be understood as a set of regulations which allow for the development of scalable and responsible mobile money businesses that can sustainably reach the underserved and foster digital financial inclusion.

The Mobile Money Regulatory Index develops these principles and incorporates a set of objective metrics (or indicators) to measure six dimensions of mobile money regulation:

- **Authorisation**: examines the eligibility to provide mobile money services, including: licensing criteria, international money transfers; the relevant authorisation instruments; and the proportionality of capital requirements.
- **Consumer protection**: examines the general consumer redress and disclosure mechanisms and the provisions for safeguarding of customer funds, including measures to protect customer funds in the event of bank failure.
- **Know-Your-Customer (KYC) Requirements**: examines the permitted identification requirements, the proportionality of KYC requirements, and the guidance provided by regulators on ID requirements.
- **Agent networks**: examines the eligibility criteria for agents, their authorisation requirements, agent permitted activities and agent liability.
- **Transaction limits**: examines the proportionality of account balance and transaction limits (entry level and ceiling).
- **Investment and infrastructure environment**: examines the external factors that are likely to affect the regulatory environment such as: affordability; ID verification infrastructure, interoperability infrastructure, provisions on the utilisation of interest income and national financial inclusion policies.
  countries

[7] See https://www.gsma.com/mobilemoneymetrics/#regulatory-index
[8] di Castri (2013)

The full list of indicators are provided in Appendix 1, along with an explanation of the scoring criteria.[9] In each country, the GSMA reviews the prevailing regulatory instruments to determine the appropriate score for each indicator.[10] Where necessary, this information is supplemented by interviews with technical experts and regulators.

Based on the criteria, each indicator has a score ranging between 0 and 100, with a higher score associated with a more enabling regulatory framework. The indicators are aggregated into six dimension scores, which are in turn aggregated into an overall index score. The aggregation weights are provided in Table 1 and are based on research carried out by the GSMA and other organisations as well as expert advice from mobile money providers and regulators. In order to aggregate the indicators into dimensions and the dimensions into an index score, arithmetic aggregation is applied.

Table 1: Indicator and dimension weights

Dimension (weight in Index)	Indicator	Weight
Authorisation (30%)	Eligibility	40%
	Authorisation instruments	30%
	Capital requirements	20%
	International remittances	10%
Consumer Protection (15%)	Safeguarding of funds	40%
	Consumer protection rules	40%
	Deposit Insurance	20%
Transaction Limits (15%)	Entry-level transaction limits	11%
	Entry-level monthly limits	11%
	Entry-level balance limits	11%
	Maximum transaction limits	22%
	Maximum monthly limits	22%
	Maximum balance limits	22%
KYC (15%)	Permitted identifications	40%
	KYC requirements	40%
	KYC proportionality	20%
Agent Network (15%)	Agent eligibility	30%
	Agent authorisation	30%
	Agent activities	30%
	Agent liability	10%
Infrastructure and Investment Environment (10%)	Affordability	30%
	ID verification infrastructure	20%
	Interoperability	20%
	Settlement access	10%
	Interest payments	10%
	Financial inclusion strategy	10%

[9] Further information can also be found in the Mobile Money Regulatory Index methodology document at https://www.gsma.com/mobilemoneymetrics/#regulatory-index

[10] Relevant regulatory instruments are not just limited to regulations and rules pertaining to the issue of e-money but also include AML/CFT laws and general Consumer Protection laws (amongst others). In some countries, there are no formal regulatory instruments that are applicable to mobile money, in which case they are left out of the Index or other relevant regulations are assessed (for example on agent or branchless banking).

3.2 Global Findex and Gallup World Poll

The second main source of data is The Global Findex Database 2017, a World Bank owned dataset that comprises data on how adults save, borrow, make payments, and manage risk.[11] The data are collected in partnership with Gallup, Inc., through nationally representative surveys and covers a population of more than 150,000 adults in over 140 countries. We use this dataset to define our measure of mobile money usage and most of the individual-level variables. The use of mobile money is measured based on whether there is an affirmative answer to the question *"In the PAST 12 MONTHS, have you, personally, used a mobile phone to make payments, to buy things, or to send or receive money using a service such as [local example of mobile money from GSMA database, like M-PESA]?"* (The World Bank, 2017, page 5).

Gallup, Inc., apart from collecting the data for The Global Findex Database 2017, is also responsible for The Gallup World Poll, which tracks several socio-economic and political measures worldwide, such as food access, employment, leadership performance, and well-being. We use this dataset jointly with The Global Findex Database 2017 to define individual-level variables. Table 2 shows these variables, their definition and the source.

Table 2. Individual-level control variables

Variable	Definition	Source
Education level	A dummy for each level: - Primary: 0-8 years of education - Secondary: 9-15 years of education - Tertiary: >15 years of education	Findex 2017
Gender	A dummy taking value 1 if female	Findex 2017
Access to formal banking	A dummy taking value 1 if having an account at a financial institution	Findex 2017
Owing a mobile phone	A dummy taking value 1 if owning a mobile phone	Findex 2017
Age (and age squared)	Age of the individual when answering the survey	Findex 2017
Income	A dummy for each quintile: - Poorest 20%. - Second 20%. - Middle 20%. - Fourth 20%. - Fifth 20%.	Findex 2017
Rural	A dummy taking value 1 if the individual lives in a rural area or on a farm	Gallup 2017
Household size	Log of number of people in the household	Gallup 2017
Marital Status	A dummy if married and a dummy if divorced or separated	Gallup 2017
Job status	A dummy for each of the following categories: - Full-time employed for employer - Full-time self-employed - Part-time - Unemployed	Gallup 2017

Notes: (1) Findex 2017 refers to The Global Findex Database 2017 from the World Bank and Gallup 2017 refers to The Gallup World Poll from Gallup, Inc.

[11] See Demirguc-Kunt et al (2018) and https://globalfindex.worldbank.org/

3.3 Other data

In addition to the MMRI, Findex and World Poll datasets, we also source data from the World Development Indicators 2017 (WDI 2017), the World Governance Indicators 2017 (WGI 2017) and the Doing Business Project (DB 2017) from the World Bank and the Financial Access Survey 2017 (FAS 2017) from the IMF. Table 3 presents the list of variables we use, their definition and the source.

Table 3. Country-level control variables

Variable	Definition	Source
GDP per capita	Log of GDP per capita in constant 2010 US$	WDI 2017
Urban population	% of total population	WDI 2017
Population density	Log of people per squared km of land area	WDI 2017
Total population	Log of total population	WDI 2017
Political stability and absence of violence/terrorism	Perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	WGI 2017
Government effectiveness	Perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	WGI 2017
Control of corruption	Perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	WGI 2017
Branch penetration	Number of commercial bank branches per 1000 km^2	FAS 2017
ATM penetration	Number of ATMs per 1000 km^2	FAS 2017
Legal rights index	Degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. The index ranges from 0 to 12, with higher scores indicating that these laws are better designed to expand access to credit.	DB 2017

Sources: World Development Indicators (WDI), Worldwide Governance Indicators (WGI), Financial Access Survey (FAS) and Doing Business Project (DB)

3.4 Countries included

Since we use several datasets that are merged together, we face some sample restrictions. The GSMA MMRI database contains information from 87 countries for 2018.[12] However, 17 of these are not included in the 2017 Findex database. These are Angola, Burundi, Gambia, Guinea-Bissau, Equatorial Guinea, Guyana, Jamaica, Maldives, Qatar, Solomon Islands, Eswatini, Seychelles, Timor-Leste, Fiji, Papua New, Guinea, Sudan and Samoa. On top of these, four other countries (Central African Republic, Nepal, Russia and Tajikistan) are discarded since they do not have information regarding our dependent variable of interest. Five more are excluded for either not being in Gallup World Poll or not being able to be merged into the main dataset (Iraq, Morocco, Paraguay, Rwanda and Malaysia) and one (Mauritania) is excluded for not having information on the household size variable.[13] Finally, we remove 14 countries from the sample that updated their regulations in 2017 or 2018, as the regulatory assessments for these countries were based on regulatory instruments that were not prevailing at the time of the Findex survey in 2017 and the MMRI does not include historic data in these markets. These 14 countries are Bangladesh, Cambodia, Georgia, Guinea, Indonesia, Jordan, Kyrgyzstan, Lesotho, Madagascar, Mexico, Mongolia, Thailand, Zambia and Zimbabwe.

That means our final sample is formed of 46 countries, which are listed in Table 4, and 48,811 surveyed individuals. Table 5 provides a set of summary statistics for the variables included in the analysis. Figure 1 shows the correlation between mobile money usage in the 2017 Findex survey and country MMRI scores for the countries included in the analysis.

Table 4. List of countries included in the final sample

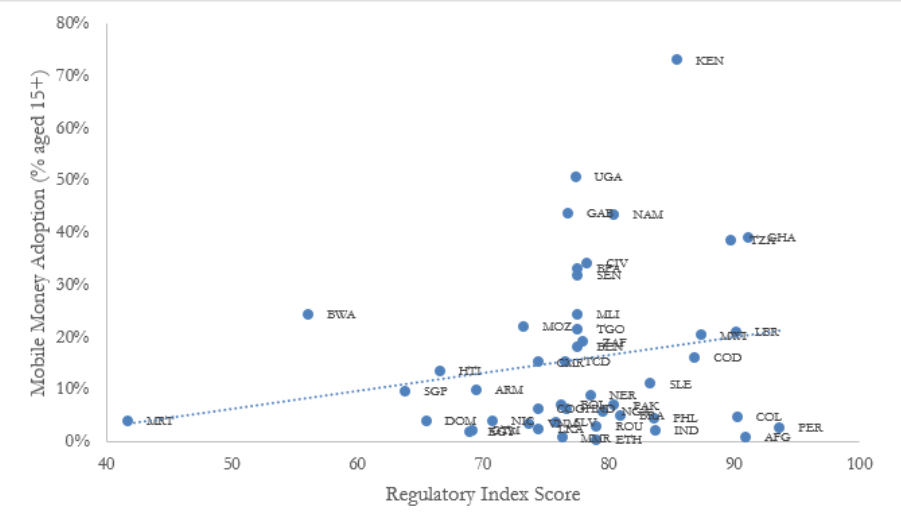
Afghanistan	Cote d'Ivoire	Liberia	Romania
Armenia	Dominican Republic	Malawi	Senegal
Benin	Egypt	Mali	Sierra Leone
Bolivia	El Salvador	Mozambique	Singapore
Botswana	Ethiopia	Myanmar	South Africa
Brazil	Gabon	Namibia	Sri Lanka
Burkina Faso	Ghana	Nicaragua	Tanzania
Cameroon	Guatemala	Niger	Togo
Chad	Haiti	Nigeria	Uganda
Colombia	Honduras	Pakistan	Vietnam
Congo	India	Peru	
Dem. Rep. of Congo	Kenya	Philippines	

[12] While the 2019 index includes 90 countries, three of these did not have formal regulations to assess in 2018 (Argentina, Tunisia and Somalia).
[13] We checked whether our results hold if we dropped the household size variable and included Mauritania and the results did not change.

Table 5. Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Individual variables					
Mobile Money holder	48,811	0.15	0.36	0	1
Primary education	48,811	0.53	0.50	0	1
Secondary education	48,811	0.40	0.49	0	1
Tertiary education	48,811	0.05	0.23	0	1
Age	48,649	35.83	16.48	15	99
Access to formal banking	48,811	0.61	0.49	0	1
Owing a mobile phone	48,811	0.71	0.45	0	1
Full time worker - employed	48,811	0.18	0.38	0	1
Full time worker - self-employed	48,811	0.18	0.39	0	1
Part time worker	48,811	0.21	0.40	0	1
Unemployed	48,811	0.08	0.27	0	1
Rural area	48,811	0.68	0.47	0	1
Log household size	48,811	1.54	0.63	0	3
Marital Status	48,811	0.53	0.50	0	1
Divorced Status	48,811	0.04	0.19	0	1
Country variables					
Log GDP per capita	46	7.57	1.11	5.98	10.95
Log population density	46	4.32	1.39	1.07	8.98
Log total population	46	16.94	1.35	14.54	21.01
Urban population	46	49.05	20.58	16.35	100.00
Political stability	46	-0.65	0.86	-2.80	1.62
Government effectiveness	46	-0.54	0.67	-2.07	2.22
Control of corruption	46	-0.56	0.60	-1.52	2.13
Branch penetration	39	22.31	90.86	0.06	571.23
ATM penetration	39	129.78	699.71	0.10	4,385.05
Legal rights index	46	5.57	2.86	0.00	11.00

Figure 1: Mobile money usage and Regulatory Index Score



Source: World Bank Findex and GSMA Mobile Money regulatory Index

4. Empirical strategy

The main objective of this paper is to study the association between mobile money regulation and usage. In order to do so, we regress mobile money usage – at the individual level – on the Regulatory Index – at the country level – controlling for individual and country characteristics. As highlighted previously, the empirical strategy does not yet aim to find a causal link but to explore the correlation between these two variables when other relevant factors are controlled for.[14] Therefore, the econometric specification can be expressed as follows:

$$y_{irc} = \beta * RI_c + \delta * X'_{irc} + \gamma * Z'_c + \mu_r + \varepsilon_{irc} \qquad (1)$$

where y_{irc} is the dependent variable and takes value 1 if individual *i* at region *r* and country *c* has a mobile money account and is 0 otherwise. RI_c is the Mobile Money Regulatory Index, X'_{irc} is a vector of individual variables, Z'_c is a vector of country variables, μ_r represents the region fixed effects – these being a collection of countries (e.g. South Asia and Sub-Saharan Africa) – and ε_{irc} is the error term, clustered at the country level. Since the dependent variable is a dummy that captures the probability of using mobile money, we use a Logit model to estimate the main results. However, we also run Probit and OLS models to test the robustness of our results. As per the control variables, we consider all the available variables discussed in Section 3. These were used in previous studies, including Gutierrez & Singh (2013) and Allen et al. (2016).

On the present empirical strategy, omitted variable bias is the main challenge to overcome. This bias arises due to potential unobserved (and thus unincluded) country-level variables that might be correlated with the MMRI and/or explaining mobile money usage.[15] Since the sample covers a large number of countries, the main solution to avoid this issue is to add as many country variables as possible. However, as a consequence, two additional threats might arise. The first one is collinearity between the included variables. We check this by considering the correlation between all variables as well as Variance Inflation Factors. The second one is Type I Error. This problem arises because, when adding too many independent variables, the number of degrees of freedom decreases, increasing the probability of getting significant estimates randomly. However, given the large number of observations in the analysis, this should not represent a significant issue.

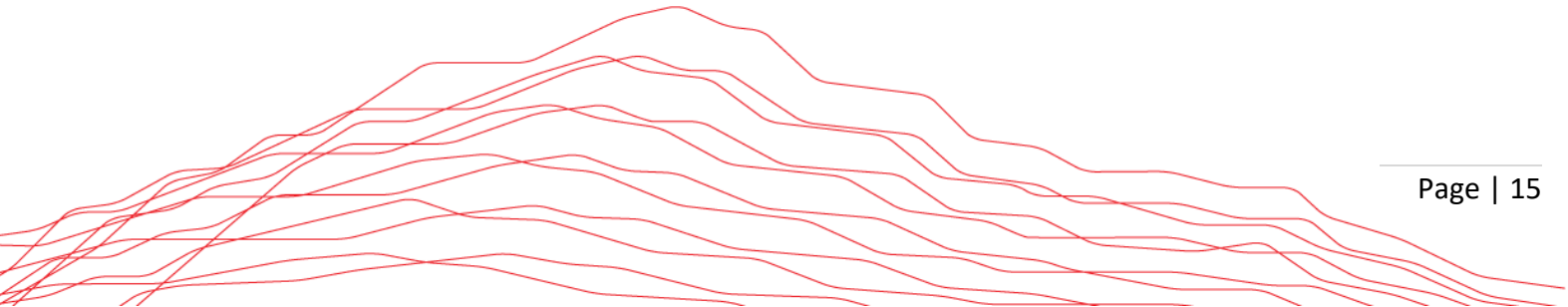
[14] Proving causation is more challenging due to the potentially endogenous nature of regulation. In particular, it is possible that as countries see increased mobile money usage, they adapt their regulations to become more enabling. Addressing endogeneity would require a more sophisticated strategy and ideally time series data.

[15] A common solution to this would be to run a fixed effects model at the country-level, however our sample only includes a single year of data and the MMRI is fixed at the country-level, thus a fixed effects model is not possible in this case.

On top of estimating the association between mobile money regulation and usage, we also explore whether regulation has any differential effects for certain groups. In particular, we focus on women, rural users, the poorest individuals and the unbanked population. Thus, we run the following equation:

$$y_{irc} = \beta * RI_c \times D_{irc} + \delta * X'_{irc} + \theta_c + \epsilon_{irc} \qquad (2)$$

where y_{irc} is the same dependent variable as before and takes value 1 if individual *i* at region *r* and country *c* has a mobile money account and is 0 otherwise. $RI_c \times D_{irc}$ is the interaction between the Mobile Money Regulatory Index (RI_c) and a dummy indicator for either being female, poor, rural or unbanked (D_{irc}), depending on the regression. As in equation (1), $X'_{irc}$is a vector of individual variables. In this specification, even though we have cross-sectional data, we have variation at the country level by interacting the index with the individual characteristics. Therefore, we can also include country fixed effects (θ_c). Finally, ϵ_{irc} is the error term, clustered at the country level. In addition, we also estimate equation (1) for separate subsamples of women, men, rural and urban users, banked and unbanked population, the poorest 40% and the 20% richest individuals.



5. Results

5.1 Regulatory Index

Table 4 presents the results of estimating a Logit model on the probability of using mobile money on the Regulatory Index conditional on individual and control variables. Column (1) shows the Baseline Model including all countries in the sample and Column (2) presents the results for the same model including the WGI variables. Column (3) shows the results for the Extended Model that includes a wider number of control variables at the country level but a smaller sample size since these variables are missing for 8 countries. Our baseline model does not include WGI variables as they capture a number of factors related to Governance and regulation and so may overlap with aspects of the MMRI. However, they provide a useful robustness check, along with the Extended Model.

Panel A presents the average marginal effects for these three specifications based on the MMRI while Panel B calculates an Index by applying indicator weights based on Principal Components Analysis (PCA). Note that the MM Regulatory Index ranges between 0 and 100, while the MM Regulatory Index by PCA ranges between -8.45 and 2.42. The PCA Index is used to test whether the results are robust to an alternative approach to aggregation and weighting.

The point estimates are quite similar across models and definitions of the Index. The coefficients show the increase - in percentage points – in the probability of using mobile money for each additional point in the index (out of 100). For example, the coefficient in column (1), our preferred specification[16], shows that one additional point in the MMRI is associated to an increase of 0.320 percentage points in such probability. In a more useful scale, that would be equivalent to say that when the index increases by 10 points, the probability of using mobile money increases by 3.2 percentage points. These results are robust to the other specifications (including WGI variables and other controls) and to the use of Probit or OLS models (see Table A.1. in the Appendix). Additionally, since our main independent variable only varies at the country level, we also performed an additional robustness check by running the regressions at that level and the results hold too.

[16] As highlighted above, our preferred estimation is the baseline model since WGI variables may, to some extent, be picking up regulatory and governance measures that are already captured in the MM Regulatory Index and the Extended model is estimated on a smaller sample.

The results for the for the Index based on PCA-derived weights are also statistically significant for the baseline and baseline plus WGI variables as well as the Probit and OLS models (see Table A.1 in the Appendix), though they lose significance in the extended model with fewer countries. Overall, this provides re-assurance that the Index is strongly associated with mobile money usage and that it is capturing relevant indicators.

When considering some of the other control variables, we note that the following individual characteristics are associated with a higher likelihood of using mobile money:

- Education – individuals with secondary and tertiary education are more likely to use mobile money than those educated to primary level or less
- Gender - women are less likely to use mobile money even when factors such as income and education are controlled for
- Age – use of mobile money increases with age but then eventually declines for older individuals (this is reflected in the negative coefficient for the square term)
- Income – individuals with higher incomes are more likely to use mobile money
- Being banked – individuals that have an account with a financial institution are more likely to use mobile money
- Employment – individuals that are in the labour force are more likely to use mobile money than those that are not, and the employed (especially full-time employed) are more likely to use than the unemployed

Interestingly, while there is a negative link between mobile money usage and living in rural areas, it is generally not statistically significant. This suggests that once other factors such as income and education are controlled for, living in rural or urban areas does not have a strong association with usage.

In terms of country-factors, most of them do not have a significant relationship with usage apart from total population – the result suggests that larger markets have less mobile money use.

Table 4. Main results

	MM index			*MM index PCA*		
	(1) Baseline	(2) Baseline WGI	(3) Extended	(4) Baseline	(5) Baseline WGI	(6) Extended
MM index	0.00320**	0.00341**	0.00342**	0.0232**	0.0244***	0.00837
	(0.00159)	(0.00153)	(0.00137)	(0.00916)	(0.00884)	(0.00563)
Secondary	0.0367***	0.0335***	0.0387***	0.0405***	0.0370***	0.0402***
	(0.00999)	(0.00832)	(0.00814)	(0.0100)	(0.00829)	(0.00808)
Tertiary	0.0935***	0.0842***	0.0835***	0.0997***	0.0911***	0.0848***
	(0.0152)	(0.0132)	(0.0138)	(0.0161)	(0.0143)	(0.0136)
Gender	-0.0186***	-0.0197***	-0.0199***	-0.0174***	-0.0188***	-0.0195***
	(0.00574)	(0.00520)	(0.00538)	(0.00579)	(0.00522)	(0.00554)
Age	0.00149*	0.00157*	0.00129	0.00159*	0.00169*	0.00132
	(0.000861)	(0.000869)	(0.000847)	(0.000889)	(0.000890)	(0.000860)
Age^2	-3.16e-05***	-3.29e-05***	-2.72e-05***	-3.21e-05***	-3.35e-05***	-2.72e-05***
	(8.95e-06)	(9.12e-06)	(9.38e-06)	(9.14e-06)	(9.28e-06)	(9.47e-06)
Second 20%	0.0136**	0.0138**	0.0124**	0.0137**	0.0138**	0.0122**
	(0.00576)	(0.00566)	(0.00612)	(0.00578)	(0.00569)	(0.00616)
Middle 20%	0.0286***	0.0292***	0.0291***	0.0283***	0.0290***	0.0284***
	(0.00703)	(0.00687)	(0.00784)	(0.00720)	(0.00705)	(0.00802)
Fourth 20%	0.0317***	0.0330***	0.0304***	0.0309***	0.0324***	0.0289***
	(0.00781)	(0.00668)	(0.00730)	(0.00829)	(0.00717)	(0.00771)
Richest 20%	0.0527***	0.0558***	0.0503***	0.0504***	0.0540***	0.0475***
	(0.0113)	(0.00919)	(0.00889)	(0.0121)	(0.00996)	(0.00986)
Unbanked	-0.0667***	-0.0638***	-0.0679***	-0.0670***	-0.0638***	-0.0705***
	(0.00916)	(0.00872)	(0.00842)	(0.00948)	(0.00891)	(0.00841)
Mobile Owner	0.123***	0.120***	0.0960***	0.118***	0.116***	0.0952***
	(0.0138)	(0.0132)	(0.0115)	(0.0128)	(0.0127)	(0.0120)
FT Employer	0.0671***	0.0647***	0.0612***	0.0675***	0.0650***	0.0616***
	(0.00953)	(0.00848)	(0.00794)	(0.00934)	(0.00839)	(0.00806)
FT Self-Employed	0.0398***	0.0401***	0.0438***	0.0408***	0.0414***	0.0440***
	(0.0112)	(0.0106)	(0.00797)	(0.0114)	(0.0108)	(0.00816)
Part Time	0.0469***	0.0474***	0.0486***	0.0475***	0.0478***	0.0497***
	(0.00713)	(0.00664)	(0.00625)	(0.00699)	(0.00656)	(0.00608)
Unemployed	0.0240***	0.0227***	0.0181**	0.0240***	0.0227***	0.0171**

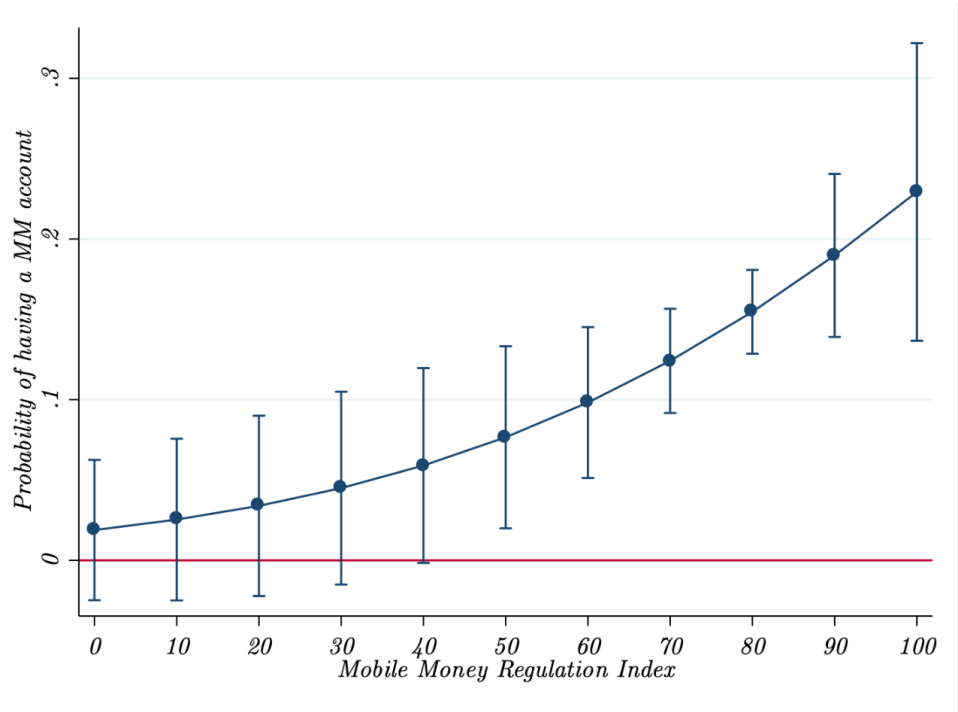
	(0.00684)	(0.00719)	(0.00736)	(0.00705)	(0.00733)	(0.00743)
Rural	-0.00350	-0.00647	-0.0113*	-0.00302	-0.00631	-0.0133**
	(0.00871)	(0.00821)	(0.00682)	(0.00847)	(0.00803)	(0.00674)
Log HH Size	0.00990	0.0107	0.00839	0.00690	0.00859	0.00603
	(0.00834)	(0.00730)	(0.00635)	(0.00859)	(0.00726)	(0.00655)
Married	-0.0151**	-0.0151**	-0.0156***	-0.0169***	-0.0171***	-0.0160***
	(0.00609)	(0.00630)	(0.00569)	(0.00583)	(0.00608)	(0.00587)
Divorced	0.0126	0.0115	0.00431	0.0122	0.0105	0.00404
	(0.0142)	(0.0138)	(0.0150)	(0.0140)	(0.0139)	(0.0151)
Log GDP per capita	0.0313	-0.00750	0.0106	0.0217	-0.0198	-0.00456
	(0.0207)	(0.0293)	(0.0289)	(0.0190)	(0.0292)	(0.0311)
Log Pop. Density	0.0147	0.00990	0.0396***	0.00836	0.00112	0.0342**
	(0.00920)	(0.00967)	(0.0142)	(0.00892)	(0.0103)	(0.0156)
Log Total Population	-0.0241**	-0.0358**	-0.0412***	-0.0325**	-0.0382**	-0.0366***
	(0.0116)	(0.0146)	(0.0133)	(0.0127)	(0.0154)	(0.0134)
Urban Pop.	-0.00189	-0.000704	-0.00337***	-0.00168	-0.000434	-0.00291***
	(0.00129)	(0.00106)	(0.000982)	(0.00119)	(0.000982)	(0.00112)
Political Stability		-0.0142	-0.0252		0.00332	-0.0178
		(0.0271)	(0.0234)		(0.0264)	(0.0242)
Government Effectiveness		0.121	0.0926		0.115	0.106
		(0.0735)	(0.0608)		(0.0699)	(0.0646)
Control Corruption		-0.0712	0.00148		-0.0793	-0.00993
		(0.0608)	(0.0372)		(0.0578)	(0.0402)
Branch Penetration			-0.00252			-0.00341**
			(0.00170)			(0.00168)
ATM Penetration			0.000301			0.000408*
			(0.000211)			(0.000210)
Legal Rights Index			-0.0111***			-0.00728*
			(0.00419)			(0.00399)
Region FE	Y	Y	Y	Y	Y	Y
Ind. controls	Y	Y	Y	Y	Y	Y
Country controls	Y	Y	Y	Y	Y	Y
Observations	48,649	48,649	41,566	48,649	48,649	41,566
Countries	46	46	39	46	46	39

Notes: (1) Standard errors clustered at country level. (2) The dependent variable is a dummy variable equal to 1 for having a MM account. (3) The coefficients are the average marginal effects. (4) The MM Index ranges between 0 and 100 and the MM Index PCA ranges between -8.45 and 2.42.

The above results show the average effect of the MM Regulatory Index on the probability of using mobile money. However, the effects may vary across the index distribution. Figure 2 plots the estimated marginal effects over the whole distribution of the index for our main specification. The plot shows an exponential relationship between the two variables conditional on the controls included in the baseline model.[17] It is important to highlight that the majority of the observations are concentrated between the index values of 60 and 90.

This is why the confidence intervals are larger on the extremes of the distribution. We also observe that, the higher the MM Regulatory index, the greater the probability of having a MM account, being statistically significant only after the value of 40. The probability ranges from around 0.06 (6%) when the MM regulatory index is 40 up to 0.23 (23%) when it is 100. Another take away from Figure 2 is that the positive relationship shown at points 90 and 100 is statistically different from that of points 40 and 50.

Figure 2. Probability of having a MM account along the regulatory index distribution



Notes: (1) Standard errors clustered at country level. (2) The dependent variable is a dummy variable equal to 1 for having a MM account. (3) The coefficients are the marginal effects alongside the MM Regulatory Index. (4) MM Regulatory Index ranges between 0 and 100 (5) Same individual and country control variables for Baseline Model as in Table 3.

[17] Results hold across models and by Probit and OLS.

5.2 Individual Indicators

We also estimate our preferred model using the index indicators instead of the composite measure. The majority of these take value 1 where an indicator gets the maximum score (100) or 0 otherwise. The exceptions are KYC requirements, Agent Activities and Interest Payments - these take value 1 if the indicator gets a score of 80 or more, as these still represent enabling regulations compared to lower scores. We omit the indicator for capital requirements as it can be measured in different ways, for example in purchasing power parity dollars, as a proportion of economy activity (GDP) or comparing them to the requirements for commercial banks. We address this indicator separately below. We also omit the indicator for maximum balance limits, as this is collinear with the indicator for maximum monthly transaction limits.

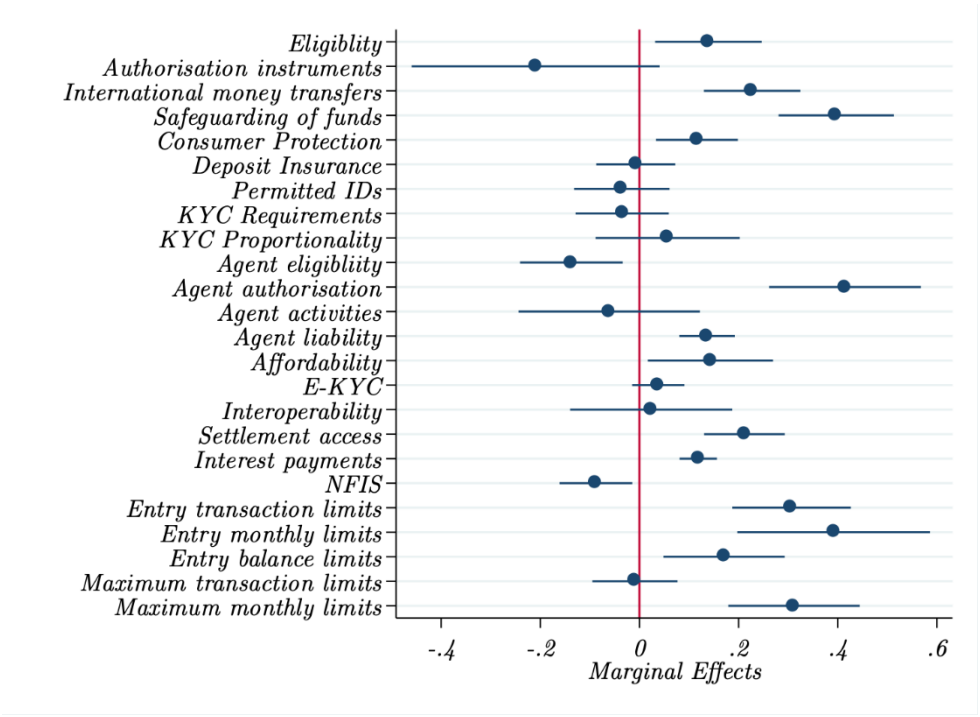
Figure 3 presents the results of our main specification (see Table A.2. in Appendix 2 for the exact point estimates and for the estimates of the baseline model with WGI variables).[18] The results show that several indicators have an important positive relationship with the probability of using mobile money. These include:

- **Eligibility** - where non-banks can offer mobile money
- **International Money Transfers** - where regulations permit mobile money customers to send or receive international remittances
- **Safeguarding of Funds** – where mobile money providers must keep 100% of e-money liabilities in liquid assets, where they cannot intermediate funds and where they must implement ring-fencing arrangements
- **Consumer Protection** – where there are consumer protection rules that provide access to dispute resolution, price and service disclosures and the protection of customer data.
- **Agent authorisation** – where providers do not have to request and receive authorisation to appoint individual or bulk agents
- **Agent liability** – where providers cannot limit their liability with respect to their agents' actions
- **Affordability** – where there are no taxes or price controls on mobile money transactions
- **Settlement access** – where non-banks providing mobile money have direct access to the country's retail payment settlement infrastructure
- **Interest payments** -where providers are permitted to earn interest on mobile money trust accounts and can distribute and utilise that interest (possibly with certain restrictions)
- **Transaction limits on entry-level accounts and monthly limits on full accounts** – where providers are *not* subject to strict transaction limits on entry-level accounts or on monthly transactions for full accounts (see Appendix 1 and the MMRI Methodology for further details on how 'strict' limits are defined).

Appendix 2 shows that these relationships are robust to most – if not all – checks and alternative models.

[18] We also estimated the extended model, but collinearity issues arise between the index component indicators, country variables and region fixed-effects.

Figure 3. Probability of having a MM by MM Regulatory Index component



Notes: (1) Standard errors clustered at country level. (2) The dependent variable is a dummy variable equal to 1 for having a MM account. (3) The coefficients are the average marginal effects. (4) MM Regulatory Index Components are dummy variables (5) Same individual and country control variables for Baseline Model as in Table 3.

Two indicators have a negative and significant relationship with mobile money usage, specifically Agent Eligibility – where regulations are not prescriptive on the identity of agents – and National Financial Inclusion Strategy (NFIS) – where a country has a written NFIS in place and it includes a specific mobile or digital element as well as a gender component.

In the case of Agent Eligibility, there is little variation in this indicator, with the majority of countries in the analysis scoring 100. If the indicator is adjusted to include countries that do have prescriptive regulations on the identity of agents but where they permit non-bank agents, the result becomes statistically insignificant. With regard to NFIS, it is possible that once other factors are controlled for, the negative coefficient is driven by reverse causality, with countries that have low levels of usage and adoption being more likely to have a NFIS in place (i.e. low mobile money usage means an NFIS is put in place, rather than the NFIS driving lower mobile money usage). However, we note that in Appendix 2, the statistical significance associated with NFIS is lost in other models and robustness checks, whereas this is generally not the case for the indicators with a positive and statistically significant association.

It is also notable that each of the dimensions considered in the MMRI include indicators that have a positive and significant relationship with mobile money usage, with the exception of KYC, where none of the three indicators have a statistically significant link. This may suggest that KYC requirements are not as an important factor relative to other aspects of regulation or it could be that the MMRI is not measuring a relevant component. Alternatively, it could be that KYC is more relevant to certain segments of the population. We explore this in Section 5.3 below.

With regard to capital requirements we ran three additional regressions that included all control variables and the MMRI along with a measure of initial capital requirements for mobile money providers.[19] The three measures considered were initial capital requirements expressed as: purchasing power parity dollars; proportion of GDP; proportion of commercial bank requirements. The results are presented in Appendix 2 (Table A.3) and show that none of the measures have a significant link with mobile money usage. However, when we exclude countries that have bank-led models and instead just look at countries where non-banks can provide e-money, some of the results suggest that individuals are less likely to use mobile money in countries with higher initial capital requirements for mobile money providers relative to commercial banks. However, this result should be treated with caution at this stage because introducing capital requirements in the models appears to generate collinearity issues with respect to other index indicators.

[19] When we included the individual index indicators with measures of initial capital requirements, some of them were dropped due to collinearity. We therefore included the index variable as the main regulatory control.

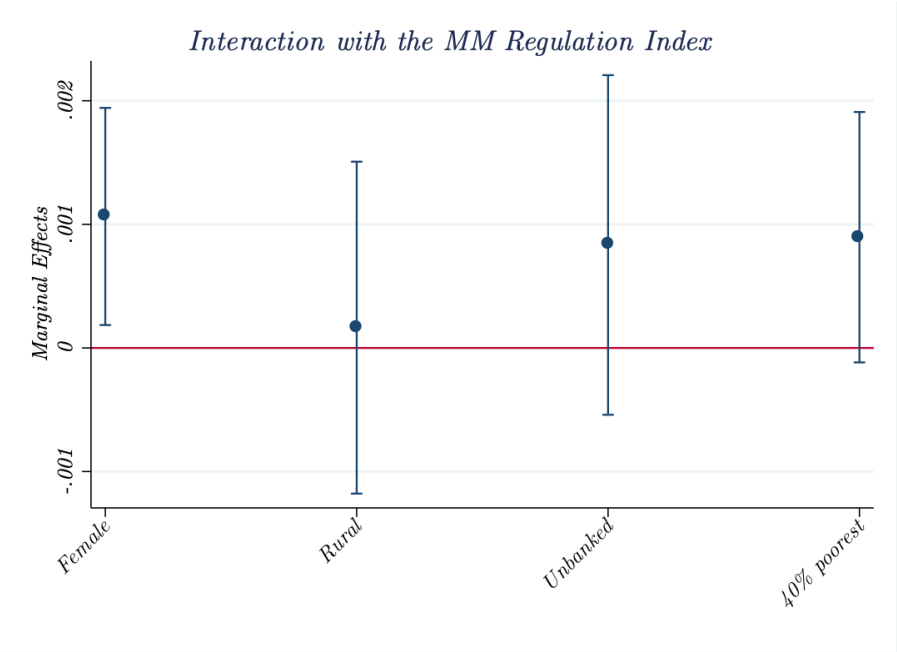
5.3 Heterogeneity analysis

In this section, we assess whether the positive association between mobile money usage and regulation is different for certain groups of individuals. In order to do so, we interact the regulatory index with different dummy variables capturing a variety of characteristics at the individual level. Figure 4 show the results of exploring whether there are differential effects for women, individuals leaving in rural areas, unbanked individuals and the 40% poorest segment of the population (see Table A.4. in the Appendix for the exact point estimates for the baseline model).

The results suggest that women benefit more than men from an increase in the MMRI score – this result is robust to a Probit specification as well as running separate regressions for male and female populations (see Table A.5 in Appendix 2). There are no significant differences in the relationship between regulation and usage between rural and urban or banked or unbanked individuals. When we run separate regressions on the different samples, we find a positive and statistically significant link for all rural/urban and banked/unbanked groups.

In terms of income, there is some evidence to suggest that a higher index score benefits the poorest 40% of the population more, though the result is only significant at the 10% level and is not robust to Probit or OLS models. On the other hand, when we run separate regressions for sub-samples, the results show a statistically significant link for the mobile money usage amongst the poorest 40% of the population and no link with the richest 20% (see Table A.5 in Appendix 2). We therefore conclude that there is some evidence to suggest that regulation is more strongly linked to usage amongst the poorest population segments, though this is not conclusive at this point.

Figure 3. Individual interactions with the MM Regulatory Index



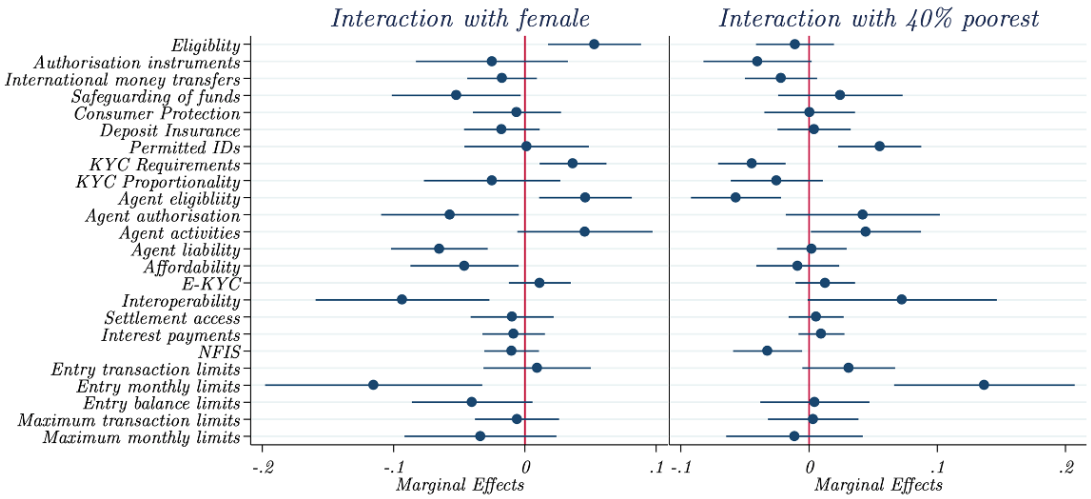
Notes: (1) Standard errors clustered at country level. (2) The dependent variable is a dummy variable equal to 1 for having a MM account. (3) The coefficients are the average marginal effects of the interaction between the MM Regulatory Index and the subgroup dummy variable (4) Same individual control variables for Baseline Model as in Table 3. (5) The regression includes country fixed-effects.

Given the results suggesting that mobile money regulation has a stronger link with usage amongst women and potentially the poorest segments of the population, we also carried out the interaction analysis using the individual indicators instead of the overall index score. This is presented in Figure 4 below, with point estimates provided in Table A.6 in Appendix 2. The results suggest that the following indicators are more strongly linked to mobile money usage amongst women than men:

- **Eligibility** - where non-banks can offer mobile money
- **KYC Requirements** - where a user can access an entry-level mobile money account with just an ID and mobile number (and any additional requested information need not be verified)
- **Agent eligibility** – where regulations are not prescriptive on the identity of agents
- **Agent activities** – where regulations permit agents to register customers and possibly carry out other activities (rather than just being restricted to cash-in and cash-out)

It is interesting that three of these indicators (all except Eligibility) were not found to have a significant association with mobile money usage in general, but they do when focusing on a particular segment of the population. This suggests that certain aspects of regulation may be more relevant to usage amongst some groups than others.

Figure 4. Individual interactions by MM Regulatory Index component



There are also some indicators that have a negative relationship with mobile money usage amongst women, including safeguarding of funds, agent authorisation, agent liability, affordability and certain transaction limits. Some of these may seem surprising upon first consideration. They could be explained by certain indicators imposing additional costs on mobile money providers, which could limit their ability to reach underserved individuals. Alternatively, there could be reverse causality - for example low mobile money usage amongst women leads regulators to put in place certain regulations on safeguarding funds, agent liability and impose price controls. It is also worth noting that some of the statistically significant findings between individual indicators and usage amongst women do not hold to all robustness checks (see Appendix 2), suggesting that the heterogeneity analysis at the indicator level requires further development. The results should therefore be treated with a degree of caution at this stage.

In terms of income, the results suggest that the following indicators are more strongly linked to mobile money usage amongst the poorest 40% of a country's population:

- **Permitted IDs** - where a country has a ubiquitous national ID that can be used to access mobile money services, or otherwise documents beyond Government-issued IDs can be used (e.g. employment ID, letter from ward or village executive).
- **Agent activities** - where regulations permit agents to at least cash-in, cash-out and register customers
- **Transaction limits on entry-level accounts** – where providers are not subject to strict limits on entry-level account transactions (see Appendix 1 and the MMRI Methodology document for further details on how 'strict' limits are defined)

Similar to the analysis for women, two of these three indicators (Permitted IDs and Agent Activities) were not found to have a significant association with mobile money usage in general, but they do when focusing on the poorest population segments. However, as was also the case for gender, there are some indicators with a negative link with mobile money usage amongst the poor, including KYC requirements, Agent Eligibility and having a NFIS. Again, this could be driven by reverse causality and given that some results do not hold to all robustness checks (see Appendix 2) we also treat these results with caution.

6. Conclusions

This paper assesses the relationship between mobile money regulation and usage in more countries and using a more comprehensive assessment of regulation than in previous studies. The results suggest compelling evidence that an enabling regulatory framework – as measured by the Mobile Money Regulatory Index – is strongly associated with higher mobile money usage. On average, when a country's Index score increases by 10 points, the probability of using mobile money increases by 3.2 percentage points. This relationship becomes stronger as the Index score increases, for example an increase from 80 to 90 points is associated with a larger increase in mobile money usage than an increase from 50 to 60 points.

There are a number of components within a regulatory framework that are linked to the use of mobile money, including: allowing non-banks to provide mobile money; permitting international money transfers; a comprehensive consumer protection framework; giving mobile money providers flexibility to appoint individual agents; not imposing strict limits, taxes or price controls on mobile money transactions; allowing non-banks to have direct access to retail payment settlement infrastructure, and; allowing providers to earn and utilise interest on mobile money trust accounts.

We also find evidence that a more enabling regulatory framework has a stronger association with mobile money usage amongst women than men, and there is some evidence to suggest that enabling regulation is more closely associated to mobile money usage amongst the poorest 40% of a country's population. Some of the factors that are particularly linked to higher usage amongst women and the poor include: regulations that permit agents to register customers (not just cash-in and cash-out), and; less strict KYC requirements, where prospective users can access entry-level mobile money accounts with just an ID and mobile number and where documents beyond Government-issued IDs can be used. However, further work is required on this to be conclusive on which specific factors are important to drive usage amongst under-served populations.

Having established that there is a strong relationship between different aspects of mobile money regulation and usage, the next phase of research should assess whether the link is causal (i.e. does more enabling regulation directly increase the adoption and use of mobile money in a country). This will require more sophisticated empirical strategy than the one employed in this paper and may also require assessing changes in regulations and usage over time, rather than looking at a single year. However, this should be achievable as the Mobile Money Regulatory Index is updated over time and can be used in combination with future versions of the Findex Database and/or other datasets on financial access and inclusion.

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Appendices

Appendix 1. Mobile Money Regulatory Index indicators

DIMENSION	INDICATOR	SCORE	CRITERIA
Authorisation	Eligibility	0	Non-banks including MNOs are not eligible to issue e-money/offer mobile money services at all
		20	Non-banks are eligible to issue e-money/offer mobile money services, but MNOs are prohibited from doing so. Alternatively MNOs are eligible to provide MM services, but no other non-bank is
		40	Non-banks (including MNOs) are NOT eligible to issue e-money/offer mobile money services EXCEPT by acquiring or establishing a lower-tiered prudentially regulated institution that is authorised to issue e-money/offer mobile money/branchless banking directly. The test here is whether the MNO owns the customer relationship with the mobile money account holders. If NO, then this indicator applies.
		60	Non-banks (including MNOs) are NOT eligible to issue e-money directly or obtain regulatory authorisation to offer mobile money services EXCEPT in partnership/in conjunction with a prudentially regulated institution whose role extends beyond providing funds custodial services (e.g. regulatory authorisation, regulatory engagement, etc. but does not have a customer relationship with mobile money account holders). The test here is whether the MNO owns the customer relationship with the mobile money account holders. If YES, then this indicator applies.
		100	Non-banks (including MNOs) are eligible to issue e-money/offer mobile money services directly or through a subsidiary (which is proportionately regulated), with the involvement of a bank or similar institution as custodian of customer funds
	Authorisation Instruments	0	There exists no regulatory framework to provide authorisation for the provision of mobile money services
		30	There exists no regulatory framework to provide authorisation for the provision of mobile money services, but letters of no objection are released or permission can be granted under a regulatory sandbox
		60	There exists a formal authorisation to provide mobile money services, which is based on regulatory framework. However, no authorisation has been released yet
		100	There exist a formal authorisation to provide mobile money services, which is based on regulatory framework, and authorizations have been released
	Capital Requirements	0	There are no initial capital requirements to provide mobile money services
		50	50 points are awarded if initial capital requirements are prescribed and EITHER of the following applies: (i) Initial capital requirements for mobile money providers are greater than $2 million (in purchasing-power parity) AND are greater than 10% of initial capital requirements for commercial banks AND are greater than 0.0025% of country GDP. (ii) Ongoing capital requirements are imposed and are set greater than 3% of outstanding balances.
		100	Mobile money regulations provide for initial capital requirements and they are either less than $2 milllion (in PPP) OR lower than 10% of requirements for commercial banks OR are lower than 0.0025% of country GDP. Ongoing capital requirements do not exceed 3% of outstanding balances.

Authorisation	**International Remittances**	0-100	100 points are awarded if EITHER of the following applies: (i) Regulations (either the mobile money regulation or other regulations that also apply to mobile money) explicitly provides for mobile money customers to send and/or receive international money transfers; OR (ii) the mobile money regulatory framework is not explicit, but it is permitted in practice.

DIMENSION	INDICATOR	SCORE	CRITERIA
Consumer Protection	**Safeguarding of funds**	0-100	100 points are awarded if ALL of the following apply: (i) MNOs and other non banks providing MM have to keep 100% of their e-money liabilities in liquid assets; AND (ii) MNOs and other non-banks must implement ring-fencing arrangements that protect the float against claims of creditors of the mobile money provider; AND (iii) MNOs and other non banks, as MM providers, cannot intermediate customer funds. If only banks are allowed to provide mobile money or issue e-money, 100 points are awarded.
	Consumer Protection Rules	0-100	20 points are awarded for EACH of the following that apply: (i) There are consumer protection rules that apply to mobile money services (either in the mobile money regulatory framework or in other consumer protection regulations or legislation); (ii) The consumer protection rules require that customers are granted access to recourse and complaint procedures in order to resolve disputes; (iii) The consumer protection rules require price disclosures for mobile money transactions; (iv) The consumer protection rules provide a general disclosure requirement to make the terms of the service available to customers; (v) The consumer protection rules provide for the protection of MM customers' data.
	Deposit insurance	0-100	100 points are awarded if deposit insurance protection is provided for each mobile money account (either in the mobile money regulatory framework or other regulations).

DIMENSION	INDICATOR	SCORE	CRITERIA
Agent Network	Agent eligibility	0	The regulation contains a prescriptive list on the identity of agents, and non-bank agents are not allowed.
		80	The regulation contains a prescriptive list on the identity of agents, and it allows for non-bank agents.
		100	The regulation does not contain a prescriptive list on the identity of agents.
	Agent authorisation	0-100	100 points are awarded if mobile money providers do not have to request and receive authorisation to appoint individual (or bulk) agents. If a notification framework is in place, the points are awarded.
	Agent activities	0	Regulation on the agents' permitted activities is prescriptive, and agents are allowed to perform only one (or none) of the following activities: cash in, cash out, customer enrolment.
		40	Regulation on the agents' permitted activities is prescriptive, and agents are allowed to perform only two of the following activities: cash in, cash out, customer enrolment.
		80	Regulation on the agents' permitted activities is prescriptive, and agents are allowed to perform the following activities and possibly others beyond these: cash in, cash out, customer enrolment.
		100	Regulation is not prescriptive on the permitted agents' activities.
	Agent liability	0-100	100 points are awarded if the mobile money regulations explicitly states that the mobile money provider cannot limit its liability with respect to its agents' actions (i.e. it is fully responsible for the actions and omissions of its agents).

DIMENSION	INDICATOR	SCORE	CRITERIA
KYC	Permitted identifications	0-100	100 points are awarded if EITHER of the following apply: (i) a national ID must be used and all population above the cut-off age are registered (based on World Bank ID4D data) and at least 90% of a country's adult population has a national ID, based on World Bank Findex data, OR; (ii) Documents beyond Government-issued IDs can be used as minimum requirements in the context of accessing MM services (e.g. employment ID, letter from ward or village executive).
	KYC requirements	0	Requirements for verification of information extend beyond a form of identification and a mobile number
		30	Anonymous or unregistered accounts are permitted
		80	ID and/or mobile number must be presented; any additional requested information need not be verified
		100	The regulation allows operators flexibility in setting the minimum KYC requirements, subject to some regulatory review or approval or according to regulations providing risk-based KYC tiers
	KYC Proportionality	0-100	100 points are awarded if KYC requirements for opening an entry-level mobile money account are less strict than the KYC requirements for standard bank accounts.

DIMENSION	INDICATOR	SCORE	CRITERIA
Transaction Limits	Entry-level transaction limits	0	Limits are less than $250 (in purchasing power-parity) AND below 5% of GDP per capita
		50	Limits are less than $500 (in purchasing power-parity) AND below 10% of GDP per capita
		100	Limits are EITHER greater than $500 (in purchasing-power parity) OR above 10% of GDP per capita
	Entry-level monthly limits	0	Limits are less than $750 (in purchasing power-parity) AND below 10% of GDP per capita
		50	Limits are less than $1500 (in purchasing power-parity) AND below 20% of GDP per capita
		100	Limits are EITHER greater than $1500 (in purchasing-power parity) OR above 20% of GDP per capita
	Entry-level balance limits	0	Limits are less than $750 (in purchasing power-parity) AND below 10% of GDP per capita
		50	Limits are less than $1500 (in purchasing power-parity) AND below 20% of GDP per capita
		100	Limits are EITHER greater than $1500 (in purchasing-power parity) OR above 20% of GDP per capita
	Maximum transaction limits	0	Limits are less than $750 (in purchasing power-parity) AND below 10% of GDP per capita
		50	Limits are less than $1500 (in purchasing power-parity) AND below 20% of GDP per capita
		100	Limits are EITHER greater than $1500 (in purchasing-power parity) OR above 20% of GDP per capita
	Maximum monthly limits	0	Limits are less than $2500 (in purchasing power-parity) AND below 50% of GDP per capita
		50	Limits are less than $5000 (in purchasing power-parity) AND below 100% of GDP per capita
		100	Limits are EITHER greater than $5000 (in purchasing-power parity) OR above 100% of GDP per capita
	Maximum balance limits	0	Limits are less than $2500 (in purchasing power-parity) AND below 50% of GDP per capita
		50	Limits are less than $5000 (in purchasing power-parity) AND below 100% of GDP per capita
		100	Limits are EITHER greater than $5000 (in purchasing-power parity) OR above 100% of GDP per capita

DIMENSION	INDICATOR	SCORE	CRITERIA
Infrastructure and Investment Environment	**Affordability**	0-100	100 points are awarded if BOTH of the following apply: (i) No discriminatory taxation (mobile specific taxes) is imposed on mobile money services, AND; (ii) No pricing regulation is imposed on any type of mobile money transaction.
	Government KYC	0-100	50 points are awarded for EACH of the following that apply: (i) Government provides KYC verification for mobile money providers (verify authenticity of ID via access to Govt database); (ii) Government provides automated KYC verification for mobile money providers.
	Interoperability	0-100	100 points are awarded if the regulation does not prescribe the technical standards for interoperability.
	Settlement Access	0-100	100 points are awarded if MNOs and other non-banks providing mobile money have direct access to the country's retail payment settlement infrastructure. If only banks can provide mobile money or issue e-money, the points are awarded. If non-bank mobile money providers only have indirect access through a custodial bank, a score of 0 is awarded.
	Interest payments	0	Mobile money regulatory framework explicitly prohibits mobile money providers from earning interest on mobile money trust accounts.
		30	Mobile money regulatory framework does not explicitly address whether mobile money providers may earn interest on mobile money trust accounts, but it appears to be happening in practice.
		70	Mobile money regulatory framework explicitly permits mobile money providers to earn interest on mobile money trust accounts, with certain restrictions on how the interest may be utilised or distributed (e.g., prohibition on distribution to customers, requirement that funds are distributed to customers, requirement that funds are used for customer benefit, etc.)
		100	Mobile money regulatory framework explicitly permits mobile money providers to earn interest on mobile money trust accounts, with no restrictions on how the interest may be utilised or distributed.
	Financial inclusion strategy	0-100	(i) 50 points are awarded if the country has or has had in place a written national financial inclusion policy/strategy. (ii) A further 25 points are awarded if the written national financial inclusion/policy has or has had at some point a specific mobile element. (iii) A further 25 points are awarded if the written national financial inclusion/policy has or has had at some point targets to address the gender gap. If the gender gap in financial access is less than 9%, according to World Bank Findex survey data, the points are awarded. If a country has no written financial inclusion policy/strategy but more than 95% of the adult population has an account (according to World Bank Findex survey data), 100 points are awarded.

Appendix 2. Further Results

Table A.1. Main results. Probit and OLS.

	Panel A					
	Baseline model		Baseline Model with WGI variables		Extended model	
	(1) Probit	(2) OLS	(3) Probit	(4) OLS	(5) Probit	(6) OLS
MM index	0.00301*	0.00414**	0.00308**	0.00398**	0.00349***	0.00582***
	(0.00157)	(0.00202)	(0.00153)	(0.00197)	(0.00129)	(0.00201)
	Panel B					
MM index PCA	0.0230***	0.0341***	0.0242***	0.0384***	0.00886	0.0189*
	(0.00880)	(0.0121)	(0.00872)	(0.0130)	(0.00573)	(0.00938)
Region fixed-effects	Y	Y	Y	Y	Y	Y
Individual-level controls	Y	Y	Y	Y	Y	Y
Country-level controls	Y	Y	Y	Y	Y	Y
Observations	48,649	48,649	48,649	48,649	41,566	41,566
Countries	46	46	46	46	38	38

Notes: (1) Standard errors clustered at country level. (2) The dependent variable is a dummy variable equal to 1 for having a MM account. (3) Marginal effects for Probit. (4) Same control variables than as in Table 3.

Table A.2. MM Index components and the probability of having a MM account

	Baseline Model			Baseline Model with WGI variables		
	(1) Logit	(2) Probit	(3) OLS	(4) Logit	(5) Probit	(6) OLS
Eligibility	0.139**	0.128***	0.131*	0.165***	0.148***	0.127
	(0.0548)	(0.0443)	(0.0690)	(0.0485)	(0.0491)	(0.0955)
Authorisation instruments	-0.209	-0.198	-0.212	-0.311**	-0.291**	-0.207
	(0.128)	(0.122)	(0.221)	(0.126)	(0.139)	(0.287)
International money transfers	0.227***	0.196***	0.114**	0.227***	0.202***	0.143***
	(0.0497)	(0.0387)	(0.0427)	(0.0444)	(0.0336)	(0.0421)
Safeguarding of funds	0.397***	0.352***	0.264***	0.380***	0.361***	0.294***
	(0.0593)	(0.0583)	(0.0688)	(0.0578)	(0.0514)	(0.0620)
Consumer Protection	0.116***	0.0981**	0.104*	0.0912**	0.0816**	0.104**
	(0.0421)	(0.0410)	(0.0522)	(0.0364)	(0.0355)	(0.0479)
Deposit Insurance	-0.00746	-0.0201	-0.0666	-0.0650	-0.0652	-0.112
	(0.0406)	(0.0423)	(0.0671)	(0.0424)	(0.0455)	(0.0753)
Permitted IDs	-0.0356	-0.0361	-0.0241	0.00233	0.00434	0.0332
	(0.0490)	(0.0326)	(0.0313)	(0.0531)	(0.0365)	(0.0389)
KYC Requirements	-0.0348	-0.0201	0.0865*	-0.0532	-0.0400	0.105*
	(0.0479)	(0.0350)	(0.0460)	(0.0460)	(0.0391)	(0.0617)
KYC Proportionality	0.0570	0.0347	-0.112	-0.0731	-0.0814	-0.245**
	(0.0741)	(0.0592)	(0.0905)	(0.0923)	(0.0647)	(0.0919)
Agent eligibility	-0.137***	-0.120**	-0.0332	-0.154***	-0.158***	-0.106*
	(0.0529)	(0.0471)	(0.0628)	(0.0493)	(0.0391)	(0.0578)
Agent authorisation	0.415***	0.352***	0.213**	0.342***	0.310***	0.173*
	(0.0781)	(0.0692)	(0.0824)	(0.0693)	(0.0650)	(0.0890)
Agent activities	-0.0610	-0.0477	-0.0156	0.0432	0.0320	0.00908
	(0.0933)	(0.0785)	(0.117)	(0.0983)	(0.0784)	(0.133)
Agent liability	0.137***	0.128***	0.134***	0.118***	0.121***	0.126***
	(0.0286)	(0.0287)	(0.0456)	(0.0232)	(0.0245)	(0.0427)
Affordability	0.143**	0.107*	0.0225	0.118**	0.101**	0.0246
	(0.0645)	(0.0546)	(0.0594)	(0.0516)	(0.0461)	(0.0553)
E-KYC	0.0380	0.0428	0.113**	0.0847***	0.0916***	0.188***

	(0.0268)	(0.0287)	(0.0427)	(0.0272)	(0.0284)	(0.0421)
Interoperability	0.0235	0.0242	0.00651	0.0912	0.107	0.0901
	(0.0834)	(0.0842)	(0.130)	(0.0656)	(0.0658)	(0.110)
Settlement access	0.212***	0.181***	0.0973**	0.193***	0.176***	0.103***
	(0.0415)	(0.0336)	(0.0379)	(0.0279)	(0.0252)	(0.0375)
Interest payments	0.119***	0.114***	0.141***	0.130***	0.131***	0.173***
	(0.0192)	(0.0187)	(0.0240)	(0.0173)	(0.0180)	(0.0249)
NFIS	-0.0877**	-0.0754**	-0.0534	-0.0577	-0.0574*	-0.0703
	(0.0374)	(0.0296)	(0.0381)	(0.0398)	(0.0309)	(0.0475)
Entry transaction limits	0.307***	0.255***	0.122**	0.213***	0.194***	0.0873
	(0.0611)	(0.0581)	(0.0594)	(0.0445)	(0.0426)	(0.0608)
Entry monthly limits	0.392***	0.320***	0.138	0.346***	0.318***	0.180*
	(0.0991)	(0.0859)	(0.0918)	(0.0902)	(0.0821)	(0.103)
Entry balance limits	0.171***	0.157***	0.209***	0.209***	0.198***	0.274***
	(0.0624)	(0.0587)	(0.0702)	(0.0601)	(0.0548)	(0.0729)
Maximum transaction limits	-0.00906	0.00472	0.0282	0.0325	0.0366	0.0500
	(0.0438)	(0.0444)	(0.0749)	(0.0353)	(0.0395)	(0.0705)
Maximum monthly limits	0.312***	0.254***	0.189*	0.213***	0.181***	0.161
	(0.0676)	(0.0697)	(0.104)	(0.0608)	(0.0640)	(0.108)
Region fixed-effects	Y	Y	Y	Y	Y	Y
Individual-level controls	Y	Y	Y	Y	Y	Y
Country-level controls	Y	Y	Y	Y	Y	Y
Obs.	48,649	48,649	48,649	48,649	48,649	48,649
Countries	46	46	46	46	46	46

Notes: (1) Standard errors clustered at country level. (2) The dependent variable is a dummy variable equal to 1 for having a MM account. (3) Average Marginal effects for Logit and Probit. (4) Same control variables than as in Table 3.

Table A.3. Capital Requirements and the probability of having a MM account

	All countries			Exclude bank-led models		
	(1) Logit	(2) Probit	(3) OLS	(1) Logit	(2) Probit	(3) OLS
Capital requirements metric						
Ratio with commercial banks	-0.0287	-0.0252	-0.0299	-1.122**	-1.019**	-0.583
	(0.0533)	(0.0507)	(0.0645)	(0.535)	(0.507)	(0.385)
PPP USD	-0.0000	-0.0000	-0.0000	-0.0018	-0.0015	-0.0014
	(0.0000)	(0.0000)	(0.0000)	(0.0017)	(0.0017)	(0.0001)
Proportion of GDP	-0.0000	-0.0000	-0.0000	-0.0007*	-0.0007	-0.0009
	(0.0000)	(0.0000)	(0.0000)	(0.0004)	(0.0004)	(0.0008)
Region fixed-effects	Y	Y	Y	Y	Y	Y
Individual-level controls	Y	Y	Y	Y	Y	Y
Country-level controls	Y	Y	Y	Y	Y	Y
Observations	48,649	48,649	48,649	35,191	35,191	35,191
Countries	46	46	46	32	32	32

Notes: (1) Standard errors clustered at country level. (2) The dependent variable is a dummy variable equal to 1 for having a MM account. (3) Marginal effects for reported for Logit and Probit. (4) Same control variables than as in Table 3 along with the MMRI variable.

Table A.4. Heterogeneity analysis – Interaction - Logit, Probit and OLS

	(1) Logit	(2) Probit	(3) OLS
Index x Female	0.00106**	0.00118***	0.00106
	(0.000448)	(0.000445)	(0.000806)
Index x Rural	0.000164	-3.01e-05	-0.000128
	(0.000685)	(0.000726)	(0.00102)
Index x Unbanked	0.000833	0.000525	-0.000399
	(0.000701)	(0.000876)	(0.00259)
Index x 20% Poorest	0.000573	0.000309	-0.000375
	(0.000762)	(0.000837)	(0.00147)
Index x 40% Poorest	0.000896*	0.000646	0.000118
	(0.000781)	(0.000603)	(0.00139)
Index x 20% Richest	-0.00138**	-0.00118*	-0.00119
	(0.000601)	(0.000660)	(0.00174)
Country fixed-effects	Y	Y	Y
Individual-level controls	Y	Y	Y
Observations	48,649	48,649	48,649
Countries	46	46	46

Notes: (1) Standard errors clustered at country level. (2) The dependent variable is a dummy variable equal to 1 for having a MM account. (3) The coefficients are the average marginal effects for Logit and Probit (4) Same individual control variables as in Table 3.

Table A.5. Heterogeneity analysis – Subsample - Logit, Probit and OLS

	Logit	Probit	OLS
Female sample (N=25,909)			
MM Index	0.00357***	0.00350***	0.00477**
	(0.00132)	(0.00129)	(0.00186)
Male sample (N=22,740)			
MM Index	0.00265	0.00236	0.00339
	(0.00195)	(0.00193)	(0.00228)
40% poorest sample (N= 16,947)			
MM Index	0.00330**	0.00316**	0.00438**
	(0.00141)	(0.00137)	(0.00183)
20% richest sample (N= 12,195)			
MM Index	0.00208	0.00186	0.00263
	(0.00224)	(0.00222)	(0.00257)
Country fixed-effects	Y	Y	Y
Individual-level controls	Y	Y	Y
Countries	46	46	46

Notes: (1) Standard errors clustered at country level. (2) The dependent variable is a dummy variable equal to 1 for having a MM account. (3) The coefficients are the average marginal effects for Logit and Probit (4) Same individual control variables as in Table 3.

Table A.6: Heterogeneous analysis using Index components

	Female			40% Poorest		
INTERACTION	(1) Logit	(2) Probit	(3) OLS	(4) Logit	(5) Probit	(6) OLS
Eligibility	0.0530***	0.0411***	-0.0142	-0.0110	-0.0132	-0.0482**
	(0.0181)	(0.0151)	(0.0174)	(0.0155)	(0.0142)	(0.0236)
Authorisation instruments	-0.0251	-0.0319	0.0586	-0.0402*	-0.0221	0.0855**
	(0.0295)	(0.0250)	(0.0362)	(0.0215)	(0.0198)	(0.0411)
International money transfers	-0.0174	-0.0135	-0.00434	-0.0218	-0.0253*	-0.0124
	(0.0136)	(0.0123)	(0.0175)	(0.0144)	(0.0139)	(0.0217)
Safeguarding of funds	-0.0523**	-0.0438**	0.00328	0.0244	0.0228	0.0200
	(0.0251)	(0.0202)	(0.0189)	(0.0248)	(0.0209)	(0.0259)
Consumer Protection	-0.00613	-0.00189	0.0174	0.000467	-0.00162	0.0108
	(0.0171)	(0.0159)	(0.0166)	(0.0180)	(0.0149)	(0.0230)
Deposit Insurance	-0.0176	-0.00982	0.0162	0.00393	0.0159	0.0281
	(0.0147)	(0.0129)	(0.0251)	(0.0146)	(0.0146)	(0.0250)
Permitted IDs	0.00133	0.0100	0.0215	0.0551***	0.0438***	0.0370*
	(0.0242)	(0.0187)	(0.0157)	(0.0166)	(0.0168)	(0.0210)
KYC Requirements	0.0366***	0.0250**	0.0243	-0.0447***	-0.0443***	-0.0425
	(0.0130)	(0.0114)	(0.0191)	(0.0135)	(0.0133)	(0.0261)
KYC Proportionality	-0.0250	-0.0207	0.00194	-0.0252	-0.0126	0.0329
	(0.0265)	(0.0204)	(0.0248)	(0.0183)	(0.0177)	(0.0410)
Agent eligibility	0.0461**	0.0335**	-0.00371	-0.0570***	-0.0547***	-0.0594***
	(0.0180)	(0.0160)	(0.0189)	(0.0179)	(0.0162)	(0.0218)
Agent authorisation	-0.0571**	-0.0496**	-0.0375	0.0419	0.0351	-0.0152
	(0.0268)	(0.0233)	(0.0312)	(0.0307)	(0.0275)	(0.0423)
Agent activities	0.0457*	0.0440**	0.00296	0.0444**	0.0392**	0.00330
	(0.0263)	(0.0206)	(0.0227)	(0.0219)	(0.0187)	(0.0285)
Agent liability	-0.0652***	-0.0518***	0.00853	0.00213	0.00718	0.0535**
	(0.0188)	(0.0145)	(0.0150)	(0.0138)	(0.0122)	(0.0210)
Affordability	-0.0460**	-0.0331*	0.0589**	-0.00888	-0.00510	0.0619**
	(0.0210)	(0.0187)	(0.0290)	(0.0165)	(0.0153)	(0.0306)

E-KYC	0.0114	0.00524	-0.0172	0.0126	0.00404	-0.0399*
	(0.0121)	(0.0115)	(0.0175)	(0.0118)	(0.0120)	(0.0208)
Interoperability	-0.0933***	-0.0672**	-0.0399	0.0727*	0.0765**	0.0629
	(0.0338)	(0.0293)	(0.0379)	(0.0376)	(0.0300)	(0.0486)
Settlement access	-0.00976	-0.00634	-0.0159	0.00554	0.00424	-0.00397
	(0.0161)	(0.0132)	(0.0178)	(0.0109)	(0.0110)	(0.0244)
Interest payments	-0.00862	-0.00869	-0.00456	0.00967	0.000869	-0.0288
	(0.0121)	(0.0103)	(0.0156)	(0.00913)	(0.00907)	(0.0182)
NFIS	-0.0101	-0.00409	0.00572	-0.0323**	-0.0283**	-0.0201
	(0.0106)	(0.00972)	(0.0147)	(0.0138)	(0.0131)	(0.0239)
Entry transaction limits	0.00932	0.00359	-0.00744	0.0310*	0.0237	0.00607
	(0.0209)	(0.0203)	(0.0261)	(0.0184)	(0.0202)	(0.0327)
Entry monthly limits	-0.115***	-0.0955***	-0.0379	0.137***	0.110***	0.0431
	(0.0422)	(0.0312)	(0.0304)	(0.0359)	(0.0313)	(0.0447)
Entry balance limits	-0.0402*	-0.0289	0.00248	0.00453	-0.00285	-0.0372
	(0.0234)	(0.0219)	(0.0307)	(0.0217)	(0.0217)	(0.0402)
Maximum transaction limits	-0.00602	0.000244	-0.00999	0.00323	-0.00190	-0.0136
	(0.0164)	(0.0151)	(0.0189)	(0.0180)	(0.0168)	(0.0264)
Maximum monthly limits	-0.0339	-0.0334	-0.00818	-0.0113	-0.00861	-0.0135
	(0.0295)	(0.0227)	(0.0279)	(0.0272)	(0.0236)	(0.0334)
Country fixed-effects	Y	Y	Y	Y	Y	Y
Individual-level controls	Y	Y	Y	Y	Y	Y
Observations	48,649	48,649	48,649	48,649	48,649	48,649
Countries	46	46	46	46	46	46

Notes: (1) Standard errors clustered at country level. (2) The dependent variable is a dummy variable equal to 1 for having a MM account. (3) The coefficients are the average marginal effects for Logit and Probit (4) Same individual control variables as in Table 3.