Bridging the Gender Gap: the role of mobile money in achieving

gender equality in developing countries

Yrabo Dabou[[1]](#footnote-1)1,2

1*Universit´e Clermont Auvergne, CNRS, IRD, CERDI, F-63000, Clermont-Ferrand, FRANCE*

2*Laboratoire d’Economie Appliquée et Théorique (LabEA), Universitée de Koudougou, Burkina Faso*

# Abstract

Gender equality is not only a fundamental human right but also an essential pillar for peace, prosperity, and sustainable development. This paper provides causal evidence of the impact of mobile money adoption on gender equality, using data from 84 developing countries over 1990–2023. Using entropy balancing and instrumental variable methods with country fixed effects, we find that mobile money adoption is associated with a significant 0.62 percentage point increase in gender equality. Our results are robust to a wide range of alternative methods, model specifications, and measures; exclusion of outliers; placebo tests; and different robust standard errors. Heterogeneity analyses indicate that the effect varies according to the type and diffusion stage of mobile money, initial gender inequality, rural demographics, female literacy, and national gender policy frameworks. We identify three principal channels : increased remittance flows to women, expanded access to financial services, and higher female self-employment. These findings highlight the potential of digital financial inclusion to advance gender equality and accelerate progress toward Sustainable Development Goal 5 in developing economies.

**JEL Classification** : C21, C23; J16; L86; O16; G21

**Keywords** : Gender equality, Mobile Money, Entropy balancing, Developing countries.

# 1 Introduction

Gender equality is no longer only a moral imperative or a human-rights issue; it has become a cornerstone of sustainable development. Enshrined in Sustainable Development Goal (SDG 5), gender parity calls for equal access to legal rights, economic resources, professional opportunities, and political participation (Elson, 2009; Sundstr¨om et al., 2017). Yet, despite two decades of multilateral commitment, the global gap is only 68.8% losed as of 2025, leaving roughly one-third of the road to parity unmet (WEF, 2025). Shortfalls are most acute in lowand middle-income countries—where parity stands near 66%—owing to persistent barriers in education, employment, reproductive health, and institutional representation (Duflo, 2012).

A key bottleneck is financial exclusion. The latest Global Findex shows that women are, on average, six percentage points less likely than men to hold a digital financial account (Klapper et al., 2025). Because such accounts enable saving, income receipt, and social transfers, they are often a prerequisite for economic empowerment (GSMA, 2025). Mobile money—delivered via mobile-phone networks—has emerged as a transformative response, providing the unbanked with remote savings, payment, and transfer services. By 2024, the sector had surpassed 2.1 billion registered accounts and half a billion monthly active users (GSMA, 2025). This rapid expansion raises a critical question : can mobile money narrow the economic and social gaps between men and women in developing countries, and through which mechanisms ?

Theoretical work highlights three pathways through which mobile money can shape gender outcomes. First, New Institutional Economics underscores how formal and informal rules shape economic performance by altering transaction costs and resource access (North, 1990). Mobile money functions as an informal institutional innovation : by bypassing low bank density, it broadens market exchange, especially where financial infrastructure is weak (Aron, 2018). Second, collective-household models show that resource control determines intra-household bargaining power (Manser & Brown, 1980; Lundberg & Pollak, 1994). Because a mobile-money wallet is linked to an individual handset, it grants women their own account and greater autonomy to spouses or relatives. Better control of liquid assets generally leads to higher spending on health, education, and productive investment (Duflo, 2012). Kenya’s M-Pesa provides clear evidence : many women escaped extreme poverty once they had access to the service (Suri & Jack, 2016). Third, the financial-inclusion literature views the relaxation of liquidity constraints—via secure, accessible tools—as pivotal for empowering marginalised groups (Demirgu¨¸c-Kunt & Klapper, 2012). Intersecting these perspectives, mobile money appears well positioned to reduce gender gaps.

Empirical studies, which are largely micro-level and focused on the African pioneers of mobile money (Kenya, Uganda, Malawi, etc.), find broadly positive effects. Mobile money (i) cushions shocks and smooths consumption (Jack & Suri, 2014; Munyegera & Matsumoto, 2016; Riley, 2018b; Patnam & Yao, 2020; Ahmed & Cowan, 2021); (ii) boosts self-employment, better-paid work, savings, credit, investment, and firm performance(Munyegera & Matsumoto, 2016; Aker et al., 2016; Riley, 2018b; Islam et al., 2018; Aggarwal et al., 2020; Riley, 2024); (iii) improves food security and raises per-capita consumption, especially in female-headed households(Munyegera & Matsumoto, 2016; Suri & Jack, 2016); and (iv) lowers the cost and increases the speed of remittances(Jack & Suri, 2011; Munyegera & Matsumoto, 2014; Mbiti & Weil, 2015; Blumenstock et al., 2016). Mobile money also strengthens women’s bargaining power and entrepreneurship (Aker et al., 2016; Suri & Jack, 2016; Batista et al., 2022; Islam & Muzi, 2020). Randomised controlled trials in Tanzania and Uganda corroborate these findings (Bastian et al., 2018; Riley, 2024). At the macro level, recent work links mobile money to more stable aggregate consumption, higher tax revenue, lower transaction costs, and broader financial access(Hamdan, 2019; Apeti, 2023; Apeti & Edoh, 2023). Nonetheless, evidence remains fragmentary, and no study has systematically tested whether—and how—mobile-money adoption improves gender equality in macro level. This paper addresses that gap by estimating the country-level effect of mobile money on gender equality in developing economies and by identifying the aggregate mechanisms that can scale micro gains to the macro level.

Drawing on the literature, we identify three principal channels through which digital financial inclusion can advance gender equality : (i) increased remittance inflows to women ; (ii) expansion of formal financial account ownership among women ; and (iii) higher female self-employment. First, direct transfers to women’s wallets increase the volume and frequency of remittances, strengthening household liquidity and women’s bargaining power. Empirical studies show that greater female control over resources leads to higher expenditures on education, health, and productive assets (Duflo, 2012). Second, mobile money dramatically lowers the cost of financial inclusion : a basic handset and chip card suffice, enabling previously excluded women to access savings, credit, and insurance independently, bolstering resilience and closing gender gaps. Third, secure digital payments reduce transaction costs and time constraints, empowering women to participate in the labor market and manage small and medium-sized enterprises more effectively.

The main contributions to the literature of this paper are as listed below. First, we extend the analysis of gender equality effects from the household and village levels to the macroeconomic scale. Using a panel of 84 developing countries, we show that the household-level benefits of mobile money documented in micro-level studies (see Suri & Jack, 2016; Batista et al., 2022; Riley, 2024) also translate into significant country-level improvements once key structural differences—such as institutional frameworks and economic conditions—are accounted for. This result is non-trivial, given that positive local effects can diminish or even reverse due to economywide interactions. Second, we address identification rigorously by applying entropy balancing to correct for observable selection bias and an instrumental-variables fixed-effects estimator to tackle endogeneity. By integrating research on digital finance and gender inclusion, our paper provides robust evidence with direct policy relevance for achieving Sustainable Development Goals.

Using a panel of 84 developing countries from 1990 to 2023, we apply entropy balancing to re-weight untreated observations, matching them to treated units on all baseline covariates. We then estimate instrumental variable fixed-effects models, using mobile network coverage and mobile money usage costs as instruments for mobile-money adoption. The results indicate that mobile money significantly improves gender equality by 0.62 percentage points. These findings are robust across a wide array of checks, including alternative estimation techniques, different indicators of gender equality and mobile-money use, outlier exclusion, placebo tests, extended control sets, and changes in sample composition. We further identify three consistent channels through which mobile money affects gender equality : (i) increased frequency of remittance flows to women ; (ii) enhanced women’s access to formal financial services ; and (iii) higher women self-employment. Finally, we document pronounced heterogeneity : the magnitude of the effect varies with regional characteristics, the type of mobile-money service, countries’ development levels, initial gender equality, rural population shares, female literacy rates, and the quality of gender-related institutions.

The remainder of the paper is organized as follows : Section 2 details the identification strategy ; Section 3 describes the data and stylized facts; Section 4 presents baseline results; Sections 5–7 cover robustness, mechanisms, and heterogeneity; Section 8 concludes with policy implications.

# 2 Identification strategy

## 2.1 Entropy balancing strategy

In this study, we evaluate the impact of mobile money adoption on gender equality by estimating the following specification :

*Yct* = *α*0 + *β MMct* + *θ*′*Xct* + *µc* + *λt* + *εct,* (1)

where *Yct* denotes the gender equality outcome (measured using either the Gender Parity Gap or the Gender Inequality Index) for country *c* in year *t*; *MMct* is a binary variable equal to 1 from the year mobile money becomes available in country *c*; *Xct* is a vector of time-varying control variables selected based on prior literature on mobile money and gender inequality (Riley, 2018a; Jacolin et al., 2021; Apeti & Edoh, 2023; Apeti, 2023; Zore, 2025); *µc* and *λt* represent country and year fixed effects, respectively, capturing time-invariant heterogeneity and common shocks; and *εct* is the idiosyncratic error term. Standard errors are clustered at the country level to account for heteroskedasticity and serial correlation.

The coefficient of interest, *β*, captures the average treatment effect of mobile money adoption on gender equality. Its identification relies on two key assumptions. First, the *parallel trends* assumption requires that, in the absence of treatment, treated and untreated countries would have followed similar trends in gender equality. Second, the timing of treatment must be exogenous to shocks affecting gender equality. This assumption may not hold if the rollout of mobile money is influenced by structural characteristics—such as economic development, digital infrastructure, or institutional quality—that also shape gender outcomes, potentially introducing selection bias (Aron, 2018; Apeti & Edoh, 2023).

To address these identification concerns, we apply *entropy balancing* (Hainmueller, 2012), a nonparametric reweighting method that ensures treated and untreated units are balanced on the distribution of pre-treatment covariates. In the first step, weights are computed for untreated countries such that their covariate moments match those of treated units. In the second step, a weighted least squares (WLS) regression of *Yct* on *MMct* and *Xct* is estimated, including fixed effects and country-specific time trends. This approach enables us to estimate the average treatment effect on the treated (ATT) with reduced bias (see Appendix A).

Entropy balancing offers several advantages over traditional techniques such as propensity score matching (PSM) or difference-in-differences (DiD). First, it guarantees covariate balance on specified moments even in small samples. Second, it reduces model dependence by orthogonalizing covariates with respect to the treatment. Third, it retains the full sample, minimizing information loss. Fourth, it fully exploits the panel structure by incorporating both country and year fixed effects. Lastly, by improving covariate balance, it strengthens the plausibility of the parallel trends assumption. This method has been used in recent panel-data studies evaluating the impact of policy interventions (Neuenkirch & Neumeier, 2016) and mobile-money (Apeti & Edoh, 2023; Apeti, 2023).

Nonetheless, entropy balancing does not fully eliminate concerns related to reverse causality and omitted variable bias. To mitigate these issues, we include one-year lags of all control variables and incorporate a comprehensive set of fixed effects. Country fixed effects capture persistent characteristics (for example, cultural norms, legal traditions, geographic distance, common borders, shared language, and colonial ties), while year fixed effects control for timevarying global shocks (for example, the COVID-19 pandemic or the 2008 financial crisis).

To further address endogeneity and confirm the robustness of our findings, we complement the baseline specification with an instrumental variable (IV) strategy and multiple alternative estimation approaches.

## 2.2 Instrumental Variables Strategy

A potential concern in our identification strategy relates to reverse causality—that is, the possibility that pre-existing levels of gender equality may influence both the timing and intensity of mobile money rollout, rather than mobile money adoption driving improvements in gender parity. For instance, empirical evidence suggests that M-Pesa was initially deployed in Kenyan counties characterized by higher-than-average female labor force participation and girls’ school enrollment rates, indicating that gender-progressive environments may have attracted mobile money investment rather than the reverse (Mbiti & Weil, 2015). If not addressed, such endogeneity could severely bias causal inference drawn from standard methods such as Differencein-Differences (DiD) or Propensity Score Matching (PSM).

To mitigate this bias and strengthen the robustness of our results, we implement an instrumental variables (IV) approach. Specifically, we leverage two external instruments related to mobile money accessibility. First, *mobile network coverage*, defined as the percentage of the population living within range of a mobile cellular signal, is a widely accepted proxy for mobile money availability (Munyegera & Matsumoto, 2016; Aron, 2018; Zore, 2025). Second, we use the *cost of mobile money use*, proxied by the “data-only mobile broadband basket (2 GB),” which captures the lowest-priced 30-day plan offering at least 2 GB of data (at a minimum speed of 256 kbit/s) from the leading provider in each country. These two instruments are presumed to influence the likelihood of mobile money adoption but there is no reason to expect a direct impact on gender equality (Zore, 2025).

The first-stage regression is specified as follows:

*,* (2)

where *MMct* denotes mobile money adoption (or alternatively, the number of active mobile

(1) (2) money accounts) in country *c* and year *t*, *Zct* and *Zct* represent the two instrumental variables, *Xct* is the vector of control variables, and *µc* and *λt* are country and year fixed effects, respectively. The error term *νct* captures idiosyncratic shocks.

The second-stage structural equation is as follows :

*Yct* = *α*0 + *β MMct* + *θ*′*Xct* + *µc* + *λt* + *εct,* (3)

Where *MMct* is the predicted value of mobile money adoption from the first stage, and *Yct* represents the gender equality outcome for country *c* in year *t*.

# 3 Data, descriptive statistic and stylized facts

## 3.1 Data description

We assess the impact of mobile money adoption on gender equality using a panel of 84 developing countries over 1990–2023. Our focus on developing countries is motivated by the fact that traditional banking infrastructure in these contexts remains limited and often inaccessible, making mobile money a widely adopted substitute. Moreover, to date, no high-income country has formally implemented mobile money services. The study period is determined by data availability : reliable and comparable measures of gender equality for developing countries are not consistently available prior to 1990. The data for our analysis are drawn from multiple sources, including the United Nations Development Programme (UNDP), the World Bank’s World Development Indicators (WDI), and the GSMA Mobile Money Deployment Tracker.

1. *Mobile Money measurement*

Our treatment variable—mobile money adoption—is sourced from the GSMA Mobile Money Deployment Tracker. Following previous studies (Munyegera & Matsumoto, 2016; Riley, 2018a; Jacolin et al., 2021; Apeti & Edoh, 2023; Apeti, 2023), we define adoption using a binary indicator that takes the value 1 from the first year a country introduces mobile money services, and 0 otherwise. According to GSMA, mobile money refers to ”a service in which the mobile phone is used to access financial services.” Because this binary indicator does not capture variation in the intensity of use, we supplement it with two additional sets of measures. First, we include the total number of active mobile money accounts and the annual number of mobile money transactions, following the approach of Aron (2018). These data are drawn from the IMF’s Financial Access Survey (FAS). Second, we incorporate country-level data on mobile money account ownership, specifically the share of adults aged 15 and over who report holding such an account, as recorded in the Global Findex database. Together, these measures allow us to capture both the extensive margin (i.e., the timing of initial adoption) and the intensive margin (i.e., the depth and frequency of use) of mobile money diffusion across countries in our panel.

1. *Gender Equality measurement*

Our primary outcome variable, gender equality, is measured using the Gender Development Index (GDI), developed by the United Nations Development Programme (UNDP). The GDI is widely recognized by researchers and policymakers as one of the most comprehensive and reliable cross-country indicators of female-to-male parity. It captures gender disparities across three core dimensions of human development: life expectancy, educational attainment, and standard of living. The index covers all countries with reliable and comparable data to ensure robustness. Formally, the GDI is defined as the ratio of the female Human Development Index (HDI) to the male HDI: *GDI* = *HDIf/HDIm*. The value is centered around 1.00, representing perfect gender parity; values below 1.00 indicate gender disadvantages faced by women.To enhance interpretability, we transform this ratio into a Gender Parity Gap, computed as 100×(*GDI*−1) and reported in percentage points. Under this transformation, zero denotes gender equality, while negative values reflect the extent of female disadvantage.

Despite its strengths, the GDI presents certain limitations. It omits important dimensions of gender inequality, particularly regarding women’s reproductive health (e.g., maternal mortality and adolescent fertility), political and economic empowerment, and labor market participation. Consistent with Zore (2025), we supplement our analysis with the Gender Inequality Index (GII)—also produced by UNDP—which incorporates a broader set of gender-specific indicators. The GII includes measures of maternal mortality, adolescent fertility, women’s representation in national parliaments, educational attainment, and labor force participation. The index ranges from 0—indicating equality across all dimensions—to 1, representing extreme gender-based disadvantage.

As an additional robustness check, we use the CPIA Gender Equality Rating from the World Development Indicators (WDI). This index ranges from 1 (low equality) to 6 (high equality) and evaluates the extent to which national institutions, policies, and programs promote equal access for men and women across four key domains : education, health, economic participation, and legal protections. The expansion of mobile money services—particularly in underserved rural and marginalized communities—may enhance women’s financial inclusion. This increased inclusion can trigger broader institutional responses (e.g., social transfers, maternity benefits) that further boost women’s economic empowerment and help reduce structural gender inequalities.

Finally, we incorporate the female-specific Human Development Index (HDI), also from UNDP, as a complementary measure reflecting health, education, and economic participation to further test the robustness of our findings.

*c) Controls variables*

Building on the existing literature on mobile money diffusion and gender-related outcomes (Riley, 2018a; Jacolin et al., 2021; Apeti & Edoh, 2023; Apeti, 2023; Zore, 2025), we incorporate a set of macro-level covariates theoretically and empirically linked to both mobile money uptake and gender equality changes. These controls help improve model specification, mitigate omittedvariable bias, and enable the construction of a synthetic control group matching treated units on pre-treatment characteristics.

We start with the initial Gender Development Index (GDI) from UNDP, hypothesizing that higher baseline gender equality correlates positively with mobile money adoption due to more inclusive norms and institutions, and potentially predicts further gender improvements postadoption. Real GDP per capita is included next, expected to correlate negatively with adoption since higher-income countries often have well-established traditional financial sectors, reducing mobile money’s appeal. Conversely, such countries usually invest more in women’s health, education, and labor market inclusion, which improves gender equality (Zore, 2025). Urban population growth rate is included as it can facilitate mobile money diffusion by reducing distribution costs and enabling transactions between urban and rural areas, while also promoting gender equality through improved access to services (Eftimoski & Josheski, 2020; Apeti, 2023). Financial deepening, proxied by domestic credit to the private sector (% GDP), may enhance mobile money interoperability and adoption (Batista & Vicente, 2020) and foster women’s access to credit and entrepreneurship (Jacolin et al., 2021; Apeti & Edoh, 2023). Female labor force participation is considered both a driver and reflection of gender equality, potentially increasing demand for mobile money as women seek secure, flexible financial tools. We also control for the Women, Business and the Law Index, which measures the legal environment affecting women’s economic participation and may reduce barriers to mobile money use among women (Perrin & Hyland, 2023). Lastly, fixed-line telephone subscriptions serve as a proxy for telecommunications infrastructure, which supports the expansion of mobile money services and enhances women’s access to digital platforms. However, fixed-line telephone adoption and mobile money uptake may be negatively correlated, since the growth of mobile payment services is fundamentally tied to the dynamism of the cell phone market (Jacolin et al., 2021; Apeti, 2023). Therefore, the direction of this effect remains ambiguous.

All variables except the initial GDI are sourced from the World Development Indicators (WDI) and lagged by one year to mitigate reverse causality concerns. Detailed definitions and descriptive statistics are provided in the Appendix.

## 3.2 Descriptive statistic and stylized facts

Table B.1 presents summary statistics for our panel of 84 developing countries covering the period 1990–2023. The average value of GDI is 0.90, corresponding to a mean gender parity gap of –10 percentage points (pp). Notably, between 50 and 75 percent of countries in the panel exhibit a negative parity gap, indicating that women continue to experience systematic disadvantages across key dimensions of development. Countries such as Pakistan, Bangladesh, Iran, Syria, Morocco, Yemen, Niger, Afghanistan, Nepal, Haiti, and Sudan record particularly low GDI values, with gender parity gaps exceeding –25 pp. These severe deprivations often stem from structural challenges prevalent in these contexts—including persistent poverty, prolonged conflict, political instability, and, in some cases, restrictive social or religious norms—that simultaneously hinder overall human development and exacerbate gender-based disparities. Conversely, at the opposite end of the distribution, countries such as South Africa, Argentina, Seychelles, Paraguay, and Venezuela display slightly positive gender parity gaps of approximately +0.5 pp. These cases reflect environments where women’s aggregate outcomes in health, education, and economic participation have marginally surpassed those of men. This wide variation in gender parity gaps underscores the importance of accounting for heterogeneous national contexts when assessing the impact of mobile money adoption on gender equality.

Figure 1 documents the cumulative number of developing countries adopting mobile money services over the period 1990–2023, along with the total number of active mobile money platforms. The first recorded deployment occurred in Russia in 2002, followed by the Philippines and Thailand in 2004, and Kenya in 2007. The pace of adoption increased sharply after 2010 : the number of developing economies offering mobile money services expanded from one in 2004 to 96 by 2023, while the total number of active services rose from one in 2002 to 493 in 2023.

Meanwhile, Figure 2 illustrates a consistent upward trend in the GDI and a corresponding decline in the GII, both indicative of gradual progress toward gender parity across the developing world. Figure 3 compares the average gender parity gap between countries that have adopted mobile money and those that have not. On average, non-adopters exhibit a gender gap of –9.30 pp, while adopters report a narrower gap of –7.49 pp. This difference of 1.81 percentage points corresponds to a 19.5% reduction relative to the untreated group and is statistically significant at conventional levels (t = 5.69, p *<* 0.001) While this evidence points to a strong association between mobile money diffusion and gender equality improvements, it does not, by itself, establish causality—highlighting the need for more rigorous econometric identification strategies.

Table 1 reports descriptive statistics for the covariates included in the baseline specification. Prior to conducting the formal econometric analysis, we compare unweighted and entropybalanced means across the treated group (mobile money adopters) and the control group (nonadopters). Panel A, Columns [1] and [2] present the group means before reweighting, while Column [3] shows the difference in means between the two groups. The unweighted comparison reveals substantial baseline imbalances : relative to non-adopters, countries that have adopted mobile money exhibit higher average levels of gender equality, female labor force participation, female political representation, urbanization, and financial freedom, but lower real GDP per capita and fixed-line telephone coverage. These descriptive patterns are consistent with the expected relationships between mobile money adoption and the covariates previously outlined, underscoring the importance of achieving covariate balance to obtain unbiased treatment effect estimates. Panel B of Table 1 shows that, after applying entropy balancing, all differences in covariate means between treated units and their synthetic controls become statistically insignificant. This confirms the credibility of the constructed counterfactual and supports the validity of the subsequent treatment effect estimation.

Figure 1: **Mobile money growth: countries vs providers**

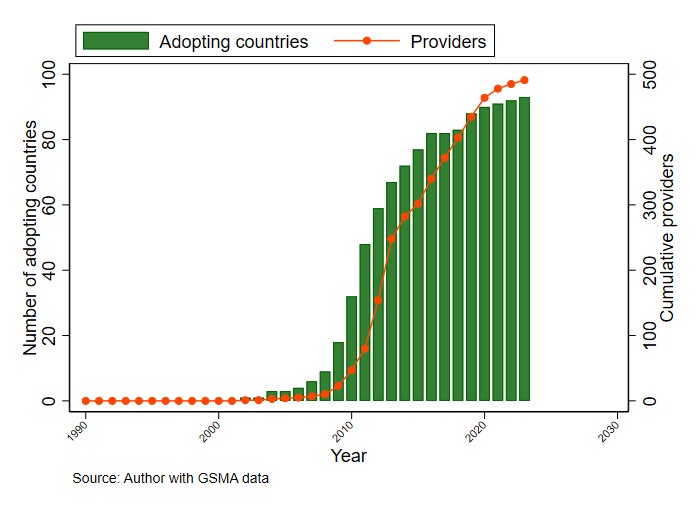
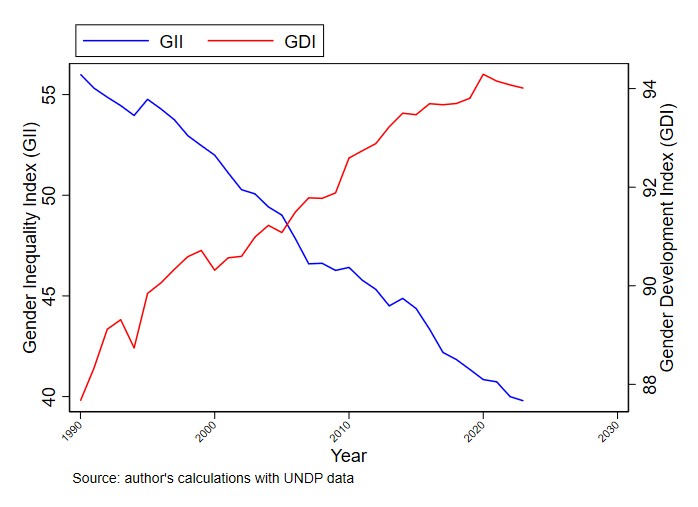


Figure2:

**Evolutionofgenderinequalityindexandandgenderdevepmentindexfrom2013**

**to 2023)**



# 4 Main results

## 4.1 Mobile money and gender equality: Entropy balancing results

We estimate Equation (1) using the weighted least squares (WLS) method, applying the entropybalancing weights reported in Table 1. The dependent variable is the gender parity gap, measured in percentage points. Our aim is to identify the causal effect of mobile money adoption

Figure 3: **Gender parity gap by Mobile money adoption**

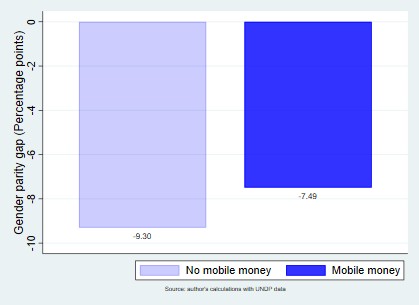


Table 1: Descriptive statistics: covariate balance before and after entropy balancing

**[1]**

**[2]**

**[3] =[1]–[2]**

**Panel A: Before balancing**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Variable* | Mobile money | No Mobile money | Diff | *p*-value |  |
| GDI initial | 0.584 | 0.521 | 0.062 | 0.000 | \*\*\* |
| Lag[100×log(Real GDP per capita) | 767.428 | 800.425 | –32.997 | 0.000 | \*\*\* |
| Lag[Female labour force] | 50.545 | 47.812 | 2.732 | 0.000 | \*\*\* |
| Lag[Women Business and Law Index] | 67.255 | 58.624 | 8.631 | 0.000 | \*\*\* |
| Lag[Urban population growth] | 2.924 | 2.402 | 0.522 | 0.000 | \*\*\* |
| Lag[Financial freedom ] | 32.865 | 29.851 | 3.014 | 0.001 | \*\*\* |
| Lag[Fixed telephone] | 31.134 | 34.733 | –3.599 | 0.401 |  |
| Observations | **900** | **1682** |  |  |  |

**[1]**

**[4]**

**[5] =[1]–[4]**

**Panel B: After balancing**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Variable* | Mobile money | Synthetic group | Diff | *p*-value |
|  | Treat | No | Diff. | p-value |
| GDI initial | 0.584 | 0.584 | 0.000 | 0.863 |
| Lag[100×log(Real GDP per capita) | 767.428 | 765.456 | 1.972 | 0.617 |
| Lag[Female labour force] | 50.545 | 50.442 | 0.103 | 0.894 |
| Lag[Women Business and Law Index] | 67.255 | 66.796 | 0.459 | 0.808 |
| Lag[Urban population growth] | 2.924 | 2.942 | –0.018 | 0.808 |
| Lag[Financial freedom] | 32.865 | 32.361 | 0.504 | 0.636 |
| Lag[Fixed telephone] | 31.134 | 30.989 | 0.145 | 0.960 |
| Observations | **900** | **1682** |  |  |
| Total weights | **900** | **900** |  |  |

*Notes*: Panel A reports raw means; Panel B reports weighted means after entropy balancing. Column labels correspond to treatment, unweighted control, and synthetic (weighted) control groups. *p*-values test equality of means.

on gender equality in developing countries, controlling for observed confounders as well as unobserved country- and time-specific heterogeneity. Table 2 reports the main results. Columns [1]–[7] present the estimated coefficients on mobile money under a sequence of increasingly saturated specifications. The progression begins with a baseline model without fixed effects, followed by specifications that successively add country fixed effects ; year fixed effects ; region fixed effects ; both region and year fixed effects ; region, year fixed effects, and region-specific trends ; and, finally, a fully specified model including both country and year fixed effects. All specifications include controls for real GDP per capita, urban population growth, financial freedom, female labor force participation, the Women, Business and the Law Index, and fixed-telephone subscriptions. Across all models, the mobile money coefficient remains positive and highly statistically significant. Its magnitude declines in the fully saturated specification, indicating that part of the measured effect may be attributable to time-invariant or country-specific unobserved factors. Nonetheless, even in the most demanding specification, mobile money adoption is associated with an average 0.62 pp reduction in the gender parity gap.

**Magnitude of the effect and economic interpretation**. The results indicate that mobile money adoption significantly reduces the gender parity gap. To evaluate the economic magnitude, we benchmark the estimated impact against the control group mean of –9.26 pp. In the fully specified model (column 6), mobile money adoption narrows this gap by 0.62 pp, improving it from –9.26 to –8.65 pp. Under the baseline specification with controls only (column 1), the estimated effect is larger by 1.81 pp, bringing the gap to –7.45 pp. This stronger effect in simpler models likely reflects unaccounted heterogeneity. Overall, these results are statistically robust and economically meaningful, supporting policy efforts to expand mobile money access as a tool for advancing gender equality in developing countries. Our findings are consistent with micro-level studies (Aker et al., 2016; Suri & Jack, 2016; Islam & Muzi, 2020; Riley, 2024).

Table 2: Mobile Money and gender equality: Entropy balancing

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Dep variable : Gender parity gap (Percentage point(pp))** | | | | |  |  |
| Mobile money | 1.809\*\*\* | 1.374\*\*\* | 1.720\*\*\* | 1.949\*\*\* | 1.759\*\*\* | 1.659\*\*\* | 0.615\*\* |
|  | (6.03) | (4.24) | (6.10) | (8.14) | (7.68) | (8.14) | (1.99) |
|  |  |  |  |  |  |  |  |
| Control group mean | –9.26(pp) | –9.26(pp) | –9.26(pp) | –9.26(pp) | –9.26(pp) | –9.26(pp) | –9.26(pp) |
| Main controls | YES | YES | YES | YES | YES | YES | YES |
| Country FE | NO | YES | NO | NO | NO | NO | YES |
| Year FE | NO | NO | YES | NO | YES | YES | YES |
| Region FE | NO | NO | NO | YES | YES | YES | NO |
| Region × Year FE | NO | NO | NO | NO | NO | YES | NO |

*Notes:* : Entropy balancing estimates of Equation 1. Dependent variable is the gender parity gap (percentage points). Significance levels: \*\*\* *p <* 0*.*01, \*\* *p <* 0*.*05, \* *p <* 0*.*10. All columns include the same set of control variables. Fixed effects are included as follows: country (col. 2), year (col. 3), region (col. 4), region + year (col. 5), region + year+ region trend and country + year + region (col. 6). Standard errors in parentheses are clustered at the country level. The reported control-group mean (–9.26 pp) refers to countries without mobile-money adoption.

## 4.2 Mobile money and gender equality : Instrumental Variables Fixed Effects (IV-FE) results

While entropy balancing effectively addresses selection bias by reweighting samples to ensure covariate balance, it may fall short in correcting for endogeneity arising from reverse causality or unobserved confounders—issues that can potentially distort causal inference. To mitigate these concerns, we employ a two-stage least squares (2SLS) estimation strategy, leveraging exogenous variation in *mobile network coverage* and *cost of mobile money use* as instruments for mobile money adoption. These instruments are applied to both a binary specification (indicating availability) and a continuous measure (log of active accounts). Their selection is grounded in empirical studies and policy relevance, as both factors shape the probability of adoption but are unlikely to exert a direct influence on gender-related outcomes (Munyegera & Matsumoto, 2016; Aron, 2018; Zore, 2025).

First-stage estimates, reported in Columns [1] and [2] of Table 3, underscore the strong relevance of the instruments. *Mobile network coverage* and *cost of mobile money use* emerge as statistically significant predictors of adoption across both specifications. The Cragg-Donald F-statistics (18.97 and 63.32) and Kleibergen-Paap rk Wald F-statistics (23.21 and 45.87) exceed standard thresholds, alleviating concerns over weak instrument bias. Second-stage results reported in Columns [3] and [4] of Table 3, suggest a robust and positive effect of mobile money on gender equality. In the continuous specification (log of the number of active mobile money accounts), a one-unit increase corresponds to a 0.67 pp reduction in the gender parity gap (i.e., an improvement in gender equality), ceteris paribus. The binary specification (mobile money adoption dummy) yields a larger estimate, 6.09 pp – likely reflecting structural transformations initiated by initial adoption and broader access effects.

Diagnostic checks support instrument validity. The Kleibergen–Paap LM test rejects underidentification at the 1 % level in both models and the Hansen J test fails to reject exogeneity, satisfying the exclusion restriction. Taken together, 2SLS and entropy-balanced estimates converge on the same conclusion : expanding mobile-money access causally improves gender equality. Finally, Entropy balancing and 2SLS yield converging estimates : both indicate that mobile money adoption contributes significantly to narrowing the gender parity gap. While entropy balancing enhances covariate comparability, the 2SLS framework addresses deeper endogeneity concerns. This convergence strengthens the empirical basis for a causal link between mobile money adoption and gender equality improvements.

Table 3: Impact of Mobile-Money Adoption on gender equality: 2SLS regression

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *First stage* | | *Second stage* | |
|  | [1] Active Mobile Money Accounts | [2] Mobile-money available | [3] | [4] |
| Cost of mobile money use | -0.0273\*\*\* |  |  |  |
|  | (0.0101) |  |  |  |
|  |  |  |  |  |
| Mobile Network Coverage | 0.0323\*\*\* | 0.0045\*\*\* |  |  |
|  | (0.0060) | (0.0006) |  |  |
|  |  |  |  |  |
| Log Active Mobile Money Accounts |  |  | 0.6651\*\*\* |  |
|  |  |  | (0.1047) |  |
|  |  |  |  |  |
| Mobile-money available |  |  |  | 6.0904\*\*\* |
|  |  |  |  | (1.0739) |
| Main controls | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES |
| Year FE | YES | YES | YES | YES |
| Countries | 57 | 82 | 57 | 82 |
| Observations | 388 | 909 | 388 | 909 |
| ***IV diagnostics*** |  |  |  |  |
| Cragg-Donald F |  |  | 18.9708 | 63.32 |
| Kleibergen-Paap rk Wald F |  |  | 23.21 | 45.87 |
| Kleibergen-Paap rk LM |  |  | 14.31 | 48.74 |
| p-value KP LM |  |  | 0.000 | 0.00 |
| Hansen J |  |  | 0.03 | 0.00 |
| Chi-sq(1) p-value H |  |  | 0.87 | . |

Notes: Robust standard errors are clustered at the country level and are shown in parentheses. All models include fixed effects for country and year. Columns [3] use two instruments (mobile data cost and network coverage), while column [4] uses network coverage as the only instrument. Significance levels: \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.10.

# 5 Robustness checks

Our results indicate that mobile money adoption contributes to improvements in gender equality. In this section, we assess the robustness of this finding by conducting a series of sensitivity and robustness checks.

## 5.1 Alternative specification

To assess the robustness of our findings, we employ an alternative specification based on a redefinition of the treatment variable—namely, mobile money adoption. In our baseline specification, this variable is measured using a binary indicator that captures whether a country has formally introduced mobile money services. However, this approach presents three major limitations in the context of gender equality. First, the binary variable fails to capture the intensity of adoption, which can vary substantially across countries. Second, it does not reflect the specific modalities of service rollout, which may directly influence women’s access to and use of the technology.[[2]](#footnote-2) Third, the mere presence of mobile money in a country does not guarantee that women have access to it or make use of it in practice. To address these issues, we rely on alternative measures of the treatment variable drawn from various data sources. On the supply side, we use structural indicators such as the number of mobile money providers (sourced from GSMA), the number of active mobile money accounts (Asongu et al., 2023), and the volume of transactions carried out via mobile money platforms, based on data from the IMF’s Financial Access Survey (FAS). On the demand side, we draw on the World Bank’s Global Findex database, including the share of the adult population with a mobile money account, as well as the proportion of women who report owning such an account. The regression results based on these alternative measures are presented in the table C.1 in the Appendix. These results confirm the robustness of our findings across multiple definitions and intensities of mobile money adoption.

In addition, gender equality trajectories differ markedly across countries. Some governments may, independently of mobile money adoption, enact legal reforms, promote girls’ education, or implement national campaigns to support women’s rights—each of which may affect gender outcomes. Ignoring these country-specific dynamics could lead to attributing changes in gender indicators to mobile money when they are, in fact, the result of structural national trends. To address this concern, our empirical specification includes country-specific linear time trends, allowing us to account for unobserved heterogeneity in gender dynamics over time. Furthermore, to mitigate omitted-variable bias arising from factors that may simultaneously influence both mobile money adoption and gender-related outcomes, we progressively augment the baseline model with a comprehensive set of control variables. These include: i) macroeconomic indicators such as annual inflation rate, trade openness, public investment, agricultural value added, migrant remittance inflows, net foreign direct investment, net official development assistance, and a composite index of financial development; ii) institutional and political-risk variables, including the incidence of internal, external, and religious conflict, corruption perception scores, government stability, and rule of law indices; iii) gender-specific institutional indicators, namely the Women’s Political Empowerment Index and the Women’s Civil Liberties Index; iv) demographic and social controls, such as the average number of years of schooling among women aged 25 and older, the total fertility rate, and the infant mortality rate. The results are reported in the table C.2 and table C. 3 in the Appendix. They show that the impact of mobile money on gender equality remains statistically significant and substantively robust. This confirms that our findings are not driven by omitted-variable bias .

## 5.2 Alternative measures of gender inequality

To ensure that our results are not driven by the choice of metric, we employ three alternative measures of gender equality: the Gender Inequality Index (which incorporates indicators of women’s reproductive health, empowerment, and labor-market participation not captured by the Gender Equality Index; see Section 3), the Human Development Index for female, and the CPIA Gender Equality Rating (1 = low to 6 = high). The estimates reported in columns [1] through [3] of the Appendix table C.4 indicate that mobile money adoption reduces the Gender Inequality Index by 0.8 percentage points, raises the CPIA Gender Equality Rating by 0.0962 points, and improves the Human Development Index for females by 0.6 percentage points, respectively. These findings confirm that mobile-money adoption enhances gender equality and demonstrate that changing the measure of gender equality does not alter our conclusions.

## 5.3 Robustness to Alternative Methods

To verify the robustness of our main estimates and guard against possible methodological bias, we apply a variety of alternative estimation techniques. We first run an Ordinary Least Squares (OLS) model, then move to several matching approaches, such as Propensity Score Matching (PSM), following Rosenbaum & Rubin (1983), as well as Regression Adjustment (RA), Inverse Probability Weighting (IPW), and IPW Regression Adjustment (IPWRA), which is known for its double robustness.

In our OLS analysis, we follow a progressive modeling approach. We begin with a simple specification that includes only the key treatment variable—mobile money adoption—and then gradually introduce the control variables used in the main entropy balancing models. This stepby-step strategy helps isolate the core relationship before testing its stability with additional covariates. All models account for country and year fixed effects, allowing us to control for unobserved country-specific characteristics and time-related global influences. Our modeling choices are in line with empirical approaches commonly used in macroeconomic and institutional studies (Neuenkirch & Neumeier, 2016; Ogrokhina & Rodriguez, 2018; Apeti & Edoh, 2023; Apeti, 2023). We then extend the specification by including a broader set of controls.

These variables capture a range of macroeconomic dynamics, political and institutional risks, gender-sensitive policy environments, and structural demographic features. Control selection was guided by both empirical literature and diagnostic checks to ensure model reliability. The choice of variables is informed by the existing literature and guided by diagnostic checks to avoid multicollinearity and overfitting. Regression outputs are reported in Appendix Table C.5, columns [1] through [10]. Column [1] corresponds to the baseline model, while column [10] includes the most comprehensive set of covariates.

Throughout the specifications, the coefficient on mobile money adoption remains positive and statistically significant, with effect sizes comparable to those found in the entropy balancing estimations. These results provide strong evidence that the link between mobile money use and gender equality is not sensitive to model specification. The consistency of results across OLS, PSM, and doubly robust estimators (RA, IPW, IPWRA) further supports the validity of our conclusions and reduces concerns about bias from selection on observables. Table C.6 summarizes these findings. Overall, our robustness analysis confirms the positive role of mobile money in reducing gender disparities, regardless of estimation method.

## 5.4 Alternative sample, placebo tests and inference robustness

To ensure our inferences are not driven by restrictive assumptions on the error structure, we implement three families of robust standard errors. First, we apply the correction proposed by Driscoll & Kraay (1998), which accounts for heteroskedasticity, serial correlation, and arbitrary contemporaneous correlation across countries, including non-spatial cross-dependence such as synchronized business cycles. Second, we employ the approach developed by Conley (1999), which accommodates spatial correlation that decays with distance—typical of regional shocks related to digital infrastructure, trade integration, or financial contagion. Third, we use twoway cluster-robust standard errors by country and year, following Cameron et al. (2011), to address both intra-country autocorrelation and common temporal shocks. Results corresponding to these corrections are reported in columns – of Table C.7 in the Appendix. Across all specifications, the effect of mobile money on gender equality remains positive and statistically significant, indicating that our findings are robust to alternative assumptions regarding error dependence.

We also use an alternative sample to ensure that our results are not driven by a specific subgroup within the dataset. First, we re-estimate Equation 1 by excluding countries that have maintained an official communist regime, namely Russia, China, North Korea, Laos, Cuba, and Vietnam. These countries are characterized by highly centralized political and economic systems, where the introduction of financial innovations such as mobile money often depends on state-led initiatives rather than market-driven dynamics. Moreover, gender equality in these contexts has historically been shaped by ideologically driven, top-down policies rather than by gradual changes linked to social or technological transformations (Gal & Kligman, 2000). As a result, their trajectories are not readily comparable to those of countries where women’s empowerment has emerged more directly through access to digital or financial services.

Second, we examine the sensitivity of our results to the presence of outliers. [[3]](#footnote-3) Outliers are defined as observations with standardized residuals (in absolute value) greater than 1.96 and a Cook’s distance exceeding the empirical threshold of 4/NT, where NT denotes the number of observations in a balanced panel. This approach assumes a 95% confidence level that nonoutlier observations belong to the true underlying data distribution. Observations classified as outliers are therefore excluded from the sample. The results are presented in the table C.7 in the Appendix. Column [1] reports the estimates obtained after excluding communist countries, while Column [2] presents the results after removing outliers.

Third, we assess the robustness of our results through a series of placebo exercises. First, we randomly assign fictitious treatment dates (column [3]). Second, we carry out a falsification test that replaces the dependent variable with the risk of external conflict[[4]](#footnote-4) (column [4]). Third, we re-estimate the model under the counterfactual assumption that mobile-money adoption occurred five years prior to its actual introduction. This strategy enables us to determine whether the estimated effect of mobile money on gender equality is driven by random noise or by an arbitrary model specification. As shown in Table C.7, column [3]-column[5], we find no statistically significant effect. Taken together, these findings confirm the robustness of our main results.

# 6 Transmission channels

Our empirical analysis shows that mobile money adoption has contributed substantively to advancing gender equality in developing countries. To elucidate the pathways through which this effect materializes, we investigate three key transmission channels identified in the theoretical and empirical literature : (i) remittance flows directed to women, (ii) women’s access to formal financial services, and (iii) female self-employment. The literature consistently documents that these channels are inversely correlated with gender inequality. For instance, remittance inflows—often received by women—tend to increase their financial autonomy, enhance savings capacities, and facilitate investments in household well-being, thereby strengthening women’s influence over economic decisions (Aker et al., 2016; Suri & Jack, 2016; Islam & Muzi, 2020). Similarly, expanded access to formal financial services provides women with crucial tools to manage risks and capital, fostering greater independence. Finally, female engagement in entrepreneurship and self-employment directly contributes to empowering women economically and socially, improving their bargaining power within households and communities.

To empirically assess these mechanisms, we proceed in two steps, following a strategy similar to Apeti & Edoh (2023). First, we estimate fixed-effects ordinary least squares (OLS) regressions of our gender equality metric on each proposed channel separately, controlling for a comprehensive set of baseline covariates as well as country and year fixed effects. The estimates, reported in Table D.1, reveal that remittance receipts (columns[2]-[3]), women’s financial inclusion(columns[1]), and female self-employment(columns[4]) each exhibit positive and statistically significant relationships with improvements in gender parity. In a second step, we evaluate the extent to which mobile money adoption influences these channels. Utilizing our principal estimation framework, which incorporates entropy balancing to ensure covariate equivalence between adopters and non-adopters, we examine the connection between mobile money uptake and the three channels. As shown in Table D.2, mobile money adoption is robustly associated with increased remittance flows benefiting women, higher levels of women’s financial inclusion, and strengthened female self-employment. Taken together, the evidence supports the hypothesis that mobile money advances gender equality principally through these interconnected pathways.

# 7 Heterogeneity

Our findings indicate that the adoption of mobile money contributes to greater gender equality. In this section, we discuss the conditions that may influence the effect of mobile money on gender equality. Specifically, we explore the heterogeneity of this effect across five dimensions : dynamic effects, type of mobile-money service, income level, geographic region, and socio-economic characteristics.

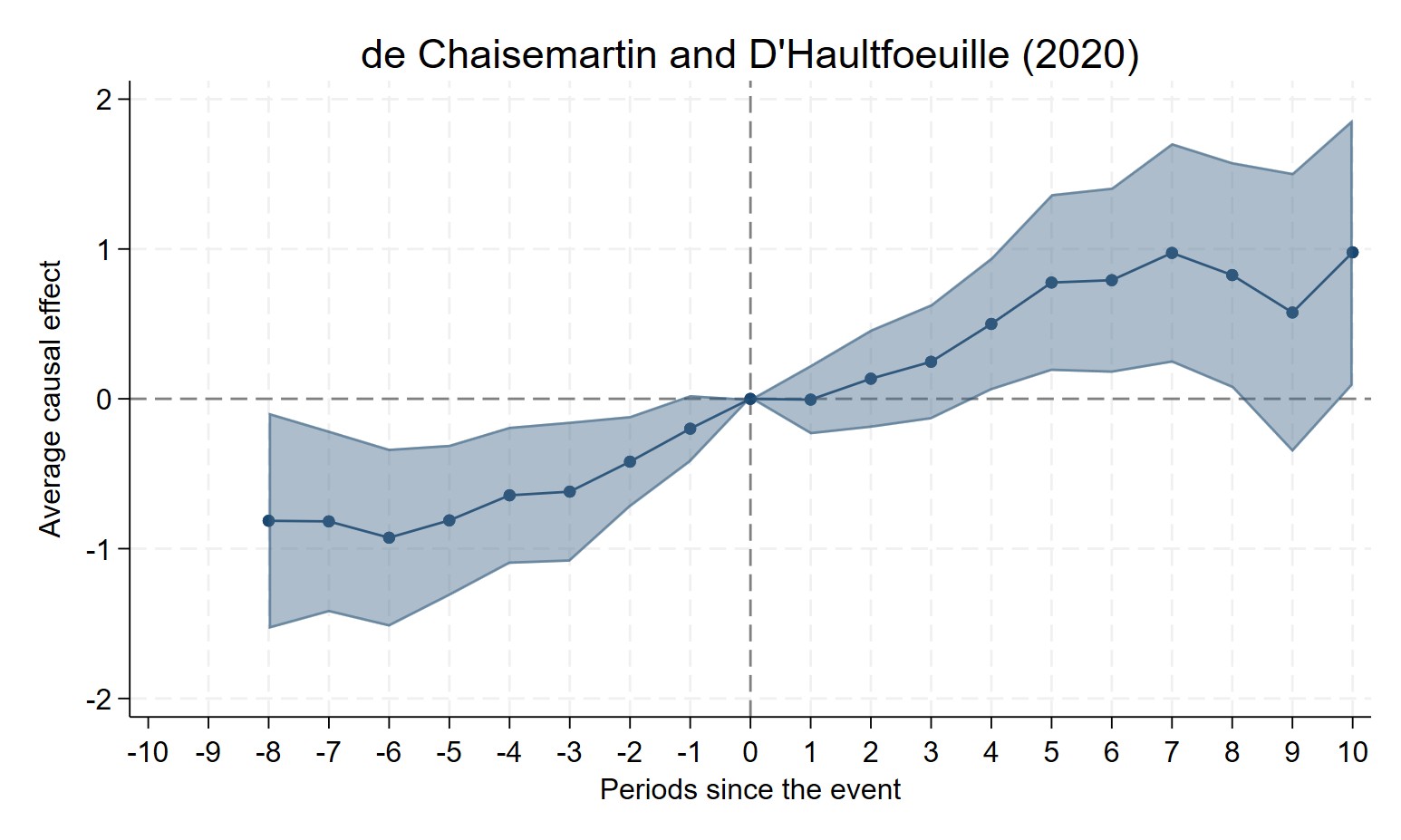
## 7.1 Dynamics effects of mobile money

We explore whether mobile-money adoption affects gender equality immediately, whether its effect is fleeting, or whether it requires a lag before becoming apparent—and, if so, whether any gains persist over time. To do this, we estimate the dynamic impact over a seven-year window following the initial year of adoption, using Equation 1. The results (see Appendix Table E.1) show that the effect only attains statistical significance in the second year after adoption ; thereafter, it increases steadily and, by the seventh post-adoption year, reaches roughly the same magnitude as our primary benchmark estimate.

To validate our baseline results, we apply two complementary event-study estimators : the difference-in-differences framework developed by De Chaisemartin & d’Haultfoeuille (2024); de Chaisemartin et al. (2024) and Local Projections Difference-in-Differences (LP-DiD) estimator developed by Dube et al. (2023). The dynamic estimates plotted in PANEL A and PANEL B of Fig 6 closely mirror our primary findings, with the effect of mobile-money adoption only becoming statistically significant in the second year following uptake. We further subject our design to standard robustness checks. Tests for parallel pre-treatment trends and no anticipation both confirm the plausibility of our identifying assumptions : the estimated pre-treatment coefficient is indistinguishable from zero, and the joint placebo test of pre-treatment leads returns a p-value of 0.1116. Together, these diagnostics lend strong support to our causal interpretation of the long-run impact of mobile money on gender equality.

## 7.2 The type of mobile money services

This subsection disaggregates the differential impact of various mobile-money services on gender equality. Based on the GSMA database, we classify services into: international remittances, government-to-person (G2P) transactions, domestic peer-to-peer (P2P) transfers, person-to[A]Event-study, de Chaisemartin et al. (2024) specification.



[B]Event-study, Dube et al. (2023) specification.

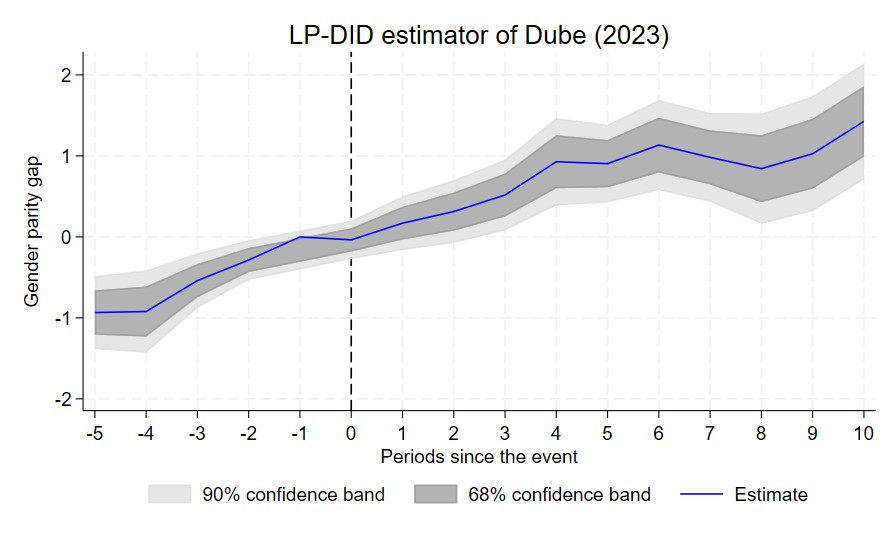


Figure 6: **Dynamic effects of mobile-money adoption on gender equality.** Panel A shows the ten-year event-study using the de Chaisemartin et al. (2024) estimator with country and year fixed effects and baseline covariates. pre-treatment coefficients remain insignificant, confirming the parallel trends. Panel B shows the same horizon using the Dube et al. (2023) estimator.

government (P2G) transactions, bulk payments, airtime top-ups, merchant payments, cash-in, and cash-out. The estimates (see Table E.2) demonstrate that each service exerts a positive and statistically significant effect on the gender parity gap. Coefficients range from 0.43 pp for bill payments to 0.81 pp for G2P transactions. The predominance of G2P services and incoming international remittances suggests that these channels are particularly powerful in enhancing women’s financial autonomy. By securing and expediting direct transfers of public benefits and migrant remittances into women’s digital wallets, these services strengthen their budgetary control and decision-making authority. Ultimately, the granularity of mobile-money offerings proves decisive : the attenuation of gender disparities hinges not on the mere ubiquity of access, but on the particular functionalities embedded within each distinct feature.

## 7.3 Income level and geographic region

We examine the impact by income level and geographic region to assess whether it varies across these dimensions. First, we classify our sample developing countries into low-income countries (LIC) and high-income countries (HIC), following the World Bank’s taxonomy. We apply the same regional classification. The estimates reported in Table E.3 reveal a pronounced polarization—both geographic and by income level—in the relationship between mobile-money adoption and gender-equality gains. In LICs, the coefficient of 0.734 closely matches our baseline estimate and is highly significant, indicating that mobile money is particularly transformative where financial markets are underdeveloped and women’s banking inclusion is lowest. By contrast, in HICs the effect is modest and statistically insignificant (0.234), suggesting that in already well-banked economies, mobile money adds little to women’s relative autonomy.

With respect to regional heterogeneity, Sub-Saharan Africa (SSA) exhibits the strongest impact (1.287). This likely reflects mobile money’s ability to compensate for inadequate banking infrastructure and to channel migrant remittances directly to female recipients. The Middle East and North Africa (MENA) region shows an intermediate effect, consistent with still-restrictive regulations but high catch-up potential. Finally, Latin America and the Caribbean, Europe & Central Asia, and Asia-Pacific display weak and statistically null effects, implying that in these regions mobile money primarily serves as a convenience innovation. Ultimately, the redistributive effect of mobile money is not observed uniformly : it is significant in contexts where women started out with a pronounced financial deficit and where banking alternatives remain costly or non-existent.

## 7.4 Socio-economic characteristics

Although developing countries share many commonalities, they are also exposed to structural forces that can shape how mobile-money adoption affects gender equality. In this section, we examine that impact across four socio-economic dimensions : initial gender parity, female human capital, place of residence, and institutional context. For each dimension, the sample is split at the median—following the approach of Apeti & Edoh (2023)—into “high” and “low” groups. The corresponding estimates appear in Table E.4.

First, heterogeneity emerges with respect to initial gender parity : in countries where the GDI lies above the median, mobile-money adoption has no statistically significant effect, whereas in those below the median the coefficient is 0.007 and remains significant at the 1 percent level. This pattern suggests that mobile-money serves as a catch-up mechanism, more effectively remedying financial-inclusion deficits when women begin from a disadvantaged position.

Second, female human capital proves decisive. In contexts of low literacy or schooling, the estimated impact of mobile-money is especially large—1.465 pp for low literacy and 0.800 pp for low schooling—compared with 0.599 pp and 0.377 pp in better-educated settings. However, the substantial standard deviation in the low-literacy subsample indicates that these figures should be viewed as orders of magnitude rather than as precise point estimates. The more pronounced effect in low-human-capital settings reflects the removal of both physical and cognitive barriers to financial access : where educational attainment is limited, digital innovations produce a leap in inclusion, yielding an average gain on the order of +1.5 pp, albeit with considerable countrylevel variation.

Third, both residential environment and institutional quality matter. The effect of mobilemoney is sizeable in predominantly rural nations (0.674 pp) and negligible in more urbanized ones, confirming that the technology primarily alleviates geographic frictions for women. Moreover, a higher Women Business & Law index amplifies the positive effect : in jurisdictions with stronger economic rights for women the coefficient reaches 0.833 pp versus 0.365 pp, and loses significance when legal protections are weak. This contrast underscores that technology alone is insufficient ; a supportive institutional framework is indispensable for translating digital access into genuine decision-making power.

Ultimately, mobile-money appears to be a potent lever for reducing gender disparities—particularly in settings marked by severe financial and geographic constraints and where institutions grant women the legal capacity to exploit this novel tool fully.

# 8 Conclusion and economic policy implications

In this paper, we examine the causal effect of mobile-money adoption on gender equality in developing countries over the period 1990–2023. Methodologically, we combine an entropybalancing approach to correct for selection bias with an instrumental-variables fixed-effects (IV-FE) strategy to address endogeneity concerns, including reverse causality and omittedvariable bias. We further subject our results to extensive robustness checks—alternative model specifications, different measures of gender equality and mobile-money uptake, varied estimation techniques, alternative sample, placebo tests and inference robustness.

Our analysis shows that mobile-money adoption significantly advances gender equality, reducing the Gender Parity Gap by approximately 0.62 pp in adopting countries relative to their synthetic control groups. A dynamic event-study reveals that this effect only becomes statistically significant in the second year post-adoption. Heterogeneity tests indicate that the impact is concentrated in low-income countries, particularly in Sub-Saharan Africa and the Middle East and North Africa. In these regions, women face acute financial constraints and limited access to formal banking services. The effect is also amplified in contexts offering G2P mobile transfers and in countries receiving substantial international remittances. Moreover, gender-equality gains are largest in countries with lower initial GDI scores, stronger legal protections of women’s economic rights, and higher rural population shares. The effect is particularly pronounced in countries with lower female human capital. Finally, we provide evidence that the expansion of remittance flows to women, improvements in women’s financial inclusion, and increases in female labor-force participation serve as key transmission channels through which mobile-money adoption fosters gender equality.

These findings suggest several policy implications. First, expanding mobile-network coverage and supporting low-cost agent networks in underserved rural and peri-urban areas can extend financial services to women who are otherwise excluded. Second, digitizing social transfers—such as pensions, cash subsidies, and salaries—onto interoperable mobile wallets will both streamline delivery and strengthen women’s control over household resources. Third, dedicated financial and digital-literacy programs for women—delivered via community workshops and mobile tutorials—can shorten the learning curve, which our event-study estimates suggest lasts about two years. Finally, gender-disaggregated monitoring of mobile-money usage and rigorous impact evaluations will help refine these interventions and allocate resources where they yield the greatest returns for equality.

Despite its contributions, this analysis has limitations. We do not explicitly model spatial spillovers—how mobile-money adoption in one area may affect neighboring regions—and our country-level panel cannot capture intra-community dynamics. Future research could address these gaps by employing geocoded transaction data or randomized roll-out designs to assess these spillover effects and explore complementary policies, such as linkages with micro-credit programs, that could further amplify the gender-equality benefits of mobile finance.

# 9 CRediT authorship contribution statement

**Yrabo DABOU** : Conceptualization, Data curation, Formal analysis, Methodology, Software, Validation, Visualization, Writing – original draft.

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.2504926

**Appendix.**

# A Identification Strategy

We estimate the average treatment effect on the treated (ATT) following Rubin’s causal modeling framework, i.e average effect of mobile money accross all countries that have ever been adopted mobile money :

*,* (4)

where *MMit* = 1 if country *i* has adopted *mobile money* in year *t* and 0 otherwise. The term

 is the observed gender-equality outcome for adopting countries, whereas  is the counterfactual value these same countries would have attained had

they not adopted. Because the counterfactual cannot be observed, a credible proxy is required. Under true random assignment, the mean outcome of non-treated units,

*,*

provides an unbiased substitute. In practice, however, mobile-money adoption is likely endogenous—correlated with structural characteristics—so a naive difference in means would be biased.

To approximate the conditions of random assignment, we match adopting and non-adopting countries on a vector of pre-treatment covariates, *X*, that affects both (i) the propensity to adopt mobile money and (ii) gender-equality outcomes. The ATT can then be expressed as

*.* (5)

Conditional on *X* = *χ*, mobile-money adoption is treated as exogenous with respect to the gender-equality outcome, allowing consistent estimation of *ATT*(*χ*).

# B Descriptive statistic

Table B.1: Summary statistics of the main variables

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **Obs** | **Mean** | **SD** | **Min** | **Max** | **Median** | **P75** |
| Mobile-money available (1=yes) | 2890 | 0.34 | 0.47 | 0.00 | 1.00 | 0.00 | 1.00 |
| Gender Parity Gap (percentage points) | 2336 | –9.80 | 8.26 | –59.30 | 4.50 | –8.00 | –3.90 |
| Gender Development Index (GDI) | 2336 | 0.90 | 0.08 | 0.41 | 1.04 | 0.92 | 0.96 |
| Gender Inequality Index (GII) | 2223 | 0.52 | 0.13 | 0.03 | 0.84 | 0.53 | 0.61 |
| Initial GDI | 2890 | 0.91 | 0.08 | 0.45 | 1.03 | 0.91 | 0.96 |
| Lag[log real GDP per capita] | 2778 | 763.12 | 109.43 | 523.99 | 1130.97 | 760.02 | 832.92 |
| Lag[Female labor force (%)] | 2772 | 50.16 | 19.58 | 4.98 | 90.45 | 51.03 | 65.64 |
| Lag[Women, Business and Law Index] | 2805 | 59.36 | 16.97 | 17.50 | 95.00 | 60.62 | 73.12 |
| Lag[Urban population growth (%)] | 2803 | 3.18 | 2.02 | –10.88 | 31.27 | 3.04 | 4.25 |
| Lag[Financial deepening (%)] | 2673 | 28.31 | 24.56 | 0.45 | 166.50 | 20.81 | 38.35 |
| Lag[Fixed-telephones ] | 2765 | 19.34 | 51.05 | 0.00 | 501.77 | 1.78 | 10.34 |

*Source*: Authors’ calculations.

Table B.2: Pairwise correlations among main covariates

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] |
| [1] Gender Parity Gap | 1.00 |  |  |  |  |  |  |  |
| [2] Initial GDI | 0.88 | 1.00 |  |  |  |  |  |  |
| [3] Lag[log real GDP per capita] | 0.51 | 0.45 | 1.00 |  |  |  |  |  |
| [4] Lag[Female labor force] | 0.26 | 0.23 | –0.29 | 1.00 |  |  |  |  |
| [5] Lag[Women, Business & Law] | 0.46 | 0.36 | –0.00 | 0.38 | 1.00 |  |  |  |
| [6]Lag[Urban population growth] | –0.26 | –0.25 | –0.26 | 0.20 | –0.30 | 1.00 |  |  |
| [7] Lag[Financial deepening] | 0.38 | 0.33 | 0.48 | –0.15 | 0.10 | –0.23 | 1.00 |  |
| [8] Lag[Fixed-line telephones] | –0.01 | –0.01 | 0.19 | –0.24 | 0.02 | –0.16 | 0.16 | 1.00 |

*Source*: Authors’ calculations.

# C Robustness checks

Table C.1: Mobile Money and Gender Equality : Robustness to alternative measure of mobile money

**Dep. Variable : Gender gap parity**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | [1] | [2] | [3] | [4] | [5] |
| Cumulative number of mobile money providers | 0.0694∗∗∗  (0.000) |  |  |  |  |
| Log Active Mobile Money Accounts |  | 0.0694∗∗∗  (0.000) |  |  |  |
| log Mobile money Transactions |  |  | 0.0813∗∗∗  (0.000) |  |  |
| Mobile money account (% age 15+) |  |  |  | 0.0337∗∗∗  (0.004) |  |
| Mobile money account, female(% age 15+) |  |  |  |  | 0.0321∗∗  (0.011) |
| Covariables | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES |
| Year FE | YES | YES | YES | YES | YES |
|  |  |  |  |  |  |
| Adjusted *R*2 | 0.939 | 0.950 | 0.949 | 0.954 | 0.954 |
| Onservations | 2176 | 1665 | 1751 | 176 | 176 |

*Notes:* : Entropy balancing estimates of Equation 1. Dependent variable is the gender inequality index. Significance levels: \*\*\* *p <* 0*.*01, \*\* *p <* 0*.*05, \* *p <* 0*.*10. All columns include the same set of control variables. Fixed effects are included as follows: country (col. 2), year (col. 3), region (col. 4), country + year (col. 5), and country + year + region (col. 6). Standard errors in parentheses are clustered at the country level. The reported control-group mean (–9.26 pp) refers to countries without mobile-money adoption.

Table C.2: Impact mobile money on gender equality : Robustness to additionals variables

**Dep. Variable : Gender gap parity**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **[1 ]** | **[2]** | **[3]** | **[4]** | **[5 ]** | **[6]** | **[7 ]** | **[8 ]** | **[9]** | **[10]** | **[11 ]** |
| Mobile money adoption (1=yes) | **1.813\*** | **0.547\*\*\*** | **0.547\*\*\*** | **0.541\*\*\*** | **0.591\*\*\*** | **0.612\*\*\*** | **0.612\*\*\*** | **0.572\*\*\*** | **0.615\*\*\*** | **0.751\*\*\*** | **0.366\*\*\*** |
|  | **(1.80)** | **(3.60)** | **(3.60)** | **(3.53)** | **(3.88)** | **(4.03)** | **(4.04)** | **(3.75)** | **(3.98)** | **(4.90)** | **(3.29)** |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Initial gdi |  |  | 94.89\*\*\* | 103.3\*\*\* | 120.1\*\*\* | 111.4\*\*\* | 111.6\*\*\* | 113.0\*\*\* | 115.5\*\*\* | 134.0\*\*\* | 7647.7\*\* |
|  |  |  | (9.92) | (7.89) | (8.23) | (7.57) | (7.41) | (7.65) | (7.74) | (9.37) | (2.30) |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Lag[log Real GDP per capita] |  |  |  | 0.00469 | 0.00376 | 0.00339 | 0.00338 | 0.00556 | 0.00705 | 0.0173\*\*\* | 0.0118\* |
|  |  |  |  | (0.89) | (0.74) | (0.67) | (0.67) | (1.12) | (1.39) | (3.81) | (1.89) |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Lag[Female labor force] |  |  |  |  | 0.0618\*\*\* | 0.0597\*\*\* | 0.0598\*\*\* | 0.0619\*\*\* | 0.0618\*\*\* | 0.0560\*\*\* | 0.0283 |
|  |  |  |  |  | (3.30) | (3.20) | (3.20) | (3.29) | (3.31) | (3.12) | (1.30) |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Lag[Women Business and Law Index] |  |  |  |  |  | 0.0226\* | 0.0226\* | 0.0241\* | 0.0229\* | 0.0232\* | 0.0280\*\* |
|  |  |  |  |  |  | (1.66) | (1.65) | (1.85) | (1.75) | (1.70) | (2.13) |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Lag[Urban population growth] |  |  |  |  |  |  | 0.00284 | -0.0150 | -0.0194 | 0.0228 | -0.111\*\*\* |
|  |  |  |  |  |  |  | (0.08) | (-0.36) | (-0.47) | (0.60) | (-4.47) |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Lag[Financial depening] |  |  |  |  |  |  |  | -0.0169\*\*\* | -0.0170\*\*\* | -0.0137\*\* | -0.0123\*\* |
|  |  |  |  |  |  |  |  | (-2.73) | (-2.77) | (-2.41) | (-2.07) |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Lag[Fixed telephone] |  |  |  |  |  |  |  |  | 0.00260\*\* | 0.00421\*\*\* | 0.00509\*\*\* |
|  |  |  |  |  |  |  |  |  | (2.49) | (4.69) | (6.18) |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Constant |  | -23.40\*\*\* | -105.0\*\*\* | -115.6\*\*\* | -134.0\*\*\* | -127.2\*\*\* | -127.4\*\*\* | -130.4\*\*\* | -133.2\*\*\* | -543.4\*\*\* | -7502.7\*\* |
|  |  | (-18.10) | (-12.14) | (-8.09) | (-8.37) | (-8.04) | (-7.86) | (-8.18) | (-8.26) | (-14.67) | (-2.54) |
| Observations | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 |
| Country FE | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | No |
| Trend | No | No | No | No | No | No | No | No | No | Yes | Yes |
| Country-Specific Time Trend | No | No | No | No | No | No | No | No | No | No | Yes |
| Observations | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 |
| Adjusted *R*2 | 0.017 | 0.972 | 0.972 | 0.972 | 0.972 | 0.972 | 0.972 | 0.972 | 0.972 | 0.971 | 0.985 |

*Notes:* Entropy balancing estimates of Equation 1. Dependent variable is the Gender Parity Gap (percentage points), measure of gender equality. Robust t-statistics in parentheses. ∗ *p <* 0*.*1, ∗∗ *p <* 0*.*05, ∗∗∗ *p <* 0*.*01. Lagged variables are indicated as Lag[.].

Table C. 3: Impact mobile money on gender equality : Robustness to additionals variables

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | | | | | | | | |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Mobile money adoption (1=yes) | 0.615\*\*\* | 0.575\*\*\* | 0.483\*\* | 0.600\*\*\* | 0.406\*\* | 0.487\*\*\* | 0.575\*\*\* | 0.374\*\* | 0.340\* |
|  | (3.98) | (3.08) | (2.30) | (4.03) | (2.56) | (2.72) | (3.08) | (2.47) | (1.86) |
|  |  |  |  |  |  |  |  |  |  |
| Initial gdi | 115.5\*\*\* | 1036.3\*\*\* | 149.4\*\*\* | 114.1\*\*\* | 36.75 | 851.9\*\*\* | 1036.3\*\*\* | 37.07 | 379.1 |
|  | (7.74) | (3.36) | (6.88) | (7.03) | (1.18) | (2.75) | (3.36) | (1.16) | (0.89) |
|  |  |  |  |  |  |  |  |  |  |
| Lag[log Real GDP per capita] | 0.00705 | 0.00142 | 0.0262\*\*\* | 0.0114\*\* | 0.0102 | 0.0118 | 0.00142 | 0.0149\*\* | 0.0112 |
|  | (1.39) | (0.13) | (3.24) | (2.17) | (1.53) | (1.06) | (0.13) | (2.18) | (0.92) |
|  |  |  |  |  |  |  |  |  |  |
| Lag[Female labor force] | 0.0618\*\*\* | 0.0278 | 0.0897\*\*\* | 0.0817\*\*\* | 0.0799\*\*\* | 0.00261 | 0.0278 | 0.0905\*\*\* | 0.0202 |
|  | (3.31) | (1.05) | (3.37) | (3.96) | (3.68) | (0.10) | (1.05) | (3.84) | (0.74) |
|  |  |  |  |  |  |  |  |  |  |
| Lag[Women Business and Law Index] | 0.0229\* | 0.0460\* | 0.0475\*\*\* | 0.0153 | 0.0227 | 0.0423\* | 0.0460\* | 0.0185 | 0.0357 |
|  | (1.75) | (1.92) | (3.10) | (1.14) | (1.43) | (1.78) | (1.92) | (1.15) | (1.44) |
|  |  |  |  |  |  |  |  |  |  |
| Lag[Urban population growth] | -0.0194 | -0.171\*\* | -0.123\*\*\* | -0.0246 | -0.0878\* | -0.132\* | -0.171\*\* | -0.104\* | -0.110 |
|  | (-0.47) | (-2.58) | (-3.00) | (-0.53) | (-1.67) | (-1.89) | (-2.58) | (-1.90) | (-1.50) |
|  |  |  |  |  |  |  |  |  |  |
| Lag[Financial depening] | -0.0170\*\*\* | -0.0282\*\*\* | -0.0233\*\*\* | -0.0145\*\* | -0.0164\*\* | -0.0185\* | -0.0282\*\*\* | -0.0122\* | -0.0128 |
|  | (-2.77) | (-2.82) | (-3.08) | (-2.28) | (-2.42) | (-1.80) | (-2.82) | (-1.70) | (-1.15) |
|  |  |  |  |  |  |  |  |  |  |
| Lag[Fixed telephone] | 0.00260\*\* | 0.00114 | 0.00359\*\* | 0.00278\*\*\* | 0.00332\*\*\* | 0.00217 | 0.00114 | 0.00359\*\*\* | 0.00284\*\* |
|  | (2.49) | (0.86) | (2.54) | (2.72) | (2.98) | (1.62) | (0.86) | (3.25) | (2.28) |
|  |  |  |  |  |  |  |  |  |  |
| Inflation, consumer prices (annual %) |  | 0.0487\*\*\* |  |  |  | 0.0512\*\*\* | 0.0487\*\*\* |  | 0.0388\*\* |
|  |  | (2.82) |  |  |  | (3.06) | (2.82) |  | (2.36) |
|  |  |  |  |  |  |  |  |  |  |
| Trade (% of GDP) |  | 0.00557 |  |  |  | 0.00335 | 0.00557 |  | 0.00501 |
|  |  | (0.91) |  |  |  | (0.58) | (0.91) |  | (0.85) |
|  |  |  |  |  |  |  |  |  |  |
| government investment (% gdp) |  | 0.00806 |  |  |  | -0.0168 | 0.00806 |  | 0.00575 |
|  |  | (0.13) |  |  |  | (-0.28) | (0.13) |  | (0.09) |
|  |  |  |  |  |  |  |  |  |  |
| Agriculture, forestry, and fishing, value added (% of GDP) |  | -0.119\*\*\* |  |  |  | -0.120\*\*\* | -0.119\*\*\* |  | -0.109\*\*\* |
|  |  | (-3.11) |  |  |  | (-3.23) | (-3.11) |  | (-2.86) |
|  |  |  |  |  |  |  |  |  |  |
| Personal remittances, received (% of GDP) |  | 0.00403 |  |  |  | -0.0108 | 0.00403 |  | -0.0190 |
|  |  | (0.17) |  |  |  | (-0.50) | (0.17) |  | (-0.85) |
|  |  |  |  |  |  |  |  |  |  |
| Net official development assistance and official aid received (constant 2020 US$ |  | -1.70e-11 |  |  |  | -2.49e-12 | -1.70e-11 |  | -1.26e-11 |
|  |  | (-0.13) |  |  |  | (-0.02) | (-0.13) |  | (-0.10) |
|  |  |  |  |  |  |  |  |  |  |
| FDI net inflows (% of GDP) |  | -0.00765 |  |  |  | -0.0205 | -0.00765 |  | -0.0248 |
|  |  | (-0.45) |  |  |  | (-1.20) | (-0.45) |  | (-1.44) |
|  |  |  |  |  |  |  |  |  |  |
| Financial development index |  | 0.934 |  |  |  | 3.898\*\* | 0.934 |  | 4.990\*\* |
|  |  | (0.53) |  |  |  | (2.00) | (0.53) |  | (2.48) |
|  |  |  |  |  |  |  |  |  |  |
| Informal sector (% of GDP) |  | -0.00102 |  |  |  | -0.000641 | -0.00102 |  | -0.000510 |
|  |  | (-1.14) |  |  |  | (-0.78) | (-1.14) |  | (-0.65) |
|  |  |  |  |  |  |  |  |  |  |
| Internal Conflict Risk index |  |  | -0.584\*\*\* |  |  |  |  |  |  |
|  |  |  | (-5.53) |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| External Conflict Risk index |  |  | 0.200 |  |  |  |  |  |  |
|  |  |  | (1.62) |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Religious Tensions Risk index |  |  | 0.111 |  |  |  |  |  |  |
|  |  |  | (0.42) |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Corruption Risk index |  |  | 0.0932 |  |  |  |  |  |  |
|  |  |  | (0.78) |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Government Stability Risk index |  |  | 0.120\*\* |  |  |  |  |  |  |
|  |  |  | (2.09) |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Law and Order Risk index |  |  | 0.0796 |  |  |  |  |  |  |
|  |  |  | (0.37) |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Women civil liberties index |  |  |  | 1.166 |  | 4.093\*\* |  | 2.416 | 4.665\*\* |
|  |  |  |  | (0.97) |  | (2.15) |  | (1.48) | (2.30) |
|  |  |  |  |  |  |  |  |  |  |
| Property rights for women |  |  |  | 0.750\*\*\* |  | 1.231\*\*\* |  | 0.545 | 1.066\*\* |
|  |  |  |  | (2.77) |  | (3.04) |  | (1.57) | (2.44) |
|  |  |  |  |  |  |  |  |  |  |
| Mean years schooling of population 25+, females |  |  |  |  | 0.560\*\*\* |  |  | 0.493\*\* | 0.387 |
|  |  |  |  |  | (3.09) |  |  | (2.55) | (1.42) |
|  |  |  |  |  |  |  |  |  |  |
| Fertility rate, total (births per woman) |  |  |  |  | -0.749\* |  |  | -0.655 | -0.0218 |
|  |  |  |  |  | (-1.69) |  |  | (-1.44) | (-0.04) |
|  |  |  |  |  |  |  |  |  |  |
| Mortality rate, infant (per 1,000 live births) |  |  |  |  | -0.0714\*\*\* |  |  | -0.0697\*\*\* | -0.0580\* |
|  |  |  |  |  | (-2.86) |  |  | (-2.68) | (-1.80) |
|  |  |  |  |  |  |  |  |  |  |
| Constant | -133.2\*\*\* | -909.8\*\*\* | -178.1\*\*\* | -136.6\*\*\* | -55.05\* | -761.4\*\*\* | -909.8\*\*\* | -61.32\*\* | -352.1 |
|  | (-8.26) | (-3.33) | (-7.47) | (-8.02) | (-1.85) | (-2.77) | (-3.33) | (-2.02) | (-0.94) |
| Observations | 2176 | 1163 | 1582 | 2095 | 1567 | 1143 | 1163 | 1521 | 1104 |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Year FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |

*Notes:* Entropy balancing estimates of Equation 1. Dependent variable is the Gender Parity Gap (percentage

Table C.4: Mobile Money and Gender Equality : Robustness to alternative measure of gender equality

|  |  |  |  |
| --- | --- | --- | --- |
|  | Gender Inequality Index | CPIA Gender Equality | Human Development Index (Women) |
| Mobile-money available | −0*.*00846∗∗ | 0*.*0962∗∗∗ | 0*.*00620∗∗∗ |
|  | (0.011) | (0.003) | (0.000) |
| Covariables | YES | YES | YES |
| Country FE | YES | YES | YES |
| Year FE | YES | YES | YES |
| R-squared | 0.949 | 0.929 | 0.995 |
| Observations | 2 072 | 864 | 2 176 |

*Notes:* Entropy balancing estimates of Equation 1. Dependent variable is the Gender Parity Gap (percentage points), measure of gender equality. Robust t-statistics in parentheses. ∗ *p <* 0*.*1, ∗∗ *p <* 0*.*05, ∗∗∗ *p <* 0*.*01. All specifications include country and year fixed effects. Lagged variables are indicated as Lag[.].

Table C.5: Mobile-Money and Gender Equality: Robustness to OLS regression

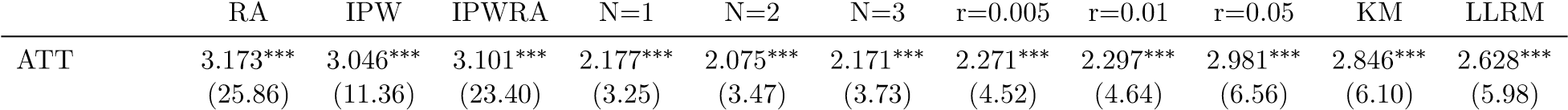
|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Mobile money adoption (1=yes) | 0.633∗∗∗ | 0.514∗∗∗ | 0.561∗∗∗ | 0.556∗∗∗ | 0.556∗∗∗ | 0.476∗∗∗ | 0.467∗∗∗ | 0.346∗∗ | 0.401∗∗ | 0.366∗ |
|  | (2.98) | (2.75) | (3.03) | (3.00) | (3.01) | (3.08) | (3.00) | (2.35) | (1.98) | (1.79) |
| Initial GDI level | 86.82∗∗∗ | 143.7∗∗∗ | 167.7∗∗∗ | 165.7∗∗∗ | 166.5∗∗∗ | 134.3∗∗∗ | 134.9∗∗∗ | 1202.1∗∗∗ | 1302.1∗∗∗ | 1375.7∗∗∗ |
|  | (8.99) | (9.64) | (9.94) | (9.88) | (9.74) | (10.30) | (10.19) | (6.27) | (5.99) | (6.88) |
| Lag[log GDP pc] |  | 0.0403∗∗∗ | 0.0408∗∗∗ | 0.0406∗∗∗ | 0.0406∗∗∗ | 0.0207∗∗∗ | 0.0209∗∗∗ | 0.0245∗∗∗ | 0.0353∗∗∗ | 0.0378∗∗∗ |
|  |  | (6.97) | (7.17) | (7.20) | (7.20) | (5.94) | (5.92) | (6.36) | (7.26) | (7.42) |
| Lag[Female labor force] |  |  | 0.0759∗∗∗ | 0.0757∗∗∗ | 0.0762∗∗∗ | 0.0424∗∗∗ | 0.0456∗∗∗ | 0.0297∗∗ | 0.0041 | 0.0559∗∗∗ |
|  |  |  | (4.67) | (4.66) | (4.68) | (3.01) | (3.20) | (2.19) | (0.25) | (3.07) |
| Lag[Women & Law Index] |  |  |  | 0.0052 | 0.0055 | 0.0020 | 0.0032 | 0.0233∗∗∗ | 0.0244∗∗ | 0.0117 |
|  |  |  |  | (0.61) | (0.63) | (0.23) | (0.37) | (2.92) | (2.57) | (1.26) |
| Lag[Urban pop. growth] |  |  |  |  | 0.0108 | 0.0005 | 0.0006 | 0.0315 | 0.0313 | 0.0167 |
|  |  |  |  |  | (0.33) | (0.02) | (0.02) | (0.85) | (0.72) | (0.43) |
| Lag[Private credit/GDP] |  |  |  |  |  | -0.0095∗∗ | -0.0088∗∗ | -0.0057 | 0.0012 | 0.0025 |
|  |  |  |  |  |  | (-2.18) | (-1.98) | (-1.34) | (0.22) | (0.49) |
| Lag[Fixed phone subscr.] |  |  |  |  |  |  | 0.0020 | -0.0014 | -0.0014 | 0.0002 |
|  |  |  |  |  |  |  | (1.30) | (-0.81) | (-0.82) | (0.12) |
| Lag[Financial dev. index] |  |  |  |  |  |  |  | -8.047∗∗∗ | -9.348∗∗∗ | -7.181∗∗∗ |
|  |  |  |  |  |  |  |  | (-6.19) | (-6.54) | (-5.29) |
| Lag[Access electricity %] |  |  |  |  |  |  |  | 0.0274∗∗∗ | 0.0294∗∗∗ | 0.0124 |
|  |  |  |  |  |  |  |  | (4.00) | (3.19) | (1.41) |
| Lag[Law & Order risk] |  |  |  |  |  |  |  |  | 0.405∗∗∗ | 0.200∗ |
|  |  |  |  |  |  |  |  |  | (3.30) | (1.73) |
| Lag[Corruption risk] |  |  |  |  |  |  |  |  | 0.0475 | 0.0850 |
|  |  |  |  |  |  |  |  |  | (0.52) | (0.99) |
| Lag[Internal conflict] |  |  |  |  |  |  |  |  | -0.185∗∗∗ | -0.183∗∗∗ |
|  |  |  |  |  |  |  |  |  | (-3.46) | (-3.54) |
| Lag[Religious tension] |  |  |  |  |  |  |  |  | -0.0742 | -0.0589 |
|  |  |  |  |  |  |  |  |  | (-0.68) | (-0.56) |
| Lag[Property rights women] |  |  |  |  |  |  |  |  |  | -0.144  (-0.58) |
| Lag[Fertility rate] |  |  |  |  |  |  |  |  |  | -0.749∗∗∗  (-2.86) |
| Lag[Infant mortality] |  |  |  |  |  |  |  |  |  | -0.0606∗∗∗  (-7.71) |
| Constant | -95.01∗∗∗ | -173.5∗∗∗ | -200.1∗∗∗ | -198.4∗∗∗ | -199.3∗∗∗ | -154.2∗∗∗ | -155.1∗∗∗ | -1074.1∗∗∗ | -1165.5∗∗∗ | -1222.2∗∗∗ |
|  | (-11.08) | (-10.93) | (-10.92) | (-10.96) | (-10.82) | (-11.71) | (-11.59) | (-6.43) | (-6.13) | (-6.98) |
| Observations | 2336 | 2307 | 2293 | 2293 | 2293 | 2210 | 2176 | 1924 | 1435 | 1435 |
| R-squared | 0.927 | 0.933 | 0.934 | 0.934 | 0.934 | 0.938 | 0.939 | 0.949 | 0.953 | 0.956 |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes:* Dependent variable is the Gender Parity Gap (percentage points). Robust t-statistics in parentheses. ∗ *p <* 0*.*1, ∗∗ *p <* 0*.*05, ∗∗∗ *p <* 0*.*01. All specifications include country and year fixed effects. Lagged variables are indicated as Lag[.].

Table C.6: Mobile-Money Adoption and Gender Equality: Alternatives methods

Nearest-NeighborMatching

RadiusMatching



Observations 2176 2176 2176 2176 2176 2176 2176 2176 2176 2176 2176

*Notes:* : t statistics in parentheses. Bootstrapped standard errors (500 reps). \*\*\* *p <* 0*.*01, \*\* *p <* 0*.*05, \* *p <* 0*.*1. No difference with Table 5 observations. RA= Regression Ajustement; IPw= Inverse-Probability weighting; IPWRA= Inverse-Probability weighting Regression Ajustement; KM=Kernel Matching ; LLRM=Local Linear Regression Matching

Table C.7: Mobile Money and Gender Equality: Robustness to Inference, Alternative Samples and Placebo Tests

Inferencerobustness

Exclusion

Outliers

PlaceboTests

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] |
| Mobile money | 0.615\*\*\* | 0.615\*\*\* | 0.615\*\*\* | 0.615\* | 0.626\*\* | 0.750\*\*\* |  |  |  |
|  | (3.06) | (2.99) | (3.00) | (2.03) | (2.00) | (8.28) |  |  |  |
| Placebo (random adoption date) |  |  |  |  |  |  | -0.0913  (-0.97) |  |  |
| Placebo (falsification outcome) |  |  |  |  |  |  |  | 0.00199  (0.03) |  |
| Placebo (five years prior) |  |  |  |  |  |  |  |  | -0.0617  (-0.40) |
| Observations | 2,176 | 2,176 | 2,176 | 2,176 | 2,132 | 2,011 | 2,176 | 1,867 | 2,176 |
| Adj/within. *R*2 | 0.436 | 0.989 | 0.989 | 0.972 | 0.972 | 0.981 | 0.972 | 0.832 | 0.972 |

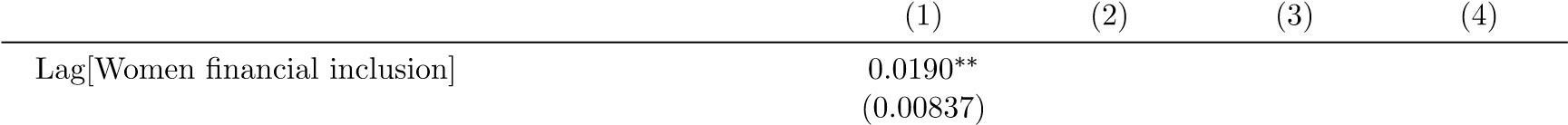
*Notes:* t-statistics in parentheses. \*\*\* *p <* 0*.*01, \*\* *p <* 0*.*05, \* *p <* 0*.*10. Columns [1]–[4] report results with alternative corrections to inference: [1] Driscoll-Kraay, [2] and [3] Conley spatial HAC standard errors with cutoff distances of 200 and 400 miles, respectively; [4] two-way clustering by country and year. Column [5] excludes countries that have maintained an official communist regime; column [6] excludes outlier observations. Columns [7]–[9] present placebo tests: [7] assigns random mobile money adoption dates, [8] uses external conflict as a falsification outcome, and [9] treats gender equality five years prior to adoption as the dependent variable. All specifications include country and year fixed effects as well as the full set of controls described in Section 3.

# D Transmission channels

Table D.1: Correlation between channels and the gender-parity gap (GapGDI)

*Dependent variable :*

Gender parity gap



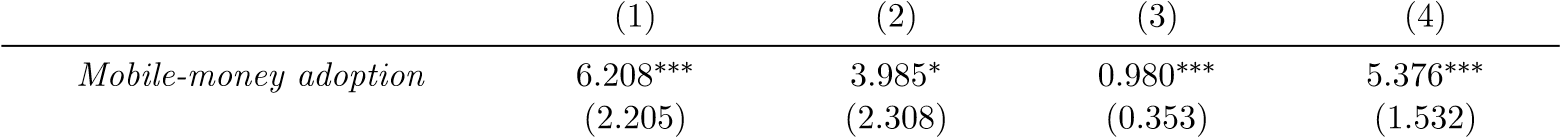
Lag[Received domestic remittances, female(% age 15+)] 0.0301∗∗

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | (0.0142) |  |  |
| Lag[Received Remittance(% GDP)] |  |  | 0.0469∗∗∗  (0.0134) |  |
| Lag[Self-employed,female(% of female employment)] |  |  |  | 0.0262∗  (0.0138) |
| Observations | 252 | 179 | 2059 | 2100 |
| Adjusted *R*2 | 0.888 | 0.875 | 0.942 | 0.938 |

*Notes*: Robust standard errors are in parentheses. All specifications include the full set of baseline controls, country and year fixed effect, a constant(not reported). ∗∗∗ *p <* 0*.*01, ∗∗ *p <* 0*.*05, ∗ *p <* 0*.*10.

Table D.2: Impact of Mobile-Money Adoption on Key Transmission Channels

*Dependentvariable*



Observations 259 185 2398 2580

Adjusted *R*2 0.842 0.789 0.942 0.775

*Notes*: Robust (heteroskedasticity-consistent) standard errors are in parentheses. Column (1): female account ownership; Column (2): domestic remittances received by women ( % aged15+); Column (3): remittances as a share of GDP; Column (4): self-employment among women (% of female employment). All regressions include the full baseline control set, country and year fixed effects, and a constant (not reported). ∗∗∗ *p <* 0*.*01, ∗∗ *p <* 0*.*05, ∗ *p <* 0*.*10.

# E Heterogeneity

Table E.1: Mobile-Money Adoption and Gender Equality: Mobile-money effect over time

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *t*0 (adoption year) | | 0.208  (0.198) |  |  |  |  |  |  |  |
| *t*+1 (1st | year) |  | 0.320  (0.212) |  |  |  |  |  |  |
| *t*+2 (2nd | year) |  |  | 0.424∗∗  (0.204) |  |  |  |  |  |
| *t*+3 (3rd | year) |  |  |  | 0.427∗  (0.219) |  |  |  |  |
| *t*+4 (4th | year) |  |  |  |  | 0.485∗∗  (0.234) |  |  |  |
| *t*+5 (5th | year) |  |  |  |  |  | 0.499∗∗  (0.243) |  |  |
| *t*+6 (6th | year) |  |  |  |  |  |  | 0.552∗∗  (0.256) |  |
| *t*+7 (7th | year) |  |  |  |  |  |  |  | 0.627∗∗  (0.258) |
| Covariables | | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | | YES | YES | YES | YES | YES | YES | YES | YES |
| Year FE | | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | | 1354 | 1432 | 1510 | 1588 | 1663 | 1734 | 1805 | 1873 |
| Adjusted *R*2 | | 0.994 | 0.993 | 0.991 | 0.989 | 0.986 | 0.986 | 0.985 | 0.984 |

*Notes*: Robust standard errors clustered at the individual level are in parentheses. The dependent variable is *Gender gap parity*. ∗∗∗ *p <* 0*.*01,

∗∗ ∗

*p <* 0*.*05, *p <* 0*.*10. Columns (1)–(8) sequentially restrict the sample: (1) adoption year only; (2) one year after; ...; (8) up to seven years

after, dropping later observations.

Table E.2: Mobile-Money Adoption and Gender Equality: Disaggregating Services

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] |
| In-remittance available | 0.679∗∗∗  (0.194) |  |  |  |  |  |  |  |  |
| P2G (domestic) available |  | 0.615∗∗∗  (0.154) |  |  |  |  |  |  |  |
| P2G (international) available |  |  | 0.700∗∗∗  (0.187) |  |  |  |  |  |  |
| G2P available |  |  |  | 0.814∗∗∗  (0.258) |  |  |  |  |  |
| Bill pay available |  |  |  |  | 0.432∗∗∗  (0.158) |  |  |  |  |
| Airtime top-up available |  |  |  |  |  | 0.568∗∗∗  (0.155) |  |  |  |
| Merchant pay available |  |  |  |  |  |  | 0.637∗∗∗  (0.165) |  |  |
| Cash-in available |  |  |  |  |  |  |  | 0.603∗∗∗  (0.153) |  |
| Cash-out available |  |  |  |  |  |  |  |  | 0.600∗∗∗  (0.153) |
| Covariables | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Year FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 | 2176 |
| Adj. *R*2 | 0.972 | 0.972 | 0.972 | 0.972 | 0.972 | 0.972 | 0.972 | 0.972 | 0.972 |

*Notes*: Robust standard errors clustered at the individual level are in parentheses. All specifications include the full set of baseline controls (not reported) and a constant. ∗∗∗ *p <* 0*.*01, ∗∗ *p <* 0*.*05, ∗ *p <* 0*.*10. The sample size and covariates are identical to those in Table 1.

Table E.3: Mobile-money adoption and gender inequality : heterogeneity across income groups and regions

Incomelevel

Regions

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | HIC | LIC | SSA | MENA | LAC | ECA | EAP |
| Mobile-money adoption | 0.234 | 0.734∗∗∗ | 1.287∗∗∗ | 0.648∗ | -0.314 | 0.201 | 0.269 |
|  | (0.155) | (0.221) | (0.272) | (0.370) | (0.362) | (0.256) | (0.250) |
| Covariables | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES |
| Year FE | YES | YES | YES | YES | YES | YES | YES |
| Observations | 834 | 1342 | 842 | 274 | 423 | 132 | 321 |
| Adjusted *R*2 | 0.979 | 0.960 | 0.939 | 0.994 | 0.951 | 0.985 | 0.972 |

*Notes*: Robust standard errors are in parentheses. All specifications include the full set of baseline controls (not reported) and a constant.

∗∗∗ ∗∗ ∗

*p <* 0*.*01, *p <* 0*.*05, *p <* 0*.*10. The sample size and covariates are identical to those in Table 1.

Table E.4: Socio-economic baseline characteristics

Initial GDI Female literacy Female schooling Rural pop. share WBL index

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | High | Low | High | Low | High | Low | High | Low | High | Low |
| mms adopt | 0.002 | 0.007∗∗∗ | 0.599∗∗∗ | 1.465∗ | 0.377∗∗∗ | 0.800∗∗∗ | 0.674∗∗∗ | 0.073 | 0.833∗∗∗ | 0.365 |
|  | (0.002) | (0.002) | (0.145) | (0.815) | (0.139) | (0.272) | (0.223) | (0.140) | (0.165) | (0.299) |
| Covariables | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Year FE | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Obervations | 1151 | 1025 | 1866 | 310 | 1221 | 955 | 1234 | 942 | 1203 | 973 |
| adj. *R*2 | 0.960 | 0.951 | 0.979 | 0.912 | 0.985 | 0.961 | 0.967 | 0.978 | 0.978 | 0.974 |

Robust standard errors clustered at the country level are in parentheses. All specifications include baseline controls plus country and year fixed effects. ∗∗∗ *p <* 0*.*01,

∗∗ ∗

*p <* 0*.*05, *p <* 0*.*10.

1. Correspondence: yrabo.dabou@inrae.fr [↑](#footnote-ref-1)
2. Telecom operators have often played a more decisive role than central banks in the expansion of mobile money. Kenya, for instance, has adopted a relatively liberal approach, in contrast with more restrictive frameworks seen in many West and North African countries. [↑](#footnote-ref-2)
3. This strategy is also used by Acemoglu et al. (2019) in their article *“Democracy Does Cause Growth”*. [↑](#footnote-ref-3)
4. Mobile money adoption in a country has no immediate effect on the risk of it entering into armed conflict with a neighbor. [↑](#footnote-ref-4)