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# Digitalization: A Catalyst for Intergenerational Occupational Mobility?

Mame Astou Diouf, Boileau Yeyinou Loko, and Rasmane Ouedraogo

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**Digitalization: A Catalyst for Intergenerational Occupational Mobility?**

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**ABSTRACT:** This paper analyzes the link between digitalization and intergenerational occupational mobility in Africa. We use a probit model estimated on a large sample of 28 million individuals aged 14 and higher and co-residing with at least one individual from the older generation. We find that digitalization could help boost upward mobility and limit the risks of downward occupational mobility, thereby improving job opportunities. While strong institutions, political and social stability, better access to adequate digital infrastructure, and education are important to increase and accelerate upward mobility, new technologies and digital tools can intensify these positive effects and contribute to creating jobs and enhancing living standards in Africa. Similar results hold for downward mobility.

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WORKING PAPERS

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Mame Astou Diouf, Boileau Yeyinou Loko, and Rasmane Ouedraogo [1]

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# 1. Introduction

**Intergenerational mobility reflects the extent to which individuals move up (or down) the social ladder compared with their parents**. It is measured in alternative ways, including income, educational, and occupational mobility. Many studies have shown that intergenerational mobility could promote socio-economic development through several channels including human capital accumulation (Dustmann 2004; Cunha et al. 2006; Cunha and Heckman 2007) and reduced inequality (Erikson and Goldthorpe, 1992; Björklund and Jäntti, 2009). First, low intergenerational mobility could lead to unrealized human potential and misallocation of resources, constraining growth. Second, the stickiness associated with low intergenerational mobility can promote a lack of equal opportunity in a society, which in turn may lead to lower productivity, and adversely affect the overall efficiency and the growth potential of the economy. Thus, understanding the drivers of intergenerational mobility matters from a policy perspective.

**While seldom, a few studies have analyzed intergenerational mobility in developing economies, particularly African countries**. For example, Ambar Narayan and Roy Van der Weide (2018) provides estimates of education and income intergenerational mobility for 148 economies, including developing countries. Using data spanning five decades, they found that, on average, mobility is considerably lower in developing economies. Moreover, sub-Saharan Africa and South Asia stand out as regions with some of the lowest magnitudes of mobility (13 of the 15 least mobile countries are either in sub-Saharan Africa or South Asia). The relatively reduced number of studies on African countries reflect several challenges, including limited data availability and quality.

**While some drivers of intergenerational mobility are related to the inheritability of traits, many of those could be affected by public policies (Jan Stuhler, 2018)**. Empirical papers have found evidence between intergenerational mobility and public support for early childhood (Cunha and Heckman, 2007; Havnes and Mogstad, 2015) and educational systems and reforms (Dustmann, 2004; Chetty et al. 2014). Yu Xie et al. (2022) found that rapid industrialization in recent decades has increased intergenerational occupational mobility in China. The recent paper by Ouedraogo and Syrichas (2021), focusing on African countries, shows that economic opportunities in terms of educational mobility has improved in Africa, but occupational mobility has remained very low. It also found that social protection coverage, education spending, good governance and the occurrence of conflict are important drivers of educational and occupational mobility. This paper uses this novel database with broad coverage of African countries, which allows deeper continental insights. While the countries' less diversified stage means less granularity compared with other classifications that would include a greater number of professional groups such as the Cambridge Social Interaction and Stratification Scale (CAMSIS), the John H. Goldthorpe's class schema, the International Standard Classification of Occupations (ISCO-88), Donald J. Treiman's prestige scale, or the Erik Olin Wright's class structure.

**In this paper, we explore whether digitalization (access to digital tools) can support social mobility in Africa**. To answer this question, we focus on intergenerational occupational mobility in African countries. We argue that digitalization could boost intergenerational upward social mobility through two main channels. First, digitalization can promote upward occupational mobility by helping create new job and income-generating opportunities in various sectors, including in services. Digitalization can also allow people to move out of traditional low-skilled agricultural jobs towards higher-skill occupations (Hjort and Poulsen, 2019). The reverse applies for downward mobility. Second, digitalization could boost intergenerational mobility through access and quality of education and enhanced human capital, information sharing and innovation, and access to financial services.

**The paper uses probit models to estimate the probability of occupational upward or downward mobility**. We control for a number of covariates, including individual characteristics (education, place of residence, access to infrastructure, and others) and country-level variables (level of development, quality of institutions and conflict). To capture digitalization, we use the arrival of submarine cables as proxy, which is exogeneous. Moreover, we check whether our findings are conditional to some enabling factors, including the access to digital infrastructure, quality of institutions, and human capital. We also run robustness checks by using an alternative definition of digitalization (mobile phone ownership) and including additional covariates.

**To the best of our knowledge, this paper is the first study shedding some light on the link between digitalization and intergenerational occupational mobility**. We find that digitalization could help boost upward mobility and limit the risks of downward occupational mobility. Our study also confirms that policies that promote strong institutions, political and social stability, and education are important to improve upward mobility, i.e., favor the move of farmers' children from the agricultural sector. Better access to adequate digital infrastructure could amplify these positive effects. The findings of the paper imply that the advent of new technologies and digital tools could lift young Africans out of the agriculture sector and enhance their living standards.

**The rest of the paper is organized as follows**. Section II presents some stylized facts on occupational mobility in Africa. Section III describes briefly our model and empirical strategy. It then discusses the empirical results of the effects of digitalization on upward and downward occupational mobility in Africa. Section IV explores the presence of non-linearity effects in the model. We test if the effects of digitalization can be amplified by the quality of institutions and the government policies about the promotion of ICT. The last section concludes and provides various policy recommendations.

# 2. Stylized Facts

## 2.1 Occupational mobility

**Upward and downward occupational mobility are defined with respect to the parents' and children's occupations (Annex 1) as follows**:

- Upward occupational mobility is a binary variable taking the value of 1 if the child born or adopted from agricultural occupied (including the informal sector) parents has taken a blue-collar or white-collar occupation and zero otherwise.
- Downward occupational mobility is a binary variable that takes the value of 1 if the child born or adopted from parents working in white-collar or blue-collar professions has an agricultural occupation and zero otherwise.

**A snapshot of the upward and downward intergenerational occupational mobility indices for each country and census year (Table 1) shows that around one quarter of individuals in Africa have experienced upward occupational mobility, while nearly one-third have lower job status than their parents**. We also observe large heterogeneity between countries. The country with the highest probability of upward mobility is Mauritius (75 percent), followed by South Africa (48 percent) and Botswana (46 percent). Several countries have about ¼ percent of probability of upward mobility, including Benin, Egypt, Ghana, Lesotho, Morocco, Senegal, and South Sudan. The probabilities of downward mobility are more homogeneous across countries, with Mauritius having the lowest probability of downward mobility.

**Table 1: Intergenerational Occupational Mobility for Each Country**

| Country | Census years | Number of observations | Upward mobility | Downward mobility |
|---|---|---|---|---|
| Benin | 1979,1992,2002,2010 | 152,114 | 0.24 | 0.19 |
| Botswana | 1981,1991,2001,2010 | 13,535 | 0.46 | 0.23 |
| Burkina Faso | 1996,2006 | 116,429 | 0.02 | 0.46 |
| Cameroon | 1976,1987,2005 | 92,846 | 0.12 | 0.18 |
| Egypt | 1986,1996,2006 | 764,120 | 0.31 | 0.18 |
| Ethiopia | 1984,1994,2007 | 652,852 | 0.03 | 0.28 |
| Ghana | 1984,2000,2010 | 480,737 | 0.24 | 0.23 |
| Guinea | 1983,1996,2014 | 147,508 | 0.16 | 0.12 |
| Kenya | 1989,1999,2009 | 50,596 | 0.21 | 0.36 |
| Lesotho | 1996,2006 | 12,622 | 0.29 | 0.37 |
| Malawi | 1987,1998,2008 | 98,933 | 0.08 | 0.44 |
| Mali | 1987,1998,2009 | 210,014 | 0.05 | 0.29 |
| Mauritius | 1990,2000,2011 | 41,470 | 0.75 | 0.10 |
| Morocco | 1982,1994,2004,2014 | 487,381 | 0.27 | 0.25 |
| Mozambique | 1997,2007 | 183,908 | 0.12 | 0.32 |
| Nigeria | 2006,2007,2008,2009,2010 | 11,583 | 0.16 | 0.22 |
| Rwanda | 2002,2012 | 121,493 | 0.08 | 0.37 |
| Senegal | 1988,2002,2013 | 193,428 | 0.23 | 0.21 |
| Sierra Leone | 2004 | 37,032 | 0.08 | 0.16 |
| South Africa | 1996,2001,2007,2011,2016 | 119,706 | 0.48 | 0.14 |
| South Sudan | 2008 | 42,368 | 0.22 | 0.46 |
| Sudan | 2008 | 198,964 | 0.09 | 0.37 |
| Tanzania | 1988,2002,2012 | 627,889 | 0.05 | 0.32 |
| Togo | 1970,2010 | 2,782 | 0.11 | 0.38 |
| Uganda | 1991,2002,2014 | 153,362 | 0.08 | 0.45 |
| Zambia | 1990,2000,2010 | 131,273 | 0.07 | 0.25 |
| Zimbabwe | 2012 | 19,895 | 0.17 | 0.30 |
| **Average** | | **5,164,840** | **0.19** | **0.28** |

Sources: IPUMS and Ouedraogo and Syrichas (2021).

## 2.2 Digitalization

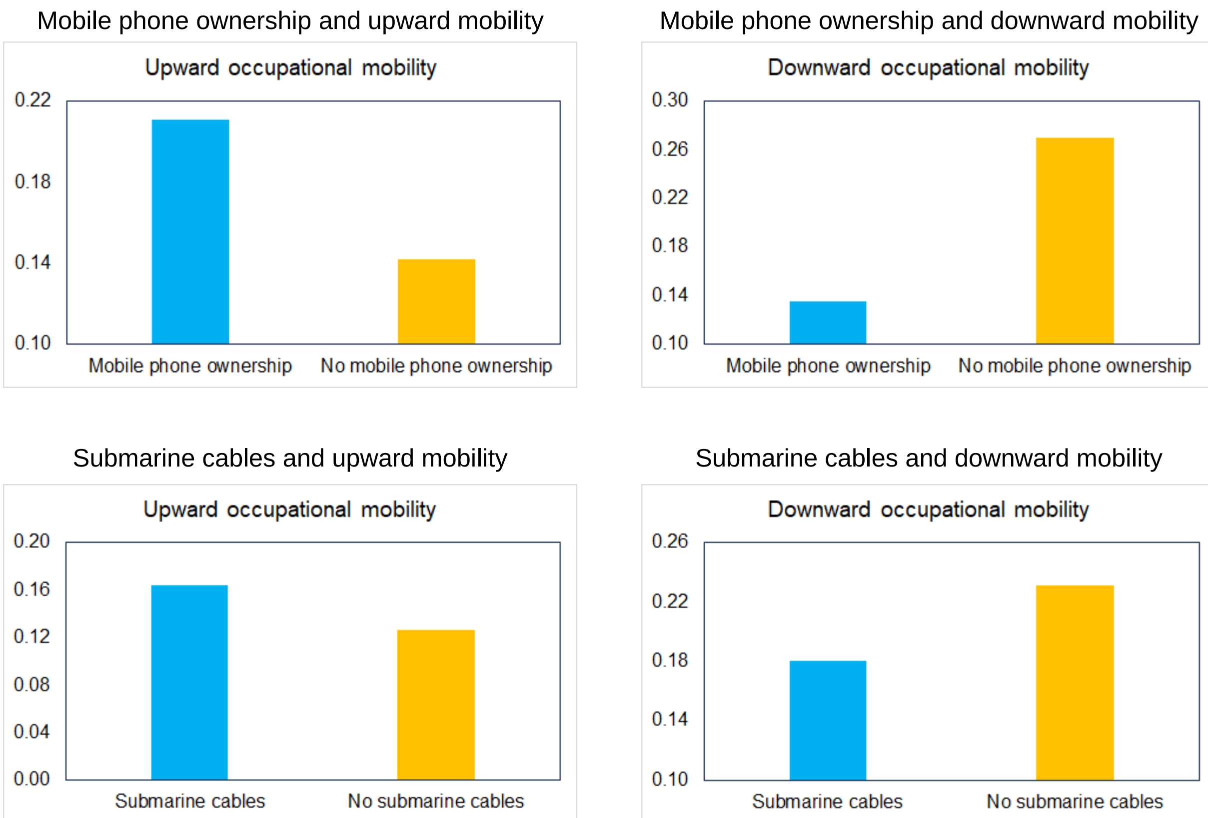
**We use two indicators to capture digitalization trends: (1) a country's connection to submarine cables and (2) mobile phone ownership**. A country's connection to submarine cables is a more recently used proxy for digitalization, as it is a relatively new concept in Africa. The seminal papers of IMF (2020) and Hjort and Poulsen (2019) document that the arrival of submarine cables in Africa has contributed to accelerate the speed and scale of internet connection in the continent. Mobile phone ownership has also been widely used to measure digitalization (IMF 2020, Ouedraogo and Sy, 2020).

**Common Trends**

**Figure 1 presents the average probability of upward and downward occupational mobility, conditional on mobile phone ownership or connection to submarine cables.** The probabilities are not conditional on any other factors. Figure 1 shows a positive association between digitalization and higher occupational mobility and between digitalization and lower downward occupational mobility.

- The probability of upward occupational mobility is higher for individuals from countries that are connected to submarine cables than those from countries not connected to submarine cables.
- The probability of upward occupational mobility for individuals who own a mobile phone is higher than for individuals who do not own a mobile phone.
- The probability of downward occupational mobility is lower for individuals who are from countries that are connected to submarine cables.
- The probability of downward occupational mobility is 2 times higher for individuals who do not own mobile phone than for individuals who own a mobile phone.

**Figure 1: Occupational Mobility and Access to Digital Tools**




Sources: Integrated Public Use Microdata Series (IPUMS) and authors' calculations.

**Statistical Significance**

**We investigate whether the probabilities depicted in Figure 1 are statistically different from one group of individuals to another**. Table 2 presents the percentage of individuals who have experienced upward or downward occupational mobility for each group with and without mobile phone, and submarine cables. The p-value of the T-test indicates the statistical significance of the difference between the probability for individuals who have access to digital tools and those who do not have access to digital tools. Table 2 shows that the differences in the probabilities are statistically different from zero for all digital tools, suggesting that individuals from countries connected to submarine cables and those who use mobile phones tend to have higher (lower) upward (downward) occupational mobility than individuals who do not use digital tools.

**Table 2: Probabilities of Upward and Downward Occupation Mobility[1]**

| | Upward occupational mobility | Downward occupational mobility |
|---|---|---|
| Mobile phone ownership | 0.21 | 0.14 |
| No ownership of mobile phone | 0.14 | 0.27 |
| ***T-test, p-value*** | ***0.00*** | ***0.00*** |
| Submarine cables | 0.16 | 0.18 |
| No submarine cables | 0.13 | 0.23 |
| ***T-test, p-value*** | ***0.00*** | ***0.00*** |

Sources: Integrated Public Use Microdata Series (IPUMS) and IMF staff calculations.
[1] P-value<0.05 means that the difference is significantly different from zero at the 5 percent level.

# 3. Empirical Strategy and Results

## 3.1. Model

**We estimate the effect of digitalization on occupational mobility using the following equation**:

$$Employment\ mobility_{ijt} = \alpha + \beta Digitalization_{ijt} + \gamma X'_{ijt} + \pi_j + \vartheta_t + \mu_{ijt} \quad (1)$$

where, for a survey conducted at year $t$, individual $i$ from country $j$,

- $Employment\ mobility_{ijt}$ is a binary variable taking the value of 1 if the individual has experienced an upward or downward occupational mobility and 0 otherwise,
- $Digitalization_{ijt}$ represents our indicator used to measure digitalization, including submarine cables and mobile phone ownership. The variable submarine cable is a binary variable taking the value of 1 if the country is connected to a submarine cable and 0 otherwise. We use connection to submarine cables as a proxy of digitalization in the baseline estimates as it is exogeneous (Hjort and Poulsen, 2019; Cariolle, 2029; IMF, 2020) and attenuate the problem of reverse causality. Moreover, this binary variable changes overtime based on the year of arrival of submarine cables, and this is not only about costal countries as some landlocked countries, like Rwanda, are connected to submarine cables. While submarine cables arrived in most African countries in the 2000s, the consideration of the period before 2000 helps to capture the temporal change and explore whether or not individuals working post-2000 have more employment opportunities than those before 2000. Mobile phone ownership is also binary variables taking the value of 1 if the individual owns a mobile phone and 0 otherwise. This variable is used as robustness check, and only individuals with available mobile phone data are considered in related model estimates.

- $\pi_j$ are the country fixed effects. The inclusion of country fixed effects will account for observable and unobservable country-specific characteristics that may explain employment mobility. The country level fixed effects remove bias due to omitted variables at the country-level.
- $\vartheta_t$ represents the time fixed effects of the years of the surveys. $\mu_{ijt}$ is the error term.
- Vector $X'_{ijt}$ includes a set of control variables on the socio economic and demographic of individuals.

These control variables include:

- Gender status is a binary variable taking the value of 1 if the individual is a female and 0 otherwise.
- Size of family represents the number of individuals in the household.
- Place of living is a binary variable taking the value of 1 if the individual lives in rural area and 0 otherwise.
- Age represents the age of the individual at the time of the survey. We also added age square to capture any potential generational effects.
- Access to infrastructure includes access to electricity and clean water, which are all binary variables taking the value of 1 if the individual has access to electricity or clean water and 0 otherwise.
- Marital status takes the value 1 if the individual is married at the time of the survey and 0 otherwise.
- Literacy level is a binary variable taking the value of 1 if the individual is literate and 0 otherwise.

**Other control variables include**: (i) the level of development proxied by GDP per capita, (ii) the quality of institutions which is a simple average of three indicators from the Worldwide Governance Indicators database including rule of law, regulatory quality, and control of corruption; (iii) conflict which is a binary variable taking the value of 1 if a country is affected by a conflict and 0 otherwise.

**Given that the dependent variable is binary, we use a probit to estimate the model and analyze the effect of digitalization on occupational mobility in Africa**. Separate probit models are estimated to assess the probability of upward or downward mobility. Country and time fixed effects are used to control for trend dynamics and country specificities including the easier access of submarine cables for coastal countries and general trends in occupation dynamics. Yet, given that there are only one-time series for several countries of the sample, it is not possible to estimate the temporal dynamic effects between digitalization and occupational mobility. Standard errors are clustered at the country-time level.

## 3.2. Estimation Results

**We start by estimating the effects of digitalization on upward and downward mobility using connection to submarine cables**. For robustness check, we use several indicators, including the level of development, the quality of institutions, and the level of security and conflict. Then, we test the effect of mobile phone ownership on upward and downward mobility. The same indicators are used for robustness check.

**Effects of connection to submarine cables on upward and downward occupational mobility**

**Many studies found that the arrival of submarine cables in Africa improved internet connection (both in terms of speed and scale) and positively affected employment rates (Hjort and Poulsen, 2019; Cariolle, 2029; IMF. 2020)**. Following the same approach, we look at whether the arrival of submarine cables has affected the likelihood of individuals born from parents working in the agriculture sector to work in other sectors (manufacturing or services) of the economy. We compare individuals in countries connected to submarine cables to those in countries with no connection.

**We find that the coefficients associated with submarine cables are positive and strongly significant at the 1 percent level in columns 1−4, and negative in columns 5−8 (Table 3)**. In other words, the arrival of submarine cables is correlated with higher probability of upward occupational mobility and lower probability of downward mobility. Based on columns 1−4, being connected to submarine cable is associated with an increase in the probability of upward occupational mobility by 17.5−26.7 percentage points, while the probability of downward occupational mobility would reduce by 17.8−36.7 percentage points (columns 5−8). The arrival of submarine cables boosts internet connection, allowing the expansion of digital trade and job opportunities.

## Table 3: Effects of Submarine Cables on Upward and Downward Mobility

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| VARIABLES | Upward mobility | | | | Downward mobility | | | |
| Submarine cables | 0.8835*** | 1.3510*** | 0.9991*** | 1.0200*** | -0.6918*** | -0.8903*** | -0.5547*** | -0.4320*** |
| | (0.011) | (0.008) | (0.007) | (0.007) | (0.018) | (0.013) | (0.012) | (0.012) |
| Female | 0.0973*** | 0.1109*** | 0.1296*** | 0.1286*** | -0.3144*** | -0.3259*** | -0.3446*** | -0.3269*** |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.004) | (0.004) | (0.004) | (0.004) |
| Rural area | -0.5979*** | -0.5817*** | -0.5893*** | -0.5825*** | 0.6724*** | 0.6835*** | 0.7039*** | 0.6792*** |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.004) | (0.004) | (0.004) | (0.004) |
| Age | 0.1013*** | 0.0972*** | 0.0973*** | 0.0975*** | -0.0828*** | -0.0762*** | -0.0744*** | -0.0766*** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Age square | -0.0014*** | -0.0014*** | -0.0014*** | -0.0014*** | 0.0012*** | 0.0011*** | 0.0011*** | 0.0011*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Access to electricity | 0.4688*** | 0.5039*** | 0.4021*** | 0.4159*** | -0.2690*** | -0.2424*** | -0.1741*** | -0.2385*** |
| | (0.004) | (0.004) | (0.004) | (0.004) | (0.006) | (0.006) | (0.005) | (0.006) |
| Access to water | 0.2948*** | 0.3060*** | 0.2933*** | 0.2966*** | -0.1644*** | -0.1829*** | -0.1815*** | -0.1843*** |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.005) | (0.004) | (0.004) | (0.004) |
| Married | -0.1133*** | -0.1097*** | -0.1067*** | -0.1087*** | 0.1056*** | 0.1016*** | 0.0976*** | 0.1072*** |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.005) | (0.005) | (0.005) | (0.005) |
| Literate | 0.6376*** | 0.6069*** | 0.6123*** | 0.6180*** | -0.3270*** | -0.3084*** | -0.3111*** | -0.3114*** |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.004) | (0.004) | (0.004) | (0.004) |
| GDP per capita | | -0.5420*** | | | | 0.5710*** | | |
| | | (0.006) | | | | (0.011) | | |
| Quality of institutions | | | 0.1496*** | | | | -0.1163*** | |
| | | | (0.006) | | | | (0.013) | |
| Conflict | | | | -0.0602*** | | | | 0.4463*** |
| | | | | (0.005) | | | | (0.008) |
| Constant | -2.8906*** | 0.8802*** | -2.4583*** | -2.6320*** | 1.4673*** | -3.5558*** | -0.0265 | 0.1309* |
| | (0.048) | (0.057) | (0.043) | (0.043) | (0.085) | (0.103) | (0.075) | (0.074) |
| Observations | 2,165,571 | 2,165,571 | 2,165,571 | 2,165,571 | 767,439 | 767,439 | 767,439 | 767,439 |

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Sources: authors' calculations.

## 3.3. Robustness tests

**As robustness tests, we introduce several socio-economic control factors in the baseline regression (columns 2−4 and columns 6−8, Table 3) and investigate how these factors impact the effects estimated above**:

- The level of development (proxied by GDP per capita). As per Table 3, the coefficients associated with submarine cables remain strongly significant in columns (2) and (6). Moreover, we find that the coefficients associated with GDP per capita are negative and significant in column (2), while positive and significant in column (6). Therefore, individuals from countries with higher income per capita tend to have lower (higher) probability of upward (downward) occupational mobility. This result could result from the fact that countries with higher GDP per capita in Africa are mostly natural resources dependent countries, where job creation out of agriculture remains challenging.
- High quality of institutions. The coefficients associated with the quality of institutions is positive (negative), suggesting that individuals from countries with better institutions enjoy higher (lower) likelihood of upward (downward) occupational mobility (columns 3 and 7). Good quality of institutions is often associated with better economic performances and macroeconomic policies, which can boost job creation and help move people out of the agriculture sector.
- Peace/stability. The coefficient associated with conflict is negative and significant in column (4), while positive in column (8). This implies that individuals from countries affected by conflict tend to have lower probability of upward occupational mobility and higher probability of downward mobility. Conflict limits the capacity of the government to implement macroeconomic policies and serve in the war zones, destroys economic activity, infrastructure and jobs.
- Urban/rural. The coefficient associated with Rural is negative in columns 1-4 and positive in columns 5-8. Living in rural area is associated with lower (higher) likelihood of experiencing upward (downward) occupational mobility. The high level of poverty and the lack of infrastructure underline the creation of economic opportunities in rural areas.
- Access to basic infrastructure. The coefficients associated with access to electricity, access to clean water and literate are positive and significant at the 1 percent level in columns 1−4 and negative in columns 5−8. Individuals who have access to basic infrastructure (electricity and water) are more likely to experience upward occupational mobility and less likely to be downgraded in terms of occupations.
- Individual characteristics. Individuals who are literate are more likely to experience upward occupational mobility and less likely to be downgraded in terms of occupations. In addition, the coefficients associated with married are negative and significant in columns 1-4, and positive in columns 5-8, suggesting that individuals who are married are less (more) likely to experience upward (downward) occupational mobility. This finding indicates that social constraints (for instance child-bearing for married women and reduced physical mobility) can impede employment and social mobility. The high level of poverty rate and the lack of diversified economic activities in rural areas could explain the limited chances of working outside the agriculture sector. Finally, the coefficients associated with the female gender is positive and significant in

columns 1-4, and negative in columns 5-8. Therefore, being female is correlated with higher likelihood of upward occupational mobility and lower likelihood of downward mobility. With women being still discriminated at work in Africa, this finding could be because they start from a low basis and due to recent initiatives aiming at reducing the gender gap in labor force participation.

**Effects of individuals' mobile phone ownership on upward and downward occupational mobility**

**To study a different angle of digitalization, we test the effects of individuals' ownership of mobile phone on upward and downward mobility, using the same indicators as above for robustness check**. Using a mobile phone rather than the countries' connection to submarine cables also serves as additional robustness test to the stability of the effects of digitalization on upward and downward mobility.

***Impact on upward mobility***

**Digitalization does boost chances of upward mobility (Table 4).** The coefficients associated with mobile phone are positive and statistically significant in all the estimated models (columns 1-4 of Table 4). This finding suggests that the ownership of mobile phone is correlated with higher likelihood of upward occupational mobility. Using a mobile phone could boost the likelihood of upward mobility by 8-10.7 percentage points (column 1 to 4).

***Impact on downward mobility***

**Digitization helps mitigate risks of downward mobility (Table 4).** The coefficients associated with mobile phone ownership are negative and highly significant at the 1 percent level in columns 5-8. Using a mobile phone tends to reduce the probability of experiencing downward occupational mobility. Quantitatively, an individual using a mobile phone could benefit from a decline in his/her likelihood of downward occupational mobility by 13-17.4 percentage points (columns 5-8).

## Table 4: Effects of Mobile Phone Use on Upward and Downward Mobility

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| VARIABLES | | Upward mobility | | | | Downward mobility | | |
| Mobile phone | 0.3373*** | 0.2736*** | 0.2570*** | 0.2918*** | -0.2625*** | -0.2206*** | -0.2045*** | -0.2467*** |
| | (0.005) | (0.005) | (0.005) | (0.005) | (0.007) | (0.007) | (0.007) | (0.007) |
| Female | 0.0403*** | 0.0042 | 0.0367*** | 0.0246*** | -0.2057*** | -0.2291*** | -0.2389*** | -0.2146*** |
| | (0.004) | (0.004) | (0.004) | (0.004) | (0.007) | (0.007) | (0.007) | (0.007) |
| Rural area | -0.5646*** | -0.5711*** | -0.5633*** | -0.5300*** | 0.6680*** | 0.6797*** | 0.6830*** | 0.6693*** |
| | (0.005) | (0.005) | (0.005) | (0.005) | (0.007) | (0.007) | (0.007) | (0.007) |
| Age | 0.0824*** | 0.0797*** | 0.0829*** | 0.0854*** | -0.0824*** | -0.0754*** | -0.0757*** | -0.0769*** |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) | (0.002) |
| Age square | -0.0011*** | -0.0011*** | -0.0011*** | -0.0012*** | 0.0012*** | 0.0011*** | 0.0011*** | 0.0011*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Access to electricity | 0.5082*** | 0.5600*** | 0.4060*** | 0.3524*** | -0.1610*** | -0.1780*** | -0.1446*** | -0.1265*** |
| | (0.008) | (0.007) | (0.007) | (0.007) | (0.012) | (0.012) | (0.012) | (0.011) |
| Access to water | 0.2343*** | 0.2211*** | 0.2589*** | 0.2854*** | -0.1319*** | -0.1386*** | -0.1406*** | -0.2356*** |
| | (0.005) | (0.005) | (0.005) | (0.005) | (0.009) | (0.009) | (0.009) | (0.009) |
| Married | -0.0499*** | -0.0311*** | -0.0594*** | -0.0879*** | 0.1031*** | 0.0999*** | 0.0945*** | 0.1329*** |
| | (0.005) | (0.005) | (0.005) | (0.005) | (0.009) | (0.009) | (0.009) | (0.009) |
| Literate | 0.5334*** | 0.5415*** | 0.5569*** | 0.5785*** | -0.3434*** | -0.3461*** | -0.3328*** | -0.3664*** |
| | (0.005) | (0.005) | (0.005) | (0.005) | (0.008) | (0.008) | (0.008) | (0.008) |
| GDP per capita | | -1.2249*** | | | | 1.1584*** | | |
| | | (0.011) | | | | (0.017) | | |
| Quality of institutions | | | 1.0075*** | | | | -1.8230*** | |
| | | | (0.018) | | | | (0.025) | |
| Conflict | | | | -0.3850*** | | | | 0.8356*** |
| | | | | (0.007) | | | | (0.011) |
| Constant | -2.3921*** | 5.1340*** | -2.1065*** | -2.4067*** | 0.3238 | -7.2477*** | -0.8690*** | -0.5661** |
| | (0.103) | (0.122) | (0.103) | (0.104) | (0.260) | (0.289) | (0.263) | (0.264) |
| Observations | 902,460 | 902,460 | 902,460 | 902,460 | 267,062 | 267,062 | 267,062 | 267,062 |

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Sources: Authors' calculations.

# 4. Sound Policies to Better Leverage Digitalization

**In this section, we explore whether digitalization would deepen structural transformation if some catalysts were in place, including the capacity of the government to make ICT tools accessible for citizens and the quality of institutions that are instrumental for the effective implementation of macroeconomic policies**.
Assuming that catalyst effects would take place in the form of some non-linearity effects, we interact the digitalization variables with each of the catalysts and include the interactive variables in the equation (1). This allows to test whether the effects of digitalization depend on the quality of institutions and the government policies about the promotion of ICT. More precisely, we interact submarine cables with the index of government success in promoting ICT and the quality of institutions as they are all collected at the country level.

**The results are displayed in Table 5. In columns (1) and (2), we have upward occupational mobility as dependent variable and in columns (3) and (4) we have downward mobility as dependent variable**. The results show that the coefficients associated with the interactive variable between submarine cables and quality of institutions are positive and strongly significant at the 1 percent level in column (1), and negative in column (3). The findings imply that the likelihood of upward (downward) occupational mobility is amplified (dampened) in countries with good quality of institutions.

**Quantitatively, moving from the 25th percentile to the 75th percentile of the distribution of index of quality of institutions is associated with an increase in the probability of upward occupational mobility** by 8.8 percentage points, while the probability of downward mobility would reduce by 3.2 percentage points. We also find that the coefficients associated with government success in promoting ICT is positive and significant at the 1 percent level in column (2), and negative in column (4). This result suggests that individuals from countries that have implemented good policies to promote ICT are more (less) likely to experience upward (downward) occupational mobility than individuals from countries where governments failed to promote ICT. An increase in the index of government success in promoting ICT from the 25th percentile to the 75th percentile would boost the likelihood of upward occupational mobility by 5.3 percentage points, while the likelihood of downward mobility would decline by 22 percentage points.

## Table 5: Interactions Between Submarine Cables, Government Success in Promoting ICT and Quality of Institutions

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Upward mobility | | Downward mobility | |
| Submarine cables | 1.1913*** | 0.3725*** | -0.5827*** | -3.1538*** |
| | (0.009) | (0.023) | (0.015) | (0.099) |
| Submarine cable*Government success in ICT | | 0.1581*** | | -0.6508*** |
| | | (0.005) | | (0.025) |
| Government success in ICT | | 0.0518*** | | -0.5185*** |
| | | (0.004) | | (0.023) |
| Submarine*quality of institutions | 0.5888*** | | -0.1007*** | |
| | (0.019) | | (0.035) | |
| Quality of institutions | 0.0815*** | | -0.1061*** | |
| | (0.007) | | (0.013) | |
| Family size | -0.0057*** | -0.0052*** | 0.0093*** | 0.0093*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Female | 0.1322*** | 0.0936*** | -0.3448*** | -0.3201*** |
| | (0.003) | (0.003) | (0.004) | (0.004) |
| Rural area | -0.5877*** | -0.5914*** | 0.7034*** | 0.7018*** |
| | (0.003) | (0.003) | (0.004) | (0.004) |
| Age | 0.0977*** | 0.1010*** | -0.0743*** | -0.0799*** |
| | (0.001) | (0.001) | (0.001) | (0.001) |
| Age square | -0.0014*** | -0.0014*** | 0.0011*** | 0.0012*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Access to electricity | 0.4071*** | 0.4199*** | -0.1741*** | -0.2044*** |
| | (0.004) | (0.004) | (0.005) | (0.006) |
| Access to water | 0.2907*** | 0.2955*** | -0.1810*** | -0.1511*** |
| | (0.003) | (0.003) | (0.004) | (0.005) |
| Married | -0.1108*** | -0.1127*** | 0.0978*** | 0.1169*** |
| | (0.003) | (0.003) | (0.005) | (0.005) |
| Literate | 0.6215*** | 0.5822*** | -0.3118*** | -0.2708*** |
| | (0.003) | (0.003) | (0.004) | (0.004) |
| Constant | -2.5402*** | -2.8159*** | -0.0164 | 1.9269*** |
| | (0.044) | (0.045) | (0.075) | (0.108) |
| Observations | 2,165,571 | 1,949,498 | 767,439 | 718,620 |

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Sources: Authors' calculations.

# 5. Conclusion

**In this paper, we provide evidence that digitalization could boost intergenerational social mobility and promote a high and inclusive growth in Africa**. Digitalization could help boost upward mobility and limit the risks of downward occupational mobility. Using a large sample of 28 million of individuals, we find that being connected to submarine cables is associated with an increase in the likelihood of upward mobility by up to 26.7 percentage points and a reduction of the likelihood of downward occupational mobility by up to 36.7 percentage points. This finding is robust to using mobile phone ownership as an alternative measure of digitalization and to the inclusion of several covariates.

**We also find evidence that policies that promote strong institutions, political and social stability and better access to adequate digital infrastructure are important** to improve occupational mobility in Africa including by favoring the move of farmers' children from the agricultural sector to white-collar jobs. While strong institutions, political and social stability, better access to adequate digital infrastructure, and education are important to increase and accelerate upward mobility, new technologies and digital tools can intensify these positive effects and contribute to creating jobs and enhancing living standards in Africa. Similar results hold for downward mobility.

**The findings of the paper imply that the advent of new technologies and digital tools could lift young Africans** out of the agriculture sector and enhance their living standards. In addition, government policies to enhance the accessibility of ITCs and improve the institutions necessary for the digital sector to strive will be essential to further unlock the potential employment opportunities from digitalization and intergenerational mobility. Paying a special attention to the youth in implementing these policies can boost macroeconomic outcomes by supporting upward mobility and reducing downward mobility.

**A few caveats driven by data availability limitations can be extended to the findings, as these limitations** constraint to the breadth and depth of analyses currently feasible on this topic. First, digitalization is a relatively new, complex, and fast-growing phenomenon not yet fully captured by data. For example, connectivity to submarine cables and mobile phone ownership (the two variables used in the paper) represent partial views of digitalization, the latter being a multidimensional concept. As such, it would be interesting to study how using other digitalization dimensions like access to artificial intelligence (AI) would impact the results compared to those in the paper. However, although digitalization is a new concept, the strong survey methodology on which this paper builds ensures the stability of the results over time and adding a dummy variable for years 2000+ did not change the results. Second, information on the adequate prevalence of digital skills could provide an add-on understanding of how much the population is able to leverage digital connectivity and tools.

**The results of this paper could be extended in future research, including when data become available**. For example, exploring other enabling factors could be interesting including the equity in access to digital tools and jobs as poor and vulnerable populations tend to have low access to digital tools and employment opportunities. Furthermore, within sectoral mobility (for instance from traditional to modern agriculture) is another avenue that could be investigated, as well as the types of digitalization (low tech vs high tech). Using within country data both for digitalization and occupational mobility measures could also allow to further granularity of analysis. To end, while other analyses could be done using an ordered probit approach, this is beyond the scope of this paper which focuses on upward and downward mobility. Future analysis could also investigate lagged effects.

# Annex I. Data Sources

**The data used in this paper are from several sources and the selection of countries is exclusively based on data availability**. Our primary source of data is Ouedraogo and Syrichas (2021), who collected household census data from the Integrated Public Use Microdata Series (IPUMS) international dataset. The study is based on 75 censuses from 27 African countries (see Table 1) conducted between 1970 and 2016, covering more than 5 million individuals. The Integrated Public Use Microdata Series database includes nationally representative samples of country censuses that correspond typically to 10% of the full census of each country.

**Although the samples belong to different years, they are harmonized by the Minnesota Population Center for comparability of variables across countries and over time**. The IPUMS dataset contains various individual level variables, including parents and children's occupations, mobile phone ownership, and several other individual characteristics such as the gender status, family size, access to water and electricity, age, the place of residence (urban or rural), and the literacy and marital status. Based on the parents and children's occupations, upward and downward occupational mobility are defined as follows:

- Upward occupational mobility is binary variable taking the value of 1 if the child born or adopted from agricultural occupied (including the informal sector) parents has taken a blue-collar or white-collar occupation and zero otherwise.

- Downward occupational mobility takes the value of 1 if the child born or adopted from parents working in white-collar or blue-collar professions has an agricultural occupation and zero otherwise.

Table Annex 1 provides a snapshot of the upward and downward intergenerational occupational mobility indices for each country, as well as the census years.

### Table Annex 1: Intergenerational Occupational Mobility for Each Country

| Country | Census years | Number of observations | Upward mobility | Downward mobility |
|---|---|---|---|---|
| Benin | 1979,1992,2002,2010 | 152,114 | 0.24 | 0.19 |
| Botswana | 1981,1991,2001,2010 | 13,535 | 0.46 | 0.23 |
| Burkina Faso | 1996,2006 | 116,429 | 0.02 | 0.46 |
| Cameroon | 1976,1987,2005 | 92,846 | 0.12 | 0.18 |
| Egypt | 1986,1996,2006 | 764,120 | 0.31 | 0.18 |
| Ethiopia | 1984,1994,2007 | 652,852 | 0.03 | 0.28 |
| Ghana | 1984,2000,2010 | 480,737 | 0.24 | 0.23 |
| Guinea | 1983,1996,2014 | 147,508 | 0.16 | 0.12 |
| Kenya | 1989,1999,2009 | 50,596 | 0.21 | 0.36 |
| Lesotho | 1996,2006 | 12,622 | 0.29 | 0.37 |
| Malawi | 1987,1998,2008 | 98,933 | 0.08 | 0.44 |
| Mali | 1987,1998,2009 | 210,014 | 0.05 | 0.29 |
| Mauritius | 1990,2000,2011 | 41,470 | 0.75 | 0.10 |
| Morocco | 1982,1994,2004,2014 | 487,381 | 0.27 | 0.25 |
| Mozambique | 1997,2007 | 183,908 | 0.12 | 0.32 |
| Nigeria | 2006,2007,2008,2009,2010 | 11,583 | 0.16 | 0.22 |
| Rwanda | 2002,2012 | 121,493 | 0.08 | 0.37 |
| Senegal | 1988,2002,2013 | 193,428 | 0.23 | 0.21 |
| Sierra Leone | 2004 | 37,032 | 0.08 | 0.16 |
| South Africa | 1996,2001,2007,2011,2016 | 119,706 | 0.48 | 0.14 |
| South Sudan | 2008 | 42,368 | 0.22 | 0.46 |
| Sudan | 2008 | 198,964 | 0.09 | 0.37 |
| Tanzania | 1988,2002,2012 | 627,889 | 0.05 | 0.32 |
| Togo | 1970,2010 | 2,782 | 0.11 | 0.38 |
| Uganda | 1991,2002,2014 | 153,362 | 0.08 | 0.45 |
| Zambia | 1990,2000,2010 | 131,273 | 0.07 | 0.25 |
| Zimbabwe | 2012 | 19,895 | 0.17 | 0.30 |
| **Average** | | **5,164,840** | **0.19** | **0.28** |

Source: Ouedraogo and Syrichas (2021).

**Regarding our other variables of interest—mobile phone ownership, we define binary variables taking the value** of 1 if the individual owns a mobile phone, and 0 otherwise. Several previous studies have used mobile phone ownership to measure digitalization in Africa (IMF 2020). Some studies have also used the connection to submarine cables to capture digitalization in a country. IMF (2020) and Hjort and Poulsen (2019) document that the arrival of submarine cables in Africa has contributed to accelerate the speed and scale of internet connection in the continent. The data on submarine cables are from IMF (2020). It is a binary variable taking the value of 1 for individuals of a country that is connected to a submarine cable, and 0 otherwise.

**Finally, we extracted GDP per capita data from the IMF's World Economic Outlook,** and the quality of institutions data from the World Bank's Worldwide Governance Indicators dataset. For the latter, we constructed a composite variable based on 3 indicators including rule of law, regulatory quality, and control of corruption. We also use conflict data from the from the Uppsala Conflict Data Program (UCDP) provided by the Department of Peace and Conflict Research, Uppsala University. The conflict variable is a binary variable taking the value of 1 if the country is affected by a conflict and 0 otherwise.

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