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Digitalization for Agricultural Employment and Rural Transformation in the WAEMU

Extended Summary

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CONTEXT AND REPORT OBJECTIVES

This report examines how the expansion of mobile connectivity and mobile phone adoption — including through basic handsets without internet access — transform rural labor markets and the economic strategies of farm households in the WAEMU. The starting point is a well-documented situation: the region faces a predominantly young and rural population, which intensifies pressure on labor markets characterized by high dependence on subsistence agriculture, high informality, and a limited supply of stable paid employment. In this context, agriculture remains an economic and social pillar, contributing on average 25.7% of GDP (2022) and representing 52.2% of total employment and 63.3% of total rural employment in the WAEMU. This weight comes with persistent structural constraints: low productivity, dependence on rainfed agriculture, limited adoption of modern technologies, and increased vulnerability to climate shocks, with potential productivity losses estimated at 30–40%.

The analysis also takes place against a pronounced digital divide. Despite the spread of mobile phones, internet access remains highly unequal, particularly in rural areas. According to the EHCVM 2018–2019 data cited in the report, 89.4% of rural youth live in a household with at least one mobile phone, but only 8.9% have access to the internet. This divide is even stronger for young rural women, 94.2% of whom have no internet access. This differential calls for particular attention to the economic effects of basic mobile telephony and network coverage, independently of mobile internet.

The report analyzes how mobile connectivity and phone adoption influence agricultural labor market integration, farm modernization, and the diversification of agricultural and non-agricultural activities in rural areas across the WAEMU, combining a literature review with descriptive and empirical analyses from the EHCVM 2018–2019 surveys. It complements a companion report (Cariolle & Carroll, 2024) documenting that mobile infrastructure deployment and basic phone adoption reduce the spatial dispersion of food prices, particu-

larly through a price catch-up in connected rural areas.

AGRICULTURAL LABOR MARKETS AND PRODUCTION IN THE WAEMU

Descriptively, the report documents marked segmentation in agricultural labor markets and the still largely traditional character of production systems. Daily agricultural wages show large gaps between men and women across the three activities studied — land preparation, weeding, and harvest. Male workers earn on average between 4,000 and 6,000 XOF per day, two to three times more than women (approximately 2,000 XOF) (Figure 1, top row). Part of this gap reflects the partial exclusion of women from wage labor in certain areas: between 30% and 40% of surveyed enumeration areas record zero female wages, depending on the activity, with a particularly high incidence in land preparation (Figure 1, bottom row).

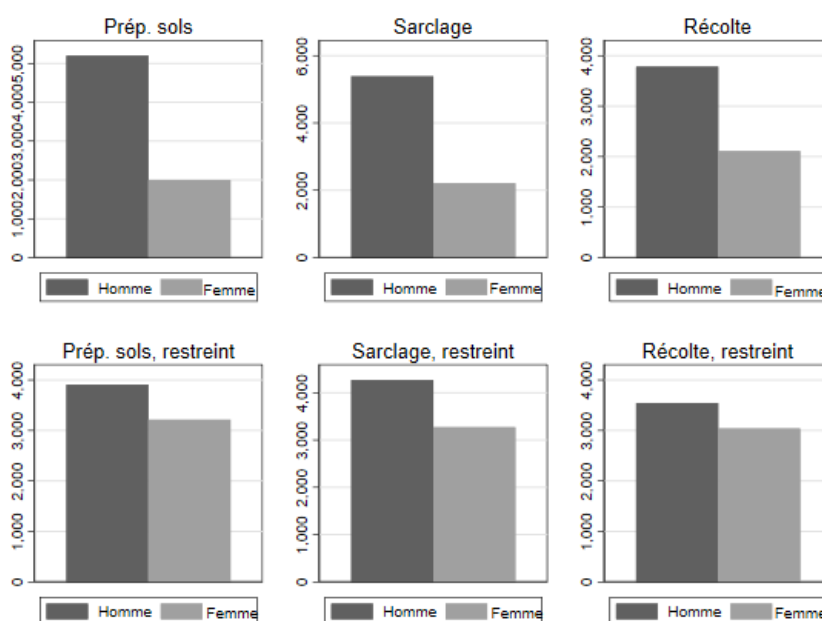


Figure 1. Average daily agricultural wages by gender and activity (XOF)

Note: Top row: full sample. Bottom row: wage-earners sample (wage > 0). Land preparation, weeding, and harvest, by gender.
 Source: Authors’ calculations, EHCVM 2018–2019.

On the production factor side, agriculture remains predominantly family-based. Family labor is mobilized on 95% of cultivated surfaces across all activities, and mechanization remains limited, with manual and animal-drawn ploughing predominating while motorized ploughing remains marginal, reflecting investment constraints and limited access to equipment. Input practices illustrate the same incomplete transition: traditional inputs remain widely used while certain modern inputs are less common, partly for economic reasons.

By reducing information and coordination frictions — searching for opportunities, matching workers and employers, comparing wages, negotiating, and organizing travel and recruitment — mobile connectivity smooths the functioning of rural labor markets, whether agricultural or non-agricultural. It should first promote better spatial integration of agricultural labor markets by bringing wage conditions closer across areas and limiting the disparities arising from isolation, which translates into wage convergence. At the same time, this reduction in search and transaction costs makes hiring simpler and less risky for farms, which can increase resort to external hired labor outside the household, particularly during seasonal peaks. By facilitating access to external workers, equipment, and information on techniques and inputs, connectivity can then support the modernization of the production model through greater mechanization and more frequent

adoption of modern inputs. Finally, these combined changes — labor market integration, hiring of workers, and productivity gains — may free up family labor time and make engagement in non-agricultural activities more attractive; family labor then partly reallocates away from the farm, leading to income diversification and, potentially, reduced economic vulnerability.

MOBILE CONNECTIVITY AND RURAL TRANSFORMATION: EMPIRICAL RESULTS

Building on this descriptive evidence and framework, the report establishes a series of converging empirical results describing a chain of rural transformation associated with mobile connectivity.

First, connectivity is associated with greater integration of agricultural labor markets, measured by a reduction in wage gap between areas. When two enumeration areas are both within 2 km of a 2G+ tower, daily wage differentials fall by 16.7% (land preparation), 14.1% (weeding), and 13% (harvest) for men. The reduction is also observed for women, at 11.2%, 10.7%, and 9.3% respectively. This convergence signals a reduction in market imperfections, consistent with better information circulation and lower transaction and intermediation costs (Figure 2).

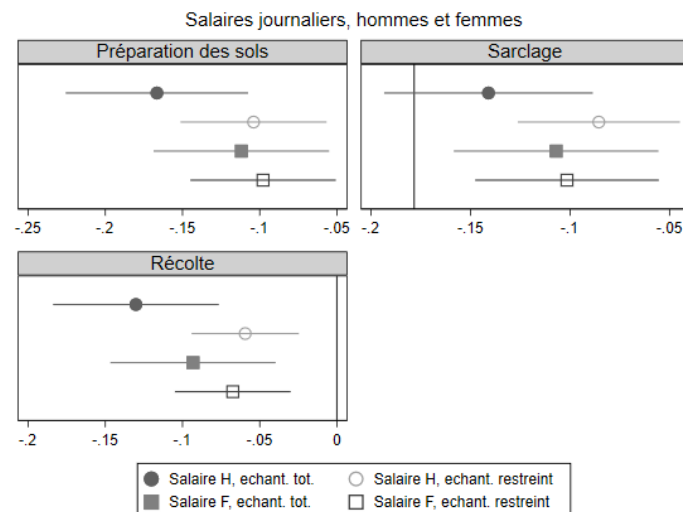


Figure 2. Effect of connectivity on agricultural wage gap, by gender and activity — Dyadic estimations.

Note: Estimated effect of connectivity on wage dispersion (log) for male and female wages in each agricultural activity, full and wage-earners samples. 95% confidence intervals. Source: Authors' calculations, EHCVM 2018–2019.

Second, beyond convergence across areas, connectivity has a particularly pronounced effect on women's remuneration. The report shows a large increase in female daily wages across all activities, including land preparation, a historically male-dominated task. The estimated effects of connectivity reach +236% for land preparation, +263% for weeding (significant at the 10% level), and +168% for harvest, while no significant increase is observed for men. The favored interpretation is one of greater commodification or monetization of female agricultural labor in connected zones, with wage increases in zones where women were already paid — specifically for weeding, where wages also rise for men. The report also notes the seasonality of effects across activities and survey periods, pointing to the central role of the agricultural calendar in wage formation and labor force allocation decisions (Figures 3 and 4).

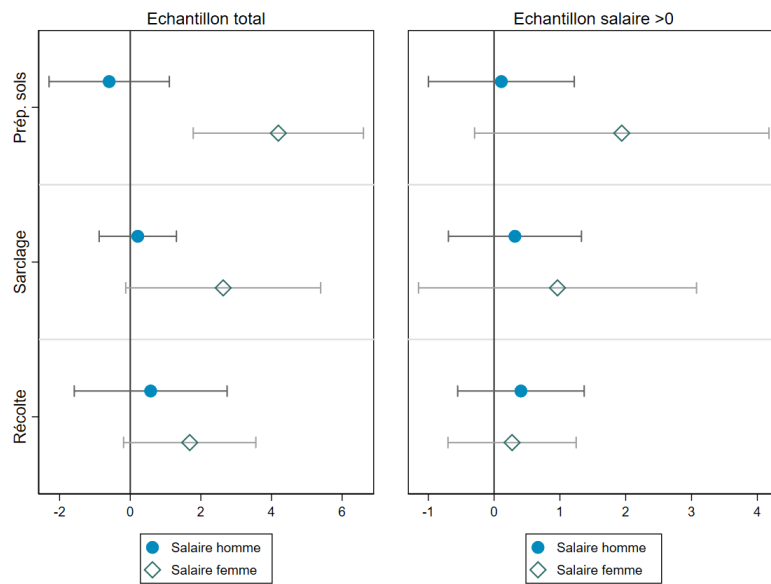


Figure 3. Effect of connectivity on agricultural wage levels, by gender — IV estimations.

Note: Estimated effect of both enumeration areas being within 2 km of a 2G+ tower on daily wage levels (log): full sample (left panel) and wage-earners sample (right panel). Filled circle = male wage; open diamond = female wage. Mobile network coverage is instrumented by the historical daily population-weighted density of lightning strikes. 95% confidence intervals. Source: Authors' calculations, EHCVM 2018–2019.

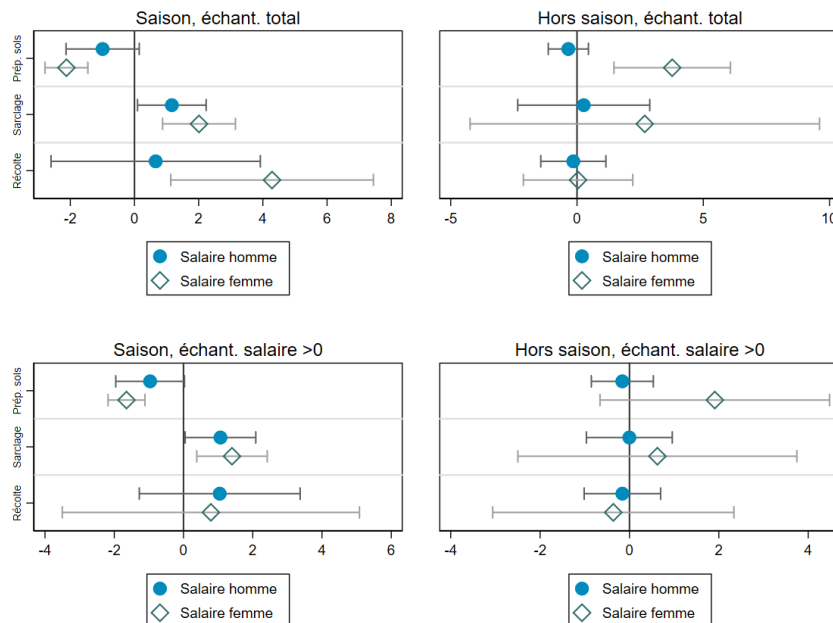


Figure 4. Seasonal effects of connectivity on agricultural wage levels, by gender — IV estimations.

Note: Estimated effect of connectivity on daily wage levels (log), by season (in-season vs. off-season) and sample (full vs. wage-earners). Mobile network coverage is instrumented by the historical daily population-weighted density of lightning strikes. 95% confidence intervals. Source: Authors' calculations, EHCVM 2018–2019.

Third, the report identifies a mechanism that may explain these dynamics: a progressive substitution of family labor by external hired labor on connected farms. Estimates indicate that the adoption of an addi-

tional mobile phone within a household reduces family labor use in weeding by 8.4 percentage points and in harvest by 10.7 percentage points, while significantly increasing resort to external hired labor across all activities (+12.1 percentage points overall), with increases of +7.6 points for land preparation, +14.8 points for weeding, and +10.5 points for harvest. This reorganization of agricultural work is consistent with easier access to labor markets through better information, coordination, and recruitment, and contributes to explaining the reduction in wage segmentation documented above (Figure 5).

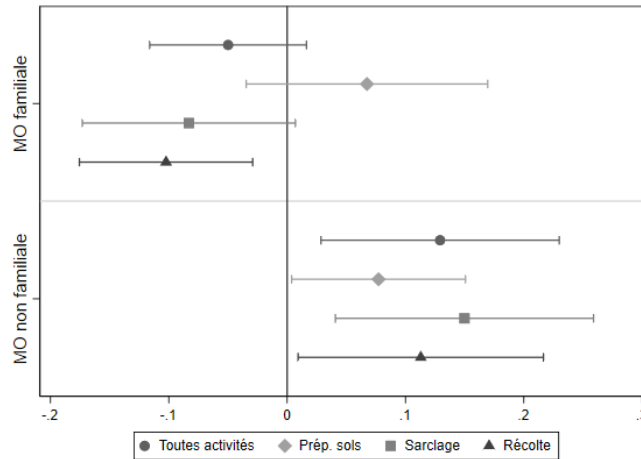


Figure 5. Effect of mobile phone adoption on family and non-family labor use, by activity — IV estimations.

Note: Marginal effect of acquiring one additional mobile phone in a connected area on the share of agricultural surfaces using family labor (top) and non-family hired labor (bottom), by activity and overall. Mobile network coverage is instrumented by the historical daily population-weighted density of lightning strikes. 95% confidence intervals. Source: Authors’ calculations, EHCVM 2018–2019.

Fourth, connectivity is associated with a modernization of agricultural practices, through investment, mechanization, and input changes. Acquiring a mobile phone in a connected area increases agricultural equipment spending per adult equivalent by approximately 45%. These investments are associated with a 15.5-point fall in the share of unploughed surfaces, and increases in shares using manual (+6.4 points), animal-drawn (+7.5 points), and motorized (+1.5 points) ploughing. Connected households also substitute some traditional inputs for more modern ones: a fall in household waste treatments (−3.8%) and animal waste (−8%), offset by an increase in pesticides (+13.6%) and urea (+10.8%). The report concludes that greater resort to agricultural labor markets in connected zones is accompanied by a modernization of the production model (Figure 6).

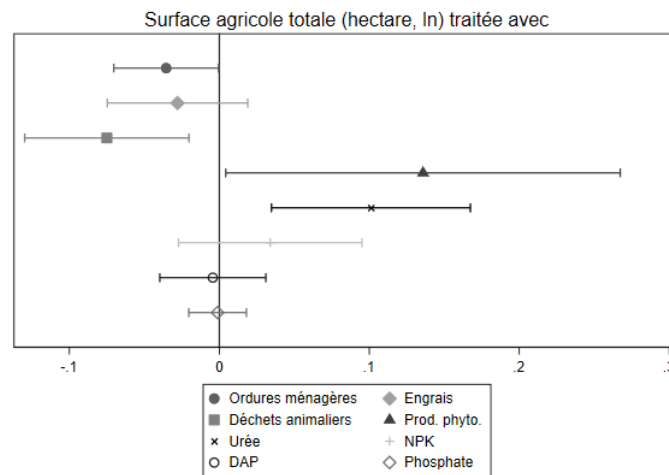


Figure 6. Effect of mobile phone adoption on input use by cultivated surface — IV estimations.

Note: Marginal effect of acquiring one additional mobile phone in a connected area on the share of cultivated surface treated with each input type. Mobile network coverage is instrumented by the historical daily population-weighted density of lightning strikes. 95% confidence intervals. Source: Authors’ calculations, EHCVM 2018–2019.

Fifth, connectivity modifies production choices in a nuanced way: it favors specialization at the farm level while maintaining diversification strategies at the plot level. Acquiring a mobile phone in a connected area reduces by approximately 0.10 (–5%) the number of main crops cultivated by the household, suggesting concentration on a more marketable crop portfolio. At the same time, mobile phone access appears to promote intercropping by increasing by approximately 0.1 the average number of main and secondary crops per plot, which can be interpreted as a risk–income optimization strategy reconciling market orientation and resilience (Figure 7).

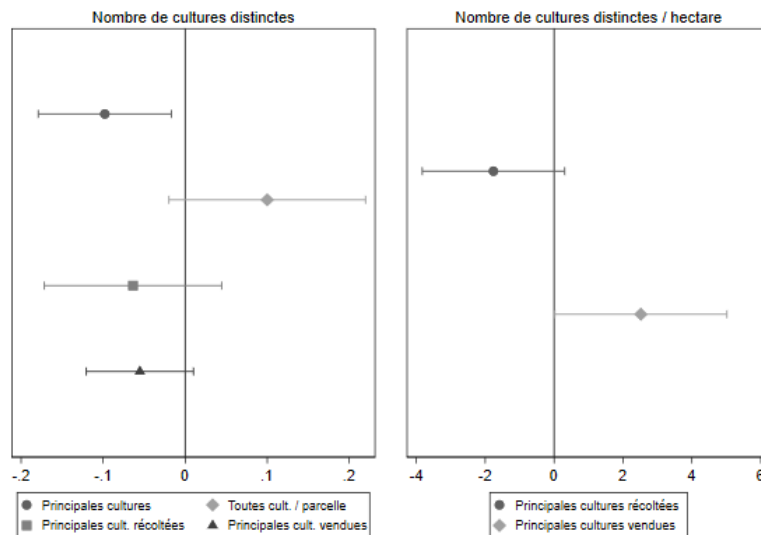


Figure 7. Effect of mobile phone adoption on crop portfolio choices — IV estimations.

Note: Marginal effect of acquiring one additional mobile phone in a connected area on the number of distinct crops cultivated (left panel) and per hectare (right panel). Mobile network coverage is instrumented by the historical daily population-weighted density of lightning strikes. 95% confidence intervals. Source: Authors’ calculations, EHCVM 2018–2019.

Sixth, results show that connectivity strengthens access to both agricultural and non-agricultural employ-

ment, with a more pronounced reallocation toward non-agricultural activities in rural areas. In the seven days before the survey, acquiring a mobile phone in a connected area increases the share of household members engaged in agricultural activities (+2.5 percentage points) and non-agricultural activities (+3.6 points). In rural areas, the effect is substantially stronger on non-agricultural activities (+18.1 points) than on agricultural activities (+11.8 points), suggesting that connectivity helps relieve underemployment constraints and facilitates activity diversification (Figure 8).

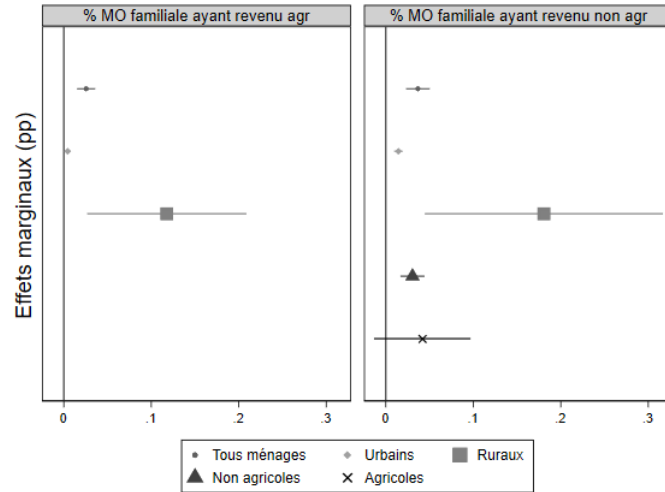


Figure 8. Effect of mobile phone adoption on agricultural and non-agricultural employment, by household type — IV estimations.

Note: Marginal effect of acquiring one additional mobile phone in a connected area on the share of household labor force engaged in agricultural (left panel) and non-agricultural (right panel) activities, by household type: all households, urban, rural, non-agricultural, agricultural. Mobile network coverage is instrumented by the historical daily population-weighted density of lightning strikes. Source: Authors’ calculations, EHCVM 2018–2019.

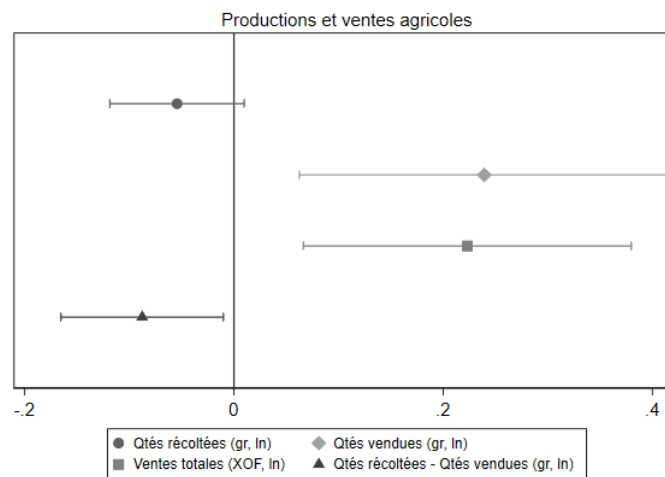


Figure 9. Effect of mobile phone adoption on agricultural production and sales — IV estimations.

Note: Marginal effect of acquiring one additional mobile phone in a connected area on harvested quantities, quantities sold, total sales revenues, and the gap between harvested and sold quantities (log). Mobile network coverage is instrumented by the historical daily population-weighted density of lightning strikes. 95% confidence intervals. Source: Authors’ calculations, EHCVM 2018–2019.

Finally, the report documents general equilibrium effects on income sources and activity structure. Mobile connectivity stimulates non-agricultural business creation (+0.11 enterprise per household, and +0.22 in ru-

ral areas and for agricultural households) and particularly promotes commercial activities in unprocessed goods sales, whose margins increase by 57% for households acquiring a phone in a connected area, and up to 168% for agricultural households. Conversely, the report identifies a negative effect on total agricultural sales, but offers a structural reading of this result: the fall in sales is accompanied by a decline in harvested quantities for main crops, yet is distinct from a deterioration in commercial performance. Connected households sell higher quantities, obtain higher average sales amounts, and reduce the gap between harvested and sold quantities, suggesting a reduced risk of unsold surplus. This configuration leads to the conclusion that connected farm households *produce less but sell better*, moving toward a more modern model calibrated to market demand (Figure 9).

DISCUSSION AND POLICY IMPLICATIONS

The analysis in this report complements that of the companion report (Cariolle & Carroll, 2024), which showed that mobile infrastructure deployment and basic phone adoption contribute to reducing the spatial dispersion of food prices, notably through a price catch-up in connected rural areas. The present report illuminates the upstream mechanisms behind this dynamic by identifying the role of connectivity in labor market integration and the reorganization of farm households' productive strategies. By improving the functioning of agricultural labor markets and access to non-agricultural labor markets, mobile telephony acts indirectly on food market integration by increasing food consumption in rural areas, and also by stimulating connected households' engagement in non-agricultural commercial activities, particularly unprocessed goods trade. The development of these activities can in turn improve the functioning of agricultural markets by turning connected households into agents that facilitate local and regional trade flows.

Taken together, the results highlight general equilibrium effects: the extension of the mobile network simultaneously supports economic diversification away from agriculture, spatial integration of labor and food markets, and a gradual upgrading of the agricultural production model. These gains may, however, diffuse unevenly and reinforce the vulnerability of poorly connected households, which remain constrained in their access to employment and are more exposed to food price increases. This points to policy priorities in four areas: improving the financial accessibility of mobile services (acting on tariffs and sector taxation); designing solutions adapted to low literacy levels (voice and USSD interfaces, local languages); linking digital investment to complementary infrastructure (electricity, roads) and to regional coordination (interoperability, cross-border markets). Finally, policy management would benefit from strengthened monitoring and evaluation, combining surveys and innovative data sources to better target interventions and protect vulnerable households.

REFERENCES

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