

Seasonal Adjustments of Labor and Household Welfare

High-Frequency Panel Data Evidence from Six Sub-Saharan Africa Countries

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The Pulse of Progress: Harnessing High-Frequency Survey Data for
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Introduction

Motivation & Contribution

- Seasonality is a defining feature of rural livelihoods in Sub-Saharan Africa, tightly linked to agricultural cycles.
- Empirical assessments of its impact on labor markets remain scarce despite its acknowledged importance. (de Janvry et al., 2022; Dercon and Krishnan, 2000; McCullough, 2017; Skoufias, 1993, 1996; Wodon and Beegle, 2006)
- Climate change is expected to change precipitation patterns and as such is likely to impact the labor market dynamics (Jesoe et al., 2018) in these economies, where agriculture remains rain dependent
- **This paper:**
 - Provides up-to-date characterization of seasonality on a broader geographical scope
 - Burkina Faso and Nigeria show pronounced declines (9.7 and 8.4 percentage points, respectively), while Malawi sees a 5.4 percent reduction in share of CWP in rural areas.

- Previous work characterizing seasonality has relied on large face-to-face surveys conducted over a year with specific modules on time use (de Janvry et al., 2022; Wodon and Beegle, 2006)
- The LSMS High-Frequency Phone Surveys (HFPS), collected over four years at relatively regular intervals, provide a unique opportunity for a basic yet much-needed assessment of seasonality in labor
- **This paper:**
 - Leverages *longitudinal* data from HFPS, conducted at a greater *temporal resolution* than traditional living conditions surveys over *several years*

Motivation & Contribution

- Examination of the link between seasonal reduction in likelihood of working and welfare outcomes.
- Literature focused on the challenge of inter-temporal consumption smoothing faced by households and the role of financial and storage technologies in mitigating the effects of seasonality (Dillon et al., 2019; Stephens and Barrett, 2011)
- **This paper:**
 - Examines the association between being less likely to work in the off-agricultural season and baseline poverty and food-security
 - Households less likely to work in the off-ag season are more likely to fall into the lower consumption quintiles in countries where share of working population decreases the most during the off-agricultural season.
 - In Malawi and Nigeria, the probability of being food insecure increases for households less likely to work in the off-agriculture season, while in Burkina Faso, it decreases.

Data

- Nationally representative HFPS in six countries (Burkina Faso, Ethiopia, Malawi, Nigeria, Tanzania, Uganda) collected from 2020-2024
- Analysis relies on harmonized data set of panel of households
 - Data on whether the respondent has worked and sector of employment, characteristics of respondent (head, gender, age), date of interview.
 - Share of currently working overall and in own farm, family enterprise, for wage.
 - Food security (FIES)
- Baseline covariates from face-to-face surveys which were used to draw HFPS sample

Sample Summary Statistics

| | <i>All rounds - Urban and Rural</i> | | | | | | |
|-----------------------------------|-------------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | All | BFA | ETH | MWI | NGA | TZA | UGA |
| <i>Labor variables (shares)</i> | | | | | | | |
| Currently working | 0.796 (0.403) | 0.823 (0.381) | 0.807 (0.395) | 0.815 (0.388) | 0.796 (0.403) | 0.723 (0.447) | 0.802 (0.398) |
| Own farm work | 0.412 (0.492) | 0.221 (0.415) | 0.556 (0.497) | 0.390 (0.488) | 0.335 (0.472) | 0.365 (0.482) | 0.488 (0.500) |
| Wage work | 0.145 (0.352) | 0.083 (0.276) | 0.191 (0.393) | 0.224 (0.417) | 0.123 (0.328) | 0.133 (0.340) | 0.097 (0.297) |
| Non-ag self-work | 0.382 (0.486) | 0.201 (0.401) | 0.614 (0.487) | 0.200 (0.400) | 0.334 (0.472) | 0.224 (0.417) | 0.210 (0.408) |
| <i>Respondent characteristics</i> | | | | | | | |
| Resp: Head | 0.763 (0.425) | 0.887 (0.317) | 0.781 (0.414) | 0.596 (0.491) | 0.735 (0.442) | 0.891 (0.312) | 0.742 (0.438) |
| Resp: Female | 0.282 (0.450) | 0.176 (0.381) | 0.264 (0.441) | 0.361 (0.480) | 0.288 (0.453) | 0.295 (0.456) | 0.308 (0.462) |
| Resp: Age | 43 (15) | 47 (14) | 39 (14) | 41 (13) | 45 (15) | 47 (14) | 47 (15) |
| <i>Sample</i> | | | | | | | |
| Share of urban HHs | 0.308 | 0.348 | 0.306 | 0.194 | 0.313 | 0.325 | 0.324 |
| Unique HHs | 17,645 | 2,936 | 4,335 | 1,729 | 3,267 | 2,717 | 2,661 |
| Rounds | 93 | 19 | 15 | 17 | 18 | 9 | 15 |
| Observations | 174,525 | 32,243 | 38,711 | 25,098 | 37,780 | 16,997 | 23,696 |

Notes: Weighted mean and (standard deviation) using all rounds available for each country.

Share of CWP over the years



Figure: Weighted share of overall CWP over the years.

▶ BFA ▶ ETH ▶ MWI ▶ NGA ▶ TZA ▶ UGA

Share of CWP by area of residence over the years

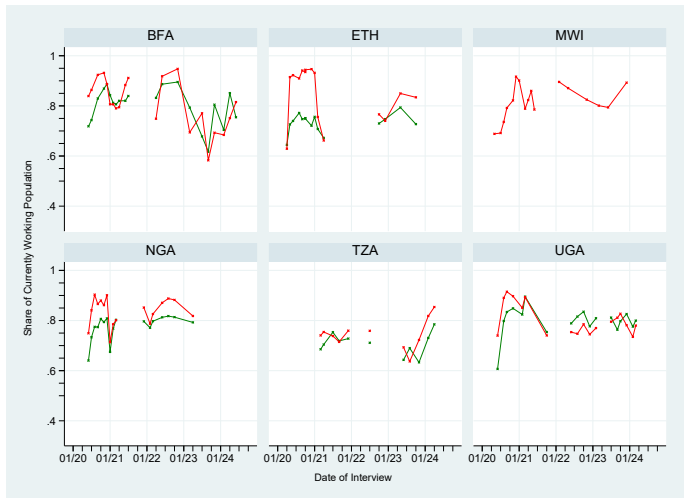


Figure: Weighted share of CWP in rural (red) and urban (green) area

CWP by over the years by gender over the years

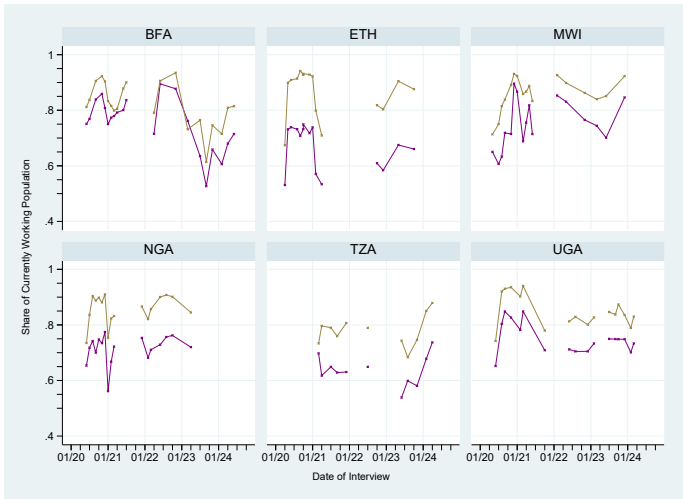


Figure: Weighted share of CWP for male (brown) and female (purple)

▶ TZA

Crop calendars : agricultural season

- Source: FAO global information and early warning system on food and agriculture



CWP by sector over a calendar year

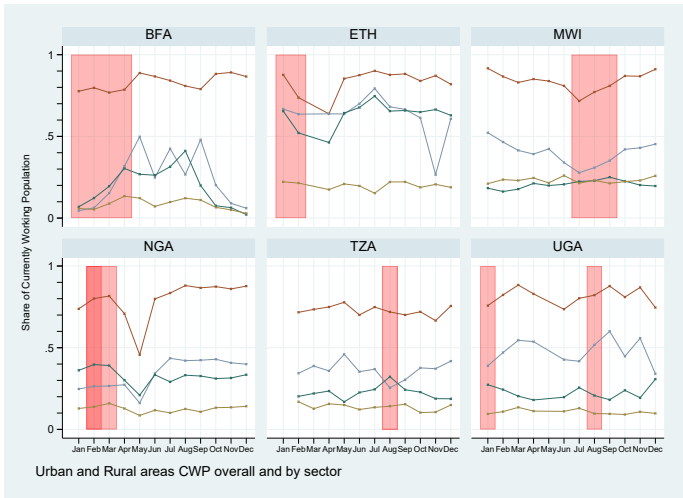


Figure: Weighted share of CWP overall (red), own farm (blue), enterprise (green) wage (brown)

▶ Table #hhs per months

▶ BFA

▶ ETH

▶ MWI

▶ NGA

▶ TZA

▶ UGA

Results

A Panel Linear Probability Model with Household Fixed Effects

$$E_{it} = \beta_0 + \beta_1 S_{it} + X_{it} + \lambda_i + \epsilon_{it} \quad (1)$$

- E_{it} is employment status of individual interviewed in household i at time t
- S is a dummy for whether the month of interview is an off-ag season month (no ag activities for the main crops according to FAO calendar). S can vary by regions in the cases of Nigeria and Uganda
- λ_i is the household fixed effects
- Controls include age, age squared and year or quarter dummies, gender
- Estimation is done by area of residence for more insights

Overall Share of Currently Working Population - Rural Areas

| | <i>Dependent variable:</i> | | | | | | |
|----------------|------------------------------|----------------------|---------------------|----------------------|----------------------|-------------------|------------------|
| | Overall share of CWP - Rural | | | | | | |
| | All | BFA | ETH | MWI | NGA | TZA | UGA |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Off-ag season | -0.029*** (0.006) | -0.097*** (0.014) | 0.229*** (0.067) | -0.054*** (0.014) | -0.084*** (0.016) | -0.009 (0.013) | 0.007 (0.013) |
| Mean dep var | 0.818 | 0.825 | 0.840 | 0.829 | 0.816 | 0.738 | 0.816 |
| HHs | 8,903 | 1,109 | 1,493 | 1,078 | 1,950 | 1,628 | 1,645 |
| Obs | 84,901 | 10,859 | 11,178 | 15,684 | 22,619 | 10,554 | 14,007 |
| R ² | 0.240 | 0.229 | 0.317 | 0.181 | 0.227 | 0.229 | 0.254 |

Notes: Weighted household fixed effect panel regressions. Off-ag season indicates that the interview took place in the off-agricultural season. Dummies for quarter of interviews are included for the pooled regression. For each of the country regressions, time dummies are adjusted from quarter to year when the off-ag season falls entirely into one quarter which would remove the effect that the seasonality variable is intended to pick up. Standard errors are clustered at the household level. Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Overall Share of Currently Working Population - Urban Areas

| | <i>Dependent variable:</i> | | | | | | |
|----------------|------------------------------|------------------|------------------|---------------------|---------------------|-------------------|------------------|
| | Overall share of CWP - Urban | | | | | | |
| | All | BFA | ETH | MWI | NGA | TZA | UGA |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Off-ag season | 0.005 (0.008) | 0.002 (0.010) | 0.098 (0.053) | -0.061** (0.022) | -0.056** (0.021) | -0.007 (0.018) | 0.012 (0.020) |
| Mean dep var | 0.749 | 0.816 | 0.733 | 0.759 | 0.751 | 0.706 | 0.792 |
| HHs | 7,917 | 1,767 | 2,750 | 628 | 1,240 | 976 | 556 |
| Obs | 83,810 | 21,195 | 27,437 | 9,253 | 15,080 | 6,321 | 4,524 |
| R ² | 0.376 | 0.351 | 0.474 | 0.231 | 0.356 | 0.275 | 0.335 |

Notes: Weighted household fixed effect panel regressions. Off-ag season indicates that the interview took place in the off-agricultural season. Dummies for quarter of interviews are included for the pooled regression. For each of the country regressions, time dummies are adjusted from quarter to year when the off-ag season falls entirely into one quarter which would remove the effect that the seasonality variable is intended to pick up. Standard errors are clustered at the household level. Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Results Summary : Seasonality of CWP

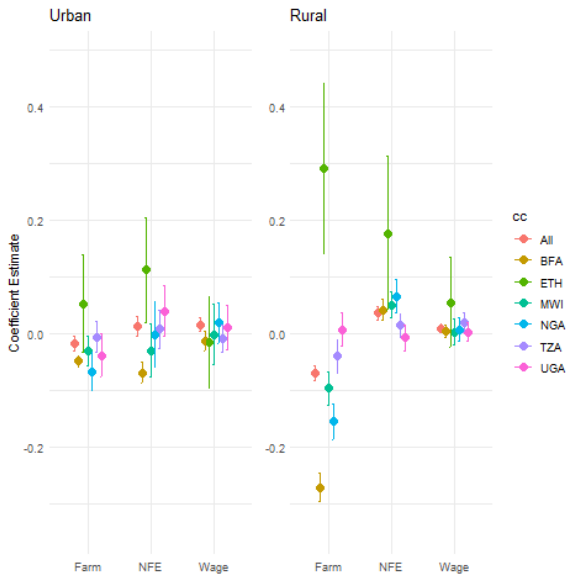
Rural Areas: Significant seasonality of share of CWP:

- **Pooled:** 3 percentage points decrease in CWP.
- **Burkina Faso:** Largest decline (-9.7%), strong dependence on agriculture.
- **Malawi (-5.4%) & Nigeria (-8.4%):** Significant reductions tied to seasonality.
- **Ethiopia:** Outlier with +22.9%, likely due to misclassified seasons.
- **Tanzania & Uganda:** No significant seasonality.

Urban Areas: Less sensibility to agricultural cycles:

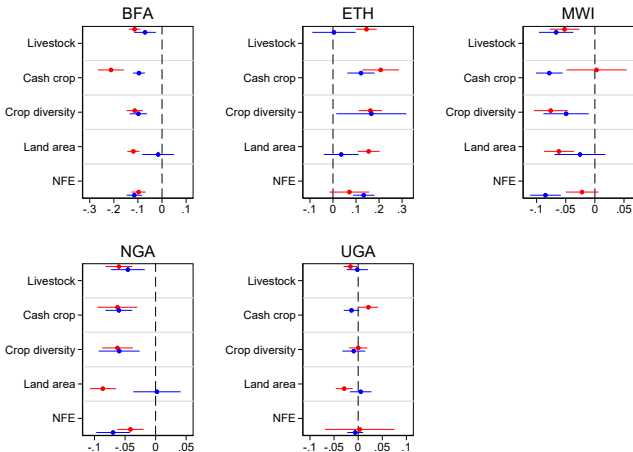
- **Pooled:** Insignificant effect.
- **Malawi (-6.1%) & Nigeria (-5.6%):** Significant declines, rural-urban linkages.
- **Ethiopia:** Increase (+8.5%), likely biased by seasonality markers.
- **Tanzania & Uganda:** Insignificant association.

Adjustment across sectors



Correlates of Labor smoothing in rural areas

- CWP difference in the off-agriculture season by participation in baseline livelihood activities. Blue indicates non-participation. Red indicates participation. The estimation is done for rural areas households.



Seasonality and gender disparities in rural areas

$$E_{it} = \beta_0 + \beta_1 S_{it} + \beta_2 Female + \beta_3 S_{it} * Female + X_{it} + \lambda_i + \epsilon_{it} \quad (2)$$

| | Dependent variable: | | | | | | |
|------------------------|------------------------------|----------------------|----------------------|----------------------|----------------------|-------------------|-------------------|
| | Overall share of CWP - Rural | | | | | | |
| | All | BFA | ETH | MWI | NGA | TZA | UGA |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Off-ag season | -0.052*** (0.005) | -0.106*** (0.012) | 0.205*** (0.043) | -0.043*** (0.013) | -0.106*** (0.011) | -0.007 (0.010) | 0.006 (0.011) |
| Female | -0.065*** (0.010) | -0.033 (0.040) | -0.150*** (0.035) | -0.091*** (0.020) | -0.150*** (0.026) | -0.013 (0.038) | 0.011 (0.020) |
| Off-ag season x female | -0.003 (0.008) | -0.003 (0.028) | -0.068* (0.032) | -0.050* (0.020) | 0.004 (0.020) | 0.003 (0.022) | -0.024 (0.013) |
| Mean dep var | 0.818 | 0.818 | 0.818 | 0.818 | 0.818 | 0.818 | 0.818 |
| HHs | 8,903 | 1,109 | 1,493 | 1,078 | 1,950 | 1,628 | 1,645 |
| Obs | 84,901 | 10,859 | 11,178 | 15,684 | 22,619 | 10,554 | 14,007 |
| R ² | 0.213 | 0.259 | 0.289 | 0.175 | 0.221 | 0.195 | 0.241 |

Notes: Weighted household fixed effect panel regressions. Off-ag season indicates that the interview took place in the off-agricultural season. Dummies for quarter of interviews are included for the pooled regression. For each of the country regressions, time dummies are adjusted from quarter to year when the off-ag season falls entirely into one quarter which would remove the effect that the seasonality variable is intended to pick up. Standard errors are clustered at the household level. Significance levels: *p < 0.1; **p < 0.05; ***p < 0.01

Sectoral Adjustments to Seasonality

● Urban Areas:

- **Wage Work & NFE:** Minimal seasonal differences.
- **Own Farm Work:** Slight decrease during off-ag season, reflecting peri-urban farming seasonality.
- **Key Insight:** Urban labor markets provide limited buffer against rural seasonal shifts.

● Rural Areas:

- **Own Farm Work:** Significant decline.
- **NFE:** Increases in non-agricultural self-employment.
- **Wage Work:** Largely unaffected, indicating limited rural wage opportunities.
- **Labor smoothing characteristics:** Owning an NFE, owning livestock (MWI), cash crop (MWI,UGA), crop diversity, larger land area

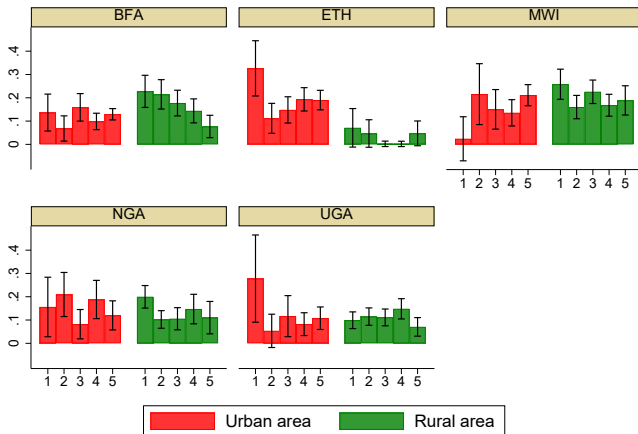
Gender Disparities

- Women are less likely to work overall and face exacerbated declines during off-ag season, particularly in Malawi.

Welfare implications for households with reduced likelihood of working in the off-ag season

- Reduced work during off-ag season likely impacts welfare through reduced household income, but direct income variables unavailable, so analysis examines correlation with welfare measures
- **Empirical Strategy:**
 - Focus on households with at least two rounds in both off-ag and non-off-ag seasons.
 - Define “underemployment” as working for less than half the off-ag season rounds.
 - Examine the correlation between “underemployment” status and baseline consumption aggregates and food security.

Not Working Population during off-agriculture season over baseline consumption Quintile



Graphs by Country Code

Not Working Population during off-agriculture season and food insecurity

| | BFA | ETH | MWI | NGA | TZA | UGA |
|----------------------------------|--------------------|-------------------|-------------------|--------------------|-------------------|-------------------|
| Moderate Food Insecurity Index | | | | | | |
| Underemployment in off-ag season | -0.044* (0.021) | -0.068 (0.069) | 0.020 (0.024) | 0.071** (0.027) | 0.076* (0.035) | 0.021 (0.023) |
| HHs | 769 | 271 | 1,093 | 855 | 840 | 1,259 |
| Obs | 8,140 | 1,509 | 11,842 | 2,788 | 2,160 | 11,069 |
| Severe Food Insecurity Index | | | | | | |
| Underemployment in off-ag season | 0.016 (0.010) | -0.029 (0.021) | -0.015 (0.013) | 0.087** (0.027) | 0.060* (0.023) | 0.019* (0.009) |
| HHs | 769 | 271 | 1,093 | 855 | 840 | 1,259 |
| Obs | 8,140 | 1,509 | 11,842 | 2,788 | 2,160 | 11,069 |

Notes: Random effect panel regressions. Underemployment in off-ag season indicates households with at least two interviews in the off-agricultural season and employed less than 50% of the time. Age, age squared of the respondent, whether the respondent is the head, and round fixed effects are used. Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Concluding Remarks

● Key Insights

- Significant seasonal reduction of likelihood to work in rural areas in the off-agricultural season, with urban areas less affected.
- Gender disparities are evident, worsening during the off-ag season in some contexts.
- Non-farm Enterprises activities are the most labor smoothing activities.

● Methodological Contributions

- Demonstrates HFPS's potential to capture seasonal labor dynamics using agricultural calendars but current measure of seasonality has limitations.


● Policy Implications

- Correlations of likelihood to work in off-ag season and welfare outcomes suggest that its suitability as a targeting tool is context-specific.

Thank You!

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Appendix

Pooling rounds of HFPS to get a calendar year picture

- Table: Number of households with labor module by months by country

| | BFA | ETH | MWI | NGA | TZA | UGA |
|------|------|------|------|------|------|------|
| Jan | 2442 | 2061 | 1549 | 2574 | 0 | 872 |
| Feb | 2416 | 2176 | 2488 | 3600 | 489 | 2786 |
| Mar | 3469 | 0 | 1831 | 3075 | 1999 | 1558 |
| Apr | 3864 | 4126 | 1547 | 4629 | 1871 | 309 |
| May | 803 | 6432 | 3838 | 975 | 548 | 0 |
| Jun | 5042 | 3165 | 3726 | 4425 | 1265 | 3112 |
| Jul | 4283 | 673 | 1483 | 2274 | 4301 | 1703 |
| Aug | 427 | 3401 | 1432 | 3879 | 554 | 3729 |
| Sept | 2492 | 2900 | 1475 | 1774 | 2702 | 2669 |
| Oct | 1110 | 7579 | 291 | 4223 | 536 | 3293 |
| Nov | 3749 | 648 | 2536 | 2129 | 556 | 1376 |
| Dec | 2144 | 4747 | 2397 | 4219 | 2168 | 765 |

▶ Back: CWP overall and by sectors over calendar year

Share of CWP over the years - BFA

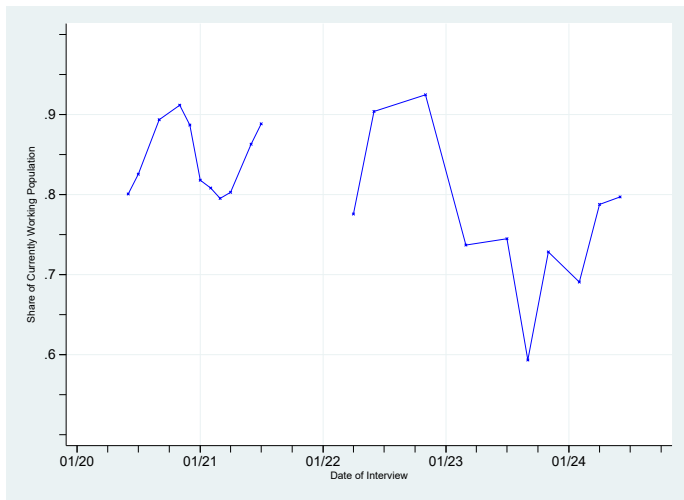


Figure: Weighted share of overall CWP over the years - BFA

▶ CWP by country

Share of CWP over the years - MWI

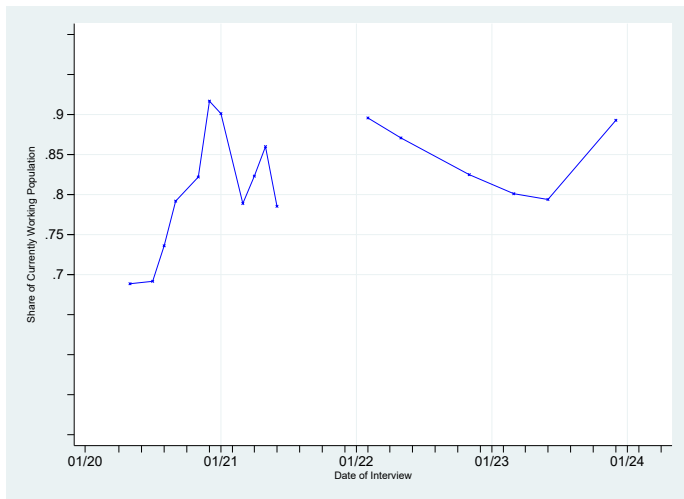


Figure: Weighted share of overall CWP over the years - MWI

▶ CWP by country

Share of CWP over the years - NGA

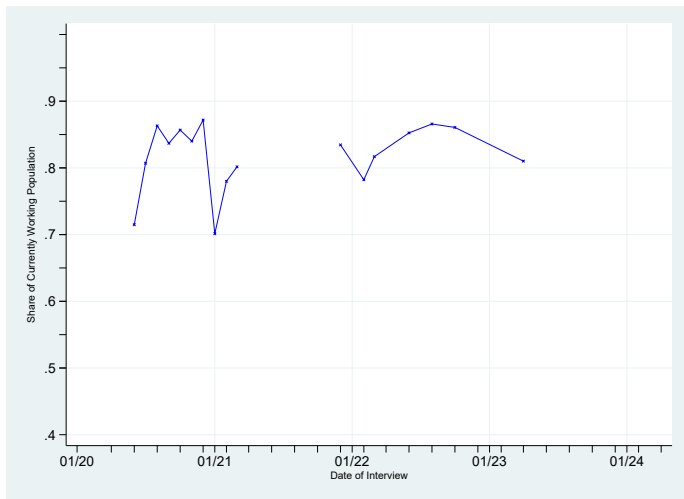


Figure: Weighted share of overall CWP over the years - NGA

► CWP by country

Share of CWP over the years - UGA

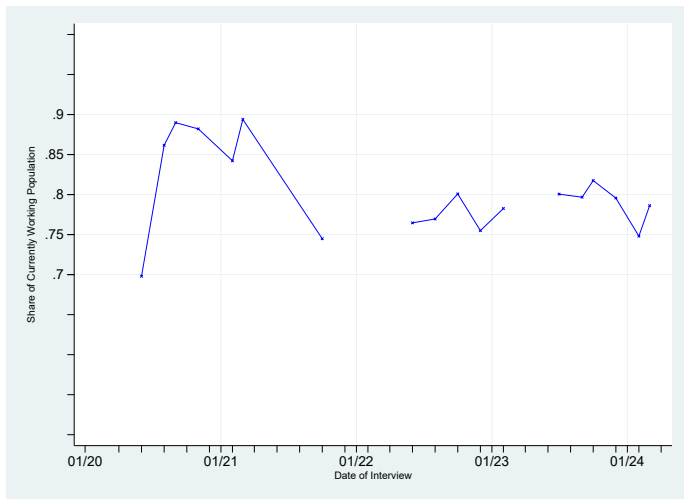


Figure: Weighted share of overall CWP over the years - UGA

► CWP by country

Share of CWP year round - BFA

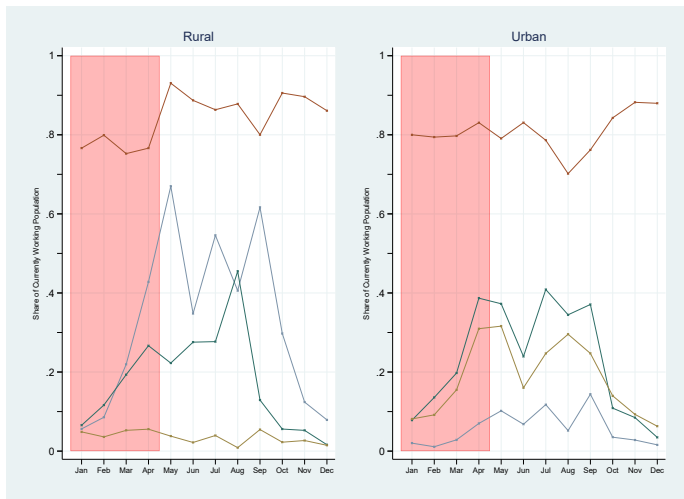


Figure: Weighted share of CWP overall (red), own farm (blue), enterprise (green) wage (brown)

► CWP season by country

Share of CWP year round - ETH

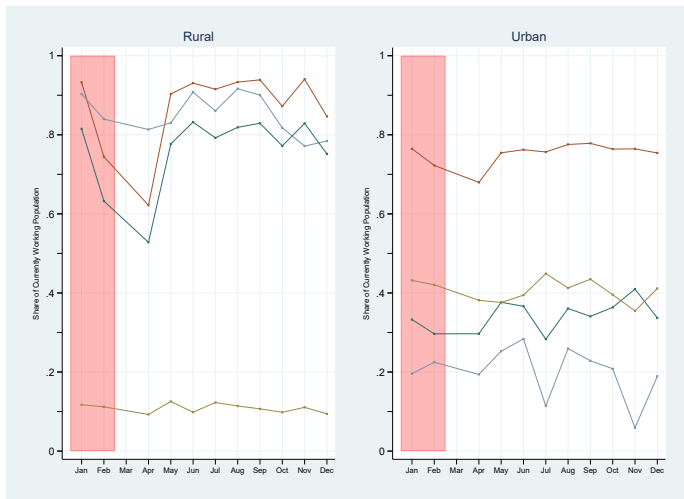


Figure: Weighted share of CWP overall (red), own farm (blue), enterprise (green) wage (brown)

► CWP season by country

Share of CWP year round - MWI

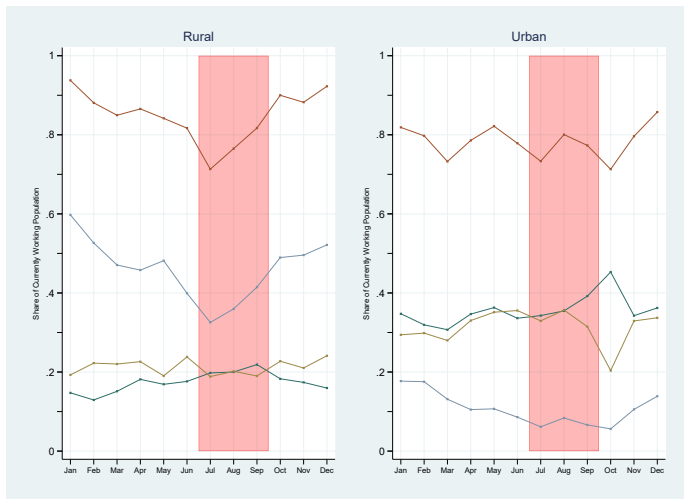


Figure: Weighted share of CWP overall (red), own farm (blue), enterprise (green) wage (brown)

► CWP season by country

Share of CWP year round - NGA



Figure: Weighted share of CWP overall (red), own farm (blue), enterprise (green) wage (brown)

► CWP season by country

Share of CWP year round - TZA

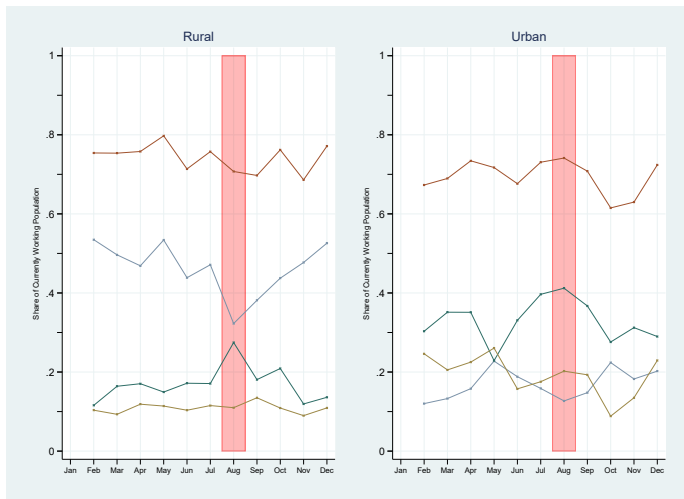


Figure: Weighted share of CWP overall (red), own farm (blue), enterprise (green) wage (brown)

► CWP season by country

Share of CWP year round - UGA

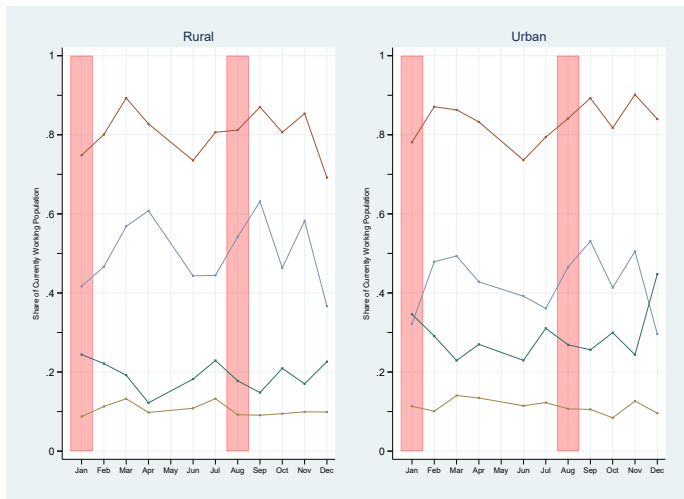


Figure: Weighted share of CWP overall (red), own farm (blue), enterprise (green) wage (brown)

▶ CWP season by country

Share of CWP by gender over the years - TZA

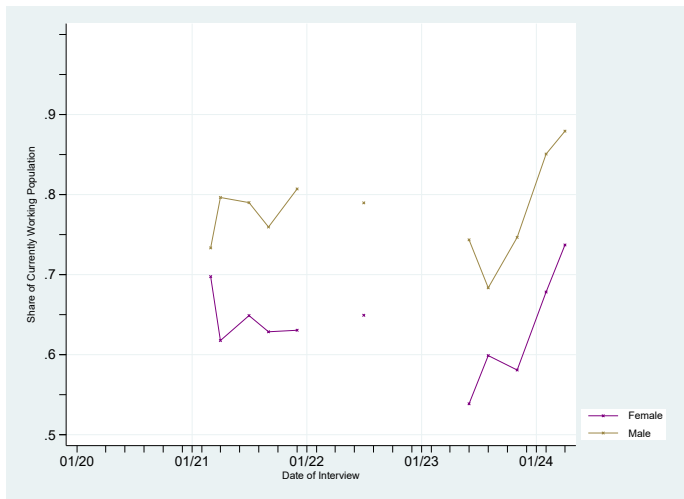


Figure: Weighted share of CWP for male (brown) and female (purple)

► CWP gender by country

CWP rural year - round

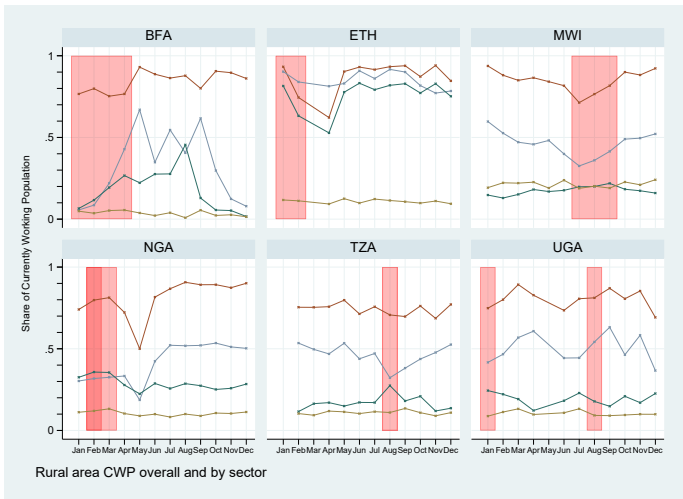


Figure: Weighted share of CWP overall (red), own farm (blue), enterprise (green) wage (brown)

CWP urban year - round

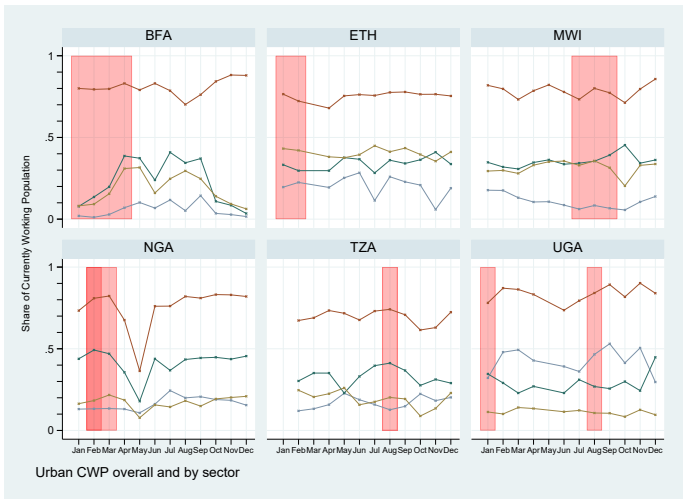


Figure: Weighted share of CWP overall (red), own farm (blue), enterprise (green) wage (brown)

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