Effects of a Currency Peg Adjustment: Evidence from the 1994 Depreciation of the CFA Franc

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Abstract

This paper studies the effects of the 1994 devaluation of the CFA Franc through the comparison of areas that were more or less suitable for crop cultivation. We estimate that, in most countries using the CFA Franc, farming increased in areas more suitable for crop cultivation, relative to other areas. We also estimate a decrease in probability of childbirth in those areas, the magnitude of which is correlated to cropland increase across CFA countries. We find no evidence of any pattern in other sub-Saharan African countries. We use those results to estimate that, on aggregate, over the years 1994 to 2000, the devaluation increased cropland by 2.14 million Ha, decreased the number of births by more than 435,000, increased yearly GDP by 10 percent and increased agricultural TFP by 33 percent.

1 Introduction

On January 12, 1994, the CFA Franc, the currency of thirteen sub-Saharan African countries, was lowered by a half. A few months earlier, several heads of state in the CFA zone, together with French officials, had publicly rejected the possibility of a devaluation. The sudden death of Felix Houphouet-Boigny, the president of Cote d'Ivoire until December 7th 1993 and one of the most influential opponents of the measure among CFA-zone leaders, seems to have precipitated it. Even though the merits of a devaluation or other currency policy changes had been raised for many years before 1994, and have been discussed since then, the 1994 devaluation has been the only change in the fixed parity rate between the CFA franc and the currency of France (the French Franc before 1999, and the Euro thereafter) since the postwar parity adjustment of 1948.

The 1994 devaluation belongs to a broad class of large currency adjustments observed in Africa since the 1990s. These episodes are often accompanied by major interventions. In Nigeria for instance, one US dollar bought 21.89 Nigerian Naira in 1998, and more than 90 in 1999, after it was officially unpegged to the USD, for instance. In Angola, the official exchange rate

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moved from around 150 Kwanza per US dollar just before 2017, to more than 600 in 2020, two years between which the currency moved from a a peg to a floating regime. How to estimate the consequences of such interventions? Large devaluations are triggered at least as much by variations in domestic economic circumstances as by exogenous variations in other currencies, including movements of the US dollar (Caballero, 2021; Fukui et al., 2025). In such an event, the parallel-trends assumption, critical to the standard difference-in-difference design, may fail.

The purpose of this paper is to estimate the effects of the 1994 devaluation of the CFA Franc on development indicators: farming, fertility and GDP. To do so, we first estimate within-country effects of a devaluation, then use those results to derive aggregate estimates. We also rely on a simple model of cropland, labor and fertility choice, similar to Becker (1991),Galor and Weil (1996) or Jones et al. (2008), to support the interpretation of our results, and derive additional estimates. The model implies that depreciation increases the returns to farming more where potential agricultural productivity is higher. Since crops are tradable goods, and farming is the most common occupation in Africa, this implication motivates comparing areas within each country that differ in crop suitability.

In practice, we use crop-suitability data at the level of 55 $\times$ 55 km grid cells. Following spatial suitability measures, as in Alsan (2015), we construct an index that is the number of months over the period 1985-2000 during which it was possible to grow at least one of the main crops cultivated in Sub-Saharan Africa. We then define exposure indicators based on whether a grid cell is above a suitability threshold. We focus on two thresholds because they lead to straightforward interpretations of the estimations results: the population-weighted median crop suitability of the grid cells of a country (the *national* median crop suitability), and the population-weighted median crop suitability of all grid cells of sub-Sahara African countries (the *continental* median suitability).

We first present within-country effects of a devaluation using the national median suitability, then we turn to estimations that use the continental median crop suitability. Using satellite data on cropland, we find that, after 1994, in CFA countries, cropland significantly increased in areas that were above the median level of suitability for cultivation, relative to areas below the median. In non-CFA countries, there was some decrease in cropland, a decrease due to one or a few non-CFA countries that are not geographically close to CFA countries, and that we consider independent of the CFA devaluation.

We then use data from the Demographic and Health Surveys to assess the potential effect of the depreciation on fertility. We find that, after the depreciation, fertility decreased more among women who live on relatively better land. This effect holds if we include women fixed effects in the specification. This means that our results may not be explained by differential social or demographic trends across cohorts between more or less suitable areas.

We interpret those results as the causal effect of depreciation on the variations in cropland and childbirth on above-median relative to below-median crop suitability land. That interpretation relies on the assumption that, within CFA countries, each outcome of interest has had parallel trends in areas above and below the national median value of crop suitability. We report event study analyses that support that assumption, and we interpret the lack of effect in other sub-Saharan countries as further supporting that assumption.

The general conclusions of the previous results hold if we use the continental median crop suitability instead of the national one.

Do the effects of the devaluation vary across countries? To assess the heterogeneity of changes in cropland and fertility, we run difference-in-difference estimations separately for every country, comparing areas above and below the national median of crop suitability. We find that in most CFA countries, cropland increased and fertility decreased in areas above the median crop suitability. In other words, the qualitative impact of the devaluation is the same in almost all CFA countries.

In addition, the quantitative effects on cropland and fertility are correlated: the more cropland increases in a country, the more fertility decreases. We attribute the heterogeneity of effects to the heterogeneity of the geographic distribution of land quality and other industries across countries. However, the negative relationship between cropland and fertility suggests that people respond the same way to increase in demand for agricultural labor, regardless of the variations in religious or cultural norms across the CFA monetary zone. Under the interpretation that the increase in cropland and the decrease in fertility reflect an increase in women's labor in agriculture, we use that correlation to provide an estimation of fertility elasticity. Even though there is no empirical estimation of the effect of depreciation on fertility, a few studies have estimated the impact of increase in labor demand on fertility (Schaller, 2016; Schultz, 1985; Kitchens and Rodgers, 2023). The two latter ones exploit an exogenous increase in the price of farming products. They find that fertility increases when demand for labor in occupations that are more likely to be held by men increases, whereas it decreases if demand for labor increases more in occupations that are more held by women. They also estimate roughly similar values of female labor demand/fertility elasticity, despite the very different contexts they examine. Our findings are consistent with this remarkable homogeneity, and contrast with a rich recent literature that finds that varying ethnic norms explain response to policy changes (La Ferrara and Milazzo, 2017; Ashraf et al., 2020; Bau, 2021).

Within non-CFA countries, there is no strong pattern of systematic qualitative change in cropland or fertility. If anything, there may be a positive correlation between those effects. The positive correlation between population growth and land use is consistent with studies linking demographic pressure, agricultural expansion, and tropical land conversion (López-Carr and Burgdorfer, 2013; DeFries et al., 2010). Our results suggest that this correlation need not characterize all development paths: when agricultural labor demand rises in an economy able to export more, cropland and female labor may increase while fertility declines.

Since the estimations presented so far include country fixed effects, they cannot be extended to derive aggregate effects without strong assumptions on the consequences of the heterogeneous conditions across countries. To assess those effects, instead of comparing areas above and below the value of a median level of crop suitability, in a given subset of countries, which is either the group of CFA countries or the group of other countries, we compare areas in and out of CFA countries, separately for areas above and below the continental median crop suitability, i.e. areas that are comparable in terms of land quality.

Quantitatively, we estimate a statistically significant 1.3% increase in cropland in CFA countries relative to non-CFA countries, in areas with above-continental median land quality, and no significant effect in areas below the continental median level of land quality. Controlling for variations of areas with similar level of crop suitability, we thus find no evidence of an aggregate negative effect of the devaluation on cropland (that an increase in price of machinery or fertilizer may induce). But, for half the population of sub-Saharan Africa who lives on

land above the continental median value of crop suitability, cropland increased in areas located in CFA countries relative to areas located in other countries. A conservative estimate of the decrease in probability of childbirth is 0.9 to 1.4 percentage point in above-continental median areas, or an aggregate decrease of childbirth of 0.37 to 0.5 percentage point per year for the whole population of CFA countries.

We also estimate the effects of the devaluation on night light intensity, using satellite data from (Li et al., 2020). Because reliable subnational data are not available, night light intensity provides a proxy for local economic activity. We find a 25% increase in above-median grid cells. Using the conversion factor in Beyer et al. (2022), this corresponds to an aggregate GDP increase of around 10% in all CFA countries together. Assuming that all that increase resulted from the increase in farming, we estimate that the agricultural TFP increased by 33 percent. According to Gollin et al. (2014), such an increase is large enough to move the agricultural productivity gap of a country in the poorest quartile of income close to the average agricultural productivity gap of middle-income countries. The estimates of our analysis show that currency changes may have first-order effects of agricultural productivity, and development outcomes in general, and may shed light on the motivations for some of the major currency adjustments of the last thirty years in Africa.

Related Literature. This paper first relates to the literature on exchange-rate shocks and devaluations. Currency depreciations can raise the relative profitability of tradable production, but their aggregate effects are theoretically and empirically ambiguous. They may be limited by inflationary pressures, imported-input costs, balance-sheet effects, or weak supply responses. Recent evidence emphasizes this ambiguity: Caballero (2021) studies the role of foreign-currency debt during depreciations, while Fukui et al. (2025) revisits the macroeconomic consequences of exchange-rate depreciations. At the micro level, Berman et al. (2012) show that firms respond heterogeneously to exchange-rate changes, so the effect of a depreciation depends on which producers are able to adjust.

The 1994 devaluation of the CFA franc is a particularly useful setting within this broader literature. It was large, discrete, and common to several countries sharing a fixed exchange-rate regime. Existing work on this episode has mainly studied aggregate outcomes such as growth, exports, poverty, or sectoral performance (Azam, 2004; Azam et al., 2007; Bouvet et al., 2022; Dillner, 2022). In agriculture, Ndiaye (2022) studies cereal yields and food availability. We contribute by using this common macroeconomic shock to study local agricultural adjustment: rather than estimating only an average effect on national aggregates, we ask whether the devaluation changed incentives differently across areas with different agricultural potential. Beyond our specific estimates, the paper shows that analyses of currency movements may need to account for potential productivity interacted with time trends. Indeed, the estimates obtained from a standard difference-in-difference estimation specification, which we report in Section 6 are quite different from the aggregate effects our approach provides.

The second strand of literature studies fertility as a response to the opportunity cost of time. Since Becker (1960), fertility choices have been understood as reflecting both the benefits of children and the costs of raising them. Galor and Weil (1996) emphasize that fertility depends on the value of women's time. Empirical work supports this mechanism. Schultz (1985) shows that changes in agricultural prices affected fertility through women's wages in historical Sweden, while Schaller (2016) and Kitchens and Rodgers (2023) show that fertility responses depend

on whether labor-demand shocks raise male or female opportunity costs. Our contribution is to study a macroeconomic price shock that may have changed the return to agricultural work. If women participate in agricultural production, the devaluation can increase the opportunity cost of childbearing and childcare, creating a channel from exchange-rate policy to fertility.

Finally, the paper is related to the literature on agricultural productivity gaps and selection. Gollin et al. (2014) document large gaps in agricultural productivity between rich and poor countries, Lagakos and Waugh (2013) show that selection into agriculture depends on absolute and comparative advantage, and Adamopoulos and Restuccia (2014) emphasize the role of farm size and factor allocation. Alvarez-Cuadrado et al. (2019) qualify this mechanism by showing that agricultural absolute advantage and agricultural comparative advantage need not be positively aligned in African household data. This literature is useful for interpreting whether agricultural expansion after a price shock changes measured productivity through selection, land use, or time allocation. Our contribution to this literature is to provide an estimate of the quantitative effect of monetary policy intervention on agricultural productivity, and more generally, to show that a relative-price shock can change measured agricultural productivity within countries. By making agriculture more attractive, the devaluation can raise output per cultivated hectare, either by drawing more productive labor into agriculture or by increasing the time and effort allocated to agricultural production.

The rest of the paper is organized as follows. The next section presents basic information about the CFA monetary zones and the 1994 devaluation. In Section 3 describes the data used in the paper. In Section 4, we develop the specification used for the estimations and discuss the identification assumptions of the estimation procedures. In Section 5, we present the results of the estimations and discuss them. In Section 6, we present the model, and the results of estimations that derive from its calibration. Section 7 concludes.

2 Background

The Franc Zone, established in 1945, is based on a monetary cooperation agreement between France and sub-Saharan African countries grouped into two unions: the WAEMU and the CEMAC.[1] This system guarantees the unlimited convertibility of the currency, the centralization of foreign exchange reserves, and a fixed parity with the French franc. Unchanged from 1948 to 1994, this parity durably anchored expectations of nominal stability in the region. However, in the early 1990s, the economies of the Franc Zone experienced significant deterioration due to two main exogenous shocks. First, the fall in world commodity prices deteriorated the terms of trade and reduced export and fiscal revenues (Wade, 2015; Ondongo, 2018). Second, European monetary policy undermined the zone's competitiveness. To anchor the French franc to the German mark for European convergence, France raised its interest rates (Howarth and Schild, 2016). This caused an appreciation of the French franc and, thus, of the FCFA against the US dollar, independently of the productivity of African economies. Consequently, this asymmetry led to a marked overvaluation of the real effective exchange rate and plunged the region into a deep recession .

[1] At the time of the 1994 devaluation, the Franc Zone included 13 countries: Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal, and Togo for the WAEMU; Cameroon, Central African Republic, Congo, Gabon, Equatorial Guinea, and Chad for the CEMAC. Guinea-Bissau only joined the union in May 1997.

Although macroeconomic imbalances justified an adjustment as early as the late 1980s, the timing and even the occurrence of the devaluation remained uncertain until the end. This uncertainty stemmed from a conflict between pressures from financial markets and a persistent "political lock." On one hand, the unsustainability of large budget deficits, exacerbated by the fall in world commodity prices, which reduced export and fiscal revenues, and by the loss of competitiveness of economies due to the overvaluation of the real exchange rate (Wade, 2015; Ondongo, 2018; Efoua, 2019), as well as the halt in financing from Bretton Woods institutions, made the status quo impossible. Indeed, the capital flight in 1993 shows that some informed actors already anticipated a monetary adjustment .

On the other hand, the credibility of the fixed parity rested on an implicit political contract, making the event unpredictable for most actors. African leaders firmly opposed the devaluation, fearing imported inflation and social unrest. This opposition was symbolized by Ivorian President Félix Houphouët-Boigny, the dean of heads of state, who conditioned Franco-African ties on maintaining the parity. Until the end of 1993, public statements of "no devaluation" were numerous: many believed that France would not impose such a break as long as Houphouët-Boigny was alive (Dossou-Cadja, 2024).

His death in December 1993 removed the last major political obstacle. On January 11, 1994, at an extraordinary summit in Dakar, the heads of state of the Franc Zone unanimously endorsed the decision. From January 12 at 00:00, the parity was halved, moving from 1 FF = 50 FCFA to 1 FF = 100 FCFA. This uniform and sudden 50% shock to relative prices constitutes the natural experiment exploited in the subsequent analysis.

The 50% devaluation aimed to allow Franc Zone countries to "regain their competitiveness on the world market and increase their exports for sustainable economic growth" (Ndiaye, 2022; Cossé et al., 1996). In this regard, this improved competitiveness was supposed to benefit exporting sectors, including agriculture. Despite its magnitude and unprecedented nature, the impact of this devaluation has been little studied in the existing literature. The following section presents a review of the relevant literature.

3 Data

Our empirical analysis is based on the combination of two distinct data sources. On the one hand, we construct a spatial panel covering the entire African continent. On the other hand, we use individual data from Demographic and Health Surveys (DHS) to analyze household behaviors.

3.1 Spatial Data

For the spatial data, the unit of observation is a regular grid cell of $0.5° \times 0.5°$, approximately 55×55 km at the equator. This exogenous grid, composed of 12,318 cells, provides a common spatial framework for combining the different datasets used in the analysis.

Land cover and agricultural expansion. To track annual changes in land cover, in particular agricultural expansion , we use high-resolution global land-cover maps from the Copernicus Climate Change Service (Copernicus Climate Change Service, 2019). This dataset, developed

by the European Space Agency Climate Change Initiative (ESA CCI), provides consistent annual land-cover classifications at a spatial resolution of 300 meters, starting in 1992.

We aggregate these high-resolution pixels to our $0.5° \times 0.5°$ analysis grid. For each grid cell and each year, we compute the share of the cell covered by each land-cover category. The detailed classes and their correspondence with the IPCC classification are reported in Appendix Table 7.

Following the literature, we construct a cropland measure by applying fractional weights to the land-cover classes. We assign a weight of 1 to pure cropland classes, and partial weights of 0.6 or 0.3 to mosaic classes, depending on whether cropland is the dominant or secondary land-cover component.

Agricultural suitability index. To evaluate the agricultural potential of land, we construct a time-invariant agricultural suitability index, following the ecological niche modeling approach of Alsan (2015). We focus on the main staple crops of sub-Saharan Africa. For each crop c, month m, and cell i, we define a binary suitability indicator based on temperature and precipitation thresholds:

$$s_{c,m,i} = \mathbb{1}\{t^c_{\min} \leq t_{m,i} \leq t^c_{\max}\} \times \mathbb{1}\{p^c_{\min} \leq p_{m,i} \leq p^c_{\max}\} \tag{1}$$

where $\mathbb{1}\{\cdot\}$ is the indicator function taking the value 1 if the condition is met, and 0 otherwise. In this specification:

- $t_{m,i}$ and $p_{m,i}$ respectively denote the average temperature and average precipitation observed for month m in cell i;
- $t^c_{\min}$ and $t^c_{\max}$ represent the thermal tolerance thresholds (lower and upper bounds) specific to crop c;
- $p^c_{\min}$ and $p^c_{\max}$ correspond to the optimal water requirements for the same crop.

The physiological parameters are derived from the EcoCrop database of the FAO (2000). Monthly climate data come from the high-resolution series of the *Climatic Research Unit* (CRU TS) (Harris et al., 2020). The final index assigned to each cell, denoted S_i, corresponds to the average of these monthly scores calculated across all reference crops during the period 1985-2000.

Economic activity. We use nocturnal light intensity as a proxy for local economic activity. The data come from the harmonized nighttime lights series of Li et al. (2020), which covers the period 1992–2018 at a resolution of 30 arc-seconds, approximately 1×1 km at the equator. This dataset corrects for technological discontinuities between satellite sensors and therefore provides a temporally consistent measure of nighttime lights. We aggregate the data to our $0.5° \times 0.5°$ grid by averaging pixel-level values within each cell and year.

3.2 Demographic and Health Surveys

We use Demographic and Health Surveys (DHS) to study fertility responses at the individual level (ICF, 1991–2014; IPUMS and ICF, 2024). The surveys used in the analysis were conducted between 2001 and 2013. The DHS provide retrospective birth histories for interviewed women, including the year of birth of each child, as well as individual characteristics such as age, education, and place of residence at the time of the survey.[2]

We convert these birth histories into a woman-year panel. For each woman and each year, we record whether she gave birth in that year. This creates an annual measure of childbirth that can be followed over the years surrounding the 1994 devaluation.

We link the DHS data to the spatial data using the geographic coordinates of survey clusters. Each woman is assigned to the grid cell in which her survey cluster is located. This allows us to compare fertility changes among women living in areas with different agricultural potential.

This structure makes it possible to study whether birth probabilities changed after 1994 in areas where agricultural production was more likely to respond to the devaluation. The individual structure of the DHS also allows us to control for permanent differences across women and for common age-specific fertility patterns over time.

4 Specification and Identification

4.1 Specification

For outcomes aggregated at the level of a grid cell g, in country c and in year t, we use a variant of the following specification:

$$\begin{aligned} y_{g,c,t} = \alpha_g + \alpha_t + \beta^{CFA} CFA_c \times Above_{g,c} \times Post_t \\ + \beta^{NOT} NOT_c \times Above_{g,c} \times Post_t + X_{g,c,t}\gamma + e_{g,c,t}. \end{aligned} \tag{2}$$

Variable $Above_{g,c}$ is an indicator variable equal to 1 if and only if grid cell g's crop suitability is above country c's median crop suitability. Variable $Post_t$ is an indicator variable equal to 1 if and only if $t > 1994$. Variable CFA_c is an indicator variable equal to 1 if and only if country c's currency is a Franc CFA, and variable $NOT_c = 1 - CFA_c$. The terms α_t and α_g denote time and grid cell fixed effects.

In the event study, the variable $Post_t$ is replaced by a vector of indicator variables for every year of observation t except 1994, and the coefficients β and γ are replaced by two vectors of coefficients.

To assess variations in fertility, which are observed at the individual level, the dependent variable is an indicator variable $y_{i,a,g,c,t}$ equal to 1 if and only if woman i, who lives in grid cell g of country c, and who was a years old in year t, gave birth in year t. The specification we use for that outcome is:

[2]Two features of the DHS data are important for interpretation. First, fertility is measured retrospectively, so the timing of births may be affected by recall error or age heaping. Second, geographic location is observed at the survey cluster and refers to residence at the time of the survey. We therefore interpret the estimates as local fertility responses associated with residence in more or less agriculturally suitable areas, and we discuss measurement error and migration as robustness concerns below.

$$y_{i,a,g,c,t} = \alpha_i + \alpha_{t,a} + \beta^{CFA} CFA_c \times Above_{g,c} \times Post_t + \beta^{NOT} NOT_c \times Above_{g,c} \times Post_t + X_{i,a,g,c,t}\gamma + e_{i,a,g,c,t}. \quad (3)$$

where the term α_i denote women fixed effects, the term $\alpha_{t,a}$ denotes interactions of a women's age a fixed effects and year t fixed effects. The variables $Above_{g,c}$, $Post_t$, CFA_c and NOT_c are defined as before.

4.2 Identification

In all estimations, the main coefficients of interest are β^{CFA} and β^{NOT}. Under the assumption that the difference in pre-1994 trends in outcome y between CFA and non-CFA countries was the same, the difference $\beta^{CFA} - \beta^{NOT}$ estimates the differential effect on outcome y of shocks occurring in 1994 or later, on grid cells with relatively high and low crop suitability.
We know of no anecdotal evidence or quantitative analysis that could help to assess the validity of that assumption. To assess it empirically, we use two approaches. The first one compares all countries. In particular, we run an event study to compare CFA and non-CFA countries in every year, that we report and comment with the other results in Section 5. Second, we estimate the previous regressions country-by-country to look for patterns in the changes experienced by CFA countries after 1994
The specification used to assess variations in fertility further address specific sources of endogeneity that would invalidate the previous assumptions. First, women fixed effects control for the variations in fertility across cohorts which may be due to changes in women's 'characteristics', such as their ideal number of children or education, over time. Since the distribution of some intrinsic characteristics, such as women's years of birth across geographic areas, may induce a correlation between crop suitability and variations of birth rate over time, we include the interactions between the year t of observation of the outcome, and a woman's age a, $\alpha_{a,t}$.
In some estimations, we also include fixed effects coding for various levels of education achievement, interacted with year of observation of the outcome and year of birth, to control for the fact that variations over time in the outcome may be explained by correlation between education level and area, and hence between education and the *Above* variable.
Under the additional assumption that no shock other than the devaluation affected grid cells above and below the country-median crop suitability, $\beta^{CFA} - \beta^{NOT}$ captures the differential effect of the devaluation itself. In Section 6, we further discuss that latter identification assumption.
Even assuming that crop suitability may explain differential effects in CFA countries, our specification may poorly capture the functional form liking crop suitability and any outcome of interest. Another functional form, however, may require additional identification assumption or may have less clear interpretation (Callaway and Sant'Anna, 2021). Absent any justification for an analytical functional form, our estimations have a conservative bias, which may vary across countries.

5 Results

5.1 Change in Cropland

Table 1 reports the results of the estimation of coefficients β^{CFA} and β^{NOT} of Equation 2. The dependent variable is the log of the number of hectares of the grid cell used for crop cultivation.[3] In all columns, the sample of observations is a longitudinal dataset with one observation by grid cell and by year. The exact sample of observations differs across columns. The sample used for the estimations of Columns 1 and 3 includes observations from all sub-Saharan countries, whereas the sample used for the estimations of Columns 2 and 4 includes observations from CFA countries and sub-Saharan countries that share a border with them only. Observations used in the estimations of Columns 1 and 2 cover the period 1992[4] to 2000, whereas observations used in the estimations of Columns 3 and 4 cover the period 1992 to 2010.

In all columns, the coefficient β^{CFA} is positive and significant: cropland increased more in areas more suitable for crop cultivation after the 1994 depreciation of the CFA Franc in CFA countries. No such change occurred in other sub-Saharan African countries on average over the same period. In Columns 1 and 3, the coefficient β^{NOT} is negative yet smaller in absolute value. That effect may be due to a lower competitiveness of farming products of those countries caused by the depreciation, or may reflect the trends of some sub-Saharan countries. The former explanation is unlikely, since, when the sample is restricted to countries that share a border with a CFA country – countries are those whose farming conditions are closer to CFA countries than the rest of Africa and would be the most likely to become less competitive – the effect is even weaker and not statistically significant (Columns 2 and 4).

The effect is larger if the sample includes observations for years after 2001 (Columns 3 and 4). There is no evidence that the effect of the depreciation on cropland was temporary, even though including more years means that more events unrelated to the depreciation may contribute to that larger effect.

To inform the identification assumption, we report the event study in Figure 1, which shows no change in cropland in CFA countries or other countries before 1995.

5.2 Change in Birth Rate

Table 2 reports the results of the estimation of coefficients β^{CFA} and β^{NOT} of Equation 3. The dependent variable is a binary variable equal to 1 if and only if woman i, living in grid cell g, gave birth in year t. All the samples used for the estimations are unbalanced panels of observations by woman and by year, excluding years in which a woman is younger than 15 (They are also younger than 50 since all women in DHS data are younger than 49 at the time of the survey), for the subsample of sub-Saharan countries for which DHS data with geographic information are available.

[3] Roughly 10% grid cells that have no cropland are excluded from the sample of observations. Removing those observations does not bias our estimations since very few grid cells (less than 0.2% of the sample) switch from no cropland to some cropland over the period. CFA depreciation has not affected whether cultivation occurs on a grid cell or not.

[4] 1992 is the first year with satellite data.

In Columns 1 and 2, we estimate variations of fertility over the period 1990 to 2000 for a given age group. For ease of interpretation, we restrict the sample to ages that are represented in *every* country and *every* year of the period 1990 to 2000. Since the most recent surveys used for this analysis were conducted in 2013, and women surveyed are at most 49, the largest interval of age categories with observations for every country and every year is 15 to 26. (We note that, all ages of that interval may not be represented in all years for all *grid cells* of a country, especially those with few residents. Further restricting the sample to exclude such grid cells lead to similar results. In particular, in a few grid cells, no woman was 15 or more in 1990.)

In both columns, the specification includes interactions between country, year and woman's age fixed effects, which controls for time variations in birth rate that affect all women of a given age in a given country, and for interactions between country, grid cell and woman's age fixed effects, which control for average variations in birth rate of women of a certain age across grid cells of a country. There are no other covariates. In Column 2, the sample is restricted to include CFA countries and neighbouring countries of sub-Saharan Africa.

Both columns show that, within CFA countries, the yearly probability of childbirth among women aged 15 to 26 significantly decreased after 1993 in areas above the median crop suitability of the country, relative to other areas. The coefficient in non-CFA countries is negative as well, but not as strong and not significant, regardless of whether we include any sub-Saharan country (Column 1) or neighbouring countries only (Column 2), and statistically significant.[5]

Those effects could be due to long term social or demographic variations across cohorts, for instance in school enrolment as documented in Vogl (2016). In Columns 3 and 4, we include women fixed effects in the specification to address that point. Here, we do not restrict the sample to have the same age interval represented in every year. Instead, for ease of interpretation, we exclude observations of women who are younger than 15 in 1990 (Since the samples are different, the numbers of observations are different between Columns 1 and 3. As mentioned previously, in a few grid cells, no woman was 15 or more in 1990. By construction, those grid cells are excluded from the sample used in Column 3 and explain why there are fewer clusters. For the same reasons, the number of clusters differ between Columns 2 and 4.) In Column 4, we further restrict it to CFA countries and their neighbours.

Both Columns show a statistically significant decrease in probability of childbirth after the depreciation in CFA countries: women who were above 15 in 1990 had relatively fewer children after 1994 in areas above the median crop suitability. In non-CFA countries, some of which did experience improvement in schooling, we see no change in fertility after 1993.[6]

We then use the same specification as in Column 3 and 4 with a slightly different sample of observations: we include all years from 1990 to the time of the survey in which a woman is observed (which can be any year between 2001 and 2013, which are the years in which the surveys we use were conducted), and we exclude all women who are 40 or younger at the time of the survey.(In some grid cells, there is no woman above 40, so that the numbers of clusters

[5]The coefficients and their standard errors are the same if we do not restrict the sample to that 15 to 26 interval of ages. However, in that case, some countries include women who may be 30 or older over the whole period 1990 to 2000, whereas for other countries, observations of women above 30 only occur in later years, so that we cannot define an exact age range affected.

[6]For most countries, the surveys from which those data derive were conducted before 2010, so we cannot estimate an average effect over the period 1990 to 2010, like we did with cropland.

between Columns 3 and 5 differ, as well as between Columns 4 and 6.) The results, in Column 3 and 4, show similar qualitative results: women kept having a relatively lower probability of childbirth by year until they became old enough to be at or near completed fertility. Those results show that there is no evidence that the women who had fewer children in the years 1994 to 2000, compensated that reduction by having relatively more children afterwards.

We also report the event study in Figure 2, which uses the sample used for the estimation reported in Column 1 and Figure 3 which uses the sample used for the estimation reported in Column 3. Neither figure shows obvious trends before 1994 in CFA countries.

5.3 Country-by-country estimations

In this section, we estimate the results of the same equations country by country, to assess how the response to the depreciation varied.

On the top panel of Table 3, we report the results of the country-by-country estimations of the relative change in cropland after 1993 in grid cells with crop suitability above the national median, for all CFA countries, using the specification defined in Equation 2.

That panel shows that in 9 CFA countries out of 13, cropland increased in land more suitable for crop cultivation, relative to the rest of the country. In 6 of them, that increase was statistically significant. Only Benin experienced a statistically significant decrease in cropland in grid cells more suitable for crop cultivation. Those results show that the effects estimated above for all countries are not due to some outlier but reflect a general increase in cropland on better land in CFA countries after the depreciation.

On the bottom panel of Table 3, we report the country-by-country estimations of the relative change in childbirth for women living grid cells with crop suitability above the national median, for the subset of CFA countries for which DHS data are available, using the specification defined in Equation 3 with women fixed effects.

The bottom panel also shows that the yearly probability of giving birth decreased after the depreciation in most CFA countries. Out of 9 CFA countries for which DHS data are available, 8 have a negative coefficient.

To compare both effects, countries appear from left to right in descending order of the coefficient estimated in the top panel. We see that, in general, countries in which cropland increased the most on more fertile land are also countries in which fertility decreased the most. For instance, Cote d'Ivoire is the (observable) country with both the largest relative increase of cropland (4.5%) and the largest decrease in probability of childbirth (2.4 p.p.), whereas Benin is the (observable) country with both the largest relative decrease of cropland (-1.1%) and the largest increase in probability of childbirth (0.9 p.p.).

We then use the same specifications to estimate changes in cropland and childbirth in non-CFA countries. In Table 4, we report results for countries that are geographically close to CFA countries only (countries that either share a border with a CFA country or are located on the same latitudes and hence have similar farming conditions). The results show no systematic pattern of change of cropland in relatively good land. The numbers of positive and negative coefficients in the top panel are the same. In the bottom panel, 5 countries out of 8 have a negative coefficient, one of which being smaller than 0.01 point of percentage (Guinea).

To illustrate those points, we report the coefficients of those estimations on Figure 4 for the

subset of countries for which DHS data are available. The figure shows the negative correlation between the two series of coefficients in CFA countries, and possibly a weak positive correlation between those two series in other sub-Saharan countries.

The positive correlation is consistent with studies that link population growth to agricultural land use and land conversion (Jana and Goli, 2025; López-Carr and Burgdorfer, 2013; DeFries et al., 2010). That literature typically emphasizes demographic pressure as a source of land conversion. Our results point to a complementary mechanism: changes in returns to farming can increase cultivated land while reducing fertility.

6 Discussion and Calibration

6.1 Discussion

The previous results are consistent with the implication of the simple model presented in Appendix. As the price of tradable goods, such a farming products, increases, people who produce them devote more time to labor and less to having children. In addition, they devote even more time to labor as their potential productivity is higher.

As far as we know, there is no reliable dataset that would allow estimating the change in labor hours in CFA countries, so we cannot directly assess that interpretation. However, using Censuses conducted a few years after 1994, we compare the difference in the probability of having attended (resp. finished) primary school for people who turned 6 (resp. 12) after 1994, relative to before 1994, in and out of areas above median crop suitability, to detect any change in education achievement. Since we find no evidence of any such change, we can reject an interpretation following Becker's quality/quantity tradeoff (Becker, 1991).[7]

In addition, there is no anecdotal evidence of substantial change in non-agricultural output or employment. The main documented change in employment overlapping with our period of study may have been the Structural Adjustment Programs, conducted by the IMF over the 1980s and 1990s, which were often accompanied by reforms or attempted reforms of the civil service over the period (Lienert and Modi, 1997). IMF structural adjustment occurred both in CFA (in Benin, Niger before 1994, in Cameroon in 1997) and non-CFA countries (in Ghana in 1997, Guinea, not RDC). It seems to have been relatively limited, since the share of civil servants in the population went from 0.8 in 1991 to 0.6 in 1996 in West Africa, from 2.6 to 2.1 in Central Africa, and from 1.5 to 1 in non-CFA countries 'close to' CFA countries.

6.2 Aggregate effects of the devaluation

In Table 5 (top panel), we report the difference-in-difference estimation of the effect of the depreciation on the previous outcomes, using the samples used in the main regressions above, as well as log GDP and log light intensity.

The coefficients are very different than those estimated in Table 1 and Table 2. This difference may be due to country trends, that bias the specification Table 5 and disappear in the previous estimations, or to the fact that if variations in land suitability is much larger

[7]The results are in an online appendix.

across countries than within countries, the estimations in Table 1 and Table 2 would miss most of any effect of the depreciation, or to shocks affecting differentially areas differing in land quality.

To address that third point, which could bias all the previous estimations, we propose a different approach that directly controls for time variations across areas with the same crop suitability. Instead of comparing areas above and below the *national* median value of crop suitability, we compare areas above and below the median value of crop suitability for all sub-Saharan countries, which we denote abusively the *continental* median hereafter. (To be consistent with the previous estimations, we use the population-weighted median where, as before the population is measured at the grid-cell level, in 1993. This approach avoids putting too much weight on desert areas which are irrelevant for our analysis.)

The estimations with country fixed effects are not reported here and are similar to those in Table 1 and Table 2: log cropland increases and childbirth decreases in areas above the continental media after 1994 in CFA countries, but do not vary in non-CFA countries. Those results are not surprising given that, in those tables, the estimations using the restricted sample of countries close to CFA countries already partly controlled for changes affecting all areas geographically similar.

We also estimate a slightly different specification: instead of including interactions between country and year fixed effects (and woman's age fixed effects in Table 2), we include interactions between the Above *continental* median variable and year fixed effects (and woman's age fixed effects in Table 2). With this modification, we can estimate relative changes between CFA and non-CFA countries separately for areas above the continental media.

The results are reported in Table 5 – bottom panel. They show results consistent with Table 1 and Table 2: where land is good, log cropland increased and childbirth decreased in CFA countries relative to non-CFA countries; where land is below the continental median, there is no clear difference, except in Column 5. That positive coefficient may be due to a specific trend of some non-CFA country independent of the devaluation since the coefficient is lower and not as statistically significant when we restrict the sample to countries close to CFA countries. In comparison with the difference-in-difference of the top panel, we find that depreciation indeed reduced fertility, and that it increased log cropland and log light intensity much more than what the top panel shows.

Although these estimations do not control for country-specific trends, they show why it is useful to compare areas with similar agricultural potential when estimating the effects of monetary policy. Country fixed effects alone may be insufficient if shocks affecting areas with similar potential productivity, especially areas growing similar crops, are large enough to bias aggregate comparisons.

We interpret the null results in areas below the continental median as evidence that there was no trend in outcome specific to CFA countries, and the significant differences between CFA and non-CFA countries where land is good as the actual effect of the depreciation. We then use those results to derive the aggregate effects of the devaluation.

Aggregate effect on cropland. Quantitatively, Columns 1 of the bottom panel show an increase of 1.3 percent cropland in above-continental median grid cells located in CFA countries. Descriptive statistics by land quality and monetary zone reported in Table 6 show that, in CFA countries, cropland in above-continental median grid cells account for $23/(23+75) = 23.5\%$ of

total cropland in CFA countries. Total cropland in all CFA countries per year was 0.3% higher than before 1994 on average.

Since the total cropland in above-median areas of CFA countries amounted to 23 million Ha in 1993,we estimate that cropland has increased by $23 \times 1.3 = 306$ thousand Ha *every year* on average because of the devaluation, or 2.14 million Ha in the seven-year period 1994 to 2000 that we consider in the estimation (and more if we assume that the post-2000 increase in cropland is not due to other events).

Aggregate effect on births. Quantitatively, Columns 3 to 6 show a decrease of 0.9 to 1.4 points of percentage of the yearly probability of childbirth by woman in above-continental median grid cells located in CFA countries, a relative decrease of 3.7 to 5.8 percent of the pre-1994 yearly probability of childbirth. Since the total population in above-median areas of CFA countries amounted to 36 million people in 1993 (Table 6), and a lower bound of the share of women who are between 15 and 40 in the total population is 20%,[8] we estimate that the devaluation led to a decrease of $0.2 \times 36 \times 0.9$ to $1.4 = 64{,}800$ to 100,800 births per year, or 453,600 to 705,600. births in the seven-year period 1994 to 2000.

Aggregate effect on GDP. Beyer et al. (2022) estimate that a 1 percent increase in night-light intensity in emerging markets and developing economies is associated with a $\frac{1}{1.55} = 0.65$ percent increase in night-light intensity in emerging markets and developing economies, so the estimate on Column 7 implies that, in above continental median grid cells, GDP increased by $0.23 \times 0.65 = 15\%$. Above-median grid cells accounted for $204/(204 + 100) = 67\%$ of light intensity in CFA countries in 1993 (See Table 6). Assuming that the GDP of those grid cells amounted to the same share of the total GDP, we estimate that the aggregate GDP of all CFA countries increased by 10% because of the devaluation.

Growth vs. yearly probability of childbirth. For people who reside on above-median land, the increase in GDP and decrease in probability of childbirth have been respectively 15% and 3.7 to 5.8 %, which is close to the magnitude reported by Kitchens and Rodgers (2023) at the peak of the agricultural boom.

Aggregate effect on agricultural TFP. Output at date t is the sum of non-agricultural and agricultural outputs.

$$Y_t = Y_t^{Not\ Ag} + TFP_t^{Ag} A_t^{\alpha} H_t^{1-\alpha}, \qquad 0 < \alpha < 1, \tag{4}$$

where $Y_t^{Not\ Ag}$ is the output of all sectors other than agriculture, A_t is cultivated land, H_t is total agricultural labor time, and TFP_t^{Ag} is agricultural total factor productivity.

Cultivating one unit of land requires θ units of agricultural time, so

$$H_t = \theta A_t. \tag{5}$$

Substituting (5) into (4) gives

$$Y_t = Y_t^{Not\ Ag} + TFP_t^{Ag} \theta^{1-\alpha} A_t. \tag{6}$$

[8] We use a lower bound, and a range of ages that is narrower than 40, because the samples are skewed towards the young, who are more likely to give birth and may respond more to the devaluation than older women. By construction, no woman is older than 26 years old in the samples used in Columns 3 and 4, and no woman was older than 42 years old before 1994 in the samples used in Columns 5 and 6.

Let s^{Ag} denote the share of total output that was agricultural before 1993. Assuming that all the change in GDP can be attributed to farming[9], i.e. that $Y_t^{Not\ Ag}$ is constant, the previous results imply:

$$\Delta \log TFP_t^{Ag} \simeq \frac{1}{s^{Ag}} \Delta \log Y_t - \Delta \log A_t \tag{7}$$

Numerically, s^{Ag} was around 30% Western and Central Africa in 1993 according to World Bank. The aggregate effects estimated above imply that $\Delta \log TFP_t^{Ag} \simeq \frac{1}{.3} \times 0.10 - 0.003 \simeq 33$ %.

That order of magnitude can be interpreted with estimates of average agricultural productivity gap computed in Gollin et al. (2014). The average agricultural gap is around 3 for the poorest quartile of countries and around 2 for the group of middle-income countries. A 33 percent increase in agricultural TFP would move a country from the range of agricultural gap of the former to the latter group of countries.

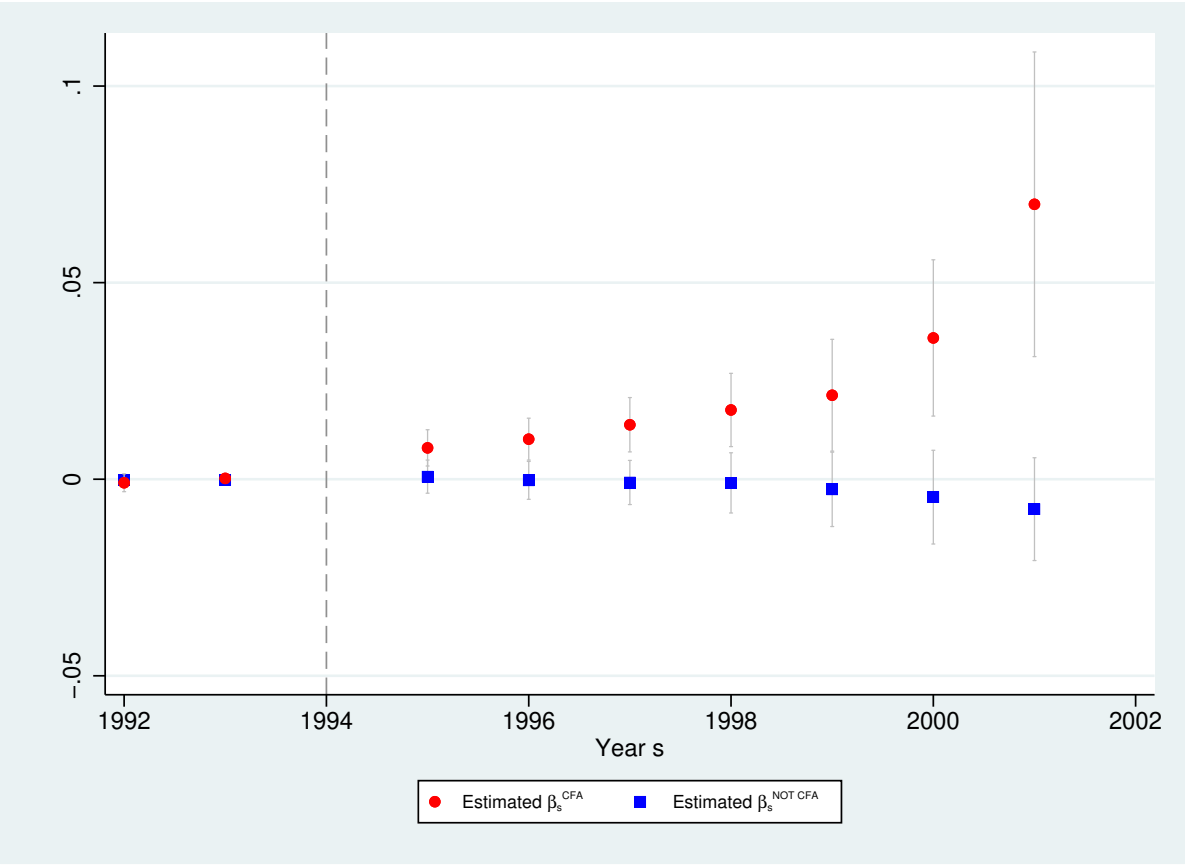
7 Conclusion

This paper estimates the effects of a currency depreciation within countries, by exploiting a shock common to several countries at the same time. Although the possibility of devaluation may have been anticipated, its timing, which appears related to the death of the president of Cote d'Ivoire, was plausibly exogenous. Similar timing issues arise in other settings: movements the US dollar for example, may be anticipated in direction as well (Fukui et al., 2025).
Our analysis shows that currency policy can have substantial local and aggregate consequences in economies where agriculture remains central to production and household decisions.

[9]There is little evidence that the production of any other sector substantially increased

8 Tables and Figures

Figure 1: **Event study for Log of Cropland**

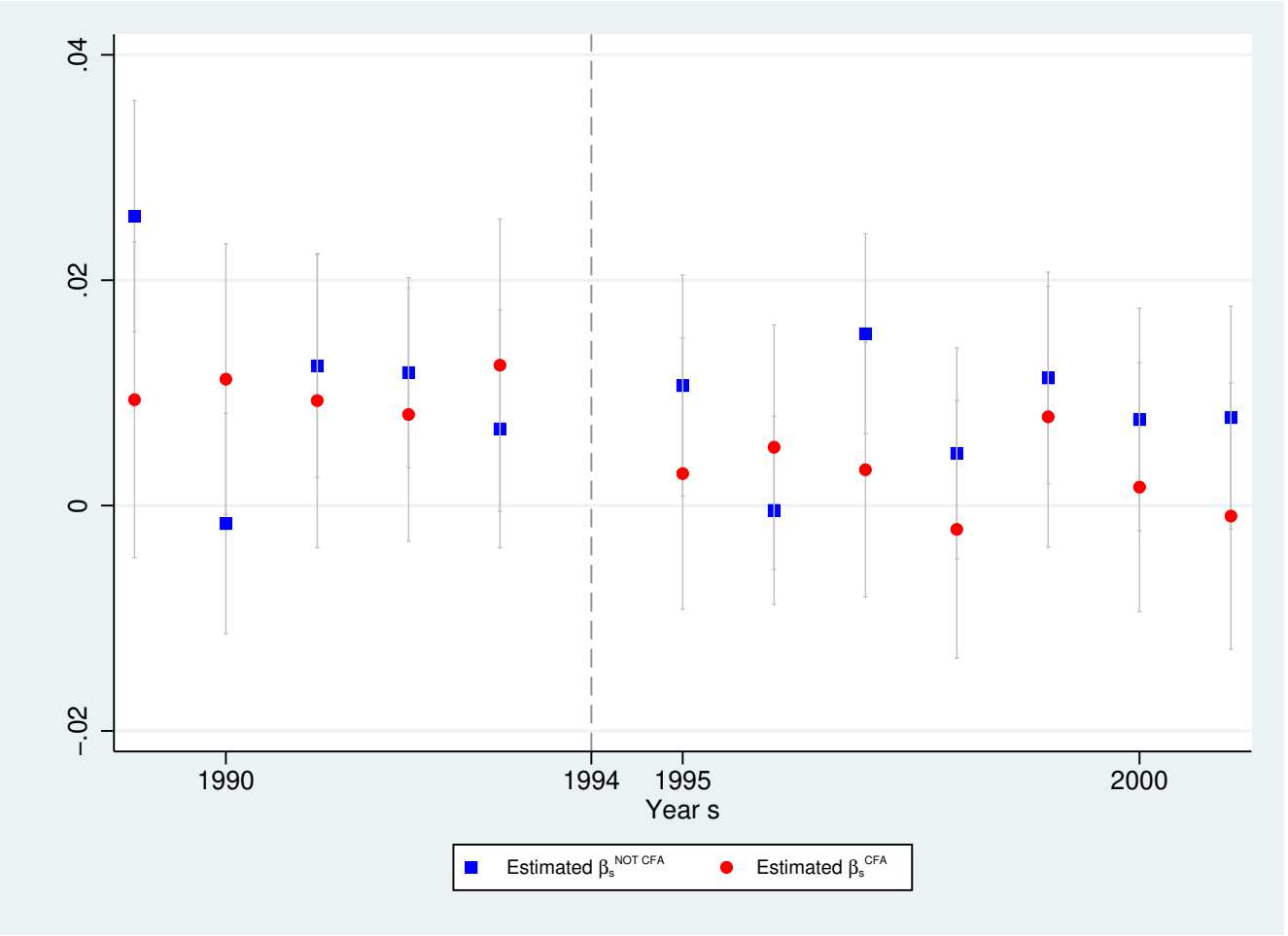


NOTES. This figure reports the OLS estimation of the coefficients β_s and β_s and their confidence intervals in the following regression:

$$y_{g,c,t} = \alpha_g + \alpha_t + \sum_{\substack{1992 \leq s \leq 2000 \\ s \neq 1994}} \beta_s CFA_c \times Above_{g,c} \times 1_{s=t} + \sum_{\substack{1992 \leq s \leq 2000 \\ s \neq 1994}} \beta_s NOT\ CFA_c \times Above_{g,c} \times 1_{s=t} + e_{g,c,t}. \quad (8)$$

There is one observation by grid cell g and year t. The dependent variable is the log of cropland on grid cell g in year t. Observations are weighed so that the weight of a grid cell in a country is proportional to its population in 1993, and the sum of the weights of all grid cells from a country is proportional to the population of that country in 1993. All columns include area FE and year FE (and no other covariate). Standard errors are clustered at area level.

Figure 2: **Event study for Probability of Childbirth, following same age groups over time**

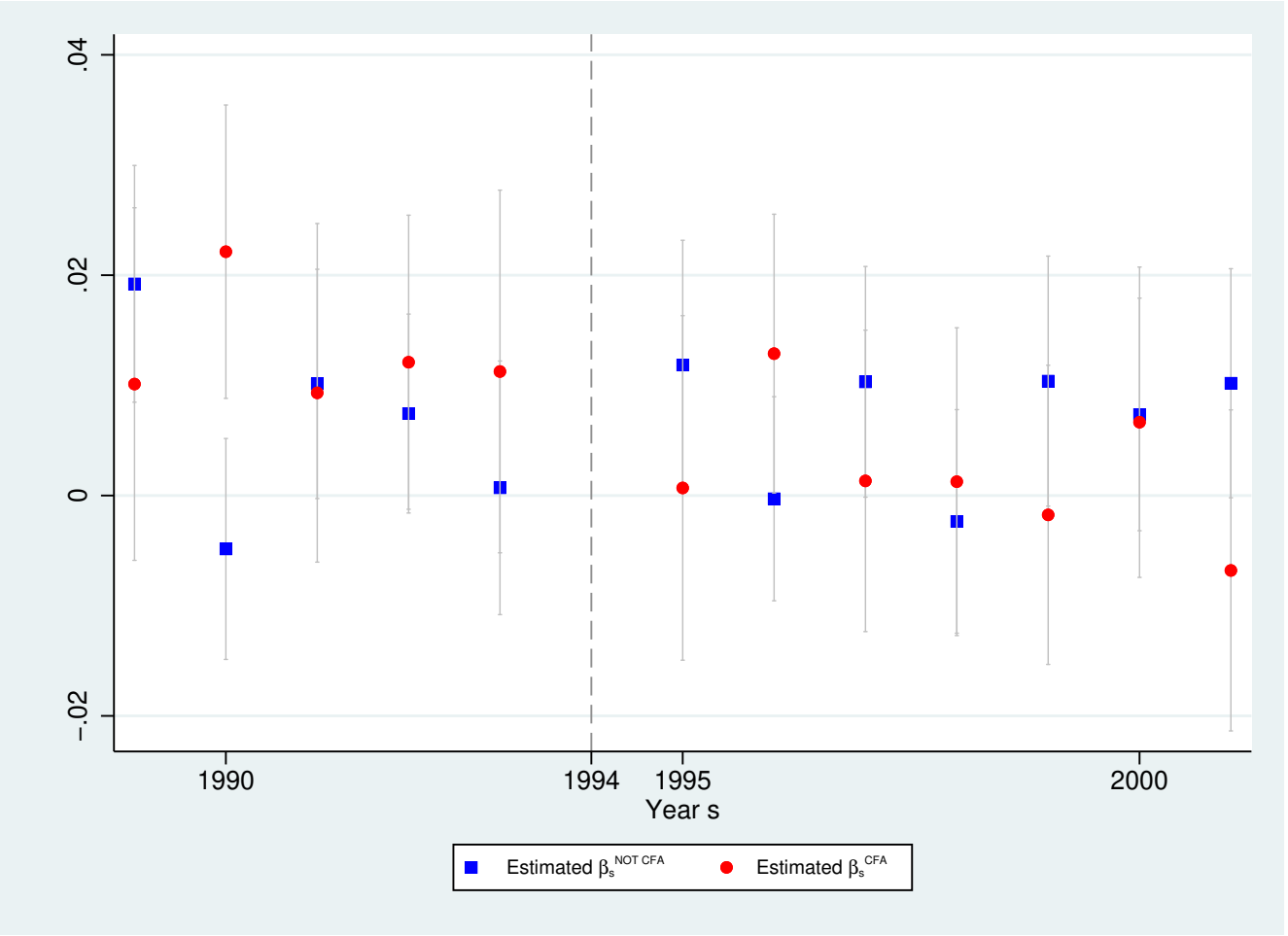


NOTES. This figure reports the OLS estimation of the coefficients β_s and β_s and their confidence intervals in the following regression:

$$y_{i,a,g,c,t} = \alpha_{a,g} + \alpha_{a,c,t} + \sum_{\substack{1992 \leq s \leq 2000 \\ s \neq 1994}} \beta_s CFA_c \times Above_{g,c} \times 1_{s=t} + \sum_{\substack{1992 \leq s \leq 2000 \\ s \neq 1994}} \beta_s NOT\ CFA_c \times Above_{g,c} \times 1_{s=t} + e_{i,a,g,c,t} \quad (9)$$

There is one observation by year t, by woman i of age a at t, who lives in grid cell g of country c. The dependent variable is an indicator variable equal to 1 if and only if woman i gave birth in year t. Observations are weighed so that the weight of a grid cell in a country is proportional to its population in 1993, and the sum of the weights of all grid cells from a country is proportional to the population of that country in 1993. All columns include age × grid cell FE and age × country × year FE (and no other covariate). Standard errors are clustered at area level.

Figure 3: **Event study for Probability of Childbirth, following same women over time**



NOTES. This figure reports the OLS estimation of the coefficients β_s and β_s and their confidence intervals in the following regression:

$$y_{i,a,g,c,t} = \alpha_i + \alpha_{a,c,t} + \sum_{\substack{1992 \leq s \leq 2000 \\ s \neq 1994}} \beta_s CFA_c \times Above_{g,c} \times 1_{s=t} + \sum_{\substack{1992 \leq s \leq 2000 \\ s \neq 1994}} \beta_s NOT\ CFA_c \times Above_{g,c} \times 1_{s=t} + e_{i,a,g,c,t} \quad (10)$$

There is one observation by year t, by woman i of age a at t, who lives in grid cell g of country c. The dependent variable is an indicator variable equal to 1 if and only if woman i gave birth in year t. Observations are weighed so that the weight of a grid cell in a country is proportional to its population in 1993, and the sum of the weights of all grid cells from a country is proportional to the population of that country in 1993. All columns include woman FE and age × country × year FE (and no other covariate). Standard errors are clustered at area level.

Table 1: **Effect on Cropland**

Dependent variable: Log Cropland, by grid cell and by year				
	(1)	(2)	(3)	(4)
CFA × Above × Post 1994	0.019***	0.019***	0.058***	0.058***
	(0.004)	(0.004)	(0.015)	(0.015)
NOT CFA × Above × Post 1994	-0.006**	-0.003	-0.013**	0.000
	(0.003)	(0.004)	(0.006)	(0.008)
within R2	0.01	0.01	0.01	0.01
# Clusters	7559	4011	7559	4011
# Observations	68031	36099	143621	76209
Grid cell FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Country × Year FE	Yes	Yes	Yes	Yes
Pre-1994 Mean of Dependent Variable	10.99	11.02	10.99	11.02
Sample of observations	[A1]	[B1]	[C1]	[D1]

NOTES. This table reports the OLS estimation of the coefficients of Equation 2. There is one observation by grid cell g and year t. The dependent variable is the log of cropland (in Ha) on grid cell g in year t. Observations are weighed by the size of the population in grid cell g in year 1993. All columns include grid cell FE, year FE, and no other covariate. The mean of the dependent variable before 1994 is reported at the bottom of each column. Sample [A1] is the longitudinal dataset comprising all observations for all years between 1992 and 2000 and all continental sub-Saharan African countries. Sample [B1] is Sample [A1] restricted to observations of countries that either belong to a CFA monetary zone, or share a border with a country in a CFA monetary zone. Sample [C1] is Sample [A1] extended to all years between 1992 and 2010. Sample [D1] is Sample [B1] extended to all years between 1992 and 2010. Standard errors (in parentheses) are clustered at the grid cell level. $***p < 1\%, **p < 5\%, *p < 10\%$.

Table 2: **Effect on Probability of Childbirth**

Dependent variable: Childbirth, by woman and by year

	(1)	(2)	(3)	(4)	(5)	(6)
CFA × Above × Post 1994	-0.008***	-0.008***	-0.011***	-0.011***	-0.010**	-0.010**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
NOT CFA × Above × Post 1994	-0.001	-0.003	0.002	0.004	-0.001	0.001
	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
within R2	0.01	0.01	0.01	0.01	0.01	0.01
# Clusters	3208	2053	3201	2052	3136	2023
# Observations	1733642	1248517	1781846	1293501	1541724	1103920
Woman FE	No	No	Yes	Yes	Yes	Yes
Country × Grid cell × Woman's age FE	Yes	Yes	No	No	No	No
Country × Year × Woman's age FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample of observations	[A2]	[B2]	[C2]	[D2]	[E2]	[F2]
Pre-1994 Mean of Dependent Variable	0.22	0.23	0.26	0.26	0.28	0.29

NOTES. This table reports the OLS estimation of the coefficients of Equation 3. There is one observation by woman i in grid cell g and year t. The dependent variable is a binary variable equal to 1 if and only if woman i gave birth in year t. The mean of the dependent variable before 1994 is reported at the bottom of each column. All columns include interactions between year (t) FE and woman's age in year t (a) FE. Columns 1 and 2 also include interactions between grid cells g and woman's age (a) FE. Columns 3 to 6 include woman FE. All samples derive from surveys from DHS conducted between 2001 and 2013. Sample [A2] comprises an observation for every year t between 1989 and 2000, and every woman who is between 15 and 26 years old in year t, so that there are observations in the same interval of ages for every year from 1989 to 2000 and every country (See Section 5.2). Sample [C2] comprises an observation for every year from 1989 to 2000, and every woman who was at least 14 (and at most 49) in 1990. Sample [E2] is sample [A2] extended to observations between 1990 and the year of the survey in which woman i is observed, and restricted to observations of women who were older than 40 at the time of the survey. Samples [B2], [D2] and [F2] are respectively Samples [A2], [C2] and [E2] restricted to observations from CFA countries and sub-Saharan countries that share a border with a CFA country. Weights are computed so that all observations in a country have the same weight, and the sum of the weights of all observations in a country equals the size of the country population in 1993. Standard errors (in parentheses) are clustered at grid cell level. $**p < 5\%, *p < 10\%$.

Table 3: **Country-by-country estimations in CFA countries**

Dependent variable: Log Cropland, by grid cell and by year

	Cote d'Ivoire	Mali	Chad	Burkina Faso	Equat. Guinea	C.A.R.	Gabon	Niger	Cameroon	Senegal	Togo	Benin	Congo Brazza.
Above × Post	0.045***	0.043*	0.040***	0.037**	0.028	0.020***	0.018	0.005**	0.002	-0.002	-0.010	-0.011*	-0.023
	(0.009)	(0.022)	(0.006)	(0.015)	(0.017)	(0.006)	(0.020)	(0.002)	(0.008)	(0.005)	(0.010)	(0.006)	(0.015)
within R2	0.18	0.04	0.10	0.05	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
# Clusters	133	266	251	125	21	203	104	191	190	95	30	60	144
# Observations	1197	2394	2259	1125	189	1827	936	1719	1710	855	270	540	1296
Pre-1994 Mean of Dep. Var.	11.6	10.4	10.9	12.0	8.89	7.58	8.88	10.8	10.2	10.3	11.3	11.3	10.2

Dependent variable: Childbirth, by woman and by year

	Cote d'Ivoire	Mali	Chad	Burkina Faso	Equat. Guinea	C.A.R.	Gabon	Niger	Cameroon	Senegal	Togo	Benin	Congo Brazza.
Above × Post	-0.024**	-0.016***		-0.003			0.000	-0.012	-0.014*	-0.000	-0.007	0.012***	
	(0.011)	(0.004)		(0.006)			(0.009)	(0.014)	(0.007)	(0.006)	(0.012)	(0.004)	
R2 within	0.01	0.01		0.01			0.01	0.01	0.01	0.01	0.01	0.01	
# Clusters	108	205		127			74	131	164	97	43	62	
# Observations	48909	307867	N.A.	232118	N.A.	N.A.	42543	49972	162119	189088	46208	156998	N.A.
Pre-1994 Mean of Dep. Var.	0.24	0.3		0.28			0.26	0.28	0.27	0.26	0.21	0.23	

NOTES. Top panel - This table reports the same estimation as in Column 1 of Table 1, except that the sample of observations used in a column is restricted to the country indicated at the top of the column. Standard errors (in parentheses) are clustered at grid cell level. Bottom panel - This table reports the same estimation as in Column 1 of Table 2, except that the sample of observations used in a column is restricted to the country indicated at the top of the column. N.A. indicates that there is no usable DHS dataset for that country. Standard errors (in parentheses) are clustered at grid cell level. Standard errors (in parentheses) are clustered at administrative area of birth level. $**p < 5\%, *p < 10\%$.

Table 4: **Country-by-country estimations in other countries**

Dependent variable: Log Cropland, by grid cell and by year

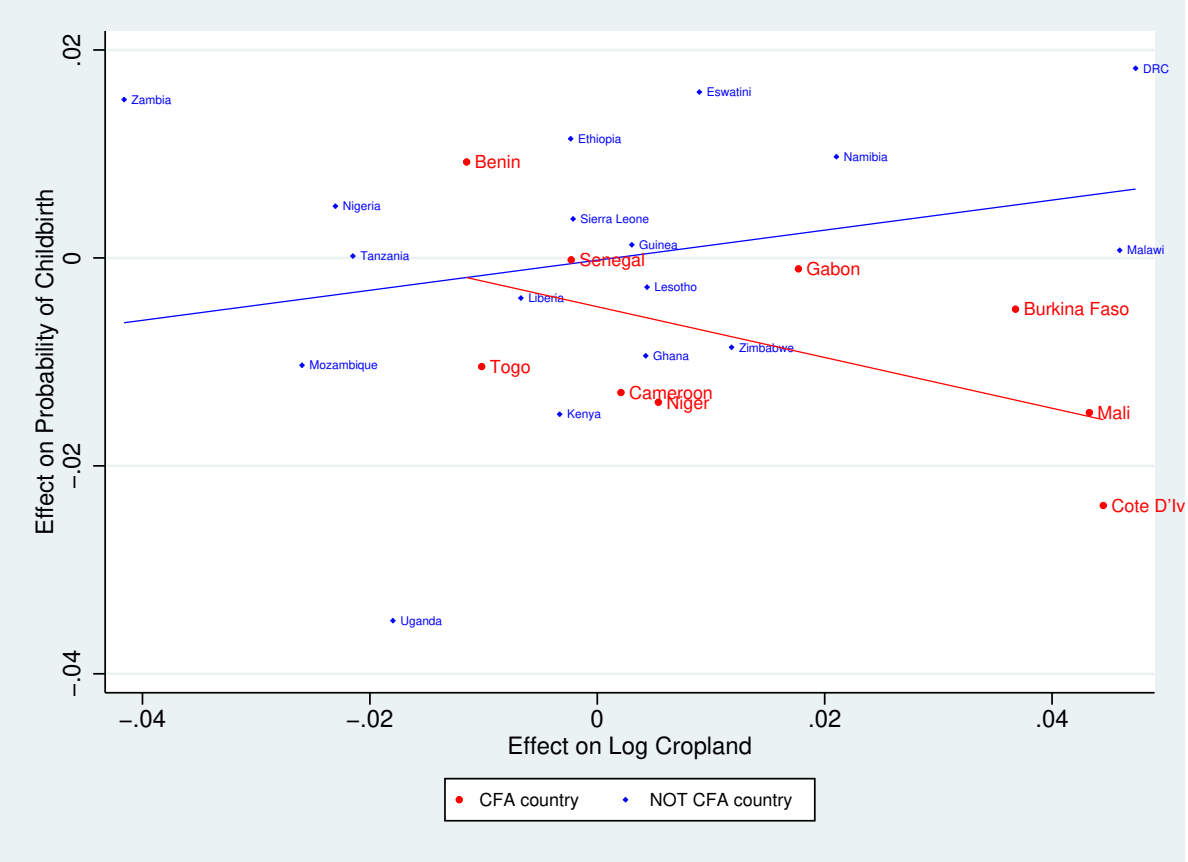
	D.R.C.	Mauritania	Gambia	Sudan	Ghana	Guinea	Guinea Bissau	Sierra Leone	Ethiopia	Liberia	Uganda	Nigeria	Angola	South Sudan
Above × Post	0.047***	0.036***	0.026	0.019***	0.004	0.003	0.000	-0.002	-0.002	-0.007	-0.018***	-0.023***	-0.069***	-0.084***
	(0.009)	(0.009)	(0.026)	(0.007)	(0.005)	(0.007)	(0.005)	(0.008)	(0.003)	(0.019)	(0.006)	(0.005)	(0.017)	(0.016)
within R2	0.02	0.04	0.07	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.02	0.02	0.03
# Clusters	829	117	11	396	104	108	19	35	372	50	94	338	459	223
# Observations	7461	1053	99	3564	936	972	171	315	3348	450	846	3042	4131	2007
Pre-1994 Mean of Dep. Var.	10.4	8.55	11.1	11.0	11.4	10.3	10.0	11.6	11.2	11.4	11.8	11.6	9.08	8.4

Dependent variable: Childbirth, by woman and by year

	D.R.C.	Mauritania	Gambia	Sudan	Ghana	Guinea	Guinea Bissau	Sierra Leone	Ethiopia	Liberia	Uganda	Nigeria	Angola	South Sudan
Above × Post	0.018**				-0.017**	0.001		0.007	0.007	-0.004	-0.025**	-0.006		
	(0.009)				(0.007)	(0.009)		(0.011)	(0.008)	(0.010)	(0.010)	(0.006)		
R2 within	0.01				0.01	0.01		0.01	0.01	0.01	0.01	0.01		
# Clusters	178				107	102		42	236	62	102	319		
# Observations	68447	N.A.	N.A.	N.A.	96680	125071	N.A.	125228	179975	102279	168484	479739	N.A.	N.A.
Pre-1994 Mean of Dep. Var.	0.26				0.23	0.27		0.22	0.28	0.26	0.3	0.26		

NOTES. Top panel - This table reports the same estimation as in Column 1 of Table 1, except that the sample of observations used in a column is restricted to the country indicated at the top of the column. Standard errors (in parentheses) are clustered at grid cell level. Bottom panel - This table reports the same estimation as in Column 1 of Table 2, except that the sample of observations used in a column is restricted to the country indicated at the top of the column. N.A. indicates that there is no usable DHS dataset for that country. Standard errors (in parentheses) are clustered at grid cell level. Standard errors (in parentheses) are clustered at administrative area of birth level. $**p < 5\%, *p < 10\%$.

Figure 4: **Increase in surface cultivated vs. decrease in number of births by year**



NOTES. This figure reports the differential increase in surface cultivated and differential decrease in number of births, between grid cells above and below median crop suitability, by year, as well as the linear prediction from those number for CFA and non-CFA countries separately. On the x-axis, the surface cultivated is the 2500 km^2 (the surface of a grid-cell) times the coefficient estimated in the top panel of Table 3. On the y-axis, the number of births is the product of 0.33 (the average share of women 15 to 50 in the population) times the average population in a cell in 1990 times the coefficient estimated in the. bottom panel of Table 3.

Table 5: **Estimations using *continental* median of crop suitability**

Dependent variable:								
	Log Cropland		Childbirth				Log Light	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CFA × Post 1994	0.008***	0.008***	0.001	0.001	0.006***	0.006***	0.122**	0.156***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.047)	(0.055)
within R2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
# Clusters	7559	4972	3208	2053	3201	2052	770	402
# Observations	68031	44748	1733642	1248517	1781846	1293501	7119	3708
Sample of reference	[A1]	[B1]	[A2]	[B2]	[C2]	[D2]	[A3]	[B3]
Pre-1994 Mean of Dependent Variable	10.9	11.0	0.22	0.23	0.26	0.26	7.72	7.58
Dependent variable:								
	Log Cropland		Childbirth				Log Light	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CFA × Above Continental Median × Post	0.013***	0.014***	-0.009***	-0.009***	-0.010***	-0.014***	0.219**	0.235**
	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.088)	(0.097)
CFA × Below Continental Median × Post	0.001	-0.001	0.004	0.002	0.007***	0.006*	0.036	0.077
	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.047)	(0.054)
within R2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
# Clusters	7559	4972	3208	2053	3201	2052	770	402
# Observations	68031	44748	1733642	1248517	1781846	1293501	7119	3708
Sample of reference	[A1]	[B1]	[A2]	[B2]	[C2]	[D2]	[A3]	[B3]
Pre-1994 Mean of Dependent Variable	10.9	11.0	0.22	0.23	0.26	0.26	7.72	7.58

NOTES. This table reports estimations of Equations 2 and 3 , with the following modifications: (1) the variables CFA × Above Median × Post and Not CFA × Above Median × Post are replaced with CFA × Above Continental Median × Post and CFA × Below Continental Median × Post (2) the interactions between country and year fixed effects are replaced with interactions between the variable Above Continental Median and year fixed effects. The continental median of crop suitability is computed with the measure of crop suitability at the grid cell level, weighed by the population of the grid cell in 1993. The samples [A1] to [D2] used for the estimations are defined in Table 1 and Table 2. Sample [A3] is a sample of larger grid cells than the ones used for other outcomes. Standard errors (in parentheses) are clustered at area level $**p < 5\%, *p < 10\%$.

Table 6: **Statistics using Continental Median**

	CFA	**NOT CFA**
Total Cropland in 1993 (in MHa)		
$Above = 1$	23	90
$Above = 0$	75	164
	CFA	**NOT CFA**
Mean Prob. of Childbirth by Woman in 1993		
$Above = 1$	0.244 (0.026)	0.236 (0.058)
$Above = 0$	0.334 (0.062)	0.214 (0.024)
	CFA	**NOT CFA**
Total Population in 1993 (in M)		
$Above = 1$	36	223
$Above = 0$	47	212
	CFA	**NOT CFA**
Total Pre-1994 Light in 1993		
$Above = 1$	204	1823
$Above = 0$	100	2136

NOTES. The median denotes the continental median value of crop suitability.

Appendix

Table 7: Classification of ESA-CCI land cover maps, correspondence with IPCC categories, and applied agricultural weights.

IPCC Category	ESA-CCI Code	ESA-CCI Description	Agric. Weight
Agriculture	10, 11, 12	Rainfed cropland	1
	20	Irrigated cropland	1
	30	Mosaic cropland (> 50%)/natural vegetation (< 50%)	0.6
Forest	50	Tree cover, broadleaved, evergreen (> 15%)	0
	60, 61, 62	Tree cover, broadleaved, deciduous (> 15%)	0
	70, 71, 72	Tree cover, needleleaved, evergreen (> 15%)	0
	80, 81, 82	Tree cover, needleleaved, deciduous (> 15%)	0
	90	Tree cover, mixed leaf type	0
	100	Mosaic tree and shrub (> 50%)/ herbaceous cover (< 50%)	0
	160	Tree cover, flooded, fresh or brackish water	0
	170	Tree cover, flooded, saline water	0
Grassland	110	Mosaic herbaceous cover (> 50%)/ tree and shrub (< 50%)	0
	130	Grassland	0
Wetland	40	Mosaic natural vegetation (> 50%)/ cropland (< 50%)	0.3
	180	Shrub or herbaceous cover, flooded	0
	220	Permanent snow and ice	0
Settlement	190	Urban areas	0
Other	120, 121, 122	Shrubland	0
	140	Sparse (Lichens and mosses)	0
	150-153	Sparse vegetation (tree, shrub, herbaceous cover)	0
	200-202	Bare areas	0
	210	Water bodies	0

Note: Land cover descriptions and codes are based on the ESA-CCI nomenclature (Copernicus Climate Change Service, 2019). The agricultural weights correspond to the fractional conversion applied in our spatial aggregation to compute the equivalent cultivated area.

A Model

Consider a representative agricultural household in location i. Land quality is denoted by q_i. The devaluation, indexed by d, raises the domestic price of crops, $P(d)$, with $P'(d) > 0$. The household chooses cultivated land A, time spent farming H and fertility n. Cultivating one additional unit of land requires θ units of time so that $H = \theta A$. Agricultural profits are

$$\pi(A; d, q_i) = P(d)q_i A - \frac{c}{2}A^2, \qquad c > 0, \tag{11}$$

where the convex term captures increasing costs of expanding cultivated area. Utility from fertility is

$$v(n) = bn - \frac{\psi}{2}n^2, \qquad b > 0, \quad \psi > 0. \tag{12}$$

The household has female time endowment T_f. A child requires ϕ units of female time. The time constraint is

$$H + \phi n \leq T_f. \tag{13}$$

The household solves

$$\max_{A,n\geq 0} \left\{ P(d)q_i A - \frac{c}{2}A^2 + bn - \frac{\psi}{2}n^2 \right\} \quad \text{s.t.} \quad \theta A + \phi n \leq T_f. \tag{14}$$

For the interior case with a binding time constraint, the first-order conditions imply

$$A^*(d, q_i) = \frac{P(d)q_i - \frac{b\theta}{\phi} + \frac{\psi\theta T_f}{\phi^2}}{c + \frac{\psi\theta^2}{\phi^2}}, \tag{15}$$

and

$$n^*(d, q_i) = \frac{T_f}{\phi} - \frac{\theta}{\phi}A^*(d, q_i). \tag{16}$$

The model delivers two local comparative statics. First,

$$\frac{\partial^2 A^*}{\partial d\, \partial q_i} = \frac{P'(d)}{c + \frac{\psi\theta^2}{\phi^2}} > 0. \tag{17}$$

The devaluation increases cultivated land more in locations with higher agricultural quality. Second,

$$\frac{\partial^2 n^*}{\partial d\, \partial q_i} = -\frac{\theta}{\phi}\frac{\partial^2 A^*}{\partial d\, \partial q_i} < 0. \tag{18}$$

The same shock lowers fertility more where agricultural expansion is stronger. The ratio

$$\kappa = \frac{\theta}{\phi} \tag{19}$$

summarizes the relative time cost of land cultivation and child-related time.

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