Currency Devaluation as a Source of Growth in Africa: A Synthetic Control Approach

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Abstract
This study examines the impact of the 1994 IMF-supported CFA franc devaluation on GDP per capita in the CFA-franc zone using the augmented synthetic control methodology. With the exception of Mali, there is no statistical evidence that GDP per capita levels rose relative to what they would have been in the absence of the IMF-supported devaluation. Three countries record statistically significant GDP per capita levels below the counterfactual following the devaluation, though these countries experienced a deterioration of their national institutional environment or were affected by external factors that offset any potential gains from the devaluation.

Keywords Currency devaluation · Augmented synthetic control method · CFA monetary union

JEL Classification E5 · F4 · O5

Introduction
The CFA franc has stood as a remarkable beacon of stability in Western Africa since its inception in 1945. With the exception of a 50%-devaluation in 1994, the CFA franc rigidly maintained its fixed rate to the French franc up to 2001 and the euro thereafter. Maintaining a stable fixed exchange rate for this length of time has benefits. This stability reduces exchange rate risk premiums and restrains inflationary...
pressures. There are potential costs as well. In addition to imposing limits on monetary sovereignty, a fixed exchange rate can become misaligned, leading to reduced competitiveness in international markets and economic hardship.

This was the case for countries in the CFA franc zone in the late 1980s and early 1990s. A series of adverse price shocks to many of the countries’ main commodity exports, combined with a persistent appreciation of the French franc relative to other currencies over this time period, led to a deterioration of the terms of trade for many CFA franc zone countries (Boughton 2012). By the early 1990s, it became clear to the member nations, the International Monetary Fund (IMF), and France that a devaluation was necessary to address the currency’s overvaluation. On January 12th, 1994, governments from the CFA franc zone accepted a 50%-nominal devaluation against the French franc. At the same time, lending and technical support from the IMF, France, and other donors were committed to contain the negative effects of the devaluation. This IMF-supported realignment was designed to restore competitiveness in export markets for countries in the CFA-franc zone and bolster their economic growth prospects (Clément 1995).

The goal of this paper is to evaluate the effectiveness of the 1994 IMF-supported CFA franc devaluation in promoting economic growth for countries in the CFA-franc zone. Evaluating the impact of this episode is important because the CFA franc is still fixed to the euro, making misalignment a real possibility and realignment a viable policy tool. Calls for a revaluation arose as recently as the mid-2010s when the euro appreciated against the US dollar and slow growth in the Eurozone renewed concerns that the CFA franc was overvalued (Gnansounou and Verdier-Chouchane 2012).

To assess the impact of the 1994 IMF-supported devaluation on per capita income levels in CFA-zone countries, the augmented synthetic control method (ASCM) proposed by Ben-Michael et al. (2021) is employed. The augmented synthetic control method follows the basic premise of the synthetic control method (SCM), by constructing a counterfactual “synthetic CFA-zone country” using a weighted linear combination of similar countries that did not experience an IMF-supported devaluation in 1994. Any difference between the actual income per capita and the income per capita of the synthetic country can be attributed to the effect of the IMF-supported devaluation. The ASCM augments the SCM by using a different matching technique which addresses bias in the SCM estimate when the pre-treatment match is not excellent, which is the case for many of the CFA-zone countries used in this analysis.

This technique is particularly useful in evaluating the IMF-supported devaluation in the CFA-franc zone for several reasons. First, the effect can be measured for each country independently, allowing for potential heterogeneous effects across the sample. Wide disparities across countries in the economic impacts of the devaluation would raise questions regarding the benefits of another devaluation, and possibly challenge policy coordination within the monetary union. Second, this 1994-devaluation was unanticipated, removing any concerns of anticipation bias influencing the results. Third, the devaluation occurred on a specific day, removing any challenges in setting a policy date from which to start the treatment. To our knowledge, there are no studies that apply the ASCM to specific policy questions in Africa, and no
SCM or ASCM papers that study the effect of the 1994 IMF-supported devaluation of the CFA franc.

The remainder of the paper is organized as follows. Section 2 provides background on the economic conditions that led to the 1994 IMF-supported CFA franc devaluation. Section 3 summarizes the relevant literature on the impacts of currency devaluations and the use of the SCM and ASCM in addressing events studies such as this. Section 4 explains the methodology and data used in the analysis. Section 5 presents and discusses the baseline results and various robustness checks. Section 6 concludes.

**Background Information**

The CFA-franc zone currently consists of 14 countries in Sub-Saharan Africa, each affiliated with one of two monetary unions: nine countries comprise The West African Economic and Monetary Union (WAEMU) and the remaining six countries form the Central African Economic and Monetary Community (CAEMC). The CFA franc was created in 1945 and pegged to the French franc and subsequently to the euro. In the early 1990s, after years of a stable fixed rate, it became increasingly apparent that the CFA franc was overvalued. The terms of trade deteriorated by 50 percent through the late 1980s, driven by a combination of dropping commodity prices on traditional export goods and an appreciation of the French franc (Clément et al. 1996). Fearing the inflationary effects of a currency realignment, the currency block resisted the idea and focused initially on internal adjustments to realign the terms of trade. Restraining wage growth and tight fiscal policy became increasingly painful, however, and by the early 1990s devaluation was beginning to look like a more viable policy option.

The IMF was paying particular attention to the ongoing deterioration of the terms of trade in West and Central Africa and became convinced that a currency realignment and structural reform were the best ways to improve their economic prospects. In the early 1990s, the IMF began working with political leaders in France and the nations in the CFA-franc zone to solidify the political will to realign the currency. The IMF also began to draw up plans for structural reform supported by IMF loans, debt forgiveness, and external loans designed to come into effect soon after the devaluation. These reforms focused on shoring up governments’ budgetary positions through broadening the tax base and reigning in spending, but also reorienting government spending to more productivity enhancing activities (Clément 1995; Boughton 2012). In addition, the IMF provided technical support for each country in

1. https://www.imf.org/external/pubs/ft/fabric/backgrnd.htm.
2. WAEMU was founded in 1994, build on the foundation of the West African Monetary Union, founded in 1973. It original members included Benin, Burkina Faso, Côte D’Ivoire, Mali, Niger, Senegal, and Togo. Guinea-Bissau joined the monetary union in 1997.
3. Cameroon, Central African Republic, Chad, Republic of Congo, Equatorial Guinea, and Gabon.
4. For a summary of the efforts of the IMF to orchestrate this devaluation see Boughton (2012, pp. 677–737).
the CFA-franc zone to coordinate the funds and policies set up to lessen the adverse effects of the devaluation, as well as provide support to enact structural reforms to maintain competitiveness (Clément 1995). By September of 1994, the IMF had borrowing arrangement set up for all of the CFA-zone countries, disbursing $508 million by the end of 1994. Eventually, they coordinated over $7 billion in debt forgiveness, committed $1.9 billion in their own lending, and coordinated an additional $4 billion in external support (Clément 1995).

The circumstances behind the 1994 devaluation in the CFA franc zone are unique. As noted above, the devaluation in the CFA franc zone was in response to an extended period of a deterioration of the terms of trade, not an event, such as a run on the currency. It was also unique in how involved the IMF was in the process. The IMF coordinated the devaluation, provided and coordinated financial support, and designed and supported structural reforms. One should be careful in applying the conclusions from this study to devaluation episodes undertaken in a different environment.

Related Literature

The Macroeconomic Impacts of Currency Devaluations

Theory suggests devaluations can support economic growth by improving competitiveness abroad. Devaluations increase foreign demand for domestically produced goods as well as make foreign-produced goods relatively more expensive, thus boosting domestic net exports. On the other hand, devaluations could be damaging through the inflationary pressure they introduce, distorting relative prices, and lowering real wages. The effect can be particularly destabilizing when government debt is denominated in a foreign currency, potentially leading to a sovereign debt crisis, all of which could hinder economic growth.5

Empirical evidence on the effectiveness of devaluations as a path to economic growth are mixed, particularly in developing countries. Because devaluations are often a policy tool used to combat balance of payment crises and speculative attacks, much of the empirical literature on the effect of devaluations focus on currency crises. Not surprisingly, these studies find that output falls immediately after a devaluation (Hutchison and Noy 2002; Basistha and Teimouri 2015). Many of these studies, however, find that a devaluation eventually contributes to economic growth (Bussière et al. 2012). Yiheyis (2006) confirms that these outcomes hold in general for countries in Africa. In an aggregate study of twenty African countries they find that nominal devaluations have a contemporaneous negative effect on output, but a positive effect a year after the devaluation.

Additional lines of research that allow for heterogeneity in institutional structure and output responses to devaluations across countries highlight the importance of

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5 See Bahmani-Oskooee and Miteza (2006) for a summary of the theoretical literature around contractionary devaluations.
taking this into account. Bahmani-Oskooee and Miteza (2006) find that devaluations in non-OECD countries are more contractionary than in OECD countries. Gupta et al. (2007) highlight significant variation in responses even among developing countries. They find that only 60 percent of currency crises in developing countries are contractionary. Bahmani-Oskooee and Gelan (2013) represents one of only a few studies that focus on the heterogeneous effects of exchange rate movements in Africa. They look at the effect of exchange rate movements in twenty-two different African countries and find eight of the twenty-two countries experienced expansionary depreciations over time, while five had contractionary depreciations. The remaining three showed no response.

The studies that focus specifically on the IMF-supported devaluation of the CFA franc, generally find that it was a success in promoting economic growth. As reported in Fig. 1, trends in per capita GDP show signs of economic recovery and growth after 1994 in at least seven of the twelve CFA-zone countries studied in this paper. The reversal of fortune is quite pronounced in Benin, Burkina Faso, and Mali. Clément (1995) initially reports a recovery in growth rates being led by exporting industries, specifically those in the agricultural sector. As illustrated in Fig. 2, the feared inflation that was anticipated following the devaluation did occur, but at a much lower rate and a shorter period than predicted.

With an additional year of data, Clément et al. (1996) still find positive growth in the CFA franc zone aided by the IMF-supported realignment, an improved world economy, favorable commodity prices, and good weather. They also begin to identify variation in post-devaluation experiences across CFA franc zone countries due
to civil unrest and raise a concern that incomplete and slow adoption of structural reforms could hamper growth in the future. Ultimately the authors conclude that “the CFA countries have largely met in 1994 the objectives of the programs they had developed in the aftermath of the devaluation of the CFA franc…” (Clément et al. 1996, p. 27). Van den Boogaerde and Tsangarides (2005) report on the aftermath of the IMF-supported devaluation ten years later. They also highlight the success of the program in the first four years after the devaluation in causing positive growth rates, controlling inflation, and improving competitiveness. Azam (2004) confirms the positive growth in the CFA franc zone post-devaluation, but they highlight the fact that the IMF-supported devaluation had not necessarily led to alleviation in poverty in these countries.

The sustained growth across all CFA countries began to diverge after 1997, due in large part to social and political unrest. Ultimately, early studies deem the program a success based on the growth in GDP per capita observed in most CFA franc countries shortly after the IMF-supported devaluation. Subsequent studies, however, shed doubt on the effectiveness of the IMF-supported devaluation. Constant (2012) finds that in the first ten years following the devaluation, the real effective exchange rate did not significantly affect growth rates in these countries. Kinda and Mlachila (2011) also point out that the growth performance in the WAEMU was disappointing relative to other Sub-Saharan African countries.

Studies on the effects of devaluations in general and the IMF-supported CFA franc devaluation in particular, each have drawbacks when trying to understand the effects of the IMF-supported devaluation in 1994. First, aggregate studies treat
all devaluation episodes the same. Aggregating the effects of a devaluation occurring within the context of an immediate crisis or speculative attack with those that are simply planned corrections not undertaken in times of crisis could miss important heterogeneity in responses. Additionally, institutional structures differ across countries and devaluation episodes, leading to heterogeneity in responses lost to aggregation. Second, most studies that allow for heterogeneity, and all of the studies specific to the IMF-supported devaluation, lack a counterfactual. The general improvement in growth of GDP per capita observed in the CFA-franc zone countries came at a time of general growth for many developing nations, including other Sub-Saharan African countries (IMF 2008), thus the challenge becomes to differentiate the growth effect of the IMF-supported devaluation from what it would have been otherwise.

The Synthetic Control Method

To analyze the impact of an event or policy, researchers typically choose between using qualitative comparative case studies and quantitative comparative statistical inference methods such as difference-in-difference analysis or randomized control trials. As pointed out in Abadie et al. (2010), qualitative comparative case studies and the difference-in-difference method can be problematic because the selection of the comparison units tend to be based on subjective measures. Randomized control trials, which are often used in microeconomic research, attempt to overcome the subjective nature of finding a comparison unit by creating one through the experimental design. This approach, however, is less useful when studying macroeconomic policies or events (such as a currency devaluation) because they are very rarely randomly assigned. Moreover, a crucial assumption for the difference-in-difference method is that outcomes for the unit affected by the policy or event (treated unit) and the comparison unit not affected by the policy or event (control unit) follow parallel paths in the absence of the policy or event (the treatment). Violation of this assumption, quite likely when the treated unit is a country, leads to biases in the estimates. The synthetic control method (SCM) developed by Abadie and Gardeazabal (2003) offers a bridge between qualitative and quantitative methodologies, by providing a systematic way to choose comparison units in comparative case studies (Abadie et al. 2015). More details on the SCM methodology and the more recent ASCM are provided in the next section.

While the SCM has been used in a number of policy evaluation studies, few address macroeconomic policies in Sub-Saharan Africa (Billmeier and Nannicini 2013; Campos et al. 2019). Newiak and Willems (2017) use the SCM to study the impact of IMF programs on inflation, economic growth, and investment in Sub-Saharan Africa. The analysis of structural reforms on economic performance presented in Marrazzo and Terzi (2017) includes five African countries, while Billmeier and Nannicini’s (2013) broad analysis of economic liberalization includes sixteen African countries.

Papers that use SCM to address currency arrangements and their effects are also limited. Most of the studies that address currency arrangements using SCM focus
on the effects of joining the Economic and Monetary Union (Hope 2016; Tovar Jalles et al. 2018; Gyoerk 2017; Puzzello and Gomis-Porqueras 2018; Bouvet 2021). Bahar et al. (2018) use the SCM to analyze how devaluations affect stock prices in Venezuela. Ndiaye (2020) uses the SCM to evaluate how joining the CFA-franc zone in 1997 affected growth in Guinea-Bissau, while Chamon et al. (2017) use the technique to evaluate the effects of a sterilized foreign exchange intervention on exchange rate volatility in Brazil. The SCM has also been used to evaluate the effectiveness of very specific IMF programs (Essers and Ide 2019; Newiak and Willems 2017). There are no studies to our knowledge, however, that leverage the advantages of a synthetic control method to evaluate the effectiveness of currency devaluations on growth, supported by the IMF or otherwise.6

**Empirical Methodology and Sample**

The design of the SCM is similar to that of the traditional difference-in-difference setting in so far as the goal is to find an appropriate control unit that is comparable to the treated unit (the country that is exposed to an intervention). Instead of comparing the outcome in countries subjected to a specific policy (the “treatment”) and other countries that were not, the synthetic control methodology employs a data-driven procedure to construct a counterfactual or “synthetic” unit (country in our case) which is obtained as a weighted combination of non-treated countries (called the “donor pool”). The identification assumption of the synthetic control method is that if the synthetic control unit provides a good approximation of the outcome for the treated unit in the pre-treatment period, then any subsequent difference between the treated and control units after the treatment can be attributed to the effect of the intervention (policy) on the outcome (Abadie, forthcoming). The goal of this study is to create a synthetic country that reproduces the trajectory of the income per capita in each of the CFA-zone countries pre-1994. The difference in the trajectories of income per capita between the synthetic control and real country post-1994 capture the causal impact of the IMF-supported devaluation.

The SCM has several advantages over other empirical methodologies, such as difference-in-difference and propensity score matching. First, it might be hard to find a single country that would provide a good comparison for the country affected by the treatment (Abadie 2021), where “the pre-intervention characteristics of the treated unit can often be much more accurately approximated by a combination of untreated units than by any single untreated unit” (Abadie et al. 2015). A major benefit of the SCM over longitudinal approaches based on difference-in-differences is that it limits this extrapolation bias by interpolating using a convex weighted average of the

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6 While the SCM has been widely used in applied economics papers, its ASCM extension has only recently been applied in published research. A few notable examples outside of the original paper that introduced the technique are Cole et al. (2020) who use ASCM to evaluate the impact of the Covid-19 lockdown on air pollution in China; Amador-Jiménez et al. (2020) who investigate the effects of forest fires in Colombia; and Mitre-Becerril and Chalfin (2021) who investigate the impact of the $15-minimum wage on public safety in Seattle.
untreated units to create a synthetic untreated unit with pre-treatment characteristics similar to those of the treated unit. These non-treated countries are chosen to match as closely as possible the pre-treatment characteristics of the treated country, so that in the pre-treatment period, the outcome for the synthetic unit is as similar as possible to the outcome of the treated unit.

The choice of the pre-treatment characteristics should include variables that can approximate the path of the treated country, but should not include variables that anticipate the effects of the intervention. Furthermore, the contribution of each control unit to the overall synthetic unit is explicitly presented so the transparency of the counterfactual allows one to validate the weights, whereas in comparative studies, the selection of the comparison units is not formalized and often relies on informal statements of affinity between the units affected by the event or intervention of interest and a set of comparison units.

The specific nature of the 1994 IMF-supported CFA franc devaluation lends itself to be particularly effectively studied using the SCM compared to other methods and in respect to weaknesses in the method itself. First, the devaluation of the CFA franc was imposed on the fourteen countries in the CFA franc zone, each with unique economic structures. While difference-in-difference analysis and propensity-score matching provide an estimate of the average treatment effect, the SCM, when applied to several treated units, allows for the estimation of individual treatment effects for each country, thus highlighting heterogeneity which one would not be able to identify with the two aforementioned methodologies. Second, many policy evaluation methods, including the SCM, cannot be effectively used if the policy change is anticipated. The policy event in our study, however, was not anticipated by market participants. In order to prevent a potentially damaging market reaction in anticipation of a devaluation, the IMF and participating countries were careful to keep the timing of the devaluation a secret. The January announcement was a surprise to market participants, thus mitigating any concerns of the analysis capturing such anticipation effects. Third, SCM can be challenging to implement for the analysis of macroeconomic policies which typically occur over an extended period of time (such as economic liberalization episodes studied in Billmeier and Nannicini (2013)) because it is difficult to identify when the treatment starts and ends. This is not a concern for the devaluation, as it was announced and enacted on a specific day.

While the SCM represents a considerable innovation in policy evaluation, it may not provide meaningful estimations if the outcome trajectory of the synthetic unit does not closely match the outcome trajectory of the treatment unit before the intervention (Abadie et al. 2015). Ben-Michael et al. (2021) have recently proposed a solution called the Augmented Synthetic Control Method (ASCM), for those cases where a good pre-intervention match between the treated unit and its synthetic unit is not achievable. ASCM “uses an outcome model to the objective function to estimate the bias caused by the poor pre-intervention match, and then uses this to de-bias the estimate” (Ben-Michael et al. 2021, p. 1.) The authors use a ridge-regularized linear

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7 This is indeed the case when using the SCM in this setting. These results are available on request.
regression model that allows for negative weights. These negative weights allow for extrapolation outside the support of the data, and thus help limit the interpolation bias observed with the original SCM.

To estimate the impact of the 1994 IMF-supported CFA franc devaluation on the WAEMU and CEMAC countries with the ASCM, annual country-level data from 1980-2003 are used. Out of the fourteen countries that comprise the CFA franc zone, Equatorial Guinea is excluded for lack of data and Guinea-Bissau is also excluded because it did not adopt the CFA franc until 1997. The donor pool used to construct the synthetic controls for each CFA franc country includes twenty-one developing countries. Countries in the donor pool have to be non-treated, which in our case means they did not experience a large devaluation during the pre-treatment period. To enhance the similarity with CFA-zone countries, we chose countries which had a fixed exchange rate in 1994, were low or middle-income countries according to the UN in 1994, and did not have a currency crisis in the 10 years previous and the 10 years after 1994. As pointed out in Campos et al. (2019, p. 92), “one needs to be aware of the potential dependence of our results on idiosyncratic shocks affecting countries in the donor pool”. A review of potential donor pool countries led to the exclusion of Burundi, which experienced dramatic changes in GDP per capita in the post-treatment period due to an idiosyncratic shock.

Results

Baseline

As theoretically advantageous as SCM is to evaluate the effects of the IMF-supported CFA franc devaluation, when the method was applied using this sample, the pre-treatment match was less than excellent. ASCM, on the other hand, is effective at correcting the bias and providing a much better pre-treatment match. As a result, the ASCM will be used exclusively in the empirical estimation. In this specification, the pre-intervention matching is obtained using only lagged values of the dependent variable (real GDP per capita). In Section 4b, the robustness of the baseline result is tested by adding covariates to the specification used to create the synthetic control and the corresponding weights.

The baseline results are presented in Fig. 3. Each subfigure graphically represents the difference between real GDP per capita of each CFA franc zone and their synthetic control over the study period. A positive (negative) post-treatment value

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8 In the original SCM, weights were restricted to be non-negative.
9 While the SCM method is more likely to suffer from interpolation bias, more traditional policy evaluation methods such as difference-in-difference estimators exhibit the opposite behavior: they limit interpolation bias at the potential expense of extrapolation bias.
10 Antigua, Bangladesh, Barbados, Belize, Bhutan, Botswana, Dominica, Grenada, Laos, Lesotho, Mauritius, Morocco, Namibia, Oman, Panama, St Kitts, St Lucia, Seychelles, Swaziland/Eswatini.
11 Following the crisis classification of Laveven and Valencia (2012).
12 Results are available upon request.
indicates that real GDP per capita of the CFA-zone country is higher (lower) than the income level of the synthetic control. The position of the line relative to zero before 1994 captures the quality of the pre-treatment fit reached by the ASCM algorithm: the closer to zero the line is in the pre-treatment period, the better the fit, and therefore the more confident one can be that any income difference measured post-1994 would be the result of the IMF-supported devaluation. As illustrated in Fig. 3, with the exception of Chad, the Republic of Congo, and Togo, the pre-treatment match is good.

The statistical significance of actual GDP per capita levels relative to the synthetic control are illustrated using 90% confidence intervals. For most CFA-zone countries, the 1994 IMF-supported devaluation did not result in significant improvements to the trend in GDP per capita relative to the synthetic control. GDP per capita rises above the synthetic control in Benin, Cameroon, and Mali, but only in Mali around 1996–1997 is the effect significantly different than the synthetic control. For Burkina Faso, Cote d’Ivoire, Niger, and Senegal the actual outcome is lower than the synthetic control, but not statistically different than the synthetic control.

In the Central African Republic, Chad, the Republic of Congo, and Gabon the IMF-supported devaluation is followed by a statistically significant decline in real GDP per capita relative to their synthetic control. In Chad and the Republic of Congo, the relative decline in income starts in 1987, well before the devaluation. As a result of the poor pre-treatment income match, these results are not reliable in analyzing the effect of the devaluation. In the Central African Republic and Gabon, the relative
declines in per capita income coincide with idiosyncratic shocks. In the Republic of Congo and the Central African Republic, the post-devaluation period coincides with time of political instability and violence, which would offset any potential positive effects of the IMF-supported devaluation. The three economic downturns observed in the Republic of Congo data clearly coincide with periods of intense conflicts in 1993, 1997, and 1998–1999 (Marshall et al. 2018). Similarly, in the Central African Republic, GDP per capita grows at the same level as the synthetic control in 1994, but sharply falls after 1994 and continues to remain well below the synthetic control for the remainder of the period. The Center for Systemic Peace (2020) reports an attempted coup d’état in 1996 as well as civil violence in the country from 2001 to 2003 with a successful coup in 2003. Due to the confluence of these external events to the, the synthetic control technique is not able to differentiate the effects of the IMF-supported devaluation from the conflict.

After increases in GDP per capita that match the synthetic control, Gabon experiences a dramatic drop in GDP per capita in 1997 relative to the synthetic control. Given the Gabonese economy’s dependence on oil production, the aforementioned decline in GDP per capita is likely to be attributed to the decline in the price of oil between 1997 and 1999 which bottomed below $20 ($17.58 a barrel) in November 1998. This large drop in oil prices certainly contributed to the drop in GDP per capita observed over these years and obscures the effect of the IMF-supported devaluation beyond 1997. Pre-1997, the effect of the IMF-supported devaluation did not significantly alter GDP per capita relative to the synthetic control. A rebound in oil prices by 2003 helped boost economic growth.

Robustness Tests

The estimated weights calculated for each country in creating the synthetic control are presented in Table 1. Laos accounts for a substantial non-zero weight in most countries (eight out of twelve). This is partially due to the fact that its income levels over the pre-treatment period are closer to those of the CFA-zone countries than most other countries included in the donor pool. As a robustness test, the analysis is run excluding Laos from the pool of donor countries. These new results are consistent with our baseline results: for most countries, the IMF-supported devaluation in 1994 did not cause substantial changes in the trends of per capita income relative to the synthetic control.13

As an additional robustness check, covariates are added to the ASCM specification to attempt to improve the pre-treatment match. In the SCM literature, covariates are exclusively used to find pre-treatment matches. The ASCM allows for covariates

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13 In the results excluding Laos, GDP per capita is significantly higher than the synthetic control in two cases: Mali and Burkina Faso. The pre-treatment match for these two countries, however, is not as satisfactory as in the baseline model, and thus the results including Laos are more reliable. It is worth mentioning that because economic growth in Laos remains relatively slow until 2000, the lack of substantial effects cannot be attributed to a dramatic change in the trend of the synthetic unit dominated by Laos. These results are available upon request.
Table 1 Country weights in the synthetic controls

| Country                  | Benin   | Togo    | Senegal | Niger   | Burkina Faso | CAR     | Cameroon | Mali    | Gabon   | Ivory Coast | Congo   | Chad    |
|--------------------------|---------|---------|---------|---------|--------------|---------|----------|---------|---------|-------------|---------|---------|
| Antigua and Barbuda      | -0.039  | -0.001  | 0.048   | 0.013   | -0.022       | -0.008  | 0.028    | -0.012  | -0.049  | -0.044      | -0.004  | 0.000   |
| Bangladesh               | 0.951   | 0.455   | -0.017  | 0.011   | 0.004        | 0.220   | -0.013   | 0.003   | 0.014   | -0.012      | 0.002   | 0.068   |
| Belize                   | 0.005   | 0.000   | -0.019  | 0.096   | 0.019        | 0.001   | -0.218   | 0.001   | 0.018   | -0.057      | -0.001  | 0.000   |
| Barbados                 | 0.005   | -0.001  | -0.054  | 0.057   | 0.024        | 0.015   | -0.084   | -0.008  | 0.027   | -0.025      | -0.003  | 0.000   |
| Bhutan                   | 0.000   | 0.000   | 0.000   | -0.010  | -0.005       | -0.002  | 0.119    | 0.001   | 0.004   | 0.016        | 0.001   | 0.000   |
| Botswana                 | -0.019  | 0.000   | 0.003   | -0.065  | -0.016       | -0.003  | -0.090   | -0.005  | -0.017  | 0.060        | -0.004  | 0.000   |
| Cabo Verde               | 0.002   | 0.000   | 0.797   | -0.008  | 0.000        | 0.002   | 0.102    | 0.004   | 0.004   | 0.159        | 0.001   | 0.000   |
| Dominica                 | -0.009  | 0.000   | 0.041   | -0.077  | -0.018       | -0.001  | 0.196    | -0.002  | -0.037  | 0.062        | 0.000   | 0.000   |
| Grenada                  | -0.005  | 0.000   | -0.071  | -0.002  | -0.009       | -0.015  | -0.215   | -0.011  | 0.006   | -0.048       | -0.001  | 0.000   |
| Saint Kitts and Nevis    | -0.008  | 0.000   | 0.082   | -0.071  | -0.005       | 0.004   | 0.129    | 0.009   | -0.028  | 0.095        | -0.002  | 0.000   |
| Laos                     | 0.003   | 0.000   | 0.038   | 1.001   | 1.000        | 0.781   | 0.719    | 1.002   | 0.009   | 0.583        | 0.862   | 0.932   |
| Saint Lucia              | -0.002  | 0.000   | 0.112   | -0.041  | 0.002        | 0.011   | 0.255    | 0.013   | -0.024  | 0.088        | 0.000   | 0.000   |
| Lesotho                  | 0.008   | 0.492   | -0.049  | 0.040   | 0.011        | 0.002   | -0.121   | 0.000   | 0.019   | -0.049       | 0.001   | 0.000   |
| Morocco                  | -0.003  | 0.000   | 0.063   | -0.031  | 0.000        | 0.003   | 0.145    | 0.008   | -0.009  | 0.021        | 0.001   | 0.000   |
| Mauritius                | -0.018  | -0.001  | -0.017  | -0.037  | -0.014       | -0.023  | -0.122   | -0.006  | -0.030  | -0.038       | -0.004  | 0.000   |
| Namibia                  | 0.085   | 0.054   | 0.139   | 0.077   | 0.044        | 0.035   | 0.219    | 0.026   | 0.278   | 0.278        | 0.005   | 0.000   |
| Oman                     | 0.032   | 0.001   | 0.041   | -0.003  | -0.016       | 0.015   | 0.065    | -0.002  | 0.798   | 0.014        | 0.153   | 0.000   |
| Panama                   | 0.015   | 0.000   | -0.060  | 0.024   | 0.006        | -0.005  | -0.076   | 0.009   | 0.013   | -0.035       | 0.002   | 0.000   |
| Eswatini                 | 0.000   | 0.000   | -0.014  | 0.048   | 0.006        | -0.007  | -0.053   | -0.002  | -0.002  | -0.053       | -0.001  | 0.000   |
| Seychelles               | -0.003  | -0.001  | -0.062  | -0.022  | -0.011       | -0.027  | 0.016    | -0.026  | 0.005   | -0.017       | -0.007  | 0.000   |
to be added to the lags of the independent variable if they improve the pre-treatment match (Ben-Michael, Feller and Rothstein, 2021). In choosing the potential covariates, variables that have been found to predict GDP per capita growth in the development literature are used (Abadie and Gardeazabal 2003; Abadie et al. 2015; Burnside and Dollar 2000; Acemoglu 2010; Acemoglu et al. 2005). To match across similar economic structures the agricultural share of GDP, industrial share of GDP, government share of GDP, and investment share of GDP are included. The Freedom House Index is used to match on institutional quality. A dummy variable that accounts for involvement in an IMF sponsored program in the pre-treatment period is also included.14 Every member of the CFA zone and half of the donor poll countries were involved in at least one IMF sponsored program in the pre-treatment period (1980–1993). Table 2 contains the list of all the variables used in the analysis and their data source.

The new results, including lags of the dependent variable and covariates, are presented in Fig. 4. The inclusion of covariates alters the results such that more countries have statistically significant levels of GDP per capita below the synthetic control. It also removes the significantly positive outcome in Mali.

A glance at the pre-treatment match of these results, however, suggest that they are less reliable. Table 3 illustrates the $L^2$ imbalance of the models with and without covariates and can be used as one metric to make comparisons across models. The $L^2$ imbalance is referencing the $L^2$ norm on the covariate outcome imbalance of pre-treatment outcomes between the treated unit and the weighted control mean. ASCM optimizes the pre-treatment fit and selects the appropriate weights for each country in the donor pool by minimizing a function that includes the $L^2$ imbalance. A specification with a lower $L^2$ imbalance should therefore be interpreted as providing a better pre-treatment fit, and thus as preferable. The $L^2$ imbalance score is lower for all countries without the covariates, indicating that, based on this metric, the pre-treatment match was not improved by adding covariates.

**Discussion**

The results suggest that in most CFA-zone countries, with the exception of Mali, the IMF-supported devaluation did not boost real GDP per capita relative to what national output would have been in the absence of a currency devaluation. Reinhart (1995) argues that for a devaluation to effectively reduce external balance and boost national production, two conditions need to be met: (1) the nominal devaluation needs to translate into a real devaluation to effectively improve the competitiveness of the national exports; (2) trade flows need to respond to relative prices.

Regarding Reinhart’s first condition, the 1994-devaluation did trigger downward trends in the CFA countries’ real exchange rates. Devarajan (1997) estimates the real exchange rate misalignment for most of the CFA franc zone countries pre- and

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14 Our results are robust to the use of other measures of institutional quality such as the Polity-2 index from the Polity IV Project and an index capturing episodes of political violence (societal and interstate).
| Variables            | Description                                                                 | Source                                |
|----------------------|-----------------------------------------------------------------------------|---------------------------------------|
| Real GDP per capita  | Expenditure-side real GDP per capita at chained PPPs (in mil. 2011US$)       | PennWorld Tables                      |
| Investment spending | as a % of GDP                                                               | PennWorld Tables                      |
| Government spending | as a % of GDP                                                               | PennWorld Tables                      |
| Agricultural production | as a % of GDP                                                              | World Bank Development Indicators     |
| Industrial production | as a % of GDP                                                              | World Bank Development Indicators     |
| Total Exports       | as a % of GDP                                                               | PennWorld Tables                      |
| Freedom             | Freedom House index for political rights and civil liberties. The index ranges from 1 (free) to 7 (not free) | Freedom House                        |
| IMF arrangements    | Dummy variable = 1 if the country is involved in an IMF program at time $t$; = 0 otherwise | IMF                                   |
Fig. 4 Trends in real GDP per capita: CFA franc countries vs. their synthetic counterparts, with covariates. Note: Plots of the difference between each country’s per capita GDP (in 2011 PPP US $) and its synthetic unit, with 90%-confidence intervals.

### Table 3 L2 imbalances for models without and with covariates

| Country                   | L2 (no covariates) | L2 (covariates) |
|---------------------------|--------------------|-----------------|
| Benin                     | 329.911            | 1453.517        |
| Burkina Faso              | 127.920            | 472.409         |
| Cameroon                  | 353.214            | 1478.911        |
| Central African Republic  | 170.382            | 1054.466        |
| Chad                      | 369.517            | 635.709         |
| Republic of the Congo     | 1430.407           | 4541.034        |
| Gabon                     | 3857.127           | 4221.524        |
| Cote d’Ivoire             | 90.266             | 1212.962        |
| Mali                      | 163.581            | 1560.363        |
| Niger                     | 212.509            | 1272.407        |
| Senegal                   | 213.359            | 1413.520        |
| Togo                      | 677.858            | 785.273         |

ASCM optimizes the pre-treatment fit by minimizing the L2 imbalance of pre-treatment outcomes between the treated unit and the weighted control mean. A specification with a lower L2 imbalance should therefore be interpreted as providing a better pre-treatment fit, and thus as preferable.
post-devaluation. The author finds that every country in the CFA franc zone, with the exception of Chad, was overvalued in 1993, though there is substantial variation in the magnitude of the overvaluation across countries. In the year following the IMF-supported devaluation, every country became less overvalued or undervalued in real terms. The changes in the real exchange rate, however, are not uniform. Cameroon, the Republic of Congo, Togo, and Gabon (the countries that were overvalued the most in 1993) remained overvalued, limiting the effect the IMF-supported devaluation could have on GDP. Overall, however, the IMF-supported devaluation was effective in reducing real exchange rates, meeting Reinhart’s first criteria.

The second criteria, on the other hand, is unlikely to be met. The CFA-franc zone countries exports consist primarily of commodities (Boughton 1991; Anderson Masters 2009). The demand for commodity exports is rather price inelastic (Reinhart 1995; Niemi 2004; Panagariya and Schiff 1990). Consequently, the real devaluation could only have a limited impact on export volumes, and Reinhart’s second criteria for devaluation led growth is not met.

Moreover, even if the IMF-supported devaluation had increased exports, this growth in trade would translate into significant growth in GDP only if exports accounted for a substantial portion of aggregate demand. As illustrated in Table 4, during the 1990s, exports played a minor role in most countries in the CFA franc zone. Other than Gabon with its large oil reserves, the ratio of exports to GDP is low for all countries in the sample. The low export the GDP ratio makes it difficult for a devaluation to have a strong effect on GDP, particularly when the devaluation did not lead to anticipated changes in the export structure of the countries involved (column 3 of Table 4). Most countries’ export shares of GDP stay the same or fall in the four years following the devaluation.

For those countries where trends in GDP per capita fell significantly below the synthetic control, political instability and violence offset any potential positive effects of the IMF-supported devaluation. Other deficiencies in the political and institutional environment could also be a contributing factor to the lack of

| Table 4 | Average export shares in GDP. Source: PennWorld Table 9.1 |
|---------|-----------------------------|
|         | 1989–1993 average (%) | 1994–1998 average (%) | 2010–2015 average (%) |
| Benin   | 3.33                      | 7.59                      | 4.06                     |
| Burkina Faso | 2.68                      | 3.14                      | 12.90                     |
| Cameroon | 12.16                     | 10.63                     | 9.80                      |
| Central African Republic | 7.58                  | 5.57                      | 3.65                      |
| Chad    | 2.23                      | 2.53                      | 22.10                     |
| the Republic of Congo | 4.86                 | 11.48                     | 17.40                     |
| Cote d’Ivoire | 16.56                  | 21.20                     | 28.46                     |
| Gabon   | 54.00                     | 57.07                     | 48.38                     |
| Mali    | 7.50                      | 5.61                      | 8.44                      |
| Niger   | 7.29                      | 7.63                      | 9.13                      |
| Senegal | 12.60                     | 11.43                     | 14.00                     |
| Togo    | 11.07                     | 9.71                      | 16.16                     |
significance in most countries relative to the synthetic control (Constant 2012). Using the Freedom Index as a proxy for institutional quality, presented in Fig. 5), Benin and Mali are the only two countries that were characterized as “free” in the Freedom House categorization of 1994 (and this only after a significant improvement immediately before 1994). The existence of weak institutions at the time of the devaluation certainly could have created headwinds against a successful IMF-supported devaluation.

As discussed in Section 2, the IMF-issued loans to support the CFA countries at the same time of the devaluation contingent on structural reform.\(^{15}\) Even if the devaluation itself could not generate growth due to the factors discussed above, the IMF hoped that its lending and contingent structural reforms could have generated growth.\(^{16}\) Though every country received IMF loans following the devaluation, only Benin, Burkina Faso, Gabon, Mali, and Senegal maintained their involvement in IMF programs through the duration of the post-treatment period (until at least 2005). This is an indicator that these were the only countries consistently meeting the conditions set with each loan. The remainder of the countries all had disruptions

\(^{15}\) The ASCM model cannot distinguish between the effects of the devaluation independent from the effects of the IMF support of the devaluation. The model does, however, demonstrate that the IMF-supported devaluation did not produce the growth effects anticipated when compared to the synthetic control, with the exception of Mali.

\(^{16}\) The effectiveness of IMF programs in generating growth is certainly still a question yet to be settled in the literature (Dreher 2009).

**Fig. 5** Measure of institutional quality. Source: Freedom House. Note the lower the index, the more freedom. Countries are characterized as free if index is between 1 and 2.5
in IMF lending over some period of time following the IMF-supported devaluation (IMF, MONA). Clément et al. (1996) reported that within two years of the IMF-supported devaluation, structural reform were slow and unevenly applied. Kinda and Mlachila (2011) highlight Mali and Burkina Faso as countries in the CFA franc zone that were most successful in implementing structural reforms. Using the Freedom House Index (Fig. 5) again as a proxy for institutional quality, only Senegal shows consistent improvement over the period after the IMF-supported devaluation. Benin, Burkina Faso, Chad, Cote d’Ivoire, Mali, and Togo experience improvements in their index score at least once in the first three years after the IMF-supported devaluation, but there is no consistency in these countries’ economic response to the devaluation relative to the synthetic control. Had countries completed the structural changes, it is possible these would have led to higher growth, but as the majority did not, the IMF-supported part of the devaluation was generally not effective in generating higher growth.

Mali is the only country in the sample with a GDP level significantly higher than its synthetic control after the IMF-supported devaluation. According to Devarajan’s (1997) estimates, Mali was significantly overvalued in 1993 (39% overvalued) and the IMF-supported devaluation helped bring the country closer to long run equilibrium (9% overvalued). According to Reinhart’s first criteria, this could account for some of the observed positive effect, but the real exchange rate adjustment does not stand out relative to other countries in the CFA-franc zone. Like other CFA-franc zone countries, Mali’s trade structure is dependent on commodity exports, limiting the devaluation’s effects on export volume. In addition, Mali’s share of trade to GDP is similar to the other CFA-franc countries and the increase in its share of trade to GDP from the pre-devaluation time period to the post-devaluation time period (5.61% to 8.44%) is less than or comparable to the changes observed in other CFA-franc zone countries. Differences in inflation do not differentiate Mail either, as the inflationary effects of the IMF-supported devaluation are similar relative to other countries in the sample (on par with Niger, and Senegal, but higher than Burkina Faso).

While increasing export volumes may not account for the economic growth observed in Mali, a significant increase in the value of Mali’s main exports relative to other CFA-franc countries post-1994 could potentially explained the observed economic growth. For most commodities, prices did increase in the mid-1990s. Cotton was the main export commodity for Mali in 1994. After a period of depressed prices in 1992 and 1993, international cotton prices almost doubled beginning in 1994 through 1995 (IMF 2020). The improved cotton prices certainly played an important role in what is observed in Mali, but cotton was also an important export for Burkina Faso, Cote d’Ivoire, and Chad. Each experienced similar or more favorable movements in the real exchange rate relative to Mali, but did not demonstrate as large a boost in GDP per capita.

17 Global Price Index of All Commoditieshttps://fred.stlouisfed.org/series/PALLFNFINDEXM.
18 Primary export commodities for the countries listed come from the 1994 World Factbook (CIA 1994).
Of the remaining factors that could explain the improved performance of Mali relative to the synthetic control post-1994, institutional factors are important. As stated above, Mali had a relatively strong institutional structure at the time of the IMF-supported devaluation. The institutional improvements (according to the Freedom Index) in the run-up to 1994 certainly could have contributed to higher economic growth, though Benin, Burkina Faso, Niger, and Central African Republic also had measurable improvements in the pre-1994 period without significant growth effects post-1994. Mali also continued to make structural improvements over the post-1994 period. They implemented the IMF programs, registered improvements in the Freedom Index, and were documented as progressing on structural changes (Kinda and Mlachila 2011). In any one of these measures of improvement, however, Mali is not the only country to show progress. Benin and Burkina Faso show similar improvement in institution and IMF sponsored programs, yet neither experienced significant growth over their synthetic control.\(^{19}\)

Ultimately, no single factor accounts for the significant result in Mali. It is likely explained by a confluence of a series of positive factors associated with the IMF-supported devaluation that in culmination led to growth stronger than would have been otherwise.

**Conclusions**

This paper is the first to apply the Augmented Synthetic Control Method to estimate the impact of the IMF-supported devaluation on per capita income in the twelve countries from the WAEMU and CAEMC. Our results suggest that the IMF-supported devaluation had neither significant negative effects nor significant positive effects for the majority of the countries relative to the synthetic controls. In the Republic of Congo and the Central African Republic, potential benefits from the IMF-supported devaluation were offset by deterioration in the national institutional environment. In Gabon, dependency on crude oil coupled with a large drop in the price of oil offset potential benefits of the IMF-supported devaluation. In most countries, this non-result is likely driven by the small export to GDP ratio and weak institutional frameworks that did not improve as much as hoped over the post-devaluation period. There is evidence that following the IMF-supported devaluation, Mali experienced higher GDP per capita levels than its synthetic control. Though no one factor can explain the better performance in Mali relative to the other countries, a combination of other growth-promoting factors, notably the existing political and institutional environment, continued support from the IMF, meeting IMF lending criteria, and stronger commodity prices for cotton, contributed to the relative success of the IMF-supported devaluation in this country.

Though the devaluation did not lead to significant increases in GDP per capita relative to what it would have been for most countries, the IMF-sponsored program was successful in some ways. The inflation that resulted from the devaluation

\(^{19}\) Though Benin, Burkina Faso, and Mali all experience strong growth post-1994.
was controlled within a year, some of the structural changes the IMF attached to their conditional loans used to support the countries through the devaluation were enacted, and the currency did become more competitive (van den Boogaerde and Tsangarides, 2005; Devarajan, 1997). These changes, however, did not lead to economic growth for the majority of the countries relative to what would have occurred had there been no devaluation. The non-significant results of this event when compared to a counterfactual suggests caution when citing the IMF-supported CFA franc devaluation in 1994 as a model to justify potential future devaluations as a path to greater prosperity.

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