About consolidated excises, the member states levy a specific tax on a liter or a kilogram protecting them from price fluctuations. Countries could fix the amount of the tax through the legislative authority. However, the gap between taxes per product has been limited to XOF 200 and must decrease over time in a proportion of XOF 20 per annum then the gap will be filled in ten years. About subsidies, only direct grants, through companies, undistorting competition, are allowed. The suppression of the other types of subventions within a period of seven years is advocated. At last, the allocation of the revenue mobilized to the general government budget is recommended.

In 2010, Benin was the only country which implemented the Directive. However, in 2012 Burkina Faso, Mali and Niger implemented the Community legislation. Nevertheless, the mentioned countries meet difficulties in terms of monthly price readjustments.

2.2 The Direct tax coordination in WAEMU

Three (3) Directives and one (1) Regulation [17] are related to the harmonization of business profits taxation.

2.2.1 Coordination of the Corporate Income Tax (CIT)

At this level, the texts define the scope of business profits taxation, determine the taxable profit and aim to avoid double taxation of profits. Profits on commercial, industrial, handicraft, forestry, mining and agricultural activities are taxable. The income tax rate should be between 25% and 30%. Member states should exempt from the tax base the following income sources : capital gains on business assets if the taxpayer intends, within three years, to reinvest the total proceeds from selling the assets in a WAEMU member state ; and intercorporate dividends to the extent that the holding company has a controlling interest (defined as at least 10 percent of the shares) in the payer company, and that both companies are WAEMU residents in all other cases, at least 40 percent of inter-corporate dividends should be taxable [18]. About the deductible charges from the tax base, one can distinguish : all types of overhead expenses [19] ; fees on transfers of business licenses, patents, trademark agreements, manufacturing processes and formulas, other similar rights and technical assistance fees ; tax imposed and payed during the budget year excepted the CIT and the minimum tax rate [20] ; linear depreciation ; loss and charge provisions ; interest paid to associates on the additional funds they provide besides capital share on condition that the interest rate is lower than the discount rate of the Central Bank increased by three points and the share of capital shall be fully paid up ; grants ; employer's contribution and additional funding for issuing

17. One can note the Directive N°07/2001/CM/UEMOA, the Directive N°01/2008/CM/UEMOA, the Directive N°08/2008/CM/UEMOA and the Regulation N°08/CM/UEMOA.

18. (Mansour and Rota-Grasiozi, 2013). Moreover, the exemption granted in the national sectoral codes are permitted.

19. Member states should fix a maximum amount deductible for staff expenses.

20. The member states could exclude other taxes.

or purchasing mutual fund shares whether the fund is located inside the Union ; insurance premium paid to companies located in WAEMU covering risks which could reduce the net assets of companies ; deficit of a previous financial year ; headquarters expenses ; research and prospecting costs of creation of a permanent establishment inside the Union, operating costs of the latter are deductible within the three first budget years ; accelerated depreciation, digressive depreciation and depreciation lease-financed assets are deductible under certain conditions ; Elsewhere, the member state could reinstate the charges on transfers between subsidiaries and parent companies. The implementation of a tax prepayment system is possible nevertheless the rate of the prepayment can't exceed 3% [21] ; the tax credits are carried forward or refunded according to the national legislation. About the Multilateral Tax Treaty, the principle of territoriality (which is more favourable to the territorial jurisdiction in which profits are made) is applied.

In 2010, all the member states implemented the tax prepayment system excepted Togo. In 2012, the harmonization of the taxable profit and that of the CIT rate were effective in all countries.

2.2.2 Coordination of the taxation of financial activities in WAEMU

The Directives coordinating such activities give to banks and other financial institutions the possibility to deduct allowance for bad debts from the corporate tax base according to the Central Bank prudential regulations [22]. Doubtful debt and litigious claims provisions saved by banks and financial institutions are also concerned by the deduction in accordance with banking regulation and reserves for reported claims, reserves for premium cancellation saved by life insurance holding companies as defined by the Code of the Inter African Insurance Market Conference. Countries should fix the duration of the forward carrying of losses with respect of a three years' minimum duration. The rates applied to securities income are as follows : 10% to 15% for dividend payments ; 2% to 7% for dividend payments by companies listed on a stock exchange approved by the "Conseil Régional de l'Epargne Publique et des Marchés Financiers (CREPMF)" ; 6% for income from bonds.

About income from bonds issued by government, public entities and their dismemberments, they are taxed to 3% if the term of the bond range from 5 (five) years to ten (10) years. The rate tax is 0% for the long-term bonds (with a duration higher than 10 years). Gains on the assignment of bonds cannot be taxed at a rate exceeding 5% of the amount. Incomes distributed by the Undertakings for Collective Investment in Transferable Securities and other collective investment funds are exempted besides the gains on the assignments of such institutions. The double taxation of income and gains on the assignment of securities

21. However, it should be set to 5% for companies which are not registered for tax purposes.
22. Three Directives have been elaborated to coordinate the taxation of financial activities in WAEMU namely the Directive N°05/2008/CM/UEMOA, the Directive N°02/2010/CM/UEMOA and the Directive N°02/2011/CM/UEMOA.

has been prohibited inside the Union. Elsewhere, income of Closed-end investment companies is exempted for CIT and tax on securities. However, this exemption should not exceed 15 years. Returns generated in the funds managed by these institutions and gains on securities are also exempted for at least 3 years. Concerning the gains reinvested the same budget year, they are exempted regardless the duration.
Niger and Togo were the only countries having transposed the Directive intended to coordinate securities taxation in WAEMU, in 2012 [23].

2.3 Harmonization and modernization of the information exchange systems between customs and domestic tax administrations inside the member states

A specific Directive [24] was elaborated for this purpose. The creation of an information exchange platform was advocated and those of a steering committee and a management committee ensuring the management of the platform. The steering committee should be in charge of preparing and supervising the implementation of the platform. The management committee should be in charge of the administrative management and monitoring the proper functioning of the platform. At last, the member states should cooperate with the Commission of WAEMU for its inception and operationalisation.

We don't find information about the implementation of this Directive.

3 Empirical analysis

Comparative case study allows to assess the impact of an event or policy intervention on an outcome. One (or more) unit(s) exposed to the event is (are) compared with one (or more) unexposed unit(s). This study uses the synthetic control method to analyse the effects of tax coordination in WAEMU on revenue mobilization.

The synthetic control method is a comparative case methodology using a data-drive approach for estimating the effects of treatments. The counterfactual of the treated unit "the synthetic control" is defined as a convex combination of unexposed units. Because the weights can be restricted to be positive and sum to one, the synthetic control method provides a safeguard against extrapolation. (Abadie et al. 2010). By carefully specifying how units are selected for the comparison group, the synthetic control method opens the door to the possibility of precise quantitative inference in comparative case studies, without precluding qualitative approaches to the same dataset. Moreover, in contrast to regression analysis techniques such as Mill's Method of Difference, the synthetic control method makes explicit the contribution of each comparison unit to the counterfactual of interest. This allows resear-

23. We only found information about the implementation of this Directive.
24. Directive N°02/2012/CM/UEMOA.

chers to use quantitative and qualitative techniques to analyse similarities and differences between the unit or units representing the case of interest and the synthetic control. (Abadie et al. 2015).

However, as limitations, the synthetic control method requires the use of a balanced dataset, the exclusion of units having experienced a similar event, the restriction of the donor pool to units with similar characteristics to the treated unit (to avoid interpolation biases and overfitting), the inclusion of a sizeable number of pre-intervention periods and a sizeable number of post-intervention periods under certain conditions.

3.1 Literature Review

The synthetic control method has been developed by Abadie and Gardeazabal (2003). Abadie, Diamond and Hainmueller (2010 & 2015) and Cavallo et al. (2013) extended the method [25].

Abadie and Gardeazabal (2003) presented the synthetic control method and used it to assess the economic effects of conflict on income in the Basque Country. Abadie, Diamond and Hainmueller (2010) investigated the application of synthetic control methods to comparative case studies, provided new inferential methods and applied the synthetic control method in estimating the effects of Proposition 99 (a large-scale tobacco control program that California implemented in 1988) on tobacco consumption. In another study conducted in 2015, the authors illustrated the ideas behind the synthetic control method and they assessed the economic impact of the 1990 German reunification on West Germany. Cavallo et al. (2013) expanded the synthetic control method in allowing several units to experience treatment at possibly different times and provided basic checks to see if the synthetic control serves as a valid counterfactual. They applied these extensions in treating the question of whether natural disasters affect economic growth.

A number of studies used the synthetic control method to assess the effects of different events. Montalvo (2011) analysed the electoral impact of terrorist attacks. Billmeier and Nannicini (2011 and 2013) assessed the impact of economic liberalization on growth. Hinrichs (2012) assessed the effects of affirmative action bans on college enrollment, educational attainment and college demographic composition in United States of America. Abdallah and Lastrapes (2012) studied how a constitutional amendment relaxing severe restrictions on home equity lending affected household spending in Texas. Dorsett (2013) explored the effect of conflict on income in Northern Ireland. Bauhoff (2014) measured the impact of a nutrition policy in improving adolescent dietary behaviour and reducing childhood obesity.

25. Abadie et al. (2011) provided a R package to implement synthetic control method for comparative case studies. Galiani and Quistorff (2016) extended the Stata package "synth" developed by Abadie et al. (2011). This extension "synth_runner" automates the process of running multiple synthetic control estimations and includes the expansion of Cavallo et al. (2013).

Bohn, Lofstrom, and Raphael (2014) evaluated the effect of the 2007 Legal Arizona Workers Act on the state's unauthorized immigration. DeAngelo and Hansen (2014) used the SCM in estimating the causal effect of police on crime. The study of Smith (2015) measured the impact of major natural resource discoveries since 1950 on growth. Liu (2015) evaluated the short- and long-run effects of universities on geographic clustering of economic activity, labor market composition and local productivity.

Besides the study of Abadie, Diamond and Hainmueller (2010), that of Adhikari and Alm (2016) evaluated the effect of a tax reform. The authors analyzed the impact of flat tax reform on income for eight Eastern and Central European countries that adopted flat tax systems. They also used SCM to estimate the causal effect of flat tax on the investment and employment recognized in standard economy as the possible mechanisms through which flat tax reforms affect economic performance.

3.2 Empirical Strategy

3.2.1 Single Unit (Individual Country) Treatment

Following Abadie et al. (2010 & 2015), suppose the sample includes $C+1$ units (units correspond to countries in this case). Without loss of generality, we regard $c=1$ as the treated country and $c=2$ to $c=C+1$ are potential comparisons in the donor pool (some non-WAEMU sub-Saharan African countries). We assume that all countries are observed at the same years $y=1,...,Y$. The sample includes a positive number of pre-reform years Y_0 and a positive number of post-reform years Y_1, then $Y=Y_0+Y_1$. Suppose a WAEMU member state having implemented the reform during years $Y_0+1,...,Y$ and its revenue mobilization has not been affected during the pre-reform years $1,...,Y_0$.

A synthetic control being a weighted average of the units in the donor pool, it can be represented by a $(C*1)$ vector of weights $W=(w_2,...,w_{C+1})'$ and $0 \leq w_c \leq 1$. $c=2...C$ and $w_2+...+w_C+1=1$. Each particular value of W is a synthetic control. As for the difference-and-difference method, the synthetic control method selects the value of W such that the characteristics of the treated unit are best resembled by the characteristics of the synthetic control (Abadie et al., 2015). Let X_1 be a $(k*1)$ vector composed of the values of the pre-reform characteristics of the treated country which must be matched as closely as possible and let X_0 be the $(k*Y)$ matrix containing the values of the same variables for countries in the donor pool ; X_1 and X_0 should include pre-reform values of the outcome (tax revenue). Thus, the vector X_1-X_0W corresponds to the difference between the pre-reform characteristics of the treated country and a synthetic control. The synthetic control W^* minimizing the size of this difference is selected. This can be operationalized in this way : for $m=1,...,k$ let X_{1m} be the value of the m-th variable for the treated country and let X_{0m} be a $1*C$ vector including the values of the m-th variable for the countries in the donor pool. W^* is defined by Abadie and Gardeazabal (2003) and Abadie, Diamond and Hainmueller (2010 & 2015) as the value of W minimizing :

$$\sum_{m=1}^{k} v_m (X_{1m} - X_{0m}W)^2 \tag{1}$$

v_m is a weight reflecting the relative importance we assign to the m-th variable when the discrepancy between X_1 and X_0W is measured. In this study, a cross-validation method is applied to choose v_m.

Let T_{it} be the outcome (tax revenue) of unit c at year y : let T_1 be a $(Y_1 * 1)$ vector collecting the post-reform values of the tax revenue for the treated country, then $T_1 = (T_{1Y_0+1}, ..., T_{1Y})$. Similarly, let T_0 be a matrix where column c includes the post-reform values of the tax revenue for country $c + 1$.

$T_1 - T_0W^*$, the synthetic control estimator of the effect is obtained by the comparison of post-reform tax revenue of the treated country having implemented the reform and the synthetic control. That is for a post-reform period (with $y \geq Y_0$), the synthetic control estimator of the impact of the reform is given by the comparison between the tax revenue for the treated country and the tax revenue for the synthetic control at that period.

$$T_{1y} - \sum_{c=2}^{C+1} W_c^* T_{cy} \tag{2}$$

The matching variables in X_0 and X_1 are regarded as the predictors of post-reform tax revenue. The latter are not affected by the reform. Once it has been established that the unit representing the case of interest and the synthetic control unit have similar behaviour over extended periods of time prior to the intervention, a discrepancy in the outcome variable following the intervention is interpreted as produced by the intervention itself [26]. Let T_{cy}^C be the tax revenue that would be raised by the country c in year y if this country didn't implement the reform and let T_{cy}^1 be the tax revenue that the country c would be raised if it implemented the reform in years $Y_0 + 1$ to Y. If $T_{cy}^C \neq T_{cy}^1$, this means that the reform affected the mobilization of tax revenue. Thus, the effect (α_{cy}) will be :

$$\alpha_{cy} = T_{cy}^1 - T_{cy}^C \tag{3}$$

3.2.2 Multiple Units (Whole Union) Treatment

As said earlier, Cavallo et al. (2013) expanded the synthetic control method in allowing several units to experience treatment at possibly different times. This allows to measure the effects of tax reforms for the whole Union. We proceed to this treatment as follows :

Let's consider equation (3) above, we can note :

$$T_{cy}^1 = T_{cy}^C + \alpha_{cy} \tag{4}$$

26. (Abadie et al., 2015).

Let D_{cy} be a dummy that takes the value 1 if country c implemented the reform in year y and 0 otherwise. The observed tax revenue for country c in year y is :

$$T_{cy} = T_{cy}^{C} + \alpha_{cy} D_{cy} \tag{5}$$

Given that only the first country implemented the reform and only after year Y_0 (with $1 \leq Y_0 \leq Y$), we have that :

$$D_{cy} = \{^{1 \ if \ c=1 \ and \ y \geq Y_0}_{0 \ otherwise} \tag{6}$$

The parameters of interest are $(\alpha_1 Y_0 + 1, ..., \alpha_1 Y)$; the lead specific impact of the reform on the tax revenue for $y > Y_0$,

$$\alpha_{1y} = T_{1y}^{1} - T_{1y}^{N} = T_{1y} - T_{1y}^{N} \tag{7}$$

T_{1y}^{1} being observed, to estimate α_{1y} we need only to come up with an estimate for T_{1y}^{N}. Let consider a $(C * 1)$ vector of weights $W = (w_2, ..., w_{C+1})'$ such that $w_c \geq 0$ for $c = 2, ..., C+1$ and $w_2 + w_3 + ... + w_{C+1} = 1$. Each value of the vector W represents a potential synthetic control, that is a particular weighted average of control countries in the donor pool. Let Z_c be a $(r * 1)$ vector of observed predictors of tax revenue (not affected by the reform). Suppose that there exists a set of weights $(w_2^*, ..., w_{c+1}^*)$ which satisfies the equality $\sum_{c=2}^{C+1} w_c^* = 1$ such that :

$$\sum_{c=2}^{C+1} w_c^* T_{c1} = T_{1,1} \tag{8}$$

$$\sum_{c=2}^{C+1} w_c^* T_{c1} = T_{1,Y_0} \tag{9}$$

$$\sum_{c=2}^{C+1} w_c^* Z_c = Z_1 \tag{10}$$

Following Abadie et al. (2010), let use $\hat{\alpha_{1y}} = T_{1y} - \sum_{c=2}^{C+1} w_c^* T_{cy}$ as an estimator of α_{1y}. The systems of equations in (8) (9) and (10) can hold exactly only if $(T_{1,1}, ..., T_{1,Y_0}; Z_1')$ belongs to the convex hull of $[(T_{2,1}, ..., T_{2,Y_0}; Z_2'), ..., (T_{C+1,1}, ..., T_{C+1,Y_0}; Z_{C+1}')]$.

3.2.3 Inference

Statistical Inference in synthetic control methods consists in conducting "placebo studies". We can distinguish "in time placebo tests" testing if the synthetic control method also estimate large effects when applied to dates when the intervention did not occur (Heckman and Hotz 1989). There is also "in-space placebos" used in the studies of Abadie and Gardeazabal (2003), Abadie et al. (2010 & 2015). This is a non-parametric method testing if the distribution of placebo effects yields many effects as large as the main estimate, then it is likely that the estimated effect was observed by chance (Galiani and Quistorff, 2016).

Cavallo et al. (2013), following the same idea, compared the treated country main effect

to the distribution of placebo effects in computing a lead-specific significance level (two-sided p-value) for the event.

$$p - value = Pr(|\hat{\alpha}_{1y}^{PL}| \geq |\hat{\alpha_{1y}}|) = \frac{\sum_{C \neq 1} 1(|\hat{\alpha_{cy}}| \geq |\hat{\alpha_{1y}}|)}{C} \tag{11}$$

Recall that $\hat{\alpha_{1y}}$ is the estimated effect for the post-reform period ; $\hat{\alpha}_{1y}^{PL} = \hat{\alpha_{1y}}$ is the distribution of corresponding in-place placebos.

We can determine the one-sided p-value for positive effect as follows :

$$p - value = Pr(\hat{\alpha}_{1y}^{PL} \geq \hat{\alpha_{1y}}) \tag{12}$$

3.2.4 Data and sample

1. **Variables**

   The sample includes Sub-Saharan African countries (for whom we obtained data on tax revenue and that we deem appropriate) [27] to reduce interpolation biases. The impact analysis is done for the Whole Union [28] and for the member states independently [29]. We assess the effects of the tax reforms, for the **overall tax revenue** [30] and for the different groups of taxes independently namely the **indirect tax**, the **direct tax** and the **trade tax**. In this way, each type of tax is used as outcome variable besides the overall tax revenue [31]. All these revenues are expressed in percentage of GDP. As predictors, we employ : **GDP per capita** and **Broad Money** given that an important income supposes a wide tax base, on the other hand, the level of development is favourable to the tax performance due to its positive correlation with education and in this way to the performance of tax collectors, the level of development may also act on tax compliance knowing that demand for public infrastructure increases with the level of development ; **Openness** due to the fact that is it easier to tax trade than domestic transactions ; moreover, it may act positively on the productivity of domestic producers and in this way, it may increase the tax base ; **Agriculture value added** : the agriculture revenue is hard to tax in developing countries in which subsistence agriculture informal remains widespread, we employ it as a dummy of shadow economy which affects negatively the tax collection ; **Resource tax** is regarded as a determinant of non-resource revenue mobilization due to the fact that resource depending countries put less effort to collect tax because they rely on the

27. The list of countries is available in the appendix (Table 2).
28. We didn't include Benin for this treatment, find further information below about dataset completion.
29. The treatment has been conducted also for Benin.
30. This concerns only the non-resource tax revenue. In fact, we excluded the resource tax revenue due the exogeneity of such revenue. As said by Brun, Chambas and Mansour (2014), the government resource revenue is largely exogenous, as it depends primarily on the existence of natural resources and on changes in the price of these resources which except for large producers are external to the country. Nevertheless, the latter is used as predictor given its importance may affect the non-resource revenue mobilization.
31. The source of data is available in the appendix.

revenue generated by the exploitation of natural resources ; Additionally we use the **Aid per capita**, this variable may affect the revenue mobilization in two ways : first the dependence to Aid may negatively affect the intention of countries to mobilize domestic resources, however Aid provided as technical assistance may be favourable to countries tax management and thereby the tax performance ; **Gini Index** : inequality may influence the tax compliance in the country and create social unrests unfavourable to the revenue collection ; **Debt service** : a higher debt service may encourage countries to mobilize resource given that they must refund the service besides the interest. **Population growth**, this variable is a proxy of the need in public infrastructure in a country thus, it should act positively on its revenue mobilization. **Corruption**, this phenomenon may affect negatively the tax performance, first due to the embezzlement of public funds, second because it may prompt tax agents to delay the processing of the applications of the good taxpayers and at last it may act on the tax compliance. **Internal Conflict** representing an assessment of political violence(namely civil war, coup threat, terrorism, political violence and civil disorder) in the country and its actual or potential impact on governance. It has an ambiguous effect on tax performance given it may encourage governments in mobilizing resources to buy arms on the other hand the unrests that it causes may be harmful to the tax performance. We include the average first half trend of the outcome in addition to the set of covariates [32].

2. **Dataset completion**

   The use of synthetic control method requires a balanced dataset, thus we put efforts to balance the dataset. We completed the data on openness for Ethiopia from 1992 to 2010 with the dataset of UNCTAD [33]and we reported the value of 1992 for the years 1990/1991. The data on Aid per capita were not available for South Africa for the years 1990/1992 and those on Debt service for the years 1990/1993, here again just report the data available for the most recent year namely 1993 and 1994. Data on corruption and internal conflict were not available for some countries such as Benin, Burundi, Cabo Verde, Comoros, Lesotho, Mauritius, Rwanda and Swaziland. We excluded these countries from the sample for treatments on the whole Union and those of the individual member states except for that on Benin [34].

3. **Period**

   Estimations are done over the period 1990/2010. The pre-reform and post-reform periods differ between the type of tax and they have been chosen according to the issuing of Directives by the Commission of WAEMU [35].

32. With such a restriction on the outcome lags, other covariates with predictive power for explaining the dependent variable receive positive weights in order to build the-now differently weighted-synthetic control unit (Kaul et al., 2016).

33. United Nations Conference on Trade and Development.

34. We assess the effects of Tax reforms in Benin without add corruption and internal conflict to the set of predictors. Table (3) and Table (4) in the appendix present the descriptive statistics respectively for the whole sample including Benin and those of the restrained sample.

35. We are aware that it would be more relevant to define the reform period as the year in which countries

About the domestic indirect tax, we define as first reform period the year following the issuing of first Value-added tax and excises Directives namely 1999. In this way, the pre-reform period is 1990-1998 and the post-reform period range from 1999 to 2010. Following Cavallo et al. (2013), Kaul et al. (2016), we didn't include entire pre-reform path of the outcome variable as economic predictors to allow the synthetic control to replicate the counterfactual trajectory [36]. Thus, we include the period 1990/1994.
We define the year 1996 (knowing that corresponds to the adoption of a transitional trade regime regulating the intracommunity trade) as the starting of tariffs coordination in WAEMU. Thereby the pre-reform period for this tax is 1990-1995 and the post-reform period 1996/2010 ; we use the period 1990/1992 outcome trend to match the affected country with the control countries.
Concerning the direct tax, we identify the year 2009 (that follows the issuing of the first direct tax coordination Directive in 2008). The pre-reform period for this tax is 1990-2008 and the post-reform period 2009/2010 ; we use the period 1999-2008 outcome's trend to match the affected country with the control countries.
At last, for the overall tax, we define the reform period as that following the adoption of the first domestic tax Directive. In this way, it corresponds to that of the indirect tax. So, as for the domestic indirect tax, we use the period 1990-1994 outcome's trend to match the affected country with the control countries.

4 Results

4.1 Fiscal Impact of the Tax Coordination in WAEMU

As explained in the previous section, we assess the effects of the tax coordination in WAEMU for the whole Union and for each member state independently. Results will be presented for the overall tax and for the different types of taxes. Overall, we find a significant impact of the harmonization process on the revenue mobilization.

4.1.1 Impact of the Tax Coordination on the overall tax revenue mobilization

As shown in figure 1 below, the tax revenue mobilization in the Union has been affected by the reforms undertaken by the member states. In fact, the predicted p-values (expressing the significance level of the tax reforms) are significant for the years 1999, 2000, 2005, 2006, 2007 and 2010 [37]. This means that the estimated effects for these years haven't been observed by chance at least at the 10% threshold. Concerning the statistical significance (expressed by the one-sided p-values) for the positive effects of the tax coordination, we don't find a

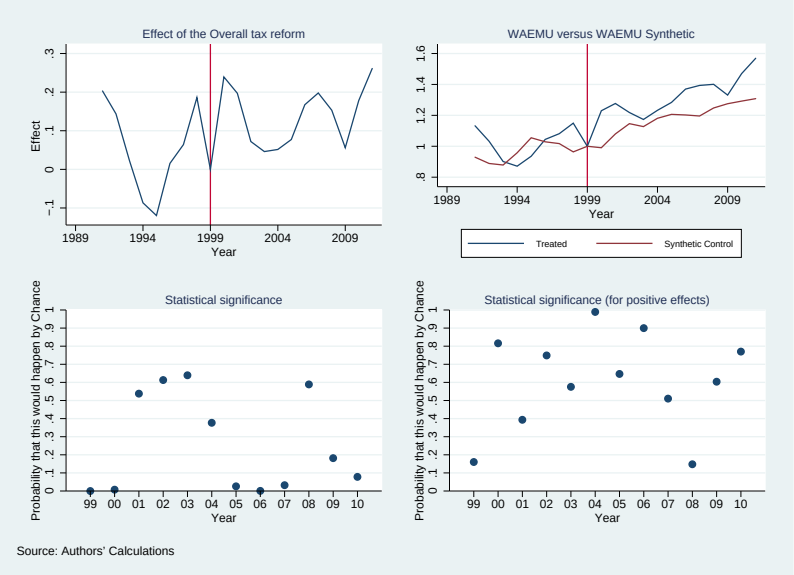
implemented the law at least de jure. The real dates of reforms are unknown even if we know the statement of the adoption by countries in 2012 as explained earlier. This is the main limit of the study.

36. Kaul et al. (2016) show that including all pre-intervention values of the outcome as economic predictors implies that only the pre-treatment fit with respect to the variable of interest is optimized.

37. Recall that the restrained sample includes all WAEMU member states excepted Benin for whom the ICTD dataset doesn't provide indicators of corruption and internal conflict.

positive effect even if the average level of the non-resource taxes to GDP increased from 10.34 to 12.88 in GDP percentage before and during the reform period [38].This result is not surprising, due to the fact that the WAEMU countries spelt out a tax transition in the purpose to reduce the share in revenue collection of the trade taxes toward less distortive taxes namely domestic taxation more favourable to the trade. In this way, one can argue that the main challenge for these countries was to stabilize the level of the tax revenue. Thereby, a deeper analysis by type of tax will be more relevant to assess the impact of the tax reforms. About the quality of the treatment itself, we obtained a e(avg-pre-rmspe-p) [39] of 0.05 representing the proportion of placebos that have a pretreatment Root Mean Squared Predictive Error (RMSPE) at least as large as the average of the treated unit. It is too low, this explains the lack of fit between the path of the overall tax outcome for the Union and its synthetic counterfactual in the pre-treatment period. [40]

FIGURE 1 – Impact of Tax Reforms in WAEMU*



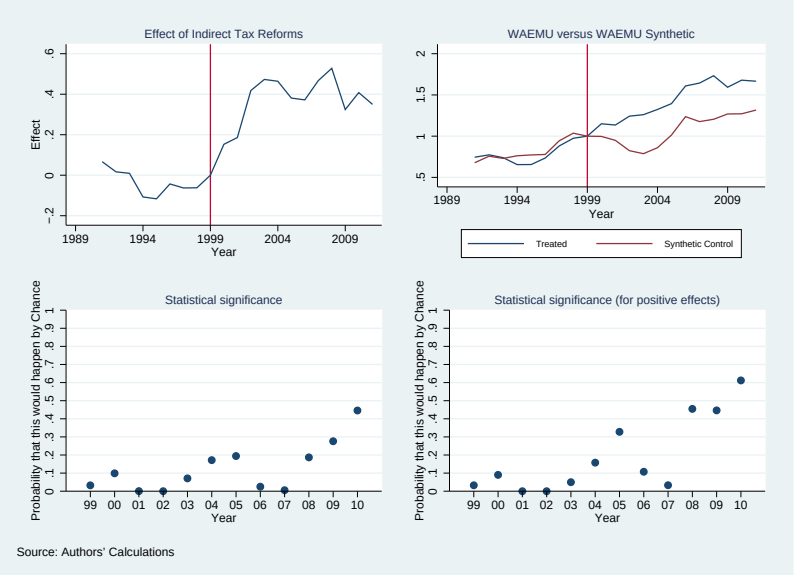
4.1.2 Impact of the Tax Coordination on the Domestic Indirect taxes mobilization

We find a positive significant impact of the coordination for the first five post-reform years (1999/2003) as for the years 2006/2007 [41]. The lack of significance for the year 2008 may result from the measures (subsidies and exemptions) undertaken by some countries in response to the food and energy price crisis of 2006-2008 to head off and contain social unrests besides the presence of multiple rates VAT systems approved by the VAT Directives. A per country analysis will allow to have a clear and accurate view of the situation. Even if the domestic indirect tax coordination in WAEMU is criticised, some of its member states

38. See figure 5 in the appendix.
39. These statistics are available in Table 5 in the appendix.
40. WAEMU* = WAEMU without Benin.
41. See Figure 2.

are renowned to have a good value-added tax productivity. Brun and Diakité (2016) found a high value-added tax effort in WAEMU comparatively to some other developing areas. The quality of the treatment is better than those of the overall tax with a e(avg-pre-rmspe-p) of 0.79.

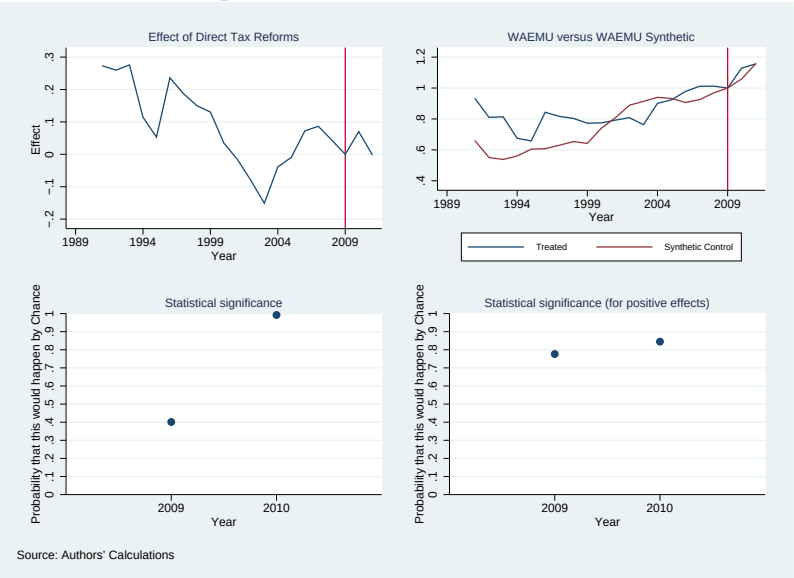
FIGURE 2 – Impact of Domestic Indirect Tax Reforms in WAEMU*



4.1.3 Impact of the Tax Coordination on the Direct taxes mobilization

The direct taxes coordination in WAEMU started in the year 2008 by the Directive N°01/2008/CM/UEMOA defining a common corporate tax base. It does not seem to have affected the revenue mobilization (Figure 3). This is not surprising, given that the direct taxes' Directives have not resolved the crucial problem of the tax exemptions granted by countries to attract the foreign direct investments. In fact, as said earlier, the WAEMU direct taxes' Directives allow countries to adopt sectoral codes (mining, petroleum...) which could be used as tax competition instruments and they are, by this way, harmful to the coordination. The tax coordination framework may have had the unintended effect of contributing to the fragmentation of policies at the national level by providing countries with the incentive to enact special tax regimes outside their tax laws. This is particularly the case of investment incentives, where the framework allows unfettered tax competition as long as it is done outside countries' main tax laws. This, in turn, has made tax systems opaque, increased their complexity, and contributed to a culture of "tax negotiation". (Mansour and Rota-Graziosi, 2013).

FIGURE 3 – Impact of Direct Tax Reforms in WAEMU*



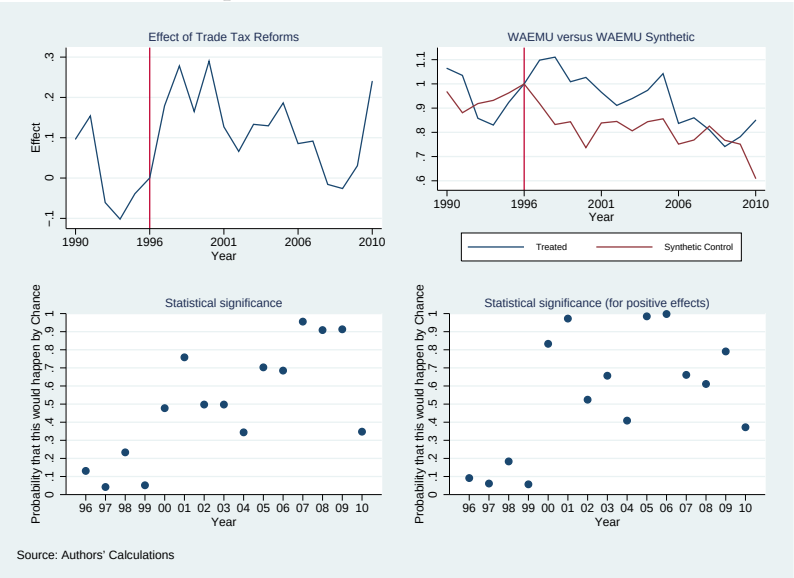
4.1.4 Impact of the Tax Coordination on the Trade taxes mobilization

Tariff reforms in WAEMU had a significant effect on trade taxes mobilization just for the first post-reform years. However, this result is not surprising. In fact, one could expect that the tariff reforms through liberalization leaded in a fall of the tariff revenues, but these revenues just ranged from 3.41 to 3.12 in GDP percentage in average from the pre-reform period to the post-reform period. This may be explained by the low share of intraregional trade in WAEMU [42]. In addition, the taxation of natural resources exports (such as that of the single export tax on cocoa (DUS) by the Cote d'Ivoire) allows collection of an important tariff revenue namely for the periods of increasing in price and demand.

Here again,the proportion of placebos that have a pretreatment Root Mean Squared Predictive Error (RMSPE) at least as large as the average of the treated unit is high(97%) what is reassuring about the quality of the treatment.

42. The study of Goretti and Weisfeld (2008) shows that the share of intraregional trade in WAEMU was relatively stable at about 11 percent of total trade from 2000 through 2006.

FIGURE 4 – Impact of Trade Tax Reforms in WAEMU*



4.2 Individual Impacts of Tax Coordination in WAEMU

The WAEMU Treaty mandates the convergence of the ratio of tax revenue-to-GDP to the threshold of 20% [43] and the convergence of tax revenue structures. However, as shown in table 1 below (figures represent the average tax revenue for each member state after the adoption of the tax transition program), the tax coordination in WAEMU could have different effects on member states' tax performance. First, because the level of coordination de jure and de facto is different between countries. Second, due to the fact that they differ in economic structure, natural endowment and in efficiency to mobilize revenue. So, an individual assessment of the effect of the tax coordination by country may be useful.

TABLE 1 – Average WAEMU member states tax revenue to GDP (2007/2010)

Country	Direct Tax	Trade Tax	Indirect Tax	Non-resource Tax	Resource Tax
Benin	3.76	5.06	7.98	16.80	0
Burkina Faso	3.07	2.10	6.89	12.27	0
Cote d'Ivoire	5.23	4.11	5.59	16.51	1.20
Guinea-Bissau	2.16	1.77	2.47	6.84	0
Mali	2.68	1.91	6.34	12.30	2.41
Niger	2.78	2.20	5.39	11.18	2.52
Senegal	4.62	3.05	9.88	18.32	0
Togo	3.69	3.81	7.31	15.54	0

Source : Mansour(2014) and authors' calculations.

4.2.1 Impact of the Tax Coordination in Benin

Regarding the results displayed in figure 6 in the appendix, the tax reforms have not affected the overall tax revenue mobilization in Benin. However, it appears that the reform

43. Additional Act N°01/2015/CCEG/UEMOA.

had significant positive effects on the domestic indirect taxes collection from 2001 to 2003. As for the whole Union, there is no effect for the direct taxes revenue. An important point highlighted by the predictions is the fact that we observe an impact of the reforms on the trade tax collection in Benin just for the first post-reform year.This is probably due to the proximity of Benin with Nigeria. Benin has capitalized on its strategic geographical location with respect to Nigeria to improve its tariff revenue through re-exports. It is the only country where this source of revenue increased significantly since 1995 in tandem with an increase in VAT revenue. (Mansour and Rota-Graziosi, 2013).
The domestic indirect taxes- synthetic Benin corresponds to the convex combination of Uganda (59%), Guinea (30.10%), Botswana (10.6%) and Cabo Verde (0.3%).

4.2.2 Impact of the Tax Coordination in Burkina Faso

According to our estimation, there was no significant impact of the reforms on the overall tax collection. In fact, we predicted positive effects from 2001 to 2008 but they are not significant [44]. However, we obtain significant effects of the domestic indirect tax reforms for the years 2002 and 2004 and the effect is positive for the year 2002. The low significance of the domestic indirect tax reforms in Burkina Faso may be related to its value-added tax performance. Brun and Diakité (2015) studying the value-added tax gaps for a large sample of African countries, found that the VAT base of Burkina Faso is narrow due to the exemptions granted by the country. The share of exempted goods reached 64.16% for the year 2011. We find any significant impact of the tariff and direct tax reforms.
The domestic indirect taxes- synthetic Burkina Faso is the convex combination of Uganda (48.3%), Botswana (40.2%), Ethiopia (5.9%) and Sierra Leone (5.6%).

4.2.3 Impact of the Tax Coordination in Cote d'Ivoire

As for the two previous countries, we don't observe an impact of the tax reforms on Cote d'Ivoire's overall tax mobilization [45]. Even for the domestic indirect taxes revenue, we find a significant impact just for the year 2005. The same case occurs for the direct taxes. The lack of significance for Cote d'Ivoire may be due at the same time to the de facto application of the Directives and to the misperformance of the country in terms of revenue mobilization. Having the higher tax potential in the Union [46], Cote d'Ivoire as other resource depending countries, put less effort to collect tax namely value-added tax. The low VAT revenue productivity in Cote d'Ivoire is partly due to its high export share in GDP (oil, Cocoa and coffee) [47]. About the tariff reforms, they had significant effects on the revenue mobilization along the post-reform period. The effects are positive for the years 1997 and 2004. The positive impact in 1997 may be related to the increase in cocoa price this year

44. See figure 7 in the appendix.
45. See figure 8 in the appendix.
46. Brun and Diakité (2016) estimated the non-resource potential of Cote d'Ivoire to 23.34 in GDP percentage for the year 2010.
47. Mansour and Rota-Grasiozi (2013).

given that the Cote d'Ivoire taxes the cocoa exports as said earlier.
The domestic indirect taxes- synthetic Cote d'Ivoire corresponds to the convex combination of South Africa (68.1%) and Gambia (31.9%).

4.2.4 Impact of the Tax Coordination in Guinea Bissau

Guinea Bissau has not set the WAEMU tax reforms in a large extent. As said earlier, it is the only country in the Union whom has not adopted a value-added tax regime. The reforms that we are confident this country set, is the tariff reforms to be conform to the Customs Union requirements. We find any significant effect of the trade tax reforms. Having similar Direct taxes systems with the other WAEMU member states, we don't observe a significant impact for the period following the reforms [48].
The trade taxes- synthetic Guinea Bissau corresponds to the convex combination of Ethiopia (37%), Nigeria (30.4%), Sierra Leone (25.6%), Tanzania (4.7%) and Kenya (2.3%).

4.2.5 Impact of the Tax Coordination in Mali

Once again, We don't find a significant impact of the reforms on the overall tax collection [49]. The domestic indirect tax reforms affected positively the revenue collection from 2002 to 2004. Following that period, we observe a relative decrease of the indirect taxes to GDP ratio and the same case occurs for the overall tax revenue given that the indirect taxes reached 43% of the overall tax revenue. Thus, the lack of significance for this post-reform period may be related to this fall in revenue collection. The latter is due to the measures (tax exemptions) undertaken by Mali in response to the food and energy price crisis of 2006-08. To contain the food price crisis, the government of Mali, in July 2007 granted VAT exemption for powder milk and edible oil for two a two months' period. Furthermore, in 2008, Mali exempted the rice importation (for VAT and trade taxes), (Diarra, 2013). Elsewhere, the reforms didn't affect the direct tax and tariffs revenue collection.
The domestic indirect taxes- synthetic Mali corresponds to the convex combination of Ethiopia (34.1%), Zambia (23.3%), Ghana (19.9%), Gambia(18.9%) and Nigeria (3.9%).

4.2.6 Impact of the Tax Coordination in Niger

Niger observed any effects of the tax reforms on its tax revenue mobilization even for the domestic indirect tax reforms [50]. This is not surprising, given that with Cote d'ivoire, Niger has the less productive value-added tax in the Zone. Brun and Diakité (2015) found an effective VAT rate [51] of 8.42% for Niger which is very low comparatively to a standard rate of 19% for the year 2011. The exemption gap of the country reached to 60.86. The decrease in trade taxes mobilization and the misperformance of the Niger in terms of indirect taxes

48. See figure 9 in the appendix.
49. figure 10 in the appendix.
50. See figure 11 in the appendix.
51. It is the total burden of VAT expressed as a percentage of total final consumption (Borselli et al., 2012).

collection make necessary an improvement of the tax administration in Niger to achieve the tax transition.
The overall tax- synthetic Niger is the convex combination of Nigeria (41.5%), Ethiopia (35.2%), Gambia (15.4%) and Guinea (7.9%).

4.2.7 Impact of the Tax Coordination in Senegal

According to the predicted results, the tax reforms affected the revenue collection in Senegal just for the domestic indirect taxes [52]. We find a statistical significance of the domestic indirect reforms throughout most of the post-reform period (2000/2010). The effects are positive for the periods (2001/2003, 2005/2009). Senegal is known in having a productive tax system. Since 2004, it meets the convergence criteria mandated by the WAEMU Commission about the tax revenue-to-GDP ratio whom must reached at least 17% [53], so one can conclude that the country succeed its tax transition. Senegal's revenue performance is impressive and almost entirely linked to the VAT and excises, which account for over 50 percent of tax revenue. Senegal seems to have progressed best in transiting from tariffs to domestic tax revenue. Mansour and Rota-Graziosi (2013).
The domestic indirect taxes- synthetic Senegal corresponds to the convex combination of Uganda (52.6%), Madagascar (15%), Mozambique (13.3%), South Africa (8%), Sierra Leone (6.8%) and Zambia (4.3%).

4.2.8 Impact of the Tax Coordination in Togo

As for the majority of WAEMU member states, we obtain a significant impact of the domestic indirect tax reforms on the revenue mobilization in Togo [54]. However, there is a significant effect just for the year 2007. Until 2010, Togo had not reached the convergence criteria of the WAEMU with a ratio of tax-revenue to GDP of 15.68 which is largely below of its non-resource tax potential predicted for the same year (20.62) [55]. About the direct tax reforms' effects, the same case encountered for the other WAEMU member states occurs, the reforms haven't affected the direct taxes revenue mobilization. Tariff reforms affected significantly the revenue collection in Togo namely during the periods 1997/1998 and 2002/2004.
The domestic indirect taxes- synthetic Togo corresponds to the convex combination of Nigeria (54.9%), Botswana (36.7%) and Ethiopia (8.4%).

5 Robustness check

To check the robustness of our results, namely the significant impact of WAEMU tax reforms on revenue mobilization, we conduct an additional analysis. In fact, we restrict the donor pool to countries having implemented Semi-Autonomous Revenue Authorities (SARA).

52. Figure 12 in the appendix.
53. The 2015 Additional Act N°01/2015/CCEG/UEMOA increased this ratio at 20%.
54. Figure 13 in the appendix.
55. Calculations of Brun and Diakité (2016).

The idea behind that is to compare WAEMU countries with the most performing countries knowing that SARA are implemented by countries for revenue performance improvement purposes. The analysis is conducted for the overall tax reform and the domestic indirect tax reform independently given that the latter has proven successful according to the above results. We include countries where the Law on SARA implementation passed before the starting of the domestic indirect tax reforms in WAEMU. In this way, the control units are limited to Ethiopia, Kenya, Rwanda, South Africa, Tanzania, Uganda and Zambia [56]. Furthermore, these countries having no borders with the WAEMU member states, this allows to limit spatial spillover effects occuring when countries adopt good practices of their neighbors and causing interpolation biases.

As shown in figure 14 in the appendix, through the restricted sample, we find a positive significant effect of the overall tax reform in WAEMU for the year 2003. This significant positive effect is found in the predictions of some countries such as Benin, Burkina Faso, Senegal and Togo. About the domestic indirect tax reforms, these additional estimations attest their positive effects on revenue mobilization (Figure 15). In fact, we find significant positive effects of the reform throughout most of the post-reform period (2000/2010) for the whole Union and it is the same for Senegal. The impact of the reform is significant for the other member states except Burkina Faso.

Overall, the significant impact of tax reforms in WAEMU, namely the domestic indirect tax reforms, has been affirmed through these additional analysis.

Conclusion

The purpose of this study was to assess the quantitative impact of the tax coordination in WAEMU. This has been realized through a comparative case study using the synthetic control method. We estimated the impact of the harmonization on the overall tax productivity and for the different types of tax. These results have been predicted for the whole Union and for each member state. We find that the harmonization of tax legislation affected the revenue mobilization in WAEMU. The effects are significant mainly for the domestic indirect tax reforms. In fact, we find that, the domestic indirect taxes revenue mobilization in a large number of WAEMU member states namely Benin, Burkina Faso, Cote d'Ivoire, Mali, Senegal and Togo (as for the whole Union) has been affected by the reforms and the effects are positive in general for the first years following the 1998 reforms. The impact of trade tax reforms is not obvious due to the low share of intraregional trade in the Union. About the direct tax coordination, it does not seem to have affected the revenue mobilization. This lack of significance is mainly due the exemption granted by countries in the sectoral codes to attract investments and these practices are approved in the WAEMU Community legislation on taxation. The domestic indirect tax mobilization is also affected by the granting of exemption causing the misperformance of countries such as Niger and Cote Ivoire which

56. We found information on SARA implementation in the study of Sarr(2016). This information is available in Table 7 in the appendix

evolved far from their potential. At last, we can state that the tax coordination in WAEMU has proven its worth namely concerning the domestic indirect taxation. However, a revision of the Community legislation to reinforce the convergence between national tax legislation and limiting the tax expenditures is required to allow countries to mobilize resources for financing development.

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Appendix

Table 2 – Sample

Benin	Guinea	Rwanda
Botswana	Guinea-Bissau	Senegal
Burkina Faso	Kenya	Sierra Leone
Burundi	Lesotho	South Africa
Cabo Verde	Madagascar	Swaziland
Comoros	Mali	Tanzania
Cote d'Ivoire	Mauritius	Togo
Ethiopia	Mozambique	Uganda
Gambia	Niger	Zambia
Ghana	Nigeria	

Table 3 – Descriptive Statistics (WAEMU)

	Observation	Mean	Standard deviation	Min	Max
Non-resource taxes to GDP	609.00	13.72	7.16	2.22	59.36
Resource taxes to GDP	609.00	1.64	5.29	0.00	32.30
Indirect taxes to GDP	609.00	4.98	2.39	0.03	11.50
Direct taxes to GDP	609.00	3.85	2.51	0.42	15.03
Trade taxes to GDP	609.00	4.33	4.94	0.30	40.30
Gini net	609.00	42.90	7.47	28.38	61.84
GDP per capita	609.00	1292.37	1648.62	160.32	8000.38
Openness/GDP	609.00	66.12	32.75	16.77	209.89
Agriculture value added/GDP	609.00	29.04	14.71	2.03	65.97
Aid per capita	609.00	76.55	80.11	-16.67	693.34
Debt service/GDP	609.00	0.03	0.04	0.00	0.68
Population growth rate	609.00	2.51	1.11	-6.34	7.99
Money(M2)/GDP	609.00	29.32	17.22	2.07	102.21
Corruption	441.00	2.55	0.93	0.00	5.00
Internal Conflict	441.00	8.22	2.06	0.25	12.00

TABLE 4 – Descriptive Statistics (WAEMU*)

	Observation	Mean	Standard deviation	Min	Max
Non-resource taxes to GDP	441.00	11.78	4.28	2.22	25.24
Resource taxes to GDP	441.00	2.25	6.10	0.00	32.30
Indirect taxes to GDP	441.00	4.81	2.31	0.48	10.77
Direct taxes to GDP	441.00	3.52	2.48	0.42	15.03
Trade taxes to GDP	441.00	2.91	1.68	0.30	9.44
Gini net	441.00	41.99	6.69	28.38	60.08
GDP per capita	441.00	1129.42	1556.63	160.32	7504.97
Openness/GDP	441.00	58.04	18.36	16.77	131.49
Agriculture value added/GDP	441.00	30.92	13.77	2.03	65.97
Aid per capita	441.00	62.05	42.22	1.83	365.00
Debt service/GDP	441.00	0.03	0.04	0.00	0.68
Population growth rate	441.00	2.72	0.73	-0.91	5.86
Money(M2)/GDP	441.00	26.26	12.44	2.07	84.83
Corruption	441.00	2.55	0.93	0.00	5.00
Internal Conflict	441.00	8.22	2.06	0.25	12.00

FIGURE 5 – Tax revenue in WAEMU before and during tax coordination

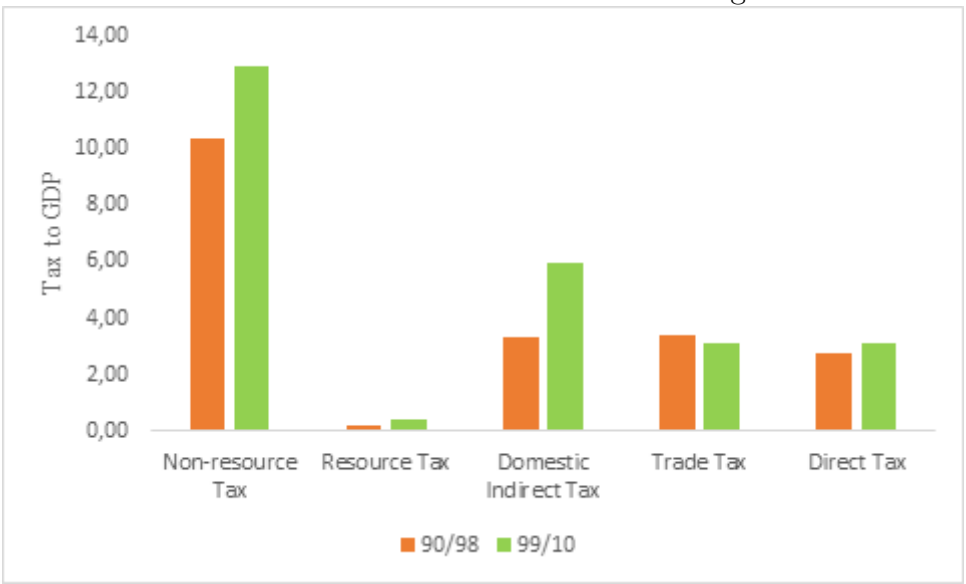


TABLE 5 – Results

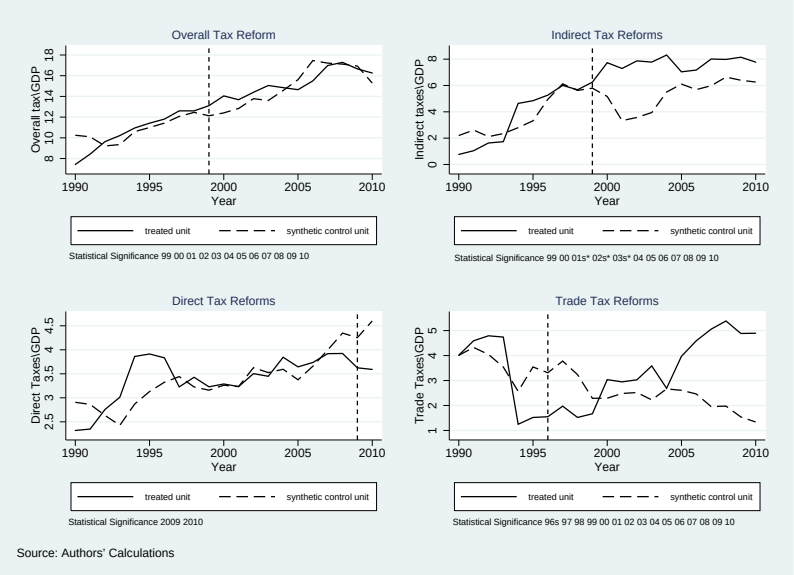
Area	Tax	e(n-pl)	e(n-pl-used)	e(pval-joint-post)	e(pval-joint-post-std)	e(avg-pre-rmspe-p)
WAEMU*	OT	77907648	1000000	0.04	0.98	0.05
	DIT	5597956	1000000	0.23	0.26	0.79
	DT	90892256	1000000	0.85	0.96	0.22
	TT	105413504	1000000	0.68	0.16	0.97
Benin	OT	21	21	1	0.95	.67
	DIT	21	21	0.29	0.38	0.24
	DT	21	21	0.33	0.19	0.67
	TT	21	21	0.52	0.95	0.14
Burkina Faso	OT	14	14	0.79	.071	1
	DIT	14	14	0.36	0.14	0.79
	DT	14	14	0.57	0.29	0.64
	TT	14	14	0.79	0.64	0.93
Cote d'ivoire	OT	14	14	1	0.5	1
	DIT	14	14	0.43	0.57	0.36
	DT	14	14	0.93	0.93	0.5
	TT	14	14	0.14	0.07	0.21
Guinea Bissau	DT	14	14	0.57	0.71	0.21
	TT	14	14	0.57	0.36	0.57
Mali	OT	14	14	0.86	1	0.21
	DIT	14	14	0.14	0.21	0.5
	DT	14	14	0.36	0.07	0.86
	TT	14	14	1	1	0.57
Niger	OT	14	14	1	1	0.79
	DIT	14	14	1	1	0.5
	DT	14	14	0.79	0.79	0.5
	TT	14	14	0.79	0.64	0.86
Senegal	OT	14	14	1	1	0.79
	DIT	14	14	0	0	0.36
	DT	14	14	0.64	0.21	0.86
	TT	14	14	0.71	0.86	0.36
Togo	OT	14	14	0.86	1	0.14
	DIT	14	14	0.36	0.79	0.14
	DT	14	14	0.64	0.79	0.21
	TT	14	14	0.29	0.86	0.14
Robustness check						
WAEMU*	OT	46656	46656	0.90	0.59	0.97
	DIT	46656	46656	0	0	0.63
Benin	OT	7	7	0.57	0.43	1
	DIT	7	7	0.29	0.86	0
Burkina Faso	OT	6	6	0.83	0.33	1
	DIT	6	6	0.83	1	0.33
Cote d'ivoire	OT	6	6	0.67	0.17	1
	DIT	6	6	0	0.33	0.33
Mali	OT	6	6	0.67	1	0.33
	DIT	6	6	0.5	0.17	0.83
Niger	OT	6	6	0.67	0.67	0.33
	DIT	6	6	0.33	0.5	0.17
Senegal	OT	6	6	0.5	0.17	1
	DIT	6	6	0	0	0.83
Togo	OT	6	6	0.33	0.67	0
	DIT	6	6	0.33	0.83	0

TABLE 6 – Adoption of Semi-Autonomous Revenue Authorities

Country	Year the Law was passed
Ethiopia	1997
Kenya	1995
Rwanda	1997
South Africa	1997
Tanzania	1996
Uganda	1991
Zambia	1994

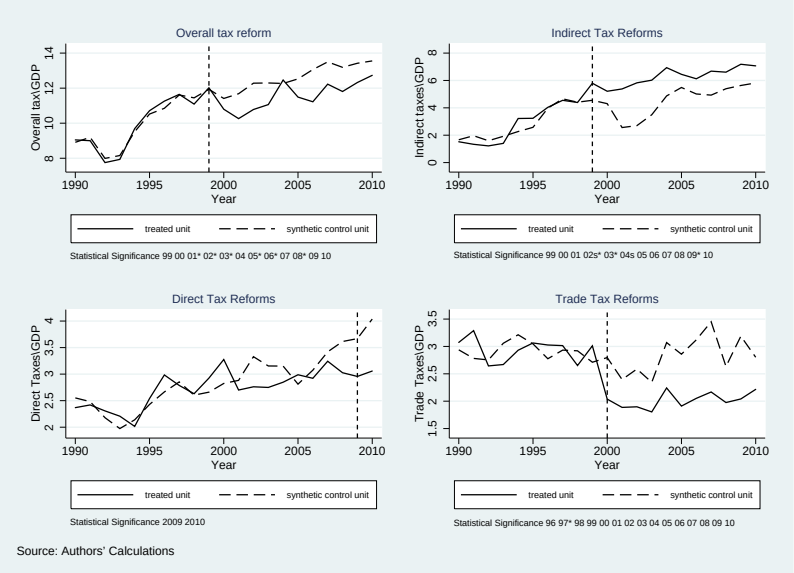
Source : Sarr(2016)

FIGURE 6 – Impact of WAEMU Tax Reforms in Benin



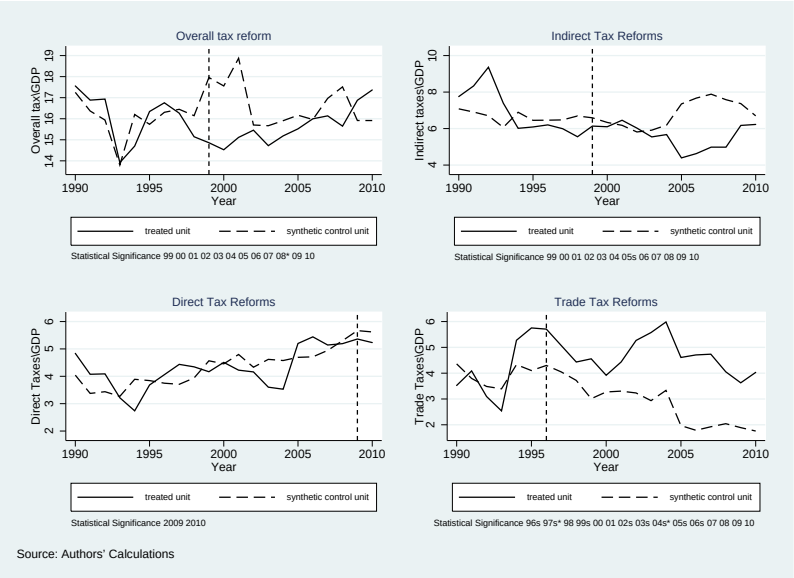
Source: Authors' Calculations

FIGURE 7 – Impact of WAEMU Tax Reforms in Burkina Faso



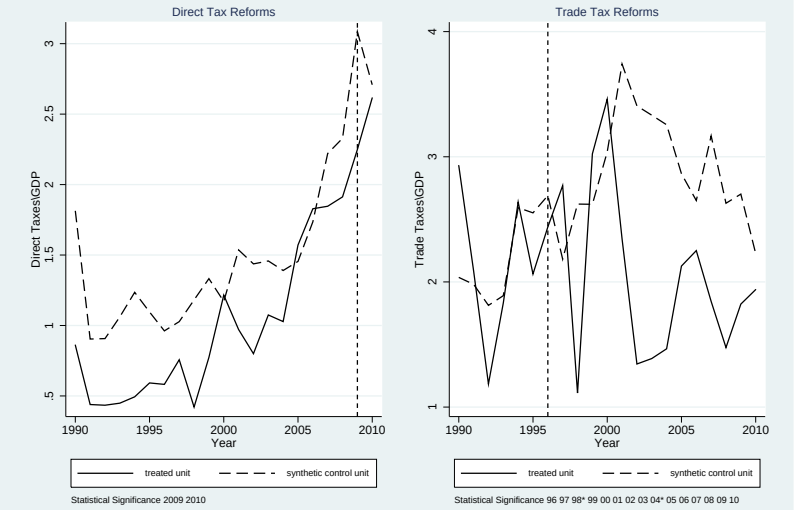
Source: Authors' Calculations

FIGURE 8 – Impact of WAEMU Tax Reforms in Cote d'Ivoire



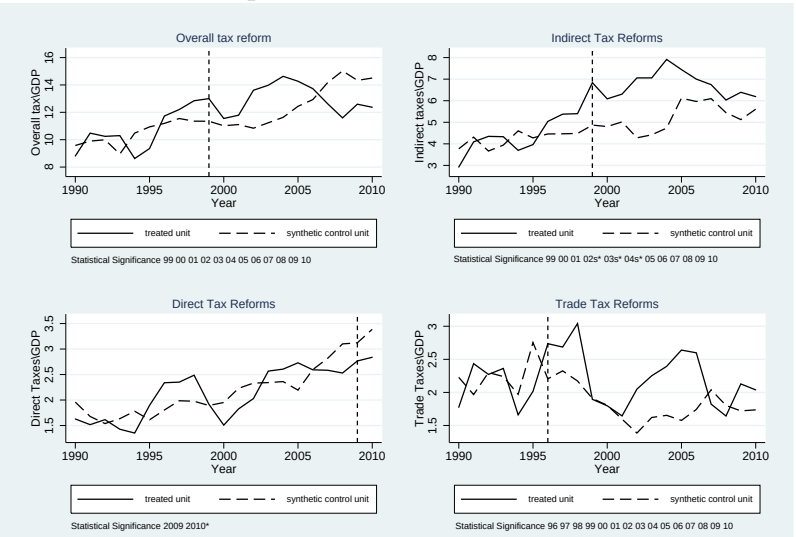
Source: Authors' Calculations

FIGURE 9 – Impact of WAEMU Tax Reforms in Guinea Bissau



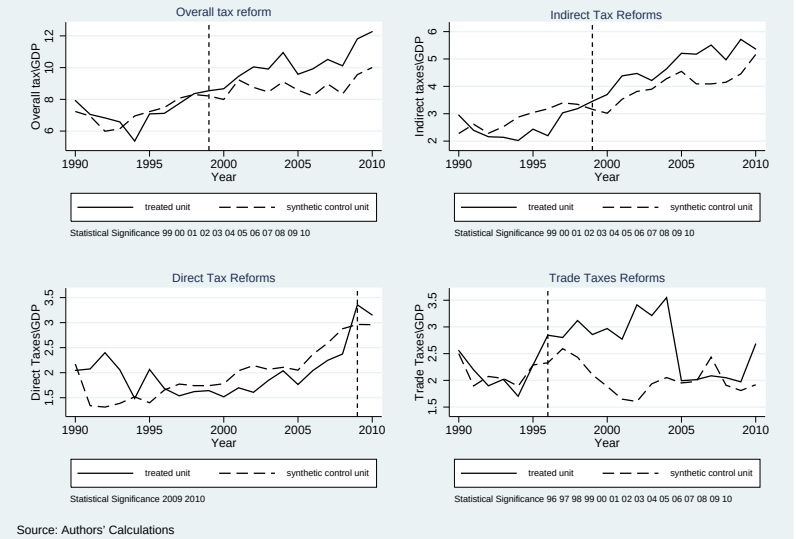
Source: Authors' Calculations

FIGURE 10 – Impact of WAEMU Tax Reforms in Mali



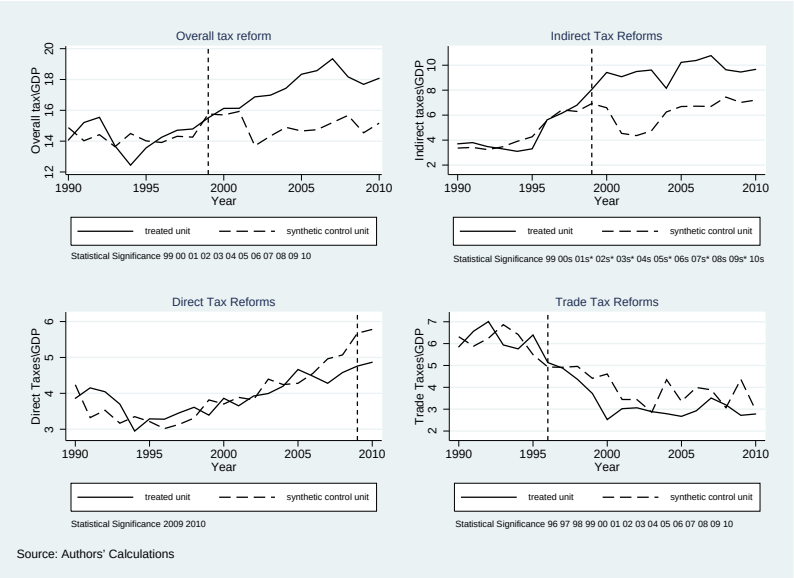
Source: Authors' Calculations

FIGURE 11 – Impact of WAEMU Tax Reforms in Niger



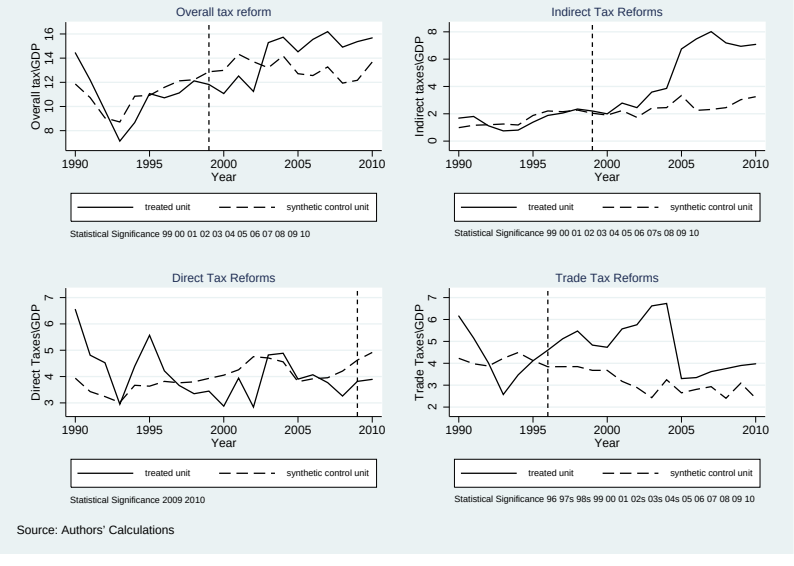
Source: Authors' Calculations

FIGURE 12 – Impact of WAEMU Tax Reforms in Senegal



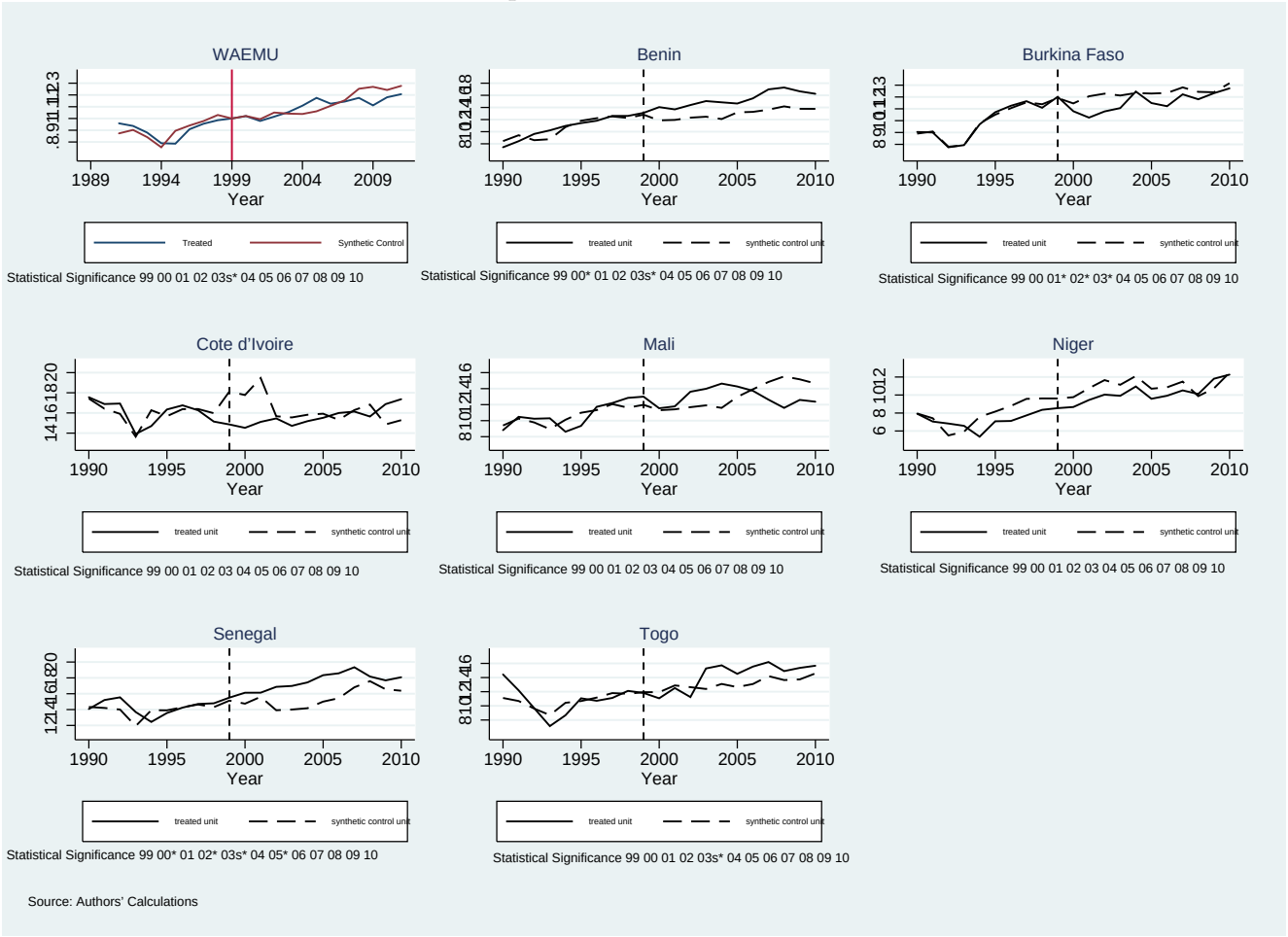
Source: Authors' Calculations

FIGURE 13 – Impact of WAEMU Tax Reforms in Togo



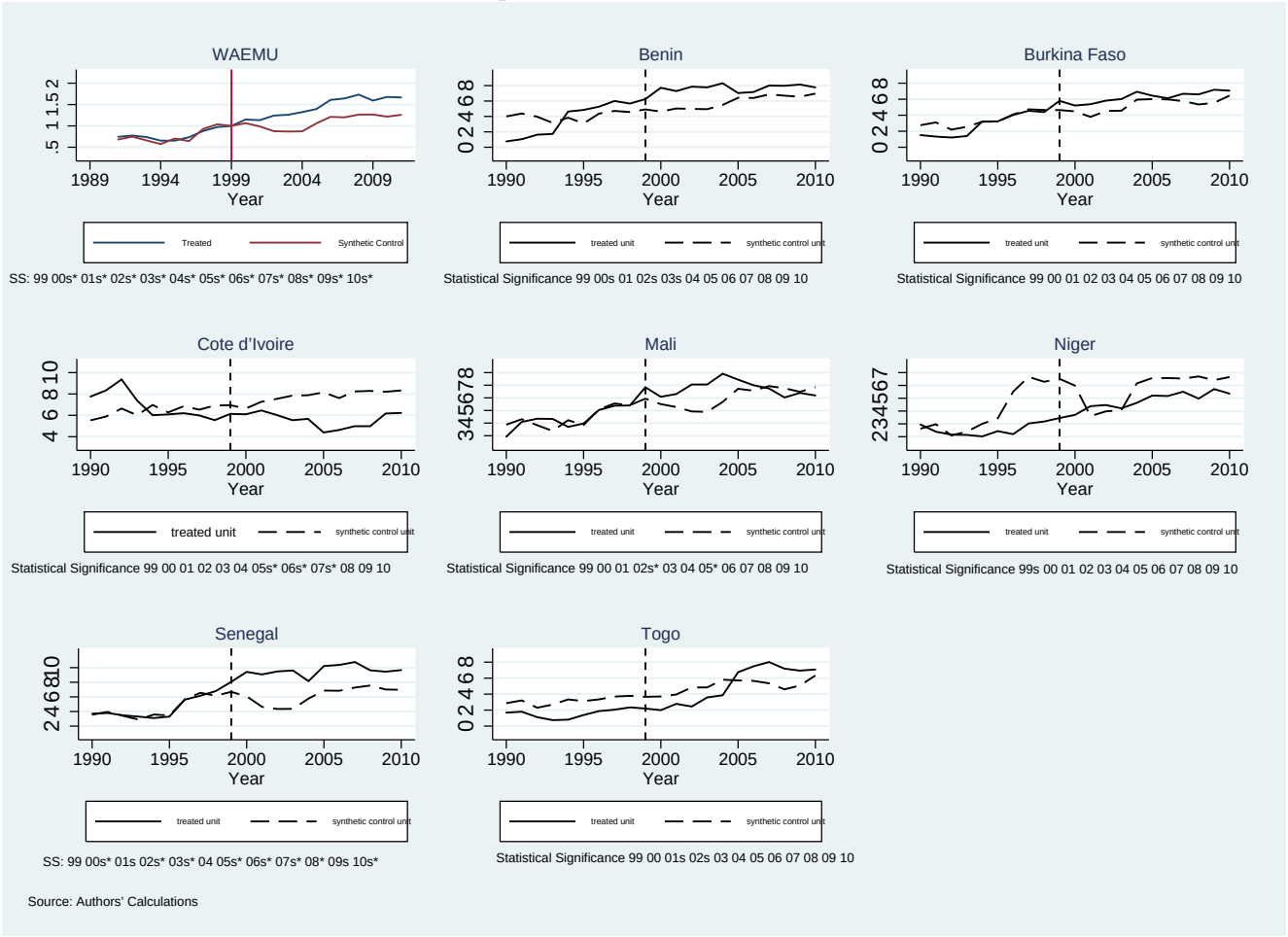
Source: Authors' Calculations

FIGURE 14 – Impact of the Overall Tax Reform



Source: Authors' Calculations

FIGURE 15 – Impact of the Indirect Tax Reforms



Source: Authors' Calculations