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The effectiveness of tax incentives in attracting investment: panel data evidence from the CFA Franc zone

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Abstract In this paper we investigate to what extent tax incentives are effective in attracting investment in Sub-Saharan Africa. We test the neo-classical investment theory prediction that tax incentives, by lowering the user cost of capital, raise investment. Next to tax incentives, we also estimate the impact on investment of other investment climate variables that are under direct control of the government, such as the transparency and complexity of the tax system, and the legal protection of foreign investors. In developing countries these variables might be as important as or even more important than the tax variables themselves.

Therefore, we analyze the policy changes in tax incentives and in the other investment climate variables for 12 CFA Franc Zone countries over the period 1994–2006. Because of their common currency (the CFA Franc) and common language (French) these countries constitute an exceptional basis of comparison to evaluate their 'policy experiments'. The use of panel data econometrics with fixed country and year effects allows us to isolate the impact of the policy changes on investment, as if it were a difference in differences analysis with multiple policy changes.

We find no robust positive relationship between tax holidays and investment in the CFA Franc zone. However, increasing the number of legal guarantees for foreign investors and reducing the complexity of the tax system helps to attract investment.

Keywords Tax incentives · FDI · Developing countries · CFA Franc zone

JEL Classification H21 · H25 · H26 · H32 · F21

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1 Introduction

Many developing countries use tax incentives to promote investment. By applying reduced corporate income tax rates, granting periodic exemptions on corporate taxes (tax holidays), allowing extra investment deductions from tax liabilities (through tax credits or investment allowances), etc. to certain economic activities governments try to reallocate or attract domestic and foreign mobile capital. Despite valuable intentions the use of tax incentives in developing countries is controversial. The use of tax incentives may bring along important costs for the country. Not only financial costs such as foregone revenue and administrative costs, but, if not carefully designed and implemented, also welfare costs through inefficient allocation of capital. Moreover, concerning the benefits, it is unclear to what extent tax incentives are effective in attracting investment.[1]

The literature on the effectiveness of tax incentives for investment has primarily focused on industrial countries. However, the results for developed countries cannot simply be generalized to the developing world. The use of tax incentives and in particular tax holidays is very widespread in developing countries, and in Sub-Saharan Africa in particular.[2] The poor performance of tax administrations and the high compliance costs for investors may disturb the effectiveness of tax incentives. The lack of legal guarantees for investors and a poor general investment climate are other reasons to evaluate the effectiveness of tax incentives in developing countries more carefully. Moreover, the possible contribution of investment—and in particular FDI—to growth and development in Africa justifies a closer look at this region. FDI is not only an important source of finance in this region with low income levels and domestic savings; it can also provide spillovers of knowhow and technology to the region.[3]

Only a few studies have investigated the impact of tax incentives on real investment outcomes in developing countries. For example, Wells and Allen (2001) find that there was no significant change in investment after the removal of the tax holiday in Indonesia in 1984; Klemm and Van Parys (2009) find a positive effect of tax holidays on FDI in some cases but not on fixed capital for a panel of 47 developing countries in Latin America, the Caribbean and Africa over the period 1985–2004.

The controversy that still exists among policy makers in developing countries and policy advisers in international institutions such as the World Bank and the IMF concerning the costs and the benefits of the use of tax incentives, the persistently low tax revenues in many developing countries especially in Sub-Saharan Africa,[4] and the little empirical evidence on the costs and benefits of incentives motivate us to answer the call for feeding the debate with more empirical evidence.

[1] Good overviews on the costs and benefits of tax incentives can be found in Shah (1995), OECD (2001), Zee et al. (2002), and Klemm (2010).

[2] Keen and Mansour (2009) state that tax incentives are much more widespread in SSA today than they were in the 80s, that CIT holidays are the most common form of incentives, and that CIT rates are not low by international standards.

[3] Good studies that focus on FDI in Africa are Naudé and Krugell (2007), Asiedu (2002) and Morisset (2000).

[4] Non-resource tax revenue in Sub-Saharan Africa remained stable at a low 13% to 14% of GDP over the period 1980–2005 (Keen and Mansour 2009).

In this paper we provide evidence of the effectiveness of tax incentives in 12 CFA Franc Zone countries in West and Central Africa over the period 1994–2006. During this period, nine countries changed their tax incentives once, the Central African Republic changed twice while Mali and Togo underwent no change. These policy experiments allow us to assess the impact of changes in the tax incentives on investment. For the sample countries the tax incentives are part of the investment code. In many cases changes in tax incentives are accompanied with other changes in the investment code, such as changes in the complexity of the tax incentives, the administrative procedure to qualify for certain incentives, or the legal guarantees for investors. We also include these 'non-tax' changes in our empirical analysis. Not only to rule out their omitted variable bias but also because their impact on investment is of interest on its own.

To assess the impact of the investment climate on investment we define four variables constituting the observed changes in the investment code: (i) the number of years of corporate income tax holiday for a regular investment projects, (ii) the number of years of corporate income tax holidays related to exporting firms, (iii) an index for the legal guarantees for investors, and (iv) an index of the complexity of the design of the tax incentives.

Investment is defined as aggregate FDI inflow or gross private fixed capital formation.

We treat the typical endogeneity problem of evaluating non-random policy changes by including fixed country effects and controlling for time-varying country characteristics.

We find no convincing evidence of the effectiveness of tax holidays on investment. However, we do find that reducing the complexity of the tax incentives significantly increases investment, measured as FDI inflow. The number of legal guarantees has a significant positive impact on incoming FDI but not on fixed capital formation. The fact that legal guarantees are particularly designed for foreign investors while fixed capital formation also includes domestic investment explains this result.

The major contribution of this paper is threefold. First, our focus is on African countries, for which there is very little empirical evidence[5] on the effectiveness of tax incentives, despite their widespread use. The Ernst and Young tax guides "FFA" allowed us to track the changes in the investment codes for 13 years. Second, the 12 countries of our dataset are relatively comparable. For over 40 years they share the same currency. The fixed exchange rate of the CFA Franc to the French Franc (and later on the Euro) since 1994 has brought monetary and relative economic stability. The countries are also culturally similar since they are all French speaking and former colonies of France. The relative homogeneity of this set of countries helps us better isolate the impact of policy changes in some countries while taking other countries as controls. Third, next to the changes in tax incentives we also include the accompanying (non-tax) changes in the investment code. The latter turn out to be most significant for investors.

[5]The only one we found is Cleeve (2008). This study uses a panel dataset but the data on tax incentives do not vary over time. The pooled regression results point to a positive effect of tax incentives on FDI.

In section two of the paper we review the theoretical and empirical literature on which this paper builds. Section 3 informs about the general institutional characteristics of the CFA Franc zone and defines the variables used in the analysis. We explain the estimation methodology in Sect. 4 and show the results and robustness checks in Sect. 5. We end with a discussion of the results and the conclusions in Sect. 6.

2 Theoretical background and literature review

2.1 Theoretical background

A large part of the tax literature is dedicated to the impact of tax policy on investment. The most widely used framework to evaluate the effects of tax on investment is the neo-classical investment theory, pioneered by Jorgenson (1963). The basic argument goes that firms accumulate capital as long as the benefits exceed the costs. With decreasing returns the firms will invest up to the point where the net present value of the cash flow from the capital equals the cost. As a result the pre tax rate of return on the marginal investment project is defined as the cost of capital. To assess the effect of corporate taxes on investment, one needs to assess the impact of taxes on the cost of capital. If a tax change lowers the cost of capital it is assumed that it raises investment. According to this theory it suffices to calculate the impact of tax changes on the cost of. This has given rise in the literature to the calculation of marginal effective tax rates (METRs). The calculation of METRs allows assessing the impact of several tax parameters (such as the statutory tax rate, investment allowances, tax credits etc.) on the cost of capital.

Some characteristics of developing countries make the impact of tax changes on the cost of capital more complex. One is the extensive use in developing countries of tax holidays. Mintz (1995) points to the ambiguous impact[6] of tax holidays on the cost of capital depending on the duration of the investment, the evolution of the revenues and the extent to which the invested capital is deductable.

Another characteristic is the high compliance cost of taxes in developing countries. The compliance burden depends on the complexity of the tax system, the transparency of the application of the tax laws and regulations, and the predictability and credibility of the tax system and authorities (OECD 2001). High compliance costs can make the benefits of tax incentives redundant. Therefore, they should be accounted for in the calculation of METRs. The time and administrative costs to navigate through the complex tax system and to fulfill formal requirements should be added as a cost factor or deducted from the investment revenue, increasing the METR. The uncertainty about the just implementation of the tax laws and the unpredictability of the tax system certainly drive the hurdle rate of return to capital that an investor requires before investing.

[6] If the objective of the country is to encourage investment in durable capital, the effectiveness of the tax holiday is ambiguous. If a firm must write off tax depreciation allowances during the holiday, the firm may face a relatively high effective tax rate if the allowances that remain after the holiday are inadequate in relation to the income-generating capacity of the asset.

As a result, in our empirical analysis we try to control for these factors by adding two variables proxying the complexity and transparency of the incentives and the legal protection offered to investors.

The neo-classical investment theory assumes that once it is shown that the tax change lowers the user cost of capital, it automatically raises investment. Recently, the New Economic Geography[7] (NEG) theory has shown that this direct relationship should not be taken for granted. The typical core-periphery NEG models emphasize the role of business concentration that is self-reinforcing leaving the world with a core region (often referred to as the north) that attracts all mobile activities and a periphery region (the south) with only basic activities. In this world policy shocks, such as tax changes, at least along some range have no effect on investment because of the stickiness of capital in the core.[8]

For this reason, we believe it is important to investigate the direct link between tax and investment, and not only calculate the impact of tax on the cost of capital.

2.2 Empirical literature

Many scholars have tested the predictions of the neo-classical investment theory by estimating equations that are directly derived from the model. They proceed in two steps. First, they need to assess the impact of corporate tax on the cost of capital and second, they need to estimate the impact of the cost of capital on investment.

For developing countries, only the first step has been taken through the calculation of METRs before and after the change in tax policies.[9] The calculations of the METRs are very useful because they reveal to what extend tax incentives reduce the cost of capital for various incentives including tax holidays. They have been calculated for many countries.[10] The main shortcoming however is that they do not continue to the second step of measuring the impact of the changed cost of capital on investment. In line with the neo-classical investment theory they assume that if tax incentives lower the user cost of capital they automatically raise investment. As a result they provide no evidence on actual investment outcomes.

Estimating the second step directly from the theoretical model requires firm level data since the theory starts from the profit maximizing behavior of the firm. Because of the availability of these data this strand of literature has primarily focused on reforms in the US tax system,[11] and not on developing countries. Hassett and Hubard

[7] For an excellent overview of the policy implications of NEG models, see Baldwin et al. (2003) "Economic Geography and Public Policy". For a good summary with respect to the implications of NEG for tax and investment, see OECD (2001) p. 40.

[8] For example, Devereux et al. (2007) show that the effectiveness of fiscal incentives depends on the presence of agglomeration externalities. Grants are more effective in attracting plants in regions where the investors find more existing plants in their industry.

[9] See for example Chaps. 7–13 of Shah's 1995 book "Fiscal Incentives for Investment and Innovation".

[10] Such as Brazil, Malaysia, Thailand, Central and Eastern European countries and Mexico.

[11] Arnold and Schwellnus (2008) provide a recent firm level data study assessing the impact of change in tax (incentives) on investment in the OECD.

(2002) provide an overview of this literature and conclude that recent empirical research is consistent with the negative relationship between the cost of capital and investment, predicted by neo-classical models.

Besides testing the neo-classical theory directly, a lot of studies have used more *ad hoc* specifications to estimate the sensitivity of investment to changes in the tax system in industrialized countries. Instead of firm level data they use aggregate investment data.[12] Particularly popular are studies on taxation and FDI. De Mooij and Ederveen (2003) review this literature and find a median tax rate elasticity of foreign capital of −3.3. However, they find substantial variation in the in the studies depending on the chosen specification, the definition of FDI (mergers and acquisitions had a lower elasticity then fixed capital investment), the tax measure[13] (higher sensitivity of FDI to effective tax rates than to statutory tax rates), etc. These results are very useful although they do not focus on the effectiveness of particular tax incentives. A few papers that do focus on particular incentives in developed countries investigate effectiveness of tax credits in attracting R&D[14] and the effectiveness of Special Economic Zones.[15]

Concerning developing countries and incentives, major contributions can be found in Shah's 1995 book "Fiscal Incentives for Investment and Innovation". Next to calculations of METRs, it evaluates the implementation of certain tax incentives in production structure models[16] and Computable General Equilibrium (CGE) models.[17]

In the absence of reliable tax and investment data, opinion surveys to investors have provided useful insights. Two well-designed recent investor surveys are done by Bolnick (2009) for Mozambique and Nguyen et al. (2004) for Vietnam. However, even if well designed, the results of surveys should be interpreted with care. "An objective assessment of the effect of tax measures is not possible since they do not provide data on observed behavior before and after a policy change" (Shah 1995, p. 95).

Despite the valuable contribution of the above studies, studies providing evidence of the impact of tax incentives on investment using real investment data in developing countries are very scarce. Wells and Allen (2001) investigate the elimination of tax holidays in Indonesia in 1984. Comparing the growth rates of foreign investment inflows and the number of projects approved between the period before and after this "natural experiment", they find no significant difference.

Klemm and Van Parys (2009) provide evidence on the effectiveness of tax holidays and investment allowances on investment using a dataset of 47 developing countries over the period 1985–2004. They find that tax holidays in some cases help to attract FDI while investment allowances do not. Moreover they find that countries compete on tax holidays and not on investment allowances.

[12] Good examples are Slemrod (1990), Swenson (1994), Benassy-Quere et al. (2005).

[13] It is not clear which tax measure is preferable. For example, in case of lumpy investment the average tax rate is more relevant than the marginal rate.

[14] E.g. Bloom et al. (2002).

[15] E.g. Bondorio and Greenbaum (2007).

[16] Chapters 14–16 of Shah (1995).

[17] Chapters 17–18 of Shah (1995).

3 Data and institutional background

3.1 Institutional background

The CFA Franc zone consists of the 14 member countries of the West African Economic and Monetary Union (WAEMU)[18] and the Communaute Economique et Monetaire de l'Afrique Central (CEMAC).[19] The zone's countries share important cultural and economic characteristics. Culturally, they all speak the same language, French,[20] and they are all former colonies of France. Guinea-Bissau and Equatorial Guinea are left out due to a lack of data.

WAEMU and CEMAC are considered a monetary union since they share the same currency, the CFA Franc.[21] In order to sustain the common exchange rate with the Euro[22] and to provide monetary certainty, there is a convertibility guarantee by the French Treasury and a set of legal, institutional and policy requirements (Gulde and Tsangarides 2008). After the 1994 devaluation,[23] both unions acknowledged the need to strengthen real and financial integration among their member countries. Key elements were an agreement on macroeconomic convergence criteria designed to help coordinate macroeconomic policies, and phased abolition of trade restrictions within each union and the creation of regional common markets. It also led to a reflow into the zone of the capital that had fled in anticipation of the exchange rate (Gulde and Tsangarides 2008). The exchange rate has not been adjusted since 1994, a good argument to take this year as the starting point of our analysis. Thanks to the exchange rate regime and the common monetary institutions the zone has achieved lower inflation and more macroeconomic stability than other countries in Sub-Saharan Africa.

Even though the common cultural and institutional characteristics of the CFA Franc Zone countries and their willingness to deeper integrate provide us with a unique basis for comparison, we are aware of the differences between and within WAEMU and CEMAC. Because of few transportation links between the countries and (non-)tariff barriers between the unions, trade between the unions is low. The seam-side of the fixed exchange rate is the regional shifts in the terms of trade. As for economic activity, average per capita income in 2006 in WAEMU was less then half the CEMAC level. Between the countries, per capita income ranged from 262 USD in Niger to 7282 USD in Gabon. Differences in income levels reflect historically higher average growth in CEMAC since the 80s. The main export product in all CEMAC

[18] WEAMU consists of Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo.

[19] CEMAC consists of Cameroun, the Central African Republic, Chad, the Republic of Congo, Equatorial Guinea and Gabon.

[20] French is an official language in all countries except Guinea-Bissau, which is left out of the analysis because of lack of data.

[21] Officially both unions have their own currency, but the name is the same (CFA Franc) and they have the same fixed exchange rate with the euro (since 1994, one Euro is 655.957 CFA Franc). They also have separate Central Banks (the BCEAO for WAEMU and the BEAC for CEMAC) which are responsible for the conduct of monetary policy beyond the exchange rate.

[22] Before being pegged to the Euro, the CFA Franc was pegged to the French Franc, which was in turn pegged to and part of the European Currency Unit (ECU) since 1979.

[23] The CFA Franc of WAEMU and CEMAC were both devalued by 50 percent.

countries except the Central African Republic is petroleum while WAEMU mainly exports agricultural goods, particularly cotton (Gulde and Tsangarides 2008).

3.2 Data

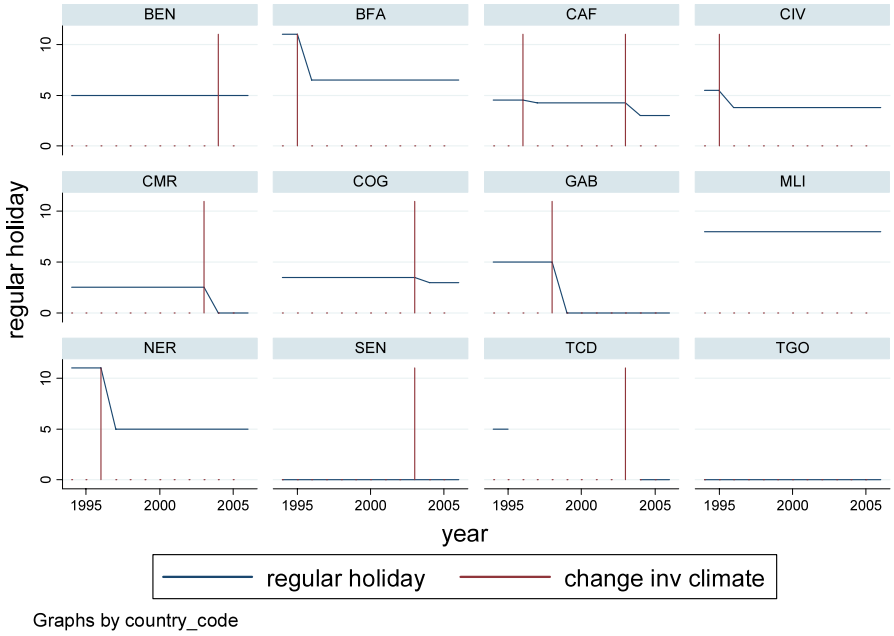
We obtained the tax incentives data for the 12 CFA Franc Zone countries over the period 1994–2006 from the Ernst and Young tax guides "Editions FFA". The guides offer a unique and detailed overview of the fiscal legislations in the investigated countries. In the yearly published guides we tracked all changes in fiscal incentives for investment per country per year. In ten of the eleven cases when the tax incentives changed this was done by the adoption of an officially new Investment Code. Along with the tax incentives changes, came changes in the complexity of the regimes and the legal protection of investors. Therefore we define four investment climate variables, two of which are pure tax incentives variables and two 'non-tax' investment climate variables: (i) the regular corporate income tax holiday (regular holiday), (ii) the corporate income tax holiday for exporters (export holiday), (iii) the number of tax incentive regimes (regimes), (iv) and the number of common legal guarantees (guarantees). We call the vector of four investment climate variables 'Inv Clim Vector'.

'Regular holiday' is the number of years of corporate income tax holidays for a regular investment project,[24] ranging from zero to 11 years. 'Export holiday' is defined as the maximum number of years of corporate income tax holidays for firms exporting a minimum share of their production or of firms located in a free export zone. It varies between zero and 30 years. 'Regimes' is the number of different tax incentive regimes that are listed in the investment code.[25] A high number of regimes points to a higher complexity and lower transparency of the investment code. By increasing the compliance burden and the unpredictability of tax incentives this may have a negative effect on investment (see for example Edmiston et al. 2003). Finally, 'guarantees' is the number of legal guarantees out of six common legal guarantees for investors. The six legal guarantees considered to be common in developed countries are the guarantee against expropriation, the guarantee to protect intellectual property, the guarantee for expatriate labor, the guarantee of national treatment, the guarantee of access to international dispute settlement fora, and the capital/profit repatriation guarantee. As such 'Guarantees' is a measure of the legal protection of investors.

This set of four variables captures practically all changes in the fiscal investment climate that we encountered in the E&Y tax guides. We realize that quantifying the changes in investment climate leaves some room for interpretation. We went consistently through the data for all countries and years and are confident to have a reliable dataset covering the most important changes in the fiscal investment climate with respect to investment.

[24] A regular investment project is roughly defined as an investment project between 200 and 1,000 million CFA Franc. It is called regular because sometimes other regimes exist for small investment projects or for exceptionally large investment project. Sometimes the length of the holiday is the same even if there are different regimes according to the investment size.

[25] For example, there can be different regimes for small, medium and big enterprises, for exporters, for certain sectors etc.

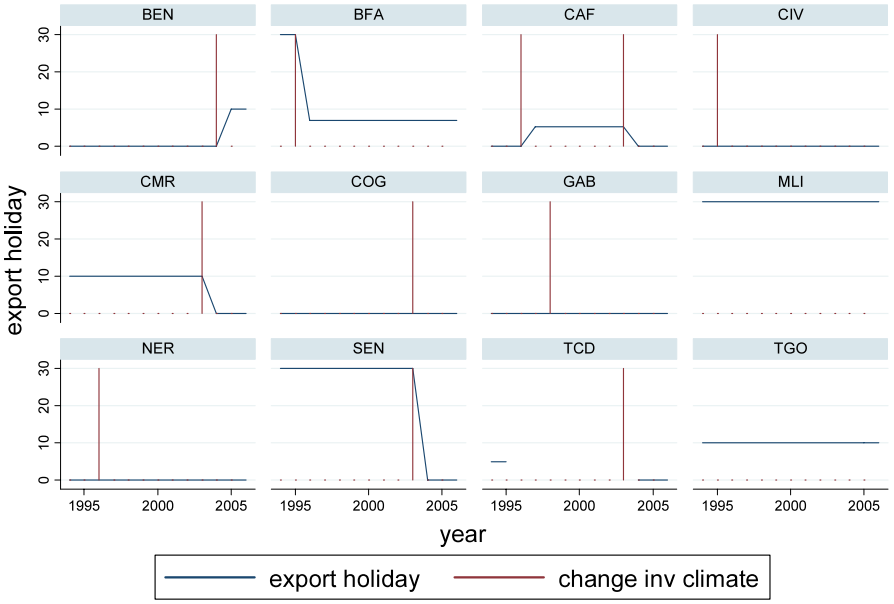


Graph 1 Regular holiday 1994–2006

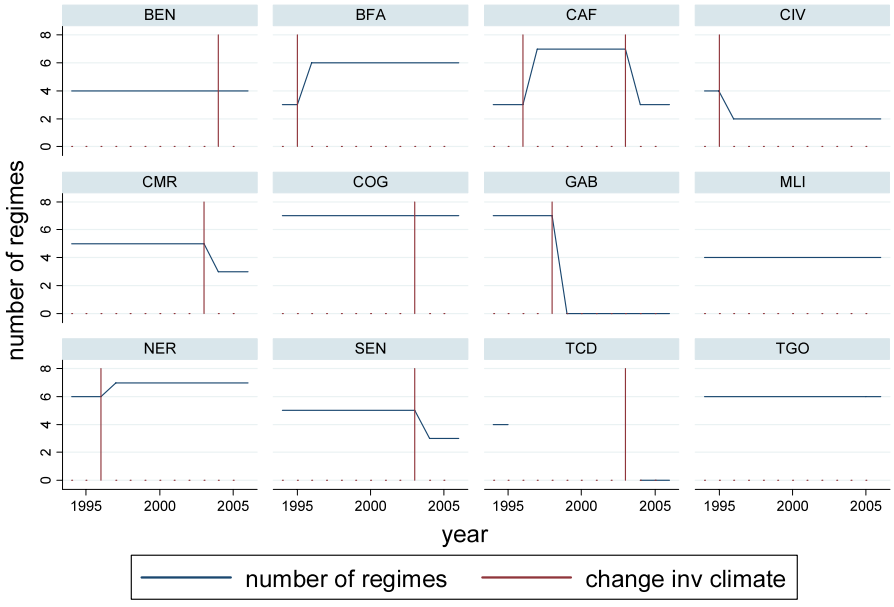
In one of the robustness checks we add a fifth investment climate variable to the equation, to capture indirect tax incentives. Although the focus of this paper is on corporate income tax incentives, one can argue that also indirect tax incentives (such as on import tariffs and VAT or sales taxes) are important for investment, especially in developing countries where much of the machinery and equipment needs to be imported. The indirect tax incentives only changed three times out of the ten investment code changes. Still, omitting them could cause an omitted variable bias of the estimators. The variable to capture the indirect tax incentives is called 'indirect holiday'. It is defined as the maximum of the number of years of tax exemption of the import tariff or the VAT or sales tax, on goods purchased during the set-up stage of the investment.

Graphs 1 to 5 show the evolution of the five investment climate variables over time in blue for each country. The vertical red lines announce a change in any of the five variables. Table 1 shows the correlation between the five variables. We observe no perfect or worrisome correlations.

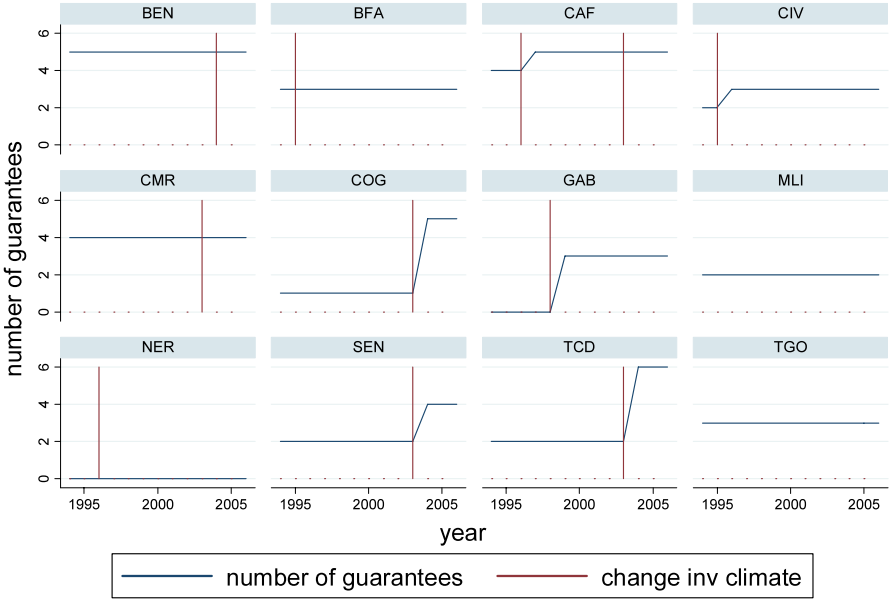
As investment variable (Inv) we use Foreign Direct Investment inflows (FDI) and gross private fixed capital formation (fixed capital), both as a percentage of GDP. Since FDI is foreign, it is rather footloose and most likely to react to changes in the investment climate. We are also interested in gross private fixed capital formation since it covers a partly different load: contrary to FDI it also includes domestic investment while it excludes takeovers, focusing only on new capital formation. Graphs 6 and 7 show the evolution of 'FDI' and 'fixed capital' formation over time. The very low level of FDI in many countries—on average FDI only mounts to 2.44% of GDP—is



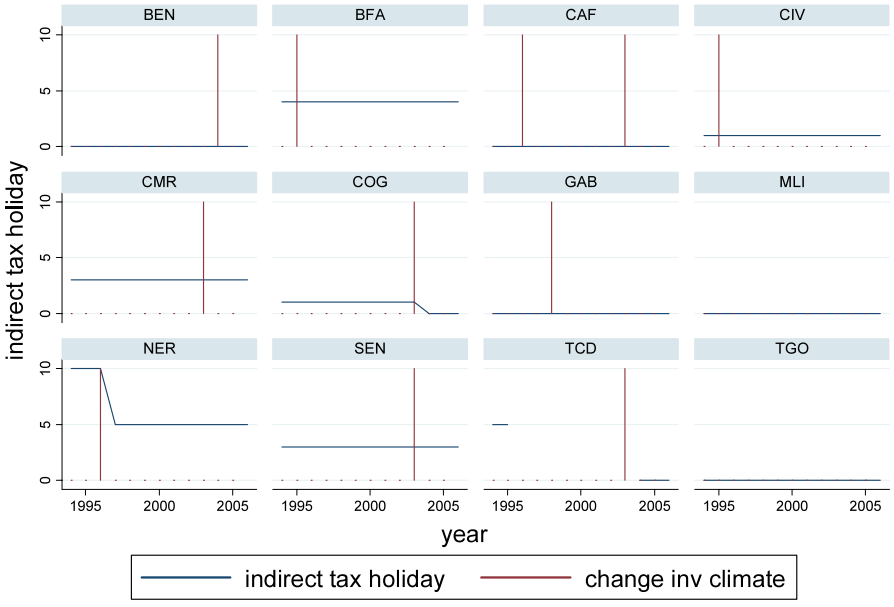
Graph 2 Export holiday 1994–2006



Graph 3 Regimes 1994–2006



Graph 4 Guarantees 1994–2006



Graph 5 Indirect tax holiday 1994–2006

Table 1 Correlation of the investment climate variables

	Regular holiday	Export holiday	Regimes	Guarantees	Indirect holiday
Regular holiday	1				
Export holiday	0.14	1			
Regimes	0.21	0.03	1		
Guarantees	−0.26	−0.13	−0.40	1	
Indirect holiday	0.28	−0.01	0.28	−0.44	1

striking. 'Fixed Capital' formation is higher but still at a low average of 12.93% of GDP. It is hard to see any change in investment that can be linked to a change in the fiscal investment climate, denoted by the vertical red lines.

Note that in our sample, for each country we have at least two years of data before the first investment climate change and two years after the last change. This is important for our analysis with fixed country and year effects, which can be interpreted as a multiple difference in differences analysis.

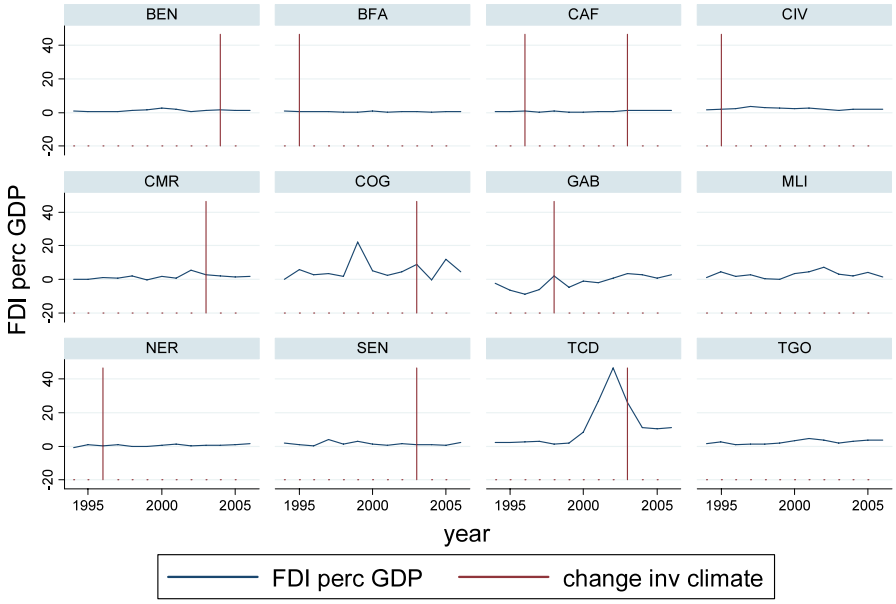
Obviously, next to tax incentives we also have to include the general corporate tax regime in the analysis. We do so by adopting the main statutory corporate income tax rate (CIT). Despite the similarities of the countries, we finally define a number of variables that control for the differences between them. GDP serves as a proxy for the market potential inside a country. To adjust for the general economic environment of a country we also include the GDP per capita (GDPpc), GDP growth and inflation. As explained above, thanks to the common currency arrangement, inflation has been relatively stable in the CFA Franc Zone countries. However, the fixed exchange rate could have been cushioned by variable terms of trade (ToT), which we include. Further, Government consumption expenditure as a percentage of GDP (Gov Cons Exp) can point to revenue needs of the government but also to public expenditure that might be beneficial to investment. To control for the openness of a country, we use a measure proposed by Squalli and Wilson (2006), which combines trade intensity and the relative importance of a country's trade level to local world trade to avoid biasing the measure upwards for small countries.[26] We also include the country's population (Pop).

Finally, we also check whether the results remain robust when taking account of variables that specifically drive investment in extractive industries. As mentioned earlier, extractive industries represent an important share of economic activity in the CFA Franc zone, especially in the CEMAC countries. In the absence of sector specific investment data, we include variables that specifically drive investment in extractives to reduce the chance of falsely attributing fiscal policy to total investment while investment in extractives is the real driver of investment. Two important drivers of invest-

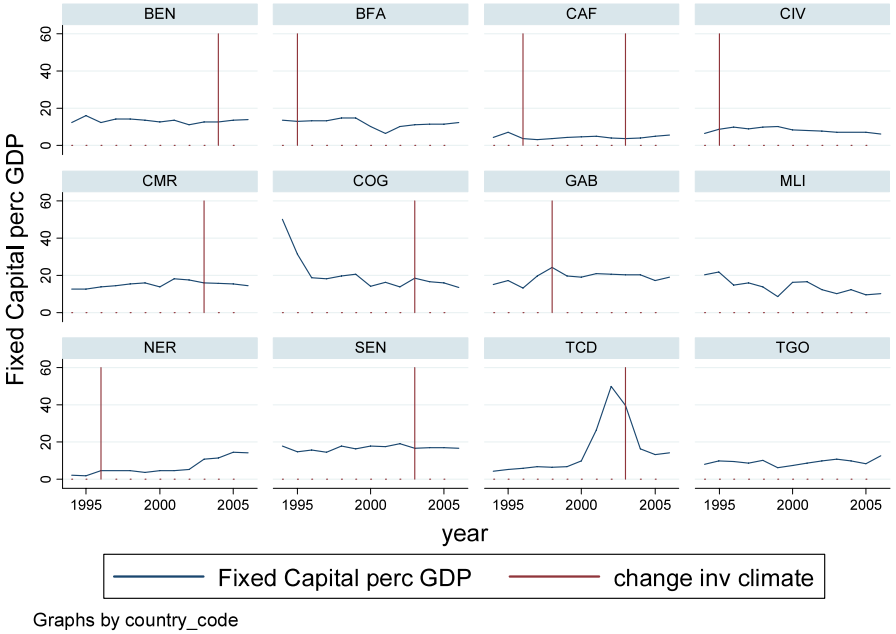
[26]The measure is defined as:

$$\frac{n(X+M)_i^2}{\mathrm{GDP}_i \sum_{j=1}^{n}(X+M)_j},$$

where X and M are exports and imports of country i, and n is the number of countries in the world.



Graph 6 FDI (percent of GDP) 1994–2006



Graph 7 Fixed capital formation (percent of GDP) 1994–2006

ment in extractive industries are the discovery of reserves and mineral prices (see for example UNCTAD 2007). Therefore, we use the variables 'oil res' and 'min price'. 'Oil res' is the level of proved oil reserves per country in billions of barrels, obtained from the US Energy Information Administration. It controls for investment due to the discovery of new oil reserves and is introduced with a one year lag. 'Min price' is a price index of the international prices of minerals produced in a country. For each country the price index is calculated as the weighted average of the international price indices (with basic year 1992) for the minerals produced in the country, weighted by the minerals' shares in total minerals exports[27] in 1992.[28] The weights and minerals for each country are presented in the Appendix table. The mineral prices come from the US Geological Survey and the export shares come from the central banks BEAC and BCEAO. As a third control variable for the extractive industry we use 'VA min', the value added of extractive industries as a percentage of GDP, obtained from the BEAC and BCEAO.

Descriptive statistics of all variables are provided in Table 2.

4 Methodology

To estimate the impact of tax incentives on investment we estimate an ad hoc investment specification. This kind of specification has proven useful in assessing the impact of taxation on investment when the only available data are aggregate investment, as in the numerous studies on taxation and FDI. We start testing a baseline specification that addresses the most important issues concerning the identification of the impact of a policy change. Then, we extend the basic specification to include the lagged dependent variable.

4.1 Baseline equation

In order to establish the relationship between changes in tax incentives and investment, we start by estimating the following baseline panel data specification:

$$\mathrm{Inv}_{it} = \alpha + \beta\,\mathrm{InvClim}_{i,t-1} + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \tag{1}$$

Subscripts i and t indicate the country and the time period. Inv is the level of investment measured as FDI and gross private fixed capital formation as a share of GDP; InvClim is the 'Inv Clim Vector' that consists of the four variables (five in one of the robustness checks). The key parameter that we are interested in is the sign and significance of the β parameters since it quantifies the impact of the policy change on the investment outcome.

The tax incentive changes that we are investigating are no random policy choices since they are decisions by governments in response to circumstances that should justify the policy change. To the extent that the factors driving the policy change are

[27] As in Bruckner and Ciccone (2009), and Deaton (1999) but only for minerals.

[28] Except for Gabon, where we use the export shares of 1996 due to lack of data for previous years.

Table 2 Descriptive statistics and sources of all variables

Variable	Unit	Mean	Std. Dev.	Min	Max	Obs.	Source
FDI	Percent of GDP	2.44	5.44	−8.75	46.48	156	UNCTAD
Fixed capital	Percent of GDP	12.93	7.14	1.80	50.16	156	WEO[a]
CIT rate	Percent	38.32	4.44	25	49	155	E&Y tax guide
Regular holiday	Years	3.75	2.88	0	11	148	E&Y tax guide
Export holiday	Years	7.59	10.83	0	30	148	E&Y tax guide
Admin		0.18	0.38	0	1	156	E&Y tax guide
Regimes		4.67	2.04	0	7	148	E&Y tax guide
Guarantees		2.81	1.57	0	6	156	E&Y tax guide
GDP	Million USD	4707	3954	853	17953	156	WDI[b]
GDPpc	1000 USD	0.73	1.16	0.16	5.00	156	WDI
GDP growth	Percent	3.97	4.39	−8.93	33.62	156	WDI
Inflation	Percent	5.65	9.16	−8.02	42.43	153	WDI
ToT	Index basis 2000	107.02	23.15	62.50	201.95	156	WEO
Gov Cons Exp	Percent of GDP	12.10	4.37	4.51	26.06	153	WDI
Openness		2.78	2.87	0.09	11.06	153	WDI
Pop	Million	8.83	4.81	1.02	18.91	156	WDI
Oil res	Billion barrels	0.34	0.69	0.00	2.50	156	US EIA[c]
Min price	Index basis 1992	1.36	0.76	0.27	5.57	156	Own calculation[d]
VA min	Percent of GDP	0.10	0.18	0.00	0.66	148	BCEOA, BOAC

[a]World Economic Outlook, IMF

[b]World Development Indicators, World Bank

[c]US Energy Information Administration

[d]Own calculation based on US Geological Survey price data and BCEOA and BOAC export data

also driving the outcome of the policy change, investment, we are facing an identification problem. We do not know then if the change in investment is directly provoked by the change in the fiscal investment climate or by a variable that causes both the change in investment climate and the change in investment. Omitting these factors would lead to an omitted variables bias of the estimated parameter β. We deal with this endogeneity problem by including the variables that could be driving the policy change and the investment outcome at the same time.

For this purpose it is very important to adopt country fixed effects[29] μ_i. Besley and Case (2000), Pitt et al. (1992) and Rosenberg and Wolpin (1986) show how important the inclusion of fixed effects can be to obtain consistent estimates of the impact of policy changes on the outcome variable. It controls for the possibility that time-invariant country characteristics are responsible for the tax policy shift and the change in investment. If the systematic determinants of tax policy are time-invariant country characteristics, then we will indeed remove concerns about endogeneity. Next to

[29]Such as the location of the country (e.g. being landlocked, etc.), geographical characteristics, the membership of either WAEMU or CEMAC, etc.

country fixed effects we also adopt year fixed effects λ_t. The year effects are important because, among others, they capture the exchange rate of the CFA Franc with other countries. Swenson (1994) has pointed to the importance of including the exchange rate in the analysis.

Another endogeneity concern is the possible simultaneity of the policy decision InvClim and the level of investment Inv. Simultaneity would raise doubt about the direction of causality between the investment policy and investment. To break the possible reverse causality of (poor) investment driving the policy change we make sure that the tax policy change comes before investment by lagging the variable InvClim with one year.[30] Apart from solving the simultaneity problem this also makes sense intuitively since investment needs time to react to the policy change.

Also time-varying country amenities may determine both the tax policy changes and the investment outcome. Therefore, we also include the vector of control variables X.[31] We include the CIT rate, GDP, GDP per capita, GDP growth, government consumption expenditure, inflation, the terms of trade, openness and population for the reasons explained in the data section. We realize that there might be other potential factors that could have an impact but that we do not include because they are unobservable or because we do not have them.[32] We lag the control variables one year since investment decisions will likely be based on data available at the time of the investment decision, before the investment takes place.

Another way of dealing with the endogeneity problem related to omitted variables, as suggested by Besley and Case (2000), is to try to identify the impact of the policy change by selecting a control group of countries that are thought to be similar to the treatment countries whose policy has changed. The more similar the countries are, the fewer variables affect their policies and investment differently, the fewer variables potentially bias the results if omitted. This provides us with a strong argument to limit our country sample to CFA Franc Zone countries. Because of the similarities between the member countries, countries that did not undergo a change in the fiscal investment climate in the same year can serve as relatively good control countries for countries that did. This way we try to exploit the advantages of difference in differences analysis, where highly similar treatment and control groups are compared before and after policy changes.[33]

[30] A good alternative to rid the analysis of potential endogeneity bias would be to use the more standardized instrumental variable procedure. Looking for instrumental variables for the fiscal investment climate policy decisions would not only be interesting as a methodological tool but also to better understand why governments are changing their investment climate. The political economy of the determinants of policy variation, where the policies themselves are taken as the dependent variable would be an interesting case on its own. Unfortunately we do not dispose of political variables to use as instruments as suggested by Besley and Case (2000). Besides, even if the political variables would exist they are likely to have an independent impact on the outcome variable investment, raising new identification problems.

[31] The control variables are explained in the data section.

[32] An important time varying characteristics that is not explicitly adopted is political stability. We reckon however that a combination of the economic stability variables and fixed effects that we do include are highly correlated with political stability and thus to some extend take account of it.

[33] See Meyer (1995) for an overview.

4.2 Dynamic panel model

As an extension of the baseline equation we add a lagged dependent variable (LDV) Inv_{it-1} to the baseline specification giving

$$\text{Inv}_{it} = \alpha + \delta\,\text{Inv}_{i,t-1} + \beta\,\text{InvClim}_{i,t-1} + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}. \tag{2}$$

Several arguments can justify the inclusion of the LDV. First, omitting the LDV could again cause an identification problem. If policy makers base their fiscal investment climate decisions on the investment in the previous year, and if investment is correlated with investment in the previous year, the estimate of the effect of the policy on investment will be biased if the LDV is excluded. Second, the LDV reduces serial correlation in the error terms. Finally, the inclusion of investment in the year before can be justified theoretically. In more advance neo-classical investment models (e.g. Auerbach and Hassett 1992) firms smooth their capital expenditures over time because of adjustment costs.

Nickell (1981) showed that the fixed effects or least square dummy variables (LSDV) estimator of the coefficients is consistent for $T \to \infty$ but inconsistent for $N \to \infty$ and T finite. Nickell (1981) predicts that the bias increases with the LDV coefficient (δ in (2)) and decreases with T. Thus the LSDV estimator performs well when the time dimension of the panel is large relative to N. Several consistent estimators have been proposed when T is not large (relative to N), such as the IV procedure of Anderson and Hsiao (1982) and the GMM procedure of Arrelano and Bond (1991) and Blundell and Bond (1998). An alternative method is proposed by Kiviet (1995) who derives a formula for the bias of the LSDV estimator and recommends subtracting this from the estimated LSDV coefficients. The corrected LSDV estimator is often called LSDVc. Judson and Owen (1999) and Bun and Kiviet (2001) compare the LSDV, IV, GMM and LSDVc estimators through simulation exercises. They find that the bias of the non-LDV variable coefficients (β and γ in (2)) is relatively small and thus cannot be used to distinguish between estimators. Concerning the bias of the LDV coefficient they find that, certainly in small samples, LSDVc outperforms the other estimators. An important trump of LSDV is its relatively small variance. The accuracy in small samples of the t statistic for testing the non-LDV coefficients (β and γ) is very reasonable for all estimators (Bun and Kiviet 2001).

Considering the size of our panel dataset, which is small with a relatively high T, the fact that our main interest is the estimation of the β's, and the small variance feature of LSDV, we decided to estimate the coefficient with LSDV and LSDVc.

5 Results

5.1 Baseline equation

Table 3 shows the results of the estimation of baseline equation (1), with FDI in column one and private fixed capital formation in column two as dependent variable, both measured as a percentage of GDP. Starting with FDI, we find that the regular tax holiday has no significant impact. The tax holiday for exporters has the expected

Table 3 Baseline equation estimation results

	FDI	Fixed capital
Inv Clim Vector		
Regular holiday ($t-1$)	−0.203	−0.625
	(−1.05)	(−1.56)
Export holiday ($t-1$)	0.064*	0.085*
	(1.81)	(1.85)
Regimes ($t-1$)	−0.351**	−0.533
	(−2.89)	(−1.40)
Guarantees ($t-1$)	0.934***	0.344
	(3.67)	(0.59)
CIT rate ($t-1$)	0.035	−0.067
	(0.46)	(−0.29)
GDP ($t-1$)	−0.000	−0.001**
	(−0.76)	(−2.50)
GDP growth ($t-1$)	0.014	0.020
	(0.33)	(0.30)
GDPpc ($t-1$)	4.537	9.752**
	(1.42)	(2.53)
Gov Cons Exp ($t-1$)	−0.007	0.028
	(−0.06)	(0.25)
Inflation ($t-1$)	0.033	−0.007
	(0.64)	(−0.05)
Population ($t-1$)	−0.480	2.236
	(−0.63)	(1.50)
Openness ($t-1$)	−0.137	−0.316
	(−0.33)	(−0.53)
ToT ($t-1$)	0.012	0.026
	(1.43)	(1.52)
Constant	−1.976	−2.459
	(−0.24)	(−0.18)
Observations	134	134
R-squared	0.45	0.30
Number of countries	12	12
Wooldridge test for autocorrelation		
$F(1, 10)$	2.782	27.386
Prob > F	0.126	0.0004

*** $p < 0.01$

** $p < 0.05$

* $p < 0.1$

Robust t statistics in parentheses

positive sign and is significant at the 10% level. Still, economically the gains from extending the export holiday by 10 years are limited to 0.64 extra FDI as a percentage of GDP. Apart from the tax incentives themselves, we observe that decreasing the complexity of tax incentives, proxied by the number of tax incentives regimes, is important for foreign investors. The number of regimes has a significantly negative impact on FDI. Reducing the number of tax incentive regimes by one lowers FDI by 0.35% of GDP. Also the number of legal guarantees for foreign investors is highly significant. Adding a legal guarantees, considered as common in the developed world, raises FDI by 0.93% of GDP.

The control variables do not explain much of the variance in FDI. Only GDP per capita (GDPpc) and the terms of trade (ToT) have an almost significantly positive impact. Despite the limited impact of the control variables, we have an R^2 of 0.45.

Turning to fixed capital formation, we also find a significant positive impact of export holidays at the 10% level. Increasing the tax holiday for exporters by 10 years raises capital formation by almost 0.85% of GDP. Contrary to FDI, here the number of regimes is just not significant, but the sign is the same. The number of legal guarantees has no significant impact on fixed capital formation. As far as the control variables are concerned a higher GDP level within a country, causes the share of fixed capital of GDP to fall. This is possible when GDP rises while fixed capital formation remains constant. GDP per capita on the other hand raises the share of fixed capital in GDP, which indicates that productivity is important for investment in fixed assets. Equation (1) explains 30% of the variance of fixed capital formation.

The results of the estimation of (1) for fixed capital formation should be interpreted cautiously, since the Wooldridge test for serial correlation in the error term, presented at the bottom of the table, indicates the presence of auto-correlated errors. This is not the case for the FDI equation: with a P value of 0.13 we cannot reject the null hypothesis of the absence of first order correlation.

5.2 Dynamic panel model

Therefore, particularly for the dependent variable fixed capital formation, it is interesting to see whether the results hold when adding the lagged dependent variable (as in (2)). Table 4 presents the dynamic panel model results for FDI and fixed capital formation, estimated by LSDV and by LSDVc. As expected from the serial correlation test, FDI of the year before has no significant impact on current FDI. The FDI graph 6 from the data section already showed that FDI has either been steadily very low or highly volatile for the investigated sample. Consequently, the results of column 1 in Table 4 are approximately the same as the ones in Table 3 when the LDV was not included. Also the R^2 remains unchanged. Note that the LSDVc coefficient estimates in column 2 hardly differ, but that the t-values are systematically lower. In case of LSDVc the standard errors (and thus t-values) are bootstrapped.[34] The efficiency advantage of LSDV, mentioned in the methodology section, is visible.

Adding a LDV to the fixed capital formation equation has a bigger impact. The LDV enters highly significant around 0.5, depending on the estimation method. We focus on the LSDV results (column 3), because of the higher efficiency, and observe that the export holiday is not significant anymore. Using LSDVc the standard errors of the estimated coefficients are even higher. GDP and the terms of trade are just significant at the 10% level. The CIT rate, with an expected negative sign, approximates significance.

The R^2 increases importantly from 30% to 59%. Including a LDV reduces the serial correlation of the errors and consequently increases the standard errors. As a

[34] The standard errors come from a bootstrap procedure based on the errors of the estimated errors from the consistent IV or GMM estimators of dynamic panel data models. Although consistent, there IV and GMM estimators are characterized by a lower efficiency, especially for small panels (Bun and Kiviet 2001).

Table 4 Dynamic panel model estimation results

Estimation method	FDI LSDV	FDI LSDVc	Fixed capital LSDV	Fixed capital LSDVc
LDV	−0.026 (−0.35)	0.060 (0.58)	0.469*** (15.56)	0.547*** (6.77)
Inv Clim Vector				
Regular holiday ($t-1$)	−0.205 (−1.05)	−0.224 (−0.89)	−0.138 (−0.90)	−0.080 (−0.34)
Export holiday ($t-1$)	0.065* (1.82)	0.059 (1.05)	0.024 (0.90)	0.018 (0.32)
Regimes ($t-1$)	−0.363** (−3.00)	−0.341 (−1.31)	−0.210 (−1.04)	−0.175 (−0.73)
Guarantees ($t-1$)	0.930*** (3.70)	0.824 (0.95)	−0.168 (−0.51)	−0.243 (−0.30)
CIT rate ($t-1$)	0.036 (0.47)	0.045 (0.37)	−0.146 (−1.35)	−0.171 (−1.47)
GDP ($t-1$)	−0.000 (−0.76)	−0.000 (−0.30)	−0.001*** (−3.14)	−0.001* (−1.65)
GDP growth ($t-1$)	0.017 (0.40)	0.015 (0.21)	0.053 (1.03)	0.064 (0.90)
GDPpc ($t-1$)	4.559 (1.40)	4.550 (0.87)	2.684 (1.34)	1.907 (0.39)
Gov Cons Exp ($t-1$)	−0.012 (−0.10)	−0.004 (−0.03)	0.141 (1.41)	0.159 (1.03)
Inflation ($t-1$)	0.035 (0.62)	0.032 (0.43)	−0.097 (−0.99)	−0.107 (−1.53)
Population ($t-1$)	−0.500 (−0.66)	−0.609 (−0.83)	0.828 (1.23)	0.655 (0.98)
Openness ($t-1$)	−0.141 (−0.33)	−0.171 (−0.35)	0.221 (1.10)	0.262 (0.58)
ToT ($t-1$)	0.012 (1.39)	0.012 (0.81)	0.022 (1.73)	0.024* (1.77)
Constant	−1.772 (−0.22)		6.259 (0.88)	
Observations	134	134	134	134
R-squared	0.45		0.59	
Number of countries	12	12	12	12

*** $p < 0.01$

** $p < 0.05$

* $p < 0.1$

Robust t statistics in parentheses

result, in the baseline equation we rejected the null hypothesis too easily when it should not be rejected.

The different results for the persistence and sensitivity to the included investment climate variables of FDI and fixed capital formation must lie in the different load they cover. FDI could be more volatile because it only consists of foreign investment while

fixed capital represents both foreign and domestic investment. If foreign investment is more footloose that could be a first explanation. Next, FDI not only contains fixed investment but also takeovers. Takeovers are more isolated events than investment in fixed assets and are less subject to adjustment costs, which could also explain the difference in persistence. The different reaction to our investment climate variables is probably a combination of two things. First, again if FDI is more footloose it reacts faster to changes in the investment climate. Second, the investment climate itself, and in particular the variables that we include, is more designed to attract foreign investment than domestic investment. For example changes in legal guarantees for foreign investors will affect only foreign investors. Also foreign investors are more likely to qualify for tax incentives.

For both FDI and fixed capital formation, it is remarkable that the tax incentives variables 'regular holiday' and 'export holiday' are not key to investors in the CFA Franc zone. If anything it is the tax holiday for exporters that has a positive impact. This could point to the higher mobility and thus higher sensitivity of exporters to incentives or to the fact that a typical exporter is more substantial and profitable than a non-exporting investor.

5.3 Robustness checks

The first robustness check relates to the possible impact of indirect tax incentives on investment. The focus of the paper is on direct taxation. Yet, also indirect tax incentives may play an important role in investment decisions. During the set-up stage of the investment project, countries often offer exemptions on import tariffs and sales or VAT taxes for the acquisition of machinery and equipment. Omitting indirect tax incentives from the analysis could cause biased estimates of the direct tax incentives coefficients or the other investment climate variables provided that the indirect tax incentives correlate with both the direct tax incentives or investment climate variables, and investment. When indirect tax incentives and direct tax incentives or other investment climate variables would be perfectly correlated we would even have an identification problem because we would not be able to isolate the impact of the direct tax incentives or other investment climate variables from the impact of the indirect tax incentives on investment. The latter is certainly not the case, given the maximum correlation of -0.44 between the variable 'regular holiday' and 'guarantees' (see Table 1). Moreover the indirect tax incentives seem to vary less over time than the direct tax incentives. For the selected dataset, only three important changes were recorded in the variable 'indirect holiday'.

Table 5 shows the regression results with and without the variable indirect holiday. The uneven columns repeat the results of Tables 3 (for FDI) and 4 (for fixed capital formation). In none of the two equations 'indirect holiday' enters significantly. As a result, the coefficients on the other investment climate variables remain almost identical with our without the additional variable. Based on these results, the negative impact on FDI of the number of regimes and the positive impact on FDI of the number of guarantees is robust to the presence of indirect tax incentives.

The second robustness check concerns the importance of extractive industries in the investigated countries. We mentioned in the data section that extractive industries

Table 5 Robustness check: indirect tax holiday

Estimation method	FDI LSDV	FDI LSDV	Fixed capital LSDV	Fixed capital LSDV
LDV			0.469***	0.469***
			(15.56)	(15.22)
Inv Clim Vector				
Regular holiday ($t-1$)	−0.203	−0.231	−0.138	0.074
	(−1.05)	(−1.11)	(−0.90)	(0.33)
Export holiday ($t-1$)	0.064*	0.066*	0.024	0.009
	(1.81)	(1.88)	(0.90)	(0.35)
Regimes ($t-1$)	−0.351**	−0.348**	−0.210	−0.230
	(−2.89)	(−2.91)	(−1.04)	(−1.05)
Guarantees ($t-1$)	0.934***	0.943***	−0.168	−0.232
	(3.67)	(3.46)	(−0.51)	(−0.71)
Indirect holiday ($t-1$)		0.047		−0.352
		(0.12)		(−1.15)
CIT rate ($t-1$)	0.035	0.037	−0.146	−0.159
	(0.46)	(0.53)	(−1.35)	(−1.41)
GDP ($t-1$)	−0.000	−0.000	−0.001***	−0.001**
	(−0.76)	(−0.64)	(−3.14)	(−2.32)
GDP growth ($t-1$)	0.014	0.015	0.053	0.049
	(0.33)	(0.34)	(1.03)	(0.94)
GDPpc ($t-1$)	4.537	4.697	2.684	1.482
	(1.42)	(1.56)	(1.34)	(0.69)
Gov Cons Exp ($t-1$)	−0.007	−0.006	0.141	0.136
	(−0.06)	(−0.05)	(1.41)	(1.38)
Inflation ($t-1$)	0.033	0.031	−0.097	−0.087
	(0.64)	(0.57)	(−0.99)	(−0.83)
Population ($t-1$)	−0.480	−0.468	0.828	0.736
	(−0.63)	(−0.57)	(1.23)	(1.05)
Openness ($t-1$)	−0.137	−0.125	0.221	0.128
	(−0.33)	(−0.28)	(1.10)	(0.66)
ToT ($t-1$)	0.012	0.012	0.022	0.022
	(1.43)	(1.47)	(1.73)	(1.67)
Constant	−1.976	−2.237	6.259	8.218
	(−0.24)	(−0.26)	(0.88)	(1.13)
Observations	134	134	134	134
R-squared	0.45	0.45	0.59	0.59
Number of countries	12	12	12	12

*** $p < 0.01$

** $p < 0.05$

* $p < 0.1$

Robust t statistics in parentheses

represent an important share of exports in some countries, such as the petroleum sector in CEMAC. It is reasonable to expect that this translates into significant shares of investment in extractive industries in total investment in these countries. The in-

vestment variables we use are aggregate investment data, which sum up investment in all sectors. Since in some countries investment in the mining sector is subject to a separate fiscal regime, two possible identification problems can occur. First, variations in investment in the extractive industries caused by determinants other than the investment climate variables that we defined, which coincide with variations in our investment climate variables, might incur spurious relationships between our investment climate variables and investment. Second, variations in the investment code for mining companies that coincide with variations in our investment climate variables might prompt us to falsely attribute variations in investment to variations in our investment climate.

The latter is unlikely since we did not observe important changes of the fiscal regimes for mining companies in the E&Y guides for the selected countries and years. To deal with the first possible problem ideally we would split the investment variable into investment in extractive and non-extractive industries. Since these data are not available, we instead control for specific determinants of investment in extractive industries. We control for the discovery of new oil reserves (oil res), a country specific price index of minerals (min price), and the added value of the extractive industry as a share of GDP (VA min). We introduce the three variables one by one[35] in Table 6. In the first three columns, we observe that none of the three new control variables enters significantly. In the last three columns, only 'min price' is close to significance with the expected positive sign.

Consequently, the coefficients on the other variables are fairly robust: 'regimes' and 'guarantees' keep their significance, while 'export holiday' just loses its significance at the 10% level. It may seem surprising that the three mining related variables appear redundant in the regressions. However, one should remember that oil reserves that were present before 1994 are captured by the country effects. In addition, if all countries produced the same minerals in the same proportions, the international price index would be perfectly captured by the year effects.

The third robustness check is a country outlier analysis. Along with the advantage of having highly comparable countries, comes the disadvantage of a relatively small number of twelve countries. One of the consequences is that each of the countries may have an important impact on the results. Therefore, in order to prevent one outlier to drive the results we estimate each equation twelve times leaving out one country every time.[36]

Table 7a presents the results for the estimation of (1) with FDI as the dependent variable. On top of each column you find the name of the country that is dropped from the estimation. To save space, the estimates of the control variables are not reported. We find that the impact of the investment climate variables 'regimes' and 'guarantees' on FDI is fairly robust for the omission of countries. They remain significant at least at the 10% level in all columns with stable values. The significance of 'export holiday'

[35] We also did the regression introducing the three variables simultaneously, but do not present them because the results are qualitatively the same.

[36] Estimating the equation separately for UEMOA and CEMAC countries, would leave us with five and seven countries respectively, too small to get meaningful results. Also remember that the fixed effects control for membership of either of the two unions.

Table 6 Robustness check: mining related variables

Estimation method	FDI LSDV	FDI LSDV	FDI LSDVc	Fixed capital LSDV	Fixed capital LSDV	Fixed capital LSDV
LDV				0.467*** (14.74)	0.460*** (14.06)	0.397*** (5.27)
Inv Clim Vector						
Regular holiday ($t-1$)	−0.217 (−1.05)	−0.209 (−1.18)	−0.136 (−0.81)	−0.148 (−0.95)	−0.164 (−1.15)	−0.175 (−1.08)
Export holiday ($t-1$)	0.066 (1.72)	0.056 (1.61)	0.065 (1.66)	0.026 (0.97)	0.002 (0.07)	0.043 (1.65)
Regimes ($t-1$)	−0.384** (−2.28)	−0.356** (−2.92)	−0.294** (−2.34)	−0.229 (−0.95)	−0.230 (−1.09)	−0.254 (−1.15)
Guarantees ($t-1$)	0.960*** (3.56)	0.892*** (3.18)	0.872*** (3.42)	−0.151 (−0.44)	−0.275 (−0.93)	−0.002 (−0.00)
CIT rate ($t-1$)	0.031 (0.39)	0.035 (0.47)	0.014 (0.17)	−0.148 (−1.34)	−0.146 (−1.54)	−0.131 (−1.12)
GDP ($t-1$)	−0.000 (−0.65)	−0.000 (−1.10)	−0.000 (−0.68)	−0.001** (−2.93)	−0.001*** (−3.32)	−0.001*** (−3.22)
GDP growth ($t-1$)	0.014 (0.33)	0.013 (0.31)	0.033 (0.66)	0.053 (1.01)	0.049 (0.94)	0.090 (1.55)
GDPpc ($t-1$)	4.617 (1.23)	4.798 (1.41)	3.841 (1.09)	2.762 (1.22)	3.556 (1.77)	1.965 (0.87)
Gov Cons Exp ($t-1$)	0.004 (0.03)	−0.017 (−0.12)	−0.023 (−0.18)	0.146 (1.38)	0.111 (1.13)	0.128 (1.14)
Inflation ($t-1$)	0.032 (0.64)	0.037 (0.74)	0.051 (0.71)	−0.097 (−0.97)	−0.082 (−0.89)	−0.083 (−0.69)
Population ($t-1$)	−0.565 (−0.68)	−0.528 (−0.66)	−0.635 (−0.82)	0.789 (1.06)	0.723 (1.20)	0.938 (1.32)
Openness ($t-1$)	−0.197 (−0.38)	−0.130 (−0.32)	−0.194 (−0.54)	0.187 (0.97)	0.231 (1.10)	0.462* (2.00)
ToT ($t-1$)	0.013 (1.41)	0.012 (1.47)	0.013 (1.38)	0.023 (1.67)	0.022* (2.05)	0.024 (1.68)
Oil res ($t-1$)	−0.636 (−0.55)			−0.344 (−0.30)		
Min price ($t-1$)		0.353 (0.53)			0.978 (1.70)	
VA min			−1.245 (−0.16)			−11.020 (−1.41)
Constant	−1.095 (−0.13)	−1.737 (−0.21)	−0.198 (−0.02)	6.693 (0.93)	6.743 (0.97)	6.126 (0.81)
Observations	134	134	129	134	134	129
R-squared	0.45	0.46	0.42	0.59	0.60	0.48
Number of countries	12	12	12	12	12	12

*** $p < 0.01$

** $p < 0.05$

* $p < 0.1$

Robust t statistics in parentheses

relies on the inclusion in the dataset of Cameroon, Gabon, Mali, and Senegal. As a result we have to be careful drawing conclusions on the positive impact of export holidays on investment overall.

Table 7b displays the results of the estimation of the dynamic equation with fixed capital formation. The coefficients only turn significant sporadically, not enough to conclude that they would have a robust impact on fixed capital formation.

6 Conclusion and discussion

Researchers, policy makers and policy advisers agree that there is a need for more empirical evidence of the effectiveness of tax incentives for investment in developing countries. This study is one of the first to investigate the impact of tax incentives on investment in Africa. Because of the focus on the relatively similar CFA Franc Zone countries, we are able to assess tax incentives changes in some of these countries, taking the other countries as controls. Next to tax incentives we also examine the importance of compliance costs and legal guarantees for investors.

For the period 1994–2006, we find that changes in tax holidays for regular investment projects did not have an effect on FDI inflows or on fixed capital formation. Tax holidays targeted to exporting firms tend to have a positive impact on investment, although the statistical significance disappears in some specifications and the economic significance is rather low. With respect to the tax compliance cost, we do find evidence that simplifying the complexity of tax incentives regimes helps to attract FDI. Also increasing investor certainty by extending the legal guarantees for investors helps to attract foreign investment. For fixed capital formation, none of the investment climate variables is consistently significant.

The robust results for reducing the complexity of tax incentives and improving the legal guarantees for foreign investors, as compared to the ambiguous result for the tax incentives themselves, suggest that for governments in developing countries it is at least as important to reduce the compliance costs of taxes and to secure a correct treatment of investors as it is to lower the tax burden itself. This is even more so because these measures are far less expensive since they do not incur any revenue loss. By increasing investment they even raise revenue. This reaffirms the point that institutional stability, credibility and transparency are key to investors, before tax incentives.

Because of the ambiguity of our tax holiday results no general conclusions can be drawn. Neither the finding of Wells and Allen (2001) for Indonesia that they are not effective nor the finding of Klemm and Van Parys (2009) that they are effective in some cases can be strongly confirmed. But, apparently, those holidays that are targeted on exporters have a bigger chance of being effective than the more general tax holidays.

Several arguments could be put forward to explain why the link between tax holidays and investment is not robust. First, it could be that the neo-classical investment theory is not valid. This theory predicts that if (i) tax holidays lower the cost of capital, (ii) they would increase investment. We do not question the negative impact of tax holidays on the cost of capital, even though we know that the impact on the METR is

Table 7a Country outlier analysis for FDI equation

Country left out:	Benin	Burkina Faso	Centr. Afr. Rep.	CIV	Cameroon	Rep. of Congo	Gabon	Mali	Niger	Senegal	Chad	Togo
Inv Clim Vector												
Regular holiday ($t-1$)	−0.223 (−1.14)	−0.120 (−0.75)	−0.232 (−1.24)	−0.148 (−0.74)	−0.260 (−1.14)	−0.195 (−1.17)	−0.079 (−0.52)	−0.150 (−0.79)	−0.535*** (−3.32)	−0.064 (−0.36)	−0.104 (−0.73)	−0.204 (−1.12)
Export holiday ($t-1$)	0.067* (1.85)	0.105*** (3.69)	0.067* (1.88)	0.079* (1.93)	0.065 (1.76)	0.066* (1.97)	0.033 (1.11)	0.062 (1.65)	0.072** (3.13)	−0.011 (−0.41)	0.057* (1.86)	0.073* (2.12)
Regimes ($t-1$)	−0.342** (−2.65)	−0.471*** (−3.34)	−0.432* (−1.99)	−0.439*** (−3.87)	−0.365** (−2.74)	−0.371*** (−3.18)	−0.212* (−1.89)	−0.339** (−2.63)	−0.245** (−2.40)	−0.348*** (−3.27)	−0.263* (−1.93)	−0.375** (−2.88)
Guarantees ($t-1$)	0.954*** (3.82)	1.014*** (3.87)	0.784** (2.31)	1.142*** (5.30)	0.870*** (3.25)	0.787** (2.61)	0.783** (2.61)	1.002*** (4.07)	0.859*** (3.57)	1.108*** (3.85)	0.742* (2.14)	0.983*** (3.94)
Observations	122	122	122	122	122	124	122	122	122	122	130	122
R-squared	0.46	0.47	0.47	0.49	0.46	0.52	0.40	0.50	0.48	0.50	0.39	0.47
Number of countries	11	11	11	11	11	11	11	11	11	11	11	11

*** $p < 0.01$

** $p < 0.05$

* $p < 0.1$

Robust t statistics in parentheses

Table 7b Country outlier analysis for fixed capital equation

Country left out:	Benin	Burkina Faso	Centr. Afr. Rep.	CIV	Cameroon	Rep. of Congo	Gabon	Mali	Niger	Senegal	Chad	Togo
LDV	0.483***	0.463***	0.464***	0.449***	0.473***	0.446***	0.462***	0.446***	0.440***	0.468***	0.478***	0.478***
	(25.39)	(12.57)	(14.96)	(10.59)	(15.32)	(7.39)	(12.86)	(10.82)	(13.07)	(17.39)	(15.54)	(16.70)
Inv Clim Vector												
Regular holiday ($t-1$)	−0.116	−0.187	−0.207	−0.125	−0.156	−0.121	−0.133	−0.077	−0.237	−0.327	−0.085	−0.104
	(−0.75)	(−0.82)	(−1.43)	(−0.70)	(−0.76)	(−1.03)	(−0.80)	(−0.55)	(−0.92)	(−1.42)	(−0.62)	(−0.67)
Export holiday ($t-1$)	0.012	−0.000	0.009	0.028	0.025	0.038	0.020	0.039	0.004	0.087**	0.024	0.024
	(0.49)	(−0.01)	(0.41)	(1.09)	(0.93)	(1.78)	(0.77)	(1.38)	(0.14)	(2.92)	(0.83)	(0.81)
Regimes ($t-1$)	−0.183	−0.153	−0.707***	−0.225	−0.201	−0.125	−0.112	−0.275	−0.185	−0.197	−0.194	−0.230
	(−1.02)	(−0.76)	(−3.84)	(−1.07)	(−0.96)	(−0.83)	(−0.60)	(−1.17)	(−1.00)	(−1.00)	(−0.87)	(−1.24)
Guarantees ($t-1$)	−0.179	−0.216	−0.712**	0.042	−0.167	0.286	−0.131	−0.264	−0.148	−0.307	−0.252	−0.121
	(−0.60)	(−0.64)	(−2.57)	(0.10)	(−0.48)	(0.99)	(−0.25)	(−0.85)	(−0.52)	(−0.91)	(−0.88)	(−0.39)
Observations	122	122	122	122	122	124	122	122	122	122	130	122
R-squared	0.62	0.62	0.61	0.61	0.60	0.50	0.61	0.65	0.56	0.62	0.58	0.61
Number of countries	11	11	11	11	11	11	11	11	11	11	11	11

*** $p < 0.01$

** $p < 0.05$

* $p < 0.1$

Robust t statistics in parentheses

more subtle than the one of a CIT rate of zero. As a result, it is the second relationship, between the cost of capital and investment, which fails. More recent theories, like the New Economic Geography theory, predict a more complex relationship between the cost of capital and investment. Due to agglomeration effects capital is sticky to the core regions and small tax changes are ineffective. Countries in the periphery, such as Africa, do not have the forces, such as the market size effect, that create endogenous capital growth.

Another possible explanation why we do not find the neo-classical link between user cost of capital and investment is that the user cost of capital in developing countries cannot be captured by the effectiveness of the tax system alone. Other cost factors, such as the high hurdle rate of return for investors due to the investment risks and compliance costs, might outweigh the usual capital cost that is measured in industrial countries by calculating the METR. The significance of the guarantees and tax complexity variables support this view.

A third possible explanation lies in the downside of granting tax incentives: the revenue forgone for the government. In countries where basic public goods such as regulatory quality, the rule of lax, infrastructure, etc are not sufficiently provided, it is possible that investors prefer paying taxes that are spent to provide the necessary public goods, to profiting from tax exemptions in a country where the necessary public goods are missing.

Finally, we recognize that in measuring the link between tax holidays and investment we are limited by the availability of more (detailed) data. It would be interesting to have more detailed data on other time-varying investment climate variables such as the administrative burden, labor force skills or infrastructure. It would also help to have investment variables at a more disaggregate level than the ones we have. For example, sector level data would allow us to evaluate whether tax holidays in certain sectors are more effective than those in others, as we observed for exports. In one of the robustness checks we controlled for determinants specific to investment in extractive industries, which are often subject to a different tax treatment. Disaggregating investment would be a more optimal methodology. Still, we believe that the tax incentives in the developing countries we study are aimed at increasing the total amount of investment.

More research on the circumstances in which tax holidays are effective is certainly needed. A way to analyze the circumstances in which they are effective would be to let the tax holiday variables interact with other investment climate variables. To do so, we need more observations.

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Appendix: Mineral export shares in total mineral exports

Country	Mineral export share in total mineral exports
Benin	Oil (100%)
Burkina Faso	Gold (100%)
Central African Republic	Diamond (100%)
Ivory Coast	Gold (1%), Oil (99%)
Cameroun	Oil (100%)
Congo	Oil (100%)
Gabon	Magnesium (6%), Oil (93%), Uranium (1%)
Mali	Gold (100%)
Niger	Uranium (100%)
Senegal	Phosphates (93%), Sea salt (7%)
Chad	Oil (100%)
Togo	Phosphates (100%)

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