

Can we curb tax evasion with VAT?
A study on the relation between the value added
tax and the size of the informal sector in Africa

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Abstract

This essay provides an analysis of the relation between the value added tax (VAT) and the size of the informal sector in Africa. The proposed hypothesis is that due to incentive mechanisms provided by VAT, tax evasion, and hence the size of the informal sector, should decrease when VAT replaces other standard consumption taxes, primarily the retail sales tax (RST) and the turnover tax (TOT).

The effect is estimated using a new panel-data set from 30 African states between 1996-2008. VAT is operationalized with a set of dummy variables that are assigned two values: either a country has a VAT, or it does not. The outcome from the estimations does not provide reliable results to support the hypothesis, nor is it possible to rule out the existence of a relationship. Since this essay is the first of its kind, more research is needed before any robust conclusions can be made regarding a causal relation between VAT and the size of the informal sector.

Keywords: value added tax, panel data, tax evasion, informal sector, Africa

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Chapter 1

Introduction

The success of publicly financed development policies depends heavily on the ability to collect taxes. Traditionally, many developing countries have relied on tariffs, a revenue source that is rapidly becoming less popular with an increasing amount of free-trade agreements and a general pressure of trade liberalisation (Kowalski 2005: 9-10). In this setting many developing countries have turned to the value added tax (VAT), often on recommendations from international organisations such as OECD or IMF, which in turn rely on academic research and findings.

However, traditional recommendations regarding the optimal level of taxes are often based on models that do not fully consider the special features of developing countries. These include low administrative capacity, less political legitimacy and foremost a non-trivial *informal sector*¹ (Bird and Gendron 2007: 22-23). Since it is a plausible assumption not only that the optimal choice of tax-rate is dependent on the size of the informal sector, but also that the size of the informal sector varies with the tax design, a successful tax-system requires an understanding of the relationship between taxes and the informal sector. Considering the fact that most of the worlds low income countries have introduced a VAT during the last ten to thirty years, this thesis will focus on the relationship between VAT and the informal sector. More specifically, it will investigate *if the move from either a turnover tax or a retail sales tax to VAT in 30 African States between 1996-2008 has caused the informal sector to shrink.*

1.1 Previous research

Besides from the fact that the relationship between VAT and the informal sector is of great significance to economic and development policy, this study fills a gap within the academic field of economics. There is a rich variety of studies investigating general determinants of the informal sector, but (from what the

¹In different settings sometimes also referred to as shadow economy/sector, informal economy, black economy, parallel economy or underground economy (Flemming et al 2000: 387).

writer is aware of and has been able to find) there is yet no study estimating the relationship between VAT and the size of the informal sector. This lack of empirical research exists despite theories and ideas supporting that VAT lowers tax evasion and informal activity. For example, economist Harvey S. Rosen writes in the textbook "Public Finance" (2004: 480) that, with regards to VAT, "compliance is better than it would be under a national retail sales tax", and in 2005 the Indian minister of finance Chidambaram stated that the VAT would help "curb the black economy" (Manu 2005).

There are studies that deal with somewhat related issues. Baunsgaard and Keen (2010) investigate whether or not the tax dollars lost due to a reduction (or even a complete removal) of tariffs have been recovered by the new taxes chosen, VAT often being one of the choices. The authors find mixed results, showing that high-income countries have been able to regain lost revenues, while the results for low-income countries are dubious. Interestingly, the authors further conclude that no evidence is found in favour of countries using a VAT-regime being able to regain tax revenues better or faster than countries with other indirect taxes (ibid 2010: 573). On the other hand, Buettner, Hertz and Woon Nam (2007) find that emerging and transitional countries have in fact been able to regain revenues lost due to trade liberalisation. The authors also find that countries that introduced VAT while being a member of WTO generally had more success than non-members. None of these studies do, however, study whether VAT causes the informal activity to decrease.

1.2 Aim, general method and disposition

The aim of the study is descriptive and explanatory. More specifically the purpose of the thesis is:

- To evaluate the changes in the informal sector in Africa due to the move from either a turnover tax or a retail sales tax to VAT.

The effect of VAT on the informal sector will be estimated via a cross-country study, using panel data consisting of 30 African states between 1996-2008. Some of these introduced a VAT during this period; some of them had already inserted it before 1996. One of the countries in the sample, Egypt, has not yet introduced a VAT. The choice of Africa as the setting of this study is practical since many African countries introduced VAT quiet recently, making it easier to obtain comparable data. Moreover, the informal economy is on average larger in Africa than in most other parts of the world, making the problem larger and more relevant.

Technically the effect of VAT will be estimated using the size of the informal sector as a dependent variable and the existence of VAT as an independent dummy variable. The size of the informal sector has been collected from a newly created panel-database by Elgin and Oztunali (2012).

The rest of the thesis is structured as follows: Section two will provide explanations of the theoretical concepts used (VAT, tax evasion and informal

sector), whilst the third part will outline the theoretical model that will be tested in the empirical part of the paper. More specifically part three will deal with the factors affecting the growth of tax evasion and informal activity, and to what extent we can expect VAT to affect the development of the sector. Section four will be devoted to explaining and discussing the method and material chosen for the empirical study. Section five will provide and discuss the results, and the concluding sixth section will summarize the main findings, implications and conclusions of the thesis.

Chapter 2

Defining the concepts - VAT, tax evasion and the informal sector

This part of the thesis will give an introduction to the main concepts of the essay: VAT, tax evasion and the informal sector. It will be structured in three main parts. The first part will focus on defining and explaining the functions and implications of VAT, briefly discuss its advantages, provide conventional wisdom regarding tax design, and discuss the special features of the developing world. The second part will provide definitions of the informal sector and tax evasion and finally the third part will describe some key features of the African context.

2.1 Value added tax

In its essence a value added tax is exactly what the name suggests, it is a tax levied on the value added to a product. VAT hence taxes the entire chain of production. To limit distortions in the production chain, companies registered for VAT can claim credits on goods purchased (Bird and Gendron 2007: 10).

An illustrative example on bread production is given by Rosen² (2004: 479). In this example the implementation is shown by four agents: A farmer who grows wheat, a miller who buys the wheat to make flour, a baker who turns the flour into bread, and a grocer who distributes the bread to consumers for final consumption. In table 2.1 the chain of production is shown without taxes, while table 2.2 shows the results with a 10 % VAT. To simplify the illustration it is assumed that the farmer is without production costs, and that consumption is inelastic.

²The example used here is similar to Rosen regarding the four suppliers. The numbers are, however, changed.

Table 2.1: Chain of production without taxes

Producer	Purchase	Sales	Profit/Value added.
Farmer	0	400	400
Miller	400	700	300
Baker	700	950	250
Grocer	950	1000	50
Total	2050	3050	1000

Table 2.2: Chain of production with 10% VAT

Producer	Purchaser	Sales	VAT (10 %)	Credit	Profit
Farmer	0	440	40		400
Miller	440	770	70	40	300
Baker	770	1045	95	70	250
Grocer	950	1100	100	95	50
Total	2160	3355	305	205	1000

Using the miller as an example, in a non-tax environment he or she purchases wheat worth 400 to make flour worth 700. The difference of 300 is the profit, or in other words *the value added*.

With VAT, the miller is charged 440, 40 being the 10 % tax now instated. The Miller charges 770 ($700 + 700 \cdot 0,10$) to account for the tax, and pays 70 to the government. Via the refund possibility the miller can claim the 10 % levied onto the purchase, finally ending up paying a net tax of 30. Noticeable is that 30 is exactly 10 % of the value added to the product, and that the final profit is exactly the same with or without a tax. In the end the entire tax falls onto the consumer, since he or she is forced to pay 100 extra in the example including VAT.

On a detailed level there are different ways of designing VAT, but for now, as to understand the general functioning of the tax, the above illustration should be adequate.

2.1.1 Why VAT?

The VAT was first launched in France during the 1950s. Since then it has spread widely, and today most countries, low-income as well as high-income countries, have some sort of VAT. Goode (1984: 157) calls it "The most important tax innovation of the second part of the twentieth century", and Fjeldstad (1995: 2) claims the speed in which the system has spread to be "unmatched by any other tax in modern times".³ Bird and Gendron (2007: 19-21) point to two possible explanations. One reason is that the IMF played an important

³Noticeable is that Fjeldstad made his statement in a paper from 1995, in which he claims there to be "more than 90 countries" with a VAT. More than ten years later Bird and Gendron (2007: 16) claimed there to be "around 140 countries" with a VAT. Thus the spread has continued with even greater pace even after the statements of Fjeldstad and Goode.

role in launching the tax in developing countries. Foremost, however, the tax was perceived a success in the European countries that adopted it. The relevant question is henceforth: Why was the tax successful? Put differently: what are the main advantages with VAT?

Fjeldstad (1995: 3) provides the rationale for choosing VAT over an income tax, which is mainly due to working incentives. VAT taxes consumption on already earned income, whilst an income tax potentially harms your working incentives, thereby lowering the number of hours worked (ibid 1995: 3). As a tax base, consumption furthermore fluctuates less than income. Despite being good arguments, these are not specific to VAT, but apply to consumption taxes in general. The important comparison should instead be made with the two other important consumption taxes, turnover tax (TOT) and a retail sales tax (RST).

TOT is similar to VAT in that it taxes intermediary goods. However, TOT does not pose the possibility of rebates paid at the different stages of production. This means that companies will be taxed double, and production will be heavily distorted, causing vertical integration.⁴

RST and VAT are from a theoretical point of view rather similar. A simple illustration is provided in table 2.3 below.

Table 2.3: Chain of production with a retail sales tax (RST)

Producer	Purchaser	Sales	RST (10 %)	Profit
Farmer	0	400		400
Miller	400	700		300
Baker	700	950		250
Grocer	950	1100	100	50
Total	2050	3150	100	1000

As is evident, when fully functional, both tax the same amount. In practice RST is however only levied on the final step of the production-chain (purchase of the consumer). Therefore, it is the obligation of the retailer to collect the full value of the tax, which potentially makes the system more vulnerable (ibid 1995: 3-4). Furthermore, various incentives principles speak in favour of VAT being the better tax in dealing with tax evasion. Since this line of reasoning is the central theme of the thesis, it will be further scrutinized in the third, theoretical section of the essay.

⁴Vertical integration is a microeconomic term for a management control style, where companies within a supply chain are integrated through the same owner. This causes efficiency losses since the market becomes monopolized. In this case it is induced by the will to evade taxation.

2.1.2 Vat design: conventional wisdom and developing countries

The standard work on VAT in developing countries is written by Bird and Gendron (2007). Their book provides an overview of the most important features when designing VAT in developing countries. As a general finding, it should be clear that the authors do not seek to change the conventional wisdom regarding VAT-design. Already on page two the authors stress that: "on the whole we conclude that much of the conventional wisdom about VAT design is sound" (2007: 2).

What is then the conventional wisdom on VAT-design? Several IMF publications such as Ebrill et al. (2001) have been written on this subject. The following points should be stressed:

1. A single positive rate with a minimal amount of exemptions.
2. Avoid zero rating with the exception of exports.
3. Taxpayers report and pay their taxes (self-assessment).
4. Base your administrative structure on requirements of VAT.

In general few authors deviate from these points, however, two things more specific for development countries deserve to be addressed. First, it is important to note the importance of the threshold. i.e. the financial level at which a company is obliged to register with the tax authorities. Originally the idea laid forward by experts was to set the threshold as low as possible, preferably at zero, which would make everyone in the VAT-pool liable for taxes. However, later practical experiences have shown that a high threshold could be preferred. Keen and Mintz (2004: 573) show how the revenue lost can be offset by lower administrative costs no longer required for collecting taxes from small agents. It is also evident that most of VAT revenues are generated from a few large actors, illustratively referred to by Bird and Gendron as *fiscal whales* (2007: 115).

Second, and related to the first issue, is the quality of the administrative process. An illustrative example by Bird and Gendron is given in the case of Egypt. In 2001, the base of the general sales tax (GST) was extended to wholesale and retail trade, tripling the number of agents registered at the TAX authority. The administrative capacity was however not large and efficient enough to deal with such a significant development, hence leading to "no concomitant gain in revenue" (Bird and Gendron, 2007: 3).

2.2 Informal sector and tax evasion

What is the informal sector? What is included, and how should one define it? According to Flemming et al. (2000: 389-391) there exist two broad schools of thought on how to define the informal sector. The first seeks a definition via the behaviour inherent in the informal sector. Feige (1990: 990) for example argues

that the informal economy constitutes a set of rules and institutions different from the ones persistent in the formal sector. Informal economic activity hence simply means activities that are not part of societal formal institutions.

The second focuses on the bare definition of informal economic activity, namely *all currently unregistered economic activities which contribute to the officially calculated (or observed) Gross National Product* (Schneider, 2002: 3). As this definition is the one most often used when the concept is operationalized, it will also be the definition referred to in this essay.

2.2.1 Tax evasion and the components of the informal sector

It is evident that the definition provided above constitutes several kinds of economic activity. Firstly, illegal activities such as drug dealing and smuggling are not excluded. Secondly, the concept involves legal tax avoidance, meaning that one changes its behaviour to enter markets not regulated or liable for taxes. Thirdly, it involves tax evasion of legal production. All of these actions can furthermore be divided into monetary and non-monetary activity. Table 2.4 provides a simple illustration of the concepts involved. The taxonomy is based on an example from Schneider (2002: 4).

Table 2.4: Informal sector taxonomy

Activity	Monetary activities		Non-monetary activities	
Illegal	Trade with stolen goods		Produce or grow drugs for own use	
Legal	<i>Tax evasion</i> Unreported income from work	<i>Tax avoidance</i> Employee dis- count	<i>Tax evasion</i> Barter of le- gal services	<i>Tax avoidance</i> Do it yourself work

It is not likely that VAT affects all of the described behaviours above, but first and foremost what is here referred to as tax evasion. Hendricks and Myles have defined the latter as "the intentional failure to declare taxable economic activity" (2006: 513). In a bigger context this is part of what shall later be explored as the evasion decision. Theoretically an agent has the possibility to declare income or not. This choice is dependent on several factors, such as the rate of taxes, government expenditures and the level of punishment. Since it is a part of the overall tax-system, VAT is expected to affect the household decision to evade income or not. It is less likely to affect certain forms of criminal activity, such as drug dealing.

Since cross country measurements are not available for tax evasion only, what will be measured in this essay is the effect of VAT on the size of the informal sector, as measured by Elgin and Oztunali (2012). A more detailed discussion on the ways to measure the informal sector can be found in the fourth section of the essay.

2.3 African context

Since this essay deals exclusively with African states, it is relevant to comment not only on the special features of developing countries, but furthermore on the African context. One important feature of the African continent is the difference between traditional and modern administration. Kreever (2008: 13-15) claims many of the former French colonies to be part of the traditional administrative culture, which includes differentiated rates instead of a single rate, and several exemptions to the standard rate.

Moreover, according to Buettner, Wertz and Woon Nam (2007), many African states have included VAT exemptions for agricultural production. Generally countries with a higher relative amount of agricultural output can therefore be expected to have a smaller tax base.

Chapter 3

Theoretical framework

This section will describe the theoretical model of the essay. It will consist of two main parts. Part one will be devoted to the relation between VAT and tax evasion, which in turn is a part of the size of the informal sector. Part two will review the literature (both empirical and theoretical) on the determinants of the informal sector and tax evasion. This part will mainly be displayed as a microeconomic model where the decision to evade is dependent on the costs and benefits associated with the informal and formal sector. The chapter will end with a simple function summarizing the relation between the informal sector and the discussed variables. Since there is no generally accepted model, the one used in this thesis will be extrapolated from different papers, ideas and empirical estimations.

3.1 VAT and tax evasion

Several authors within the field of microeconomics and public economics have tried to model the optimal tax system given the presence of a large informal sector. In the specific case of VAT, Pigott and Whalley (2001) question conventional tax wisdom, suggesting that VAT base broadening induces actors in certain sectors to start using less efficient home production instead. Emran and Stiglitz (2005) furthermore suggest that, since informal operators can evade VAT, trade taxes should be used instead. Keen (2008) however suggests that VAT in practice is levied on imports, making it more efficient than suggested by previously mentioned authors.

These well-known examples do however not take into account the possibility that the size of the informal sector might be endogenous to the chosen tax regime. Instead, in an even more recent study, Boadway and Sato (2008) develop a model where the size of the informal sector changes depending on the regime chosen. The conclusion is not clear-cut, which should be made clear from this quote from the authors:

More generally, we have allowed the size of the informal sector to

respond endogenously to the tax system. As it turns out, both tax systems (*tariff and VAT*) have an influence on the size of the informal sector, although the relative magnitude and efficiency of that effect is ambiguous (Boadway and Sato 2008: 29).

More specifically the authors focus a great deal on other factors which are inherent to the formal sector. For example, regarding the VAT regime, for an importer, a producer (j) chooses the formal sector if, and only if:

$$R^{jFV} > R^{jSV} \tag{3.1}$$

$$\alpha_j r^j (1) > r^j (1 - v) \tag{3.2}$$

Equation 3.1 simply states that the revenue (R) for producer (j) in the formal sector (F) with a VAT-regime (V) has to be larger than the same revenue in the informal sector (S). Equation 3.2 is a specification, where r is the underlying profitability for producer j , v is the tax and α means the exogenously given advantage if being in the formal sector. Regarding α , the authors mention the legal system and public infrastructure (ibid 2008: 7, 21-22).

Evidently equation 3.1 and 3.2 can lead to different results. The authors conclude that it is possible for the tariff regime to give a larger informal sector as well as the opposite. A lot is dependent on the benefits and costs of the formal sector. These will therefore be discussed in detail in section 3.2.

3.1.1 Does VAT decrease tax evasion?

Boadway and Sato do however not go into detail on the relationship between tax evasion and VAT. For a more specific theoretical analysis, Keen and Smith (2006: 865) provide an overview of how VAT affects the decision to evade. The most important thought, which will be the basics of the hypothesis of this thesis, is that VAT can be considered *self-enforcing* and *self-correcting*. Self-enforcing means that one supplier has an incentive to make sure that their suppliers are registered for VAT according to the correct standards, and that the invoices received from the suppliers are valid. Otherwise, the purchasing corporation in question will not be able to claim credits. The tax can also be considered self-correcting, when the self-enforcing mechanism is non-functioning. If for some reason any corporation has not registered for VAT in a correct manner, the amount evaded will be collected at the next stage of production.

To illustrate this in a simple manner it is possible to reuse table 2.2. This time however, only the farmer and the miller are shown. The results can be seen in table 3.1.

Table 3.1: VAT with only farmer and miller

Producer	Purchaser	Sales	VAT (10 %)	Net tax	Profit
Farmer	0	440	40	40	400
Miller	440	770	70	30	300

The self-enforcing mechanism means that the miller has an incentive to make sure that the farmer properly registers for the tax since if the farmer is an informal company, there will be no credit to claim, and the miller will be forced to pay the full 70 in taxes. Within this example lies the self-correcting principle as well. If the farmer chooses to evade, the full tax will still be collected by the miller, and the state revenues remain the same.

There are arguments opposing that VAT lowers tax evasion. Firstly, Hemming and Kay (1981) note that the incentives to evade for final sellers to private individuals are the same under a VAT-regime as under a retail sales tax. In addition, while a purchasing company have incentives to demand an invoice from their supplier that is acceptable with authorities as a right to a refund, there exist no incentive to make sure that the actual taxes are paid. The total amount of taxes paid may therefore not increase. Third, VAT brings certain new possibilities of evasion not possible under a regular retail sales tax. The most important is the possibility of false credit claims. Some companies forge invoices to be able to claim credits with exaggerated purchases. This possibility is especially important to new companies that potentially could be expected to invest in large volumes of capital during start-up. Related to this is the possibility to set up companies for the simple reason of providing invoices. The evasion possibility arises since it is not possible to check every invoice against the specific tax that is supposed to be paid by the supplier.

While these are good arguments, several things can be said in defence of the idea that VAT lowers tax evasion. Hemming and Kay may be correct when stating that final sellers have the same incentives under VAT as under RST, however, this is only one stage of the production chain. Furthermore, while one cannot check every invoice against the specific tax, *some* can be checked, and the simple chance of being caught is enough for the self-enforcing principle to be relevant. Lastly, regarding fraud opportunities, it is true as Keen and Smith (2006) discuss, that some fraud opportunities are specific to a VAT-regime. However, the fraudulent behaviour mentioned (setting up invoice companies and forging invoices) could often be deemed complex and administratively demanding. This implies that only a few companies have the technical and financial resources to do this. These should be even fewer in a developing context.

A better counter argument might instead be that registration with tax authorities might mean that one is liable for more taxes, such as a capital tax and a profit tax. It might therefore be that very few register in the first place. Since this fact is equal no matter the consumption tax chosen, it should not matter when comparing the consumption taxes (RST, TOT and VAT). Furthermore, taxes are a cost of the formal sector, and will be included in the model as such.

A last possibility arises because of different rates and exemptions. If a company produces different supplies, they could be subject to different rates regarding different products. In this case, a company has the incentive to allocate the purchased input to the production subject to VAT (Keen and Smith 2006: 867-868). This last point is however not relevant as an argument against VAT in itself, but is instead a point to be made on how to design VAT. It is fully possible to install a VAT with a minimum amount of exemptions and rates.

Before moving on to the other determinants of the informal sector, a word of caution should be stressed. It is unclear whether the effect of VAT can be expected to kick in immediately. VAT is a tax reform implying a new tax administration, hence the effect can only be expected to be immediate in very rare cases with well functioning tax administrations. It might therefore be necessary to look at lagged effects of VAT as well.

3.2 Other determinants of the informal sector

Economically, the most elaborated cause of the informal sector is tax evasion. Within this field exists a vast literature, mostly originated from a 1972 paper by Allingham and Sandmo ("Income tax evasion, a theoretical analysis"). In the paper, the authors use a utility function to model the evasion decision as a rational choice between formal and informal occupation. The model roughly concludes that the probability of detection, the level of taxes and the level of punishment negatively affect the decision.

Later studies have indicated that the model by Allingham and Sandmo consistently overestimates the degree of evasion (Bernasconi 1998: 124; Frey and Torgler 2007: 137) and hence the size of the informal sector. Because of this several authors have sought to expand the model.

3.2.1 The evasion decision

To provide a simple review of the literature on this matter, it is nonetheless illustrative to use a similar structure as is used by Allingham and Sandmo, namely to model the decision to evade as a rational decision. This will provide a simple framework for the determinants of the informal sector. A modern example is given by a recent OECD-paper (Andrews, Sanchez and Johansson 2011: 24). The authors represent the individual decision as the following:

$$w_i^F(1 - t_i) - C_i^F + B_i^F \geq (1 - p)(w_i^{IF} + \alpha B_i^F) + p(w_i^{IF} + B_i^F - Pen_i) \quad (3.3)$$

Equation (3.1) includes w_i^F and w_i^{IF} that represent earnings in the formal and the informal economy for a specific individual i . Furthermore, t_i is the tax rate, C_i^F equals other costs in the formal sector (for example labour regulations and start-up costs), B_i^F represents benefits with being formal (this includes any public goods or welfare services), p means probability of being caught cheating, Pen_i is the penalty when caught and finally α denotes how much of the benefits provided by the formal economy that informal workers can use (clearly it is not possible to exclude individuals from pure public goods, two classical examples being national defence and light houses). The left part of the inequality symbol represents benefits with a formal occupation, and the right part of the equation shows the benefits with informal occupation. In theory the decision is very simple: the sector that gives the highest level of benefits is the sector of choice.

With equation (3:1) there is hence a very good analytical tool to organize the factors influencing the size of the informal sector. However, to fully evaluate the

factors determining the size of the informal sector (besides VAT) it is necessary to further develop the variables C and B (costs and benefits of the formal sector). To simplify I will speak of only costs. Any benefits of the formal sector will henceforth be evaluated as costs in the informal sector. Theoretically the size of the informal sector should grow with costs of the formal sector and shrink as costs of the informal sector goes up.

3.2.2 Costs of the formal sector

Taxes have already been incorporated as a formal cost in the models described in the previous section. The explanation is simply that a tax is a cost that is carried mostly by the formal sector, making it less profitable to work within the formal framework. However, the relationship must be treated with caution. As concluded by Friedman et al. (2000: 465), higher taxes could theoretically have two effects. First, a direct cost-effect which increases the incentives for a single individual to evade, but also an indirect revenue-effect, which decreases the incentives. The logic of the latter effect is that tax-revenues made from the high taxes provide the government with the possibility to invest in a better institutional environment, which lowers the costs of the formal sector. Hence the **quality of institutions** must be accounted for. Second, and naturally of essential importance to this essay, one must consider not only the level of tax-rates, but also the **complexity of the tax-systems** (Andrews, Sanchez and Johansson 2011: 31). Less complex and better organized tax systems pose possibilities of raising taxes. Keeping this line of reasoning in mind it is less surprising that Friedman et al. (2000: 475) find a negative correlation between the level of taxes and the size of the informal sector.

Furthermore, many have demonstrated the correlation between **regulations in the formal sector** and the size of the informal sector. De Soto for example claims that 73 % of the costs in the formal sector is due to complex regulations (1989). Loayza, Oviedo and Servén (2006: 124) moreover construct a regulation index, consisting of for example labour-market regulations, contract enforcement and bankruptcy regulations. The authors perform regressions on 72-75 developing countries and find a positive correlation, meaning that more regulation, increases the size of the informal sector. The theoretical case for this correlation is that more complex regulations in mainly product markets create higher production costs and henceforth lower incentives to enter the formal sector. Once again the relationship is sensitive depending not only on the quantity, but also the **quality of regulations**. The relationship is, as was the case with taxes, also affected by the quality of institutions (Enste 2010: 233).

3.2.3 Costs of the informal sector

The most intuitive cost of the informal sector, already mentioned above is the **penalty** if caught cheating. This cost in turn depends on the **probability of being detected**; hence there is a negative correlation between the level of penalty, the probability of being detected and the size of the informal sector.

Besides from the penalty levied on detected informal economic activity, the informal sector is furthermore costly since informal workers are unable to "take full advantage of government provided goods." These include for example **property rights, the possibility of utilizing the judicial system, access to education, health care and job security** (Loayza 1996: 134; Andrews, Sanchez and Johansson 2011: 24).

A more specific example of benefits in the formal sector is provided by Gordon and Li (2009). The critical assumption provided by the authors is that any company, any day, can turn to the informal economy by using cash transactions only. Since the authors further assume that a corporation is either completely formal or informal, and that a company using financial intermediaries can be detected by authorities, no informal work can be conducted with the help of the financial sector.⁵ This has two implications for the costs of the informal sector. First, the decision on whether or not to engage in informal activity will be based on an agent's **dependence on the financial sector**, and the **quality of the financial institutions**. Second, the **rate of inflation** becomes a specific cost on the informal sector, since companies could potentially use the bank system, and earn the nominal interest rate (ibid: 856-859). This means that high inflation levels could increase the incentives to enter the formal sector.

Besides from these strict monetary costs, an increasing amount of literature has laid focus on social conventions and moral conceptions. Frey and Torgler (2007: 140-156) for example expand the traditional model by Allingham and Sandmo with regard to the social context, showing that the perception of **tax morale** is negatively correlated with the level of evasion. The concept basically states that if people perceive tax evasion as something morally bad, or as something that violates social conventions, the informal sector will decrease.

Tax morale in turn depends on the social context, sometimes referred to as **conditional cooperation**. This concept implies that my own behaviour is dependent on the behaviour of the people close to me. If lots of other people evade, I am more prone to evade. Practically speaking then, tax evasion grows independently, meaning that a larger informal sector creates an even larger informal sector (Cule and Fulton 2009: 811- 813). Closely related to the idea on the social context is the **quality of governance**. This simple reasoning implies that tax evasion decreases when people perceive the governments expenses as somewhat useful and good (Frey and Torgler 2007: 141).

3.2.4 Looking past the evasion decision: The developing context

It should be noticed that the moral perceptions of paying taxes, as described in the previous section, can, and have been argued to be of less importance in developing countries. This is simply because some authors view the choice to work in the informal sector as a survival strategy. Kim (2005) develops a model

⁵To specify it refers to formal financial activities. The paper does not include informal financial services.

where rational agents still maximises utility, but where the number of hours of formal sector employment is exogenously given, and the choice becomes one between leisure and informal sector work. Since the poor cannot afford leisure time, the theoretical result of the model is that more **poverty** means a larger informal sector. This idea is later strengthened by empirical testing of Romanian micro data, something Kim concludes points to the informal sector being a survival strategy, at least in transition countries (Kim 2005: 183).

Lastly an important factor is the **reach of the tax system**. Child (2008: 133-134) addresses these issues, when pointing to the perhaps less significant examples of low levels of leaflets in Zambia, or how South African tax authorities have used cartoon characters to enhance tax payer compliance/education. Still the examples point to a key figure: the **spread and knowledge of tax laws**. This could of course be due to both **poor outreach** from tax authorities, as well as **general segregation**.

3.3 Summing up

The theoretical discussion is summarized below in a relationship showing variables affecting the size of the informal sector. In general, costs of the formal sector will cause higher tax evasion and costs of the informal sector will cause the sector to shrink. Of the other variables mentioned, increased poverty and segregation causes higher levels of informal activity, while better reach of tax authorities should lower informal activity. A special case is the tax rate, which as discussed could cause both higher and lower informal activity. Because of the incentive principles stated earlier, having a VAT over another form of consumption tax should cause the informal sector to decrease. This is simply stated below as choice of consumption tax.

Informal sector = costs of the formal sector (tax rates, complexity of tax system, regulation costs); costs of informal sector (formal institutions, public goods, inflation, financial quality, penalties/probability of being caught, tax morale); Other causes (poverty, segregation, reach of tax authorities); Choice of consumption tax

With regards to the discussion in section 3.2 the central idea and hypothesis of the essay is that:

Choosing VAT over another consumption tax will lower tax evasion, and hence cause the informal sector to shrink.

Chapter 4

Empirical model

Empirically the essay models the introduction of VAT as a dummy-variable, and uses panel data from 30 African states between the years 1996 and 2008 to estimate a possible effect of VAT on the size of the informal sector. This section will focus on explaining and discussing these methodological choices. It will include two main sections. Firstly, the dependent, independent and control variables used in the model will be presented and discussed. This section will also include a short discussion on the country and time dimension of the essay. Secondly, the econometrical models will be specified.

4.1 Variables

The variables used in the essay were gathered from different sources, such as the World Bank, IMF and Heritage Foundation. All choices of variables are based in the theoretical section and relevant academic literature regarding operational measures. As shall be seen below, the data on the dependent variable is collected from a new data source, which has not been included in empirical research before.

4.1.1 Dependent variable - informal sector size

As discussed in the theoretical section, tax-design can be expected to have an impact on the level of tax evasion. Since cross-country data on tax evasion (particularly for developing countries) are unavailable, the dependent variable used will be the size of the informal sector. Tax evasion is only one part of informal activity, hence we can expect the effect of VAT (if any) to be rather small.

To measure the informal sector is not an easy task. Ever since the concept was introduced in the beginning of the 70s, several authors have striven to find both accurate as well as comparable numbers. So far, there is no general consensus on how to measure it. Roughly the methods used so far can be sorted

under direct, indirect or model approaches; the former two are sometimes also referred to as micro and macro estimates.

A micro estimate means time consuming efforts such as qualitative surveys or use of national auditing records. For example Gönenç and Tanrivermis (2007) investigate the factors affecting the rural informal sector in Turkey. To do this, a household survey is carried out for many months to hundreds of respondents. The advantage of this kind of study is the depth of the investigations. The numbers produced can be analysed in several useful ways. The biggest weaknesses are firstly that the results depend greatly on the structure and formulation of the survey, and secondly the number of hours needed to conduct a valid study. The latter also means that there is a lack of cross-country data, as well as very few time series studies (Greenidge, Holder and Mayers 2009: 202; Elgin and Oztunali 2012: 4).

On the other end some researches use simplified assumptions, and via these calculate the evolution of the informal sector based on macro-indicators. These are the indirect methods, and include: i) calculating the difference between electricity consumption and GDP, ii) using the difference between actual and official labour force participation and iii) calculating differences between expenditures and income (Greenidge, Holder and Mayers 2009: 203-204; Elgin and Oztunali 2012: 5). The biggest weakness of these methods is the simplifying assumptions needed to perform the relevant calculations. As an example, the electricity approach assume that the elasticity between electricity and GDP is close to 1, and that electricity output is a correct measure of economic activity. To calculate the evolution of the informal sector all you need is hence to withdraw the growth in GDP from the growth in electricity, and the result is the growth-rate of the informal sector. The problems are several: not all informal activities can be said to use electricity, and productivity improvements generates a more efficient use of electricity over time. Similar problems exist in other macro-methods.

Lastly some efforts have been made to produce a model-approach, building on a function, where the informal economy is the result of several known variables. Once you have determined the relationship between a set of independent variables and the growth of the informal sector, you simply insert the variables to produce the size of the sector. The biggest problems with this rather complex method are mainly that you need to be certain about the specific variables creating the informal sector, but also that you face a lot of missing data on relevant variables.

The latest effort to produce a measure can be found in a working paper by the Turkish economists Elgin and Oztunali (2012). The authors see three critical flaws in the subgroups of measures mentioned above. These are

1. The overuse of ad hoc assumptions and econometric specifications.
2. Measurement errors due to heavy use of econometric estimations.
3. Lack of microeconomic foundations.

Elgin and Oztunali build the model as an attempt to overcome these challenges. Since the model is mathematically complex, only the basic features will

be explained here. A more thorough explanation of the model can be found in appenix A.

The calculations are performed in four steps:

In the first step the authors define a dynamic household maximisation problem. The members of a household have the choice to make on how many hours they are to devote working in the formal as well as the informal sector. The goal is to maximise lifetime utility. In the second step the authors find the first order conditions of the maximisation problem, and rewrite them for the third task, which is to find the steady state equilibrium path for the hours devoted to working in the informal sector. At the fourth and most important stage the expression for the informal sector as percentage of GDP is presented:

$$(\theta_S N_S^\gamma)/(\theta_F K^\alpha N_F^{1-\alpha}) \tag{4.1}$$

Where θ_S is the productivity parameter of the informal sector, N_S^γ is the number of hours devoted to working in the informal sector, (γ being a cobb-douglas exponential.) θ_F is the productivity parameter of the formal sector, K is the capital stock in the formal sector, and $N_F^{1-\alpha}$ is the number of hours devoted to formal work (α being a cobb-douglas exponential).

The specific numbers for the variables are collected using different sources and methods. Some are backtracked using the steady state equilibrium path calculated from the problem in the first three stages of the model (N_S), some are taken from standard business cycle literature (α and γ) and some are taken from acknowledged data bases such as Penn World Tables (N_F).

It is evident that, to a certain extent, at least two of the three targets set up by the authors are reached. Firstly, by including a dynamic household maximization problem, the model has a clear microeconomic foundation. Secondly, there are few econometric specifications creating measurement errors. Whether or not the model decreases ad hoc assumptions is however less clear. As an example, in the household maximisation problem the authors include taxes as a strict cost of the formal sector. It is furthermore assumed that the budget is balanced which means taxes are measured as government expenditures. Both these assumptions could be deemed as ad hoc. The calibrations and calculations are radically simplified by the very existence of the assumptions, but it is in most cases quiet strong to assume balanced budgets and no taxing of the informal sector. Regarding the latter, Keen (2007: 13) has argued that informal producers face taxes in different forms.

Despite the issues raised above, the model is transparent, the authors argue reasonably and foremost create a huge dataset available for comparisons. Primarily for the last reason the numbers provided by Elgin and Oztunali will be the dependent variable of this paper. Again it is important to notice that the data is new, which means there is no reference of empirical research using it. This is important to keep in mind when the output is reviewed.

4.1.2 Independent variable: VAT

The independent variable is a dummy that simply takes on two values. Either a country has a VAT, or it does not (*VAT*). The interest from this essay lies in testing the theoretical idea that VAT lowers tax evasion. Hence countries with a VAT are (*ceteris paribus*) expected to have a smaller informal sector.

The information on which year a country installed VAT is taken from Kreever (2008: 3-4). A full list of the thirty African countries and respective year of VAT introduction can be found in table 4.1. In all cases, VAT replaced another consumption tax.

Table 4.1: African states and introduction of VAT

Country	Year	Country	Year
Algeria	1992	Madagaskar	1994
Benin	1991	Malawi	2002
Botswana	2002	Mali	1991
Burkina Faso	1993	Mauretaniien	1995
Cameroon	1998	Morocco	1986
Cap Verde	2004	Mozambique	2008
Chad	2000	Namibia	2000
Republic of Congo	1997	Niger	1986
Egypt	-	Nigeria	1994
Ethiopia	2002	Rwanda	2001
Gabon	1995	South Africa	1991
Ghana	1998	Tanzania	1999
Guinea	1996	Tunisia	1988
Kenya	1990	Uganda	1996
Lesotho	2003	Zambia	1995

As was shortly discussed in section two and three, the effect of VAT might differ depending on certain design features, such as threshold level, tax-rate, the number of exemptions and the number of different rates. While these design features are of crucial value, I have not been able to consider any of them. The simple reason is that none of these numbers are accessible. The amount of time potentially required to search bilaterally via every country is out of reach of this essay.

Furthermore, it is important to note that it is fully possible that the VAT dummy captures several other features. Introducing VAT in its essence implies a tax reform. Hence it could in fact be that what the dummy captures is the possible simplification of the tax system that was brought on due to the tax reform. Since the initiation of VAT always implies a tax reform, it is hard to control for. This inherent weakness of the VAT dummy should instead imply careful interpretations of the results of the essay.

A further weakness of the VAT-dummy is that it might hold too little variation. Once a country has inserted a VAT, the dummy takes the value 1, implying no variation thereafter. Another dummy (*VAT_ONLY*) is hence used, that sim-

ply takes the value 1 the year VAT is introduced. This dummy hence assumes only a temporary effect.

4.1.3 Control variables

The choice of control variables is based on the decision to evade and the developing context. The variables will hence be presented according to costs of the formal and informal sector as well as developing context considerations. As a general rule, higher costs of the formal sector should produce higher levels of informal activity, while higher costs of the informal sector naturally should lower the size.

Costs of the formal sector

To represent the **level of taxes** the regressions performed involve the Heritage foundation index fiscal freedom (*FISC_FREE*). This index measures the overall tax burden of a country, which includes total taxes as a percentage of GDP and top taxes on corporate and individual income. The variable is an index from 1-100, where a higher number represents higher fiscal freedom. More precisely, the index is created by weighting individual taxes, corporate taxes and total tax-burden equally. Each of the three factors is converted into a value between 1-100. Taking the average of the three values combined produces the overall fiscal freedom. The raw material for the index is taken from several sources, including the staff country reports of IMF, PricewaterhouseCoopers publications and government authorities (Heritage Foundation 2012:a). The strength of the index is the amount of data available. Even for developing countries an extensive dataset between 1996 and 2008 is available. The biggest weakness is that consumption taxes are not reflected in the index.

According to traditional models within public finance the effect of the index should be negative, meaning that as the index grows, and the tax burden is lowered, less people will evade. However, as discussed earlier it might be that smaller tax-revenues reflect a less well functioning tax-administration or that lower revenues provide less opportunities for investment in public goods, which decreases the benefits of the formal sector, and hence could increase informal sector growth. The effect of fiscal freedom is therefore slightly ambiguous.

Within the traditional models there is also an emphasis on the **quantitative burden of regulation**. Again this will be presented by a Heritage foundation index, called business freedom (*BUS_FREE*). The index is based in ten factors from the *World Bank doing business report*. These include the number of procedures and days as well as the overall cost it takes to start a business and to obtain a licence. Furthermore the index values minimum capital to start a business and the time, cost and recovery rate of closing the business. As was done with fiscal freedom above, each factor is converted to a number between 1 and 100. The average number of the ten figures represents the index (Heritage Foundation 2012:c). A problem with the data of this variable is the lack

of variation over time. For some countries the year to year variation is almost non-existent. The results might therefore be less reliable.

Nicoletti and Pryor (2006: 434-436) discuss how it could be important to include both subjective and objective measures of regulation, partly since they are not always correlated, partly because they hold different strengths and weaknesses. Objective indexes such as regulation quantity are not influenced by personal judgement and ideology. However, objective measurements rarely have the possibility to say anything about the enforcement of laws, which is instead possible to a greater extent with subjective measures. Because of the above line of reasoning, **regulatory quality** (*REG_QUAL*) from the World Bank governance indicators is included as a control variable. The variable draws on several sources such as surveys of households and firms, commercial business information providers, non-governmental organizations and public sector organizations. The World Bank state that the variable captures "*perceptions*" [my italics] of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development" (World Bank 2012:a).

The variable is measured as an index between -2.5 and 2.5, where the latter number represents a perfect view on the regulatory quality of the country. The predicted effect of business freedom and quality of regulation on informal sector growth is negative. Higher index means less regulation with higher quality, which should ease the burden of companies and lower the incentives to evade.

To account for the **institutional quality**, three further World Bank governance indicators are used: control of corruption (*CORR*), government effectiveness (*GOV_EFF*) and rule of law (*RULE_OF_LAW*). The indexes are similar to regulatory quality in the sense that they capture perceptions, are based in a similar combination of references and index similarly (-2.5 to 2.5).

The former of these, *control of corruption*, has a straightforward interpretation. It measures to which extent public officials exercise public power to gain privately. A positive number hence means less corruption, meaning that the effect on informal sector growth should be negative (World Bank 2012:b).

The function of *rule of law* is similar. The variable measures the perceived trust in the judicial system of a country. A higher trust brings better predictability, which decreases the expected costs of the formal sector. In particular the World Bank tries to capture the extent of trust in "the quality of contract enforcement, property rights, the police, and the courts as well as the likelihood of crime and violence." (World Bank 2012:c).

Lastly, *government effectiveness* is a measure of how public service is perceived. To exemplify, this includes the quality of education and hospitals, the credibility of the government and the quality of civil servants, as well as to what extent the latter is independent (World Bank 2012:e).

The strength of the variables from the World Bank governance index is the detailed information provided by the bank. The weakness is that there is no data available for the years 1997, 1999 and 2001. The reason for this is simply that between 1996 and 2002, the study was only performed once every second year. In the data set I have therefore used a simple formula calculating the annual

trend for each year, and via this inserted values for 1997, 1999 and 2001. Based on the fact that the numbers changes extremely little from year to year, the effect should be minimal. However, hypothetically it is of course possible that certain years experienced drastic decreases or increases in perceptions. Hence the results provided from the World Bank governance variables should not be over emphasized.

Another reason to adress the institutional variables carefully is that these might not be suited for year to year studies. The World Bank concludes that for some observations the margin of error is almost as large as the change from one year to another. Results from panel data between 1996-2008, where observations include every year, might therefore give somewhat arbitrary results. To see whether or not this is a problem I have added regressions where the effect over ten years is tested. This will be further explained below.

Costs of the informal sector

In the previous section it was noted that taxes might create ambiguous effects on the evasion decision. One of the prime reasons was that higher taxes could create possibilities for more **investments in public goods**. To control for the latter effect, it is important to include a variable representing public investments and transfers. These were measured using another Heritage foundation index, measuring the degree of **government spending** (*GOV_SPEND*). The index is similar to the other Heritage Foundation-indexes, in that all countries are awarded a value from 1-100, 1 being extreme levels of government spending and 100 being non-existent levels of expenditure. The index is however non-linear, which means that very high levels of government spending are penalized with a quadratic approach. Since most countries within the African context have relatively low levels of expenditure, this way of non-linear indexation should not affect the results a great deal (Heritage Foundation 2012:b). The marginal effect of this index should be positive, since higher index values means lower level of investment. The variable could, however, easily be subject to endogeneity problems (a limited formal sector means less spending possibilities). Because of this, the variable is lagged one year (*LAG_GOV_SPEND*).

A further cost of the informal sector is the loss of finance due to **inflation**. As a proxy for inflation the World Bank data on annual percentage price changes is used. There is however a weakness with using inflation as a linear variable, since it has been indicated by previous research, that the effect in certain cases could be non-linear (Bulir 2001: 140). To account for this problem the model will include a dummy variable (*INFL_DUMMY*), where Bulir (2001: 146) is used as inspiration. Bulir assigns values from 1-4, where 1 is very low inflation ($\leq 5\%$) and 4 is hyperinflation ($\geq 300\%$). Since the inflation documented in this case is rather low, only two values were assigned, either 0 for inflation $\leq 5\%$, and 1 for inflation $\geq 5\%$.

The effect of inflation draws theoretically on the assumption that informal activity is restricted to cash-transactions. Therefore it is interesting to look at the effects from the **quality of the financial sector**. Relevant measurements

of financial quality exist, such as World Bank CPIA ratings: *financial sector quality* and *quality of budgetary and financial management*. These however lack extensive data-coverage, which is why financial deepening (*FIN_DEEP*) is used as a proxy. Financial deepening is according to IMF a concept describing *access, liquidity* and *diversification* of the financial sector (Goyal 2001: 4). The easiest way to measure this is M2 (money and quasi money supply) to GDP. A higher ratio means higher financial deepening which should lower the size of the informal sector. The data on GDP and M2 was collected from the world development indicators.

The developing context

To account for the developing context a measure of **poverty** was included. Intuitive measures of poverty (such as the number of people living on less than USD 1.5 per day) exist but suffer from extensive loss of data. This essay therefore uses **GDP per capita**, based on **purchasing power parity** (*GDP_PPP*). The variable is collected from the world development indicators. Since it is primarily a measure of wealth, GDP per capita PPP is clearly not the best way to measure poverty. It does not take into account neither distribution nor the type of goods or services produced, and new estimates indicate that the majority of the worlds poor live in middle income countries (Sumner 2010: 1). However, previous studies have indicated a correlation between higher GDP per capita and lower poverty rates (Deaton 2005: 2). The variable furthermore holds the general advantage of being yearly available in almost all developing countries. To account for the endogeneity problem posed by the fact that the size of the informal sector could influence GDP per capita, the variable has been lagged one year (*LAG_GDP_PPP*).

Lastly, in the second section of the essay it was shortly mentioned that several countries in Africa often exempt agricultural products. To account for this, I use the relative size of the agricultural output to total GDP (*AGR*). Agriculture in this case includes hunting, forestry, fishing, livestock production and cultivation of crops (World Bank 2012:f). This measure was also collected from world development indicators, and should have a positive marginal effect on the dependent variable.

4.1.4 Time and country dimension

As mentioned above the model is a panel data set with 30 African countries over the years 1996-2008. Regarding the time-dimension the years were picked from an availability perspective. The panel data set used to measure the informal sector only stretches as far as 2008, and for many control variables in the model, such as the institutional variables, 1996 was the first year of observation.

The ambition was to produce a representative sample of the African continent. Hence all current African states (except South Sudan) were originally included in the sample. Countries were gradually left out as more variables were added to the model. The thirty countries left are the countries with adequate

available data. The sample is however from certain points of view still representative. Firstly the selection involves both low income, lower-middle income and upper-middle income countries. Secondly the population varies from the largest state to some of the smallest states. Finally, the countries belong to different parts of the African continent. Table 4.2 shows the distribution between south, north, west, east and central Africa.

Table 4.2: Countries divided by region

East Africa	Burkina Faso	Tunisia
Ethiopia	Cap Verde	
Kenya	Ghana	South Africa
Madagascar	Guinea	Botswana
Malawi	Mali	South Africa
Mozambique	Mauretania	Lesotho
Rwanda	Niger	Namibia
Tanzania	Nigeria	
Uganda		Central Africa
Zambia	North Africa	Cameroon
	Algeria	Chad
West Africa	Egypt	Republic of Congo
Benin	Morocco	Gabon

4.2 Model specification

The variables described in the previous section are inserted in a multiple linear regression model to estimate the effect of VAT on the size of the informal sector. The variables included are according to equation 4.2, where i is the country-dimension and t is the time-dimension.

$$\begin{aligned}
 \text{INFORMAL}_{it} = & \beta_1 \text{LAG_GDP_PPP}_{it} + \beta_2 \text{AGR}_{it} + \\
 & \beta_3 \text{REG_QUAL}_{it} + \beta_4 \text{CORR}_{it} + \beta_5 \text{RULE_OF_LAW}_{it} + \beta_6 \text{GOV_EFF}_{it} + \\
 & \beta_7 \text{BUS_FREE}_{it} + \beta_8 \text{FISC_FREE}_{it} + \beta_9 \text{LAG_GOV_SPEND}_{it} + \\
 & \beta_{10} \text{INFL_DUMMY}_{it} + \beta_{11} \text{FIN_DEEP}_{it} + \beta_{12} \text{VAT}_{it} \quad (4.2)
 \end{aligned}$$

Since the data has a cross-country dimension, it is likely that some country specific variables remain unobserved. This could include for example cultural qualities, which are constant over time but affects growth levels in each country. The same reasoning can be applied for unobserved effects from specific years. According to Dougherty (2007: 421) whenever the sample is not randomly chosen, this problem should be accounted for with a fixed effect model. This is done in two simple steps. Firstly one specifies the original model including the unobserved factors. Mathematically the basic model is specified in the following way:

$$Y_{it} = \beta_1 x_{it} + a_i + u_{it} \quad (4.3)$$

Where Y equals the size of the informal sector, x are the different independent variables, i and t are cross country and time-dimensions, u is the residual and a represents the unobserved factors, which are constant over time.

Secondly, one changes the equation to be able to perform an estimation without a_i . This can be done in several ways, one being the within estimation:

$$Y_{it} - \tilde{Y}_i = \beta_1 x_{it} - \tilde{\beta}_1 \tilde{x}_i + a_i - \tilde{a} + u_{it} - \tilde{u}_i \quad (4.4)$$

$$Y_{it} - \tilde{Y}_i = \beta_1 x_{it} - \tilde{\beta}_1 \tilde{x}_i + u_{it} - \tilde{u}_i \quad (4.5)$$

As can be seen in equations 4.3 the mean of each variable is withdrawn to produce the final equation 4.4. a_i disappears because we assumed the effects are constant over time, hence $a_i = \tilde{a}_1$.

In the baseline regression model only country specific effects will be tested for. When exploring the model later on, time specific effects will be included as well. I will return to this in the next section.

It is also important to note the different specifications of VAT . As was earlier discussed in the theoretical section, it is unclear whether one can expect an immediate effect. Hence, in all regressions, VAT is analyzed with an immediate effect, a one year lag and a three year lag. Furthermore, VAT will be presented in two ways. The first variable (VAT) takes the value 1 for each year a country has a VAT. The second variable (VAT_ONLY), simply takes the value 1 the year VAT was initiated. The latter variable is lagged as well.

4.2.1 Exploring the model

The multiple regression described above in equation 4.5 is the baseline scenario of the essay. This model will be explored in several ways:

The numbers provided on the size of the informal economy by Elgin and Oztunali (2012) distributed an unrealistic trend towards the last year included in the data-set. The average annual growth over the years 1996-2007 is distinctly lower than between 2007 and 2008. It might of course be that the time-period between 2007 and 2008 included circumstances which triggered an extreme expansion of the informal sector (for example via an international financial crisis). A more realistic explanation might however be that since the data-set is new, it could include initial problems. To account for this, time specific fixed effects are included. By this is meant, that the model controls not only for unobserved factor that are constant over time, but also effects which are constant over space (in this case countries).⁶

⁶Considering the potential problems with the data on the dependent variable, and the fact that the data set is new, the results would be more robust if I were to include a different data set with a different method on the dependent variable. However, no other panel data set on the size of the informal sector has been found. Measurements including only cross-country

Furthemore, earlier it was concluded that the growth of the informal sector could be partly endogenous. The theoretical logic is that the behavoiur of those around me effects what I do. Hence, if more people evade, I am more likely to do it as well. To control for this a model where the dependent variable is lagged was added. This model still include time and country fixed effects, and simply adds a lagged dependent variable.

Regressions were further added to test the effect over ten years. This sample includes only the years 1996 and 2008. The purpose is to test whether the institutional variables give a different result when measured over ten years. As was discussed in the section explaining the control variables, there might be a problem using the world governance variables in year to year data, since the margin of error might be larger than the annual change.

Lastly the institutional variables where added as interaction terms as well. This is to test for the theoretical idea that the effect of taxes is dependent on institutional quality. To get the interaction term, one simply multiplies the relevant variables (in this case *fiscal freedom* and the institutional variables). The interaction model is, however, slightly different from a regular linear additive model. Since the idea tested is that taxes depend on institutions, the hypothesis becomes *conditional*. A couple of important things should be noticed regarding this.

It is important to include all interacted terms. Lets for example say that we want to interact control of corruption with fiscal freedom. Lets further assume that these are the only variables in the model. The interacted term becomes *FISC_FREE * CORR*, and the model:

$$Y = \beta_0 + \beta_1 FISC_FREE + \beta_2 CORR + \beta_3 FISC_FREE * CORR \quad (4.6)$$

According to equation 4.6, all interaction terms should be included. Another way to say this is, as Brambor, Clark and Golder (2005: 66): "X should be included when the interaction term is X^2 and X, Z, J, XZ, XJ , and ZJ should be included when the interaction term is XZJ ." The reason for this is somewhat complex, and not of grave importance for the conclusions of the essay. For now, it is sufficient to state that all terms should be included.

The implication for this essay is that it becomes very hard to use only one interaction model. To illustrate this consider all the institutional variables: *RULE_OF_LAW*, *CORR*, *GOV_EFF* and *REG_QUAL*. Imagine that the interaction model were to interact all terms in one model. This would demand not only an interaction term (*FISC_FREE * RULE_OF_LAW * CORR * GOV_EFF * REG_QUAL*) and the separate variables *FISC_FREE*, *CORR*, *GOV_EFF*, *REG_QUAL* and *RULE_OF_LAW*, but also the institutional variables interacted with each other. This model would therefore demand over thirty variables, making it complex and hard to illustrate. Because of this four different regressions will be made, as the following:

dimensions (such as Schneider (2002)) are not useful in this context, since the effect of VAT needs to be tested over time.

$$Y_{lag} = \beta_0 + \beta_1 VAT + \beta_2 FISC_FREE + \beta_3 CORR + \beta_4 FISC_FREE * CORR + \beta_5 Control \quad (4.7)$$

Where *control* stands for control-variables and *VAT* represents the different VAT-dummies. Naturally similar regressions will be performed for each institutional variable.

It is further important to notice that the interpretation of the interacted institutional terms differs from the other models in the thesis. For example, the coefficient for *CORR* in equation 4.7 (β_3) describes the effect of *CORR* on the informal sector when *FISC_FREE* is equal to zero. This is of course of grave importance when interpreting the results. Furthermore, the interaction models include time and country fixed effects.

Lastly, before moving on to the results-section, it is important to notice that the panel data set suffers from both potential autocorrelation and heteroscedasticity. To control for this all the regressions are estimated using a coefficient covariance matrix estimator for robust inference. This estimator is similar to one developed by Arellano in a paper from 1987 (*Computing Robust Standard Errors for Within-groups Estimators*). Based on this paper, the estimator is robust against both autocorrelation and heteroscedasticity, as long as $N > T$, where N =cross section units and T = time units. This is the case in all regressions.

Chapter 5

Results

This chapter will display the results of the study. Three basic sections will be included. First, the correlation of the variables will be briefly discussed. Second, I analyze the baseline regression. Third, I explore the model by including time fixed effects, a lagged dependent variable, an interaction variables model and a model including only 1996 and 2006. The most important regressions will be displayed within this section, the remaining can be found in appendix C.⁷

5.1 Correlations

A simple correlation matrix for the sample 1996-2008 (Appendix B) shows high correlations between the institutional variables (*RULE_OF_LAW*, *CORR*, *GOV_EFF*, and *REG_QUAL*). A simple variance inflation factor furthermore indicates multicollinearity. To address this, the four institutional variables were transformed according to a first difference model. The change is shown in equation 5.1 and 5.2, where x is any of the four institutional variables mentioned above:

$$Y_t = \beta_0 + \beta_1 x_t + u_t \quad (5.1)$$

$$Y_t = \beta_0 + \beta_1 (x_t - x_{t-1}) + u_t \quad (5.2)$$

Performing this operation in Eviews 7.1 gives four new variables: *dCORR*, *dRULE_OF_LAW*, *dGOV_EFF*, and *dREG_QUAL*. Looking at the new matrix (Appendix B.3), the correlation between the variables have shrunk.

It is however important to notice that since the first difference operation demands yearly data from the current and previous year, 1996 is no longer usable. The simple reason is that no data from 1995 is available, which makes the first difference operation for 1996 impossible. The new sample for the baseline regression hence consists of 1997-2008.

⁷Noticable is that the regression-tables will include p-values instead of standard errors in parantheses.

5.2 Baseline regressions

5.2.1 1997-2008 sample

Table 5.1 shows the regression outputs for the cross-country fixed effect model with the sample 1997-2008. In the basic model without *VAT*, only two out of eleven control variables are statistically significant on either a 1, 5 or 10 % level. Of these, only one, *LAG_GDP_PPP* have the expected sign. Higher GDP per capita PPP reduces the size of the informal economy. The results indicate one of the strongest relationships in the model. It is highly significant and shows that as GDP per capita PPP goes up a dollar, the informal sector size shrinks with $-5.43\text{E-}06$ percentage points. While this variable is not the best way to measure poverty, the results provide some support to the idea that informal sector activity in developing countries is comparable to a survival strategy. A possible explanation is that, as people become richer, they simply need to work less informally. The results should, however, be treated with caution. GDP per capita PPP may effect other forms of informal activity than tax evasion, and the coefficient ($-5.43\text{ E-}06$) does not indicate a very large marginal effect. Furthermore the relationship could simply show that people in general have more money to spend, which means that the tax base becomes bigger.

The financial variables *INFL_DUMMY* and *FIN_DEEP* both show the expected negative signs, but neither are significant on either a 1, 5 or 10 % level. The inflation dummy shows particularly weak results with a p-value ranging from 0.5702 to 0.8907 in the first four regressions. From what the author is aware of, the correlation between inflation and the size of the informal sector has not been empirically investigated before, hence the results are difficult to interpret. Firstly it is of course possible that the actual correlation in fact is close to zero, and that inflation matters very little in general, and even less in developing countries. Secondly, the classification of inflation as bigger or larger than 5 % is collected from another theory created by Bulir to establish a relation between inflation and income inequality. For future estimations, it might be that a different taxonomy on the size of inflation is needed to investigate the relationship.

The results provided from the institutional variables are not according to the theoretical expectations. Only two, *dCORR* and *dGOV_EFF* show the expected negative signs, while *dRULE_OF_LAW*, and *dREG_QUAL* show that better institutional quality causes the informal sector to grow. A probable reason for the poor results indicated from the institutional variables are that they are in fact not suited for year to year studies. If this is a relevant explanation the problems could be aggravated by the correction of multicollinearity. Another explanation could be that institutional variables only matter when interacted with taxes or regulations. I will return to this question in the next section. For now it is sufficient to conclude that no conclusions regarding institutional quality and informal economic activity can be made from the baseline regressions.

Of the heritage foundation variables, *LAG_GOV_SPEND* and the index on fiscal freedom (*FISC_FREE*) show a positive coefficient. Larger fiscal freedom,

Table 5.1: Baseline regressions

Variable	Baseline	With VAT	With VAT(-1)	With VAT(-3)
<i>C</i>	0.369528 (0.0000)***	0.371358 (0.0000)***	0.368035 (0.0000)***	0.370675 (0.0000)***
<i>AGR</i>	0.046244 (0.2483)	0.038337 (0.2785)	0.036635 (0.2788)	0.036447 (0.2572)
<i>BUS_FREE</i>	0.000189 (0.2721)	0.000282 (0.1200)	0.000287 (0.1245)	0.000232 (0.1960)
<i>DCORR</i>	-0.002937 (0.3861)	-0.003219 (0.3529)	-0.001023 (0.7718)	0.001028 (0.7521)
<i>DGOV_EFF</i>	-0.004196 (0.6318)	-0.004380 (0.6049)	-0.003612 (0.6840)	-0.006242 (0.4224)
<i>DREG_QUAL</i>	0.017381 (0.0530)*	0.015700 (0.0552)*	0.014119 (0.0871)*	0.012361 (0.1466)
<i>DRULE_OF_LAW</i>	0.001790 (0.6022)	0.003179 (0.4066)	0.002504 (0.4870)	0.000619 (0.8435)
<i>FIN_DEEP</i>	-0.030938 (0.3151)	-0.025895 (0.3884)	-0.027893 (0.3362)	-0.030467 (0.2822)
<i>FISC_FREE</i>	0.000187 (0.3784)	0.000217 (0.3054)	0.000241 (0.2493)	0.000248 (0.2480)
<i>INFL_DUMMY</i>	-0.000973 (0.6129)	-0.001005 (0.5702)	-0.000593 (0.7167)	-0.000232 (0.8907)
<i>LAG_GOV_SPEND</i>	0.000243 (0.1239)	0.000217 (0.1855)	0.000241 (0.1391)	0.000224 (0.1845)
<i>LAG_GDP_PPP</i>	-5.43E-06 (0.0012)***	-4.32E-06 (0.0013)***	-3.93E-06 (0.0026)***	-3.55E-06 (0.0093)***
<i>VAT</i>		-0.011986 (0.0712)*		
<i>VAT(-1)</i>			-0.013423 (0.0669)*	
<i>VAT(-3)</i>				-0.013632 (0.0436)**
R-squared	0.962470	0.963855	0.964464	0.965084
Adjusted R-squared	0.957764	0.959194	0.959883	0.960582
Within R-squared	0.186441319	0.216460329	0.229682313	0.24310291

Significance levels are shown as: ***=1%, **=5%, *=10%.

implying less taxes, gives a larger informal sector. This relationship is somewhat unconventional but not surprising. Earlier research (Friedman et al. 2000: 475) have found a positive relationship, which could be due to many things such as a better tax administration, higher tax morale, or the fact that countries with a larger general tax pressure potentially inherit higher public trust. The interpretation of *LAG_GOV_SPEND* is straightforward since it simply implies that when the government spend more, the informal economy shrinks.

BUS_FREE, showing freedom from quantitative regulation however shows the less expected positive sign, implying that more business freedom gives a larger informal sector. The most probable explanation for this is the quality of the data. The variable does at times show no variation at all.

Lastly *AGR* shows the expected positive coefficient. A larger rural economy gives a larger informal sector. The latter confirms the earlier observation that the agricultural sector often is exempted from taxes in many African states.

Since most variables show non-significant results, it is surprising that both R-squared and adjusted R-squared are extremely high (around 0.96 for all four regressions). High R-squared values are not uncommon when dealing with fixed effects, and can be controlled for by calculating the *R-squared within*. By subtracting the standard errors in a model where the dependent variable is regressed against only fixed effects, from the standard errors in the full model, the R-squared within is calculated.

This value is evidently more reasonable. Unfortunately the numbers are also dissappointing. At its highest the within R-squared reaches 0.24. Hence, 24 % of the variation can be explained by the independent variables, excluding specific country properties. While it is generally unusual for panel data models to show high R-squared values, the fact that the basic model without VAT shows only a R-squared within of 0.19, points to a great importance of country specific effects.

VAT-dummy

Interestingly *VAT*, *VAT(-1)* and *VAT(-3)* are all significant on a 5 or 10 % level. They also show a negative coefficient, which is in line with the hypothesis that countries with a VAT has a lower informal sector. This could hence give support to the hypothesis. One explanation could be due to incentive structures within VAT. Another explanation is that VAT demands a more sophisticated tax-administration.

The almost non-existent change between the coefficients of *VAT* and the lagged variables (between -0,011986 and -0,013632) and the low range of variation between the p-values (0,0712 and 0,0436) however points to that the dummy captures other features than it is supposed to. These could for example include an initial higher administrative quality within the countries adopting a VAT. Another possibility is that the low variation in the dummy captures the fixed effects.

To evade the latter pitfall of the permanent dummies (*VAT*, *VAT(-1)* and *VAT(-3)*) table 5.2 includes the baseline regressions with temporary VAT-

dummies. In table 5.2 only the dummies are included, the full regressions can be found in appendix C.1.

Table 5.2: Temporary VAT effects

Variable	VAT_ONLY	VAT_ONLY(-1)	VAT_ONLY(-3)
<i>VAT_ONLY</i>	0.006608 (0.1194)		
<i>VAT_ONLY(-1)</i>		0.002855 (0.5004)	
<i>VAT_ONLY(-3)</i>			-0.002651 (0.3732)
R-squared	0.962688	0.962511	0.962524
Adjusted R-squared	0.957878	0.957678	0.957692
Within R-squared	0.19117967	0.187339809	0.187614085

While none of the dummies are statistically significant, an interesting trend from the immediate effect to the three year lag variable is noticeable. (*VAT_ONLY*) is close to significant on a 10 % level with a positive coefficient (implying that the year VAT was introduced, the African states in the sample increased the size of the informal sector). When the effect of VAT is measured after a year, the coefficient becomes smaller, and the p-value much larger. With a three year lag, the p-value decreases again, and the coefficient turns negative. While the numbers do not provide hard evidence, they indicate that the introduction of VAT initially increases informal activity, which later decreases. This is theoretically intuitive, and could imply initial problems with a new administration that becomes functional only after a couple of years. It is furthermore possible that general knowledge of the tax becomes national only after two or three years. A further possibility is of course that the presence of VAT creates new opportunities of fraud, which at first increases the size of the informal sector. The new fraudulent behaviour is better dealt with after some time, with a more advanced and experienced tax-administration. A last possibility, speaking against the hypothesis of the essay, is that the initial increased size of the informal sector creates pressure on governments to act to lower the size of informal activity. This pressure could be self-imposed or created by international organizations, and would later reduce the size of the informal sector. Such an interpretation however assumes that countries have some sort of "medicine" towards informal sector activity. This is clearly doubtful. If such a policy existed, and governments were aware of it, a puzzle would be why it has not been used to a greater extent.

Table 5.3: With time and country fixed effects

Variable	Basic	VAT	VAT(-1)	VAT(-3)
<i>C</i>	0.349257 (0.0000)***	0.354438 (0.0000)***	0.355232 (0.0000)***	0.360897 (0.0000)***
<i>AGR</i>	0.053503 (0.1386)	0.050607 (0.1436)	0.049306 (0.1425)	0.049254 (0.1313)
<i>BUS_FREE</i>	4.18E-05 (0.8110)	9.86E-05 (0.6068)	0.000123 (0.5365)	0.000126 (0.5438)
<i>DCORR</i>	0.000448 (0.8892)	-0.000166 (0.9540)	0.000865 (0.7885)	0.002141 (0.5438)
<i>DGOV_EFF</i>	-0.005183 (0.4023)	-0.004876 (0.4254)	-0.004202 (0.5084)	-0.005895 (0.3494)
<i>DREG_QUAL</i>	0.011875 (0.1212)	0.011722 (0.1152)	0.010715 (0.1333)	0.009105 (0.1913)
<i>DRULE_OF_LAW</i>	0.001437 (0.7129)	0.002297 (0.5843)	0.002108 (0.6065)	0.001120 (0.7679)
<i>FIN_DEEP</i>	-0.010111 (0.7513)	-0.011857 (0.6965)	-0.014819 (0.6071)	-0.020426 (0.4502)
<i>FISC_FREE</i>	0.000481 (0.0976)*	0.000451 (0.1084)	0.000441 (0.1126)	0.000407 (0.1291)
<i>INFL_DUMMY</i>	-0.003938 (0.0148)**	-0.003893 (0.0127)**	-0.003754 (0.0143)**	-0.003684 (0.0203)**
<i>LAG_GOV_SPEND</i>	0.000219 (0.1843)	0.000205 (0.2172)	0.000217 (0.1893)	0.000208 (0.2124)
<i>LAG_GDP_PPP</i>	-3.87E-06 (0.0462)**	-3.73E-06 (0.0476)**	-3.65E-06 (0.0489)**	-3.77E-06 (0.0339)**
<i>VAT</i>		-0.005441 (0.3555)		
<i>VAT(-1)</i>			-0.007578 (0.2540)	
<i>VAT(-3)</i>				-0.009524 (0.1450)
R-squared	0.971609	0.971833	0.972105	0.972530
Adjusted R-squared	0.966908	0.967062	0.967380	0.967877
Within R-squared	0.136722429	0.143541305	0.151806206	0.164727577

5.3 Exploring the model

5.3.1 Including time fixed effects

It is hard to say whether the model including both country and time fixed effects provides a better fitted model. R-squared and adjusted R-squared does not provide instructive numbers, and since more fixed effects are added, R-squared within is as expected lower than before. A few of the variables do however show more significant results, which is viewable in table 5.3.

As is evident from the table, most variables show the same results as in the previous sample. *BUS_FREE* still shows a positive coefficient, meaning less regulation giving a larger informal sector. Furthermore the institutional variables are non-significant and only *DCORR1* display the expected negative correlation. Assuming that the explanations given during the last sample is correct (low data quality for *BUS_FREE* and high yearly margins of error for the institutional variables) these results are expected.

The slight improvement in the model can instead be seen in the other variables. *LAG_GDP_PPP* is still significant with the expected coefficient. To that *FISC_FREE* and *INFL_DUMMY* are added as significant on a 10 and 5% level.

The fact that *FIN_DEEP* and *INFL_DUMMY* both show the expected negative coefficient is interesting since it gives some support to the ideas provided by Gordon and Li (2009), namely that the size of the informal economy is negatively affected by the level of inflation and the dependence of the financial sector. As always the results should be treated with caution. It is fully possible that *INFL_DUMMY* captures more than it was attended to do. Regarding *FIN_DEEP*, it also suffers from the problem of being linear to GDP.

The results from the permanent VAT-dummies are different to the ones provided in the previous sample. The significance levels are now essentially larger. This implies, as suspected, that the permanent VAT-dummies captures more than it was assigned to. In this case it captures the time fixed effects. More interesting however, is the trend from an immediate effect to a three-year lagged effect. The coefficients are negative with a low range of variation, but still increases with each year (-0.005441 to -0.009524). Also, the p-values becomes smaller with each year.

In table 5.4 the results of the temporary VAT-dummies are shown. The results once again points to a trend, where the immediate effect of VAT is an enlargement of the informal sector, which after three years goes negative. Less encouraging is however that the p-value goes down to approximately 0.52 for the three year lagged VAT-variable.

5.3.2 Adding a lagged dependent variable

To test for the possibility of an endogenous model where some informal activity creates even more informal activity, this subsection shows the result with a lagged dependent variable. Based on the results provided above, (i.e.

Table 5.4: Temporary VAT-dummies with country and time fixed effects

Variable	VAT_ONLY	VAT_ONLY(-1)	VAT_ONLY(-3)
VAT_ONLY	0.004985 (0.1615)		
VAT_ONLY(-1)		0.002407 (0.5210)	
VAT_ONLY(-3)			-0.002178 (0.5216)
R-squared	0.971730	0.971638	0.971645
Adjusted R-squared	0.966941	0.966834	0.966842
Within R-squared	0.140397193	0.137598005	0.137823532

that the VAT-dummies seem to capture time specific effects) all the regressions below include both time and country specific effects. The outputs can be found in appendix C.3.

The output of the new regressions are similar to those provided earlier. The R-squared within show a somewhat equally well fitted model, and the significance results are close to the same. Variables that showed poor numbers in the previous outputs (mainly the institutional variables and *BUS_FREE*) now show similar results and henceforth indicate the same problems. *AGR* is stable around 10% significance, and the financial variables still show the negative coefficients expected.

One variable that show an interesting change is *FISC_FREE*. The tax variable is the only significant variable in the model, with p-values around 0.02. The coefficient is furthermore positive, once again indicating a correlation between higher taxes and a lower degree of informal sector activity. Consistently in all three models specified so far, taxes have shown this relation with informal sector activity. The reason is not clear-cut, but besides from economic causes already mentioned (tax morale, administration etc.) one cause might be found in the methodology of the dependent variable. When designing the size of the informal sector, Elgin and Oztunali (2012) assume that all taxes collected are used, hence the budget is fully balanced. This assumption allows the authors to use tax-revenues as an approximation for government expenditure. Even if Elgin and Oztunali do not use the heritage foundation variable fiscal freedom, it is possible that the relationship in this study simply shows a correlation between government expenditure and formal sector activity, or in other words: between formal sector spending and formal sector activity.

Focusing on the main interest of the study, coefficients- and significance-numbers for the permanent and temporary VAT variables once again show a trend where the initial effect is weak or positive and the lagged effect is stronger and negative. The permanent VAT have negatively increasing coefficients, and the temporary VAT-dummies show positive immediate coefficients and a negative three year lagged effect.

5.3.3 Exploring the institutional variables

To better account for the institutional variables, two methods were used. In the first one, only two years, 1996 and 2006, were used to account for the possible problem with relatively large margins of error from year to year. The regressions performed are found in appendix C.4. The fact that three out of four variables (*CORR*, *REG_QUAL* and *RULE_OF_LAW*) now show the expected negative coefficients points to an improvement of the model. However, none of the three are statistically significant on either a 1, 5 or 10 % level. This points to further problems with the model. One possibility is that the institutional quality is of less importance in developing countries. Based on previous research this conclusion is however less likely.

Another possibility might instead be that institutions matter only when interacted with taxes and regulations. In the last table of this section a summary of the interaction models is therefore viewable. As explained earlier in the methodological section, an interaction variables model almost always demands that all the terms are included. Because of this, four different models including each institutional variable was used. In table 5.5 four of the regressions (including *VAT*) are presented. The R-squared values are excluded, since the purpose is mainly to show the effect on the interaction terms. All the regressions using interaction terms can however be found in appendix C.5-C.8.

All of the four institutional variables show positive coefficients and low significance numbers. However, the possibility to draw conclusions from the coefficients presented here is limited, since the numbers are conditional. As an example, the positive coefficient of *RULE_OF_LAW* states that as this variable increases with one unit, the informal sector grows with 0,086869 percentage points, assuming that fiscal freedom is zero. Since fiscal freedom never takes the value of zero (this would mean 100 % taxes) the result is not very informative. The same holds for *GOV_EFF*, *CORR* and *REG_QUAL*, which also show positive coefficients. The interaction terms are in all cases negative, implying that as fiscal freedom becomes larger than zero, the effect of the institutional variables turn negative (which is according to the theoretical expectations).

The same line of reasoning can be applied to the tax-variable. The sole term *fiscal_freedom* is (in most cases) negative, which means that a lower tax rate decreases the size of the informal sector, given that institutional quality is zero. As the value of the institutional variables turn positive, the size of the coefficient grows, implying that the the informal sector becomes even smaller. This is also in line with theoretical expectations.

The fact that R-squared within is drastically higher when interaction terms are used, points to a generally better fitted model. These numbers are located in table C.5 to C.8.

Regarding the VAT-dummies, the trend is similar to what has been shown so far. The significance numbers and coefficients indicate that the initial effect is slightly negative or even positive. This changes after lagging the variable, when the effects becomes more negative.

Table 5.5: Interaction models - VAT

	Rule	Gov_Eff	Corr	Reg_Qual
<i>C</i>	0.401281 (0.0000)***	0.402603 (0.0000)***	0.400255 (0.0000)***	0.378169 (0.0000)***
<i>AGR</i>	0.066108 (0.0485)**	0.066766 (0.0172)**	0.071154 (0.0529)*	0.069307 (0.0688)*
<i>BUS_FREE</i>	-1.81E-05 (0.9268)	-6.56E-05 (0.7211)	1.10E-07 (0.99959)	-1.98E-05 (0.9129)
<i>FIN_DEEP</i>	-0.013615 (0.6356)	-0.017100 (0.4643)	-0.017261 (0.5352)	-0.017659 (0.5074)
<i>FISC_FREE</i>	-7.33E-05 (0.8124)	-5.72E-05 (0.8489)	-0.000129 (0.6998)	0.000334 (0.2092)
<i>INFL_DUMMY</i>	-0.002164 (0.2718)	-0.002898 (0.1190)	-0.002476 (0.1985)	-0.002379 (0.2080)
<i>LAG_GDP_PPP</i>	-2.12E-06 (0.3466)	-1.37E-06 (0.6556)	-1.18E-06 (0.6451)	-1.74E-06 (0.3883)
<i>LAG_GOV_SPEND</i>	0.000180 (0.1737)	0.000193 (0.2016)	8.79E-05 (0.5738)	8.71E-05 (0.6032)
<i>VAT</i>	-0.004953 (0.3773)	-0.002264 (0.6677)	-0.004341 (0.4639)	-0.005997 (0.3757)
<i>RULE_OF_LAW</i>	0.086869 (0.0651)*			
<i>INTER_RULE</i>	-0.000971 (0.0883)*			
<i>GOV_EFF</i>		0.094973 (0.0286)**		
<i>INTER_GOV</i>		-0.000940 (0.0454)**		
<i>CORR</i>			0.087641 (0.0793)*	
<i>INTER_CORR</i>			-0.001229 (0.0549)*	
<i>REG_QUAL</i>				0.041056 (0.1844)
<i>INTER_REG</i>				-0.000342 (0.3800)

Chapter 6

Conclusion

In this essay I tried to model and estimate a relationship between the choice of consumption tax and the level of tax evasion. More specifically, the aim of the essay was to model whether the choice of a value added tax (VAT) over other consumption taxes (mainly retail sales tax and turnover tax) has produced a smaller informal sector in thirty African states between 1996-2008. The idea was based mainly on incentive principles. The improvement of the administrative quality is however also recognized as a possible cause of lower informal economic activity.

Both the subject and the data utilized were new, and had not been dealt with before in economic empirical studies. The data on the dependent variable (the size of the informal sector) was collected from a panel data set available in a working paper as of this year (2012). Similarly, the ambition to establish a correlation between VAT and the size of the informal sector was empirically (however not theoretically) new. Studies have been made on the relation between different economic, social and political variables and the size of the informal sector, but not with specific reference to VAT. These facts made the modelling of the essay more difficult, and should also lead to a certain caution when making conclusions.

If one were to look at the control variables, the results were fluctuating. The institutional variables (rule of law, government effectiveness, regulatory quality and control of corruption) proved hard to model. The variables suffered from initial data problems as the year-to-year changes were small, possibly smaller than the margin of error. The sign of the coefficient changed, and did not show any consistency. When interacted with taxes, the terms improved somewhat, but it is still impossible to draw any robust conclusions from the results of this study. To have better use of the variables in a future study, it might be good, if possible, to use longer time intervals in combination with an interaction model. Since data was only available for ten years in this study, a model displaying this property was simply not possible.

The financial variables (financial deepening and inflation) showed an interesting indication of a negative trend. The coefficients were exclusively negative,

implying that the size of the informal sector decreases with inflation and the quality of the financial sector. This is in line with the theoretical expectations of earlier mentioned Gordon and Li (2009). The results were however, sparsely significant, which points to the need of more research.

Agriculture consistently displayed positive coefficients and low significance numbers, implying that as the value of agriculture went up, so did the informal sector. Since a prior observation has been that agriculture is often exempted from taxes in many African countries, this result was not surprising. The same holds for the GDP variable, which implied that higher GDP PPP brings a smaller informal sector. In this case, the variable was used as an approximation for poverty, which means that some support was given to the survival hypothesis. However, to be able to say something more robust in the subject of poverty and informal sector activity, a better approximation of poverty is needed.

The heritage foundation variables showed mixed results. Business freedom gave the least instructive output, with mixed signs of coefficients and very high p-values. The most probable reason is the low quality of the data. Another potential reason is that the low variation from year to year is a display of a static legal context that changes very little. If this is the case, a future study will have better success using only cross-country data, excluding time-series information. The tax variable, fiscal freedom, showed both negative and positive signs, implying the possibility that taxes can decrease and increase informal sector activity. It should however be stressed that several features that theoretically could have been evaluated was in fact not. In the interaction model I used institutional variables as a condition to the tax-rate. A more complete model would also use tax morale, quality of administration and government quality. Lastly, government spending showed the intuitive positive coefficient. Since the index distributed numbers from 1-100, where high numbers means less spending, a positive coefficient simply states that less formal spending means less formal activity.

Moving to the main part of the essay, the VAT-dummies showed interesting but hardly conclusive results. The permanent dummies were all significant in the basic model, which turned out to be partly an effect of the lack of time fixed effects. When exploring the model with time specific effects, a lagged dependent variable, interaction terms and a new sample, the p-value increased, but rarely went higher than 0,4. Interesting was that the dummies showed the same trend no matter the model used. First, coefficients were exclusively negative, implying the expected hypothesis that VAT lowers the size of the informal sector. Second the p-value sunk and the negative coefficient became larger when the dummy was lagged. This could provide an indication that the effect is stronger after a couple of years.

The trend was similar when including the temporary VAT. The p-value sunk after lagging the variable and the negative effect became stronger. However, the effect turned from an initial positive effect (VAT creates a larger informal sector) to the lagged negative effect. As mentioned in the results, this effect might be due to many things, such as initial problems with a new administration. There might also be problems with new fraudulent behaviour, which tax authorities

become better equipped to combat only after a few year. Furthermore, it should take time before knowledge of the new tax spreads.

Once again it is important to stress caution. Many of the important features of VAT, such as tax-rate, threshold level and administrative quality, were not included in the model. In almost all cases this was due to missing data. Furthermore, the results are clearly not robust, having indicated very few cases of significant results. An overall conclusion is that if there is any negative effect at all, the results indicate that this effect is lagged, and potentially kicks in after a couple of years.

Since both the subject of the thesis and the data set used for the dependent variable were new, the expectations were clearly not to produce hard evidence. However, the trend showed by the permanent and temporary VAT-dummies are interesting and hence deserve more extensive research. When such research is executed, a couple of lessons and recommendations should be mentioned. Some regarding specific variables have already been mentioned. On a more general level, the following applies:

1. A new study might be better of using a micro model where only a few countries or even a single region is investigated. This way it is possible to better separate properties of VAT, such as threshold level, rates and exemptions. Used within a field study it might even be possible to dig deeper into the structure of the informal sector, and differentiate between tax evasion and other forms of informal sector activity.
2. If a macro-model is used it should probably be complemented with different data. This includes using other continents, longer time periods and a different way of calculating the informal sector.
3. A possibility is of course always to use more advanced econometrics. In particular the linear regression of this study could be limited when dealing with interaction models with many terms.

No matter in which way future studies are done, one can only hope that research will continue. Both VAT and the informal sector will continuously be a big part of most development countries around the world. To address and understand the relationship between them should hence be a priority for any country using a VAT.

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Appendix A

Derivation of informal sector size

The model includes five steps.

1. Specify the model.

The model assumes a dynamic household maximisation problem, where the choice stands between two production technologies (formal and shadow). The goal is to maximise lifetime utility. The informal sector has lower productivity but no taxes.

Maximise:

$$\sum_{t=0}^{\infty} \beta^t U(C_t) \quad (\text{A.1})$$

Where β is a discount factor ≤ 1 , U is the lifetime utility, C equals consumption and t stand for the time unit. The utility function is strictly increasing and strictly concave. The utility is subject to three constraints:

$$C_t + X_t = (1 - \tau)\theta_F K_t^\alpha N_{Ft}^{1-\alpha} + \theta_s N_{st}^\gamma \quad (\text{A.2})$$

$$K_{t+1} = X_t + (1 - \delta)K_t \quad (\text{A.3})$$

$$N_{st} + NFt = T \quad (\text{A.4})$$

Restriction A.2 is a household resource constraint. The left hand side of the equation stands for consumption (C) and investment (X) at time t . This must be equal to the right hand side, meaning the production in the formal and informal sector. The production is given by a standard cobb-douglas function, where formal production is given by multiplying the household capital stock (K) with a formal productivity parameter (δ_F) and the numbers of hours spent working with formal technology.

The informal production function differ from the formal in several ways. First of all there is a different informal productivity level δ_s , second only labour inputs are possible, assuming no capital stock, and finally no taxes can be levied on the informal sector. Noticeable is that the model assumes it to be costless to hide production from authorities.

Restriction A.3 is the households law of motion for capital. This equation simply states that the capital stock in period $t + 1$ must equal the depreciated capital stock from the previous period plus investments. Lastly the authors include a time restriction (A.4), stating that the effort spent in informal and formal sectors combined equals total time T .

2. Solve the maximisation problem.

This renders the following two first order conditions, A.5 and A.6:

$$\frac{C_{t+1}}{C_t} = \beta[(1 - \tau)\theta_F\alpha K_{t+1}^{1-\alpha} N_{Ft+1}^{1-\alpha} + 1 - \delta] \quad (\text{A.5})$$

$$\theta_s N_{st}^{\gamma-1} = (1 - \tau)\theta_F(1 - \alpha)K_\alpha^t N_{Ft}^{(-\alpha)} \quad (\text{A.6})$$

3. Find a steady state equilibrium

The authors rewrite both expressions to be able to find a steady state equilibrium. Equation A:5 can be rewritten as an expression for the capital stock:

$$K_{t+1} = N_{Ft+1} \left[\frac{(1 - \tau)\theta_F\alpha}{\frac{1+g_c}{\beta-1+\sigma}} \right]^{\frac{1}{1-\alpha}} \quad (\text{A.7})$$

$$N_{st+1} = \left[\frac{\gamma\theta_S}{(1 - \tau)(1 - \alpha)\theta_F} \left[\frac{\frac{(1+g_c)}{\beta-1+\sigma}}{\alpha(1 - \tau)\theta_F} \right]^{\frac{\alpha}{1-\alpha}} \right]^{\frac{1}{1-\gamma}} \quad (\text{A.8})$$

4. Calibration

The forth step involves using the findings on the capital stock (K) and the amount of hours a household devotes to informal production (N_s) as well as the assumptions to construct the size of the informal sector as percentage of GDP. The latter is given by the following expression:

$$(\theta_S N_S^\gamma) / (\theta_F K^\alpha N_F^{1-\alpha}) \quad (\text{A.9})$$

As is evident from the expression A:9. The informal sector as percentage of GDP is given by informal productivity times the number of hours spent working in the informal sector, divided by the formal productivity times the capital stock times the number of hours spent in the formal sector.

Numbers are gathered from different sources. The authors use standard business cycle literature to assign values to $\alpha=0.36$, $\sigma=0.08$ and $\gamma=0.425$. Formal employment (N_{Ft}) is gathered from Penn World Tables. The tax (τ) is gathered from national records of share of government spending of GDP. For a more detailed version of the calibration, see Elgin and Oztunali (2012: 7-8).

Appendix B

Correlation matrix and descriptive statistics⁸

Table B.1: Descriptive stats 1997-2008

	<i>Mean</i>	<i>Median</i>	<i>Max</i>	<i>Min</i>	<i>Std. Dev.</i>	<i>Skew</i>	<i>Kurtosis</i>	<i>Jarque-Bera</i>	<i>Prob</i>	<i>Sum</i>	<i>Obs.</i>
<i>AGR</i>	0.22	0.22	0.58	0.00	0.14	0.08	1.90	18.45	0.00	79.56	360
<i>BUS</i>	58.87	55.00	85.00	28.80	10.80	0.28	3.08	4.67	0.10	21193.10	360
<i>DCORR</i>	0.00	0.00	1.00	-0.54	0.16	0.59	8.19	424.72	0.00	1.02	360
<i>DGOV</i>	0.00	0.00	0.61	-0.41	0.11	0.28	6.25	163.26	0.00	1.47	360
<i>DREG</i>	0.00	0.01	0.54	-0.70	0.12	-0.51	6.93	247.13	0.00	1.52	360
<i>DRULE</i>	0.01	0.00	1.15	-1.06	0.16	0.72	24.19	6767.23	0.00	2.11	360
<i>FIN</i>	0.32	0.24	1.09	0.00	0.22	1.36	4.27	134.93	0.00	116.47	360
<i>FISC</i>	68.00	69.30	90.80	45.80	10.17	-0.51	2.61	18.02	0.00	24481.10	360
<i>INFL</i>	0.57	1.00	1.00	0.00	0.50	-0.28	1.08	60.09	0.00	205.00	360
<i>SPEND</i>	75.54	78.60	97.60	0.00	15.70	-1.51	6.14	285.44	0.00	27195.70	360
<i>GDP</i>	2618.71	1234.37	14343.67	354.98	3041.87	2.12	7.08	518.40	0.00	942734.00	360
<i>VAT</i>	0.84	1.00	1.00	0.00	0.36	-1.90	4.61	255.78	0.00	304.00	360
<i>VAT(-1)</i>	0.81	1.00	1.00	0.00	0.39	-1.57	3.45	150.37	0.00	291.00	360
<i>VAT.O(-1)</i>	0.04	0.00	1.00	0.00	0.19	4.97	25.73	9233.42	0.00	13.00	360
<i>VAT(-3)</i>	0.72	1.00	1.00	0.00	0.45	-0.96	1.92	72.83	0.00	258.00	360
<i>VAT.O(-3)</i>	0.06	0.00	1.00	0.00	0.23	3.88	16.06	3461.52	0.00	20.00	360
<i>VAT.O</i>	0.04	0.00	1.00	0.00	0.19	4.97	25.73	9233.42	0.00	13.00	360

⁸Some names for the variables are changed to better fit the width of the page: *BUS* = business freedom, *FIN*= financial deepening, *FISC*= fiscal freedom, *INFL*= Inflation dummy, and *SPEND*= government spending.

Table B.2: Correlation matrix; sample 1996-2007

	<i>AGR</i>	<i>BUS</i>	<i>CORR</i>	<i>FIN</i>	<i>FISC</i>	<i>GOV</i>	<i>HEAL</i>	<i>INFL</i>	<i>VAT</i>	<i>RULE</i>	<i>REG</i>	<i>SPEND</i>	<i>GDP</i>
<i>AGR</i>	1.00	-0.22	-0.15	-0.34	0.08	-0.23	-0.13	0.27	-0.17	-0.19	-0.21	0.33	-0.46
<i>BUS</i>	-0.22	1.00	0.46	0.37	0.01	0.46	0.04	-0.07	0.17	0.48	0.52	-0.21	0.42
<i>CORR</i>	-0.15	0.46	1.00	0.44	0.13	0.79	0.27	0.06	-0.13	0.79	0.72	-0.34	0.38
<i>FIN</i>	-0.34	0.37	0.44	1.00	0.08	0.48	0.00	-0.14	-0.20	0.56	0.34	-0.36	0.30
<i>FISC</i>	0.08	0.01	0.13	0.08	1.00	0.16	-0.07	0.35	0.12	0.15	0.24	-0.04	-0.13
<i>GOV</i>	-0.23	0.46	0.79	0.48	0.16	1.00	0.16	0.03	-0.12	0.78	0.77	-0.34	0.41
<i>INFL</i>	0.27	-0.07	0.06	-0.14	0.35	0.03	-0.14	1.00	-0.09	0.04	0.10	-0.16	-0.16
<i>VAT</i>	-0.17	0.17	-0.13	-0.20	0.12	-0.12	0.04	-0.09	1.00	-0.20	0.03	0.25	0.05
<i>RULE</i>	-0.19	0.48	0.79	0.56	0.15	0.78	0.26	0.04	-0.20	1.00	0.77	-0.40	0.39
<i>REG</i>	-0.21	0.52	0.72	0.34	0.24	0.77	0.18	0.10	0.03	0.77	1.00	-0.19	0.49
<i>SPEND</i>	0.33	-0.21	-0.34	-0.36	-0.04	-0.34	-0.21	-0.16	0.25	-0.40	-0.19	1.00	-0.24
<i>GDP</i>	-0.46	0.42	0.38	0.30	-0.13	0.41	0.38	-0.16	0.05	0.39	0.49	-0.24	1.00

Table B.3: Correlation matrix first difference model

	<i>AGR</i>	<i>BUS</i>	<i>FIC</i>	<i>FIN</i>	<i>INFL</i>	<i>GDP</i>	<i>SPEND</i>	<i>HEAL</i>	<i>VAT</i>	<i>DCORR</i>	<i>DGOV</i>	<i>DREG</i>	<i>DRULE</i>
<i>AGR</i>	1.00	-0.21	0.11	-0.34	0.27	-0.46	0.31	-0.15	-0.14	0.02	0.21	0.14	0.06
<i>BUS</i>	-0.21	1.00	0.01	0.39	-0.05	0.41	-0.23	0.04	0.14	-0.02	0.02	-0.07	-0.01
<i>FIC</i>	0.11	0.01	1.00	0.09	0.38	-0.13	-0.04	-0.07	0.10	0.01	0.05	-0.10	0.02
<i>FIN</i>	-0.34	0.39	0.09	1.00	-0.15	0.31	-0.36	-0.01	-0.23	-0.02	-0.05	-0.05	-0.04
<i>INFL</i>	0.27	-0.05	0.38	-0.15	1.00	-0.16	-0.14	-0.16	-0.05	-0.07	0.07	-0.03	-0.03
<i>GDP</i>	-0.46	0.41	-0.13	0.31	-0.16	1.00	-0.26	0.38	0.03	-0.03	-0.11	-0.11	-0.01
<i>SPEND</i>	0.31	-0.23	-0.04	-0.36	-0.14	-0.26	1.00	-0.23	0.26	-0.08	0.07	0.05	-0.02
<i>VAT</i>	-0.14	0.14	0.10	-0.23	-0.05	0.03	0.26	0.03	1.00	-0.04	0.01	-0.07	0.04
<i>DCORR</i>	0.02	-0.02	0.01	-0.02	-0.07	-0.03	-0.08	0.04	-0.04	1.00	0.31	0.32	0.37
<i>DGOV</i>	0.21	0.02	0.05	-0.05	0.07	-0.11	0.07	0.00	0.01	0.31	1.00	0.32	0.22
<i>DREG</i>	0.14	-0.07	-0.10	-0.05	-0.03	-0.11	0.05	-0.01	-0.07	0.32	0.32	1.00	0.35
<i>DRULE</i>	0.06	-0.01	0.02	-0.04	-0.03	-0.01	-0.02	0.03	0.04	0.37	0.22	0.35	1.00

Appendix C

Regression outputs⁹

⁹Significance levels are shown as: ***=1%, **=5%, *=10%. This applies to all regression tables

Table C.1: Basic model: *VAT_ONLY*

Variable	With <i>VAT_ONLY</i>	With <i>VAT_ONLY</i> (-1)	With <i>VAT_ONLY</i> (-3)
<i>C</i>	0.367785 (0.0000)***	0.369748 (0.0000)***	0.368874 (0.0000)***
<i>AGR</i>	0.045873 (0.2471)	0.046313 (0.2473)	0.046382 (0.2489)
<i>BUS_FREE</i>	0.000187 (0.2812)	0.000184 (0.2802)	0.000199 (0.2573)
<i>DCORR</i>	-0.001840 (0.5936)	-0.003108 (0.3746)	-0.002923 (0.3901)
<i>DGOV_EFF</i>	-0.003807 (0.6739)	-0.003770 (0.6749)	-0.004419 (0.6077)
<i>DREG_QUAL</i>	0.016701 (0.0628)*	0.017142 (0.0554)*	0.017179 (0.0520)*
<i>DRULE_OF_LAW</i>	0.001376 (0.6817)	0.001675 (0.6146)	0.002025 (0.5464)
<i>FIN_DEEP</i>	-0.032218 (0.2906)	-0.031646 (0.3010)	-0.030711 (0.3218)
<i>FISC_FREE</i>	0.000197 (0.3495)	0.000189 (0.3788)	0.000181 (0.3924)
<i>INFL_DUMMY</i>	-0.000769 (0.6666)	-0.000930 (0.6299)	-0.001052 (0.5925)
<i>LAG_GOV_SPEND</i>	0.000256 (0.1018)	0.000241 (0.1293)	0.000249 (0.1101)
<i>LAG_GDP_PPP</i>	-5.30E-06 (0.0012)***	-5.36E-06 (0.0012)***	-5.40E-06 (0.0011)***
<i>VAT_ONLY</i>	0.006608 (0.1194)		
<i>VAT_ONLY</i> (-1)		0.002855 (0.5004)	
<i>VAT_ONLY</i> (-3)			-0.002651 (0.3732)
R-squared	0.962688	0.962511	0.962524
Adjusted R-squared	0.957878	0.957678	0.957692
Within R-squared	0.19117967	0.187339809	0.187614085

Table C.2: Country and time fixed effects. Temporary VAT-effects

Variable	VAT_ONLY	VAT_ONLY(-1)	VAT_ONLY(-3)
<i>C</i>	0.348440 (0.0000)***	0.349529 (0.0000)***	0.348524 (0.0000)***
<i>AGR</i>	0.053395 (0.1363)	0.053637 (0.1382)	0.053481 (0.1390)
<i>BUS_FREE</i>	4.31E-05 (0.8058)	4.02E-05 (0.8180)	4.90E-05 (0.7810)
<i>DCORR</i>	0.001284 (0.7070)	0.000309 (0.9235)	0.000477 (0.8807)
<i>DGOV_EFF</i>	-0.004819 (0.4514)	-0.004809 (0.4453)	-0.005336 (0.3911)
<i>DREG_QUAL</i>	0.011251 (0.1367)	0.011615 (0.1229)	0.011696 (0.1236)
<i>DRULE_OF_LAW</i>	0.001091 (0.7788)	0.001343 (0.7275)	0.001618 (0.6731)
<i>FIN_DEEP</i>	-0.011608 (0.7110)	-0.010882 (0.7277)	-0.009727 (0.7633)
<i>FISC_FREE</i>	0.000482 (0.0955)*	0.000480 (0.0987)*	0.000478 (0.0989)*
<i>INFL_DUMMY</i>	-0.003859 (0.0149)**	-0.003937 (0.0163)**	-0.004001 (0.0149)**
<i>LAG_GOV_SPEND</i>	0.000232 (0.1583)	0.000219 (0.1885)	0.000225 (0.1730)
<i>LAG_GDP_PPP</i>	-3.86E-06 (0.0452)**	-3.85E-06 (0.0479)**	-3.83E-06 (0.0494)**
<i>VAT_ONLY</i>	0.004985 (0.1615)		
<i>VAT_ONLY(-1)</i>		0.002407 (0.5210)	
<i>VAT_ONLY(-3)</i>			-0.002178 (0.5216)
R-squared	0.971730	0.971638	0.971645
Adjusted R-squared	0.966941	0.966834	0.966842
Within R-squared	0.140397193	0.137598005	0.137823532

Table C.3: Outputs with lagged dependent variable

	Basic	VAT	VAT(-1)	VAT(-3)	VAT_ONLY	VAT_ONLY(-1)	VAT_ONLY(-3)
<i>C</i>	0.345459 (0.0000)***	0.349847 (0.0000)***	0.350486 (0.0000)***	0.357682 (0.0000)***	0.344779 (0.0000)***	0.345819 (0.0000)***	0.344916 (0.0000)***
<i>AGR</i>	0.066518 (0.1007)	0.064066 (0.1014)	0.062987 (0.1019)	0.062056 (0.0893)*	0.066428 (0.0992)*	0.066696 (0.0992)*	0.066502 (0.1012)
<i>BUS_FREE</i>	-7.03E-06 (0.9708)	4.11E-05 (0.8412)	6.11E-05 (0.7628)	8.14E-05 (0.7063)	-5.98E-06 (0.9751)	-9.18E-06 (0.9619)	-1.67E-06 (0.9930)
<i>DCORR</i>	0.001477 (0.5458)	0.000957 (0.7020)	0.001827 (0.4721)	0.003255 (0.1548)	0.002172 (0.3866)	0.001293 (0.6049)	0.001499 (0.5358)
<i>DGOV_EFF</i>	-0.001193 (0.7993)	-0.000933 (0.8420)	-0.000367 (0.9376)	-0.001940 (0.6697)	-0.000890 (0.8511)	-0.000697 (0.8781)	-0.001306 (0.7818)
<i>DREG_QUAL</i>	0.006244 (0.4450)	0.006115 (0.4441)	0.005268 (0.4889)	0.003336 (0.6472)	0.005726 (0.4816)	0.005900 (0.4638)	0.006112 (0.4532)
<i>DRULE_OF_LAW</i>	0.001786 (0.5618)	0.002513 (0.4370)	0.002350 (0.4553)	0.001452 (0.6259)	0.001497 (0.6209)	0.001660 (0.5832)	0.001920 (0.5251)
<i>FIN_FREE</i>	-0.021042 (0.4491)	-0.022521 (0.3897)	-0.025004 (0.3215)	-0.031875 (0.1722)	-0.022288 (0.4221)	-0.022063 (0.4207)	-0.020758 (0.4579)
<i>FISC_FREE</i>	0.000635 (0.0256)**	0.000610 (0.0224)**	0.000602 (0.0248)**	0.000558 (0.0292)**	0.000636 (0.0252)**	0.000634 (0.0264)**	0.000633 (0.0260)**
<i>INFL_DUMMY</i>	-0.002307 (0.2151)	-0.002268 (0.2132)	-0.002152 (0.2304)	-0.002040 (0.2777)	-0.002241 (0.2209)	-0.002305 (0.2229)	-0.002353 (0.2090)
<i>LAG_GOV_SPEND</i>	0.000101 (0.5425)	8.80E-05 (0.5969)	9.89E-05 (0.5598)	8.82E-05 (0.6056)	0.000111 (0.5070)	9.99E-05 (0.5474)	0.000105 (0.5333)
<i>LAG_GDP_PPP</i>	-1.91E-06 (0.4056)	-1.78E-06 (0.4273)	-1.72E-06 (0.4357)	-1.80E-06 (0.3857)	-1.90E-06 (0.4050)	-1.88E-06 (0.4123)	-1.87E-06 (0.4153)
<i>VAT</i>		-0.004608 (0.4469)					
<i>VAT(-1)</i>			-0.006376 (0.2862)				
<i>VAT(-3)</i>				-0.010001 (0.1125)			
<i>VAT_ONLY</i>					0.004147 (0.1388)		
<i>VAT_ONLY(-1)</i>						0.003184 (0.3252)	
<i>VAT_ONLY(-3)</i>							-0.001615 (0.5128)
R-squared	0.975939	0.976101	0.976294	0.976966	0.976023	0.975990	0.975959
Adjusted R-squared	0.971955	0.972053	0.972278	0.973065	0.971962	0.971923	0.971887
R-squared within	0.16509434	0.170730213	0.177407498	0.200732051	0.168019481	0.16685555	0.165783509

Table C.4: Model over ten years, 1996 and 2006

	Baseline	VAT
<i>C</i>	0.425470 (0.0008)***	0.426542 (0.0011)***
<i>AGR</i>	0.131314 (0.0491)**	0.129502 (0.0639)*
<i>BUS_FREE</i>	-0.000173 (0.7524)	-0.000123 (0.8325)
<i>CORR</i>	-0.010392 (0.4703)	-0.008146 (0.6692)
<i>FIN_DEEP</i>	-0.119993 (0.1146)	-0.117571 (0.1248)
<i>FISc_FREE</i>	0.000696 (0.3446)	0.000722 (0.3561)
<i>GOV_EFF</i>	0.091690 (0.1402)	0.085175 (0.2432)
<i>INFL_DUMMY</i>	-0.048955 (0.1041)	-0.047007 (0.1579)
<i>LAG_GOV_SPEND</i>	-8.50E-06 (0.9936)	-8.74E-05 (0.9363)
<i>REG_QUAL</i>	-0.006696 (0.8437)	-0.004841 (0.8950)
<i>RULE_OF_LAW</i>	-0.006767 (0.7769)	-0.005084 (0.8386)
<i>LAG_GDP_PPP</i>	-2.64E-07 (0.9679)	1.12E-07 (0.9870)
<i>VAT</i>		-0.003294 (0.8475)
R-squared	0.984421	0.984489
Adjusted R-squared	0.951622	0.949157
R-squared within	0.773769	0.774743

Table C.5: Interaction model: Rule of law

	VAT	VAT(-1)	VAT(-3)	VAT_ONLY	VAT_ONLY(-1)	VAT_ONLY(-3)
<i>C</i>	0.401281 (0.0000)***	0.401189 (0.0000)***	0.411407 (0.0000)***	0.395463 (0.0000)***	0.397535 (0.0000)***	0.395990 (0.0000)***
<i>AGR</i>	0.066108 (0.0485)**	0.064911 (0.0478)**	0.063485 (0.0367)**	0.068573 (0.0475)**	0.068877 (0.0466)**	0.068627 (0.0492)**
<i>BUS_FREE</i>	-1.81E-05 (0.9268)	6.46E-06 (0.9725)	2.64E-05 (0.8924)	-6.78E-05 (0.7251)	-7.10E-05 (0.7158)	-6.23E-05 (0.7493)
<i>FIN_DEEP</i>	-0.013615 (0.6356)	-0.016050 (0.5658)	-0.023364 (0.3619)	-0.013330 (0.6547)	-0.013479 (0.6470)	-0.011616 (0.6985)
<i>FISC_FREE</i>	-7.33E-05 (0.8124)	-6.54E-05 (0.8281)	-0.000155 (0.6257)	-3.89E-05 (0.8977)	-5.89E-05 (0.8484)	-5.21E-05 (0.8636)
<i>RULE_OF_LAW</i>	0.086869 (0.0651)*	0.085245 (0.0616)*	0.090094 (0.0449)**	0.086090 (0.0702)*	0.088034 (0.0665)*	0.087006 (0.0679)*
<i>INFL_DUMMY</i>	-0.002164 (0.2718)	-0.002018 (0.2969)	-0.002063 (0.3175)	-0.002160 (0.2692)	-0.002196 (0.2749)	-0.002310 (0.2476)
<i>INTER_RULE</i>	-0.000971 (0.0883)*	-0.000937 (0.0875)*	-0.001024 (0.0642)*	-0.000958 (0.0981)*	-0.000993 (0.0908)*	-0.000974 (0.0926)*
<i>LAG_GDP_PPP</i>	-2.12E-06 (0.3466)	-2.09E-06 (0.3440)	-2.16E-06 (0.3050)	-2.27E-06 (0.3269)	-2.23E-06 (0.3431)	-2.21E-06 (0.3443)
<i>LAG_GOV_SPEND</i>	0.000180 (0.1737)	0.000190 (0.1736)	0.000177 (0.1935)	0.000204 (0.1221)	0.000193 (0.1409)	0.000199 (0.1420)
<i>VAT</i>	-0.004953 (0.3773)					
<i>VAT(-1)</i>		-0.007069 (0.1917)				
<i>VAT(-3)</i>			-0.010558 (0.0633)			
<i>VAT_ONLY</i>				0.004673 (0.1164)		
<i>VAT_ONLY(-1)</i>					0.004289 (0.1813)	
<i>VAT_ONLY(-3)</i>						-0.002394 (0.306)
R-squared	0.979284	0.979530	0.980261	0.979203	0.979187	0.979138
Adjusted R-squared	0.975932	0.976218	0.977067	0.975838	0.975819	0.975763
R-squared within	0.614689368	0.619261838	0.63286432	0.613187102	0.612891574	0.611980364

Table C.6: Interaction model: Government effectiveness

	VAT	VAT(-1)	VAT(-3)	VAT_ONLY	VAT_ONLY(-1)	VAT_ONLY(-3)
<i>C</i>	0.402603 (0.0000)***	0.403192 (0.0000)***	0.409662 (0.0000)***	0.399998 (0.0000)***	0.401303 (0.0000)***	0.400258 (0.0000)***
<i>AGR</i>	0.066766 (0.0172)**	0.065522 (0.0179)**	0.063385 (0.0122)**	0.067596 (0.0158)**	0.068015 (0.0147)**	0.067811 (0.0163)**
<i>BUS_FREE</i>	-6.56E-05 (0.7211)	-4.15E-05 (0.8163)	-1.09E-05 (0.9532)	-8.77E-05 (0.6288)	-9.26E-05 (0.6125)	-8.37E-05 (0.6452)
<i>FIN_DEEP</i>	-0.017100 (0.4643)	-0.019060 (0.4080)	-0.025725 (0.2270)	-0.017589 (0.4627)	-0.017849 (0.4457)	-0.016002 (0.5045)
<i>FISC_FREE</i>	-5.72E-05 (0.8489)	-5.86E-05 (0.8435)	-8.50E-05 (0.7768)	-4.25E-05 (0.8878)	-4.86E-05 (0.8726)	-5.13E-05 (0.8652)
<i>GOV_EFF</i>	0.094973 (0.0286)**	0.093872 (0.0273)**	0.091381 (0.0248)**	0.094609 (0.0308)	0.095282 (0.0293)**	0.095388 (0.0293)**
<i>INFL_DUMMY</i>	-0.002898 (0.1190)	-0.002821 (0.1214)	-0.002791 (0.1263)	-0.002894 (0.1157)	-0.002896 (0.1223)	-0.003004 (0.1065)
<i>INTER_GOV</i>	-0.000940 (0.0454)**	-0.000925 (0.0443)**	-0.000885 (0.0443)**	-0.000925 (0.0504)*	-0.000933 (0.0470)*	-0.000939 (0.0464)**
<i>LAG_GDP_PPP</i>	-1.37E-06 (0.6556)	-1.32E-06 (0.6301)	-1.40E-06 (0.5880)	-1.44E-06 (0.6115)	-1.41E-06 (0.6232)	-1.39E-06 (0.6270)
<i>LAG_GOV_SPEND</i>	0.000193 (0.2016)	0.000197 (0.2202)	0.000185 (0.2491)	0.000210 (0.1901)	0.000202 (0.2092)	0.000206 (0.2118)
<i>VAT</i>	-0.002264 (0.6677)					
<i>VAT(-1)</i>		-0.004230 (0.3826)				
<i>VAT(-3)</i>			-0.008555 (0.0769)*			
<i>VAT_ONLY</i>				0.003935 (0.1612)		
<i>VAT_ONLY(-1)</i>					0.004736 (0.1795)	
<i>VAT_ONLY(-3)</i>						-0.002015 (0.4349)
R-squared	0.981029	0.981146	0.981752	0.981067	0.981103	0.981021
Adjusted R-squared	0.977959	0.978096	0.978799	0.978004	0.978045	0.977950
R-squared within	0.647148158	0.649331779	0.660586458	0.647854141	0.648519078	0.647000394

Table C.7: Interaction model: Control of corruption

	VAT	VAT(-1)	VAT(-3)	VAT_ONLY	VAT_ONLY(-1)	VAT_ONLY(-3)
<i>C</i>	0.400255 (0.0000)***	0.398675 (0.0000)***	0.408431 (0.0000)***	0.395249 (0.0000)***	0.396758 (0.0000)***	0.395921 (0.0000)***
<i>AGR</i>	0.071154 (0.0529)*	0.070436 (0.0536)*	0.068657 (0.0422)**	0.073308 (0.0549)*	0.073651 (0.0529)*	0.073375 (0.0554)*
<i>BUS_FREE</i>	1.10E-07 (0.99959)	1.29E-05 (0.9439)	4.33E-05 (0.8276)	-4.43E-05 (0.8127)	-4.72E-05 (0.8015)	-4.18E-05 (0.8210)
<i>FIN_DEEP</i>	-0.017261 (0.5352)	-0.019227 (0.4803)	-0.026464 (0.2895)	-0.016634 (0.5720)	-0.017019 (0.5564)	-0.015659 (0.5940)
<i>FISC_FREE</i>	-0.000129 (0.6998)	-0.000105 (0.7510)	-0.000172 (0.6032)	-9.58E-05 (0.7729)	-0.000111 (0.7399)	-0.000109 (0.7439)
<i>CORR</i>	0.087641 (0.0793)*	0.084990 (0.0782)*	0.087319 (0.0581)*	0.086691 (0.0888)*	0.088158 (0.0833)*	0.087702 (0.0846)*
<i>INFL_DUMMY</i>	-0.002476 (0.1985)	-0.002361 (0.2201)	-0.002314 (0.2476)	-0.002488 (0.1961)	-0.002496 (0.2016)	-0.002573 (0.1859)
<i>INTER_CORR</i>	-0.001229 (0.0549)*	-0.001185 (0.0550)*	-0.001217 (0.0383)**	-0.001214 (0.0638)*	-0.001238 (0.0583)*	-0.001231 (0.0594)*
<i>LAG_GDP_PPP</i>	-1.18E-06 (0.6451)	-1.17E-06 (0.6448)	-1.23E-06 (0.6091)	-1.32E-06 (0.6169)	-1.28E-06 (0.6280)	-1.29E-06 (0.6266)
<i>LAG_GOV_SPEND</i>	8.79E-05 (0.5738)	9.66E-05 (0.5453)	8.25E-05 (0.6069)	0.000106 (0.5070)	0.000100 (0.5242)	0.000103 (0.5187)
<i>VAT</i>	-0.004341 (0.4639)					
<i>VAT(-1)</i>		-0.005305 (0.3557)				
<i>VAT(-3)</i>			-0.010078 (0.0907)*			
<i>VAT_ONLY</i>				0.002533 (0.4007)		
<i>VAT_ONLY(-1)</i>					0.003869 (0.2350)	
<i>VAT_ONLY(-3)</i>						-0.001114 (0.6195)
R-squared	0.977717	0.977816	0.978634	0.977603	0.977647	0.977581
Adjusted R-squared	0.974111	0.974226	0.975177	0.973979	0.974030	0.973953
R-squared within	0.585547055	0.587385893	0.602605569	0.583420897	0.584241807	0.583010442

Table C.8: Interaction model: Regulation quality

	VAT	VAT(-1)	VAT(-3)	VAT_ONLY	VAT_ONLY(-1)	VAT_ONLY(-3)
<i>C</i>	0.378169 (0.0000)***	0.377845 (0.0000)***	0.382976 (0.0000)***	0.367770 (0.0000)***	0.368871 (0.0000)***	0.368547 (0.0000)***
<i>AGR</i>	0.069307 (0.0688)*	0.068338 (0.0677)*	0.067251 (0.0594)*	0.071901 (0.0713)*	0.072157 (0.0712)*	0.072041 (0.0724)*
<i>BUS_FREE</i>	-1.98E-05 (0.9129)	5.49E-07 (0.9975)	1.02E-05 (0.9576)	-7.37E-05 (0.6753)	-7.73E-05 (0.6631)	-7.11E-05 (0.6852)
<i>FIN_DEEP</i>	-0.017659 (0.5074)	-0.020231 (0.4302)	-0.026751 (0.2565)	-0.016928 (0.5526)	-0.016697 (0.5527)	-0.015439 (0.5909)
<i>FISC_FREE</i>	0.000334 (0.2092)	0.000335 (0.2063)	0.000297 (0.2719)	0.000423 (0.1202)	0.000417 (0.1277)	0.000409 (0.1297)
<i>REG_QUAL</i>	0.041056 (0.1844)	0.040212 (0.1494)	0.040157 (0.1389)	0.032759 (0.2116)	0.033436 (0.2060)	0.034177 (0.1933)
<i>INFL_DUMMY</i>	-0.002379 (0.2080)	-0.002256 (0.2301)	-0.002320 (0.2234)	-0.002362 (0.2139)	-0.002392 (0.2150)	-0.002484 (0.1974)
<i>INTER_REG</i>	-0.000342 (0.3800)	-0.000327 (0.3517)	-0.000366 (0.3008)	-0.000228 (0.4939)	-0.000241 (0.4730)	-0.000248 (0.4538)
<i>LAG_GDP_PPP</i>	-1.74E-06 (0.3883)	-1.71E-06 (0.3928)	-1.82E-06 (0.3458)	-1.94E-06 (0.3403)	-1.91E-06 (0.3499)	-1.89E-06 (0.3579)
<i>LAG_GOV_SPEND</i>	8.71E-05 (0.6032)	9.96E-05 (0.5617)	9.04E-05 (0.5927)	0.000109 (0.5148)	0.000100 (0.5475)	0.000105 (0.5329)
<i>VAT</i>	-0.005997 (0.3757)					
<i>VAT(-1)</i>		-0.007445 (0.2368)				
<i>VAT(-3)</i>			-0.009509 (0.1283)			
<i>VAT_ONLY</i>				0.003942 (0.1586)		
<i>VAT_ONLY(-1)</i>					0.002720 (0.3646)	
<i>VAT_ONLY(-3)</i>						-0.001897 (0.4389)
R-squared	0.977157	0.977369	0.977812	0.976966	0.976926	0.976916
Adjusted R-squared	0.973461	0.973707	0.974222	0.973239	0.973192	0.973181
R-squared within	0.575137913	0.579078282	0.587320221	0.571583372	0.570828134	0.570655743