THE DETERMINANTS OF VALUE ADDED TAX REVENUES IN THE EUROPEAN UNION

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Abstract

In this paper we assess the critical factors of Value Added Tax revenues in the European Union, by using a panel data of the 27 countries, between 1998 and 2011. Our findings show that EU governments have been using tax rates increases to collect more revenues, both at the normal and the minimum rate. It was also found that an increase in the implicit rate increases revenues as well. Tax administration efficiency and experience is a critical factor for the capacity to collect VAT revenues. A better legal and institutional environment is shown to be related with higher revenues. Finally, countries in the Eurozone are shown to have higher revenues, mainly due to the fiscal rules that they are subject to. Higher income, as measured by GDP per capita, increases revenues, on account of the higher propensity for consumption.

Key words: Value Added Tax, Revenues, VAT revenues, Tax system, European Union.

Introduction

Value Added Tax (VAT) can be defined as being "a broad-based business tax imposed at each stage of the production and distribution process which, when applied nationally, is typically designed to tax final household consumption" (Tait, Ebel, & Le, 2005, p. 461).

VAT has become more and more relevant in the tax systems around the world, and more than 140 countries using it to tax consumption, which represents over 20% of tax revenues (Keen, 2009). However, particularly in the European Union (EU), VAT is one of the main source of public revenues. Looking at data from 2011, VAT revenues represented around 7% of GDP, both for the European Union and the Eurozone, from a total taxation (including social security contributions) of around 38% of GDP (Eurostat, 2013). According to the same source, total taxation, excluding social security contributions, represents around 26% of GDP. This means that, in the EU, VAT represents almost a third of all tax collection. As indirect taxes revenues represent around 13% of GDP, VAT accounts for more than half of this. In the EU, only personal income taxes have a higher value than VAT, representing 9% of GDP. Corporate taxes revenues represent just 2.5% of GDP.

Despite the relevance of VAT in tax revenues and the increased pressure of fiscal constraints in increasing public revenues, little economic research has been carried out on VAT revenues, particularly at the European level. As far as we know, no paper addresses the main determinants of VAT revenues in Europe. Some literature exists with databases covering OECD and non-OECD countries, measuring both the decision to adopt VAT, and the impact of VAT on revenues (Bogetic & Hassan, 1993, for a panel data of OECD and non-OECD countries, with data for a single year: 1988; Legeida & Sologoub, 2003 for Ukraine; Keen & Lockwood, 2010 for a panel of 143 countries for 25 years, focusing on the impact on adopting VAT rates and VAT revenues; Addison & Levin, 2011 for sub-Saharan Africa; Kaczyńska, 2015, for Poland). These studies found a positive impact on revenues from VAT rates, VAT base, economic openness, and administration efficiency; and a negative impact from the agriculture share of GDP, the use of several tax rates, and exemptions.

This paper addresses the issue regarding what are the main determinants of VAT revenues in the European Union. For this purpose, we collected data on the VAT revenues in billions of Euros (and then use the log function) and in percentage of GDP. We aim to assess the impact on VAT revenues from tax administration efficiency and experience, from the level of VAT rates, from the level of imports and services in the GDP, from the fiscal position and the participation in the Eurozone, and also from the country's legal environment. We divided the variables into four groups: 1) VAT variables (VAT rate, minimum rate and implicit rate); 2) Economic variables (imports, services and fiscal deficits as a percentage of GDP); 3) Tax administration efficiency (measure by VAT C-efficiency, by the number of years of VAT application, and by Government efficiency); 4) Legal and institutional environment (measure by the level of corruption and the rule of law). We then added two control variables: whether the country is a member of the Eurozone, and the log of GDP per capita.

We found a positive relationship between VAT rates and the amount of revenues, which shows that, over the last years, countries have increased their tax rates in the face of fiscal constraints. Tax administration efficiency also plays an important role in the capacity of governments to collect revenues. A better legal and institutional environment tends to increase revenues. Countries in the Eurozone are more likely to have higher revenues, which could be explained by the fact that they are more subject to tight fiscal rules. A higher income, measured by GDP per capita, tends to produce more VAT revenues, which could be explained by the marginal propensity for consumption, particularly for goods and services subject to the normal rate.

This paper is novel with regards to previous literature in several aspects: first, it is the only study, to our knowledge, that specifically addresses VAT revenues in the European Union and the Eurozone context. Particularly important is the fact that we compared only European Union countries, their VAT rates and tax administrations, and their economic, legal and institutional environment. Second, with exception of the study by Keen & Lockwood (2010), all recent studies have focused on a single country. Third, with regards to the study mentioned, we address different questions. Whereas Keen & Lockwood (2010) study the impact on revenues from adopting VAT and the impact of the VAT on the effectiveness of the tax system, we focus on what are the main determinants of VAT revenues. We also innovate by considering new variables, such as corruption, rule of law, and tax administration efficiency measures.

This paper is organized as follow: Chapter 2 presents a literature review on VAT revenues studies. Data and methodology are presented in Chapter 3 and results in Chapter 4. Chapter 5 concludes.

Literature review

Despite the importance and popularity of VAT as a way of taxing consumption and of increasing public revenues, there is little academic literature on the subject (Keen, 2009). VAT has been adopted by all the European Union countries (VAT is mandatory, see for instance De La Feria et al., 2010, Cnossen, 2011), and also in almost all African and Latin America countries (Tait, 1989; Williams, 1996; Bird & Gendron, 2007; Keen, 2009). In the developing world, it has also been seen as a source of change in tax and economic policy (Ebrill et al., 2001; Bird & Gendron, 2007; Keen, 2009, Keen & Lockwood, 2010). The introduction of VAT over the past few decades has been the most visible tax reform undertaken by developing countries (Tanzi & Zee, 2000). There is some evidence, particularly in the Third World, that those countries that have adopted VAT raise more revenues (Keen & Lockwood, 2010).

The popularity of VAT comes from several sources, one being its potential scope for identifying and taxing the economic contribution - or added value - made by any activity of a business or commercial nature (Williams, 1996). The other issue regards its relative simplicity, with an invoice-credit mechanism for collection (Mello, 2008, 2009). There is also the issue of it being economic neutral, and the fact that it is a powerful tool for economic stabilisation (Lindholm, 1970). Finally,

several authors point out VAT's efficiency and its high impact on collecting revenues. It is sometimes referred to as a "cash machine" (Keen & Lockwood, 2006, 2010), but, as with any tax, it is vulnerable to tax evasion, particularly "carrousel fraud" (Keen & Smith, 2006; van Brederode, 2008; Sergiou, 2012).

The Economic literature on taxation has been mainly focused on the optimal design of tax systems and tax evasion (see Hanlon & Heitzman, 2010, for a review of tax research, Slemrod, 1990 for the optimal tax system issue, and Dharmapala, 2014 for tax evasion). However, there is less literature on the main determinants of tax revenues, and particularly on VAT revenues.

One of the first studies on the determinants of VAT revenues was carried out by Bogetic & Hassan (1993). Using a sample of 34 countries, they found that the key variables influencing VAT revenue performance were: tax rate, tax base (i.e, if VAT applies to all goods and service, or there is some exceptions), and tax rate dispersion. The first two increase tax revenues, whereas the last tends to reduce it. Bogetic & Hassan also found that countries with a single VAT rate tend to have more revenues than countries with several rates. The positive impact of tax rates on VAT revenues was also evidenced in Shoup et al. (1990). There is also evidence that VAT tax base has an impact on VAT revenues (Kay & Davids, 1990). In the case of the negative impact of several tax rates, Bogetic & Hassan (1993) confirms the previous results of Tait (1988). Similar results were latterly obtained by Legeida (2003).

Godin & Hindriks (2015), using a database covering 203 countries with 40 tax items over the period 1980-2010, assess some of the main determinants of tax collection. The authors found a positive effect on tax revenues from economic growth, government efficiency, and trade openness, along with the size of tax rates. On the contrary, trade taxes and a higher share of agriculture in GDP decreases the amount of tax revenues. Another study, by Keen and Lockwood (2010), used a panel set of 143 countries over 26 years. The authors analysed what leads countries to adopt VAT, and the impact of VAT on tax revenues. Their study concludes that, in the long run, VAT is associated with an increase in tax revenues. They found several positive determinants of VAT revenues, namely: income per capita, the openness of the economy, and the size of the younger population. On the contrary, countries were agriculture has a higher share of GDP tend to have less revenues. Keen (2009) also found evidence of the negative impact of exemptions and the use of reduced rates on revenues. The fact that trade also has a positive impact on VAT revenues was also concluded by Rodrick (1998) and Hines & Desai (2005). Similar results were found for sub-Saharan Africa by Addison & Levin (2011).

Data and methodology

The objective of this paper is to assess the main determinants of VAT revenues. For this purpose, we collected as our first dependent variable - annual VAT revenue in billions of Euros - for a panel data of 27 EU countries, for a period between 1998 and 2011. For the Eurozone countries, data is

available directly from Eurostat (2013). For the non-Eurozone countries, we first collected from Eurostat (2013) the value of VAT revenues as a percentage of GDP, and then multiplied that value for the country's GDP in billions of Euros. This last information is available at AMECO, the European Commission's online database. For the robustness check, we used a second dependent variable - VAT revenue as a percentage of GDP, which is also available from Eurostat (2013).

We study VAT revenues by means of the following model (we run OLS with fixed effects, and also, in the case of the second dependent variable, a GLM):

$$Yit = \beta_0 + \beta_1 VATrate_{it} + \beta_2 minrate_{it} + \beta_3 implicitrate_{it} + \beta_4 Imports_{it} + \beta_5 Service_{it} + \beta_6 Deficit_{it} + \beta_7 Ceffic_{it} + \beta_8 nyearsVAT_{it} + \beta_9 Geffic_{it} + \beta_{10} LowCorr_{it} + \beta_{11} rlaw_{it} + \mu i$$

Where:

Yit stands for our dependent variable (log of VAT revenues) or, for control of robustness of our model, our second dependent variable - VAT revenue as a percentage of GDP. *i* and *t* are country and time indicators respectively.

The main determinants were divided into the following categories: variables regarding Value Added Tax, in order to assess how changes in VAT rates affect revenues; variables regarding the economic environment, in order to analyse the impact of economic conditions in collecting revenues, and; institutional variables. For the latter, we have variables regarding how tax administration efficiency increases VAT revenues, and also variables concerning the impact of the legal and political environment of each country on VAT revenues.

For the VAT variables, we expect normal statutory rate and implicit rate to increase tax revenues. We use the following variables:

VATrate represents the normal statutory VAT rate for each year, in each country. Data was collected from Eurostat (2015). Naturally, increases in VAT rate are expected to increase revenues (see several studies regarding the impact of VAT rates on revenues: Engel et al., 2001; Pagan et al., 2001 and regarding the impact of the standard VAT rate in revenues: Ebrill et al., 2001; Matthews, 2003; Bikas & Rashkauskas, 2011). Therefore, we expect this variable to be positively related with VAT revenues.

minrate referees to the minimum statutory rate used in each country for the designed period. VAT directives allow countries to choose which services and products (usually related with social issues) have a lower VAT rate than the normal rate. Data was collected from Eurostat (2015). The literature tends to consider that a minimum rate tends to increase the consumption of the abovementioned products, creating a positive price-elasticity (see for instance Zee, 1995; Creedy et al., 2004; Booters et al, 2010). We expect minimum rate to have a negative impact on VAT revenue, as it represents an erosion of the tax base.

Implicitrate represents the implicit VAT rate of each country, in each year of our sample. This is the effective VAT rate, measured according to Eurostat (2013) as the total VAT revenues divided by the tax base (in this case consumption). It could be argued that this is the value of a single VAT tax rate that would provide the same revenue as the current VAT rates in each country. Furthermore, Eurostat (2013) refers that implicit rates are computed as being the ratio of total tax revenues of the category (either consumption, labour, or capital taxes) to a proxy of the potential tax base, defined using the production and income accounts of the national accounts. A higher tax is associated with higher revenues, despite the negative impact that it can have on private consumption (Alm et al., 2013).

Regarding the economic variables, we expect good economic times to have, naturally, a positive impact on VAT revenues. We used the following variables:

Imports represents the imports of the country as a percentage of GDP. Data was collected from AMECO. Imports are associated with more revenues, as VAT is charged by Customs. However, in this case, for most of the countries, the majority of the imports are from inside the European Union, and therefore, we do not anticipate a clear signal from this variable.

Services represents the proportion of services in the GDP (as a percentage). Data was collected from AMECO, and it has a higher component of added value, and is expected to increase revenues.

Deficit represents the government fiscal deficit, in the national accounts. Data was collected from AMECO. We do not have a predefined signal for this variable. Higher deficits can be the result of lower tax revenues, but they can also cause an increase in tax rates, leading to higher revenues.

We also expect tax administration efficiency to have a positive impact on revenues. To measure this efficiency, we used the following:

Ceffic stands for the C-efficiency of VAT for each country, for each year of the sample. C-efficiency is a wider and broadly used efficiency measure for VAT. C-efficiency is an indicator of the departure of VAT from a perfectly enforced tax, which is levied at a uniform rate on all consumption (Keen, 2013). C-efficiency is calculated by VAT revenues divided by the value of the consumption, which is divided again by the normal VAT rate. The data used to calculate C-efficiency was collected from Eurostat (2013) for VAT revenues, and from AMECO for consumption values, and Eurostat (2015) for normal rate VAT. This indicator has been used in the literature to understand the determinants of VAT compliance (Gebauer et al., 2007; Aizenman & Jinjarak, 2008; De Mello, 2009), and to analyse and compare the level of VAT evasion across countries (Jack, 1996; Bird & Gendron, 2007; OECD, 2008), and also in several countries, across time (Hybka, 2009). Using a sample of several European countries, Keen (2013), found that changes in VAT revenues have been driven much less by changes in standard rates, than by changes in 'C-efficiency'. A higher value in C-efficiency means a more efficient tax administration for collecting revenues and for fighting tax evasion. It is also important to stress that VAT tends to lead to less tax evasion than other taxes, mainly due to the

invoice-credit mechanism used for its collection (Allingham & Sandmo, 1972; Slemrod & Itzhaki, 2002; Mello, 2009). There is some agreement in the literature, that indirect taxes are easier to administrate (Piccolino et al., 2014). Increasing tax administration efficiency and enforcement spending have a positive impact in reducing tax evasion (Engel et al., 2001). Therefore, we expect this variable to have a positive coefficient, as a higher efficiency in collecting taxes is associated with lower tax evasion, and naturally, with higher revenues.

nyearsVAT represents the number of years since VAT was introduced in each country. Data was collected from Eurostat (2015) and it was found that more experience is related with better tax compliance, and thus with greater efficiency and lower tax evasion (Agha & Haughton, 1996; Ebrill et al., 2001; Aizenman & Jinjarak, 2008). Thus, we expect this variable to have a positive coefficient.

Geffic is an indicator of government efficiency. This is a dynamic variable, which ranges from 0 to 10 (with 10 being the highest level of efficiency in the government), and it was collected from the World Bank. However, for each country and year, we used the quartile positions of each country in the index. Godin & Hindriks (2015) found evidence of a positive relationship between better government and transparency and the overall performance of government tax collection. We used this variable as a proxy for tax administration efficiency. As mentioned by Tanzi & Zee (2000) and Cnossen (2015), a complex tax system, in terms of tax rates, brackets, exemptions and deductions, is generally less efficient. We expect more efficient governments to be more able to reduce tax evasion and to collect revenues. Therefore, we expect this variable to be positive.

To measure a country's legal and institutional quality (we expect this to have a positive impact on the collection of tax revenues), we used the following variables:

LowCorr represents the corruption level of each country, for each year, measured by the World Bank. The index is a dynamic variable ranging from 0 to 10 (with 10 being the lowest corruption). Once again, we used the quartile positions of each country in the index. Corruption should decrease tax revenues, either by increasing the size of the shadow economy (Bird, 2008; Braşoveanu et al., 2009; Sokolovska, 2015), or by reducing the efficiency of tax administration. Therefore, as this index increases when corruption is reduced, we expect a positive coefficient (i.e.: an increase in the index means less corruption, and therefore more revenues).

Rlaw represents the level of the rule of law. The index is a dynamic variable, ranging from 0 to 10 (with 10 being the highest level of rule of law), collected from the World Bank. Once again, we used the quartile positions of each country in the index. This represents the quality and strength of the legal system, and it shows the judicial limits of government to realize their policy programme through the legislative arm of government. Better enforcement is expected to increase revenues.

For control purpose, we add the following independent variables:

Euro is a dummy that equals 0 if the country did not belong to the Eurozone in that year, and 1 if it did belong to it. As Eurozone countries have been subject to more fiscal constraints, mainly from

the Stability and Growth Pact (Buti, 1998, 2003, 2005, 2007; Dworak et al., 2002; Heipertz, 2004; Afonso, 2010, Hernández et al., 2013), we expect an increase in tax revenues.

LogofGDPpercapita is the log-function of GDP per capita. Higher GDP per capita should increase revenues. This increase is due to the propensity to consumption of wealthier people, particularly in goods and services subject to the normal tax rate. Several authors have showed that higher GDP per capita (using the log values) is associated with higher VAT efficiency and VAT revenues (Ebrill et al., 2001; Cizek et al., 2012; Alm et al., 2013; Zidkova, 2014 and Godin & Hindricks, 2015).

Table 1 exhibits their descriptive statistics. The correlation matrix and the VIF test shows multicollinearity between the three variables from the World Bank (corruption, rule of law, and government efficiency), which we used separated in each model. There is also multi-collinearity between the normal VAT rate and the implicit rate (as expected). The Breusch–Pagan test for heteroskedasticity rejects the null hypothesis. The Jarque-Bera test on variables' normality is statistically significant, and thus we can safely consider that the data have a normal distribution. The Ramsey test did not show any omitted variable. There is some evidence of dependent variable normality of data in Figures 1 and 2. Data for each country in the sample is presented in Table 2.

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent variables					
Log VATrev	365	2.20	1.70	-1.88	5.25
VATrevGDP	365	7.48	1.17	4.14	10.9
Explanatory variables					
VAT variables					
VAT rate	365	19.66	2.96	8	25
Minrate	365	5.78	3.24	0	17
Implicitrate	365	21.2	4.34	11.1	34.2
Economic variables					
ImportsGDP	365	54.2	27.2	21.1	158.6
ServicesGDP	365	50.1	25.9	0.19	10.5.7
Deficit	365	3.09	3.53	-6.83	15.4
Tax administration efficiency					
Ceffic	365	50.3	9.36	30.8	86.7
nyearsVAT	365	22.7	11.8	1	45
GovefficQ	365	82.9	13.5	28.3	100
Institutional and legal variables					
LowCorruptionQ	365	80.1	15.4	30.2	100
RuleofLawQ	365	82.1	14.7	37.3	100
Control variables					
Euro	365	0.50	0.5	0	1
LogGDPcapita	365	3.39	1.39	0.50	7.94

Source: The Author

Table 1 – Descriptive statistics

| Country	VAT Revenue Rate in Billion €					VAT Revenues as % GDP				
	Mean	Sd	Min	Max	Median	Mean	Sd	Min	Max	Median
Belgium	20.9	3.37	15.4	25.98	20.74	6.98	0.13	6.74	7.18	7
Bulgaria	2.24	1.03	0.96	3.86	2.19	9.12	1.12	7.31	10.9	8.87
Czech Republic	6.91	2.72	3.36	10.94	6.82	6.49	0.41	5.87	7.04	6.36
Denmark	20.06	3.20	15.18	23.87	20.06	9.9	0.26	9.57	10.39	9.82
Germany	152.75	21.09	128.37	191.19	139.91	6.77	0.41	6.26	7.48	6.73
Estonia	0.91	0.38	0.41	1.42	0.86	8.39	0.44	7.68	9.07	8.41
Ireland	10.13	2.68	5.59	14.4	10.08	7.05	0.48	6.15	7.77	7.08
Greece	15.8	0.96	14.91	17.02	15.67	7.15	0.36	6.45	7.44	7.25
Spain	49.14	10.70	30.86	64.35	49.37	5.81	0.62	4.14	6.53	5.97
France	121.89	13.81	101.21	140.84	123.42	7.27	0.24	6.91	7.75	7.25
Italy	84.4	10.33	66.16	98.6	83.42	6.08	0.21	5.69	6.47	6.1
Cyprus	1.1	0.50	0.39	1.82	1.15	7.83	2.07	4.48	10.59	8.4
Latvia	0.98	0.41	0.48	1.73	0.9	7.19	0.71	5.99	8.59	7.04
Lithuania	1.9	0.55	1.11	2.59	1.96	7.46	0.60	6.44	8.11	7.57
Luxembourg	1.78	0.56	0.96	2.63	1.76	5.94	0.37	5.37	6.71	5.8
Hungary	6.45	1.81	3.3	8.44	7.05	8.25	0.43	7.6	8.86	8.18
Malta	0.35	0.11	0.15	0.53	0.37	6.81	1.16	4.35	8.05	7.34
Netherlands	35.97	6.16	24.31	43.22	36.38	7.15	0.21	6.76	7.5	7.22
Austria	19.36	2.49	15.58	23.33	19	7.96	0.21	7.62	8.37	7.95
Poland	19.28	6.83	10.92	29.94	16.95	7.52	0.49	6.77	8.34	7.46
Portugal	11.79	2.16	7.98	14.42	11.77	7.85	0.49	7.1	8.56	7.73
Romania	6.08	3.46	2.04	11.41	5.26	7.2	0.85	6.05	8.69	7.14
Slovenia	2.44	0.53	1.67	3.17	2.39	8.51	0.10	8.27	8.61	8.52
Slovakia	2.88	1.22	1.31	4.7	2.83	7.12	0.44	6.35	7.87	6.98
Finland	13.18	2.25	9.64	16.84	13.3	8.45	0.25	7.98	8.93	8.44
Sweden	26.81	4.87	19.86	36.41	26.21	9.02	0.35	8.6	9.67	8.9
United Kingdom	113.15	15.28	84.48	135.97	113.8	6.58	0.34	5.7	7.34	6.58

This table presents the descriptive statistics of the dependent and independent variables used in this study.
Source: The Author

Table 2 – Country data
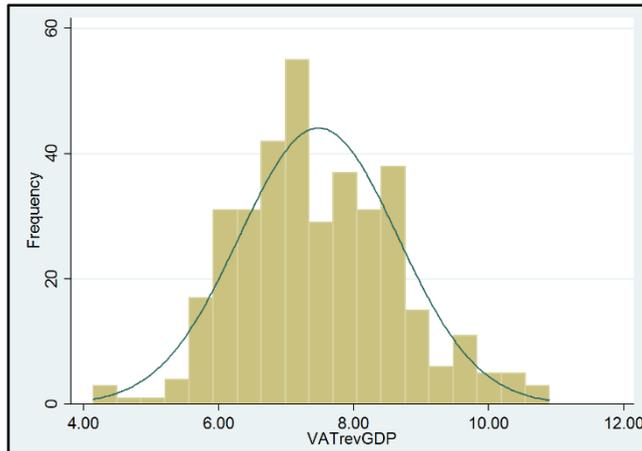
Source: The Author

Figure 1 – Histogram of VAT revenue as % of GDP
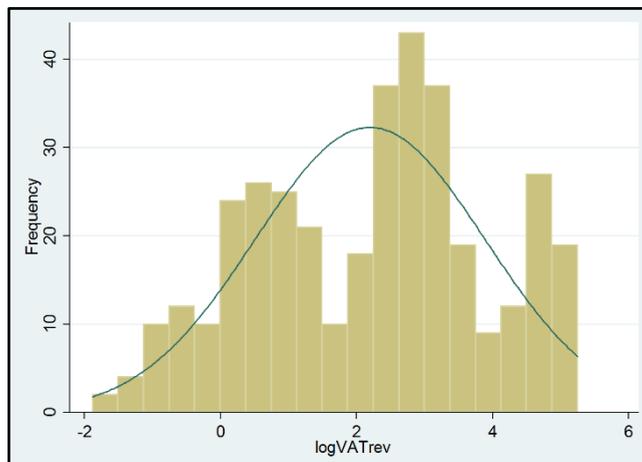
Source: The Author

Figure 2 – Histogram of the variable Log of VAT RevenueVAT revenue as % of GDP

Results and discussion

For a comparative to assess and evaluate the main determinants of VAT revenues, we estimate an OLS with fixed effects (due to the Hausmann test), using the *log of the VAT revenues* as a dependent variable. Results are shown in Table 3. A robustness check was performed, adding a variable *Euro* to the model and a variable *log of GDP per capita*. Results of this new model are shown in Table 4.

Later, we run these models with our second dependent variable (*VAT revenue as a % of GDP*), as a robustness for our results. Table 5 presents the first model, and Table 6 shows the model with the two control variables already mentioned. This subsection addresses conclusions from all models.

VARIABLES	(1) logVATrev	(2) logVATrev	(3) logVATrev	(4) logVATrev
VAT variables				
VAT rate	0.0355***	0.0352***	0.0351***	
	(0.0056)	(0.0056)	(0.0052)	
Minrate	0.0331***	0.0332***	0.0252***	0.0330***
	(0.0038)	(0.0038)	(0.0036)	(0.0039)
implicitrate				0.0250***
				(0.0056)
Economic variables				
Imports%GDP	-0.0043***	-0.0046***	-0.0034***	-0.0043***
	(0.0011)	(0.0011)	(0.0010)	(0.0011)
Services%GDP	0.0063***	0.0061***	0.0052***	0.0050***
	(0.0016)	(0.0016)	(0.0015)	(0.0016)
Deficit	-0.0037*	-0.0034	-0.0055***	-0.0041*
	(0.0022)	(0.0022)	(0.0020)	(0.0022)
Tax administration efficiency				
Ceffic	0.0308***	0.0313***	0.0280***	0.0229***
	(0.0017)	(0.0017)	(0.0016)	(0.0020)
nyearsVAT	0.0566***	0.0565***	0.0550***	0.0580***
	(0.0021)	(0.0021)	(0.0019)	(0.0021)
GovefficQ		0.0042**		
		(0.0018)		
Institutional and legal variables				
Low CorruptionQ	0.0051***			
	(0.0019)			
RuleoflawQ			0.0159***	
			(0.0020)	
Constant	-2.0074***	-1.9369***	-2.6619***	-1.0048***
	(0.2350)	(0.2307)	(0.2104)	(0.1320)
Observations	365	365	365	365
R-squared	0.8855	0.8849	0.9019	0.8762
Number of Country	27	27	27	27

This table presents the results of an OLS with fixed effects (due to the Hausmann test results). The dependent variable is the logarithm of VAT revenues in millions of Euros (for non-Eurozone countries, values in national currencies were converted to Euros), for 1998 to 2011. Country effects were used, but were omitted. Variables CorruptionQ, GovefficQ, RuleoflawQ and implictrate were used separated, due to multicollinearity.

Robust standard errors in parentheses. *** stands for $p<0.01$, ** stands for $p<0.05$, and * for $p<0.1$.

Source: The Author

Table 3 – Regression results with dependent variable LogVATrevenues

VARIABLES	(1) logVATrev	(2) logVATrev	(3) logVATrev	(4) logVATrev
VAT variables				
VAT rate	0.0430***	0.0426***	0.0417***	
	(0.0034)	(0.0035)	(0.0033)	
Minrate	0.0085***	0.0086***	0.0064**	0.0056**
	(0.0025)	(0.0026)	(0.0025)	(0.0027)
implicitrate				0.0363***
				(0.0035)
Economic variables				
Imports%GDP	-0.0039***	-0.0038***	-0.0034***	-0.0034***
	(0.0007)	(0.0007)	(0.0006)	(0.0007)
Services%GDP	0.0130***	0.0131***	0.0124***	0.0127***
	(0.0010)	(0.0011)	(0.0010)	(0.0011)
Deficit	-0.0035***	-0.0037***	-0.0046***	-0.0045***
	(0.0013)	(0.0013)	(0.0013)	(0.0014)
Tax Administration efficiency				
Ceffic	0.0249***	0.0246***	0.0237***	0.0128***
	(0.0011)	(0.0011)	(0.0011)	(0.0014)
nyearsVAT	0.0217***	0.0231***	0.0251***	0.0246***
	(0.0020)	(0.0019)	(0.0019)	(0.0020)
GovefficQ		-0.0004		
		(0.0011)		
Institutional and legal variables				
Low CorruptionQ	0.0031**			
	(0.0012)			
RuleoflawQ			0.0066***	
			(0.0014)	
Control variables				
Euro	0.1048***	0.1117***	0.1080***	0.1101***
	(0.0245)	(0.0247)	(0.0238)	(0.0259)
logGDPpercapita	0.6162***	0.5962***	0.5541***	0.6091***
	(0.0272)	(0.0264)	(0.0266)	(0.0276)
Constant	-2.7618***	-2.9407***	-3.3138***	-2.3694***
	(0.1472)	(0.1494)	(0.1393)	(0.1026)
Observations	365	365	365	365
R-squared	0.9574	0.9566	0.9595	0.9520
Number of Country	27	27	27	27

This table presents the results of our robustness checks, using an OLS with fixed effects, with the dependent variable being the logarithm of the VAT revenues in millions of Euros (for non-Eurozone countries, values in national currencies were converted to Euros), for 1998 to 2011. Country effects were used, but were omitted. The following variables were introduced in the model for control purposes: Euro (a dummy variable, whether the country belongs to the Eurozone or not), and a variable with the log of the GDP per capita. Variables CorruptionQ, GovefficQ, RuleoflawQ and implictrate were used separated, due to multicollinearity.

Robust standard errors in parentheses. *** stands for $p<0.01$, ** stands for $p<0.05$, and * for $p<0.1$.

Source: The Author

Table 4 – Robustness check log of VAT Revenue

VARIABLES	(1) VATrevGDP OLS	(2) VATrevGDP OLS	(3) VATrevGDP OLS	(4) VATrevGDP OLS	(5) VATrevGDP GLM	(6) VATrevGDP GLM	(7) VATrevGDP GLM	(8) VATrevGDP GLM
VAT variables								
VATrate	0.3596*** (0.0559)	0.3604*** (0.0595)	0.3602*** (0.0594)		0.3900*** (0.0162)	0.3889*** (0.0159)	0.3856*** (0.0163)	
Minrate	0.0001 (0.0213)	-0.0036 (0.0210)	-0.0006 (0.0210)	-0.0146 (0.0238)	0.0131 (0.0103)	0.0132 (0.0105)	0.0118 (0.0107)	0.0092 (0.0134)
implicitrate				0.2358*** (0.0677)				0.1710*** (0.0145)
Economic variables								
ImportsGDP	-0.0137 (0.0086)	-0.0123 (0.0084)	-0.0128 (0.0083)	-0.0099 (0.0099)	-0.0136*** (0.0024)	-0.0131*** (0.0023)	-0.0130*** (0.0023)	-0.0152*** (0.0027)
ServicesGDP	0.0019 (0.0052)	0.0019 (0.0052)	0.0025 (0.0052)	-0.0037 (0.0064)	0.0066*** (0.0016)	0.0065*** (0.0015)	0.0061*** (0.0015)	-0.0060*** (0.0019)
Deficit	-0.0052 (0.0108)	-0.0055 (0.0105)	-0.0045 (0.0107)	-0.0093 (0.0091)	0.0399*** (0.0104)	0.0407*** (0.0106)	0.0418*** (0.0106)	0.0511*** (0.0149)
VAT Administration efficiency								
Ceffic	0.1271*** (0.0165)	0.1237*** (0.0175)	0.1250*** (0.0181)	0.0385*** (0.0117)	0.1181*** (0.0073)	0.1162*** (0.0070)	0.1153*** (0.0071)	0.0412*** (0.0091)
myearsVAT	0.0157** (0.0069)	0.0151** (0.0066)	0.0163** (0.0069)	0.0291*** (0.0099)	0.0172*** (0.0037)	0.0187*** (0.0037)	0.0192*** (0.0038)	0.0256*** (0.0037)
GovefficQ		-0.0052 (0.0045)				0.0108*** (0.0038)		
Institutional and legal variables								
Low CorruptionQ	0.0175** (0.0069)				0.0109*** (0.0034)			
RuleoflawQ			-0.0080 (0.0056)				0.0083** (0.0037)	
Constant	-4.2741** (1.8748)	-5.1208** (2.0096)	-5.0096** (2.0019)	0.7317 (1.5340)	-4.6589*** (0.4911)	-4.5178*** (0.4787)	-4.5935*** (0.4850)	3.2616*** (0.3652)
Observations	365	365	365	365	365	365	365	365
Number of Country	27	27	27	27	27	27	27	27

Table 5 - Regression results with dependent variable VATrevenues as percentage of GDP

This table presents the results of an OLS with fixed effects, using as a dependent variable the logarithm of VAT revenues in millions of Euros (for countries outside the Eurozone, values in national currencies were converted to Euros), for the period between 1998 and 2011 for Test 1 to 4, and a GLM for Test 5 to 8. Variables CorruptionQ, GovefficQ, RuleoflawQ and implicitrate were used separated, due to multicollinearity. Robust standard errors in parentheses. *** stands for $p<0.01$, ** stands for $p<0.05$, and * for $p<0.1$.

Source: the Author.

VARIABLES	(1) VATrevGDP	(2) VATrevGDP	(3) VATrevGDP	(4) VATrevGDP
VAT variables				
VAT rate	0.3513***	0.3490***	0.3495***	
	(0.0143)	(0.0143)	(0.0143)	
Minrate	-0.0075	-0.0083	-0.0088	-0.0270*
	(0.0106)	(0.0106)	(0.0108)	(0.0141)
implicitrate				0.2629***
				(0.0184)
Economic variables				
Imports%GDP	-0.0156***	-0.0157***	-0.0152***	-0.0136***
	(0.0027)	(0.0028)	(0.0028)	(0.0037)
Services%GDP	0.0006	0.0013	0.0005	-0.0033
	(0.0043)	(0.0043)	(0.0044)	(0.0057)
Deficit	-0.0098*	-0.0104*	-0.0109*	-0.0175**
	(0.0055)	(0.0055)	(0.0056)	(0.0073)
VAT Administration efficiency				
Ceffic	0.1278***	0.1271***	0.1265***	0.0378***
	(0.0045)	(0.0045)	(0.0046)	(0.0071)
nyearsVAT	0.0271***	0.0334***	0.0327***	0.0480***
	(0.0082)	(0.0080)	(0.0080)	(0.0102)
GovefficQ		0.0052		
		(0.0047)		
Institutional and legal variables				
Low CorruptionQ	0.0087*			
	(0.0052)			
RuleoflawQ			0.0044	
			(0.0058)	
Control variables				
Euro	0.2761***	0.2834***	0.2914***	0.2865**
	(0.1022)	(0.1023)	(0.1021)	(0.1344)
logGDPpercapita	-0.0614	-0.1388	-0.1477	-0.0445
	(0.1133)	(0.1092)	(0.1140)	(0.1433)
Constant	-4.8251***	-5.7820***	-5.6284***	0.0055
	(0.6139)	(0.6186)	(0.5973)	(0.5333)
Observations	365	365	365	365
R-squared	0.8208	0.8200	0.8196	0.6863
Number of Country	27	27	27	27

This table presents the results of ours robustness checks, using an OLS with fixed effects with the dependent variable being the logarithm of VAT revenues in millions of Euros (for non-Eurozone countries, other values were converted to Euros), for 1998 to 2011. The following variables were introduced for control purposes: Euro (a dummy, whether the country belongs to the Eurozone or not), and the log of the GDP per capita. Variables CorruptionQ, GovefficQ, RuleoflawQ and implictrate were used separated, due to multicollinearity.

Robust standard errors in parentheses. *** stands for $p<0.01$, ** stands for $p<0.05$, and * for $p<0.1$.
Source: the Author

Table 6 - Robustness check VAT Revenue as percentage of GDP

As expected, we found evidence of a positive impact in revenues from increasing the normal statutory rate. In average, an increase in 1 p.p. in the statutory rate increased VAT revenues by 0.4 p.p. of GDP. An increase in the implicit rate represents, on average, an increase of 0.2 p.p. in revenues as a percentage of GDP.

Up until the financial crisis of 2008, we found that normal rate had increased by an average of 0.4 p.p., from an average of 18.9% in 1998, to an average of 19.3% in 2007. After 2008, the fiscal constraints and the need of most European countries to reduce their deficits, led most countries to use VAT as one of their measures to increase revenues. In many cases, countries opted not only to increase the tax base, but also to increase tax rates. After the crisis, normal rates have increased, in average by 2.2 p.p.., from an average of 19.3% in 2007, to an average of 21.5% in 2014 (see Bozio et al., 2015 for an overall perspective of the European responses to the crisis, and Marti et al. (2015) for the Spanish response to the crisis, Figari et al. (2015) for the Italian case, and Keane (2015) for Ireland, with all finding that VAT was one of the main tools for increasing revenues). For instance, in the countries that had a bail-out, we found that, after 2008, Hungry increased the normal rate by 7 p.p., Spain increased it by 5 p.p., Greece by 4 p.p., and Portugal and Ireland, both increased it by 2 p.p. Therefore, we also found evidence of a positive impact of the *implicit VAT rate* on revenues. What was less expected however, was the positive impact of *minimum rate*. This could be explained by the significant increases in minimum rates over the last years. Minimum rates increased, on average by 1 p.p. from 2008 to 2012 (from an average of 5.7% in 2007, to an average of 6.7% in 2014). However, this represents an average growth of 15%, which compares with 11% for the case of the normal rate. For all the three variables, there is some evidence that there is still some space in Europe to increase VAT revenues by increasing tax rates.

Economic environment also has an impact on VAT revenues. We found, a negative impact on the variable *Imports*. On the contrary, countries whose GDP has a higher percentage of services are related with higher VAT revenues. This is explained by the higher added value of services when compared with industry or agriculture. With regards to the fiscal position of each country, we found that higher deficits have a negative impact on VAT revenues.

Tax administration efficiency is a relevant issue regarding the collection of VAT revenues. All the three variables used are positive and statistically significant. Not only does *C-efficiency*, but also a higher *number of years* also increases revenues. There is some evidence that more experience in the administration of this tax (which is measured here by the number of years since VAT was introduced) increases the potential for higher revenues. It appears that tax administrations are subject to a learning curve in becoming more efficient. Furthermore, a more efficient government impacts positively on tax revenues.

A better legal and institutional environment is also related with a higher capacity for a country to collect VAT revenues. Lowering corruption and a higher value in the variable *rule of law* tends to increase revenues. In the case of rule of law, this could be attributed to the fact that conflicts between the tax administration and taxpayers can be resolved in court if the legal system is fast,

reliable, and fair. A strong *rule of law* appears to have the effect of making taxpayers more compliant, thus increasing tax revenues.

Finally, our control variables do not change the results from our previous models. Additionally, we can see that belonging to the Eurozone tends to increase VAT revenues. This could be explained by the tighter fiscal rules present in the Eurozone, which make countries more willing to increase revenues. A higher GDP per capita (measured by the log function) also increases VAT revenues.

Table 7 summarises the signals for each variable.

Independent variable	Dependent variable: VAT revenues	Dependent Variable: VAT revenues as % GDP
VAT rate	Positive	Positive
Minimum rate	Positive	n.s.
Implicit rate	Positive	Positive
Imports	Negative	Negative
Services	Positive	Positive
Deficit	Negative	Negative
C-Efficiency	Positive	Positive
N° years	Positive	Positive
Gov. efficiency	Positive	Positive
Low Corruption	Positive	Positive
Rule of Law	Positive	Positive
Euro	Positive	Positive
GDP per capita	Positive	n.s.

This table summarizes the results of this paper. n.s. stands for 'not significant'.
Source: the Author

Table 7 – Variables results

Conclusions

In this paper we assess the critical determinants of VAT revenues in the European Union. By means of a panel data of the 27 EU countries, from 1998 to 2011, we test VAT revenues in millions of Euros, and VAT revenues as a percentage of GDP. We divided our explanatory variables into groups for different categories: 1) VAT rates, using normal rate, minimum rate, and implicit rate; 2) economic variables, using imports as a percentage of GDP, share of services in GDP, and fiscal deficit as a percentage of GDP; 3) Tax administration efficiency, using the C-efficiency ratio, number of years since VAT was introduced, and the government efficiency ratio, and; 4) the legal and institutional environment, using level of corruption, and the rule of law. Two control variables were

used to test the robustness of our results, namely: whether the country belongs to the Eurozone, and the log of the GDP per capita.

Results bring to light important issues regarding collecting VAT revenues in the EU, namely that tax rates are very relevant, as they increase significantly revenues, even the minimum tax rate. Governments have used VAT as a main source of increasing revenues, particularly over the last years, due to fiscal consolidation. Another important issue regards tax administration, where greater efficiency is a critical determinant for increasing revenues. There is also evidence that tax administrations with more years of using VAT tend to have higher revenues. This could represent a learning process for the public sector in dealing with this tax. Finally, a lower level of corruption, higher compliance, and a better legal and judicial system tend to impact positively on VAT revenues.

As VAT is increasingly being used by governments in Europe to increase revenues, concern about the efficiency of collecting these revenues has grown. This paper address a very relevant topic - what determines the collection of VAT revenues? However, the literature is still scarce on this aspect, mainly focusing on developing countries, and not Europe. Nonetheless, VAT has been a key public policy for all of Europe. This paper should be useful for both academics and practitioners alike, and it should help increase our understanding of VAT revenues and their determinants. However, further research is still required before concrete conclusions can be reached. Additional research on VAT revenues is still needed, using comprehensive data, especially concerning the possible relationship between economic shocks and political cycles, along with tax administration efficiency and the legal and institutional environment. Thus, it is clear that research on VAT revenues is still at an early stage.

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