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Working Paper

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Working Paper, No. 1317

Provided in Cooperation with:

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Suggested Citation: Schneider, Friedrich; Buehn, Andreas (2013) : Shadow Economies in highly developed OECD countries: What are the driving forces?, Working Paper, No. 1317, Johannes Kepler University of Linz, Department of Economics, Linz

This Version is available at:

<https://hdl.handle.net/10419/97433>

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**Shadow Economies in highly developed OECD countries:
What are the driving forces?**

by

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Working Paper No. 1317
August 2013

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Shadow Economies in highly developed OECD countries: What are the driving forces?

by

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Revised Version: August 1, 2013

Abstract: *The main focus of this paper lies on the “driving forces” of the development and size of the shadow economy in 39 highly developed OECD countries. The most influential factors on the shadow economy are tax policies and state regulation, which, if rising, increase the shadow economy, though other, economic factors like unemployment are important, too. Specifically, it is shown that the main driving forces of the size and development of the shadow economy are unemployment, self-employment and the tax burden, which impact the shadow economies in these 30 OECD countries to a different degree. Between 1999 and 2010 unemployment and self-employment have on average the largest relative impact (14.6%), followed by tax morale (14.5%), GDP growth (14.3%), business freedom (14.2%) and indirect taxes (14.1%).*

JEL-Classification: K42, H26, D78

Keywords: Shadow economy, tax morale, tax pressure, state regulation, undeclared work

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1. INTRODUCTION

Fighting the shadow economy or tax evasion have been important policy goals in OECD countries for decades. Doing so requires profound knowledge about the size and development of the shadow economy, the individuals who engage in those activities, and the incentives that motivate them. That information would enable governments to better formulate policy measures that either deter shadow economic activities or incentivize their transformation into official ones. Of course, these are obvious goals of economic policy. However, in the light of the recent financial and world-wide economic crisis governments across Europe are in even greater need to achieve this goal as they urgently have to reduce their mountains of debt built up by bailing out banks, other financial intermediaries and even entire southern European countries. In this paper we are concerned to provide a first analysis to what extent a particular determinant contributes to the size and development of the shadow economy and how that relative impact differs across different countries. We will answer questions such as whether the direct or indirect tax burden is relatively more important and how much an improving labor market may contribute.¹ Governments thus have a toolbox at hand to reduce shadow economic activities most efficiently.

The remainder of the paper is organized as follows: Section 2 presents some theoretical considerations about the shadow economy. In section 3, the most important section, we (i) present a MIMIC model estimation of causal variables influencing indicator variables of the shadow economies in 39 OECD countries and (ii) estimates of the shadow economy's size in those countries over the period 1999-2010. In a second step we analyze the relative impact of the causal variables on the size and development of the shadow economy, paying particular attention to Austria, France, Germany, Italy and Spain. Finally, section 4 provides a summary and some policy conclusions.

2. THEORETIZING ABOUT THE SHADOW ECONOMY

A useful starting point for a theoretical discussion of the shadow economy is the paper by Allingham and Sandmo (1972) on income tax evasion. While the shadow economy and tax evasion are not congruent, activities in the shadow economy in most cases imply the evasion

1. Our paper focuses on the size and development of the shadow economy for uniform countries and not for specific regions. Recently, first studies have been published aiming to measure the size of the shadow economy as well as the “grey” or “shadow” labor force for urban regions or states. See e.g. Williams and Windebank (2001), Marcelli (2004), Tafenau, Herwartz and Schneider (2010), and Buehn (2012).

of direct or indirect taxes, such that the factors determining tax evasion will most certainly also affect the shadow economy. According to Allingham and Sandmo tax compliance depends on its expected costs and benefits. The benefits of tax non-compliance result from the individual marginal tax rate and the true individual income. In the case of the shadow economy the individual marginal tax rate is often roughly calculated using the overall tax burden from indirect and direct taxes including social security contributions. The expected costs of non-compliance derive from deterrence enacted by the state, i.e., the state's auditing activities raising the probability of detection and the fines individuals face when they are caught. Individual morality also plays a role for compliance and additional costs could pertain beyond the tax administration's pure punishment in the form of psychic costs like shame or regret, but also additional pecuniary costs if, for example, a reputation loss results.

Individuals are rational calculators who weight the costs and benefits a legal status entails. Their decision to partially or completely participate in the shadow economy is a choice under uncertainty facing a trade off between the gains if their activities are not discovered and a loss if discovered and penalized. Shadow economic activities SE thus negatively depend on the probability of detection p and potential fines f , and positively on the opportunity costs of remaining formal denoted as B . The opportunity costs are positively determined by the burden of taxation T and high labour costs W – the individual income generated in the shadow economy is usually categorized as labor income rather than capital income – due to labour market regulations. Hence, the higher the tax burden and labor costs, the more incentives individuals have to avoid those costs by working in the shadow economy. The probability of detection p itself depends on enforcement actions A taken by the tax authority and on facilitating activities F accomplished by individuals to reduce detection of shadow economic activities. This discussion suggests the following structural equation:

$$SE = SE \left[p \begin{matrix} - & + & - \\ \left(A, F \right) \end{matrix}; f; B \begin{matrix} - & + \\ \left(T, W \right) \end{matrix} \right]. \quad (1)$$

Hence, shadow economic activities may be defined as those economic activities and income earned that circumvent government regulation, taxation or observation. More narrowly, the shadow economy includes monetary and non-monetary transaction of legal nature, hence all productive economic activities that would generally be taxable were they reported to the state (tax) authorities. Those activities are deliberately concealed from public authorities to avoid payment of income, value added or other taxes and social security contributions, to avoid compliance with certain legal labor market standards, such as minimum wages, maximum

working hours, or safety standards and administrative procedures. The shadow economy thus focuses on productive economic activities that would normally be included in the national accounts but which remain underground due to tax or regulatory burdens.² Although such legal activities would contribute to the country's value added, they are not captured in the national accounts because they are produced in illicit ways. Informal household economic activities such as do-it-yourself activities and neighborly help are typically excluded in the analysis of the shadow economy.³

Kanniainen, Pääkönen and Schneider (2004) incorporate many of these insights in their model of the shadow economy. They hypothesize that tax hikes unambiguously increase the shadow economy, while the availability of public goods financed by taxes moderates participation in the shadow economy. The latter effect however depends on the ability to access those public goods. A shortcoming of this analysis is the neglected endogeneity of tax morale and good governance, which is addressed by Feld and Frey (2007) who argue that tax compliance is the result of a complicated interaction between tax morale and deterrence measures. It must be clear to taxpayers what the rules of the game are and as deterrence measures serve as signals for the level of tax morale a society wants to elicit (Posner, 2000), deterrence may also crowd out the intrinsic motivation to pay taxes. Tax morale does not only increase if taxpayers perceive the public goods received in exchange for their tax payments. It may also decrease if individuals perceive political decisions for public activities or the treatment of taxpayers by the tax authorities to be unfair. Tax morale is thus not exogenously given but influenced by deterrence and the quality of state institutions. Table 1 presents an overview of the most important determinants influencing the shadow economy. We will use them in the empirical analysis presented below.

2. Although classical crime activities such as drug dealing are independent of increasing taxes and the causal variables included in the empirical models are only imperfectly linked (or causal) to classical crime activities, the footprints used to indicate shadow economic activities such as currency in circulation also apply for the classic crime. Hence, macroeconomic shadow economy estimates do typically not distinguish legal from illegal underground activities; rather they represent the whole informal economy spectrum.

3. From a social perspective, may even from an economic one, soft forms of illicit employment, such as moonlighting (e.g. construction work in private homes) and its contribution to aggregate value added may be assessed positively. For a discussion of these issues see Thomas (1992) and Buehn, Karmann and Schneider (2009).

Table 1: The main causes determining the shadow economy

Causal variable	Theoretical reasoning	References
Tax and Social Security Contribution Burdens	The distortion of the overall tax burden affects labor-leisure choices and may stimulate labor supply in the shadow economy. The bigger the difference between the total labor cost in the official economy and after-tax earnings (from work), the greater is the incentive to reduce the tax wedge and to work in the shadow economy. This tax wedge depends on social security burden/payments and the overall tax burden, making them to key determinants for the existence of the shadow economy.	E.g. Thomas (1992), Johnson, Kaufmann, and Zoido-Lobaton (1998a,b), Giles (1999), Tanzi (1999), (2003, 2005), Dell’Anno (2007), Dell’Anno, Gomez-Antonio and Alanon Pardo (2007), Buehn and Schneider (2012)
Quality of Institutions	The quality of public institutions is another key factor for the development of the informal sector. Especially the efficient and discretionary application of the tax code and regulations by the government plays a crucial role in the decision to work underground, even more important than the actual burden of taxes and regulations. In particular, a bureaucracy with highly corrupt government officials seems to be associated with larger unofficial activity, while a good rule of law by securing property rights and contract enforceability increases the benefits of being formal. A certain level of taxation, mostly spent in productive public services, characterizes efficient policies. In fact, the production in the formal sector benefits from a higher provision of productive public services and is negatively affected by taxation, while the shadow economy reacts in the opposite way. An informal sector developing as a consequence of the failure of political institutions in promoting an efficient market economy, and entrepreneurs going underground, as there is an inefficient public goods provision, may reduce if institutions can be strengthened and fiscal policy gets closer to the median voter’s preferences.	E.g. Johnson et al. (1998a,b), Friedman, Johnson, Kaufmann, and Zoido-Lobaton (2000), Dreher and Schneider (2009), Dreher, Kotsogiannis and Macorriston (2009), Schneider (2010), Buehn and Schneider (2012), Teobaldelli (2011), Teobaldelli and Schneider (2012)
Regulations	Regulations, for example labor market regulations or trade barriers, are another important factor that reduces the freedom (of choice) for individuals in the official economy. They lead to a substantial increase in labor costs in the official economy and thus provides another incentive to work in the shadow economy: countries that are more heavily regulated tend to have a higher share of the shadow economy in total GDP. Especially the enforcement and not the overall extent of regulation – mostly not enforced – is the key factor for the burden levied on firms and individuals, making them operate in the shadow economy.	E.g. Johnson, Kaufmann, and Shleifer (1997), Johnson, Kaufmann, and Zoido-Lobaton (1998b), Friedman, Johnson, Kaufmann, and Zoido-Lobaton (2000), Kucera and Roncolato (2008)

Public Sector Services	An increase of the shadow economy may lead to fewer state revenues, which in turn reduce the quality and quantity of publicly provided goods and services. Ultimately, this may lead to increasing tax rates for firms and individuals, although the deterioration in the quality of the public goods (such as the public infrastructure) and of the administration continues. The consequence is an even stronger incentive to participate in the shadow economy. Countries with higher tax revenues achieved by lower tax rates, fewer laws and regulations, a better rule of law and lower corruption levels, should thus have smaller shadow economies.	E.g. Johnson, Kaufmann, and Zoido-Lobaton (1998a,b)
Tax Morale	The efficiency of the public sector also has an indirect effect on the size of the shadow economy because it affects tax morale. Tax compliance is driven by a psychological tax contract that entails rights and obligations from taxpayers and citizens on the one hand, but also from the state and its tax authorities on the other hand. Taxpayers are more heavily inclined to pay their taxes honestly if they get valuable public services in exchange. However, taxpayers are honest even in cases when the benefit principle of taxation does not hold, i.e. for redistributive policies, if such political decisions follow fair procedures. The treatment of taxpayers by the tax authority also plays a role. If taxpayers are treated like partners in a (tax) contract instead of subordinates in a hierarchical relationship, taxpayers will stick to their obligations of the psychological tax contract more easily. Hence, (better) tax morale and (stronger) social norms may reduce the probability of individuals to work underground.	E.g. Feld and Frey (2007), Kirchlner (2007), Torgler and Schneider (2009), Feld and Larsen (2005, 2009)
Deterrence	Despite the strong focus on deterrence in policies fighting the shadow economy and the unambiguous insights of the traditional economic theory of tax non-compliance, surprisingly little is known about the effects of deterrence from empirical studies. This is due to the fact that data on the legal background and the frequency of audits are not available on an international basis; even for OECD countries such data is difficult to collect. Either is the legal background quite complicated differentiating fines and punishment according to the severity of the offense and the true income of the non-complier, or tax authorities do not reveal how intensively auditing is taking place. The little empirical survey evidence available demonstrates that fines and punishment do not exert a negative influence on the shadow economy, while the subjectively perceived risk of detection does. However, the results are often weak and Granger causality tests show that the size of the shadow economy can impact deterrence instead of deterrence reducing the shadow economy.	E.g. Andreoni, Erard and Feinstein (1998), Pedersen (2003), Feld and Larsen (2005, 2009)

From Table 1 we derive the following six core hypotheses:

1. The higher the tax burden, measured by the personal income tax, payroll taxes, and/or indirect taxes, the bigger the shadow economy, *ceteris paribus*.
2. The lower tax morale is, the bigger the shadow economy, *ceteris paribus*.
3. The higher unemployment is, the bigger the shadow economy, *ceteris paribus*.
4. The more regulated official business activities are, the bigger the shadow economy, *ceteris paribus*.
5. The higher the self-employment quota is, the bigger the shadow economy, *ceteris paribus*.
6. The lower the quality of institutions measured by the rule of law (or lower levels of corruption) is, the bigger the shadow economy, *ceteris paribus*.

3. ANALYZING THE SHADOW ECONOMY

3.1. Measurement

Although shadow economic activities have been studied for a long time, the discussion regarding the “appropriate” methodology to assess them has not come to an end yet.⁴ Generally, the size of the shadow economy can be measured in two ways: at the micro level using surveys or questionnaires or alternatively indirect methods such as the currency demand or latent variable approaches making use of macroeconomic indicators. The virtue of the latter approaches – especially of the latent Multiple Indicators Multiple Causes (MIMIC) approach – is that the shadow economy is formalized as the outcome of a multitude of causes like tax rates, the degree of regulation, or the level of unemployment. While those methods allow approximating the development of the shadow economy over time, direct approaches better reveal the motivation of individuals to escape into the shadow economy.

Today indirect estimation of the shadow economy is mostly based on a combination of the MIMIC procedure and the currency demand method, or the sole use of the currency demand method. The MIMIC procedure assumes that the shadow economy remains an unobservable phenomenon (latent variable) that can be estimated using measurable causes of illicit employment, e.g. the tax burden and regulatory intensity, and indicators reflecting illicit activities, e.g. the currency demand or official working time. A disadvantage of the MIMIC proce-

4. For the strengths and weaknesses of the various methods see e.g. Bhattacharyya (1999), Breusch (2005), Feige (1989), Feld and Schneider (2010), Giles (1999), Schneider (2003, 2005, 2011), Schneider and Enste (2000), Tanzi (1999), Thomas (1999).

ture is however, that it produces only relative estimates of the size and development of the shadow economy. Thus, exogenous absolute estimates (e.g. in percent of GDP) of the shadow economy – typically taken from the currency demand method⁵ - are necessary to calibrate the relative MIMIC estimates into absolute shadow economy figures.

Alternatively, the size of the shadow economy is estimated by using survey methods (e.g. Isachsen and Strøm (1985), Pedersen (2003), Feld and Larsen (2005, 2009), Enste and Schneider (2006)). In order to minimize the number of respondents dishonestly replying or totally declining answers to the sensitive questions, the respondents are slowly accustomed to the main purpose of the survey: The first part of the questionnaire shapes the respondents' perception to the issue at hand, the second part asks questions about the respondents' activities in the shadow economy, and the third part finally contains the usual socio-demographic questions. While the questionnaires are broadly comparable in design, recent attempts by the European Union to provide survey results for all EU member states run into difficulties regarding comparability (Renooy et al. 2004): the wording of the questionnaires becomes more and more cumbersome depending on the culture of different countries with respect to the shadow economy. In tax compliance research, the most interesting data stem from tax audits by the US Internal Revenue Service (IRS). The Taxpayer Compliance Measurement Program (TCMP) studies actual compliance behavior of taxpayers and may be analyzed empirically (Andreoni, Erard and Feinstein, 1998). The approach of the IRS is broader in a certain sense as tax evasion from all sources of income is considered, while the two methods discussed before aim at capturing the shadow economy or undeclared work. However, even the data obtained from the TCMP is biased because the actually detected tax non-compliance could only be the tip of the iceberg. Although the perfect data on tax non-compliance does therefore not exist, the existing imperfect data in this area can still provide interesting insights also for the size, development and determinants of the shadow economy and the shadow economy labor force.

Although each method has its strength and weaknesses, and biases in the estimates of the shadow economy almost certainly prevail, no better data are currently available. Clearly, there can be no exact measure of the size of the shadow economy and estimates differ widely with an error margin of +/- 15 percent. These days, macro estimates derived from the MIMIC

5. This indirect approach assumes that cash is used for transactions in the shadow economy. It estimates a currency demand function including independent variables like the tax burden, regulation, and so forth that drive the shadow economy. The estimated equation is used to simulate that money demand necessary to generate the official GDP and compares it to actual money demand. The difference - multiplied by the velocity of money in the official economy – allows calculation of a value added figure for the shadow economy.

model, the currency demand method, or the electricity approach are seen as upper bound estimates, while micro (survey) estimates are seen as lower bound estimates.

3.2. Econometric results

We analyse the shadow economies of 39 developed OECD countries over the period 1999 to 2010 using a MIMIC approach, which allows us to employ a number of potential measures of shadow economic activities, i.e., its indicators, simultaneously. Suitable indicators of shadow economic activities are currency demand, official working time or labour force participation, and official GDP. The effect of a larger shadow economy on official GDP figures can be expected to be negative, all other things being equal. The larger the shadow economy, the lower the government's tax revenues and thus the ability to provide public goods and services, i.e. public demand, that significantly contributes to official GDP. In addition, the more individuals participate in shadow economic activities, the less work officially. Hence, the expected correlation between the shadow economy and official labour market indicators can also be expected to be negative, all other things being equal. Using currency in circulation as an indicator of shadow economic activities seems most reasonable, as cash is mostly used as means of payment in the shadow economy protecting principal and agent best. The expected correlation is positive. Table 1 has already presented the most important determinants (causes) incentivizing economic agents to operate in the shadow economy. Their empirical implementation in the form of causal and indicator variables in a MIMIC model as well as the predicted signs are given in table A.1 in the Appendix, while table 2 in the main body of the paper presents the countries included in the sample.

[Insert table 2 here]

Table 3 shows five different MIMIC model specifications to demonstrate the robustness of our results. The second reason is that some of the causal variables cannot be included in the empirical models at the same time as they are highly correlated with each other. Turning first to the direct and indirect tax burden, we find that both causal variables are highly statistically significant and have the expected positive sign in all equations. This is not the case for the payroll taxes. Also the "soft" factor tax morale is highly statistically significant and has the predicted negative sign in all equations, i.e., a lower level of tax morale is correlated with larger shadow economies. Looking at the more economic causal variables, unemployment, business freedom, and self-employment, we also find that all three causal variables have a highly statistically significant influence and carrying the expected signs. This holds also for

GDP growth, which has a positive and again highly statistically significant influence. The Rule of Law is only statistically significant in specification 1 and 2, while the alternative measure of institutions, i.e., the variable corruption, is not statistically significant at all. The causal variable education is also highly statistically significant and has the expected sign indicating that the more or better people are educated on average, the less they operate in the shadow economy, all other things being equal. Concerning the indicators, the labor force participation is highly statistically significant and has the predicted negative influence, while the measure of currency in circulation is only statistically significant in specification 3 and 4. In general the estimation results are quite satisfactory, especially as most causal variables have the predicted sign and are highly statistically significant.

The standardized coefficients presented allow to directly comparing the relative influence of the different causal variables. Table 3 clearly shows that the coefficient of the unemployment rate has the biggest influence on the shadow economy with a standardized coefficient between 0.53 and 0.65; followed by the personal income tax with a standardized coefficient between 0.27 and 0.40; followed by business freedom with a standardized coefficient between 0.29 and 0.35. GDP growth and education show very similar standardized coefficients with value of 0.29 and 0.30 and between 0.27 and 0.31, respectively. Concerning the tax burden measures, indirect and direct taxes have standardized coefficients between 0.27 and 0.40 and the tax morale variable between 0.21 and 0.30. The dominating influence of the unemployment rate is not amazing as being unemployed quite often means a severe income loss; hence unemployed people try to compensate this income or utility loss by expanding their activities in the shadow economy.

[Insert table 3 here]

3.3. Size and Development of the Shadow Economy of 39 OECD Countries

In table 4 the size and development of the shadow economy of 39 countries over the period 1999 to 2010 is shown. No detailed interpretation is given here but some general trends are discussed. In most countries, the shadow economy increases in the year 2009, which is due to the world financial and economic crisis. For example in Canada the shadow economy was 14.9% of official GDP in the year 2008 and had increased to 15.5 %. In Chile, the shadow economy was 19.1% of official GDP in 2008 and had increased to 20.5 % in 2009; or in Norway, the shadow economy had a size of 17.7% of official GDP in 2008 and had increased to

18.6 % in 2009. The countries with the largest shadow economies are Bulgaria, Romania and Turkey with 34.6%, 32.2%, and 30.6%, respectively; Luxemburg, Switzerland and the United States are the countries with the smallest shadow economies, with sizes of 9.2%, 8.6% and 9.0% of official GDP, respectively. The un-weighted average size of the shadow economy across the 39 OECD countries was 20.3% of official GDP in 1999 and had decreased to 18.3% in 2010.

The highlighted rows in table 4 present the size and development of the shadow economies for selected countries, i.e., for Austria, France, Germany, Italy and Spain, for which we will discuss the relative impact of the different causal variable in more detail in the next section. Concerning first the size of their shadow economies, table 4 shows that Austria has the lowest shadow economy with an average value of 9.8% of official GDP, while Italy has the largest with an average value of 26.9 %, followed by Spain with 22.8%, Germany (15.7%) and France (14.8%). All five countries experienced increasing shadow economies between 1999 and 2004/05; since 2006 the shadow economy in these countries, except for Spain, had decreased.

[Insert table 4 here]

3.4. The Relative Impact of the Causal Variables on the Shadow Economy

Tables 5 to 9 present the relative impact of the causal variables on the size of the shadow economy for the five selected countries of Austria, France, Germany, Italy and Spain over the period 1998 to 2010. To calculate the relative impact, we make use of the benchmark procedure applied to calculate the shadow economy estimates in the first place. In the first step, the MIMIC model index $\tilde{\eta}_t$ of the shadow economy is calculated by multiplying the estimated coefficients \hat{c}_i of the significant causal variables (see the estimation results in table 3) with the respective time series x_{it} :

$$\tilde{\eta}_t = \sum \hat{c}_i \cdot x_{it}. \quad (1)$$

While computation of the size of the shadow economy in percentage of GDP is only possible by applying an exogenous benchmark figure and a certain benchmark procedure, the relative impact (weight) W_i of each determinant i can on the contrary be computed using $\tilde{\eta}_t$ only. It is calculated as:

$$W_i = \frac{\hat{c}_i \cdot x_{it}}{\tilde{\eta}_t}, \quad (1)$$

i.e., it is simply the weighted – the estimated coefficient \hat{c}_i being the weight – contribution of each causal variable to the MIMIC index $\tilde{\eta}_t$.

Starting with the relative impact of the causal variables on the shadow economy in Austria (table 5 and figure 1) we see that self-employment contributes most, i.e. 16.8%, to the Austrian shadow economy. The second most influential causal variable is GDP growth with an average relative impact of 15.9%, followed by the indirect taxes, which average relative impact is 14.6%. Personal income taxes explain on average 12.4% of the shadow economy's variation, the variable tax morale 14.1%, and the business freedom variable – measuring the impact of regulations on the ability and flexibility to run a business – 14.4%. Of lower importance is the unemployment rate, which relative impact is “only” 11.8% on average. One reason for the lower explanatory power of the unemployment rate may be that the growth rate of GDP already captures a great deal of the shadow economy's variation induced by the macroeconomic environment and the business cycle. Concerning the evolution of the causal variables during the observation period we observe a decreasing relative impact of the business freedom variable from 16.2% (1998) to 11.8% (2010). The contribution of indirect taxes had increased from 14.1% in 1998 to 17.0% in 2010, while the relative impact of the variable tax morale had reduced from 16.1% (1998) to 12.6% (2010).

Looking at France – the results are shown in table 6 and figure 2 – we find that the causal variables GDP growth and unemployment are equally important. Their relative contribution to the shadow economy is on average 15.1%. The relative influence of indirect taxation had increased from 13.3% in 1998 to 16.1% in 2010. The impact of the unemployment rate had increased from 7.2% in 1998 to 17.3% in 2010. The causal variables tax morale and self-employment are also important having an average relative impact of 14.8% and 17.3%, respectively. While the influence of tax morale had remained stable between 1998 and 2010, self-employment had become slightly less important: its impact had decreased from 20.2 % in 1998 to 16.1% in 2010. The relative influence of the personal income tax was 11.8% in 1998 and had decreased to 8.6 % in 2010. The same holds for the business freedom index, which contributed 16.0% in 1998 and 10.3% in 2010.

Table 7 and figure 3 present the results for Germany. The predominant causal variables of the shadow economy are personal income taxes and GDP growth with average relative impacts of 16.6% and 15.2%, respectively. While the influence of the indirect tax burden had decreased from 16.3% in 1998 to 11.0% in 2010, the impact of the causal variable unemployment shows the opposite movement: It had increased from 11.4% in 1998 to 16.1% in

2010. For Germany we also observe a strong increase of the relative impact of the causal variable tax morale. It was 12.4 % in 1998 and had increased to 16.6 % in 2010. The causal variable self-employment has no clear trend. The average relative contribution to estimates of the German shadow economy is 12.8%. Business freedom on the other hand shows a decreasing trend from 17.5% in 1998 to 11.7% in 2010.

The simulation results concerning the relative impact of the causal variables on the Italian shadow economy are shown in table 8 (figure 4), demonstrate that the causal variable GDP growth has the highest influence, which was 15.3% in 1998 and had increased even further to 19.6% in 2010. The second most important variable is unemployment with a relative impact of 12.9% in 1998, which had increased to 14.8% in 2010. The average relative impact of indirect taxes is 13.9%, the causal variable personal income tax contributed 13.8% to shadow economy estimate in 1998 and 12.2% in 2010. The relative impacts of the variables tax morale and business freedom show a similar pattern, both had decreased slightly between 1998 and 2010. The decrease of the tax morale variable was 1.1% from 14.5% (1998) to 13.4% (2010) and that of the business freedom index 1.6% from 14.7% in 1998 to 13.1% in 2010.

Finally table 9 and figure 5 present the relative impact of the causal variables on the Spanish shadow economy during 1998 and 2010. We find a predominant relative impact of the causal variable unemployment; its average contribution to the development of the Spanish shadow economy is 17.5% and had increased from 11.8% in 1998 to 17.0% in 2010. The second most-important determinant is self-employment with an average relative impact of 16.4% that had been almost stable between 1998 and 2010. Changes of the indirect tax burden contributed 13.6% to the shadow economy and its impact had increased between 1998 and 2010. The average impact of the two causal variables GDP growth and tax morale is similarly important for the size and development of the shadow economy. GDP growth contributed 13.8% on average and the mean relative impact of tax morale was 14.6 %. Finally, the business freedom index had lost importance between 1998 and 2010: Its relative impact had decreased from 17.3% in 1998 to 9.5 % in 2010.

In general the simulation results for the selected 5 OECD-countries clearly demonstrate that the determinants of the shadow economy are not equally important across countries. For that reason, table 10 presents the average relative influence (in %) of the causal variables onto the size and development of the shadow economies for all 39 OECD countries between 1999 and 2010. It shows that tax morale, unemployment, and self-employment are the most influential determinants of the shadow economy for the majority of countries. Looking at the average values in the last row of table 10 first, we observe that unemployment and self-

employment have the highest influence (14.6%) across countries. It is followed by tax morale with an average relative impact of 14.5%, then by GDP growth (14.3%), business freedom (14.2%), indirect taxes (14.1%), and finally the personal income tax with an average relative impact of 13.8%. Considering single variables, the personal income tax shows a large variance with respect to the relative impact on the shadow economy. It has a very large relative impact in Germany (16.6%) and Estonia (16.4%), while the impact in France (9.1%) and Greece (10.3%) is smallest. The relative impact of indirect taxes concerning the shadow economy's evolution is largest in Greece (16.1%), followed by the Czech Republic (16.0%); the relative impact of indirect taxes is smallest in Belgium (12.8%) and Switzerland (13.0%). The tax morale variable has the highest relative impact on the shadow economy in Switzerland with an average value of 15.7% between 1998 and 2010, and the lowest in the United States (13.7%). The unemployment variable has the largest impact in Canada (18.4%), followed by Denmark (18.2%). The relative impact of the unemployment rate is smallest in Greece (10.4%), the Czech Republic (11.5%), and Austria (11.8%). Self-employment is on average most important in Greece (18.7%), France (17.3%), Finland (16.9%), Austria (16.8%), and Spain (16.4%). Again, table 10 demonstrates that – as one would expect – the 39 OECD countries are very different regarding the influence of the causal variables on the size and development of their shadow economies.

4. SUMMARY AND CONCLUSIONS

Our paper has first theoretically discussed the importance of the determinants of shadow economic activities, like the direct and indirect tax burden, tax morale, unemployment, self-employment and other factors. We have then presented estimates of the size and development of the shadow economy for 39 countries using a MIMIC approach. The estimation results show that the causal variables personal income tax, indirect taxes, tax morale, unemployment, self-employment, GDP growth and business freedom have the theoretically expected signs and are highly statistically significant. Considering the MIMIC model's standardized coefficients, we find that unemployment has by far the largest influence, followed by the personal income tax and GDP growth. Calculating the size and development of the shadow economy for these 39 countries, Bulgaria, Romania and Turkey have the largest shadow economies between 1999 and 2010 with average sizes of 34.6%, 32.2% and 30.6% of official GDP, respectively. The shadow economies in Switzerland, the United States, and Luxembourg are the smallest, with average sizes of 8.3%, 8.7% and 9.6% of official GDP, respectively. Looking

at the average relative impact of the causal variables on the shadow economy across the 39 OECD countries between 1999 and 2010 it turns out that unemployment and self-employment have the largest relative impact (14.6%), followed by tax morale (14.5%), GDP growth (14.3%), business freedom (14.2%), indirect taxes (14.1%) and finally the personal income tax with an average relative impact of 13.8%.

The final question remaining is what type of policy conclusions we can draw? One conclusion may be that – besides the indirect tax and personal income tax burden, which the government can directly influence by policy actions – self-employment and unemployment are two very important driving forces of the shadow economy. Unemployment may be controllable by the government through economic policy in a traditional Keynesian sense; alternatively, the government can try to improve the country’s competitiveness to increase foreign demand. The impact of self-employment on the shadow economy is less or only partly controllable by the government and may be ambiguous from a welfare perspective. A government can deregulate the economy or incentivize “to be your own entrepreneur”, which would make self-employment easier, potentially reducing unemployment and positively contributing to efforts in controlling the size of the shadow economy. Such actions however need to be accompanied with a strengthening of institutions and tax morale to reduce the probability that self-employed shift reasonable proportions of their economic activities into the shadow economy, which, if it happened, made government policies incentivizing self-employment less effective.

Our paper clearly shows that a reduction of the shadow economy can be achieved using various channels the government can influence. The main challenge still is to bring shadow economic activities into the official economy in a way that goods and services previously produced in the shadow economy are still produced and provided but in the official economy. On then, the government gets additional taxes and social security contributions.

TABLES

Table 2: OECD countries included in the sample; estimation period: 1998/99–2010

Australia, Austria, Belgium, Bulgaria, Canada, Chile, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Ko-
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rea, Latvia, Lithuania, Luxembourg, Malta, Mexico, Netherlands. New Zealand, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States

Table 3: MIMIC model estimations (standardized coefficients)

Specification	1	2	3	4	5
Causes					
Personal income tax	0.27*** (3.27)	0.33*** (3.99)	0.37*** (4.30)	0.40*** (4.80)	0.39*** (4.74)
Payroll taxes	-0.08 (0.98)	-0.11 (1.35)			
Indirect taxes	0.24*** (2.75)	0.22*** (2.66)	0.31*** (3.85)	0.21*** (2.67)	0.24*** (2.97)
Tax morale	-0.31*** (3.29)	-0.22*** (2.40)	-0.26*** (2.84)	-0.22*** (2.51)	-0.21*** (2.38)
Unemployment	0.63*** (5.92)	0.65*** (6.30)	0.63*** (5.96)	0.55*** (5.56)	0.53*** (5.47)
Business freedom	-0.29*** (3.35)	-0.26*** (3.11)	-0.29*** (3.36)	-0.35*** (4.06)	-0.35*** (4.20)
Self-employment	0.29*** (2.68)	0.30*** (2.88)	0.34*** (3.17)	0.33*** (3.18)	0.27*** (2.57)
Rule of Law	-0.14* (1.81)	-0.14* (1.83)	-0.10 (1.31)	-0.08 (1.03)	
GDP growth		0.30*** (3.62)	0.31*** (3.70)	0.27*** (3.35)	0.29*** (3.52)
Education				-0.31*** (3.51)	-0.26*** (2.83)
Corruption					0.14 (1.56)
Indicators					
GDP pc	-0.52	-0.52	-0.48	-0.51	-0.50
Currency in circulation	0.09 (1.39)	0.07 (1.07)	0.10* (1.75)	0.10* (1.69)	0.08 (1.26)
Labour force participation	-0.56*** (6.42)	-0.55*** (6.58)	-0.52*** (6.36)	-0.50*** (6.48)	-0.51*** (6.46)
Observations	151	151	151	151	151
Degrees Freedom	44	54	42	52	52
Chi-square	88.88	89.68	24.10	32.51	34.57
RMSEA	0.08	0.06	0.00	0.00	0.00

Note: The sample includes 39 OECD countries and the estimation period is 1998 to 2010. Absolute z-statistics are reported in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 4: Size and development of the shadow economy (in % of GDP)¹⁾ in 39 OECD countries

Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Australia	14.4	14.3	14.3	14.1	13.9	13.7	13.7	13.7	13.7	13.2	13.5	13.4	13.8
Austria	10.0	9.8	9.7	9.8	9.8	9.8	9.8	9.6	9.7	9.5	9.7	10.6	9.8
Belgium	22.7	22.2	22.1	22.0	22.0	21.8	21.8	21.4	20.8	20.3	20.5	20.7	21.5
Bulgaria	37.3	36.9	36.6	36.1	35.6	34.9	34.1	33.5	33.0	33.7	32.1	31.9	34.6
Canada	16.3	16	15.9	15.8	15.7	15.6	15.5	15.3	15.2	14.9	15.5	15.4	15.6
Chile	19.9	19.8	19.6	19.6	19.4	19.1	18.9	18.7	18.4	19.1	20.5	19.8	19.4
Cyprus	29.2	28.7	28.2	27.8	28.2	28.1	27.7	27.3	27.3	27.7	26.9	25.4	27.7
Czech Rep.	19.3	19.1	18.9	18.8	18.7	18.4	17.8	17.3	16.3	15.2	15.7	15.5	17.6
Denmark	18.4	18.0	18.0	18.0	18.0	17.8	17.6	17.0	16.5	15.3	16.2	16.2	17.3
Estonia	-	25.6	25.3	24.9	24.3	24.0	23.4	22.7	22.5	20.8	24.3	22.5	21.7
Finland	18.4	18.1	17.9	17.8	17.7	17.6	17.4	17.1	16.6	16.4	16.7	16.8	17.4
France	15.7	15.2	15.0	15.1	15.0	14.9	14.8	14.8	14.5	14.0	14.5	14.6	14.8
Germany	16.4	16.0	15.9	16.1	16.3	16.1	16.0	15.6	15.3	14.8	14.6	15.1	15.7
Greece	28.5	28.7	28.2	28.0	27.4	27.1	26.9	26.4	26.5	26.0	25.3	25.1	27.0
Hungary	25.4	25.1	24.8	24.5	24.4	24.1	24.0	23.7	23.7	23.1	23.1	23.1	24.1
Iceland	16.0	15.9	15.8	16.0	15.9	15.5	15.1	15.0	14.4	13.8	14.7	14.4	15.2
Ireland	16.1	15.9	15.9	15.9	16.0	15.8	15.6	15.5	15.9	15.9	17.5	16.5	16.1
Italy	27.8	27.1	26.7	26.8	27.0	27.0	27.1	26.9	26.8	26.7	26.5	26.7	26.9
Japan ²	11.4	11.2	11.2	11.3	11.2	10.9	10.7	10.4	10.3	11.0	11.0	11.0	11.0
Korea, Rep.	28.3	27.5	27.3	26.9	26.8	26.5	26.3	25.9	25.8	25.6	24.5	24.7	26.3
Latvia	23.9	23.6	23.2	22.9	22.5	22.1	21.5	20.8	20.8	22.6	20.0	21.5	22.1
Lithuania	27.2	27.1	26.7	26.2	25.4	25.1	24.4	23.8	24.3	26.0	23.6	25.4	25.4
Luxembourg	10.0	9.8	9.8	9.8	9.8	9.8	9.7	9.6	9.3	9.1	9.3	9.6	9.6

Table 4: Size and development of the shadow economy (in % of GDP)¹⁾ in 39 OECD countries (continued)

Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Malta	27.4	27.1	27.3	27.3	27.5	27.6	27.3	27.0	26.8	27.0	26.7	28.1	27.3
Mexico ²⁾	30.8	30.1	30.3	30.4	30.5	30.1	29.9	29.2	28.8	30.0	30.0	30.0	30.0
Netherlands	13.3	13.1	13.1	13.2	13.3	13.2	13.2	13.2	13.1	12.7	12.9	13.6	13.2
New Zealand	13.0	12.8	12.6	12.4	12.2	12.0	12.1	12.1	12.0	11.8	12.0	12.0	12.2
Norway	19.2	19.1	19.0	19.0	19.0	18.5	18.5	18.2	18.1	17.7	18.6	18.2	18.6
Poland	27.7	27.6	27.7	27.7	27.5	27.3	26.9	26.4	25.4	24.7	24.6	23.8	26.4
Portugal	23.0	22.7	22.6	22.7	23.0	23.1	23.3	23.2	22.5	21.9	22.0	22.2	22.7
Romania	34.3	34.4	33.7	33.5	32.8	32.0	31.7	30.7	30.8	31.5	30.0	30.9	32.2
Slovak Rep.	18.9	18.9	18.8	18.6	18.3	18.1	17.6	17.2	16.6	16.0	15.8	15.8	17.5
Slovenia	27.3	27.1	26.7	26.6	26.4	26.2	25.8	25.3	25.3	24.6	23.5	23.7	25.7
Spain	23.0	22.7	22.4	22.4	22.4	22.5	22.4	22.4	22.3	22.9	24.5	23.5	22.8
Sweden	19.6	19.2	19.1	19.0	18.7	18.5	18.6	18.2	18.0	17.7	17.9	18.1	18.6
Switzerland	8.8	8.6	8.6	8.6	8.8	8.6	8.5	8.3	8.0	7.2	7.8	8.0	8.3
Turkey	32.7	32.1	32.8	32.4	31.8	31.0	30.0	29.5	28.0	28.6	29.4	29.0	30.6
United Kingdom	12.8	12.7	12.6	12.6	12.5	12.4	12.4	12.3	12.4	12.1	12.9	12.0	12.5
United States	8.8	8.7	8.8	8.8	8.7	8.6	8.5	8.4	8.6	8.6	9.3	9.1	8.7
Average	20.3	20.7	20.6	20.5	20.4	20.1	19.9	19.6	19.3	19.2	18.3	18.3	20.3

Source: Own calculations

- 1) Estimates before 2007 are taken from Buehn and Schneider (2012).
- 2) Data for 2009 and 2010 are not available for all causes, hence 2009 and 2010 estimates are a linear interpolation of the 2008 estimate and the country average.

Table 5: The relative impact of the causal variables on the shadow economy of AUSTRIA over 1998 to 2010

Austria Year	Personal Income Tax (PIT)	Indirect taxes	Tax morale	Unemployment	Self- employment	GDP growth	Business free- dom
1998	11.7	14.1	16.1	12.4	16.0	13.5	16.2
1999	10.9	13.0	15.4	16.0	15.6	13.4	15.6
2000	12.0	13.0	14.6	17.2	15.6	12.6	15.2
2001	9.6	14.1	13.9	16.1	15.5	15.9	14.9
2002	11.2	12.1	14.5	13.9	16.4	15.9	16.0
2003	11.3	11.3	14.3	11.6	18.0	17.2	16.3
2004	12.9	12.7	14.8	6.8	19.1	16.4	17.3
2005	14.8	14.2	14.4	4.1	18.4	16.7	17.5
2006	14.9	16.8	14.2	8.8	18.2	15.4	11.7
2007	14.5	17.4	13.7	11.7	16.2	14.7	11.9
2008	11.7	17.3	12.1	15.8	16.2	15.5	11.2
2009	12.9	16.3	12.1	7.2	16.9	22.3	12.2
2010	13.0	17.0	12.6	11.6	16.5	17.6	11.8
Average	12.4	14.6	14.1	11.8	16.8	15.9	14.4

Table 6: The relative impact of the causal variables on the shadow economy of FRANCE over 1998 to 2010

France Year	Personal Income Tax (PIT)	Indirect taxes	Tax morale	Unemployment	Self-employment	GDP growth	Business freedom
1998	11.8	13.3	15.7	7.2	20.2	15.7	16.0
1999	10.9	14.0	15.5	7.6	20.6	15.6	15.9
2000	8.9	14.0	13.7	13.1	18.4	13.1	18.8
2001	8.2	14.3	12.7	16.9	16.9	14.3	16.6
2002	8.8	12.4	13.2	16.5	17.0	15.6	16.5
2003	8.8	11.7	13.8	17.0	16.2	15.7	16.6
2004	9.3	12.8	14.8	15.3	17.1	13.6	17.0
2005	7.8	14.6	14.7	16.0	16.5	14.1	16.3
2006	8.7	15.9	16.1	16.9	17.1	13.9	11.3
2007	8.9	16.1	15.8	18.6	16.6	13.2	10.9
2008	8.0	16.5	15.2	19.1	15.9	15.4	9.9
2009	8.8	15.7	15.6	14.3	15.8	19.5	10.3
2010	8.6	16.1	15.5	17.3	16.1	16.1	10.3
Average	9.1	14.4	14.8	15.1	17.3	15.1	14.3

Table 7: The relative impact of the causal variables on the shadow economy of GERMANY over 1998 to 2010

Germany Year	Personal Income Tax (PIT)	Indirect taxes	Tax morale	Unemployment	Self-employment	GDP growth	Business freedom
1998	15.6	16.3	12.4	11.4	13.4	13.4	17.5
1999	15.3	15.0	12.8	14.2	14.0	13.8	15.1
2000	14.8	14.8	13.1	16.3	13.7	12.4	14.9
2001	13.7	13.9	13.5	16.0	13.3	14.7	14.9
2002	16.1	13.2	13.7	13.2	13.1	15.9	14.7
2003	17.6	13.1	14.3	11.2	12.7	16.2	15.0
2004	20.1	13.6	15.4	8.3	11.7	15.2	15.7
2005	20.4	13.5	16.3	5.7	11.7	16.2	16.2
2006	19.6	14.4	17.6	9.0	12.7	13.6	13.1
2007	17.3	12.0	17.2	14.6	12.6	13.8	12.5
2008	14.8	11.4	16.8	17.6	12.6	15.0	11.7
2009	14.7	9.9	15.9	16.0	12.1	20.4	11.0
2010	15.6	11.0	16.6	16.1	12.5	16.5	11.7
Average	16.6	13.2	15.0	13.0	12.8	15.2	14.2

Table 8: The relative impact of the causal variables on the shadow economy of ITALY over 1998 to 2010

Italy Year	Personal Income Tax (PIT)	Indirect taxes	Tax morale	Unemployment	Self-employment	GDP growth	Business freedom
1998	13.8	14.3	14.5	12.9	14.5	15.3	14.7
1999	13.5	14.3	14.6	13.2	14.6	15.2	14.7
2000	14.2	14.8	15.0	14.2	15.0	11.8	15.1
2001	13.5	14.3	14.5	14.4	14.4	14.4	14.5
2002	13.2	13.9	14.0	14.2	14.0	16.6	14.1
2003	13.0	13.7	13.8	14.1	13.8	17.8	13.8
2004	13.2	13.9	14.0	14.9	13.9	16.0	14.1
2005	13.0	13.7	13.9	14.9	13.9	16.7	13.9
2006	13.2	14.0	14.2	15.8	14.3	14.6	13.9
2007	12.9	13.9	14.0	16.0	14.1	15.5	13.7
2008	12.2	13.5	13.4	15.0	13.6	19.2	13.2
2009	11.6	12.9	12.8	13.6	13.0	23.7	12.5
2010	12.2	13.4	13.4	14.8	13.5	19.6	13.1
Average	13.0	13.9	14.0	14.5	14.0	16.6	13.9

Table 9: The relative impact of the causal variables on the shadow economy of SPAIN over 1998 to 2010

Spain Year	Personal Income Tax (PIT)	Indirect taxes	Tax morale	Unemployment	Self- employment	GDP growth	Business free- dom
1998	12.6	11.8	17.7	11.8	16.3	12.5	17.3
1999	12.4	10.4	17.7	15.1	16.3	11.7	16.4
2000	12.5	10.0	16.8	16.8	16.6	11.3	15.9
2001	11.5	10.0	15.5	19.8	15.7	12.7	14.9
2002	10.9	13.5	14.5	17.9	15.6	13.5	14.2
2003	11.2	13.5	14.1	17.9	16.0	13.3	14.2
2004	11.4	13.7	13.8	18.1	15.9	13.0	14.1
2005	10.9	13.5	13.4	20.0	15.7	12.5	14.0
2006	10.9	14.7	13.9	22.0	16.9	12.8	8.9
2007	9.8	15.6	13.4	22.0	16.8	13.2	9.2
2008	10.2	16.4	13.0	18.4	16.8	16.0	9.2
2009	11.0	17.4	13.1	10.7	17.3	20.6	10.0
2010	10.3	16.4	13.2	17.0	17.0	16.6	9.5
Average	11.2	13.6	14.6	17.5	16.4	13.8	12.9

Table 10: Average relative impact (in %) of the causal variables on the shadow economy of 38 OECD countries over 1999 to 2010

Country	Average size of the shadow economy	Personal income tax	Indirect taxes	Tax morale	Unemployment	Self-employment	GDP growth	Business freedom
Australia	13.8	12.4	13.4	14.1	18.1	15.8	13.2	13.0
Austria	9.8	12.4	14.6	14.1	11.8	16.8	15.9	14.4
Belgium	21.5	12.9	12.8	14.4	16.2	16.0	14.2	13.3
Bulgaria	34.6	14.9	13.5	14.8	14.8	14.2	13.7	14.2
Canada	15.6	12.7	14.9	14.9	18.4	11.7	13.8	13.6
Chile	19.4	16.1	14.1	14.1	14.2	12.9	14.4	14.3
Cyprus	27.2	13.8	14.5	14.5	14.3	14.5	13.8	14.6
Czech Rep.	17.6	15.1	16.0	14.0	11.5	13.1	14.3	15.9
Denmark	17.3	10.8	13.1	14.7	18.2	15.6	14.4	13.2
Estonia	21.7	16.4	14.4	14.5	12.4	13.1	14.0	15.2
Finland	17.4	15.4	13.0	14.8	12.9	16.9	13.7	13.3
France	14.8	9.1	14.4	14.8	15.1	17.3	15.1	14.3
Germany	15.7	16.6	13.2	15.0	13.0	12.8	15.2	14.2
Greece	27.0	10.3	16.2	14.5	10.4	18.7	14.3	15.5
Hungary	24.1	14.0	14.1	15.0	15.0	14.2	13.5	14.2
Iceland	15.2	12.4	14.3	14.7	15.1	14.4	14.8	14.3
Italy	26.9	13.0	13.9	14.0	14.5	14.0	16.6	13.9
Korea	26.3	13.3	14.4	14.9	13.3	14.6	15.3	14.2
Latvia	22.2	14.6	14.3	13.9	15.1	14.6	13.3	14.2
Lithuania	25.4	13.1	14.5	14.1	15.1	14.5	14.2	14.5
Luxembourg	9.6	14.7	14.3	14.2	13.0	14.9	14.5	14.3
Malta	27.3	14.3	14.3	15.1	14.3	14.3	13.4	14.3
Mexico	30.0	14.3	13.7	14.5	14.4	14.2	14.9	13.9
Netherlands	13.2	14.6	13.6	14.0	16.1	13.7	14.2	13.8
New Zealand	12.2	14.6	14.2	14.2	15.2	14.3	13.2	14.2
Norway	18.6	14.1	13.8	14.2	14.1	14.5	15.4	13.9
Poland	26.4	14.1	14.4	14.4	14.2	14.5	14.1	14.4
Portugal	22.7	12.5	14.1	14.9	14.2	14.4	15.9	14.1
Romania	32.2	15.5	14.2	13.9	14.2	14.1	14.0	14.2
Slovak Rep.	17.5	15.0	14.7	14.7	14.4	14.4	12.0	14.8
Slovenia	25.2	14.4	14.3	14.4	14.8	14.4	13.2	14.4
Spain	22.8	11.2	13.6	14.6	17.5	16.4	13.8	12.9
Sweden	18.6	14.9	14.3	14.6	13.3	14.2	14.2	14.5
Switzerland	8.3	13.8	13.0	15.7	13.4	14.4	14.8	14.8
Turkey	30.6	13.9	14.1	14.5	13.7	14.5	15.1	14.3
United Kingdom	12.5	13.6	14.0	14.3	18.1	12.4	13.7	14.0
United States	8.7	13.9	14.1	13.7	14.9	14.4	15.0	14.1
Average	20.3	13.8	14.1	14.5	14.6	14.6	14.3	14.2

FIGURES

Figure 1: Relative impact of the causes on the Austrian shadow economy (1998 to 2010)

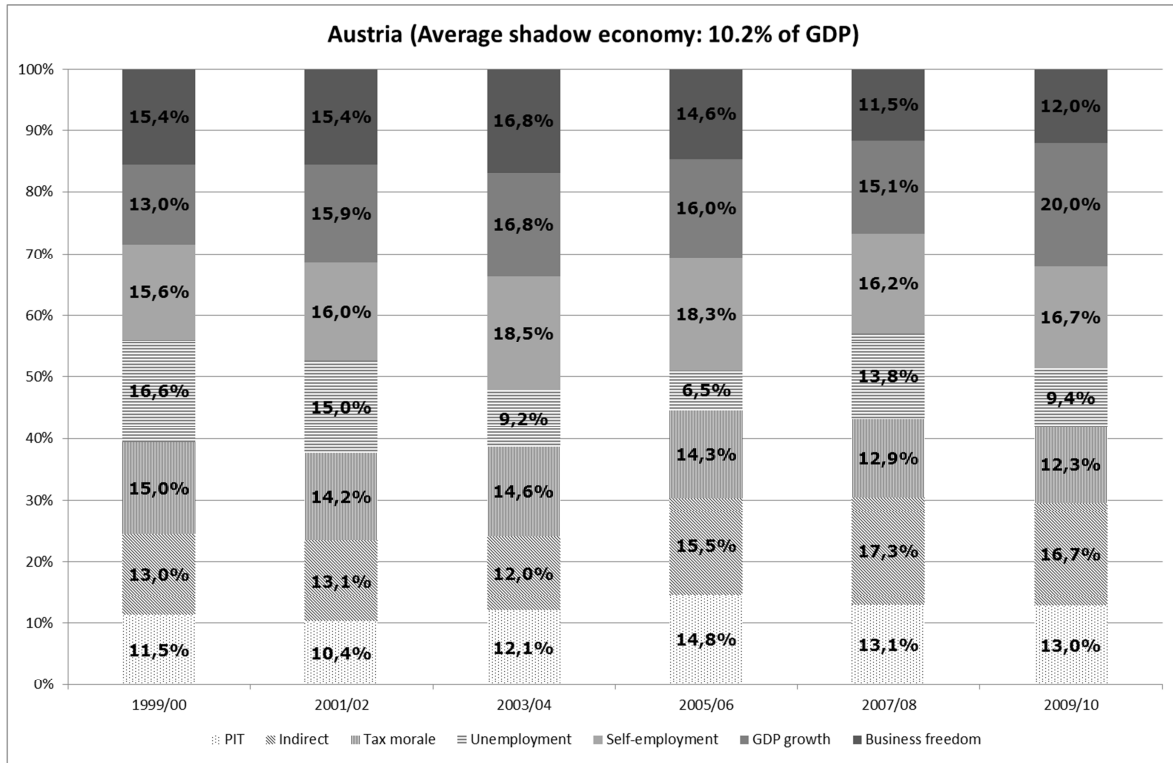


Figure 2: Relative impact of the causes on the French shadow economy (1998 to 2010)

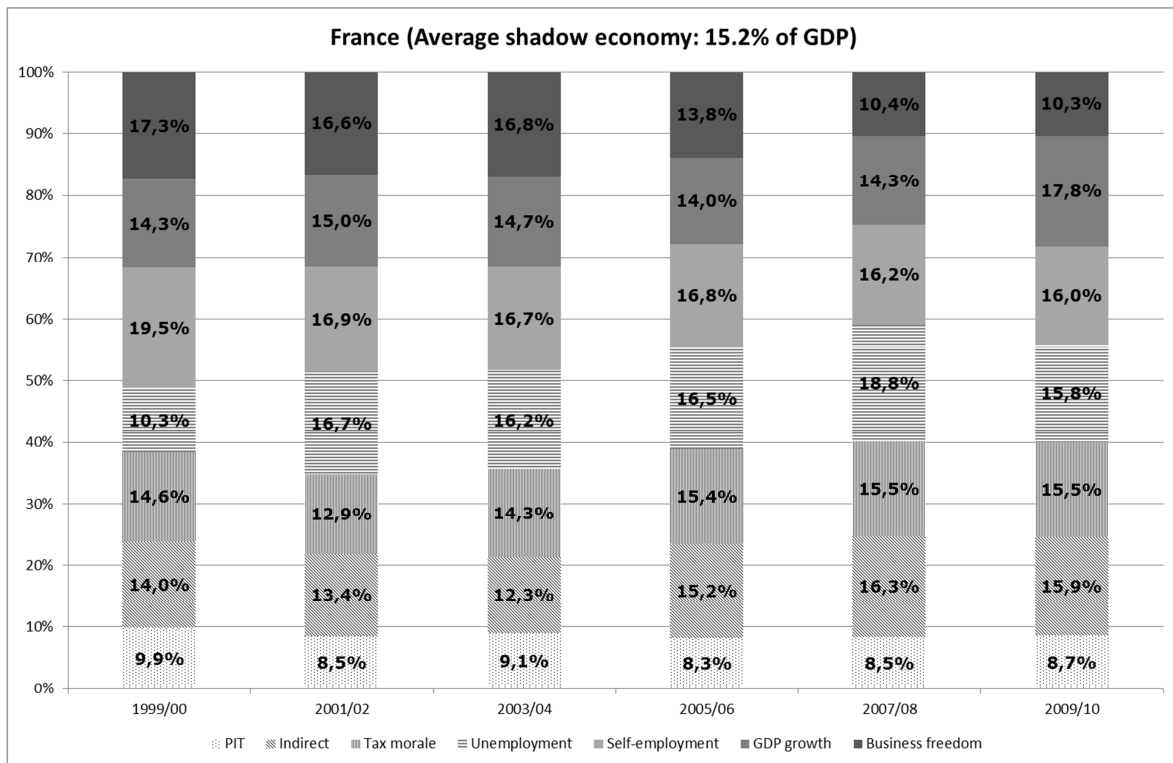


Figure 3: Relative impact of the causes on the German shadow economy (1998 to 2010)

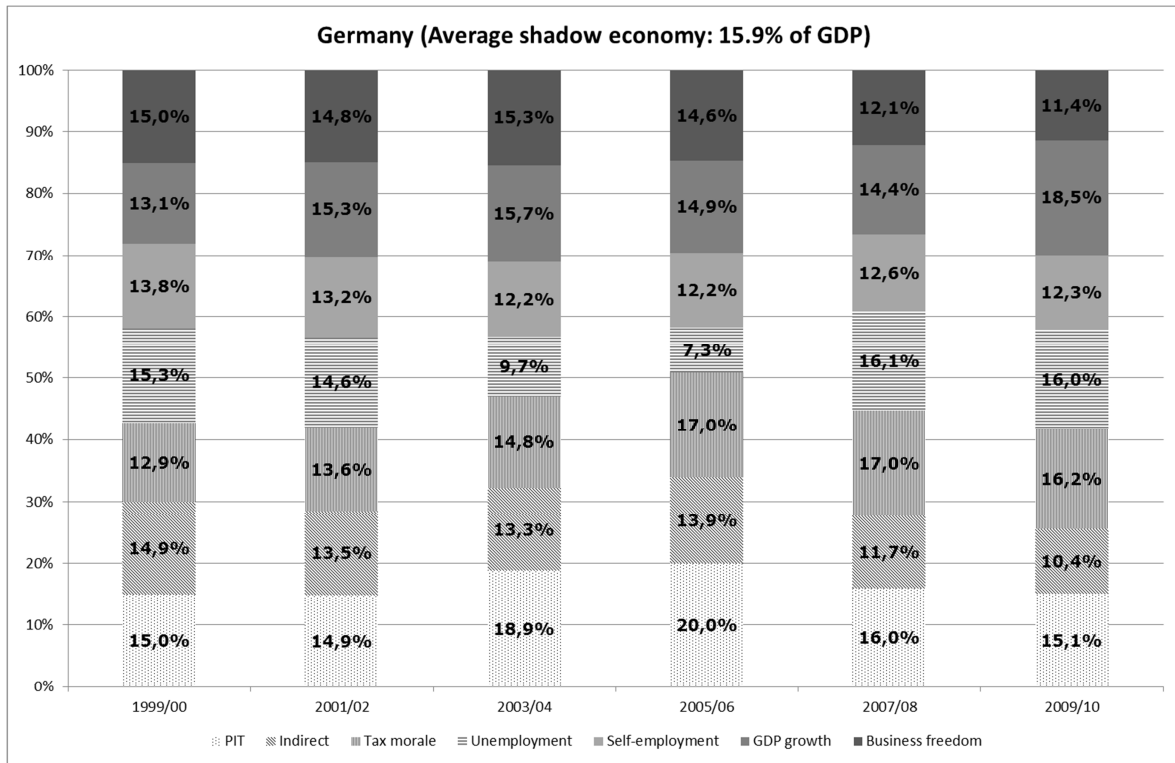


Figure 4: Relative impact of the causes on the Italian shadow economy (1998 to 2010)

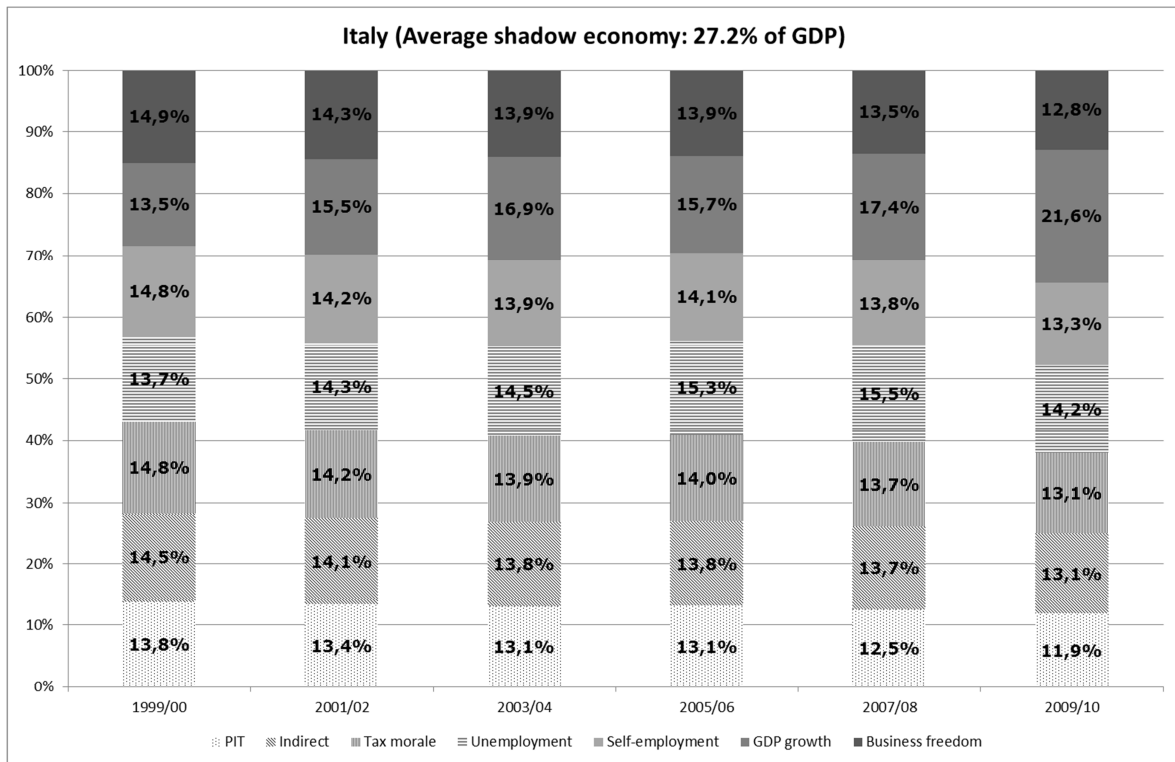
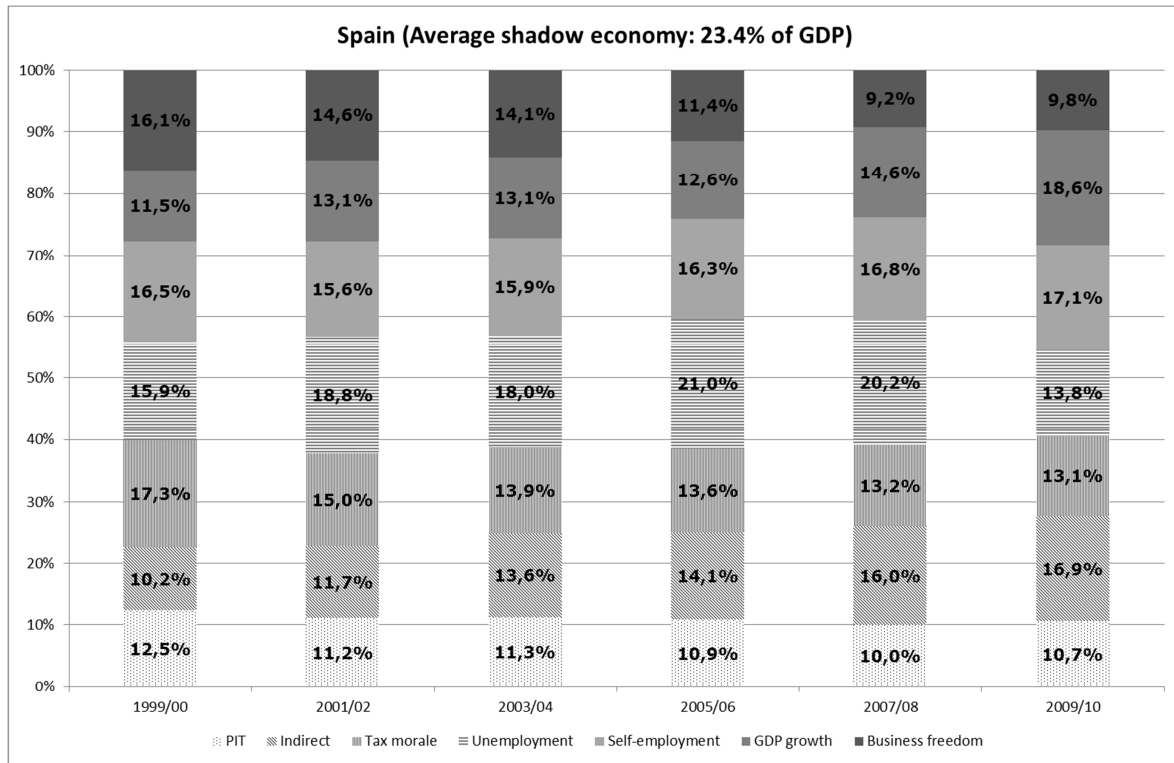


Figure 5: Relative impact of the causes on the Spanish shadow economy (1998 to 2010)



REFERENCES

- Allingham, M.G. and A. Sandmo (1972), Income Tax Evasion: A Theoretical Analysis, *Journal of Public Economics* 1/3, pp. 323-338.
- Andreoni, J., B. Erard and J. Feinstein (1998), Tax Compliance, *Journal of Economic Literature* 36/4, pp. 818-860.
- Bhattacharyya, D.K. (1999), On the Economic Rationale of Estimating the Hidden Economy, *Economic Journal* 109/3, 348-359.
- Breusch, T. (2005a), The Canadian Underground Economy: An Examination of Giles and Tedds, *Canadian Tax Journal* 53/4, 367-391.
- Buehn, A. (2012), The Shadow Economy in German Regions: An Empirical Assessment, *German Economic Review* 13(3), 275–290.
- Buehn, A. and F. Schneider (2012), Shadow Economies Around the World: Novel Insights, Accepted Knowledge, and New Estimates, *International Tax and Public Finance* 19, 139-171.
- Buehn, A., A. Karmann and F. Schneider (2009), Shadow Economy and Do-it-yourself Activities: The German Case, *Journal of Institutional and Theoretical Economics* 165 (4), 701-722.
- Dell'Anno R. (2007), The Shadow Economy in Portugal: An Analysis with the MIMIC Approach, *Journal of Applied Economics* 10, 253-277.
- Dell'Anno R., M. Gomez-Antonio and A. Alanon Pardo (2007), Shadow Economy in three different Mediterranean Countries: France, Spain and Greece. A MIMIC Approach, *Empirical Economics* 33, 51-84.
- Dreher, A. and F. Schneider (2009) Corruption and the Shadow Economy: An Empirical Analysis, *Public Choice*, 144/2, pp.215-277.
- Dreher, A., C. Kotsogiannis and S. McCorriston (2009), How Do Institutions Affect Corruption and the Shadow Economy?, *International Tax and Public Finance*, 16/4, pp.773-796.
- Enste, D. and F. Schneider (2006), Umfang und Entwicklung der Schattenwirtschaft in 145 Ländern, in: F. Schneider and D. Enste (eds.), *Jahrbuch Schattenwirtschaft 2006/07. Zum Spannungsfeld von Politik und Ökonomie*, LIT Verlag, Berlin, 55-80.
- Feige, E.L. (ed.) (1989), *The Underground Economies. Tax Evasion and Information Distortion*, Cambridge University Press, Cambridge.
- Feld, L.P. and B.S. Frey (2007), Tax Compliance as the Result of a Psychological Tax Contract: The Role of Incentives and Responsive Regulation, *Law and Policy* 29/1, pp. 102-120.
- Feld, L.P. and C. Larsen (2005), *Black Activities in Germany in 2001 and 2004: A Comparison Based on Survey Data*, Study No. 12, The Rockwool Foundation Research Unit, Copenhagen.

- Feld, L.P. and C. Larsen (2009), *Undeclared Work in Germany 2001-2007 – Impact of Deterrence, Tax Policy, and Social Norms: An Analysis Based on Survey Data*, Springer, Berlin et al.
- Feld, L.P. and F. Schneider (2010), Survey on the Shadow Economy and Undeclared Earnings in OECD Countries, *German Economic Review* 11/2, pp. 109-149.
- Friedman, E., S. Johnson, D. Kaufmann and P. Zoido-Lobaton (2000), Dodging the Grabbing Hand: The Determinants of Unofficial Activity in 69 Countries, *Journal of Public Economics* 76/4, pp. 459-493.
- Giles, D.E.A. (1999), Measuring the Hidden Economy: Implications for Econometric Modelling, *Economic Journal* 109/3, 370-380.
- Isachsen, A.J. and S. Strøm (1985), The Size and Growth of the Hidden Economy in Norway, *Review of Income and Wealth* 31/1, 21-38.
- Johnson, S., D. Kaufmann and P. Zoido-Lobaton (1998a), Regulatory Discretion and the Unofficial Economy, *American Economic Review, Papers and Proceedings* 88 (2), 387-392.
- Johnson, S., D. Kaufmann and P. Zoido-Lobaton (1998b), Corruption, Public Finances and the Unofficial Economy, World Bank Policy Research Working Paper Series No. 2169, The World Bank, Washington, D.C.
- Johnson, S., D. Kaufmann and A. Shleifer (1997), The Unofficial Economy in Transition, *Brookings Papers on Economic Activity* No. 2, pp. 159-221.
- Kanniainen, V., J. Pääkönen and F. Schneider (2004), Fiscal and Ethical Determinants of Shadow Economy: Theory and Evidence, *Discussion Paper*, Department of Economics, Johannes Kepler University of Linz, Linz, Austria.
- Kirchler, E. (2007), *The Economic Psychology of Tax Behaviour*, Cambridge (UK) University Press, Cambridge.
- Kucera, D. and L. Roncolato (2008), Informal Employment: Two Contested Policy Issues, *International Labor Review* 147/3, 321-348.
- Marcelli, E.A. (2004), Unauthorized Mexican Immigration, the Labour and other Lower-Wage Informal Employment in California, *Regional Studies* 38/1, pp. 1-13.
- Pedersen, S. (2003), *The Shadow Economy in Germany, Great Britain and Scandinavia: A Measurement Based on Questionnaire Service*, Study No. 10, The Rockwool Foundation Research Unit, Copenhagen.
- Posner, E.A. (2000a), *Law and Social Norms*, Harvard University Press. Cambridge.
- Renooy, P., S. Ivarsson, O. van der Wusten-Gritsai and E. Meijer (2004), Undeclared Work in an Enlarged Union – An Analysis of Undeclared Work: An In-Depth Study of Specific Items, European Commission, Brussels.
- Schneider, F. (2003), Shadow Economy, in: C.K. Rowley and F. Schneider (eds.), *Encyclopedia of Public Choice* Vol. II, Kluwer Academic Publishers, Dordrecht, 286-296.

- Schneider, F. (2005), Shadow Economies around the World: What Do We Really Know? *European Journal of Political Economy* 21/4, 598-642.
- Schneider, F. (2010), The Influence of Public Institutions on the Shadow Economy: An Empirical Investigation for OECD Countries, *European Journal of Law and Economics*, 6/3, pp.441-468.
- Schneider, F. (eds.), (2011), Handbook on the Shadow Economy, Cheltenham (UK), Edward Elgar Publishing Company.
- Schneider, F. and D. Enste (2000), Shadow Economies: Size, Causes and Consequences, *Journal of Economic Literature* 38/1, 73-110.
- Tafenau, E., H. Herwartz and F. Schneider (2010), Regional Estimates for the Shadow Economy in Europe, *International Economic Journal*, 24/4, pp. 629-636.
- Tanzi, V. (1999), Uses and Abuses of Estimates of the Underground Economy, *Economic Journal* 109/3, 338-347.
- Teobaldelli, D. (2011), Federalism and the Shadow Economy, *Public Choice* (2011) 146/3, pp. 269-269.
- Teobaldelli, D. and F. Schneider (2012), Beyond the veil of ignorance: The influence of direct democracy on the shadow economy, CESifo Working Paper MO3749, University of Munich, Munich.
- Thomas, J.J. (1992), *Informal Economic Activity*, Harvester/Weatsheaf, New York et al.
- Thomas, J.J. (1999), Quantifying the Black Economy: 'Measurement Without Theory' Yet Again?, *Economic Journal* 109, 381-389.
- Torgler, B. and F. Schneider (2009), The Impact of Tax Morale and Institutional Quality on the Shadow Economy, *Journal of Economic Psychology* 30/3, 228-245.
- Williams, C.C. and J. Windebank (2001), Reconceptualizing Paid Informal Exchange: Some Lessons from English Cities, *Environment and Planning A* 33, 121-140.

APPENDIX

Table A.1: Definitions, expected signs and sources of the causal and indicator variables

Causal Variable	Description and source	Expected sign
Business freedom	Business freedom index measuring the time and efforts of business activity ranging; 0 = least business freedom, and 100 = maximum business freedom; Heritage Foundation	-
Corruption	Corruption index (score between 0 and 100 with higher values indicating more corruption); Heritage Foundation	+
Education	Secondary school enrolment rate (% gross); World Development Indicators (WDI)	-
GDP growth	GDP per capita growth, annual (%); WDI	+/-
Indirect taxes	Taxes on goods and services (% of total tax revenue); WDI	+
Payroll taxes	Taxes on income, profits and capital gains (% of total tax revenue); WDI	+
Personal income tax	Personal Income Tax (PIT) to GDP, Government Finance Statistics; International Monetary Fund	+
Rule of Law	Rule of Law index summarizing the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence, -2.5 = no compliance, and 2.5 = total compliance; World Bank Governance Indicators	-
Self-employment	Total self-employed workers (proportion of total employment); WDI	+
Tax morale	To assess the level of tax morale we use the following question: <i>“Please tell me for each of the following statements whether you think it can always be justified, never be justified, or something in between: . . . Cheating on tax if you have the chance”.</i> The question leads to a 10-scale index of tax morale with the two extreme points “never justified” (1) and “always justified” (10). Using the proportion of respondents who answered the question with a value of 6 or higher, higher values of our tax morale variable indicate a lower level of tax moral; European and World Value Surveys	-
Unemployment	Unemployment rate (% of total labor force; WDI	+
Currency in circulation	Monetary aggregates M0 over M1; International Monetary Fund, International Financial Statistics	+
GDP pc	GDP per capita, PPP (constant 2005 international \$); WDI	-
Labour force participation	Labor force participation rate (% of total population); WDI	-