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Labor Institutions and their Impact on Shadow Economies in Europe

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Abstract:

This paper analyzes the role of labor market institutions in explaining developments of shadow economies in European countries. We use several alternative measures of the shadow sector, and we examine effects of labor institutions on shadow sector in two specific regions: new and old European Union member countries, as their respective shadow sectors exhibited a different development in the last decade. While the share of shadow economy in GDP averaged 27.7% in the new member countries in 1999-2007, the respective share in the old member states stood at 18.0% only. In our paper, we estimate effects of labor market institutions on two sets of shadow economy indicators—shadow production and shadow employment. Comparing alternative measures of the shadow sector allows more granulated analysis of the labor market institutions effects. Our results indicate that the one institution that unambiguously increases shadow economy production and employment is the strictness of employment protection legislation. Other labor market institutions—active and passive labor market policies, labor taxation, trade union density and the minimum wage setting—have less straightforward and statistically robust effects and their impact often diverge in new and old EU member countries. The differences are not robust enough, however, to allow us to reject the hypothesis of similar effect of labor market institutions in new and old EU member states.

Keywords: labor market institutions, shadow economy, shadow employment, European Union

JEL: J08, O17, O52

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Introduction

Shadow economy covers a wide range of activities that are, by the definition, uneasy to observe and measure.¹ Consequently, there are even many ways how to define shadow economy.² In our paper, following definition is used in correspondence with the European Commission (EC, 2004), OECD (OECD, 2004) or related research (for instance Schneider et al., 2010): shadow economy covers production of goods and services that is lawful by its nature, but is intentionally not declared to the public authorities. That means, this definition excludes any illegal activities and also household production.

Shadow economy and informal labor markets are closely connected: by its very definition, any activity taking place in shadow economy involves informal labor market to some degree.³ Economic subjects may be either excluded from the formal labor market by lack of opportunities or exit the formal sector voluntarily because of both monetary and non-monetary benefits of informality. These two motives may be considered as complementary with different accent on each of them in different social and economic environments. Perry et al. (2007) link the voluntary exit motive mainly with independent workers acting as self-employers, while majority of salaried employees is considered to be involuntarily excluded from formal labor market in Latin America and the Caribbean. Usually, the exclusion motive is perceived far less important in developed countries (see Oviedo et al., 2009). Turning into shadow economy might pursue several goals, from avoiding payment of taxes and social security contributions to avoiding complying labor market, environmental or other standards and administrative procedures. Furthermore, the phenomenon has many dimensions, from full non-compliance and non-reporting of employment or business activities to under-reporting of employment, wages etc.

Despite being usually referred to in a negative perspective, shadow economy can also comprise some positive aspects (e.g. opportunity to escape dysfunctional and inefficient government regulations). These are, however, generally limited to less developed countries and in European context, the inefficient regulation might be addressed together with efforts to fight shadow economy (OECD, 2004).⁴ Consequently, shadow economies in Europe represent rather an obstacle to economic development, bringing substantial costs. These can be identified in several areas on both micro and aggregate level, ranging from direct impact on public finance, performance of firms and situation of individuals.

Among the most important negative consequences and costs of shadow economies are usually cited: revenue losses in form of taxes and social security contributions which necessitate larger burden put on formal workers; deficient protection of informal workers by labor standards and social protection system; lower productivity of informal firms given by small size, restricted access to capital, technologies and markets, no legal enforcement of contracts

¹ A variety of names has been used in the literature to describe this highly complex phenomenon. For instance: hidden, informal, undeclared, clandestine, moonlight, parallel, underground, second, irregular, illicit, unofficial economy.

² For a broader discussion of the definition of the shadow economy, see e.g. Thomas (1992), Pedersen (2003), Enste (2003) or OECD (2004).

³ Informal work can take many forms, from a second job together with a regular employment to non-participation in formal labor market at all. For a discussion on this topic see Schneider (2003).

⁴ On the other hand, Enste (2003) cites a research done by Friedrich Schneider, showing also the positive aspect of the issue, given by the fact that about two-thirds of the income earned in the informal economy is spent in the formal sector, having a stimulating effect there. Furthermore, the author claim that about two-thirds of the value added produced by the informal sector would not be produced in the formal sector if the informal did not exist.

and property rights etc.;⁵ unfair competition; overutilization of public goods and services by informal sector that does not contribute to public budgets. In a broad perspective, shadow economy might be a source of distortion to efficient allocation of resources, constrain economic growth and undermine social cohesion and legitimacy of state.⁶ For a detailed overview of shadow economy consequences see for instance Schneider and Enste (2000) or Oviedo et al. (2009).

Besides these direct consequences, existence of informal economy might alter the effect of economic policy which might become less efficient, the magnitude of this effect depending on the size of shadow economy. Informal economy may intensify unfair competition between the states and social dumping. On the European level, for example, different size of shadow economies distorts the contributions to the EU budget that are based on the officially declared GDP. Some studies also point to link between illegal immigration and undeclared work (see for instance EC, 2007).

European Union has been addressing the shadow economy phenomena with emphasis since late 1990s, developing a strategy to combat undeclared work (this even became one of the goals listed in the Lisbon agenda). In its study, European Commission (EC, 2004) puts a special attention to the group of new member states (hereafter “NMS”) and candidate countries, where informality has a slightly different character given the previous era of centralized economies and consequent transformation period connected with large institutional, economic and societal changes. Indeed, there exist marked differences between the size of shadow economies in old and new European Union member countries.⁷ While the share of shadow economy on GDP averaged on 27.7% in new member states over period 1999-2007, the respective share in the old member states stood at 18.0% only.

Shadow economy is a complex phenomenon, determined by numerous economic, institutional, regulatory, social and cultural factors. Generally, these are the factors affecting decision-making of individuals and firms whether to stay formal or turn informal, based on financial motives with potentially different moral evaluation of both situations. In our research, we focus on labor market institutions as these have been considered one of the main forces driving economic agents to informality in existing economic research (see e.g.. Schneider and Enste, 2000, OECD, 2004, Oviedo et al., 2009). Substantial differences in institutional frameworks exist across the European countries, although some convergence could be observed recently (see Fialová and Schneider, 2009).

In this paper, we present a multiple country, aggregate level econometric analysis of the impact of labor market institutions and institutional reforms on the size of shadow economies in European countries and various trends in their development in period 2000-2007. We analyze changes in labor market institutions and their impact on the share of the labor force in shadow employment and on the shadow economy production. Furthermore, we address the

⁵ In contrast, Schneider (2003) argues that informal sector exhibits higher level of productivity compared to the official economy. One of the reasons he mentions is stronger work effort of informal workers, whose pay is not burdened by huge taxes, social contributions and other regulations.

⁶ For a detailed survey of costs and benefits considered by individuals and firms in decision-making about turning informal, see Djankov et al. (2003).

⁷ For the purpose of this paper, we consider old EU countries group as Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Austria, Portugal, Finland, Sweden, United Kingdom and non-EU Norway (sixteen countries). New member states group (“NMS”) consists of countries acceding to the EU in 2004 and 2007: Bulgaria, Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Romania (twelve countries) unless indicated otherwise.

differences between the old EU members and new member states that joined the EU in 2004 and 2007.

We use panel data estimation techniques and two stage least squares estimation procedure with instrumental variables on country level data and aggregated variables constructed to capture changes in key labor and social protection institutions over time. Our estimations exploit cross-country and time series variability in key variables, covering employment protection legislation, taxes on labor including social insurance, labor market policy spending, minimum wage setting, and the effect of collective bargaining over wages. Furthermore, we control for other factors such as economic environment, business regulation, overall fiscal regulation and regulatory quality and control of corruption. We use two separate concepts of the informal sector, or shadow economy: (i) shadow production (measured as percentage share on official GDP); and (ii) shadow employment (measured as share of people earning money from unregulated employment and self-employment). Using two different alternative measures of the informal sector and running regressions on the same set of explanatory variables gives revealing results and it is one of the key contributions of our paper to recent economic research. Our results indicate that the strictness of employment protection legislation unambiguously increases shadow economy production and employment. Other labor market institutions examined in our paper—active and passive labor market policies, labor taxation, trade union density and the minimum wage setting—tend to have less straightforward and statistically robust effects and their impact sometimes diverge in new and old EU member countries, as is the case of trade unions membership that tends to increase the shadow economy in old EU member states, but it works in the opposite direction in the new member states. These differences are not robust enough, however, for us to reject the hypothesis of similar effect of labor market institutions in new and old EU member states.

The paper is organized as follows. In the first section, we briefly sketch the development of shadow economy in European countries and compare old and new EU members. The next section describes the main factors driving economic subjects to informality and offers a short literature overview. In the following section, we discuss major institutional indicators and their developments and we also overview main theoretical arguments about their role in development of shadow economy. The fourth section offers data and methodology description. The fifth section then summarizes key findings and results of our analysis of the labor market institutions' effects. The final part discusses conclusions from our research and their limits.

1. Shadow economy in Europe

Given the substantial heterogeneity of motives for being informal and the difficulty to even define the large number of phenomena that shadow economy might cover, it is also very hard to measure its scope in different countries. Generally, three approaches to measuring the shadow economy can be distinguished: direct methods, indirect methods and model approaches. For detailed discussion of the advantages and disadvantages of different estimation methods see Schneider and Enste (2000), Oviedo et al. (2009) or Perry et al. (2007). While direct methods based on micro evidence enable uncovering individual motives and characteristics of informal workers and firms, indirect methods and model approaches lend an aggregate perspective. In our approach, we follow two sets of indicators of shadow economies in European countries based on different sources and approaches. The statistics are given in Annex 1.

Firstly, we use the *estimation of shadow production as percentage share on official GDP* of countries. The source of the data is research of Schneider et al. (2010), who provide a unique database of the size and trends in the shadow economies of 162 countries between 1999 and 2006/2007. The estimations are based on a Multiple Indicators Multiple Causes (MIMIC) model approach.⁸ The clear advantage of this dataset is the unified methodology and a broad sample. Many other studies also use this data (see e.g. Loayza et al., 2005, Perry et al., 2007). Besides stating the share of shadow economy output on overall official output of the economy, this indicator estimates the share of employment in the informal sector as well under the assumption that the trends in productivity of informal labor track the similar development as the productivity of formal labor force. Still, this model approach also has considerable shortcomings and the data should be considered with caution. The main concern about this approach is the theoretical background of relation between the shadow economy and its indicators and question of causality that might be subject to discussion. Nevertheless, although some other approaches may give a different picture about the situation in shadow economy, we believe that the unified methodology offers an opportunity to consistently study the differences among countries and development in time. For comparison of estimation by different methods see Schneider and Enste (2000).

As the second set of indicators we utilize *shadow employment as the share of labor force in unregulated self- and wage-employment*. To estimate this variable we have four proxies with different data sources coming from the Eurostat. Firstly, we use one indicator from the household survey European Union-Statistics on Income and Living Conditions (EU-SILC), stating the share of labor force not contributing to pension system (both private and public) adjusted for the unemployment rate.⁹ Yet, this variable is available for 2007 only and offers a very rough picture of shadow employment. Also the reliability of the information is questionable.¹⁰ Moreover, comparison of this variable with previously mentioned indicator of shadow production uncovers substantial differences between these two data sets. As described in Annex 1, ranking of countries changes substantially when ordered according to values of these variables.¹¹ Secondly, based on the Labor Force Survey (LFS) we use three proxies of shadow employment. Two of them indicate the share of labor force working in small firms with less than ten employees and the share of self-employed. Both these groups are supposed to be more exposed to shadow employment (Perry et al., 2007); however, the link need not be as straightforward and need not be of the same intensity in all the countries. Again, these variables are available for 2006-2007 only. The last proxy from the Eurostat consolidated LFS we use states "workers without a contract" as the share of labor force. For our country sample, the variable is available in longer time series since 2001. The shortcoming of this proxy is that Eurostat adds up all workers who are on temporary legal contracts and workers with no written contract, all together.¹² That means, this group covers both those who are indeed employed in the shadow economy, and those who are employed legally, but on a temporary

⁸ For details on the methodology used, see Schneider et al. (2010).

⁹ The adjustment for the unemployment rate makes this variable methodologically comparable to the other indicators on shadow employment that we use in our analysis. Furthermore, this approach of course represents an implicit assumption that the unemployed are not primarily considered to be engaged in the informal sector.

¹⁰ Some cases needed to be deleted due to evident inconsistencies regarding development in time or comparison with similar countries.

¹¹ Comparison of values of these two indicators per se is not possible given the different nature of data and different methodology.

¹² OECD (2002) shows that temporary employment is concentrated in groups of younger and less educated workers, workers employed in low-skill occupations, agriculture and small firms. These are also categories more prone to informal behavior.

basis.¹³ This variable is clearly also not ideal for the purposes of our analysis, nor are the other shadow employment proxies and we are thus dealing with second- and third-best variables to identify informal workers. Yet, no other official data on shadow employment with a comparable methodology are available. Given the above-mentioned deficiencies of the whole second set of indicators on shadow employment, we will mostly use the first dataset on shadow production estimated by Schneider et al. (2010) further in this section.

Generally, Europe ranks rather low on the informality scale. According to Schneider et al. (2010), the average size of the shadow economy was 34.0% of GDP in eighty-four developing countries in 2007, 32.6% in twenty Eastern European and Central Asian transition countries and 16.6% in twenty-five OECD countries. The respective average for twenty-eight selected European countries examined in this paper was 21.1% in 2007: 25.9% in the NMS group and 17.4% in old European countries. Yet, there still persist large differences among the particular countries.

The heterogeneity in the old European countries group is stable: in period 1999-2007, the variation coefficient hovered around 30% without any clear trend in the old Europe. The heterogeneity of shadow economies in the NMS group was higher at the beginning of the examined period and consequently decreased considerably, well below the level prevailing among the old EU members (variation coefficient fell from 34.7% in 1999 down to 18.9% in 2007).

Nevertheless, alongside substantial reduction of the heterogeneity within its own respective group, differences between new and old member states have been decreasing only moderately as Table 1 and Figure 1 show: the gap between the average values of these two groups shrank from 9.5 to 8.4 percentage points between 1999 and 2007 with a local peak in 2001-2 (10.3 percentage points). The share of shadow economy seems to be decreasing in recent years in the entire sample with slightly stronger dynamics registered in the NMS group. Moreover, while the major cuts in shadow production took place at the beginning of the examined period in old European countries, NMS group recorded the largest reductions rather by the end of the period. Overall, the differences between these two groups of countries generally tend to diminish.

Informality was least prevalent in Austria and Luxembourg, where its share on GDP did not exceed 10% in 2005-2007, followed by the Netherlands, France and the United Kingdom (less than 15%) and Ireland and Germany.¹⁴ On the contrary, the highest ratios of shadow economy to official GDP, exceeding 30%, were registered in the NMS group: in Bulgaria, Lithuania, and Romania;¹⁵ Estonia and Latvia managed to cut their shadow production just below this threshold in the examined period. Poland, Malta and Cyprus follow very closely with 26-28%. Yet, issue of large informal sector is not limited to post-transition countries only. Several old member states (southern European countries—Greece and Italy in particular) also exhibit a

¹³ The rationale is that "contract" is only for formally contracted employees with an open ended position. This, of course, disregards those who are contracted legally on a temporary or term appointment basis. This limitation might have been overcome with a sort of dummy variable that would control for whether countries allow temporary contracts or not. However, as indicated by OECD (2002), temporary work is an important feature of the employment legislation in most OECD European countries and, hence, there is no sufficient variation across countries' labor regulation on this matter for further investigation of this issue.

¹⁴ In case of Germany, smaller shadow economy was, perhaps surprisingly, documented in the eastern part (Schneider, 2003).

¹⁵ This situation is confirmed by the European Commission report (EC, 2007), according to which the share of informal economy on the GDP in Bulgaria and Romania was the highest in the group of countries acceding to the EU between 2004 and 2007.

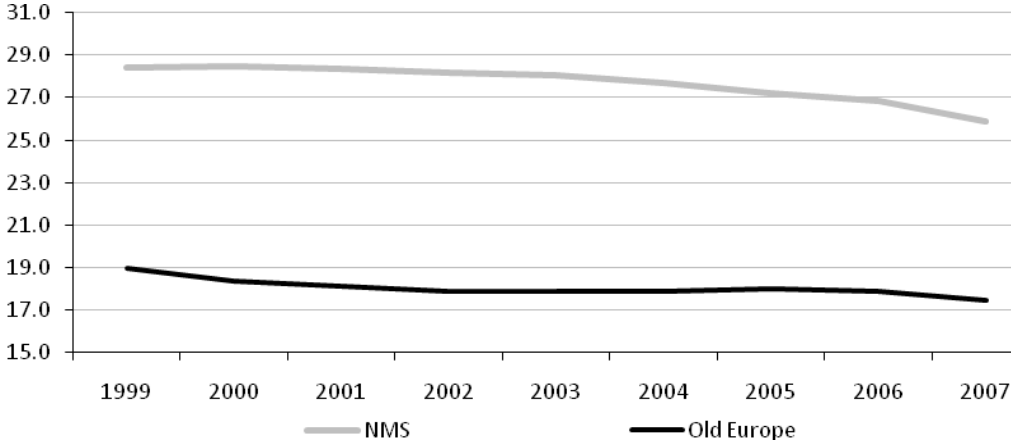
large degree of informality. Within the NMS group, the Czech Republic and Slovakia found themselves close to the average of old EU members.

Table 1: Shadow economy in Europe: % of GDP, 1999-2007

	1999-2001	2002-2004	2005-2007
Austria	10.1	10.0	9.8
Belgium	22.7	21.7	21.6
Bulgaria	36.9	35.9	33.7
Cyprus	28.9	28.5	27.5
Czech Republic	19.3	19.3	17.9
Denmark	18.3	17.8	17.3
Estonia	31.6	30.8	29.8
Finland	18.5	17.7	17.4
France	15.5	14.7	14.7
Germany	16.6	16.2	15.9
Greece	29.0	27.6	27.2
Hungary	25.2	24.9	24.2
Ireland	16.3	16.0	15.7
Italy	27.6	26.5	26.9
Latvia	31.6	30.5	28.6
Lithuania	33.6	32.1	30.5
Luxembourg	10.1	9.9	9.8
Malta	27.4	27.7	27.1
Netherlands	13.6	13.4	13.4
Norway	18.9	18.5	18.2
Poland	27.7	27.6	26.6
Portugal	22.6	22.2	22.9
Romania	34.1	33.2	31.3
Slovak Republic	18.9	18.4	17.2
Slovenia	27.1	26.7	25.5
Spain	23.2	22.5	22.6
Sweden	19.6	18.5	18.4
United Kingdom	12.8	12.5	12.4
NMS average	28.4	28.0	26.7
Old Europe average	18.5	17.9	17.8

Source: Schneider et al. (2010), own calculations

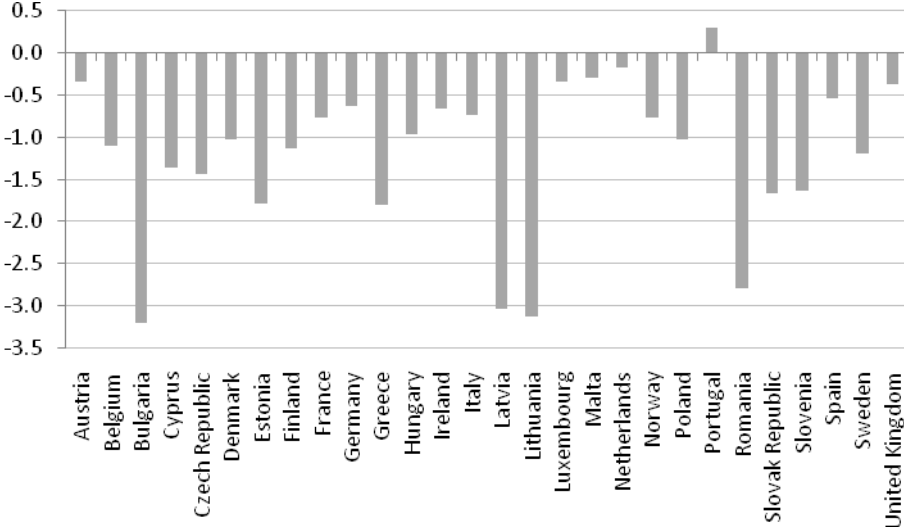
Figure 1: Shadow economy in Europe: % of GDP, comparison of old EU members and NMS averages, 1999-2007



Source: Schneider et al. (2010), own calculations

Figure 2 sheds some light on development of informal economic sectors in particular countries, showing the difference in size of shadow economy between average of 1999-2001 and average of 2005-2007. The only country where shadow production share increased (by negligible 0.3 percentage points) was Portugal. In contrast, extensive shadow economies (the Baltics, Bulgaria, Romania, Greece etc.) shrank the most, weakening their leading positions in the countries' ranking. Faster reduction of shadow economy was generally recorded in all the new member states; Finland and Sweden also decreased the share of their respective shadow economies considerably.

Figure 2: Increase/decrease (+/-) of the shadow economy in Europe, average 1999-2001 compared to average 2005-2007, difference in percentage points



Source: Schneider et al. (2010), own calculations

2. Factors influencing the shadow economy

Previous part showed that the overall trend in size of shadow economy in Europe has been towards further growth in recent years. That means that the relevance of this issue increases in time. What are the main factors driving economic subjects to informality? This and the next sections offer a short literature overview. Generally, there exist no general and universal factors determining the existence, size and development of a shadow economy. Instead, it is a result of a complex interplay of various factors varying between countries. Moreover, economic factors can only partly explain the development of shadow economies; interdisciplinary approach to this issue is necessary (see Enste, 2003).

Level of economic development is often considered one of the most important factors determining the size of shadow economy: less developed countries tend to have larger informal sectors (see Perry et al., 2007). In contrast, no consensus exists as regards the development of informality over the business cycle. Countercyclical development would be expected based on the view that informal sector mainly consists of employment excluded from formal sector as a result of labor market rigidities. This traditional view was supported by research of Loayza and Rigolini (2006). However, in a broader perspective taking into account also the voluntarily opt-out of formal sector, pro-cyclical development might be advocated. This is supported by the view that informal workers are not covered by

employment protection and firms are free to dismiss them during downturns, enabling also more flexibility in hiring during expansions. People might be also more likely to decide for informal self-employment connected with higher riskiness in case that there are plenty of opportunities in formal sector during the economic boom enabling an easy potential return to formal sector (Taylor, 1996). Moreover, as Perry et al. (2007) show, informality is mainly connected with smaller firms and limited access to capital, both meaning a greater vulnerability during recessions. This perspective was confirmed for instance by research of Fiess et al. (2008) or Maloney (1998). The distinction between the particular sub-segments of shadow employment (employees vs. self-employed) is of crucial importance in this respect.

Regulatory distortions and corruption represent another highly important factor influencing the size of shadow economies (the effect was described in detail e.g. in Djankov et al., 2002, Johnson et al., 2000, or Friedman et al., 2000). Regulation tends to bring about to economic subjects both direct costs (fees, bribes etc.) and indirect costs (time, forgone profits etc.); moreover, both quantity and quality of regulation is of importance. Loayza et al. (2005) classify overall regulation from the shadow economy viewpoint into three categories, judging that regulation policy comes in “packages”. The authors distinguish fiscal, labor and product-market regulations, where the latter consists of the entry, trade, financial markets, bankruptcy, and contract enforcement indices. These all are rather quantitative measures. Consequently, the authors assess the quality of regulatory framework by a governance index, composed of indicators of corruption, prevalence of law and order and level of democratic accountability. They conclude that heavier regulatory burden, especially in product and labor markets, depresses economic growth and has a positive effect on informality. The adverse effects might be, however, mitigated by improved governance. Apparently, labor market regulations might have a considerable impact on inducing informality. Perry et al. (2007) show that part of growth in shadow employment in Latin America and Caribbean was due to the increased burden of labor costs and other legal restrictions in several countries. Similar result showing the adverse effect of labor regulations in Latin America environment presents Loayza (1994). Labor regulations are separately dealt with in detail in the next section

The above mentioned research of Loayza et al. (2005) represents one of the studies stressing the importance of general legitimacy of the state, trust in government and quality of governance and public services provided by the state as another crucial factor determining size of shadow economies. Enste (2003, p. 98) considers shadow economy itself “...an indicator of a serious deficit of legitimacy of the present social order and the existing rules of official economic activities”. In turn, quality of governance and public services might enhance the incentives of operating formally by increasing the benefits of contributing to the system and maintain individuals and firms in the formal sector in spite of large taxation and regulation, outweighing its negative effect (as was showed e.g. on case of Belgium—see Djankov et al., 2003).

Besides these general drivers of shadow economy, specific factors may be important as well. Among these might be counted effects of macroeconomic policies (macroeconomic stabilization, liberalization of capital account, trade reforms), demographic and structural factors etc. We will not consider these in case of our European sample, given the level of development of old member states and the fact that main transformation changes in the new members economies took place already during the 1990s.

Development and determinants of shadow economy in the post-transition countries of Central and Eastern Europe have recently begun to draw increasing attention in economic research. The main findings were summarized by Belev (2003) for the entire group of EU new member

states and other South European countries and OECD (2008) for the Czech Republic, Slovakia, Poland and Hungary. According to OECD (2008), early 1990s witnessed a rapid growth of informality in the Czech Republic, Slovakia, Poland and Hungary due to sudden lack of formal job opportunities. In the Czech and Slovak Republics, complete informality is not considered a major problem. One of the main issues is under-declaration of income, similarly to Hungary and Poland. That potentially means that the main reason for opting-out for informality is not pure survival but rather tax and regulation evasion. Enste (2003) mentions other specific factors effective in Eastern Europe: lack of competence and trust in state, corruption, weakly guaranteed property rights, insufficient enforcement of law and regulations, high taxes, large regulation, general acceptance of illicit work. Furthermore, he considers lack of clear and stable institutional framework as the major driver of shadow economy in transitive countries

3. Labor institutional indicators, their effects and developments

This section discusses in detail the effect of particular components of labor market regulation on informality and sketches the situation in European countries with an accent on difference between the NMS and old European countries. According to Perry et al. (2007), labor market institutions affect shadow economy through three different channels:

- excessive labor costs (resulting from taxes and social contributions, minimum wages, trade unions' claims, employment protection legislation rigidity etc.) tend to reduce number of jobs in formal sector;
- inappropriate legislation creates incentives for voluntary opt for informal sector—both for employees, self-employers and small firms;
- labor market rigidity impacts productivity growth.

The perspective of our research mainly focuses on the first and partly also the second channel. However, also the third channel might be highly important in European context.¹⁶ In our approach we follow five main aspects of labor market institutional framework:¹⁷ taxation of labor, employment protection legislation, minimum wage setting, the effect of collective bargaining over wages, and labor market policy spending.

Labor taxation

Taxes distort basic decision-making of individuals between work and leisure and affect the official labor supply and consequently also the shadow employment. The larger the tax wedge on labor and difference between labor costs and take-home wage, the greater the incentive to avoid paying taxes and other contributions.¹⁸ Schneider and Enste (2000) consider the raise of taxes and social contributions one of the main factors contributing to growth of shadow economy.¹⁹ The overall complexity of the tax system might play a role as well, as higher

¹⁶ See for instance the debate on diverging economic performance of the United States and Europe in Nickell (1997).

¹⁷ Similarly to other studies on effects of labor market institutions (e.g. Nickell, 1997, Riboud et al., 2001, Cazes and Nesporova, 2003).

¹⁸ In this respect, it is irrelevant whether we analyze income taxes or social security contributions, as highly redistributive nature of most social security programs separates their contributions from entitlements.

¹⁹ The adverse effect on increasing motives to turn informal might stem not only from taxation of labor (payroll taxes and social contributions), but also from indirect taxes (Spiro, 1993) and corporate tax burden (Johnson et al., 1998b). The influence of taxation may also be asymmetrical, i.e. raising taxes may drive employment into the shadow at the margin, by a greater extent, than lowering taxes brings employees back into the formal economy.

intricacy brings about both direct costs and opportunity costs to evade and encourages hiding in the system (Schneider and Enste, 2000). Johnson et al. (1998a, 1998b) mention that the extent of regulatory and administrative discretion is the main factor driving people to informality, not higher taxes per se. The authors demonstrate that higher income and corporate tax rates reduce the size of the shadow economy. Friedman et al. (2000) also identified a negative relationship between tax rates and shadow economy and claimed that economic subjects turn into informality not to avoid taxes, but rather to reduce bureaucratic burden and corruption. Taxes, in their view, have two potentially offsetting effects: the direct effect represents incentive to evade taxes, while indirect effect encourages official economic activity through provision of a better legal environment.

The issue of labor taxation and shadow economy is closely connected with public goods provision—Johnson et al. (1997, 1998b) present a model of relationship between these variables. High taxes increase motivation for tax evasion, reducing the tax revenues, which ultimately leads to further erosion of state legitimacy and resources for public goods provision. This development results in a vicious circle, driving countries to bad equilibrium defined by high taxes, low tax collections and poor quality of public goods. The authors show that smaller shadow economies are connected with lower taxes resulting in higher tax revenues, lower regulation and less corruption and bribery and better rule of law—i.e. good equilibrium (characteristic for both some high-income OECD countries and also some Eastern European countries). In contrast, several transition countries have higher regulation, corruption and weaker rule of law and higher tax rates resulting in lower tax collections and greater shadow economy—i.e. bad equilibrium (Latin America, former Soviet Union countries).

Labor taxes in the European Union are very high, the highest in the world. Measured by implicit tax rate on labor incomes, average tax on labor in 2000-2007 period exceeded 40% in Austria, Belgium, Finland, France, Italy and Sweden (see Annex 2). On the other hand, Cyprus, Ireland, Luxembourg, Malta, Portugal and United Kingdom emerged as the low-tax countries with the implicit tax rates on labor under 30%. In period 2000-2007, average tax rate stood at 35.1% in all the examined countries and the respective averages for new member states and old European countries reached 33.5% and 36.2%, indicating lower tax burden on labor in the NMS group. Generally, European countries exhibited an average trend towards reduction of the tax burden on labor in given period, NMS group recording a more pronounced decline compared to the old member states. In particular, large cuts in implicit tax rates on labor took place in Slovakia, Lithuania, Latvia, Estonia, Bulgaria, Romania, Denmark and Finland. In contrast, Cyprus, Spain, Portugal, Luxembourg and the Netherlands increased their labor taxation somewhat.

Employment protection legislation

Employment protection legislation (EPL) is a part of overall regulations referring to legal framework governing conditions of hiring and firing. It mainly restricts freedom of individuals in the formal sector by restricting the employers' freedom to dismiss workers and thus reduces the flows into, but also out of, unemployment. Restrictions on hiring and firing increase adjustment costs of firms and might result in preferred use of fixed-term and

Moreover, there exists substantial inertia in reaction of shadow employment to hikes in taxes. Spiro (1993) describes a growth in informal economy connected with hikes in indirect taxes in Canada during recession in 1991 and hypothesizes that going informal might turn into a habit and decline in respect for legal modes of behavior might not be abandoned with revival of economic growth.

temporary contracts. Ultimately, strict employment protection might reduce incentives for formal employment by firms. Moreover, the increased costs can be shifted to employees and provide them an incentive to turn informal as well. Generally, enforcement of the regulation is the crucial factor, not the extent of regulation itself

The adverse effect of rigid regulation on incentive for operating formal has been largely documented in empirical literature, as has been summarized above. Johnson et al. (1997, 1998a, 1998b) present an empirical evidence of significant positive effect of overall regulation on shadow economy. Loayza et al. (2005) reach a similar conclusion as regards the effect of regulation on shadow economy. The study utilizes several measures of regulation and shows a positive effect of each of them including labor regulations.

We follow the OECD methodology (2004) for measuring the strictness of employment protection.²⁰ Data for old European countries and NMS-4 (Czech Republic, Poland, Slovakia and Hungary) are available from OECD in longer time series. Data for the rest of NMS group except Malta and Cyprus come from IZA database and were available for years 1999, 2003 and 2007 only. Therefore, NMS average in the following paragraph and Annex 2 refers to above mentioned four countries only for sake of comparability of development in time. Overall situation in European countries is shown in Annex 2.

The most liberal hiring and firing conditions were recorded in Denmark, Hungary, Ireland and Slovak Republic in period 2000-2007. France, Greece, Portugal and Spain found themselves on the opposite side of the spectrum. Southern European countries have the toughest regulation while the rules are more relaxed as one moves north. The most substantial changes leading to relaxation of employment protection in this period took place in Slovak Republic, Greece, Italy, Austria, and Portugal. On the contrary, Poland, Hungary and Ireland tightened their legislation moderately. Generally, EPL in NMS-4 is not as strict as in the other group—the average EPL index was significantly lower (1.9 in period 2000-2007). Old European countries recorded average EPL index at 2.4 with a decreasing trend in given period. However, if we extend our comparison to other NMS countries not covered in OECD data as well, the situation looks much different. The rest of the NMS group has generally much tougher legislation compared to NMS being OECD members. Taken altogether, NMS-10 group has in average comparably rigid employment protection legislation as old European countries (reaching 2.3 for all three years with data available). The toughest legislation was recorded in Lithuania and Slovenia, but the latter mentioned country relaxed its hiring and firing conditions in given period substantially (similarly to Bulgaria). In contrast, Romania exhibited certain tightening of its employment protection during the examined period.

Minimum wages

Economic theorists have not reached a broad consensus regarding the consequences of the minimum wage so far. Nevertheless, on the microeconomic level it is usually generally accepted that although it might have some positive impact on the motivation to increase productivity among low-paid workers (Stigler, 1946; Acemoglu and Pischke, 1998; Cahuc and Michell, 1996), on shifting the employment composition toward high-wage jobs

²⁰ The OECD developed a system of indicators, including a single overall composite indicator. As many as twenty two measures describing various aspects of EPL, covering regular and temporary contracts and collective dismissals, were aggregated into a summary indicator using a set of weights. The resulting EPL index 2 covers conditions of regular and temporary contracts, and terms of collective dismissals. Indices reach the values from 1 to 6, low index indicates flexible legislation and liberal hiring and firing environment, while stricter protection is reflected in a higher value of the index.

(Acemoglu, 2001), as a motivational device in the efficient wages framework (Rebitzer and Taylor, 1995; Manning, 1995), or in the case of a monopsony (Card and Krueger, 1995), there exists a threshold over which the negative effects of the minimum wage tend to prevail. Here, effective minimum wage increases labor costs of firms and prevents them from employing workers whose productivity does not exceed the minimum wage tariff (Deere, Murphy, and Welch, 1995; Neumark and Wascher, 2003; Abowd, Kramarz, and Margolis, 1999; Bazen and Martin, 1991). The higher its level is set, the larger negative consequences do occur. The effect is considered stronger for particular groups of workers with the lowest productivity, especially the youngest and the least experienced. These low-productive workers excluded from the official labor market than either enter the pool of unemployment, find a job in informal sector, or become officially unemployed while working in the shadow economy.²¹ In all these cases, minimum wage causes economic losses in terms of efficiency. The situation is confirmed to some extent by the existing empirical research. For a summary of the empirical research results on this issue, see for example Brown et al. (1982) or OECD (1998).

Apart from influencing labor market performance directly, the minimum wage might have additional indirect effects due to its interaction with other institutions and policies. OECD (2004) mentions the minimum wage's potential to mitigate tax evasion by under-reporting of earnings of employees (together with measures to restrict part-time and temporary work).²² These fiscal effects in terms of reducing tax evasion in a competitive environment characterized by underreporting of earnings by employed labor were confirmed by research of Tonin (2007). Different conclusion can be made based on the results of Bassanini and Duval (2006) who report that a binding minimum wage might amplify the adverse unemployment effects of labor taxation by preventing tax shifting to workers.

All the NMS but Cyprus have introduced legally binding minimum wage. Furthermore, many old European countries don't have legally binding minimum wage, but usually there exist an effective minimum wage determined by collective bargaining (Austria, Germany, Denmark, Italy, France, Norway, and Sweden). Real economic burden represented by the minimum wage is usually measured by a relative share of minimum wage on average/median wage in the economy. However, this indicator is not available for some countries or periods. Situation in the NMS and other European countries with data available is reported in Annex 2. Belgium, France, Greece, Luxembourg and Malta had the highest real minimum wage exceeding 45% of average wage in industry and service sector in 2007. On the contrary, the lowest minimum wages relative to average wage were recorded in Estonia, Latvia, Poland, Romania and Slovakia. Generally, NMS exhibited considerably lower minimum wages compared to old Europe, but there was a clear trend in increasing the minimum wage tariffs in period 2000-2007. By raising its level, the differences between the NMS and the other group narrowed in the examined period.

Trade unions

The role of trade unions in collective bargaining process is also a factor influencing wage formation and determining labor costs and flexibility of firms. Theory suggests that the trade unions generally tend to raise wages, cause labor market rigidities and thus influence

²¹ For details on higher prevalence of low-qualification and low-productivity labor in the informal sector see for instance Perry et al. (2007) for Latin America or Grabowski (2003) for Poland.

²² Besides the potential positive effect on tax collection, all these measures ultimately reduce the labor market flexibility—see for instance Fialová and Schneider (2009).

unemployment and formal employment. The more workers they cover, the higher this impact. Moreover, trade unions might push toward higher regulation of the official labor markets, which might be consequently reflected in higher informality. For summary of empirical findings see for instance OECD (1997, 2004). In reality, the negative effect might be offset by the extent to which unions and/or firms coordinate their wage determination (Nickell and Layard, 1999; OECD, 1997). Presence of trade unions in a firm might also lead to a more intense oversight of potentially informal activities of the firm. As showed in Zahariev (2003) using Bulgarian data, weak trade unions give more powers to management of companies in raising tax evasion and informal activities without employees' agreement. As a result, the overall effect of trade unions on informality might be ambiguous.

In most of the European countries, trade unions play an important role in wage determination process. Their power is traditionally measured by the share of workers who are trade unions' members—trade union density.²³ Overall situation in European countries is depicted in Annex 2. The source of our data is the OECD database mainly, that covers old European countries and NMS-4 (Czech Republic, Poland, Slovakia and Hungary) in longer time series. Data for the rest of NMS group except Malta and Cyprus again come from IZA database and were available for years 1999, 2003 and 2007 only. Therefore, NMS average in the following paragraph and Annex 2 refers to above mentioned four countries only for sake of comparability of development in time.

The data show higher trade union influence in old member countries, which might be on the other hand offset by higher degree of centralization and coordination (see for instance Fialová and Schneider, 2009). Trade union density is in average much lower in the NMS group compared to old European average. Moreover, while the indicator has had an increasing tendency in old Europe, NMS group clearly exhibited an opposite trend. The highest unionization exceeding 50% of wage earners among the examined countries has traditionally been characteristic for northern Europe—Sweden, Norway, Finland, Denmark and Belgium. In contrast, relatively modest levels of trade unionization (under 20%) were recorded in France, the Netherlands, Portugal, Spain and several NMS—Hungary, Poland, Estonia and Lithuania. Most countries exhibited a decline in trade union density in period 2000-2007 (with exception of Belgium, Norway and Slovenia); the largest reductions were registered in Slovakia, Estonia, Lithuania, Latvia and Romania.

Labor market policies

Labor market policies (LMP) may also have ambiguous impact on unemployment, labor market performance and incentives for informal behavior. Empirical literature on determinants of informality does not provide any clear evidence on effects of this factor as far as the authors know. Nevertheless, we assume that potential consequences of this factor are

²³ However, even if the density might be rather low in some countries, it is a common practice to extend the agreements also to non-unionized workers, thus covering a large share of employees in the whole economy (e.g. France, Spain). Thus, the degree of collective bargaining coverage (share of all salary earners whose wage is actually determined by a collective agreement—legal extension of bargained wage rates to non-unionized workers) might be a more reliable indicator in terms of real economic consequences. The level of union coordination and centralization is also an important aspect. Coordination refers to ability to coordinate bargaining among various unions and employers' organizations. Centralization refers rather to the level of bargaining (firm, industry, country) and the role of the government; high degree of centralization does not necessarily have to mean close coordination. Yet, data on these aspects of trade union functioning are rather limited.

implied by its influence on labor market flexibility and motivation of individuals to seek employment and adjust their wage claims.

Active LMP aim at enhancing human capital and sustaining employability of their participants; the provisions may improve the efficiency of job-matching process. Although negative effects do occur (substitution effects and deadweight losses—see for instance Martin, 2000), empirical studies often find overall positive effects of these provisions on employability of workers (OECD, 1993). Consequently, involuntary shift to informality might be limited; the effect on voluntary opting for informality is not clear.

On the other hand, passive LMP may decrease the job-search intensity and motivation of unemployed to accept a job offer and lower the economic costs of unemployment, raise the employees' wage claims and thus might push up the overall unemployment. Furthermore, it might strengthen the incentive for operating informally while receiving unemployment benefits at the same time. At the same time, passive LMP might have a negative effect on informality—securing income during unemployment might increase “informal reservation wage” of the unemployed and thus reduce shadow economy. The generosity of unemployment insurance system is of particular importance (Layard et al., 1991). The overall effect is therefore again rather ambiguous.

Main characteristics of European countries' LMP systems are presented in Annex 2. We measure the relative generosity of the system by its expenditure as a share of official GDP per percentage point of unemployment in the country in given year. Generally, countries spend relatively more resources on passive LMP. There exist very significant differences between the two groups of countries. NMS in average spend relatively small amount of resources on LMP. The difference is especially remarkable in case of active LMP, where the old European average exceeds the NMS average nearly seven-times. The similar comparison for passive LMP expenditure gives a five-fold difference. While old European countries in general tended to cut their LMP expenditure in given period, the trend in the NMS group was slightly opposite, although any more precise comparison is impossible due to data limitation. The most generous LMP systems as regards both active and passive measures are observed in Denmark and the Netherlands. On the contrary, the smallest amount of resources directed to active LMP measures was recorded in Greece, Malta, Latvia, Romania, Slovakia and the United Kingdom. The smallest expenditure on passive LMP was recorded in Bulgaria, Czech Republic, Estonia, Lithuania and Slovakia.

4. Data and methodology

This section describes the methodology and data used in our analysis of labor market institutions' effects on various shadow economy's indicators. To this end, we use econometric models inspired by recent empirical research and by economic theory set out in previous parts of this paper.²⁴ To estimate the effect of labor institutions on shadow economy, we use panel data estimation techniques and two stage least squares estimation procedure with instrumental variables. As there is scarce data available, we utilize three data samples covering different countries and time periods. Definition and data sources for all the variables used in our analysis are given in Annex 3.²⁵

²⁴ Similar methodology was applied for instance in Loayza et al. (2005) or Friedman et al. (2000).

²⁵ Descriptive statistics are available from the author upon request.

First, we constructed a panel of nineteen European countries and used data for period 2000-2007 (basic data sample—“S1”).²⁶ Out of all the countries in the panel, fourteen are old member countries, one is Norway, which we classify as an old member country for purposes of this paper, and remaining four countries are the NMS. The source of the data is mainly the OECD and partly also Eurostat, World Bank and Heritage Foundation. However, as this sample covers only four NMS (the Czech Republic, Slovakia, Hungary and Poland) we expanded our analysis to other NMS as well in the second, extended data sample (“S2”). The panel consists of twenty-eight countries, twelve of which are the NMS.²⁷ Yet, the availability of relevant data is a serious obstacle. Several OECD variables had to be replaced by less accurate indicators provided by the Eurostat. Moreover, the necessary set of indicators is available for a shorter time period of 2006-2007 only. The third sample we use in our analysis (“S3”) consists of twenty-six countries, ten of which are the NMS.²⁸ The time period concerned is years 2003 and 2007. The source of the data is mainly the OECD and partly also Eurostat, World Bank and Heritage Foundation, similarly to the first sample. Furthermore, we extended OECD data for information from IZA database, which includes all the OECD measures of labor market institutions for the non-member countries of Central and Eastern Europe.²⁹ Given the limited amount of data available, the second and the third samples are used for robustness checks mainly.

We examine the impact of institutional factors on five indicators of shadow production and employment: shadow economy as percentage share on overall official GDP (*SHEC*), share of labor force in unregulated self- and wage-employment measured by share of labor force not contributing to the pension system adjusted for the unemployment rate (*CONTRIB*), share of labor force employed in small firms with less than ten employees (*LESS10*) or being self-employers (*SELFEMPL*) and share of labor force employed without a legal written contract (*CONTRACT*).³⁰ The shortcomings of the four latter indicators were already described in previous part of our paper. Moreover, utilization of the first mentioned dependent variable is also partially problematic because some of the independent variables we use (or similar measures to those we use) were also utilized as elements in the MIMIC estimation of the shadow economy.³¹ As a result, estimation based on this dependent variable might bias the results to certain extent. Still, as shown in Friedman et al. (2000), utilizing these data does not change the nature of general findings when compared to results obtained for data estimated by other methods. But once again, no better indicators of shadow economy in comparable methodology are available. Still, one has to bear these limitations in mind when viewing our results.

²⁶ Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, and United Kingdom.

²⁷ Austria, Belgium, Bulgaria, Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Romania, and United Kingdom.

²⁸ Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Romania, and United Kingdom.

²⁹ For details on methodology see Lehmann and Muravyev (2009).

³⁰ For description of data sources and discussion of information relevancy of these indicators see Section 1 and Annex 3.

³¹ This method estimates the size of the shadow economy from both likely causes and effects of the informal activity. The underlying variables comprise the size of the government, the unemployment rate, government effectiveness, the GDP per capita, currency (M0 over M1), the growth rate of GDP per capita, the labor force participation rate, the fiscal freedom index, the share of direct taxation, the business freedom index, the growth rate of total labor force (Schneider et al., 2010).

The regression coefficients are estimated using the generalized two stage least squares random-effects instrumental variables regression estimation procedure (models 1.1, 3.1-5.1), two stage least squares estimation procedure with instrumental variables on cross-sectional samples (models 2.2 and 2.3) and two stage least squares estimation with instrumental variables on pooled panel data (for models 1.2, 3.2-5.2 and 1.3, 3.3-5.3). The feasibility of utilization of these approaches was tested by Durbin-Wu-Hausman tests (which were replaced by *xtoverid* test procedure in Stata application, introduced by Schaffer and Stillman, 2006, for testing coefficients estimated in the RE and FE panel estimation procedure in case that covariance matrix in Hausman test was not positive definite) and Breusch-Pagan Lagrange Multiplier test for presence of random effects.

The regression equation has following form for all samples:

$$X_{it} = \alpha + \beta_1 EPL_{it} + \beta_2 MW_{it} + \beta_3 TU_t + \beta_4 TAX_{it} + \beta_5 LMPA_{it} + \beta_6 LMPP_{it} + \beta_7 \ln GDP_{it} + \beta_8 FISF_{it} + \beta_9 BUSF_{it} + \beta_{10} CORR_{it} + \beta_{11} REGQUAL_{it} + \varepsilon_{it} \quad (1),$$

where X takes the form of *SHEC*, *CONTRIB*, *SELFEMPL*, *LESS10*, and *CONTRACT* in consequent regressions (Model 1, 2, 3, 4 and 5 respectively). The detailed description of all the models applied in our analyses is given in Annex 4.

The independent variables and their expected effects were described in the previous section. In our samples S1 and S3, we used the OECD's employment protection legislation index, version 2 (*EPL*). In the sample S2, this variable was replaced by inverse value of indicator of labor freedom as the employment protection index is not available for non-OECD countries over a longer time period. Minimum wage (*MW*) is a cluster variable constructed according to minimum wage level as a share of median wage in the economy in the basic sample S1 and according to minimum wage level in purchasing power parities in sample S2 and S3. The trade unions' power is represented by the trade union density as percentage of all workers in the economy (*TU*). This variable was omitted in sample S2. Tax system consequences are reflected by total tax wedge on labor income in samples S1 and S3 (*TAX*). In the extended sample S2, this variable was replaced by implicit tax rate on labor. Finally, to reflect the influence of labor market policies, expenditure on active (*LMPA*) and passive labor market policies (*LMPP*) as percentage share of official GDP per percentage point of unemployment were included. Both variables on labor market policies expenditure were instrumented.³²

Other variables describing country's political-economic environment needed to be covered too to control for their potential effects besides the labor market factors that are in main focus of this paper. First, we control for level of country's economic development by adding the variable GDP per capita in purchasing power parities (*GDPPC*). In line with the previous research, the variable is represented in logs. Furthermore, two more variables reflecting the degree of regulation in other fields apart from the employment protection were added: Fiscal freedom indicator has an inverse relationship to the overall tax burden imposed by government (*FISF*).³³ Business freedom is a quantitative measure of the ability to do business and has an inverse relationship to the overall burden of regulation as well as the efficiency of government in the regulatory process (*BUSF*). Finally, informality might be also affected by political factors such as control of corruption in the country or regulatory quality. To account

³² These variables might be endogenous because they relate the expenditure to the actual rate of unemployment, potentially affecting the decision about turning informal. For this reason we instrumented these variables by new variables relating the expenditure to the average unemployment rate in 5-year period before the actual year.

³³ Construction of this indicator (described in Annex 3) should guarantee existence of no colinearity between this variable and variable *TAX*.

for these factors, two more variables were added in the regression model (*CORR*, *REGQUAL*).³⁴

Economic theory and empirical research described in previous sections indicate expected effect of the variables used in our regressions. Policies that distort effective functioning of labor markets—high minimum wages and excessive employment protection legislation—should increase attractiveness of the shadow economy. In several instances—impact of trade unions, labor taxes and income support during unemployment—neither theory nor empirical research provide unambiguous predictions, as summarized in Table 2. Pair-wise correlations between the dependent variables and independent variables are given in Annex 5.

Table 2. Expected effect of explanatory variables on dependent variables

EPL	positive
MW	positive
TU	positive/negative
TAX	positive/negative
LMPA	negative
LMPP	positive/negative
GDPPC	negative
FISF	negative
BUSF	negative
CORR	negative
REGQUAL	negative

The basic data sample S1 covers only four NMS. Therefore it was not possible to run a separate analysis for this group of countries. Only the differences in the role of institutions between the whole group of countries and the old member countries and its implications for the NMS were examined using a modified Chow test (see also Cazes and Nesporova, 2003).³⁵ Similar test was also applied to the extended data samples S2 and S3. These two samples cover more NMS which allows for running separate regressions but still, the samples suffer from lower data reliability given by less accurate and relevant indicators with different underlying methodology and implied limited robustness of the results. Therefore, variation between the NMS and old member countries might be studied only partially given the above mentioned limitations.

³⁴ Some authors (e.g. Lehmann and Muravyev, 2009) include the macro environment and policy variables in a lagged form. The underlying logic is that it is reasonable to expect the outcome of interest in time t to be more related to the hypothesized causal variable in time $t-1$. In our estimations, we assume that the environment prevailing at the time the decision is being made has the major effect on decision-making of economic subjects and, therefore, we do not use lagged form of these control variables. Furthermore, there exists substantial inertia in development of macroeconomic and policy environments, which reduces potential differences in outcomes of these two approaches. Nevertheless, we considered this eventuality as well and we checked robustness of our results by utilization of models with lagged macro environment and policy variables. The results were not altered significantly by this step.

³⁵ We used a modified version of the test hypotheses and statistics, because number of observations in the NMS group is smaller than the number of parameters, $n_{NMS} < k$, and thus we can not use the standard methods in this case. We test the hypothesis $H_0 : E(y | X; \beta_{OE}) = E(y | X; \beta_{NMS})$. This is done by calculating the statistic

$$F = \frac{\frac{SSR_T - SSR_{OE}}{n_{NMS}}}{\frac{SSR_{OE}}{n_{OE} - k}} \approx F(n_{NMS}, n_{OE} - k).$$

The applied models use an aggregate approach uncovering the main correlations between countries' characteristics and scope of informality. The direction of causality that we assume could be in some cases subject to criticisms given the close mutual interaction between development of shadow economy and labor institutions, which might even be endogenous and their effect might vary in time.³⁶ The deeper explanation power of the model is rather limited due to the lack of relevant data. Our model is also unable to explain individual motives and flows of economic subjects between formality and informality. Consequently, our results should be interpreted with caution and all these limitations should be born in mind.

5. Results of empirical estimations

In this section, we present results of our models estimating the effect of labor market institutions on various indicators of shadow production and employment. Pair-wise correlations between the dependent variables used in particular models are described in Annex 5. The theory suggests that dependent variables in Models 1, 2 and 5 (shadow production, share of labor force not contributing to the pension system and share of labor force employed without a legal written contract) should be strongly correlated, as they have a tighter relationship to informality. In contrast, dependent variables of Models 3 and 4 (employment in small firms and self-employment) mainly reflect different phenomena and their relationship to examined variable—shadow employment—should be weaker. However, empirical evidence represented by correlation coefficients between the dependent variables in all three samples indicates closer relationship between Models 1, 2 and 4. Yet, simple correlations still do not reveal the complexity of effects of explanatory variables in these models.

Model 1 – Share of the shadow economy as percent of GDP

Table 3 offers an overview of results of Model 1, using the shadow production as percentage of official GDP as dependent variable for all three samples we use. We use G2SLS random-effects instrumental variables regression estimation on panel data for sample S1 and instrumental variables 2SLS estimation procedure on pooled data for samples S2 and S3. Explanation power of the models measured by R-squared varies from 28% for total sample S1 to 97% for NMS subsample of S2. The model is quite strong in explaining the intra-group variability in the data for the S1 sample, while its ability to reflect the differences between countries is somewhat weaker. Samples S2 and S3, which are used predominantly as robustness checks, have higher explanatory power of regressions, but the individual coefficients' significance is similar to our baseline model S1. While most general political-economic variables are insignificant in the model S1 (fiscal and business freedom, control of corruption), quality of regulation significantly reduces share of the shadow sector. All labor market institutional variables and control variables on countries' political-economic environment proved to be significant in samples S2 and S3.

The main result of our regression analysis is an unambiguous confirmation of the stricter employment protection legislation positive effect on the shadow production. The result is robust across all the subsamples we use and confirms our hypotheses based on previous theoretical and empirical research in this area. Increasing the strictness of employment protection legislation by one grade (out of six) increases the shadow production by

³⁶ For a detailed discussion on this topic see e.g. Freeman (2007).

approximately $\frac{1}{2}$ percent GDP. The effect seems to be even stronger in the old member countries of the EU, where it reaches 0.86 and is significant at 1 percent level. Model 1 on sample S1 also suggests that trade union density decreases shadow production—by 0.05 percent for each percent of trade union density increase. However, sample S3 does not confirm the negative relationship between shadow economy share and trade union density, as it shows different estimated coefficient that varies across the subsamples. We should, thus, refrain from any strong conclusions on the trade unions' role.

The estimates of labor taxation, minimum wage and both active and passive labor market policy expenditure are inconclusive. The negative effect of higher level of taxation, suggested by the samples S2 and S3, but unconfirmed by the baseline model on sample S1, might be connected to the effect on improving quality of public services and provision of a better legal environment. Yet, the result suffers from limited robustness, as the old European subsamples indicate rather positive effect, which is, however, insignificant in S2 and S3 and significant at 10% level only in S1. Further, greater passive labor market policy expenditure exhibits a negative effect on shadow production in sample S2. We find the main reason for this result in fact that securing social income might increase informal reservation wage of the unemployed and reduce shadow economy. The consistently, if statistically weak, negative effect of higher minimum wage on shadow production might result from its effect on increasing productivity in the formal sector covered by the minimum wage. Its negative effect on shadow economic activities might also stem from higher motivation of workers to find a job in formal sector compared to lower work remuneration in informal sector uncovered by the minimum wage. Finally, positive effect of active labor market policy expenditures, indicated by the samples S2 and possible S3, might be explained by potential abuse of these programs, when their participants work in shadow while subscribed to the programs due to low efficiency of state control over these policy measures.

Shifting to the controlling variables, we find a strong and negative effect of the GDP per head variable on shadow economic activities. The relationship holds across all data samples and models. Therefore, the negative GDP effect is not entirely driven by the old-new EU members divide, but holds within these groups as well. However, the effect of higher GDP per head gets more complex when we turn to other measures of the shadow economy below, so we provide some tentative interpretation of the relationship between economic development and shadow economy measurements in the concluding chapter. Regulatory quality seems to have a negative effect on shadow economy production in sample S1, but results from samples S2 and S3 suggest that statistical robustness of coefficients is rather limited.

Remaining political-economic variables show insignificant results in the baseline sample S1 but their effects are, however, significant in S2 and S3. Fiscal freedom shows a diminishing effect on shadow production. The negative sign of fiscal freedom coefficients might seem to contradict the labor taxes result, but labor taxation is only one of three components of fiscal freedom that takes into account also corporate income taxation and total tax revenue as a percentage of GDP. Business freedom seems to increase the shadow economy, but the result suffers from limited robustness as it is significant in total sample S2 only. The effect of control of corruption seems to differ between the old Europe and the NMS groups. While better control of corruption seems to boost share of shadow production in the NMS group, it has an intuitive opposite effect in old member countries (that dominate overall results in samples S2 and S3). The counterintuitive result for the NMS might be determined by the generally higher level of corruption prevailing in this group. The widespread corruption at the public administration system in new EU member countries pushes private entrepreneurs out

of the official economy and there might exist an inertia, preventing functioning of the traditional mechanisms prevailing in the old European group.

Taking into account the potentially different development in NMS countries before 2004 (i.e. the year of accession of ten of the NMS to the EU) connected with the pre-accession preparations and limiting our estimations to the development after 2004 only does not alter our results substantially. Also, limiting our estimations to the group of old EU member countries only in case of S1 and old Europe and NMS group in case of S2 and S3 does not affect our results or explanation power of the model significantly (with exception of variable control of corruption as described above). To examine the potential differences in the role of explanatory variables between the total country sample and old European countries subsample we applied modified Chow tests as described above. The tests' results did not reject the hypothesis of stability of regression coefficients between these two groups for all three samples on 5% significance level. This outcome, however, is rather inconclusive and does not allow for evaluating the behavior of these two groups of countries as similar.

Table 3. Results of Model 1 – dependent variable SHEC

	S1 – Model 1.1		S2 – Model 1.2			S3 – Model 1.3		
	Total	Old Europe	Total	Old Europe	NMS	Total	Old Europe	NMS
EPL	0.4511 **	0.8574 ***	720.7024 ***	501.5741 ***	919.6004 ***	3.7928 ***	1.1424	7.2518 ***
MW	-0.0540	-0.1809 **	-1.1889 ***	-0.1778	-2.2956 ***	-0.2483	0.1184	1.8569
TU	-0.0453 **	-0.0063				0.0661 *	0.1317 ***	-0.2723 ***
TAX	0.0336	0.0400 *	-0.4033 ***	0.1925	-0.1874 ***	-0.1145 **	0.0135	-0.0085
LMPA	-1.2587	-1.4342	28.3654 *	96.0294 ***	120.4396 ***	16.2197	35.2575	78.2427 ***
LMPP	0.9073	1.2234	-14.7030 **	-35.6742 ***	18.0091	-11.5430	-12.6552	-132.4044
lnGDPPC	-6.0677 ***	-4.1416 ***	-7.0800 ***	-9.9681 ***	-20.6832 ***	-7.4908 ***	-8.6845 ***	-11.8780 ***
FISF	0.0049	-0.0120	-0.2151 ***	0.1419	-0.1346 ***	-0.0562	0.0982	-0.0215
BUSF	0.0015	0.0023	0.1656 ***	0.1075	0.0585	0.0807	-0.0144	0.0825
CORR	0.0522	-0.1327	-10.2046 ***	-10.2401 ***	4.5060 ***	-5.7668 ***	-5.2701 ***	9.7344 ***
REGQUAL	-0.9367 ***	-1.7974 ***	6.4314 *	6.5884	6.3532 ***	3.6520	-2.6098	-12.2151 **
constant	39.0851 ***	32.4610 ***	52.3808 ***	24.8000 **	73.8464 ***	38.9960 ***	47.0597 ***	51.4402 ***
R sq. Within	0.6863	0.6854						
R sq. Between	0.2775	0.4075						
R sq.	0.2808	0.4063	0.8163	0.8770	0.9696	0.8186	0.8844	0.8583
N	152	120	56	32	24	49	31	18
groups	19	15						
Method	RE	RE	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS
Wald test Chi ² statistics p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Chow test F statistics p-value	0.1715		0.1157			0.1864		

Note: *** significant at 1% level, ** significant at 5% level, * significant at 10% level. RE - random effects estimation procedure, POOLED IV 2SLS - pooled two stage least squares procedure with instrumental variables on panel data; robust standard errors utilized. The detailed description of all the models applied in our analyses is given in Annex 4.

Source: OECD, Eurostat, World Bank, Heritage Foundation, IZA, own calculations.

Model 2 – Share of non-contributing labor force

Estimation of Model 2 using the share of labor force not contributing to the pension system as dependent variable for samples S2 and S3 (there is not enough data to estimate the model on sample S1) yields results summarized in Table 4. The model's fit is quite strong: R-squared

reached more than 80%. All explanatory variables but minimum wage and trade union density exhibit a significant impact on the explained variable. Similarly to Model 1, taxation of labor and fiscal freedom have negative impact on this proxy of shadow employment. The negative effect of labor taxation might be again connected to improving quality of public services and provision of a better legal environment in high-tax countries. Furthermore, negative effect was also estimated for active labor market policy expenditure and control of corruption, both confirming our initial hypotheses.

On the other hand, stimulating impact on level of shadow employment was again recorded for employment protection legislation, and in this case also for passive labor market policy expenditure, GDP per capita, business freedom and regulatory quality. As regards employment protection legislation, the result confirms our initial hypothesis, although the outcome is significant for sample S3 only. Likewise, the estimation outcomes for business freedom and regulatory quality were significant for one of the two utilized samples only. Positive coefficient for passive labor market policies may be explained by potential abuse of the system, enabling both reception of unemployment benefits and simultaneous engagement in informal economy. The positive influence of level of economic development on the share of non-contributing workers seems to contradict results of Model 1 and previous economic research. Potential explanation of this counterintuitive result is that increasingly generous pension benefits, unrelated to life-time contributions to the system, made contributing to the pension systems in rich European countries redundant as the eventual pensions reflect non-contributing periods only partially. Yet, this result must be taken carefully and should be subjected to further research.

In case of this explanatory variable, we also examined the possibility that our results might be biased by adjustment of the dependent variable for the unemployment rate. This might happen for instance if people were working informally and declaring themselves unemployed in order to receive benefits as is indicated by above-mentioned regression coefficients for passive labor market policies. However, analysis of unadjusted data yields very similar results to those presented in Table 4.³⁷

Due to limited data available, we were not able to examine differences between old European countries and NMS group.

Table 4. Results of Model 2 – dependent variable CONTRIB

	S2 – Model 2.2	S3 – Model 2.3
	Total	Total
EPL	222.1883	9.4872 **
MW	-0.7356	0.0106
TU		0.2190 *
TAX	-0.4715 ***	-0.3733 **
LMPA	-127.6588 ***	-138.9402 ***
LMPP	36.2993 ***	63.5549 ***
lnGDPPC	19.5971 ***	16.0823 ***
FISF	-0.3434 ***	-0.1456 ***
BUSF	0.3849 ***	0.0196
CORR	-18.2655 ***	-21.1944 ***
REGQUAL	13.9020	25.5393 ***
Constant	-41.0798 **	-54.3431 **
R sq.	0.8007	0.8601

³⁷ Regression estimation results for the share of labor force not contributing to the pension system unadjusted for the unemployment rate used as dependent variable are available from the author upon request.

N	18	17
Method	IV 2SLS	IV 2SLS
Wald test Chi ² statistics p-value	0.0000	0.0000

Note: *** significant at 1% level, ** significant at 5% level, * significant at 10% level. IV 2SLS - two stage least squares procedure with instrumental variables on cross-sectional sample; robust standard errors utilized. The detailed description of all the models applied in our analyses is given in Annex 4.

Source: OECD, Eurostat, World Bank, Heritage Foundation, IZA, own calculations.

Models 3 and 4 – Small firms and self-employed

Models 3 and 4 analyze effects of labor market institutions on the share of workers in small firms (employing fewer than ten employees) and share of self-employed. Both measures should reflect labor market restrictions that presumably push workers into self-employment or prevent firms to expand beyond certain size, approximated here by the number of employees. Table 5 and 6 offer estimation outcomes of Model 3 and Model 4 for all three samples. The results indicate that our model explain the two chosen indicators weakly, particularly in case of Model 4 (self-employers). The poor explanatory power of regressions is probably caused by much more complex relationship between the labor market indicators chosen as dependent variables and the size of the shadow economy or shadow employment, as it was already discussed in previous sections of our paper.

Results of Model 3 are not statistically very robust, despite explaining a solid part of variability in dependent variable (R-squared reaching from 35% to 90%). Moreover, the Model 3 results are not consistent with results of Models 1, 2 and 5 (see also below). As in Models 1 and 2, the strictness of employment protection legislation seems to have a positive effect on indicators of shadow economy—with every grade of EPL strictness, the share of employment in small firms increases by almost 10 percent.

Level of labor taxation seems to reduce share of small firms' employment in the labor force, confirming the apparent negative relationship between shadow market indicators and labor taxation detected in models 1 and 2.³⁸ Effect of passive labor market policy expenditures is ambiguous; business freedom tends to increase employment in small firms. Effects of other variables—trade union density, active labor market policy expenditures, minimum wage, economic development, fiscal freedom, control of corruption, and regulatory quality—are statistically insignificant in baseline sample S1. In samples S2 and S3, active labor market policy expenditures seem to have a negative effect on employment in small firms in new member states, but it has insignificant effects in old EU member states. Further, minimum wage exhibits a negative effect on dependent variable, which might be a reasonable result for pure legal employment in small companies, but fails to meet our hypotheses regarding the effect on shadow employment, similarly to results of previous models.

Results of Model 4 relating the development of explanatory variables to self-employers proxy of shadow employment are not robust and the effect of independent variables (mostly significant) varies a lot between the particular samples and subsamples to which the model was applied.

³⁸ We examined this relationship further by utilization of more specific dependent variable stating the share of labor force employed in firms with fewer than five employees, which should have a closer relationship to examined shadow employment. The source of these figures was EU-SILC and they concern time period 2005-2007. Regression estimation results confirmed the negative relationship between employment in small firms and labor taxation. The results thus stay inconclusive as regards the effect of this variable on shadow employment. Regression estimation results for the share of labor force employed in firms with fewer than five employees used as dependent variable are available from the author upon request.

Examining the potential differences in the role of explanatory variables between the NMS and old European countries by the modified Chow tests, we were not able to reject the hypothesis of stability of regression coefficients between these two groups of countries in all the sub-models of Models 3 and 4 but Model 4 on sample S1.

Table 5. Results of Model 3 – dependent variable LESS10

	S1 – Model 3.1		S2 – Model 3.2			S3 – Model 3.3		
	Total	Old Europe	Total	Old Europe	NMS	Total	Old Europe	NMS
EPL	9.5992 ***	11.6807 ***	-14.3667	-2111.9680 **	-1044.6590 ***	6.1988 ***	16.9680 *	-5.3567 ***
MW	-1.0595	-2.0185	-4.4364 ***	-4.3909 **	-3.4194 *	-3.1874 **	-4.0462 **	-5.7700 **
TU	-0.0164	0.0450				-0.0516	0.1096	0.5342 ***
TAX	-0.2569	-0.4995 **	-0.8584 ***	-2.8924 ***	0.2956	-0.7366 **	-2.1621 *	-0.1829
LMPA	43.2387	-0.3349	43.7352	-52.3072	-110.8614 **	-54.5490	-388.9695 *	-79.3016 ***
LMPP	-43.4472 **	-20.1008	-32.9602	49.0924	74.2611	-2.2491	133.0819 *	455.4081 ***
lnGDPPC	6.9031	13.9637	34.0757 ***	63.4543 ***	11.8531	19.0370 **	59.6104	-2.5173
FISF	-0.0524	-0.1028	0.0822	0.3677	0.1149	-0.2703 *	-1.1172	0.2014 **
BUSF	0.3234 ***	0.3345 ***	0.3385	1.5403 ***	0.1287	0.2060	0.6140	-0.1992 *
CORR	-5.9810	-8.3002 *	1.4953	36.7892 ***	4.5089	-4.9543	-9.8134	-9.3639 *
REGQUAL	4.5365	2.3194	-35.2486 **	-145.9063 ***	-10.5129 ***	-8.3761	-11.8015	28.4193 ***
Constant	-20.0245	-31.3592	-32.0524	-46.7966	-6.9510	12.6085	-63.2875	8.6908
R sq. Within	0.1336	0.1257						
R sq. Between	0.5686	0.7480						
R sq.	0.3464	0.4208	0.4632	0.7259	0.8980	0.3497	0.3454	0.7602
N	143	112	53	31	22	48	30	18
Groups	19	15						
Method	RE	RE	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS
Wald test Chi ² statistics p- value	0.0018	0.0001	0.0000	0.0000	0.0000	0.0009	0.0042	0.0000
Chow test F statistics p- value	0.9479		0.9992			0.9985		

Note: *** significant at 1% level, ** significant at 5% level, * significant at 10% level. RE - random effects generalized least squares estimation method, POOLED IV 2SLS - pooled two stage least squares procedure with instrumental variables on panel data; robust standard errors utilized. The detailed description of all the models applied in our analyses is given in Annex 4.

Source: OECD, Eurostat, World Bank, Heritage Foundation, IZA, own calculations.

Table 6. Results of Model 4 – dependent variable SELFEMPL

	S1 – Model 4.1		S2 – Model 4.2			S3 – Model 4.3		
	Total	Old Europe	Total	Old Europe	NMS	Total	Old Europe	NMS
EPL	-0.5499	0.9708 *	83.5359 **	-339.8728 **	902.4133 ***	2.1267 *	1.7783 **	2.0232
MW	-0.0558	0.2647	-0.7486	0.3260	1.9215	0.0258	-0.1448	1.2082
TU	-0.0967 **	-0.0381				0.0723 *	0.0722 **	-0.1344
TAX	0.0083	-0.0633	-0.4235 ***	0.3509 ***	0.1803	-0.3400 ***	-0.1236 *	0.2239
LMPA	2.0591	4.5337	-56.0010 ***	78.0071 ***	-25.2625	-81.4802 ***	-10.0164	-37.7993
LMPP	-1.9254	-6.9724 **	28.6895 ***	-29.0602 ***	187.4907 ***	35.6506 ***	5.0697	15.1356
lnGDPPC	-3.6395 ***	-8.6731 ***	4.7138 ***	-15.7035 ***	-5.8213 *	4.9850 **	-8.5828 ***	1.4612
FISF	0.0545 ***	0.0372	-0.2426 ***	0.4481 ***	0.2494 *	-0.1727 ***	0.1274 **	0.0156
BUSF	0.0024	0.0275 **	0.0756 ***	-0.3247 ***	-0.2684 ***	0.0160	-0.0262	-0.0744
CORR	0.6946	-2.9335 ***	-6.8451 ***	-3.3139 *	-10.8332 ***	-6.6594 ***	-9.5263 ***	-2.2346
REGQUAL	0.9451	0.6155	-2.1653	3.1040	5.7631 **	-0.6917 ***	7.8841 **	-8.8696
constant	24.6757 ***	45.8326 ***	32.9592 ***	63.2909 ***	-4.1078	23.8789 ***	41.8845 ***	9.1444
R sq. Within	0.2055	0.0881						
R sq. Between	0.0666	0.7635						
R sq.	0.0761	0.7565	0.5825	0.9201	0.8192	0.5790	0.9009	0.7119
N	149	118	54	32	22	49	31	18
groups	19	15						
Method	RE	RE	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS
Wald test Chi ² statistics p- value	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Chow test F statistics p- value	0.0000		0.8832			0.9534		

Note: *** significant at 1% level, ** significant at 5% level, * significant at 10% level. RE - random effects generalized least squares estimation method, POOLED IV 2SLS - pooled two stage least squares procedure with instrumental variables on panel data; robust standard errors utilized. The detailed description of all the models applied in our analyses is given in Annex 4.

Source: OECD, Eurostat, World Bank, Heritage Foundation, IZA, own calculations.

Model 5 – Share of workers without a legal contract

The last model that we examine is Model 5 with share of labor force employed without a legal written contract as a dependent variable, the results of which are summarized in Table 7. The results of this model are close to Models 1 and 2 (in contrast with Models 3 and 4). The explanation power of the model is solid, explaining more than 40% of variability in dependent variable on S2 and S3. However, the explanation power of the model is rather weak for S1 (R-squared below 11%) and its fit measured by the Wald test is poor for old European subsample of S1 indicating joint insignificance of the regression coefficients. For this reason, we omit the results of the S1 sample from further analysis and discussion and we concentrate on samples S2 and S3. Their explanation power measured by the R-squared is higher for the NMS group, while their ability to describe the variability in the old European subsample is lower (see Table 7).

All the labor market institutional variables and factors related to political-economic environment of the countries proved to be significant in the model. The employment protection legislation coefficient is again positive, indicating that the excessive legal protection leads to a higher share of workers who have no legal written contract. The result is intuitive both given the variable's literal meaning—share of workers on temporary contracts and without any legal contract, i.e. workers not protected by strong EPL—and its role as a

proxy for shadow employment. It is also consistent with similar effect of the EPL in Models 1 and 2.

Other indicators show weaker effects. Level of labor taxes seems again to diminish shadow economy indicator, in this model share of workers without a contract. The same effect has a higher trade union density, as trade unions may exercise pressure on government to impose harsher penalties for non-contract workers. Higher minimum wage seems to increase the share of workers without the contract, but only in the new EU members subsample. Labor market policy expenditures, both passive and active, have ambiguous effects on non-contract employment.

Out of the other control variables, only fiscal freedom and business freedom seem to have a consistent—negative—effect on the dependent variable. Level of economic development measured by GDP per capita tends to reduce shadow employment, but the robustness of this outcome is limited to S2 only. Control of corruption, level of economic development measured by GDP per capita and regulatory quality all show statistically weak effects.

The extended data samples S2 and S3 allow us to run separate regressions for NMS group and old European countries. Although the estimated coefficients suggest different behavior of the two groups of countries, the results of applied Chow tests do not allow for rejection of the hypothesis of stability of regression coefficients between these two groups of countries in either of the sub-models.

Table 7. Results of Model 5– dependent variable CONTRACT

	S1 – Model 5.1		S2 – Model 5.2			S3 – Model 5.3		
	Total	Old Europe	Total	Old Europe	NMS	Total	Old Europe	NMS
EPL	4.1585 ***	0.0980	562.1071 ***	653.9701 ***	499.0793 ***	2.7880 **	6.5737 ***	6.9879 ***
MW	-0.5562 *	-0.2438	-0.1224	-0.0793	4.6800 ***	-0.0925	-0.4403	6.2950 **
TU	-0.1036 *	-0.0752				-0.1006 *	-0.0865 **	-0.5563 ***
TAX	0.1701 *	0.0614	-0.3391 **	-0.4405	-0.8808 ***	-0.1898 **	-0.2152	-0.2119
LMPA	5.5891	-6.2919	-33.2684 **	-26.3724	114.2258 ***	-20.5066	-15.8073	44.6655
LMPP	-1.3019	4.9171	13.3768 **	17.5201	49.1185	-1.8657	-0.3121	-160.8801
lnGDPPC	4.7619 **	-3.0364	-4.6410 **	-4.0338	-7.8942 ***	-1.5095	-8.8021	0.9432
FISF	0.0340	-0.0020	-0.3544 ***	-0.2476	-0.2773 **	-0.2135 ***	-0.1099	-0.4078 **
BUSF	-0.0075	0.0354 **	-0.2533 ***	0.0556	-0.5684 ***	-0.0381	0.1100 *	-0.2582 *
CORR	-2.9826 ***	-0.6461	4.4729 *	4.5274 *	1.2196	5.4242 **	4.0122 *	3.7078
REGQUAL	1.9812	0.0067	-4.1349	-10.8420	6.8003 **	-4.1791	2.2713	-11.2454
constant	-17.8050 **	19.8145	70.7803 ***	46.6566 **	93.1514 ***	35.6348 ***	27.7419 ***	61.5898 ***
R sq. Within	0.3339	0.1382						
Rsq. Between	0.1076	0.0676						
R sq.	0.1058	0.0612	0.6150	0.6108	0.9269	0.4100	0.5604	0.7847
N	146	115	53	31	22	49	31	18
groups	19	15						
Method	RE	RE	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS	POOLED IV 2SLS
Wald test Chi ² statistics p-value	0.0000	0.1843	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Chow test F statistics p- value	0.1582		0.9462			0.9994		

Note: *** significant at 1% level, ** significant at 5% level, * significant at 10% level. RE - random effects generalized least squares estimation method, POOLED IV 2SLS - pooled two stage least squares procedure with instrumental variables on panel data; robust standard errors utilized. The detailed description of all the models applied in our analyses is given in Annex 4.

Source: OECD, Eurostat, World Bank, Heritage Foundation, IZA, own calculations.

6. Conclusions

Several estimation approaches for different data samples and explanatory variables were used in this paper to analyze the impact of labor market institutions on the development of shadow production and employment in European countries. The presented results for different model specifications show that the most robust estimation outcomes come from specifications that use as dependent variables the shadow economy as percentage share on overall official GDP, the share of labor force not contributing to the pension system and the share of labor force employed without a legal written contract. Models explaining the share of labor force employed in small firms with fewer than ten employees or being self-employers do not offer robust results, as the two indicators proxy shadow employment only weakly and are influenced by other factors and patterns of development. Our findings also confirm that availability of relevant data related to the shadow economy and employment for European countries as it is being processed and published by Eurostat is a serious obstacle in examining this issue.

Despite giving more consistent and robust results, the three models (Model 1, 2 and 5) have also substantial shortcomings as was discussed in previous sections. Generally, the robustness of the results is partially limited by the character of data available. Still, no better indicators are recently available and our results do allow us to claim that the development of shadow sector in European countries in period 2000-2007 was significantly affected by the development of labor market institutional environment. While the effect of some institutions proved to be straightforward and corresponds with our initial hypotheses based on previous theoretical and empirical research, some of the variables showed a rather ambiguous impact.

Our results confirm economic theory and previous empirical analyses that stricter employment protection legislation tends to stimulate shadow production and employment. The EPL coefficient is the most consistent across the models and sub-samples and indicates that countries with stricter legislation that makes labor markets more rigid and cumbersome will indeed end up with a larger shadow sector, no matter how measured.

Effects of other variables are less unambiguous and statistically robust. The higher trade union density effect is not clear, as the sign of the regression coefficient differs across models and samples. Theoretically, both negative and positive effects of trade unionization might be justified. The negative influence of unions on shadow employment may reflect their strength in preventing more flexible forms of employment to be offered by firms, while the positive effect would be consistent with the “insider vs. outsider” arguments: unionized labor fights to keep expensive benefits and tends to increase labor costs, that makes it difficult for employers to offer formal employment. Our empirical results do not provide a robust answer to this dilemma.

Similarly, larger passive labor market policy expenditure also has an ambiguous effect on examined variables, tending to increase shadow employment and reduce shadow production. Effects of the active labor market policy expenditures are almost opposite to the passive ones. They tend to reduce shadow employment in general and in the old European sample in particular, but the NMS group seems to register an opposite direction of this effect. The effect on shadow production is, on the other hand, positive. The positive effect of labor market policies in general might be determined by potential inefficiency in their provision, enabling people and firms to simultaneously take part in the programs and engage in informal activities

as well. In contrast, negative impact on reducing shadow economy might stem from improved efficiency of labor market functioning and better job-matching process.

Minimum wage also exhibited ambiguous impact on shadow economic activities in our estimations. Generally, negative influence on shadow production tends to prevail, but robustness of this finding is limited by significantly positive effect on shadow employment registered in the NMS group. Theoretically, positive effect on shadow employment would be expected driven by adverse effects of the minimum wage in terms of formal employment potential of low-productivity workers. Yet, the negative effect on shadow production might result from its potential pressure towards productivity increases in the formal sector covered by the minimum wage.

Last of the labor market institutional variables, taxation of labor, proved to have a significant negative impact both on shadow production and employment. This counterintuitive and controversial result was also reported in several previous studies on this topic using comparable tax variables (for a detailed study see e.g. Friedman et al., 2000) and might be explained by the positive effect of higher taxation on improving quality of public services and provision of a better legal environment, offsetting the potential impact on lower motivation of economic subjects to engagement in formal sector. In our sample, moreover, several low-income countries with larger shadow economies have lowered their taxes recently, and their low income and large informal sector are not consequences of low taxes, but rather of a long socialist experiment (characterized, among others, by high taxes).

Further, our results show that the level of economic development measured by GDP per capita has a significant negative impact on shadow production in Europe. This finding is in line with previous economic research on this topic. However, the effect of this factor on shadow employment is not clear, as the results differ across the models. While a similar, negative influence was registered for shadow employment proxied by the share of labor force employed without a legal written contract, opposite direction of this effect seems to be the case for shadow employment proxied by the share of labor force not contributing to the pension system. Positive effect contradicts results of previous economic research on this topic. Potential explanation of this counterintuitive result is that increasingly generous pension benefits, unrelated to life-time contributions to the system, made contributing to the pension systems in rich European countries redundant as the eventual pensions reflect non-contributing periods only partially. Yet, this result must be taken carefully and should be subjected to further research.

Among the variables describing political environment of the European countries, larger fiscal freedom proved to have a significant impact on reducing shadow production and employment. Apparently, lower fiscal burden imposed by the countries is connected with smaller incentive for informal behavior. This finding seems to contradict the labor taxes result, but labor taxation is only one of three components of fiscal freedom that takes into account also corporate income taxation and total tax revenue as a percentage of GDP. Furthermore, the effects of level of business freedom and regulatory quality proved to be ambiguous in our analyses as the estimated coefficients are not robust in different model specifications. Finally, the effect of control of corruption seems to differ between the old Europe and the NMS groups. While better control of corruption seems to boost share of shadow production in the NMS group, it has an opposite effect in old member countries. The counterintuitive outcome for the NMS group suggests that the development in post-socialist countries (NMS group) may have a different nature than in more “traditional” developing countries, where the negative relationship between control of corruption and informality prevails in empirical

literature. Countries in our sample were generally reducing the role of the state during their development, as they set out to reform their former centrally-planned system. This state retrenchment, often compounded by mass-scale privatization, increases the space available for informal sector and provided motivation for informal private sector to expand. Our results should, therefore, be interpreted carefully and in context of economic transition that took place in Central and Eastern Europe. Moreover, one has to bear in mind substantial shortcomings of the data utilized in our estimations, as was described in the paper.

Results of applied Chow tests examining the potential differences in the role of explanatory variables between the NMS and old European countries are inconclusive. Generally, we were not able to reject the hypothesis of stability of regression coefficients between these two groups of countries in all the tested models. Yet, some of the estimated coefficients suggest different behavior of the two groups of countries but with the data available, we were not able to study this issue in detail and it remains open to further research.

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Annex 1 – Statistics on shadow economy

Shadow economy in Europe: % of official GDP, 1999-2007

	Years									Country average
	1999	2000	2001	2002	2003	2004	2005	2006	2007	
Austria	10.4	10.1	9.9	9.8	9.8	9.8	9.8	10.0	10.1	9.8
Belgium	23.1	22.8	22.3	22.4	22.4	22.6	22.6	22.9	23.1	22.5
Bulgaria	37.2	36.9	37.2	37.7	38.3	39	39.7	40.4	41.2	38.5
Cyprus	29.3	28.7	29.2	29.6	29.2	29.3	29.7	30.1	30.8	29.4
Czech Republic	19.5	19.1	19.3	19.4	19.5	19.8	20.4	20.9	21.2	19.8
Denmark	18.9	18.1	18.0	18.0	18.0	18.2	18.4	18.9	19.0	18.2
Estonia	n.a.	31.6	38.8	39.3	40.0	40.3	41.1	41.9	42.3	40.3
Finland	19.3	18.3	18.3	18.4	18.5	18.6	18.8	19.1	19.2	18.5
France	15.9	15.4	15.4	15.3	15.4	15.5	15.6	15.6	15.7	15.4
Germany	17.1	16.6	16.1	16.0	15.8	15.9	16	16.4	16.7	16.1
Greece	29.1	29.3	29.2	29.4	30.0	30.4	30.6	31.0	31.0	29.9
Hungary	25.4	25.1	25.4	25.7	25.8	26.1	26.2	26.5	26.4	25.8
Ireland	16.9	16.2	15.9	15.9	15.8	16.0	16.2	16.3	16.4	16.0
Italy	28.5	27.5	27.5	27.4	27.2	27.2	27.1	27.3	27.4	27.2
Latvia	31.9	31.6	40.4	40.9	41.4	42.0	42.7	43.7	44.3	41.7
Lithuania	33.9	33.7	30.7	31.2	31.9	32.2	32.8	33.4	34.0	31.9
Luxembourg	10.4	10.1	9.8	9.8	9.8	9.8	9.9	10.0	10.2	9.9
Malta	27.5	27.1	26.9	27.0	26.7	26.7	26.9	27.2	27.7	27.0
Netherlands	14.2	13.4	13.1	13.0	12.9	13.0	13.0	13.0	13.2	13.0
Norway	19.2	18.5	19.2	19.2	19.2	19.7	19.7	20.0	20.2	19.5
Poland	27.8	27.6	27.6	27.5	27.7	27.9	28.3	28.7	29.1	28.0
Portugal	22.9	22.2	22.8	22.7	22.4	22.3	22.2	22.2	22.5	22.5
Romania	34.1	34.4	35.1	35.4	36.1	37.0	37.3	38.3	38.9	36.3
Slovak Republic	19.0	18.9	19.0	19.2	19.5	19.7	20.2	20.6	21.1	19.7
Slovenia	27.2	27.1	27.5	27.6	27.8	28.0	28.4	28.9	29.5	28.0
Spain	24.0	22.9	22.9	23.0	23.0	22.9	23.0	23.0	23.1	22.9
Sweden	20.1	19.6	19.3	19.4	19.6	19.9	19.8	20.2	20.4	19.6
United Kingdom	13.1	12.5	12.8	12.8	12.9	13.0	13.0	13.1	13.2	12.9

Source: Schneider et al. (2010)

Informal employment in Europe: share of labor force not contributing to pension system (%) adjusted for the unemployment rate, 2007

	Labor force without pension system contributions (%)	Unemployment rate (%)	Labor force without pension system contributions (%), adjusted for unemployment rate
Austria	11.06	4.40	6.66
Belgium	21.49	7.50	13.99
Bulgaria	n.a.	6.90	n.a.
Cyprus	20.26	4.00	16.26
Czech Republic	15.17	5.30	9.87
Denmark	5.95	3.80	2.15
Estonia	10.34	4.70	5.64
Finland	10.85	6.90	3.95
France	n.a.	8.40	n.a.
Germany	n.a.	8.40	n.a.
Greece	38.60	8.30	30.30
Hungary	14.45	7.40	7.05
Ireland	23.32	4.60	18.72
Italy	23.57	6.10	17.47
Latvia	15.85	6.00	9.85
Lithuania	n.r.	4.30	n.r.
Luxembourg	n.r.	4.20	n.r.
Malta	n.a.	6.40	n.a.
Netherlands	6.79	3.20	3.59

Norway	6.44	2.50	3.94
Poland	n.r.	9.60	n.r.
Portugal	n.r.	8.10	n.r.
Romania	n.a.	6.40	n.a.
Slovak Republic	16.53	11.10	5.43
Slovenia	10.90	4.90	6.00
Spain	24.00	8.30	15.70
Sweden	6.88	6.10	0.78
United Kingdom	n.r.	5.30	n.r.

Source: Eurostat: European Union-Statistics on Income and Living Conditions (EU-SILC), own calculations
Note: n.a. – data not available, n.r. – data not reliable due to divergent development in time or too low value compared with the unemployment rate.

Informal employment in Europe: share of labor force working in small firms or being self-employed (%), 2006-2007

	Workers in firms with less than 10 employees (% of labor force)		Self-employers (% of labor force)	
	2006	2007	2006	2007
Austria	30.09	30.28	11.48	11.43
Belgium	19.84	19.38	12.42	12.52
Bulgaria	18.47	18.66	10.80	10.47
Cyprus	37.82	38.89	18.43	17.90
Czech Republic	23.54	22.92	14.36	14.74
Denmark	21.15	20.86	8.04	8.18
Estonia	18.21	18.17	7.37	8.32
Finland	28.56	28.41	11.31	11.64
France	25.41	25.74	9.37	9.24
Germany	21.17	20.94	10.10	10.02
Greece	46.60	47.24	27.20	26.91
Hungary	25.26	26.57	11.27	11.06
Ireland	27.31	n.a.	15.17	15.65
Italy	31.83	31.98	22.90	22.78
Latvia	25.52	32.57	9.33	8.62
Lithuania	16.97	15.86	12.58	11.42
Luxembourg	15.43	17.95	7.29	6.78
Malta	n.a.	n.a.	n.a.	n.a.
Netherlands	17.24	17.38	11.88	12.05
Norway	95.05	96.35	7.89	7.44
Poland	20.36	21.34	17.14	17.39
Portugal	33.12	33.59	21.47	21.58
Romania	23.89	23.80	19.20	19.82
Slovak Republic	27.70	27.66	10.90	11.41
Slovenia	22.04	20.78	10.65	10.57
Spain	33.77	32.98	15.12	15.26
Sweden	21.75	21.70	9.69	9.68
United Kingdom	19.39	19.59	12.06	12.28

Source: Eurostat: Labor Force Surveys, own calculations
Note: n.a. – data not available.

Informal employment in Europe: share of labor force employed on temporary contract basis or without a legal contract (%), 2001-2007

	Years							Country average
	2001	2002	2003	2004	2005	2006	2007	
Austria	7.05	6.43	6.25	8.23	7.88	7.81	7.62	7.32
Belgium	7.46	6.45	7.25	7.41	7.51	7.41	7.37	7.27
Bulgaria	5.58	4.95	5.33	6.64	5.46	5.40	4.50	5.41
Czech Republic	6.90	6.95	7.62	7.92	7.26	7.30	7.20	7.31

Denmark	8.48	8.05	8.59	8.96	8.97	8.08	7.95	8.44
Estonia	2.65	2.08	2.73	2.72	2.45	2.53	1.94	2.44
Finland	15.58	15.01	15.59	14.95	15.87	15.68	14.39	15.30
France	13.31	12.67	11.92	11.61	12.61	12.91	13.20	12.60
Germany	..	10.87	11.01	11.17	12.60	12.29	12.83	11.80
Greece	8.12	7.16	6.91	7.88	7.52	6.79	6.99	7.34
Hungary	6.44	6.47	6.47	5.92	6.07	5.88	6.39	6.23
Ireland	3.79	4.00	3.85	2.79	n.a.	n.a.	7.47	4.38
Italy	6.88	7.16	6.92	8.55	8.98	9.67	9.77	8.28
Latvia	6.06	10.05	8.24	7.94	7.43	6.33	3.73	7.11
Lithuania	5.26	5.98	6.38	5.37	4.61	3.80	3.06	4.92
Luxembourg	4.04	3.95	2.88	4.40	4.86	5.59	6.33	4.58
Netherlands	12.64	12.66	12.81	12.80	13.55	13.57	14.70	13.25
Norway	8.39	9.38	8.78	9.41	8.82	9.68	9.38	9.12
Poland	8.60	11.13	13.82	16.58	19.05	20.65	21.59	15.92
Portugal	14.41	15.69	15.03	14.72	14.51	15.53	16.88	15.25
Romania	1.61	0.55	1.28	1.79	1.55	1.20	1.06	1.29
Slovak Republic	4.60	4.37	4.49	4.82	4.35	4.47	4.42	4.50
Slovenia	10.83	12.33	11.75	15.20	14.76	14.47	15.57	13.56
Spain	25.61	25.90	25.98	26.25	27.28	26.94	24.99	26.14
Sweden	14.08	13.98	14.14	14.04	11.73	12.87	13.12	13.42
United Kingdom	5.98	5.45	5.15	5.06	4.87	4.93	5.08	5.22

Source: Eurostat: Labor Force Surveys, own calculations

Note: n.a. – data not available.

Comparison of indicators: shadow production (% of GDP) vs. shadow employment in Europe (share of labor force not contributing to pension system adjusted for the unemployment rate, %), 2007

	Labor force without pension system contributions (%) (CONTRIB)	Shadow economy (% GDP) (SHEC)	Ranking CONTRIB	Ranking SHEC	Difference in ranking
Austria	6.7	9.5	9	1	8
Belgium	14.0	21.3	13	10	3
Cyprus	16.3	26.5	15	14	1
Czech Republic	9.9	17.0	12	6	6
Denmark	2.1	16.9	2	5	-3
Estonia	5.6	29.5	7	18	-11
Finland	4.0	17.0	5	6	-1
Greece	30.3	26.5	18	14	4
Hungary	7.0	23.7	10	12	-2
Ireland	18.7	15.4	17	3	14
Italy	17.5	26.8	16	16	0
Latvia	9.9	27.2	11	17	-6
Netherlands	3.6	13.0	3	2	1
Norway	3.9	18.0	4	9	-5
Slovak Republic	5.4	16.8	6	4	2
Slovenia	6.0	24.7	8	13	-5
Spain	15.7	22.2	14	11	3
Sweden	0.8	17.9	1	8	-7

Source: Schneider et al. (2010), Eurostat: European Union-Statistics on Income and Living Conditions (EU-SILC), own calculations

Note: countries with absolute value of difference in ranking higher than 5 marked red.

Annex 2 – Labor institutional variables – development in European countries in 2000-2007

Implicit tax rate on labor incomes (%), 2000-2007

	2000	2001	2002	2003	2004	2005	2006	2007	2000-2007 average	2000-2002 average (1)	2005-2007 average (2)	Difference (2) - (1)
Austria	40.1	40.6	40.8	40.8	41.0	40.8	40.8	41.0	40.7	40.5	40.9	0.4
Belgium	43.9	43.5	43.6	43.4	44.0	43.8	42.7	42.3	43.4	43.7	42.9	-0.7
Bulgaria	38.7	34.3	32.9	35.5	36.3	34.7	30.6	29.9	34.1	35.3	31.7	-3.6
Cyprus	21.5	22.8	22.2	22.7	22.7	24.5	24.1	24.0	23.1	22.2	24.2	2.0
Czech Republic	40.7	40.3	41.2	41.4	41.8	41.7	41.1	41.4	41.2	40.7	41.4	0.7
Denmark	41.0	40.8	38.8	38.1	37.5	37.1	37.1	37.0	38.4	40.2	37.1	-3.1
Estonia	37.8	37.3	37.8	36.9	36.1	34.1	33.9	33.8	36.0	37.6	33.9	-3.7
Finland	44.1	44.1	43.8	42.5	41.5	41.5	41.6	41.4	42.6	44.0	41.5	-2.5
France	42.1	41.7	41.2	41.5	41.4	41.9	41.9	41.3	41.6	41.7	41.7	0.0
Germany	40.7	40.5	40.4	40.4	39.2	38.8	39.0	39.0	39.8	40.5	38.9	-1.6
Greece	34.5	34.6	34.4	35.6	33.7	34.2	35.1	35.5	34.7	34.5	34.9	0.4
Hungary	41.4	40.9	41.2	39.3	38.3	38.4	38.8	41.2	39.9	41.2	39.5	-1.7
Ireland	28.5	27.4	26.0	25.0	26.3	25.4	25.4	25.7	26.2	27.3	25.5	-1.8
Italy	43.7	43.6	43.5	43.4	43.1	42.9	42.5	44.0	43.3	43.6	43.1	-0.5
Latvia	36.7	36.5	37.8	36.6	36.7	33.2	33.1	31.0	35.2	37.0	32.4	-4.6
Lithuania	41.2	40.2	38.1	36.9	36.0	34.9	33.6	32.3	36.7	39.8	33.6	-6.2
Luxembourg	29.9	29.6	28.3	29.3	29.5	30.4	30.7	31.2	29.9	29.3	30.8	1.5
Malta	20.6	21.4	20.8	20.4	21.0	21.3	21.3	20.1	20.9	20.9	20.9	0.0
Netherlands	34.5	30.6	30.9	31.5	31.4	31.6	34.6	34.3	32.4	32.0	33.5	1.5
Norway	n.a.	n.a.	38.7	39.0	39.2	38.5	37.9	37.8	38.5	38.7	38.1	-0.6
Poland	33.6	33.2	32.4	32.7	32.7	33.1	34.2	35.0	33.4	33.1	34.1	1.0
Portugal	27.0	27.4	27.6	27.8	27.9	28.1	28.6	30.0	28.1	27.3	28.9	1.6
Romania	32.2	31.8	31.1	29.5	28.9	28.0	30.4	30.1	30.3	31.7	29.5	-2.2
Slovakia	36.3	37.1	36.7	36.1	34.5	32.9	30.5	30.9	34.4	36.7	31.4	-5.3
Slovenia	37.7	37.5	37.6	37.7	37.5	37.6	37.4	36.9	37.5	37.6	37.3	-0.3
Spain	28.7	29.5	29.8	29.9	29.9	30.3	30.8	31.6	30.1	29.3	30.9	1.6
Sweden	47.2	46.2	44.8	44.7	44.7	45.0	44.5	43.1	45.0	46.1	44.2	-1.9
United Kingdom	25.3	25.0	24.1	24.3	24.8	25.5	25.8	26.1	25.1	24.8	25.8	1.0
Total average	35.9	35.5	35.2	35.1	34.9	34.7	34.6	34.6	35.1	35.5	34.6	-1.0
Old Europe average	36.7	36.3	36.0	36.1	35.9	36.0	36.2	36.3	36.2	36.5	36.2	-0.3
NMS average	34.9	34.4	34.2	33.8	33.5	32.9	32.4	32.2	33.5	34.5	32.5	-2.0

Source: Eurostat, own calculations

Note: n.a. – data not available.

Employment protection legislation index, version 2, 2000-2007

	2000	2001	2002	2003	2004	2005	2006	2007	2000-2007 average	2000-2002 average (1)	2005-2007 average (2)	Difference (2) - (1)
Austria	2.4	2.4	2.4	2.2	2.2	2.2	2.2	2.2	2.2	2.4	2.2	-0.2
Belgium	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.0
Czech Republic	1.9	1.9	1.9	1.9	1.9	2.1	2.1	2.0	2.0	1.9	2.1	0.1
Denmark	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.8	1.9	1.9	1.8	-0.1
Finland	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	0.0
France	2.8	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	0.0
Germany	2.6	2.6	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.5	2.4	-0.1
Greece	3.5	3.5	3.5	2.8	2.8	2.8	2.8	2.8	3.1	3.5	2.8	-0.6
Hungary	1.5	1.5	1.5	1.8	1.8	1.8	1.8	1.9	1.7	1.5	1.8	0.2
Ireland	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.3	0.2
Italy	2.9	2.5	2.5	2.3	2.3	2.3	2.3	2.3	2.4	2.6	2.3	-0.3
Netherlands	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.2	2.3	2.3	2.2	0.0
Norway	2.6	2.6	2.6	2.6	2.6	2.6	2.7	2.7	2.6	2.6	2.7	0.1

Poland	1.9	1.9	1.7	2.1	2.2	2.2	2.2	2.2	2.0	1.8	2.2	0.4
Portugal	3.5	3.5	3.5	3.5	3.4	3.4	3.4	3.4	3.4	3.5	3.4	-0.2
Slovak Republic	2.2	2.2	2.2	1.7	1.7	1.7	1.7	1.7	1.9	2.2	1.7	-0.4
Spain	3.0	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.0
Sweden	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.0
United Kingdom	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.0
Bulgaria*	2.8	n.a.	n.a.	2.0	n.a.	n.a.	n.a.	1.9	2.2	2.8	1.9	-0.9
Estonia*	2.4	n.a.	n.a.	2.6	n.a.	n.a.	n.a.	2.3	2.4	2.4	2.3	-0.1
Lithuania*	2.7	n.a.	n.a.	2.8	n.a.	n.a.	n.a.	2.8	2.8	2.7	2.8	0.1
Latvia*	2.5	n.a.	n.a.	2.5	n.a.	n.a.	n.a.	2.6	2.5	2.5	2.6	0.1
Romania*	2.0	n.a.	n.a.	2.8	n.a.	n.a.	n.a.	3.0	2.6	2.0	3.0	1.0
Slovenia*	3.3	n.a.	n.a.	2.5	n.a.	n.a.	n.a.	2.6	2.8	3.3	2.6	-0.7
Total average	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	-0.1
Old Europe average	2.5	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.4	2.4	2.3	-0.1
NMS-4 average	1.9	1.9	1.8	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	0.1

Source: OECD, IZA (*), own calculations

Note: n.a. – data not available; * data for year 2000 refer to year 1999

Monthly minimum wage as a proportion of the mean value of average monthly earnings in industry and service sector, %, 2000-2007

	2000	2001	2002	2003	2004	2005	2006	2007	2000-2007 average	2000-2002 average (1)	2005-2007 average (2)	Difference (2) - (1)
Austria	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Belgium	48.8	47.5	47.6	46.2	45.5	45.7	45.5	45.3	46.5	48.0	45.5	-2.5
Bulgaria	32.2	35.4	38.8	40.4	41.4	46.6	44.7	42.1	40.2	35.5	44.5	9.0
Cyprus	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Czech Republic	31.0	34.2	36.9	38.1	38.4	39.1	39.7	38.1	36.9	34.0	39.0	4.9
Denmark	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Estonia	n.a.	n.a.	30.5	32.4	34.6	33.2	30.5	30.4	n.a.	n.a.	n.a.	n.a.
Finland	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
France	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	48.1	n.a.	n.a.	n.a.	n.a.
Germany	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Greece	56.2	52.9	54.7	48.6	47.5	48.6	47.7	46.3	50.3	54.6	47.5	-7.1
Hungary	n.a.	n.a.	42.1	42.2	41.2	41.3	41.7	39.8	41.4	42.1	40.9	-1.2
Ireland	n.a.	n.a.	n.a.	43.4	n.a.	n.a.	39.7	38.6	n.a.	n.a.	n.a.	n.a.
Italy	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Latvia	34.8	39.7	37.4	39.9	41.9	36.2	33.3	34.2	37.2	37.3	34.6	-2.7
Lithuania	44.9	44.7	43.7	42.1	45.4	44.9	42.1	38.7	43.3	44.4	41.9	-2.5
Luxembourg	n.a.	n.a.	45.5	46.6	46.0	46.8	46.2	46.8	46.3	45.5	46.6	1.1
Malta	44.6	36.9	44.9	48.2	47.4	50.5	50.4	49.0	46.5	42.1	50.0	7.8
Netherlands	n.a.	n.a.	49.3	47.7	46.1	45.5	44.1	44.2	n.a.	n.a.	n.a.	n.a.
Norway	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Poland	n.a.	n.a.	33.0	33.9	35.1	33.7	36.1	32.4	n.a.	n.a.	n.a.	n.a.
Portugal	43.6	43.3	43.0	40.7	40.0	40.5	40.7	41.6	41.7	43.3	40.9	-2.4
Romania	26.3	30.9	31.3	37.3	34.4	32.6	30.2	29.1	31.5	29.5	30.6	1.1
Slovakia	n.a.	n.a.	32.4	34.0	34.1	34.4	34.8	n.a.	n.a.	n.a.	n.a.	n.a.
Slovenia	43.5	44.5	45.3	45.8	45.9	46.2	45.2	43.4	45.0	44.4	44.9	0.5
Spain	34.7	34.2	33.5	32.9	33.6	35.1	35.8	36.5	34.5	34.1	35.8	1.7
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	34.2	33.0	34.6	34.5	36.5	37.9	37.9	38.9	35.9	33.9	38.2	4.3
Total average	39.6	39.8	40.3	40.8	40.8	41.0	40.3	40.2	40.3	39.9	40.5	0.7
Old Europe average	43.5	42.2	44.0	42.6	42.2	42.9	42.2	42.9	42.8	43.2	42.7	-0.6
NMS average	36.8	38.0	37.8	39.5	40.0	39.9	39.0	37.7	38.6	37.5	38.9	1.3

Source: Eurostat, own calculations

Note: n.a. – data not available

Trade union density, %, 2000-2007

	2000	2001	2002	2003	2004	2005	2006	2007	2000-2007 average	2000-2002 average (1)	2005-2007 average (2)	Difference (2) - (1)
Austria	36.5	35.7	35.4	34.4	34.1	33.0	31.7	n.a.	34.4	35.9	32.4	-3.5
Belgium	49.3	49.9	51.2	52.2	52.9	52.9	54.1	52.9	51.9	50.1	53.3	3.2
Czech Republic	29.5	25.6	21.7	22.0	22.3	21.6	21.0	21.0	23.1	25.6	21.2	-4.4
Denmark	74.2	73.8	73.2	72.4	71.7	71.7	69.4	69.1	71.9	73.7	70.1	-3.7
Finland	75.0	74.5	73.5	72.9	73.3	72.4	71.7	70.3	73.0	74.3	71.5	-2.9
France	8.3	8.2	8.4	8.2	8.0	8.0	7.9	7.8	8.1	8.3	7.9	-0.4
Germany	24.6	23.7	23.5	23.0	22.2	21.6	20.7	19.9	22.4	23.9	20.7	-3.2
Greece	27.0	26.1	25.3	24.4	23.7	23.0	n.a.	n.a.	24.9	26.1	23.0	-3.1
Hungary	24.2	22.5	20.5	18.5	18.2	17.8	17.3	16.9	19.5	22.4	17.3	-5.1
Ireland	39.3	38.2	36.3	37.9	35.7	34.2	32.6	31.7	35.7	37.9	32.8	-5.1
Italy	34.7	34.2	33.6	33.5	33.9	33.8	33.4	33.3	33.8	34.2	33.5	-0.7
Luxembourg	43.1	42.9	42.6	42.4	42.1	41.8	n.a.	n.a.	42.5	42.9	41.8	-1.1
Netherlands	22.6	21.9	21.7	21.2	21.3	21.0	20.4	19.8	21.2	22.1	20.4	-1.7
Norway	54.4	53.9	54.5	55.1	55.0	54.9	54.9	53.7	54.6	54.3	54.5	0.2
Poland	21.8	17.6	18.4	19.2	17.4	15.8	14.4	14.4	17.4	19.3	14.9	-4.4
Portugal	19.6	19.3	19.1	18.9	18.7	n.a.	n.a.	n.a.	19.1	19.3	n.a.	n.a.
Slovak Republic	36.3	32.8	31.1	29.9	27.8	25.8	23.6	23.6	28.9	33.4	24.3	-9.1
Spain	16.7	15.9	16.0	15.8	15.5	15.0	14.6	n.a.	15.6	16.2	14.8	-1.4
Sweden	79.1	78.0	78.0	78.0	77.3	76.5	75.1	70.8	76.6	78.4	74.1	-4.2
United Kingdom	29.6	29.1	29.1	29.0	28.8	28.8	28.2	28.0	28.8	29.3	28.3	-0.9
Bulgaria*	26.0	n.a.	n.a.	21.9	n.a.	n.a.	n.a.	21.3	23.1	26.0	21.3	-4.7
Estonia*	20.0	n.a.	n.a.	15.0	n.a.	n.a.	n.a.	13.2	16.1	20.0	13.2	-6.8
Lithuania*	24.1	n.a.	n.a.	16.8	n.a.	n.a.	n.a.	14.4	18.4	24.1	14.4	-9.7
Latvia*	26.0	n.a.	n.a.	17.9	n.a.	n.a.	n.a.	16.1	20.0	26.0	16.1	-9.9
Romania*	46.1	n.a.	n.a.	38.5	n.a.	n.a.	n.a.	33.7	39.4	46.1	33.7	-12.4
Slovenia*	43.0	n.a.	n.a.	41.3	n.a.	n.a.	n.a.	44.0	42.8	43.0	44.0	1.0
Total average	37.3	36.2	35.7	35.4	35.0	35.2	34.8	35.5	35.6	36.4	35.2	-1.2
Old Europe average	39.6	39.1	38.8	38.7	38.4	39.2	39.6	41.6	39.4	39.2	40.1	1.0
NMS average	28.0	24.6	22.9	22.4	21.4	20.3	19.1	19.0	22.2	25.2	19.4	-5.7

Source: OECD, IZA (*), own calculations

Note: n.a. – data not available; * data for year 2000 refer to year 1999

Active labor market policy expenditure, % of GDP per percentage point of unemployment, 2000-2007

	2000	2001	2002	2003	2004	2005	2006	2007	2000-2007 average	2000-2002 average (1)	2005-2007 average (2)	Difference (2) - (1)
Austria	0.108	0.121	0.098	0.106	0.090	0.089	0.113	0.117	0.105	0.109	0.106	-0.003
Belgium	n.a.	n.a.	n.a.	n.a.	0.115	0.114	0.122	0.144	0.124	n.a.	0.127	n.a.
Bulgaria	n.a.	n.a.	n.a.	n.a.	0.038	0.043	0.043	0.044	0.042	n.a.	0.043	n.a.
Cyprus	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.012	0.022	0.017	n.a.	0.017	n.a.
Czech Republic	n.a.	n.a.	0.016	0.015	0.016	0.015	0.018	0.023	0.017	0.016	0.019	0.003
Denmark	0.404	0.381	0.378	0.300	0.276	0.263	0.311	0.269	0.323	0.388	0.281	-0.107
Estonia	n.a.	n.a.	n.a.	0.005	0.004	0.006	0.008	0.006	0.006	n.a.	0.007	n.a.
Finland	0.076	0.075	0.074	0.083	0.090	0.087	0.096	0.102	0.085	0.075	0.095	0.020
France	0.112	0.115	0.104	0.091	0.078	0.071	0.073	0.082	0.091	0.110	0.076	-0.035
Germany	0.137	0.135	0.123	0.101	0.086	0.056	0.060	0.060	0.095	0.132	0.059	-0.073
Greece	0.021	0.023	0.017	0.009	0.013	0.006	0.016	0.018	0.015	0.020	0.013	-0.007
Hungary	n.a.	n.a.	n.a.	n.a.	0.033	0.028	0.026	0.028	0.029	n.a.	0.027	n.a.
Ireland	0.154	0.181	0.140	0.118	0.110	0.108	0.101	0.102	0.127	0.159	0.104	-0.055
Italy	0.056	0.070	0.082	0.083	0.067	0.062	0.060	0.061	0.068	0.069	0.061	-0.008
Latvia	n.a.	n.a.	n.a.	0.008	0.008	0.018	0.027	0.018	0.016	n.a.	0.021	n.a.
Lithuania	n.a.	n.a.	n.a.	0.012	0.014	0.018	0.032	0.053	0.026	n.a.	0.034	n.a.
Luxembourg	0.082	0.099	0.077	0.083	0.072	0.088	0.085	0.090	0.084	0.086	0.087	0.001
Malta	n.a.	n.a.	n.a.	n.a.	0.072	n.a.	0.009	0.005	0.007	n.a.	0.007	n.a.
Netherlands	0.346	0.457	0.378	0.269	0.194	0.175	0.187	0.212	0.277	0.393	0.191	-0.202

Norway	0.154	0.151	0.153	0.159	0.150	0.137	0.137	0.180	0.153	0.153	0.151	-0.002
Poland	n.a.	n.a.	n.a.	n.a.	0.007	0.020	0.026	0.042	0.024	n.a.	0.029	n.a.
Portugal	0.093	0.119	0.086	0.080	0.082	0.067	0.058	0.048	0.079	0.099	0.058	-0.041
Romania	n.a.	n.a.	n.a.	0.016	0.012	0.015	0.014	0.012	0.014	n.a.	0.014	n.a.
Slovakia	n.a.	n.a.	n.a.	n.a.	0.004	0.010	0.011	0.011	0.009	n.a.	0.011	n.a.
Slovenia	n.a.	n.a.	n.a.	n.a.	n.a.	0.030	0.029	0.023	0.027	n.a.	0.027	n.a.
Spain	0.059	0.059	0.051	0.051	0.052	0.063	0.074	0.076	0.061	0.056	0.071	0.015
Sweden	0.270	0.244	0.224	0.153	0.133	0.141	0.162	0.146	0.184	0.246	0.149	-0.096
United Kingdom	n.a.	n.a.	n.a.	n.a.	0.013	0.011	0.008	0.009	0.010	n.a.	0.009	n.a.
Total average	0.148	0.159	0.133	0.092	0.070	0.067	0.069	0.071	0.101	0.147	0.069	-0.078
Old Europe average	0.148	0.159	0.142	0.120	0.101	0.096	0.104	0.107	0.122	0.150	0.102	-0.047
NMS average	n.a.	n.a.	n.a.	0.011	0.015	0.020	0.021	0.024	0.018	n.a.	0.022	n.a.

Source: Eurostat, own calculations

Note: n.a. – data not available.

Passive labor market policy expenditure, % of GDP per percentage point of unemployment, 2000-2007

	2000	2001	2002	2003	2004	2005	2006	2007	2000-2007 average	2000-2002 average (1)	2005-2007 average (2)	Difference (2) - (1)
Austria	0.330	0.334	0.300	0.323	0.290	0.292	0.292	0.284	0.305	0.321	0.289	-0.032
Belgium	0.306	0.323	0.309	0.299	0.283	0.274	0.262	0.266	0.290	0.312	0.267	-0.045
Bulgaria	n.a.	n.a.	n.a.	n.a.	0.022	0.021	0.020	0.022	0.021	n.a.	0.021	n.a.
Cyprus	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.143	0.117	0.130	n.a.	0.130	n.a.
Czech Republic			0.038	0.039	0.030	0.031	0.032	0.038	0.035	0.038	0.034	-0.004
Denmark	0.554	0.505	0.502	0.493	0.484	0.488	0.477	0.394	0.487	0.520	0.453	-0.067
Estonia	n.a.	n.a.	n.a.	0.019	0.018	0.015	0.014	0.021	0.017	n.a.	0.016	n.a.
Finland	0.213	0.216	0.223	0.229	0.231	0.226	0.221	0.207	0.221	0.217	0.218	0.001
France	0.153	0.170	0.183	0.192	0.183	0.170	0.150	0.148	0.169	0.169	0.156	-0.013
Germany	0.252	0.253	0.255	0.245	0.237	0.219	0.213	0.193	0.233	0.253	0.209	-0.045
Greece	0.035	0.033	0.032	0.038	0.038	0.041	0.043	0.040	0.038	0.033	0.041	0.008
Hungary	n.a.	n.a.	n.a.	0.061	0.061	0.054	0.048	0.048	0.054	n.a.	0.050	n.a.
Ireland	0.190	0.183	0.185	0.192	0.198	0.188	0.190	0.198	0.191	0.186	0.192	0.006
Italy	0.061	0.067	0.077	0.077	0.092	0.105	0.116	0.117	0.089	0.068	0.113	0.044
Latvia	n.a.	n.a.	n.a.	0.035	0.036	0.035	0.043	0.048	0.039	n.a.	0.042	n.a.
Lithuania	n.a.	n.a.	n.a.	0.012	0.010	0.015	0.022	0.026	0.017	n.a.	0.021	n.a.
Luxembourg	0.196	0.245	0.193	0.156	0.128	0.142	0.128	0.124	0.164	0.211	0.131	-0.080
Malta	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.057	0.056	0.057	n.a.	0.057	n.a.
Netherlands	0.625	0.761	0.610	0.527	0.456	0.427	0.437	0.434	0.535	0.665	0.433	-0.233
Norway	0.157	0.159	0.179	0.206	0.196	0.190	0.146	0.166	0.175	0.165	0.167	0.003
Poland	n.a.	n.a.	n.a.	n.a.	0.042	0.048	0.051	0.053	0.049	n.a.	0.051	n.a.
Portugal	0.206	0.238	0.192	0.194	0.185	0.171	0.158	0.134	0.185	0.212	0.155	-0.057
Romania	n.a.	n.a.	n.a.	0.075	0.060	0.055	0.038	0.036	0.053	n.a.	0.043	n.a.
Slovakia	n.a.	n.a.	n.a.	n.a.	0.019	0.016	0.025	0.033	0.023	n.a.	0.025	n.a.
Slovenia	n.a.	n.a.	n.a.	n.a.	n.a.	0.060	0.064	0.061	0.062	n.a.	0.062	n.a.
Spain	0.121	0.133	0.133	0.131	0.141	0.158	0.168	0.174	0.145	0.129	0.167	0.038
Sweden	0.239	0.180	0.169	0.179	0.174	0.154	0.137	0.109	0.168	0.196	0.133	-0.063
United Kingdom	0.055	0.051	0.048	0.045	0.039	0.038	0.034	0.030	0.043	0.051	0.034	-0.017
Total average	0.231	0.241	0.213	0.171	0.146	0.140	0.133	0.128	0.175	0.228	0.134	-0.095
Old Europe average	0.231	0.241	0.224	0.220	0.210	0.205	0.198	0.189	0.215	0.232	0.197	-0.035
NMS average	n.a.	n.a.	n.a.	0.040	0.033	0.035	0.046	0.047	0.040	n.a.	0.043	n.a.

Source: Eurostat, own calculations

Note: n.a. – data not available.

Annex 3 – Variables used in the analysis – definitions and data sources

SHADOW ECONOMY					
<i>Name</i>	<i>Abbreviation</i>	<i>Source</i>	<i>Years</i>	<i>Sample</i>	<i>Description</i>
Shadow economy as percentage share on official GDP	SHEC	Schneider et al. (2010)	1999-2007	S1+S2+S3	Estimations based on a Multiple Indicators Multiple Causes (MIMIC) model approach
Share of labor force not contributing to pension system	CONTRIB	Eurostat: European Union-Statistics on Income and Living Conditions (EU-SILC)	2007	S2+S3	Share of labor force not contributing to pension system (both private and public) adjusted for the unemployment rate (%)
Share of labor force working in small firms	LESS10	Eurostat: Labor Force Survey (LFS)	2006-2007	S1+S2+S3	Share of labor force working in small firms (under 10 employees; %)
Share of labor force being self-employers	SELFEMPL	Eurostat: Labor Force Survey (LFS)	2006-2007	S1+S2+S3	Share of labor force being self-employers (%)
Share of labor force employed without a legal contract	CONTRACT	Eurostat: Labor Force Survey (LFS)	2001-2007	S1+S2+S3	Share of labor force employed on temporary contract basis or without a legal contract (%)
LABOR MARKET INSTITUTIONS					
<i>Name</i>	<i>Abbreviation</i>	<i>Source</i>	<i>Years</i>	<i>Sample</i>	<i>Description</i>
Employment protection legislation	EPL2	OECD	2000-2007	S1+ S3	Employment protection legislation index, version 2, higher index reflects more rigid legislation.
Minimum wage	MWSH	OECD	2000-2007	S1	Minimum wage: share on median wage in the economy, cluster variable (0-3), higher score means greater burden of minimum wage (0 in case statutory minimum wage not implemented).
Trade union membership	TU	OECD	2000-2007	S1+ S3	Trade union membership, share of all workers (%).
Total tax wedge on labor	TAXW	OECD	2000-2007	S1+ S3	Total tax wedge on labor: average personal income tax and social security contribution rates on gross labor income, 100% of average wage. The combined central and sub-central government income tax plus employee and employer social security contribution taxes, as a percentage of labor costs defined as gross wage earnings plus employer social security contributions. The tax wedge includes cash transfers.
Active labor market policy expenditure	LMPA	OECD	2000-2007	S1+ S3	Active labor market policy expenditure (categories 20-70), % GDP per percentage point of unemployment
Passive labor market policy expenditure	LMPP	OECD	2000-2007	S1	Passive labor market policy expenditure (categories 80-90), % GDP per percentage point of unemployment
Labor freedom	EPL	Heritage Foundation	2006-2007	S2	Measure describing legal and regulatory framework of a country's labor market. Six quantitative factors are equally weighted, with each counted as one-sixth of the labor freedom component: 1) ratio of minimum wage to the average value added per worker, 2) hindrance to hiring additional workers, 3) rigidity of hours, 4) difficulty of firing redundant employees, 5) legally mandated notice period, 6) mandatory severance pay.
Minimum wage	MWPPS	Eurostat	2006-2007	S2+ S3	Minimum wage in PPS, cluster variable (0-4), higher score means greater burden of minimum wage (0 in case statutory minimum wage not implemented).
Implicit tax rate on labor	TAXR	Eurostat	2006-2007	S2	Total tax rate on labor computed as the ratio of total tax revenues of the category labor to a proxy of the potential tax base defined using the production and income accounts of the national accounts.
Active labor market policy expenditure	LMPA	Eurostat	2006-2007	S2	Active labor market policy expenditure (categories 20-70), % GDP per percentage point of unemployment.
Passive labor market policy expenditure	LMPP	Eurostat	2006-2007	S2 + S3	Passive labor market policy expenditure (categories 80-90), % GDP per percentage point of unemployment.
Employment protection legislation	EPL2	IZA	2007	S3	Employment protection legislation index, version 2, higher index reflects more rigid legislation.
Trade union membership	TU	IZA	2007	S3	Trade union membership, share of all workers (%).

Total tax wedge on labor	TAXW	IZA	2007	S3	Total tax wedge on labor: average personal income tax and social security contribution rates on gross labor income, 100% of average wage. The combined central and sub-central government income tax plus employee and employer social security contribution taxes, as a percentage of labor costs defined as gross wage earnings plus employer social security contributions. The tax wedge includes cash transfers.
Active labor market policy expenditure	LMPA	IZA	2007	S3	Active labor market policy expenditure (categories 20-70), % GDP per percentage point of unemployment.
CONTROL VARIABLES ON ECONOMIC-POLITICAL ENVIRONMENT					
Name	Abbreviation	Source	Years	Sample	Description
GDP per capita	GDPPC	World Bank	2000-2007	S1+ S2+ S3	Logarithm GDP per capita, purchasing power parities
Fiscal freedom	FISF	Heritage Foundation	2000-2007	S1+ S2+ S3	Measure of the tax burden imposed by government. Includes both the direct tax burden on individual and corporate incomes and the overall amount of tax revenue. Composed of three quantitative factors: 1) top tax rate on individual income, 2) top tax rate on corporate income, 3) total tax revenue as a percentage of GDP.
Business freedom	BUSF	Heritage Foundation	2000-2007	S1+ S2+ S3	Quantitative measure of the ability to start, operate, and close a business that represents the overall burden of regulation as well as the efficiency of government in the regulatory process. The business freedom score for each country is a number between 0 and 100, with 100 equaling the freest business environment. The score is based on 10 factors, all weighted equally, using data from the World Bank's Doing Business study.
Control of corruption	CORR	World Bank, Worldwide Governance Indicators	2000-2007	S1+ S2+ S3	The measure shows the extent to which public power is exercised for private gain, including petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. The higher the score, the better control of corruption. Data for 2001 interpolated from years 2000 and 2002.
Regulatory quality	REGQUAL	World Bank, Worldwide Governance Indicators	2000-2007	S1+ S2+ S3	Measure of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. The higher the score, the better regulatory quality. Data for 2001 interpolated from years 2000 and 2002.

Source: OECD, Eurostat, World Bank, Heritage Foundation, IZA

Note: specification of the samples (S1, S2 and S3) is given in text.

Annex 4 – Detailed description of applied regression models

Model 1.1

Dependent variable: shadow economy as percentage share on overall official GDP (*SHEC*)

Explanatory variables:

EPL2	OECD index, version 2
MWSH	OECD, share of minimum wage on median wage in the economy
TU	OECD, Trade union membership, % wage earners
TAXW	OECD, Total tax wedge on labor
LMPA	OECD, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	OECD, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	WB, GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2000-2007, S1 (15 old EU members, 4 NMS)

Model 1.2

Dependent variable: shadow economy as percentage share on overall official GDP (*SHEC*)

Explanatory variables:

EPL	Heritage Foundation, Labor freedom
MWPPS	Eurostat, minimum wage in PPS
TAXR	Eurostat, Implicit tax on labor
LMPA	Eurostat, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	Eurostat, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2006-2007, S2 (16 old EU members, 12 NMS)

Model 1.3

Dependent variable: shadow economy as percentage share on overall official GDP (*SHEC*)

Explanatory variables:

EPL2	OECD index, version 2
MWPPS	Eurostat, share of minimum wage on median wage in the economy
TU	OECD, Trade union membership, % wage earners
TAXW	OECD, Total tax wedge on labor
LMPA	OECD, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	OECD, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	WB, GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2003 and 2007, S3 (16 old EU members, 10 NMS)

Model 2.1

Dependent variable: share of labor force not contributing to the pension system – both public and private (*CONTRIB*)

Data sample: 2007, S1 - 9 countries only, **LACK OF DATA FOR REGRESISON ESTIMATION**

Model 2.2

Dependent variable: share of labor force not contributing to the pension system – both public and private (*CONTRIB*)

Explanatory variables:

EPL	Heritage Foundation, Labor freedom
MWPPS	Eurostat, minimum wage in PPS
TAXR	Eurostat, Implicit tax on labor

LMPA	Eurostat, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	Eurostat, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2007, S2 (11 old EU members, 7 NMS)

Model 2.3

Dependent variable: share of labor force not contributing to the pension system – both public and private (*CONTRIB*)

Explanatory variables:

EPL2	OECD index, version 2
MWPPS	Eurostat, share of minimum wage on median wage in the economy
TU	OECD, Trade union membership, % wage earners
TAXW	OECD, Total tax wedge on labor
LMPA	OECD, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	OECD, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	WB, GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2003 and 2007, S3 (11 old EU members, 6 NMS)

Model 3.1

Dependent variable: share of labor force employed in small firms with less than 10 employees (*LESS10*)

Explanatory variables:

EPL2	OECD index, version 2
MWSH	OECD, share of minimum wage on median wage in the economy
TU	OECD, Trade union membership, % wage earners
TAXW	OECD, Total tax wedge on labor
LMPA	OECD, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	OECD, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	WB, GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2000-2007, S1 (15 old EU members, 4 NMS)

Model 3.2

Dependent variable: share of labor force employed in small firms with less than 10 employees (*LESS10*)

Explanatory variables:

EPL	Heritage Foundation, Labor freedom
MWPPS	Eurostat, minimum wage in PPS
TAXR	Eurostat, Implicit tax on labor
LMPA	Eurostat, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	Eurostat, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2006-2007, S2 (16 old EU members, 11 NMS)

Model 3.3

Dependent variable: share of labor force employed in small firms with less than 10 employees (*LESS10*)

Explanatory variables:

EPL2	OECD index, version 2
MWPPS	Eurostat, share of minimum wage on median wage in the economy
TU	OECD, Trade union membership, % wage earners
TAXW	OECD, Total tax wedge on labor
LMPA	OECD, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	OECD, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	WB, GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2003 and 2007, S3 (15 old EU members, 9 NMS)

Model 4.1

Dependent variable: share of labor force being self-employers (*SELFEMPL*)

Explanatory variables:

EPL2	OECD index, version 2
MWSH	OECD, share of minimum wage on median wage in the economy
TU	OECD, Trade union membership, % wage earners
TAXW	OECD, Total tax wedge on labor
LMPA	OECD, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	OECD, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	WB, GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2000-2007, S1 (15 old EU members, 4 NMS)

Model 4.2

Dependent variable: share of labor force being self-employers (*SELFEMPL*)

Explanatory variables:

EPL	Heritage Foundation, Labor freedom
MWPPS	Eurostat, minimum wage in PPS
TAXR	Eurostat, Implicit tax on labor
LMPA	Eurostat, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	Eurostat, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2006-2007, S2 (16 old EU members, 11 NMS)

Model 4.3

Dependent variable: share of labor force being self-employers (*SELFEMPL*)

Explanatory variables:

EPL2	OECD index, version 2
MWPPS	Eurostat, share of minimum wage on median wage in the economy
TU	OECD, Trade union membership, % wage earners
TAXW	OECD, Total tax wedge on labor
LMPA	OECD, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	OECD, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	WB, GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2003 and 2007, S3 (16 old EU members, 9 NMS)

Model 5.1Dependent variable: share of labor force without a legal written contract (*CONTRACT*)

Explanatory variables:

EPL2	OECD index, version 2
MWSH	OECD, share of minimum wage on median wage in the economy
TU	OECD, Trade union membership, % wage earners
TAXW	OECD, Total tax wedge on labor
LMPA	OECD, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	OECD, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	WB, GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2000-2007, S1 (15 old EU members, 4 NMS)

Model 5.2Dependent variable: share of labor force without a legal written contract (*CONTRACT*)

Explanatory variables:

EPL	Heritage Foundation, Labor freedom
MWPPS	Eurostat, minimum wage in PPS
TAXR	Eurostat, Implicit tax on labor
LMPA	Eurostat, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	Eurostat, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2006-2007, S2 (16 old EU members, 11 NMS)

Model 5.3Dependent variable: share of labor force without a legal written contract (*CONTRACT*)

Explanatory variables:

EPL2	OECD index, version 2
MWPPS	Eurostat, share of minimum wage on median wage in the economy
TU	OECD, Trade union membership, % wage earners
TAXW	OECD, Total tax wedge on labor
LMPA	OECD, Active LMP expenditure, % GDP per percentage point of unemployment
LMPP	OECD, Passive LMP expenditure, % GDP per percentage point of unemployment
GDPPC	WB, GDP per capita, purchasing power parities
FISF	Heritage Foundation, Fiscal freedom
BUSF	Heritage Foundation, Business freedom
CORR	WB, Control of corruption
REGQUAL	WB, Regulatory quality

Data sample: 2003 and 2007, S3 (16 old EU members, 9 NMS)

Annex 5 – Pair-wise correlations between dependent and independent variables

Sample S1

	shec	contrib	less10	selfempl	contract
shec	1				
contrib	0.6016*	1			
less10	0.2611*	0.1083	1		
selfempl	0.6642*	0.9045*	0.4063*	1	
contract	0.1601	-0.0546	-0.0125	0.0596	1

	shec	contrib	less10	selfempl	contract
tax	0.1353	-0.1844	-0.1859*	-0.2421*	0.0183
epl	0.3478*	0.2557	0.3907*	0.3477*	0.5477*
tu	-0.1104	-0.4298	-0.035	-0.3489*	-0.0875
Impa	-0.3329*	-0.5016	-0.1359	-0.4035*	0.0745
Impp	-0.4478*	-0.3473	-0.2081*	-0.3785*	0.1296
mw	0.1551	0.6074*	-0.0339	0.2778*	-0.0477
Ingdppc	-0.5417*	-0.1287	0.1055	-0.3425*	0.0163
fisf	0.1734*	0.2627	0.0701	0.2995*	-0.1638*
busf	-0.3531*	-0.386	0.0114	-0.2620*	-0.1323
corr	-0.6557*	-0.5973*	-0.1551	-0.5771*	0.1561
regqual	-0.6919*	-0.5246	-0.2174*	-0.4956*	-0.0039

	tax	epl	tu	Impa	Impp	mw	Ingdppc	fisf	busf	corr	regqual
tax	1										
epl	0.2480*	1									
tu	0.0775	-0.1314	1								
Impa	-0.0051	0.0221	0.4855*	1							
Impp	0.0801	0.0551	0.3436*	0.8894*	1						
mw	-0.1751*	0.0262	-0.5391*	-0.1987*	-0.1656*	1					
Ingdppc	-0.1514	0.0283	0.4247*	0.5448*	0.5315*	-0.2704*	1				
fisf	-0.4106*	-0.3246*	-0.4858*	-0.6500*	-0.6114*	0.2840*	-0.4783*	1			
busf	-0.2618*	-0.3620*	0.4056*	0.2769*	0.2627*	-0.097	0.4422*	-0.1119	1		
corr	-0.0271	-0.0773	0.5869*	0.6381*	0.6646*	-0.3767*	0.7673*	-0.5431*	0.4836*	1	
regqual	-0.1836*	-0.3372*	0.4952*	0.5896*	0.6397*	-0.2346*	0.6966*	-0.3390*	0.5414*	0.8769*	1

Sample S2

	shec	contrib	less10	selfempl	contract
shec	1				
contrib	0.4152	1			
less10	-0.0074	0.1622	1		
selfempl	0.3750*	0.8856*	0.1286	1	
contract	-0.1448	-0.0216	0.0881	0.1535	1

	shec	contrib	less10	selfempl	contract
tax	-0.2292	-0.2937	0.0374	-0.1731	0.1432
epl	0.0361	-0.1167	0.1646	-0.0154	0.4042*
Impa	-0.4831*	-0.4058	0.114	-0.3410*	0.2023
Impp	-0.5483*	-0.2569	-0.0023	-0.1865	0.3041*
mw	-0.1831	0.3542	-0.2908*	0.0617	0.0789
Ingdppc	-0.7995*	-0.0741	0.2439	-0.2448	0.2338
fisf	0.5077*	0.2193	-0.1348	0.1163	-0.4433*
busf	-0.4702*	-0.3682	0.0742	-0.3931*	-0.0084
corr	-0.7627*	-0.5389*	0.0989	-0.4737*	0.2607
regqual	-0.7435*	-0.434	-0.0616	-0.4855*	-0.0022

	tax	epl	Impa	Impp	mw	Ingdppc	fisf	busf	corr	regqual
tax	1									
epl	0.0979	1								
Impa	0.3710*	-0.2107	1							
Impp	0.2666*	-0.1335	0.8745*	1						
mw	-0.3177*	0.0956	-0.1598	-0.0615	1					
Ingdppc	0.231	0.1195	0.5536*	0.5617*	0.1706	1				

fisf	-0.5247*	0.0248	-0.7248*	-0.6635*	0.0035	-0.6506*	1			
busf	0.2542	-0.026	0.6473*	0.5776*	-0.0512	0.5670*	-0.5273*	1		
corr	0.1907	0.1124	0.6925*	0.6965*	-0.0151	0.8206*	-0.6709*	0.7590*	1	
regqual	0.008	-0.1282	0.5744*	0.6033*	0.1006	0.7671*	-0.4390*	0.6998*	0.8834*	1

Sample S3

	shec	contrib	less10	selfempl	contract
shec	1				
contrib	0.3811	1			
less10	0.0447	0.1421	1		
selfempl	0.3593*	0.8799*	0.2558	1	
contract	-0.1484	-0.031	0.0791	0.0996	1

	shec	contrib	less10	selfempl	contract
tax	-0.1644	-0.1521	-0.1621	-0.2082	0.054
epl	0.2637	0.211	0.2661	0.2166	0.3202*
tu	-0.2606	-0.3635	0.072	-0.223	0.0231
lmpa	-0.4717*	-0.3923	0.0293	-0.3400*	0.2053
lmpp	-0.5470*	-0.2478	-0.0757	-0.2426	0.2683
mw	-0.2157	0.4353	-0.169	0.1368	0.0711
lngdppc	-0.8236*	-0.0497	0.1371	-0.247	0.2188
fisf	0.4812*	0.1715	-0.1018	0.1189	-0.4232*
busf	-0.4396*	-0.3332	0.046	-0.3452*	0.0083
corr	-0.7828*	-0.5310*	-0.0176	-0.4481*	0.2936*
regqual	-0.7524*	-0.4402	-0.1283	-0.4781*	0.0888

	tax	epl	tu	lmpa	lmpp	mw	lngdppc	fisf	busf	corr	regqual
tax	1										
epl	0.2962*	1									
tu	0.1226	-0.1252	1								
lmpa	0.0877	-0.0434	0.5534*	1							
lmpp	0.1442	-0.0398	0.4114*	0.8951*	1						
mw	-0.1483	0.0069	-0.3710*	-0.1017	-0.0121	1					
lngdppc	0.1609	-0.0427	0.4145*	0.5676*	0.5423*	0.2115	1				
fisf	-0.3623*	-0.0694	-0.5639*	-0.7014*	-0.6840*	0.0325	-0.5934*	1			
busf	-0.0588	-0.2064	0.4338*	0.4423*	0.3801*	0.0234	0.5561*	-0.2855*	1		
corr	0.1248	-0.117	0.5686*	0.6993*	0.7051*	-0.0072	0.8181*	-0.6606*	0.6342*	1	
regqual	0.0443	-0.2705	0.4059*	0.5817*	0.5743*	0.1001	0.7829*	-0.4275*	0.6800*	0.8868*	1

Note: coefficients significant at 5% significance level marked with asterisk.

Source: OECD, Eurostat, World Bank, Heritage Foundation, IZA, own calculations

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