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Selected Aspects of Performance of the Government Sector in the Czech Republic in the Context of EU Countries

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Abstract

Comparative study deals with the development of important aspects of performance of the government sector in the EU countries since 2000. Using standard outputs of national accounts shows shifts in position of individual countries in terms of government deficit and debt. These key Maastricht criteria are examined also in different phases of economic cycle. This relationship is complex as seen the example of new EU countries, which created notable deficits also in period of economic upturn. Significant long-term differences in structure of revenues and expenditures between CR and whole EU are depicted. In boom period (2000-2008) share of the government debts repayments dropped in favour of growth of investment expenditures, notably in new EU members. In 2009 in two thirds of member countries pecuniary social benefits were relatively most dynamic expenditure item, especially in the Baltics. In a subsequent period of consolidation both the weight of expenditures on the operation of the government sector and investment expenditures were reduced. Finally the attention is paid to structure of government debt from the aspect of different types of creditors or financial instruments covering the debt. The role of local government in growth of whole government debt is outlined.

Keywords	JEL code
Government deficit and debt, structure of revenues and expenditures of government sector, economic development, government bonds yields, EU countries, local government	*H11, H62, H63, H72, H81*

INTRODUCTION, AIM OF THE STUDY

At present, the enduring crisis in the EU countries raises wide spectrum of questions. Up to which measure the current lengthy economic slow-down affected the revenues and expenses of government institutions? Which countries have chosen the way of reducing the deficits at a price of the investment reduction and which by cutting of expenses of the government sector "operation"? How big scope is given to individual countries to the improvement of their public finance by current performance of economy and its implications on the labour market? What is the share of individual central or local-governments

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in the total indebtedness of the Union countries? Which countries brought their debt already from the earlier period of the economic growth? What is the burden of the debt service management in the budgetary expenses of individual countries and what is their contribution to current reported deficits? The following analysis attempts to provide answers to some of the above questions.

The analysis is aimed to mapping out the development of important aspects of overall performance of the sector of government institutions in the EU[2] countries (according to data completed also in the EFTA countries) by standard outputs of national accounts. Primarily the period from 2000 has been analysed mainly in the annual aspect.

The government sector includes all institutional units whose principal economic function subsists in the provision of non-market services and distribution of income and national wealth. They are financed especially by mandatory (direct and indirect) payments from other units. Majority of its operating costs they do not cover from their own revenues but by subsidies allocated by central or local authorities. The government sector includes especially central budgetary organizations, state funds, other extra-budgetary funds (e.g. Land Fund or Vine-grower Fund), public universities and some semi-budgetary organizations (centrally managed). Government sector includes also social security funds (mainly health insurance companies managing compulsory health insurance) as well as local government institutions (territorial government units and various institutions, which are directly controlled by them – e.g. Voluntary Municipalities Associations, Regional Councils of Region and some semi-budgetary organizations (locally managed).

The performance of government sector is outlined mainly by set of main aggregates[3] including non-financial transactions of institutional units classified in the general government sector (S.13) and they are split by its sub-sector. They are based on methodology of national accounts (the Regulation (ES) No 2223/96 on European System of Accounts – ESA95) and on complementary regulations of European union on the ESA95 and on notifications of government deficit a debt,[4] to capture short-time development some additional indicators were used (e.g. long term government bond yields).

1 LONG-TERM DEVELOPMENT OF DEFICIT AND THE GOVERNMENT SECTOR DEBT

Performance of the government sector is, like that of all other institutional sectors of economy, recorded in detailed set of tables of national accounts. In respect of specific function of the government sector some of the indications from this set acquire an extraordinary importance. Basic indicators describing economic behaviour of the government institutions sector are generally considered the government surplus/deficit[5] (showing the ability of the general government sector to finance other entities (+) or the need of the general government sector to be financed (–) in the given year) and total government debt[6] arising mainly from the accumulation of budgets deficits from the past and which can be understood also as a result of long-term economic activity of government institutions.

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[2] From 1 July 2013 became the order of the 28th EU member Croatia. At the time of compilation of this study, however, relevant data on government statistics for Croatia were available only for 2009–2012. Therefore, the position of Croatia in most cases is only briefly commented on in the text. Only in those parts of the analysis that specifically focus on the government sector in period of recession, the position of Croatia was captured also in graphical form. Effect of Croatia itself to the values of performance indicators of the government sector in the whole EU is virtually negligible.

[3] For better understanding described aggregates are provided with codes of non-financial transactions corresponding to ESA95 rules and to the regulations of EU

[4] E.g. 1500/2000, 2516/2000, 2558/2001, 351/2002, 3605/1993 a 2103/2005.

[5] I.e. EDP B.9. Refers to net borrowing (–) – net lending (+) including interest on swap transactions.

[6] The government debt is defined as the total consolidated gross debt at nominal value at the end of the year in the following categories of government liabilities (as defined in ESA95): currency and deposits (AF.2), securities other than shares excluding financial derivatives (AF.3, excluding AF.34), and loans (AF.4). At the national level, data for the general government sector are consolidated between sub-sectors.

The share of the government sector debt in the whole EU (including 27 countries) oscillated long without bigger fluctuations closely above the level of 60% of the GDP. It thus failed to reach the debt of the Eurozone, yet, since 2009 it slightly converged to its level (mainly due to the high growth of the government debt of the third biggest Union economy – Great Britain). It is interesting that this convergence took place in the period when the y-o-y growth rate of the GDP was comparable in these formations while between the years 2001–2005, when the growth of the Eurozone economy was moderately lagging behind the whole EU, the growth of indebtedness in both formations took place identically (see Figure 1). Within the Eurozone the Maastricht criterion of the government debt is exceeded continually by five members – Greece, Italy, Belgium, Austria and Germany (save for the year 2001). Gradually, their number was increased by France (since 2003), Portugal (since 2004), the Netherlands, Ireland (since 2009) and Spain (since 2010) and out of new members then Malta, Cyprus and recently Slovenia.

Figure 1 Long-term development of the government sector debt* and the GDP in the CR, EU and the Eurozone countries
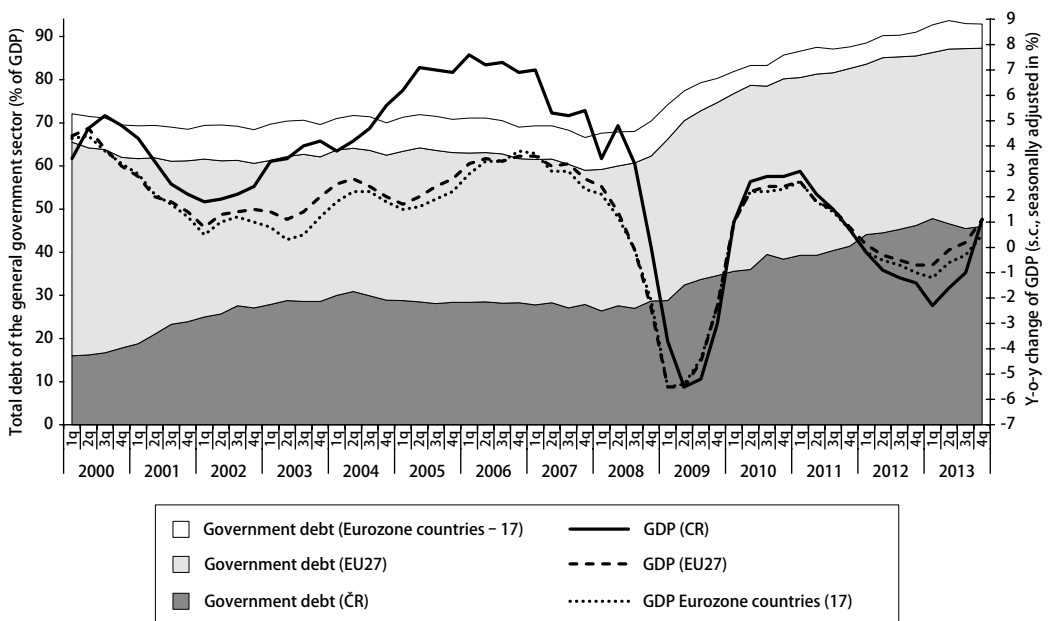
* Quarterly government debt is defined as the total gross debt at nominal value outstanding at the end of each quarter between and within the sectors of general government.
Note: Considering the availability of comparable long time series the membership of the countries in economic formations (EU, Eurozone) was assessed by the situation relevant for the end of 2012.
Source: Eurostat

The development of the government sector debt in the countries which became members of the EU as late as after the year 2000 showed the features of significant difference attributed also to different "starting position". The government sector in Bulgaria, Hungary and partly in Poland brought rather big debt from the years of transformation and its squeezing required after the year 2000 a relatively significant share of government expenditures. The level of the Czech government debt in the latter half of the 1990's belonged in Europe, along with the Baltics and Romania, to the smallest ones, however, contrary to them, after 2000 the level of debt in the CR began to increase and its development until 2010 has significantly copied the growth rate and debt level in Slovenia since. High budgets deficits exceeding also the deficit

in the period 2009–2012 were the main reason for growing indebtedness in the CR between the years 2000 and 2003. The dynamic growth of economy between 2003 and 2008 did not lead to a significant reduction of the government debt in the CR only but the similar situation took place also in Poland, Slovenia or Hungary. Government sector of these economies remained in deficits (rather significant in Hungary) also due to a big share of investment expenditures (environment, infrastructure, etc.).

Profound economic recession which gradually affected practically all European countries has reflected relatively quickly in the growth rate of their government debt. The debt (in relation to GDP) markedly increased as early as in the 4th quarter of 2008 (e.g. in the Eurozone countries to 70.4% from 68.0% in the previous quarter). In majority of Union member countries the debt has been increasing continually. The most significant growth was recorded just in 2009 when a sharp y-o-y drop of total revenues of government sector (usually more marked than the drop of GDP) was impossible to quickly and adequately compensate at the expenditure side. In the following years the governments of individual countries reacted both by economies at the expense side (especially in case of non-mandatory expenditures which can be adjusted faster) and the efforts to increase revenues. This referred mainly to an increase of indirect tax rates (only seven EU countries – Germany, Austria, Denmark, Belgium, Luxembourg, Sweden have not adjusted the VAT rates since 2009 and the same applies to Slovenia as the only one of new member countries). In addition almost two thirds of countries in this period decided to adjust the income taxes of physical persons – in the overwhelming majority in the upward direction while the increase of rates was more marked in the Eurozone countries than in the whole EU. This has lead to deepening of the difference between rates within both formations. Between 2009 and 2013 more significant adjustment of corporate tax rates took place roughly in one third of the EU countries, in most of cases slightly downward.

The above effects along with the return to a moderate growth of economy in 2010–2011 helped a significant majority of countries to cut down high government deficits and consequently also to slow down the rate of growth of total indebtedness. An exception was represented by the South European countries (Spain, Portugal, Italy, Cyprus) whose government sector debt in relation to the GDP grew most as late as during 2012. Similar problems would probably face also Greece if it were not for a strong financial injection from powerful European institutions. In context of the whole period from the beginning of recession, in the last year (2012) the biggest increase of the government debt was recorded also in Slovakia (from 43.6% of GDP by the end of 2011 to 52.7% a year later), the Netherlands, Estonia and Bulgaria – it most refers to relatively less indebted countries. Higher increase of the government sector debt was recorded also in the CR in 2012 (from 41.4 % to 46.2 %), the result was negatively affected, among other things, by the emission of government bonds exceeding the level of deficit at a time when in the long-term bond market a relatively favourable situation dominated.

Deficits of the government sector in the Eurozone countries (17) have been since 2006 always slightly smaller than in the whole EU27 which resulted into a different growth rate of the government debt in these formations. The government sector in the CR has recorded more profound deficits then in EU since 2000 almost up to the beginning of the deep recession regardless the fact that the growth of Czech economy was stronger (mainly in the years 2004–7). The subsequent worsening of government deficits in the period of the outbreak of economic crisis, however, in the CR it did not reach the depth of majority of the Union countries. An exception was the year 2012, when bigger deficit (–4.4 % GDP) was attributed to financial compensations within the church restitutions (CZK 59 bln) and corrections of EU subsidies pre-financed from the state budget (returned means in the amount of CZK 12 bln). If it were not for both above mentioned effects, the government sector deficit would have reached –2.5% of GDP.

Government sector in the Czech Republic achieved on the long-term basis smaller deficits than in Slovakia and this tendency has been strengthened by deep recession since 2009. In addition situation in Slovakia is worsened also by striking disparities in the labour market (high unemployment rate

accompanied by strong regional disparities and growing number of persons threatened by poverty). On the contrary, some of Czech neighbours – Austria and Germany – traditionally belong to countries managing to tame their government deficits with relative success although they did not succeed to avoid the significant drop in 2009. Relatively favourable situation in both German and Austrian labour market is as contribution in this respect. Germany along with Sweden, Estonia and Luxembourg as sole Union countries managed from the beginning of global recession to reach (by 2013) balanced government budgets. In addition Sweden (as the only EU country) between 2009 and 2012 did not increase its total government debt (in relation to the GDP).

Figure 2 Development of total debt of the government sector (by the year-end, % GDP)
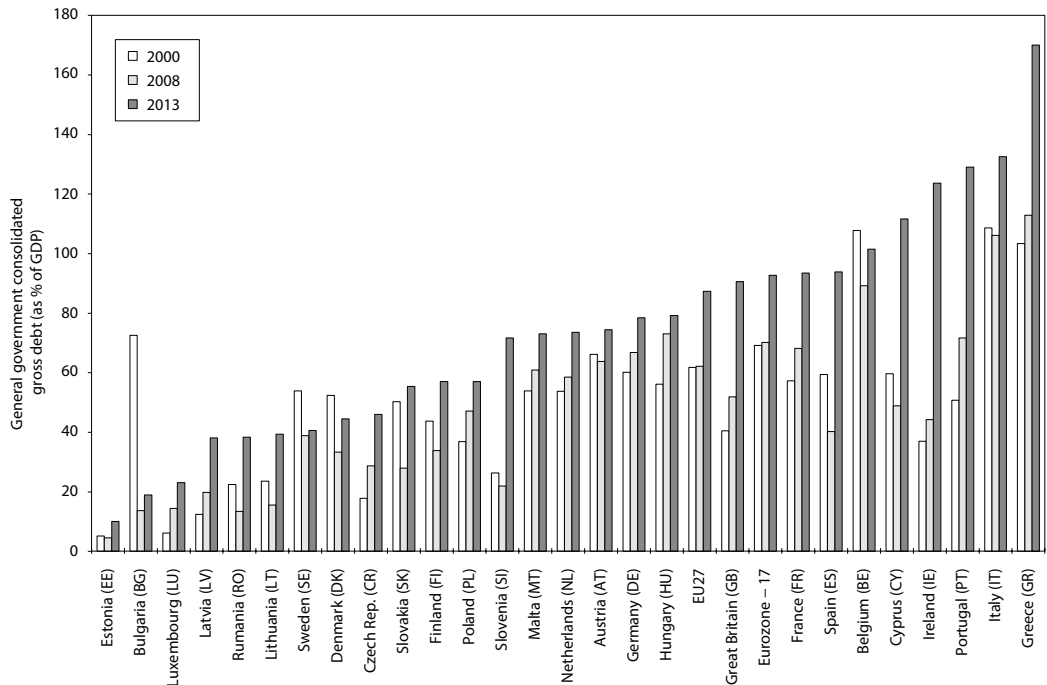
Note: Membership of countries in economic formations (EU, Eurozone) was in all period assessed by the condition at the end of 2012.
Source: Eurostat

In the last decade, almost in all EU countries the increase of total indebtedness of government sector (in relation to GDP) was recorded (see Figure 2). Some less indebted Northern countries (Denmark, Sweden), as well as Bulgaria or Belgium (which brought the big debt already from the 1990's) were an exception. Out of countries showing big debts especially Belgium succeeded to tame its public finance for the last decade. By contrast, the biggest increase of relative indebtedness was recorded in Ireland and in South European countries most severely affected by deep recession. Position of the CR in 2012 was in the first third of countries showing the lowest level of indebtedness, its growth rate, however, exceeded the EU average in the last decade. The Czech Republic may thus benefit from the fact that it entered the new millennium as the fourth least indebted country (following Luxembourg, Estonia and Latvia).

In European context, Northern countries traditionally cope with the smallest problems with government deficits in despite of the fact that their budgets, as usual, allocate (in relation to GDP) significant amounts to social politics. Government sector in Finland maintained until the outbreak of crisis an exclusive position in the whole Union (in 2000–2008 it generated on average the surplus exceeding

Figure 3 Long-term development of net lending (+) / net borrowing (–) of government sector in selected countries within the Eurozone and outside (% GDP)
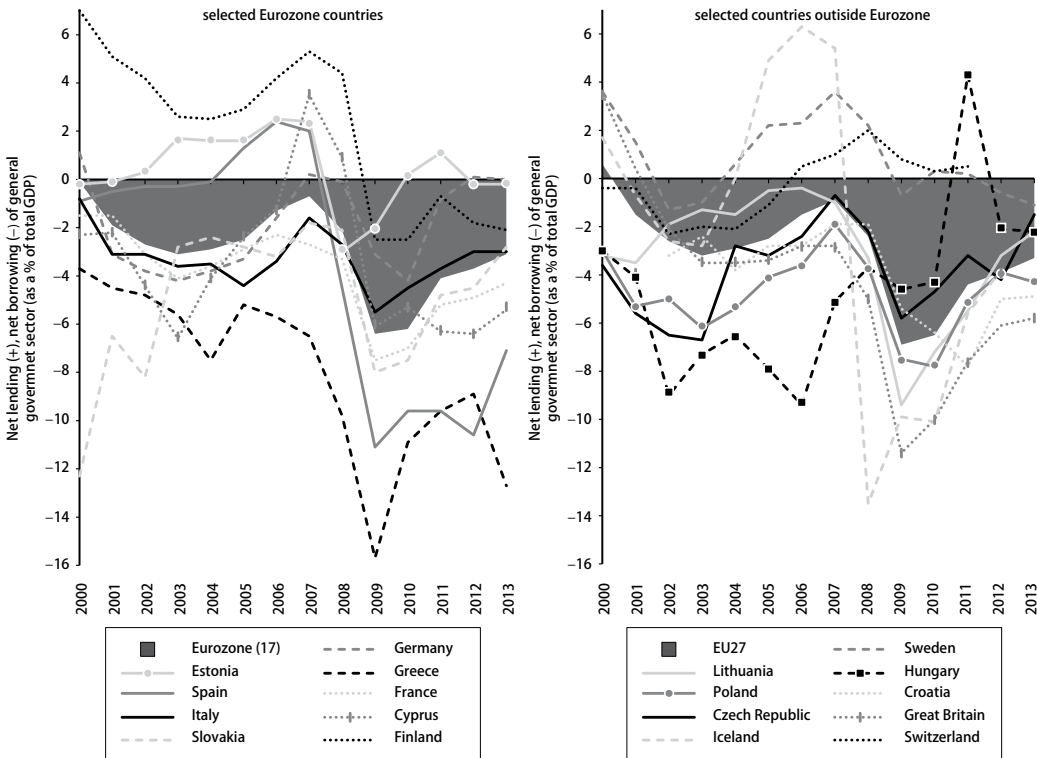
Note: Membership of countries in economic formations (EU, Eurozone) was in all periods assessed by the condition at the end of 2012.
Source: Eurostat

+4% GDP) and their consequent drop in 2009 was, compared to the rest of Europe, smaller and as soon as during 2011 they again approached the balanced position.

Dragging economic slow-down has significantly worsened in the last years the results of economic performance of government sector across EU countries. While in 2007 only three countries (Greece, Portugal, Hungary) failed to fulfil the Maastricht 3% deficit criterion, a year later half of all EU countries failed to meet it and in 2011 the number of failing countries increased almost to two thirds (including the Czech Republic). In the last three years (2011–2013) this criterion was performed only by Northern countries, Luxemburg and two of Czech neighbours (Austria and Germany), then Hungary, Bulgaria and Estonia (see Figure 3).

2 DYNAMICS OF RELATIONSHIP BETWEEN DEFICIT/SURPLUS THE GOVERNMENT SECTOR, GOVERNMENT DEBT AND ECONOMIC DEVELOPMENT

The result of mutual confrontation of revenues and expenses of the government sector is, as a rule, government deficit (net borrowing). Especially the development of revenues of the government sector (mainly direct taxes) is, however, tightly bound to the performance of national economy. Government deficit in each year becomes then a basis for the government debt increase. Countries suffering from long-term government deficits as well as indebtedness have limited options for support its economic growth (e.g. via government investment).

The relationship between the above macroeconomic terms is not a direct one. For the sake of better understanding it is possible to make a rough division of the period after 2000 into three time intervals, which mutually differ by their dynamics of real growth (drop) of GDP. The first period (2001–2003) is characterised in the EU countries by general, however, moderate economic growth, modest y-o-y growth rate of GDP was obvious especially in the biggest Union economies. The second period (2004–2008) was practically for all countries linked with the economic upturn – in the Baltics the average y-o-y growth reached almost two-digit values and in less successful countries (Italy, Portugal) the growth-rate of GDP approached the level of the whole EU in 2001–2003. The last period (2009–2013) is linked with dragging economic recession which in all countries (save for Poland) in 2009 showed a deep y-o-y drop of real GDP, humble growth in the following two years and return to more shallow economic drop in 2012–2013 (which affected almost half of the EU countries).

Relationship between the balance of the government sector (deficit/surplus) and economic growth was in all EU27 countries weak and mainly in the first two assessed periods. However, there were marked differences between "new" countries joining the EU after 2000 compared to the "traditional" Union countries. Majority of these new countries showed significantly better results in the y-o-y growth-rate of GDP compared to the whole EU, yet, concurrently, they had (as a potential members of the Eurozone) problems with the performance of the Maastricht criterion specifying the government deficit. This discrepancy showed in all periods, most obviously in Poland and Slovakia (see Table 1). Similar discrepancy showed Latvia and Lithuania, which reached in the first two periods only shallow budget deficits, however, they belonged to the Union economies reporting the fastest growth.

By contrast, Austria, the Benelux countries and mainly the Northern countries did not have (until the outbreak of global recession) any significant problems with its government deficits and assessed by their amounts within all EU countries markedly better ranking then by the y-o-y growth rate of GDP. This group of countries can be enlarged by Estonia, which kept the step with the Baltics in terms of dynamic economic growth, but in terms of slight government surplus (net lending) resembled the Scandinavian countries. Greece holds an eccentric position among the Eurozone countries. Since its joining this formation it continuously fails to fulfil the 3% criterion of the government deficit and on the long-term basis it belonged (along with Portugal) to the Eurozone countries showing the worst performance of government sector. At the same time, Greece in 2001–2009 reported lower growth-rate of GDP (than in the whole EU) only once.

The position of Croatia, as "freshest" member of the EU, largely mirrored the position of the neighboring Slovenia. In both periods (2001–2003, respectively 2004–2008) to Croatia had relatively strong economic growth (average annual GDP growth exceeded 4.0%). The favorable development was fundamentally undermined by deep recession (GDP in 2009 fell by almost 7%), since the annual growth of the Croatian economy has not even returned yet (e.g. –2% in 2012). The recession also resulted in deep government sector deficit (annual average for 2009–2012: –6% of GDP), which was reduced very slowly (in 2012 reached –5% of GDP). Susequent striking increase in governemt debt (37% of GDP at the end of 2009 to 56% of GDP three years later) ranked Croatia as the forth (following Hungary, Cyprus and Malta) most indebted new EU member (among countries joining EU after 2000).

Relationship between the government deficits and the increase of their debts was, by contrast, relatively strong, especially in the last assessed period when government revenues as well as expenditures in majority of the EU countries were affected by recession. Between 2008 and 2013 the government debt increased most in Ireland (from 44% of GDP up to 124% of GDP) which in this five-year period recorded profound government deficits (on average almost 15% of GDP). Similarly did also majority of South European countries and the Great Britain. Due to high deficits (–4.6 to –7.5 %) the total indebtedness has sharply increased also in some countries of Central and Eastern Europe (Slovenia, Slovakia, Romania, Latvia and Lithuania) which earlier recorded minimum debts, however, by the end of 2012 they still met the Maastricht debt criterion (except for Slovenia, that witnessed in 2013 the highest government deficits in the whole EU).

Table 1 Relationship between government deficit (surplus), debt and the development of economy in different periods after 2000

| | 2001–2003 (annual average) | | | | 2003 (end of the year) | | 2004–2008 (annual average) | | | | 2008 (end of the year) | | 2009–2013 (annual average) | | | | 2013 (end of the year) | |
| | y-o-y change of real GDP | | Net lending (+) / net borrowing (−) | | Total government debt | | y-o-y change of real GDP | | Net lending (+) / net borrowing (−) | | Total government debt | | y-o-y change of real GDP | | Net lending (+) / net borrowing (−) | | Total government debt | |
	%	ranking	% GDP	ranking	% GDP	ranking	%	ranking	% GDP	ranking	% GDP	ranking	%	ranking	% GDP	ranking	% GDP	ranking
EU27	1.6	x	−2.4	x	61.9	x	2.4	x	−2.0	x	62.2	x	−0.2	x	−5.0	x	87.4	x
Eurozone(17)	1.2	x	−2.6	x	69.2	x	2.1	x	−1.9	x	70.2	x	−0.4	x	−4.7	x	92.7	x
Belgium	1.0	22	0.1	6	98.4	2	2.3	22	−0.7	10	89.2	3	0.3	8	−4.0	13	101.5	6
Bulgaria	4.8	5	−0.2	7	44.4	17	6.4	5	1.5	4	13.7	25	−0.4	14	−2.3	8	18.9	26
Czech Repub.	3.0	12	−6.3	25	28.6	21	5.5	7	−2.3	17	28.7	19	−0.4	15	−3.9	11	46.0	19
Denmark	0.5	26	0.7	3	47.2	14	1.8	25	4.1	1	33.4	18	−0.6	16	−2.3	7	44.5	20
Germany	0.4	27	−3.7	19	64.4	7	2.0	23	−1.7	15	66.8	7	0.7	6	−1.6	4	78.4	11
Estonia	6.8	3	0.6	4	5.6	27	5.7	6	1.0	6	4.5	27	0.9	5	−0.2	1	10.0	27
Ireland	4.7	6	0.3	5	31.0	20	3.7	12	−0.3	9	44.2	14	−1.1	21	−14.6	27	123.7	4
Greece	4.5	7	−5.0	22	97.4	3	3.1	14	−6.9	27	112.9	1	−5.2	27	−11.6	26	175.1	1
Spain	3.2	11	−0.4	9	48.8	13	3.1	15	0.2	7	40.2	15	−1.3	22	−9.6	25	93.9	7
France	1.2	19	−2.9	16	62.9	8	1.8	24	−3.0	20	68.2	6	0.2	10	−5.8	20	93.5	8
Italy	0.8	23	−3.3	18	104.1	1	1.1	27	−3.1	21	106.1	2	−1.5	24	−3.9	12	132.6	2
Cyprus	2.7	15	−4.4	21	69.7	4	4.2	10	−0.7	10	48.9	12	−1.6	25	−5.9	21	111.7	5
Latvia	7.4	2	−2.0	13	14.7	25	7.4	1	−1.4	14	19.8	22	−0.9	18	−4.6	15	38.1	24
Lithuania	7.9	1	−2.2	14	21.0	24	7.1	3	−1.3	12	15.5	23	0.0	11	−5.5	17	39.4	22
Luxembourg	2.8	14	2.9	2	6.2	26	4.1	11	1.4	5	14.4	24	0.3	9	−0.2	2	23.1	25

Note: Membership of countries in economic formations (EU, Eurozone) was in all periods assessed by the condition at the end of 2012.
Source: Eurostat

Table 1 Relationship between government deficit (surplus), debt and the development of economy in different periods after 2000 – continuation

| | 2001–2003 (annual average) | | | | 2003 (end of the year) | | 2004–2008 (annual average) | | | | 2008 (end of the year) | | 2009–2013 (annual average) | | | | 2013 (end of the year) | |
| | y-o-y change of real GDP | | Net lending (+) / net borrowing (−) | | Total government debt | | y-o-y change of real GDP | | Net lending (+) / net borrowing (−) | | Total government debt | | y-o-y change of real GDP | | Net lending (+) / net borrowing (−) | | Total government debt | |
	%	ranking	% GDP	ranking	% GDP	ranking	%	ranking	% GDP	ranking	% GDP	ranking	%	ranking	% GDP	ranking	% GDP	ranking
Hungary	4.0	9	−6.8	26	58.6	10	2.7	19	−6.5	26	73.0	4	−0.9	19	−1.8	5	79.2	10
Malta	1.0	21	−7.0	27	66.0	5	2.8	17	−3.4	22	60.9	9	1.4	3	−3.2	10	73.0	14
Netherlands	0.8	24	−1.8	12	52.0	11	2.7	20	−0.2	8	58.5	10	−0.7	17	−4.3	14	73.5	13
Austria	1.2	20	−0.7	10	65.3	6	2.8	18	−1.9	16	63.8	8	0.4	7	−3.0	9	74.5	12
Poland	2.2	16	−5.5	23	47.1	15	5.4	8	−3.7	24	47.1	13	2.7	1	−5.7	19	57.0	16
Portugal	0.6	25	−4.0	20	59.4	9	1.2	26	−4.4	25	71.7	5	−1.4	23	−7.1	22	129.0	3
Romania	5.3	4	−2.3	15	21.5	23	6.8	4	−2.6	19	13.4	26	−0.3	13	−5.3	16	38.4	23
Slovenia	3.2	10	−3.0	17	27.2	22	4.9	9	−1.4	13	22.0	21	−1.9	26	−7.5	23	71.7	15
Slovakia	4.3	8	−5.8	24	42.4	18	7.3	2	−2.5	18	27.9	20	1.0	4	−5.5	18	55.4	18
Finland	2.0	17	4.0	1	44.5	16	3.4	13	3.9	2	33.9	17	−0.9	19	−1.9	6	57.0	16
Sweden	2.0	17	−0.3	8	51.7	12	2.9	16	2.2	3	38.8	16	1.4	2	−0.4	3	40.6	21
Great Britain	2.8	13	−1.7	11	38.7	19	2.4	21	−3.5	23	51.9	11	−0.1	12	−8.2	24	90.6	9

Note: Membership of countries in economic formations (EU, Eurozone) was in all periods assessed by the condition at the end of 2012.
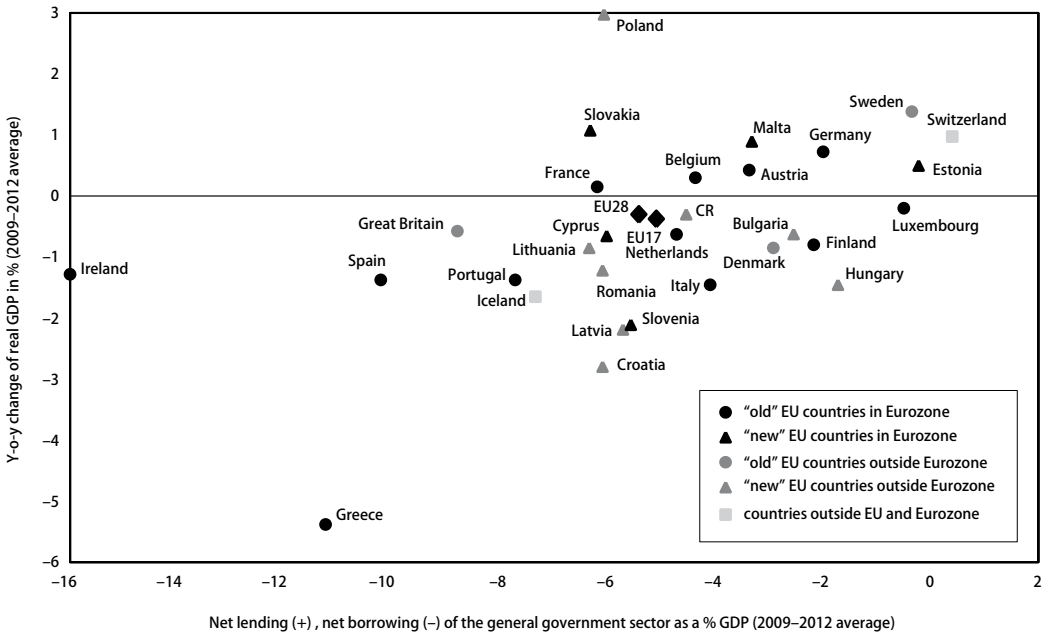**Source:** Eurostat

Figure 4 Net lending (+) / net borrowing (–) of the general government sector and y-o-y dynamics of real GDP (selected European countries, average for the years 2009–2012*)

* For Switzerland the period 2009–2011.
Source: Eurostat

The growth of the government debt is not only the result of cumulated deficits from previous periods although they usually form its decisive part. During the economic boom (2004–2007) most of countries managed to reduce its government debt (it stagnated in the CR) and in spite of moderate government deficits, Northern countries and also Spain then managed to squeeze them more markedly showing budget surpluses. Some countries managed to reduce their indebtedness even when they showed government deficits also in periods of humble economic growth (2001–2003). It was mainly due to high repayments of previous loans (share of paid up credits in total expenditures of the government sector was about 15% e.g. in Greece, Italy, Belgium; two-digit value were approached also in the Balkans or in Slovakia).

Despite the relationship between dynamics of total GDP growth and government deficit (surplus) was not any significant in the EU countries on the long-term basis, the year 2009 brought a change. A deep y-o-y drop of total economic performance has quickly weaken (in absolute terms) mainly government revenues so in 2009 ended up in majority of the EU countries in profound deficits.

An example of last economic recession (2009–12) may show relationship between the GDP dynamics and deficits of the government sector (correlation coefficient in all EU countries made +0.42). Only two countries make an exception: Ireland (showing deep deficits and relatively small drop of economy) and Poland which has avoided recession as the only one of the Union countries, however, its government deficits belonged (not only in this period) to the biggest within the EU. Having excluded Poland and Ireland the closeness of relationship expressed by the correlation coefficient has increased (up to +0,59). The Czech Republic did not show significant difference compared with the level of the whole EU (or the Eurozone) in this period in terms of its government deficits and real drop of economic performance (see Figure 4).

3 SIZE OF GOVERNMENT SECTOR FROM THE ASPECT OF REVENUES AND EXPENDUTURES IN RELATION TO GDP

Majority of the European Union countries responded in the last years to significant deficits of their public budgets by measures combining the increase of revenues and squeezing of government expenditures. In the whole EU between 2009 and 2012 the share of total revenues of government institutions in the GDP grew from 44.1% to 45.4% (reaching the level in 2000). The share of total government expenditures in the same period dropped by almost by 2 p.p. down to 49.3% of GDP. The relation of expenditures, however, in 2012 was in majority of "new" member countries (save for Slovakia, the Balkans and the Baltics) and practically in all "ancient" members of the EU (save for Sweden) significantly above the level relevant at the beginning of millennium when total government expenditures in the Union did not reach even 45% of GDP. The growth rate of government expenditures advancing the growth of GDP was for majority of EU countries after 2000 a characteristic feature. This discrepancy became stronger when a sharp drop of economy in 2009 took place, which was also due to an increased need for social transfers (also due to rapidly growing unemployment).

As late as in the following years when in majority of counties a moderate economic growth was restored, the government sector applied more tangible cut of its expenditures. This took place sometimes also under the pressure of international institutions, mainly in the most indebted members of the Eurozone which were provided financial aid. Between the years 2009 and 2012 the share of total government expenditures in the GDP was falling most in the Baltics and in Ireland (see Figure 5). At the same period in Portugal and Greece the government expenditures dropped also in absolute terms (the cut of expense was, however, partly or almost completely overshadowed by more marked drop of the GDP). In the last four years

Figure 5 Change of total revenues and expenditures of government sector in relation to GDP (selected European countries, difference between 2012 and 2009 in p.p.*
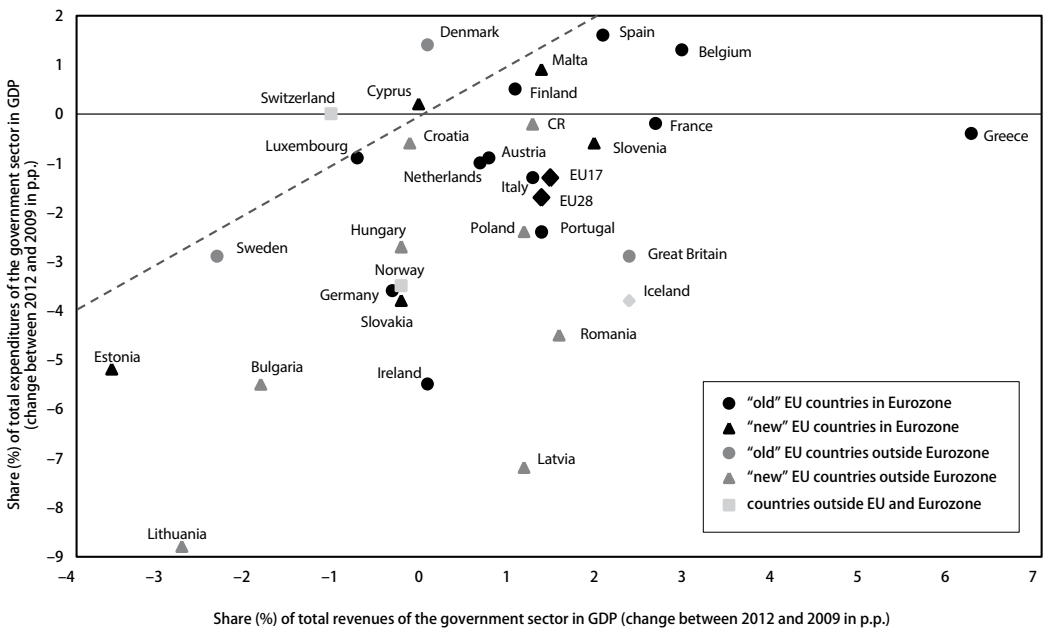
* For Switzerland the comparison refers to the years 2009 and 2011.
Source: Eurostat

almost all countries of the EU showing different relative dynamics of total government revenues and expenditures reached smaller deficits (e.g. countries located below the diagonal in Figure 5). The only EU country which in 2012 reported (compared to 2009) bigger deficit of the government sector, was Denmark which, however, as one a few countries met in 2009–2011 the Maastricht criterion for deficits.

Among the European countries still survive marked differences in relative size of government expenditures. While in Denmark the total expenditures of the government sector reached in 2012 almost 60% of GDP, in Bulgaria they only moderately exceeded one third. Similar discrepancies may be found among the EU countries also at the beginning of the previous decade. Above the average relative expenditures are traditionally maintained by Northern countries, France, Belgium, Austria and from among "poorer" members of the Eurozone by Greece and Italy. "New" Union countries show, by contrast, lower share of government expenditures, only the governments of Hungary and Slovenia spend, in relation to the whole economic performance, similar amounts as was the average of the EU countries. Of the leading economies of the Eurozone lower expenditures were maintained by Germany, on the long-term basis (permanently near to 45%). By contrast, Spain and Great Britain, whose government expenditures at the beginning of the millennium did not reach even 40% of GDP, have markedly increased their relative expenditures and in 2012 already approached the average of the Eurozone countries.

Ireland has undergone an interesting development, At the period of strong economic growth in 2000–2006 it showed the lowest government expenditures (31–34% of GDP) of all the Eurozone countries. When being hit by deep financial crisis, expenditures rapidly increased in 2010 (up to 66% of GDP) as well as the deficit of the whole government sector (up to historic value in the whole period of functioning of the Eurozone: –31% of GDP). Two years later, at a moderate y-o-y economic growth and still strong government deficit (–8% GDP) these expenditures sharply dropped down to 43% of GDP (after Slovakia and Estonia this referred to the lowest value of the Eurozone countries).

If we omit the year 2003, the expenditures of the government sector in CR were long below the level of the whole EU and save for Slovakia they were the lowest of the whole Centre European region. The CR, however, belonged to a few countries, which between the years 2009 and 2012 practically did not reduce their share of their government expenditures in GDP. The Czech government sector, in terms of relative government expenditures and their long-term dynamics, is approaching to the position of Poland and Germany.

4 LONG-TERM DEVELOPMENT OF THE STRUCTURE OF REVENUES AND EXPENDITURES OF THE GOVERNMENT SECTOR

Changes in total revenues and expenditures of the government sector may be attributed to opposite-direction trends in the development of partial but important items of revenues and expenditures. More detailed view into the structure of revenues and expenditures of the government institutions is necessary in order to decode them.

4.1 Structure of revenues

In the CR like in other EU countries the key part of government revenues are mandatory payments. This refers to a group of taxes (taxes on production and imports, current and capital taxes) and social contributions (working people and the unemployed in the benefit of social benefits providers). Within the whole EU the share of three most important items of mandatory payments in total government revenues is long-term balanced (see Figure 6). Like in Slovakia, Germany or France, in the CR the decisive parts of revenues of the government sector is represented by social contributions (D.61). Their share was in 2012 in the CR the biggest (followed by Germany and France) of all EU countries.

Like in the overwhelming majority of new member EU countries in the Czech government revenues lower weight was assigned to direct taxes (from physical persons and legal entities, tax on interest), more markedly were represented revenues from EU (in Figure 6 included in "other revenues"). Less important in the CR was, by contrast, market production of the government institutions (including

Figure 6 Long-term development of the structure of revenues of the government sector and share of total revenues in GDP (comparison of CR and EU27)
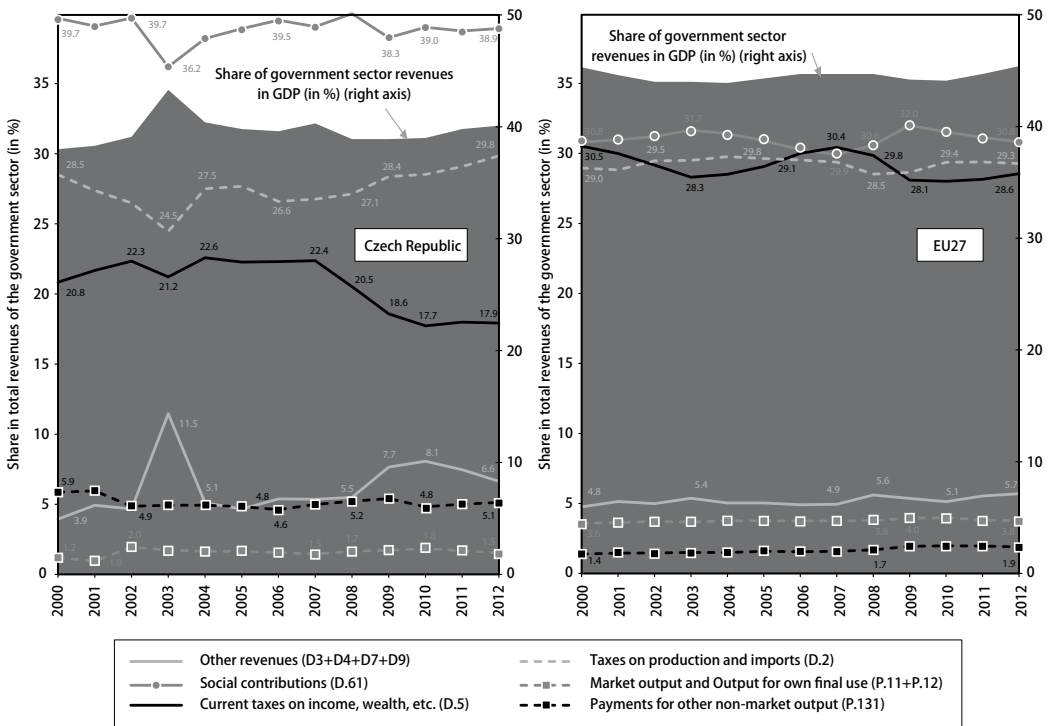
Note: *Payments for non-market output (P131)* comprise payments for providing of services and products such as school fees, administrative and court fees, waste deposition charges or fees for use of public areas, etc., which are provided at economically insignificant prices (when less then 50% of the production costs is covered by sales). *Other revenues* include property income (especially interest, dividends and shares in profit, rents on land), subsidies receivable, other received current transfers (e.g. means obtained within international development projects, income from sanctions and penalties) and income capital transfers (e.g. collected inheritance and gift taxes, investment subsidies from the EU institutions).

Source: Eurostat

e.g. revenues of the government sector from transport services or waste treatment), its share in total revenues of the government sector reaches, compared to the EU countries, a half level.

At the period of recession in the revenues of CR government sector (contrary to EU) a marked drop of direct taxes took place in favour of indirect ones (VAT, excise taxes). This was due to a different approach to the tax rate adjustment (the CR like majority of new Union countries between 2008 and 2012 did not increase the direct tax rates). Both indirect taxes and revenues from the EU budget helped mitigate of the government deficits in the last 2–3 years. The size of the government sector measured by the share of its revenues in GDP in CR was long below the EU level. Mild increase in the share of total revenues in both CR and EU was connected in the last years with the above effects.

4.2 Structure of expenditures

Differences between the CR and the EU countries are obvious for a long time also in the structure of the government sector expenditures. In all the EU countries pecuniary social benefits dominate (mainly expenditures on old-age pension, sickness benefits, unemployment benefits and state social

Figure 7 Long-term development of the structure of the government sector expenditures and the share of total expenditures of governments in the GDP (comparison between the CR and EU27) (selected main items)

Czech Republic

EU27

Share in total expenditures of the government sector (in %)

Share of government sector expenditures in GDP (in %) (right axis)

Legend	
Intermediate consumption (P.2)	Compensation of employees (D.1)
Subsidies (D.3)	Property income (D.4)*
Soc. benefits-pecuniary (D.62)**	Soc. transfers in kind (D.631)***
Gross fix.capital formation(P.51)	
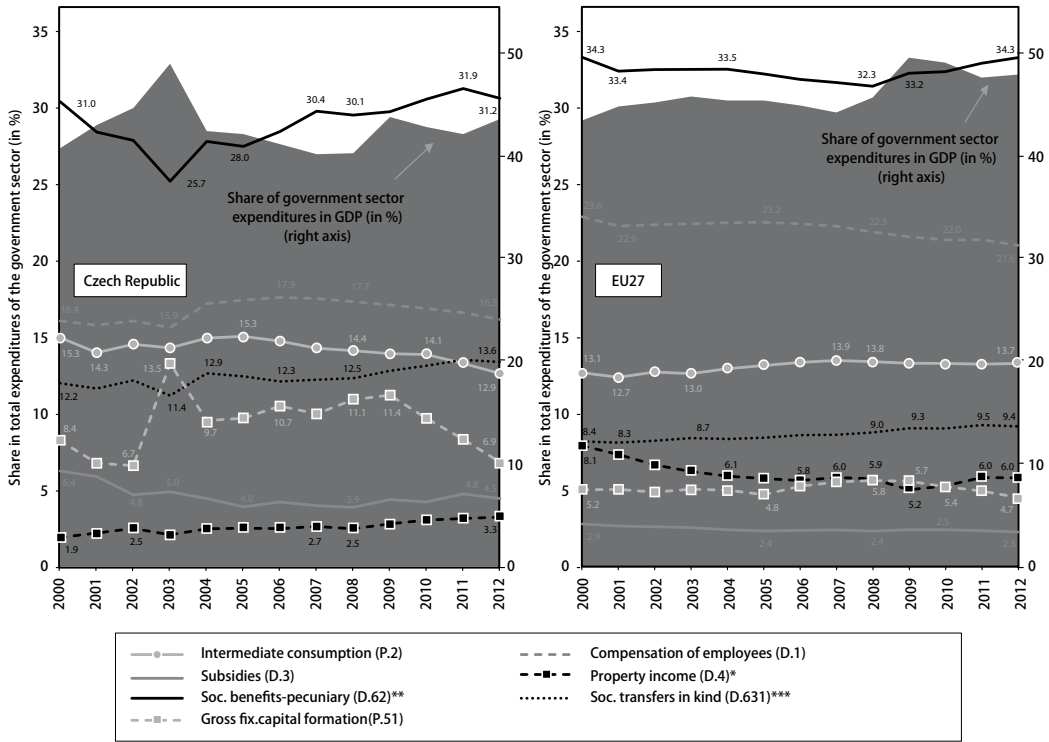
* *Property* income payable include mainly instalments of interest of the government sector debt.
** *Social benefits other than social transfers in kind* consist of social benefits in cash provided under social insurance schemes and social assistance benefits in cash, provided by the government units to households out of the social insurance schemes.
*** *Social transfers in kind* = expenditure on products supplied to households via market producers.
Source: Eurostat

support) which, in respect of high mandatory social deliveries, is not surprising. The share of these benefits, i.e. social benefits (other than social transfers in kind) in the structure of the government sector expenditures in the CR is growing on the long-term basis, however, also in 2012, it was below the EU level (see Figure 4). Almost two fifths of government expenditures were allocated in 2012 to pecuniary social benefits in Italy or Portugal, by contrast, in the Netherlands or in Latvia, only one fifth.

An important section of social transfers is divided also in form of in-kind social transfers (their size is estimated on the basis of an amount paid out by health insurance companies to medical facilities for services provided to households.) Social in-kind transfers traditionally represent a higher proportion of total government expenditures in the CR than in the whole EU. The biggest weight is attributed to these expenditures in Germany and the Benelux countries.

Another important item is represented by the "operating" expenditures of the government sector which contributes by almost one third to the total government expenditures in majority of the EU countries. They cover the intermediate consumption and employees compensations (all costs of the government sector on its employees). While the share of intermediate consumption in the government expenditures in the

CR until 2010 has been maintained slightly above the level of EU countries, in case of employees compensations the weight of these expenditures for the CR in 2012 in all the EU countries was the lowest (near the Czech level were all our neighbours save for Poland). Out of other items of expenditures of the government sector in the CR it should be mentioned a relatively high share of investment (gross fixed capital formation) and also higher weight of subsidies. By contrast, relatively low were, compared with the EU (despite long-term growing weight) expenditures on repayments of the government debt interest. In the period of economic recession both in the CR and EU the share of pecuniary and also in-kind social benefits was growing (among other things, also due to the growing unemployment). The government sector, by contrast, was reducing the weight of the operating expenditures and investment. In the CR between 2009 and 2012 a sharp drop of the share of investment expenditures took place (also due to their high weight in previous years). In the CR, the weight of the operating expenditures of the government sector was more reduced in form of intermediate consumption, in the EU countries, by contrast, the share of employees' compensations was falling (by cutting salaries and reducing positions in the government sector).

The structure of the government sector expenditures showed certain changes as time passed. In economically relative favourable period between 2000 and 2008 the reduction of share of the government debt repayments took place across all EU27 countries (mainly in the South European countries, Romania or Denmark). The CR was, in this respect, an exception, the share of paid out property income in the total government expenditures increased from 1.9% to 2.5% and an item which the governments reduced most, were subsidies. The government expenditures in this period, by contrast, preferred more investment expenditures and especially in countries which joined the EU after 2000 (mainly in the Baltics and Balkan countries). E.g. in Romania the share of gross fixed capital formation expenditures in total expenditures of the government sector increased between 2000 and 2008 from 9% up to almost 17% (in the CR from 8.4% to 11.1%) In some countries the share of expenditures on social benefits grew most rapidly be it pecuniary (i.e. D.62: Hungary, Ireland, Portugal, Cyprus) or in kind benefits (i.e. D.631: Greece, the Netherlands, Slovakia). Five countries then showed the biggest changes in the expenditure on intermediate consumption of the government sector.

In 2009, when the public budgets were most markedly affected by deep economic recession, across all member EU countries the share of expenditures on social benefits increased. In two thirds of member countries the relatively most dynamic item were pecuniary social benefits (D.62), the most obvious was their growth in the Baltics (e.g. in Latvia it grew from 21% in 2008 up to almost 29% a year later; in the CR their share in all government expenditures remained constant, closely above 30%). More intensive need for social benefit expenditures was narrowly linked with the impacts of economic crisis on the labour market and, consequently, on the income of households. In 2009, the government sector, by contrast, reduced the share of investment expenditures (mainly so far generously investing new member countries, but also Ireland or Greece) but also the operating costs of the government sector (mainly Latvia and Bulgaria). Some big economies (Germany, France, Italy) supported their budgets by reducing the share of expenditures on the government debt repayments.

Between the years 2009 and 2012 the efforts in the whole EU to consolidate government deficits by reducing relative weights of expenditures both on the operation of the government sector, and the investment, continued. Operating costs were reduced more often by cutting the compensations of employees in the government sector, in ten EU countries (incl. CR and Slovakia), however, by reducing the weight of expenditures on intermediate consumption. This group may include Greece where the share of expenditures on intermediate consumption of the government sector between 2009 and 2012 dropped from 13.7% to 8.9%, in case of the employees costs in this sector the reduction of their weight was more moderate – from 24.9% to 22.8%. The decrease of weight of intermediate consumption expenditures as well as the reduction of the expenditures on the government sector employees was between the years 2009 and 2012 obvious almost in half of the EU countries. Two thirds of the Union members

in this period reduced also the share of the investment expenditures, most in Spain (from 9.6% to 3.7%) and in CR (from 11.4% down to 6.9%). Finally, one third of the EU countries reduced in this period their share of expenditures on pecuniary social benefits (D.62), however, in most cases it referred to relatively moderate reductions and save for Germany, it referred rather to small-scale economies. If we include also the year 2008 (where already the first effects of the crisis on the labour marked appeared) then between 2008 and 2012 the share of pecuniary social benefits in total expenditures of the government sector dropped only in four countries (Germany, Sweden, Luxembourg and Hungary – in all cases by less the 1 p.p.) and by more than 5 p.p. the share increased, by contrast, in Latvia, Ireland and Bulgaria and from countries outside EU also in Iceland (+6.6 p.p.).

5 DYNAMICS OF MOST SIGNIFICANT ITEMS OF EXPENDITURE OF THE GOVERNMENT SECTOR IN THE PERIOD OF BUDGETARY CONSOLIDATION

From the shock, which suffered government sector in 2009, individual European countries in the following years have been gradually recovering. Except for Denmark and Cyprus all EU member countries managed between 2009 and 2012 to reduce government deficits (in relation to GDP). Let us examine how the most important groups of expenditure items contributed to fiscal consolidation in individual countries.

5.1 Gross fixed capital formation

One of possibilities to alleviate the government deficits at the period of recession is the reduction of investment expenditures (gross fixed capital formation). This form has been chosen by many member countries, which is attested by the fact that countries which (between the years 2009 and 2012) managed to most tame their deficits simultaneously reduced their investment (in relation to GDP). This referred to both

Figure 8 Development of deficit (surplus) of the government sector in relation to GDP and change of share of government investment expenditures in GDP in the period of recession (selected European countries, difference between the years 2012 and 2009 in p.p.*
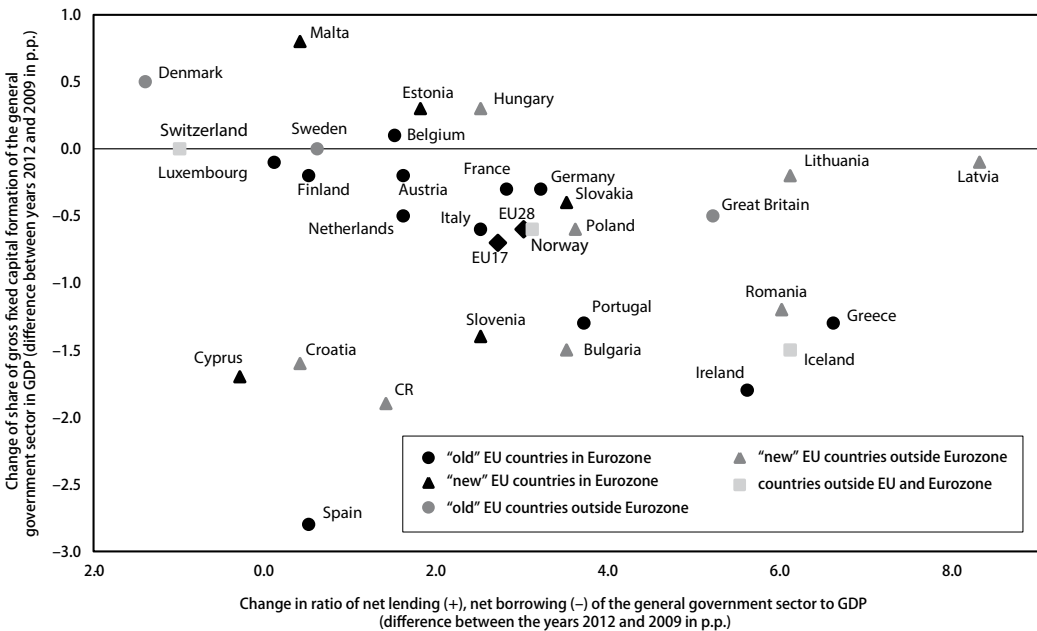
* For Switzerland comparison refers to the years 2009 and 2011.
Note: Membership of countries in economic formations (EU, Eurozone) was assessed by the condition at the end of 2013.
Source: Eurostat

countries coping with deep debt crisis (Greece, Portugal, Island) and so far relatively less indebted Balkan countries (see Figure 8). This relationship, however, is not direct since e.g. the Baltics have significantly cut their high deficits at the beginning of crisis without any marked reduction of relative volume of their investment. Another example may serve some small open economies strongly hit by crisis (Cyprus, partly also Slovenia) which in spite of strong reduction of investment expenditures did not significantly reduce their deficits between the years 2009 and 2012.

The options for short-term reduction of investment to directly mitigate the government deficits depend on total size of previous government investment. On the long-time basis mainly new member EU countries show high investment of government sector to GDP which is due especially to lower level of their infrastructure (transport network, environment) as well as investment stimulation by the EU policies. As other EU members concerned the higher government investment (above 3% of GDP) is traditionally reported by the Netherlands and Sweden. In spite of strong cuts in investment expenditures of the Czech government sector (as late as in 2009 the share of the gross fixed capital formation in total GDP by 5.1%, which was the third biggest value recorded in EU) the relative scope of government investment remained still significantly above both EU and Eurozone level.

5.2 Intermediate consumption and compensations of employees

Another way how the government institutions may relatively fast diminish their deficits is the rationalization of "operating" costs of the government sector. These expenditures may be very roughly expressed as the sum of intermediate consumption and costs per employee in the government sector (expressed in form of employee compensations).

Expenditures on "operation" of the government sector cut off in 2012 in the whole EU 35% from government expenditures. This share is long stable, however, significant differences between individual countries survive – big share is specific for Northern countries and the Great Britain, and also for

Figure 9   Share of expenditures on the government sector "operation" in 2012 and its change (selected European countries, condition as of 2012 and differences between the years 2012 and 2009 in p.p.*
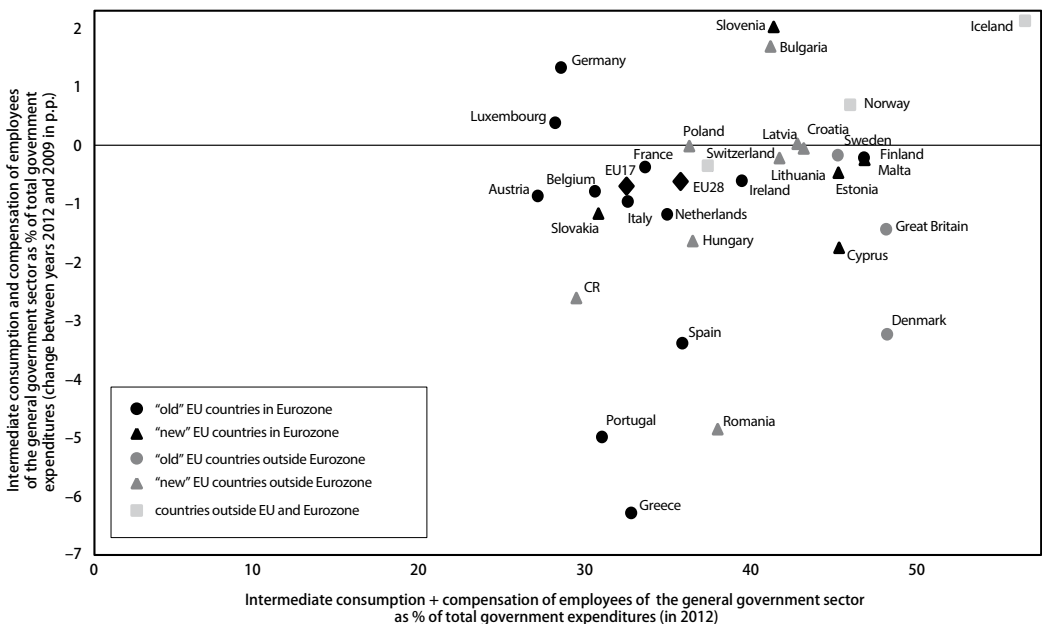
* For Switzerland the comparison refers to years 2009 and 2011.
Source: Eurostat

the Baltics if considering new member countries. Disparities across the EU countries can be attributed to the preference of another (often more important in terms of weights) items of government expenditures – mainly social benefits and transfers, then subsidies and the above mentioned investment.

The upcoming recession since 2008 has started up in majority of countries the process of gradual reduction of the share of "operating" expenditures. It happened so in the CR two years earlier. The share of operating costs of the Czech government sector in total expenditures has been continuously falling down to current level (approaching the current level in Germany –30%). Countries coping with deep government deficits and high indebtedness (e.g. Greece, Portugal) were forced to make radical reduction of "operating" expenditures of their government sector (see Figure 9). Certain deviation is represented here by Denmark, which was motivated rather by both high share of "operating" expenditures (in 2009 they made 51% of total government expenditures which was the biggest within the EU) and limited options for speedy reduction of other expense items (e.g. investment expenditures of the government sector was on the long-term basis below 2% of GDP). Germany as the only one of leading EU economies in the last three years reported a slight increase of the operating expenditure of the government sector. This was made possible, among other things, by relatively low share of operating expenditures, lower government deficit and the efforts to maintain the low level of unemployment (in the European context). On the other hand some countries reduced more markedly the share of their expenditures on the operation of government sector as soon as in 2009 (the Baltics, Bulgaria).

5.3 Social benefits (other than social transfers in kind)

These social benefits (D.62) represent the most important expenditure items of the government institutions almost in all the EU (except for relatively small countries – Malta, Cyprus and Denmark). In this respect, from purely statistical aspect, the biggest potential for fiscal consolidation lies in this expenditure. In real economy this potential is, however, significantly reduced and mainly in the short-term period since a big part of these expenditures is of mandatory character. In addition, these expenditures are affected by the situation in the labour market which was within the last five years in the EU hit by sharp growth of unemployment up to so far unprecedented maximum (11% – in the half of 2013).

Among the European countries significant differences between the share of these social benefits in GDP persist (in South European countries it almost doubled in 2012 compared to the Baltics or most of Balkan countries). Between the years 2009 and 2012 half of the EU countries recorded an increase of this share (see Figure 10). Reduction thereof was obvious both in the countries in which the negative consequences of recession (e.g. unemployment) showed immediately mainly in 2008–9 and in the subsequent years the labour marked was sufficiently stabilized (the Baltics, Iceland) and in countries whose labour market was not so negatively affected by the recession (Germany, Austria and some of the Northern states). Although the volume of paid out social benefits in relation to GDP (or to the total government expenditures) in the last three year in EU as a whole did not fall, in this period two thirds of the member countries recorded a slight growth of percentage of people at risk of poverty or social exclusion (even after the social transfers) – particularly in South European countries and the Balkans.

5.4 Paid up government debt interest

Depth of government deficit is affected also by costs of the debt service. This refers mainly to interest on issued government sector debt securities. Its amount reflects both the volume and the level of interest of the earlier issued government bonds and its structure, e.g. from the aspect of maturity as well as rate of exchange impact.

She share of paid interest (D.41) in total EU government sector expenditures as a whole does not change significantly on the long-term basis – governments allocate about 6% of its expenditures to settle the debts. In Greece, Italy or Hungary for this purpose they allocate to settle the debts one tenth

Figure 10 Share of paid out social benefits* in GDP and its change (selected European countries, condition as of 2012 and differences between the years 2012 and 2009 in p.p.)*
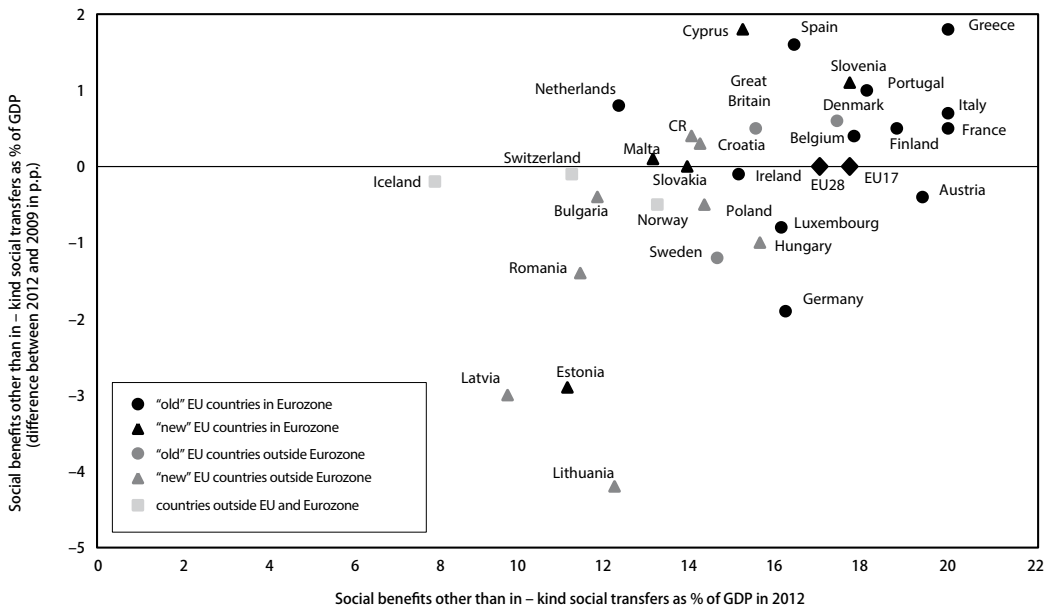
* Social benefits (other then in-kind social transfers) paid out by government institutions (ESA95 code D.62) represent transfers to households, pecuniary or in-kind, and designed to mitigate financial burden resulting from many risks or need (according to the Convention, this refers to the following: illness, disability and incapability, industrial injury, occupational disease, old-age, survivors, motherhood, family, employment promotion, unemployment, housing, general necessity).
Note: For Switzerland the comparison refers to the years 2009 and 2011.
Source: Eurostat

of their government expenditures, in Iceland even one eighth (see Figure 11). The Czech Republic belonged to a one third of the EU countries where the share (3%) of expenditures of this kind was the lowest and well corresponded with the ranking of the CR in total relative indebtedness. Between the years 2009 and 2012 the share of the government expenditures on interest increased in two thirds of the EU countries especially in Ireland (from 4.2% to 8.5%) and Portugal (from 5.7% to 9.3%). Among countries, which were not seriously hit by the debt crisis, this share markedly increased also in Great Britain where governments benefited from the good position of the country in the bond markets to cover deep government deficits (in 2009 and 2010 they oscillated between –10 to –11.5% of GDP).

One of the significant tools of the government debt management strategy are the government bond issues. The yields from long-term (ten years) bonds reflects the confidence of creditors into the respective country (prospective of economic growth, economic policy), however, it is also affected by interventions of important global institutions (e.g. European Central Bank).

After the out-break of deep economic recession in the latter half of 2008 in EU an obvious divergent tendencies in long-term government bond yields took place. While at the beginning of 2008 in more than two thirds of countries the yields of their long-term bonds moved in the narrow zone 4.0–4.5%, five years later in one fourth of countries these yields exceed 5%, however, the yields still did not reach the level of 2% in one third of EU countries. Recession also markedly shuffled positions of individual countries. Just before the out-break of recession the biggest yields were generated by Hungarian and Romanian government bonds (7%), these yields in the bond marked reflected the economic level

Figure 11 Paid-up debt interest * and total expenditures of the government sector and their relation to the GDP (selected European countries, annual average in the period 2009 and 2012, in %)
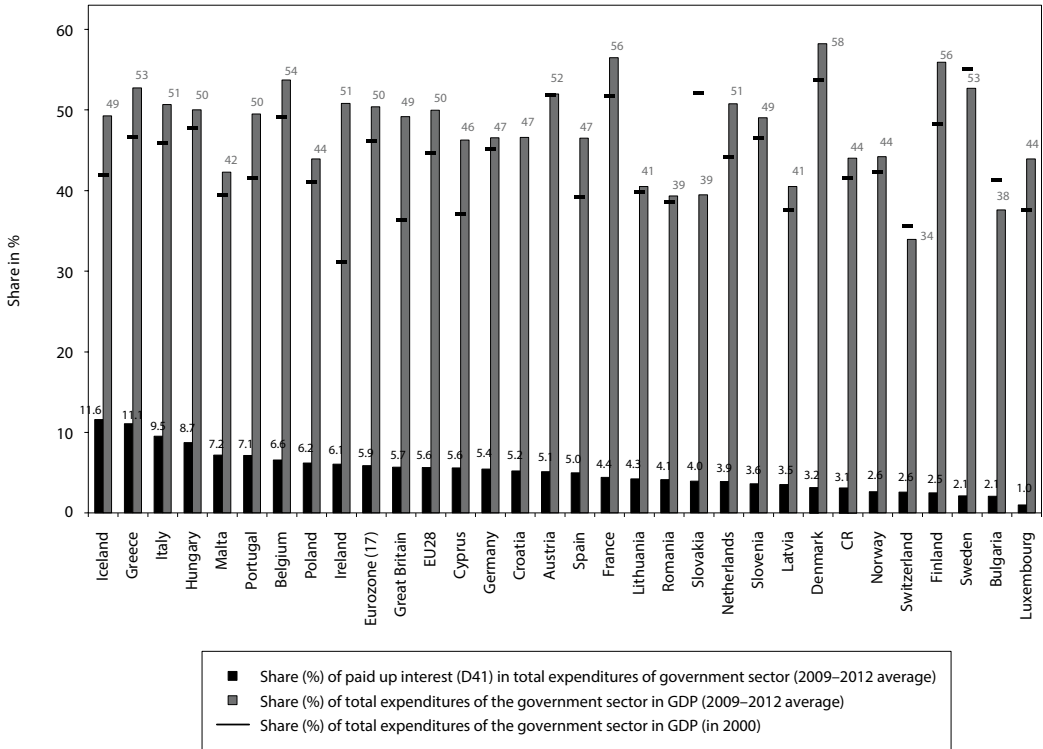
* Interest payable (D.41) covers interest on issued debt securities and on received loans and an estimate of interests on financial leasing. Interest resulting from swap arrangements and forward rate agreements is not included; they have been recorded as a financial transaction within financial derivatives (in compliance with EU regulation No 2558/2001).
Note: For Switzerland the period 2009–2011 is assessed.
Source: Eurostat

of the respective countries (expressed e.g. by GDP per capita in PPS). While the position of Hungary and Rumania did not show much improvement during the last years, majority of other younger member countries of the Union managed to gradually issue their bonds with lower interest rates (especially the Baltics which implemented sharp cuts in government expenditures). The yields of the Czech government bonds copied (like in case of Slovakia) between the years 2008 and 2010 the level of the whole EU, then, however, Czech bonds followed (along with Austrian) the descending trend (to level below 2%) while Slovak bonds yields were obviously above the EU level and by the end of 2012 they ended up still slightly above 4% (see Figure 12). The effect of rapid economic growth in Slovakia (compared to the CR) was in the recent years overwhelmed by deeper government deficits and subsequently by higher dynamics of the government debt.

Since the latter half of 2012 it is possible to detect in the European bond market the signs of certain calming down which produced a gradual drop of long term government bond yields. This drop referred mainly to countries most threatened by further escalation of the debt crisis. An exception was Cyprus, hit by the bank crisis where the average long-term bond yields were for almost a year at 7%. Recent drop of yields affected also the Czech government bonds, which in March 2013 fell below the 2% limit (a year earlier they showed the yields over 3.5%). In other Union member countries a slight drop in yields in the last months did not occur in Germany, Sweden, Denmark and Great Britain – i.e. in countries

Figure 12 Long term government bond yields (Maastricht definitions)* in selected EU countries (monthly average, in %, not seasonally adjusted)
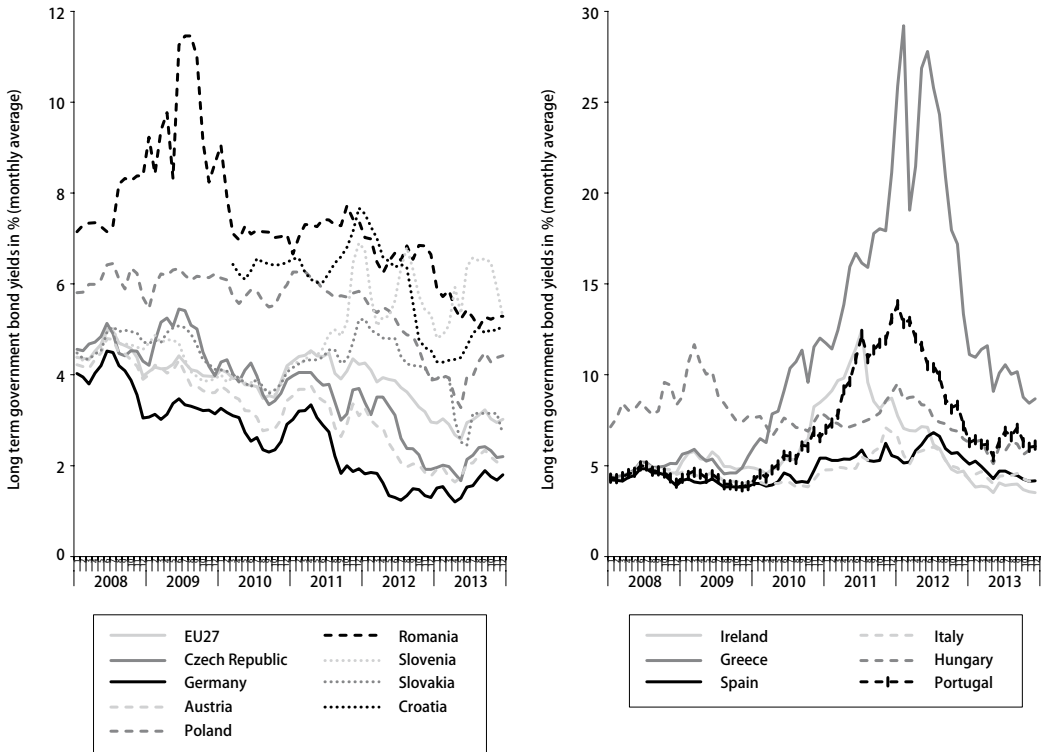
* Long-term government bonds yields refer to the yields of central government bonds in the secondary market, before taxation with the out standing maturity about 10 years. This definition is used in convergence criteria of Economic and Monetary Union for long-term interest rates The series are harmonised for all the Member States apart from Estonia.
Source: Eurostat

whose economies long cope with current recession (e.g. from the aspect of the labour market) relatively successfully and yields of their 10-year old bonds moved obviously below the level of the Czech bonds.

The amount of expenditures on the government debt interest is not lined only with the total level of indebtedness and position of individual countries in the bond markets. An important role is played also by the structure of the government debt – be it from the aspect of representation of different types of creditors, types of financial instruments covering the debt or debt rescheduling by maturity or by currency.

6 STRUCTURE OF THE GOVERNMENT SECTOR DEBT

The Czech Republic along with Slovakia belong to the half of the assessed countries within the EU where the main group of creditors of the government sector debt represent financial institutions (see Figure 13). These creditors dominate especially in small usually less indebted economies (e.g. Luxembourg, Malta). The second important group of creditors are the non-residents having an important position both in countries with high government debt (Hungary, Portugal) or low debt (the Baltics), they can also be found in "younger and "older" member countries.

On the basis of available data (21 EU countries) it can be stated that between the years 2005 and 2010 the share of non-resident creditors was gradually increasing, representation of other groups

Figure 13 Government debt structure by the type of creditor at the end of 2012
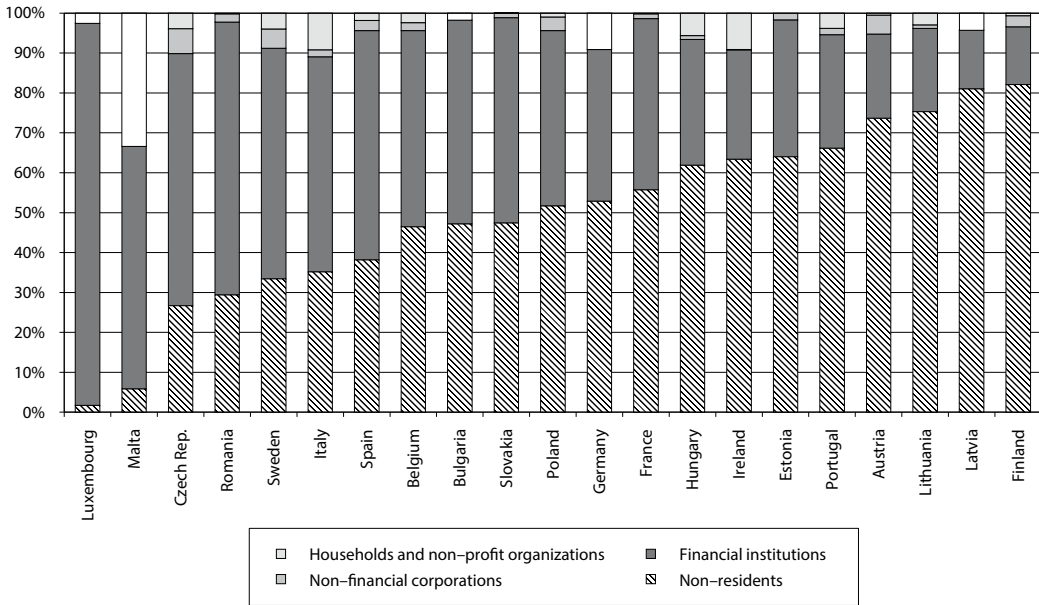
Note: For Bulgaria, Germany, Luxembourg, Latvia and Malta the summary for households, non-profit organizations and non-financial corporations is given.
Source: Eurostat

of creditors, by contrast, fell (households) or slightly fluctuated (other sectors). During 2011–2012 mainly in big economies (France, Italy, Spain) the position of non-residents (as creditors) slightly weakened in favour of financial institution. However, some in new EU members (Poland, Hungary, Slovakia and the Baltics) the share of government debt held by non-residents continue to strengthen.

In case of the Czech government sector debt the share of non-resident creditors was increasing faster (by the end of 2005 they "hold" one fourth of debt expressed in Euro, six years later more than one third), however, in 2012 their share dropped significantly (to levels 2008). On the other hand, position of non-financial corporation as well as households has been strengthened recently. In respect of so far last issue (November 2013) of state saving bonds it can be assumed that household share in possession of total government sector debt of the CR will approach to 5%.

Individual European countries differ also by kind of financial instruments, which they use to cover the government debt. In all the EU countries, however, at the end of 2012 dominated instruments of long-tem character (see Figure 14) – in overwhelming majority of cases it referred to securities, long-term loans prevailed in Greece, Estonia and Latvia). Structure of individual main financial instruments remains in long-term view in the whole EU and Eurozone relatively stable – almost four fifths of the government debt is financed by securities (with the exclusion of financial derivatives), one sixth by loans and during the last decade 3–5% was represented currency and deposits (which played more important role only in Italy, Great Britain and Ireland).

At the Czech government sector debt the importance of securities is growing, the share of debt financed by loans between the years 2000 and 2012 fell from one third to one tenth. At the same time the importance in instruments of long-term character is growing – for loans they constituted almost 99%, in case of securities their share by the end of 2012 climbed up to 88% while until 2001 in the Czech gov-

Figure 14 Structure of government debt by financial instruments at the end of 2012

Legend:

- ☐ Currency and deposits
- ☐ Short–term loans
- ☐ Long–term loans
- ▦ Short–term securities other than shares*
- ▨ Long–term securities other than shares*
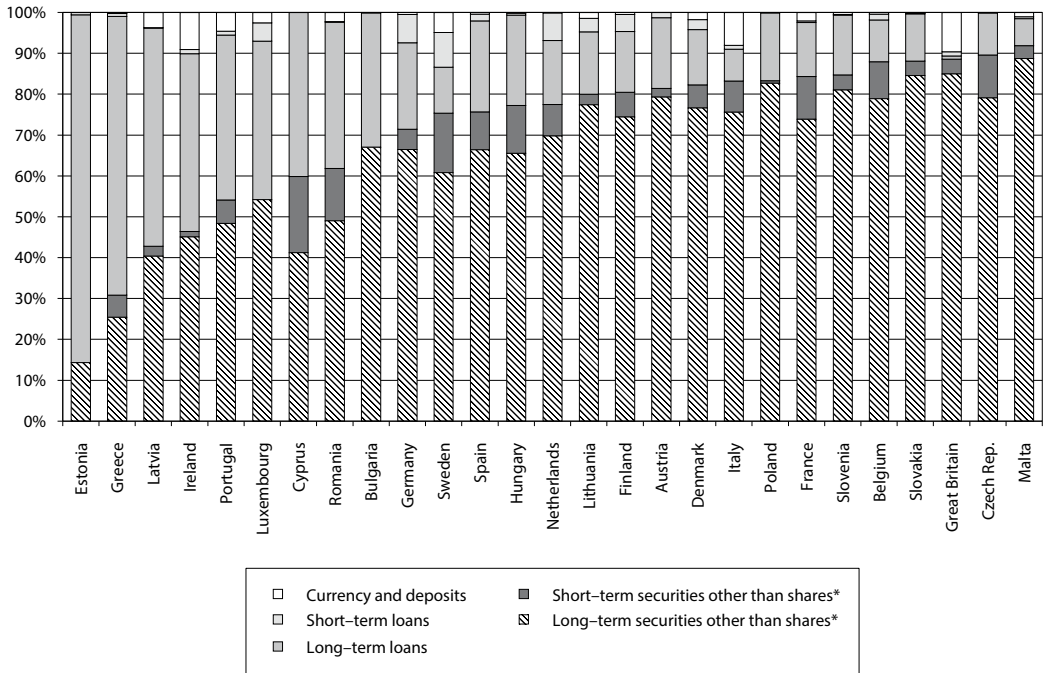
* Except for financial derivatives.
Source: Eurostat

ernment debt financing (as for one of a few European countries) short-term securities prevailed over long-term ones. It was made possible due to, among other things, relative low level of total indebtedness.

One of other important views on the structure of the government debt is its segmentation by sub-sectors of the government sector. The overwhelming majority of this debt is long concentrated in central government institutions which include namely organizational units of state, state funds and other out-of-budget funds and also public universities and some (centrally controlled) state-funded institutions. In the whole EU 85% of the government sector debt falls on central government institutions. One third of the EU countries (including the Czech Republic) concentrated in 2012 over 95% of its government debts in the sector of central government institutions (see Figure 15). Local government indebtedness was more obvious in countries with a strong tradition of regional self-administrative units, especially then in the states with federative system (e.g. Germany). Debts of local governments show higher representation also in so far little indebted Northern countries and the Baltics – in Estonia they made in 2012 almost one third of debt of the general government sector of this country. Relatively marked disparities in the share of total government debt concentrated by local governments can be attributed, among other things, to the relative size of local budgets (in Denmark or Sweden they make more than a half of expenditures of general government sector while in Austria or Portugal one seventh and in the CR one fourth).

To more marked increase of debt of the whole government sector contribute except for central government institutions also local (or state) governments. While between the year 2008 and 2012 the amount of central government (S1311) debt (expressed in euro) in the EU countries increased by 46%, in case

Figure 15 Structure of government debt by subsectors of government sector at the end of 2012*
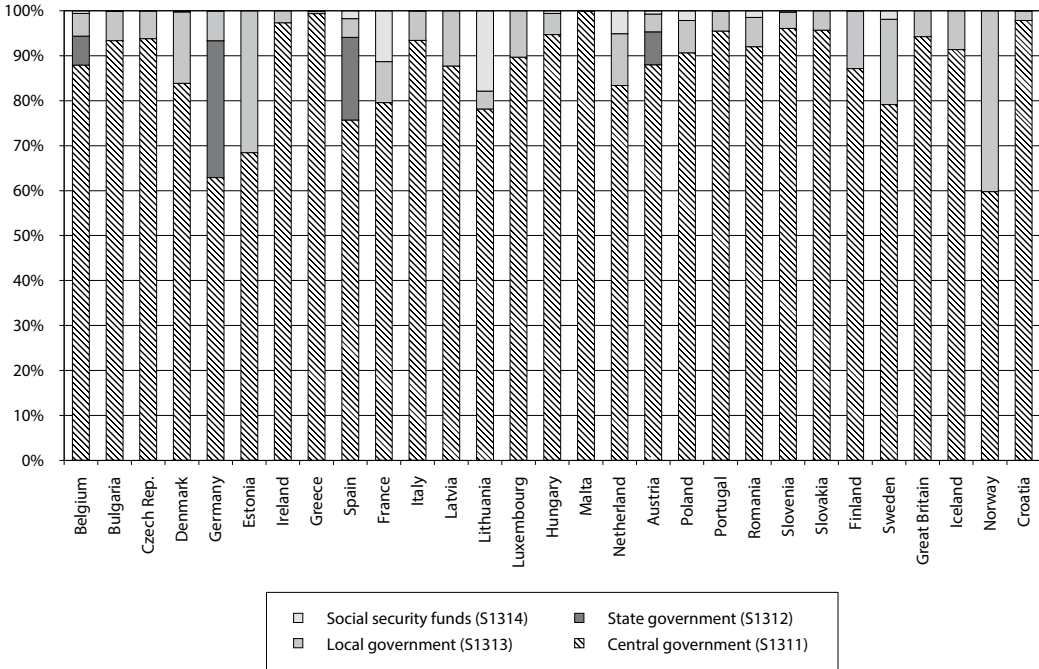
* Unconsolidated data, due to high influence of consolidation Cyprus was excluded from comparison.
Source: Eurostat

of local governments (S1313) only by one fifth. Consolidated debts of state government (S1312), relevant only in five EU countries, for the same period increased by two fifths.

Local (or state) government debts increased between 2009 and 2012 relatively most in Sweden and Spain. In Sweden, where budgets of territorial self-administrative units swallow a big part of general government expenditures, local governments participated in the increase of so far relatively low debt of the whole government sector by a complete one half. Both local and state governments in Spain were between 2009 and 2012 responsible for the growth of the already big debt of the whole government sector in almost one third. In Spain the rapid growth showed mainly expenditures of provincial governments (S1312), which doubled their debt in the period 2010–2012 (for comparison in Germany the similar debt grew by one sixth and in Austria by one third). Indebtedness of provincial governments in Spain was in 2012 almost 4.5 times bigger than indebtedness of local governments (total expenditures of local governments were at the same time three times lower compared to provincial governments).

In group of highly indebted countries since 2009 indebtedness grew faster mainly in central government institutions, negative role of other government subsectors was obvious only in Spain, to lesser extent in Belgium and Austria. In period 2010–2012 consolidated local (and state) government debt exceeded the growth rate of central government debt only in seven EU countries (see countries located left and above the diagonal in Figure 16). This was mainly due to the influence of local governments (Poland, Bulgaria, Sweden), in case of Belgium and Austria also with participation of provincial governments. In spite of relatively humble increase of indebtedness of local and state governments in Germany these subsectors contributed (between years 2009

Figure 16 Relationship between the development of central and state or local governments debts (in euro), development between the years 2009 and 2012
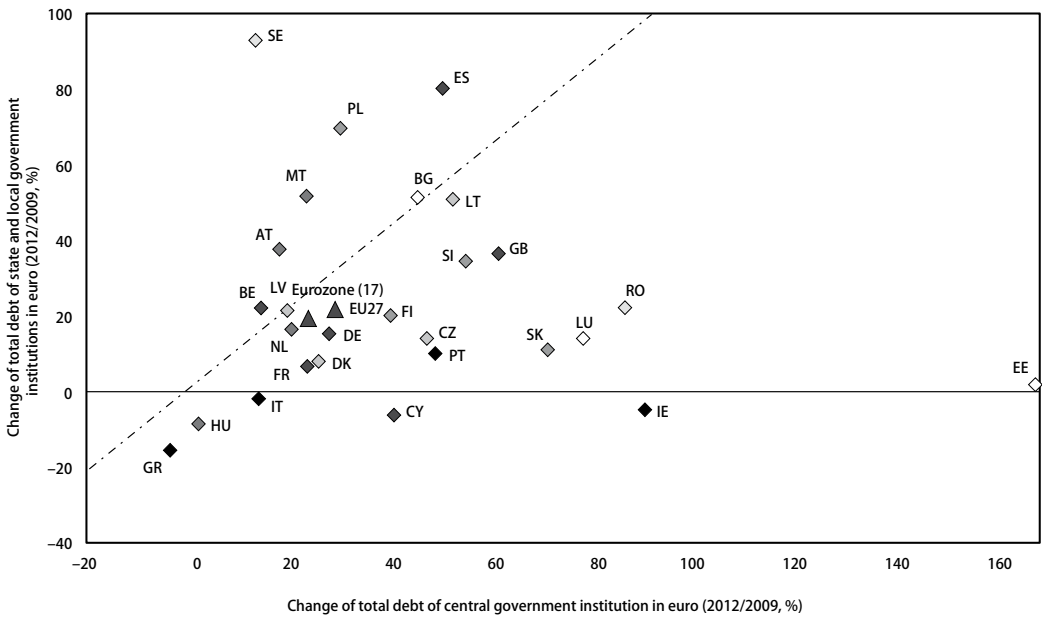
Note: For countrie's abbreviations see Figure 2. Different colours for individual countries expresses the amount of total debt of the general government sector at the end of 2012.

< 30 % GDP	30–39 %	40–49 %	50–59 %	60–79 %	80–99 %	> 100 % GDP

Source: Eurostat

and 2012) to the general government debt increase in Germany by more than one fourth. An important role of state and local governments in Germany stems from their big share in overall general government expenditures and is stressed also by their almost 40% share in the whole debt of the government sector of Germany in 2012.

In the CR the role of local government institutions is, in comparison with EU countries less important. It applies both from the aspect of budget sizes (they contribute by one fourth to total expenditures of the government sector), the level of indebtedness (6% of weight in total government debt) and the growth rate of debt itself in the period of recession (between the years 2008 and 2012 they contributed to the growth of the whole government debt of the CR by slightly more than 2.5%). The indebtedness of regions in the CR grew more quickly and, according to non-consolidated data of the Ministry of Finance, it increased between 2008 and 2013 from CZK 14.6 bln. to CZK 26.8 bln. while in municipalities from CZK 80.1 bln. to CZK 92.2 bln. Almost half of the debt at municipal level in the CR was at the end of 2012 generated by four biggest cities, the aggregate amount of their debts showed, however, in the last years, contrary to other municipalities, no significant increase.

CONCLUSION, SUMMARY

Deep economic recession intensified across EU countries the government deficits (net borrowing) and started up the rapid growth of the government debts. These trends erupted most intensively in 2009 when it was not possible to sufficiently and quickly compensate a profound y-o-y drop of total government

revenues (deeper than the drop of GDP) at the expenditure side. In the following years the governments of individual countries reacted both by efforts to reduce expenditures (this applies mainly to non-mandatory expenditures which can be adjusted faster) and by measures to strengthen revenues (most countries increased indirect tax rates and especially the Eurozone countries increased the income taxes of physical persons). The above effects along with moderate economic growth in 2010–2011 helped a significant majority of countries to hammer down high deficits of their government sector and, consequently, also to slow down the growth rate of total indebtedness. South European countries (Spain, Portugal, Italy, Cyprus) whose government debt in relation to GDP grew most as late as during 2012, were an exception.

While in 2007 only government sector in Greece, Portugal and Hungary failed to meet the Maastricht criterion of 3% deficit, a year later half of the EU countries did not meet the criterion, and in 2011 almost two thirds of the EU members (incl. the CR). Referring to traditionally strong economies in both 2011 and 2012 this criterion was performed only by Northern European countries, Luxemburg and two of Czech neighbours (Austria and Germany). The growth rate of the government debt (in relation to GDP) between 2008 and 2011 in the whole EU exceeded the growth rate in Eurozone. Within the Eurozone the Maastricht debt criterion was continuously exceeded by five member countries – Greece, Italy, Belgium, Austria and Germany (save for the year 2001). Gradually, they were joined by France (since 2003), Portugal (since 2004), the Netherlands, Ireland, (since 2009) and Spain (since 2010) out of new member then Malta, Cyprus and quite recently Slovenia.

Relationship between the balance of the government sector (deficit/surplus) and economic growth was in all EU27 countries very weak, mainly in the period 2000–2008. There was a striking difference between "new" member countries, which joined EU after 2000 and "traditional" Union countries. Majority of these new countries showed obviously better results in the y-o-y growth rate of GDP than the whole EU, at the same time, however, it had (as potential Eurozone) problems to meet the Maastricht criterion concerning the government deficit. By contrast, Austria, the Benelux countries and mainly the Northern countries did not have (until the outbreak of global recession) any significant problems with its government deficits and assessed by their amounts within all EU countries markedly better ranking then by the y-o-y growth rate of GDP. The link between the GDP growth-rate and government sector deficits in the EU countries increased in the period of economic recession.

Among the European countries significant differences between relative amount of total government expenditures survive. While in Denmark expenditures of the government sector reached almost 60% of GDP, in Bulgaria they moderately exceeded one third. Above the average relative expenditures are long maintained by Northern countries, France, Belgium, Austria, and in terms of poorer Eurozone members by Greece and Italy. New Union countries show long-term lower share of government expenditures. It also applies to the expenditure of the Czech government sector whose relative expenditures were long-term below the whole EU level and, with the exception of Slovakia, they were the lowest out the whole Central European region.

The structure of the government sector expenditures showed changes. In relatively favourable period in terms of economic growth (2000–2008) across all current EU members the share of the government debts repayments (mainly in South European countries, Romania or Denmark) dropped. Government sector in this period, in contrast, more preferred investment expenditures, mainly in new member countries (the Baltics and the Balkans). In Romania the share of gross fixed capital formation in total government expenditures increased between 2000 and 2008 from 9% up to almost 17% (in the CR from 8.4% to 11.1%). Higher share of investment expenditures in new EU members can be explained by lower level of their infrastructure (transport network, environment) as well as investment stimulation by the EU policies.

In 2009 when the public budgets were most markedly affected by deep economic recession, across all EU members the share of social benefits expenditures increased. In two thirds of member countries pecuniary social benefits (other than social transfers in kind) were relatively most dynamic item, most

obvious was their growth in the Baltics (e.g. in Latvia increased from 21% in 2008 to almost 29% a year later, in the CR their share in total government expenditures remained constant, just above 30%). Bigger need for expenditures on social benefits was closely linked with the impacts of economic crisis on the labour market and consequently on the household's primary income.

In period 2010 and 2012 in the whole EU the efforts to consolidate government budgets by reducing the relative weight of expenditures on the operation of the government sector (in the CR more in form of intermediate consumption, the EU countries preferred more cuts in employees' compensations) continued. Two thirds of the Union members reduced in this period also the share of investment expenditures, most in Spain (from 9.6% to 3.7%) and the CR (from 11.4% to 6.9%).

The growth of government debt in the period of recession was the driven mainly by central governments. In Spain the provincial government between 2009 and 2012 doubled their debt and along with local governments contributed to the high growth of the whole government sector by almost one third. In the CR the role of local government institutions is, in comparison with all the EU states, less important. This applies both from the aspect of the sizes of their expenditures, the level of indebtedness (6% weight in the total government debt) and the growth rate of debt itself in the period of recession (between the years 2008 and 2012 they contributed to the growth of the general government sector debt of the CR only by more than 2.5%).

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How to Read Government Deficit and Debt

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Abstract

Economic situation of the government described by the indicators of the national accounts is currently under the spotlight of the professional public. The indicators have its relevance to considerations of the fiscal sustainability and the European Monetary Union enlargement. However, awareness of the methodology is rather weak; the indicators are in many cases confused with other indicators related to public finance. The main aim of the text is to provide a detailed explanation of nature of key indicators used for the purpose of the Excessive Deficit Procedure. At the same time, main differences between indicators related to the state budget, public sector and EDP procedure are outlined.

Keywords	JEL code
National accounts, government deficit, government debt, state budget, EDP, public sector	*H62, H63, H71, E62*

PREFACE, INTRODUCTION

As a member of the European Union, the Czech Republic is obliged to follow the rules of fiscal stability defined in the Stability and Growth Pact. The Pact specifies well-known thresholds of government deficit (3% of GDP) and government debt (60%). These (Maastricht) criteria are presented in the Excessive Deficit Procedure (EDP).[3] EDP is launched with a Member State having breached or being in risk of breaching the deficit rule, or with a Member State with the government debt exceeding 60% and if, at the same time, the debt is not reduced at a satisfactory pace.

Economic situation of the government described by the indicators of the national accounts is currently under the spotlight of the professional public. The indicators have its relevance to considerations of the fiscal sustainability and the European Monetary Union enlargement.[4] However, an awareness

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[3] The legal basis of the SGP is represented by Articles 121 and 126 of the Treaty on the Functioning of the European Union. Fiscal thresholds are specified in the Protocol No. 12 on the excessive deficit procedure, which is annexed to the Treaty on European Union. To enhance the fiscal responsibility, new regulations were introduced during last years. In December 2011, the Sixpack has entered into force, followed by the Fiscal Compact in 2013. It is worth to mention, that the Czech Republic has not ratified the Fiscal Compact so far. On May 2013, the regulation "Two Pack" intended for the eurozone members has also entered into force. Aim of these regulations is to strenghten the surveillance mechanism in the Euro Area.

[4] However, within the Six-pack regulation additional set of rules has been introduced. If public expenditures are not matched by appropriate revenues, than public expenditures must not rise faster than medium-term potential GDP growth (so-called "expenditure benchmark"). More attention is also paid to structural deficit, i.e. balance not affected by the economic cycle. Structural deficit can not breach the threshold 0.5% of GDP.

of the methodology is rather weak; the indicators are in many cases confused with other indicators related to public finance. The main aim of the text is to provide a detailed explanation of nature of key indicators used for the purpose of the Excessive Deficit Procedure. At the same time, main differences between indicators related to the state budget, public sector and EDP procedure are identified.

Quantification of government ("Maastricht") deficit and debt is based on methodology of the national accounts (ESA95, ESA2010 respectively) which is defined by the Regulation; for reflection of specific features of the government and to make the methodology more flexible, Eurostat publishes complementary guidance the "Manual on Government Deficit and Debt", recommendations related to calculation of taxes or social contributions, but also advices given by the Eurostat to member states concerning specific issues.

The quality of final data is under strong supervision of users. EU member states are obliged to provide twice a year the "notification of government deficit and debt"; integral part of the notification process is the period of "clarifications" within which appropriate application of methodology is bilaterally discussed by national statistical office and the Commission. Parts of the verification process are also dialogue mission focused on compilation process and data quality.

Aim of this text is to provide a detailed explanation of relation between indicators describing the public sector, the Public, the State on the one hand, and the government deficit and debt as defined by the regulation on the application of the Protocol on the EDP.[5] For better understanding, also description of the data compilation process in the Czech Republic is presented. Because of the revision being in process during 2014, the most important changes in the methodology having impact on the government deficit and debt are also indicated in the following paragraphs.

1 GOVERNMENT VS. STATE

Methodology and delimitation of units standing behind the government deficit and debt are considerably different from those used for calculation of state budget and state debt or for public deficit and public debt. The adjective "state" signifies that given indicators are related to the state budget (i.e. Organizational Units of the State – so-called "central budgetary institutions" – CBO). Definition of the term "state" is thus narrower than the definition of "government".

Compared to the indicators for budgetary institutions, the delimitation of the group of units which have direct influence on a level of government deficit and debt for EDP is a broader concept. ESA2010 (§ 2.111) states that *"the general government sector (S.13) consists of institutional units which are non-market producers whose output is intended for individual and collective consumption, and are financed by compulsory payments made by units belonging to other sectors, and institutional units principally engaged in the redistribution of national income and wealth."*

It is evident that the general government sector contains units managing not only compulsory payments, i.e. taxes, fees, and contributions to the general social and health insurance. Government units can be also engaged in the distribution of subsidies or providing services to other government units. In addition, as government units are also classified institutions managing government assets or units which are involved in the privatization process and also other (non-market) entities according to quantitative or qualitative criteria mentioned below.

Government institutions are split into subsectors according to the scale of their competence and specific functions. In the Czech Republic, there are three sub-sectors of the general government sector:

a) *central government (S1311)* – organizational units of the state (ministries and central offices and units managed by the entities including Czech Social Security Administration, State Land Office, financial and labour offices etc.), state funds, central (state) semibudgetary organizations (CSBO)

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[5]   Council Regulation (EC) No 479/2009.

Railway Infrastructure Administration (RIA), Support and Guarantee Agricultural and Forestry Fund SGAFF), Wine-grower Fund (VF), PPP Centre (since 2013 as Centre-F), public universities (PU), public research institutions (PRI), and CPP Transgas and Balmed, Council for Public Supervisory over Audit (CPSA) and a nursery school (established by a public university); there were 549 units classified in S1311 in 2012,

b) *local government (S1313)* – territorial self-governing units, Voluntary Associations of Municipalities, Regional Councils of Cohesion Regions (local budgetary organizations – LBO) and semibudgetary organizations established (LSBO) and manages by the LBO), non-profit institutions (e.g. Union of Towns and Municipalities, Association of regions of the Czech Republic), other non-market units according to 50% criterion (e.g. public non-financial enterprises and public research institutions);[6] there were 16 939 units in 2012,

c) *social security funds (S1314)* – health insurance companies (HIC) managing general (compulsory) health insurance,[7] associations of health insurance companies and Centre for International Reimbursement (CIR); this subsector counts 12 units in 2012.

The overview of government institutions is not stable over time, some units can be cancelled (e.g. The National Property Fund, the Czech Consolidation Agency or its subsidiaries) or new units are established; units may also change the legal form or they can be reclassified from/to other institutional sector on the basis of quantitative and qualitative criteria.

Moreover, both groups of indicators (for the State and for the government sector) are based also on different accounting principles. While "the deficit of State budget" is a result of cash transactions as requested by the methodology GFS1986,[8] the national accounts are based on accrual principle, i.e. recording of transactions in the period in which they actually occur, as requested by the ESA methodology. It is worth mentioning that gradual implementation of the methodology GFS 2001 or GFS 2014 respectively, will make the statistical presentation of government sector in both methodologies of similar nature.[9]

Definition of government revenues and expenditures influencing government deficit are explicitly defined in the manual ESA 2010 (par. 20.76-20.111).[10] One of the most important differences between state balance and government deficit/surplus is an influence of financial transactions. Even if financial transactions positively or negatively affect the state budget balance, they have no impact on indicator of government deficit or surplus based on the national accounts standard. As examples we can put repayments of existing loans by the State (revenues) or provision of new loan (expenditures) – so called transactions "below line".

Elimination of financial operations is the first important difference between state budget balance and government deficit/surplus. Last but not least, Maastricht indicators are based on accrual basis while the state budget balance is a sum of cash transactions. Maastricht indicators are thus affected also by transactions not linked to transfers of cash. This can take form of debt assumption, recognition of payables by government (for example financial compensation in case of church restitutions), called guarantees, differences between selling and market price of any asset, etc.

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[6] Semibudgetary organizations, public universities, public research institutions that have features of non-profit and non-market units carry out of government functions, e.g. in education, research, cultural or of social areas, etc. and their production expenditures are paid from the state budget or local budget from over 50%.

[7] Health instance companies administrating compulsory health instance are based under acts No. 551/1991 Coll., on General Health Insurance Company and No. 280/1992 Coll., on departmental, branch, corporate and other health instance companies, as amended. Other units are established as non-profit institutions serving health insurance companies.

[8] MoF applied this methodology until 2005.

[9] The Ministry of Finance publishes GFS data on cash basis and for selected government units; in new Manual GFS 2014, also the issue of public sector is addressed, i.e. delimitation and presentation of data.

[10] For more detailed analysis, see part 3.1 of this text.

Following charts clearly illustrates the differences between the state budget balance and the government deficit based on the ESA in the Czech Republic. As mentioned above, these differences are caused by dissimilar delimitation of units for which the indicators are compiled, by the different applied accounting principle and by different handling with financial transactions.

Figure 1 The state budget balance and the government deficit in the Czech Republic (CZK billions)
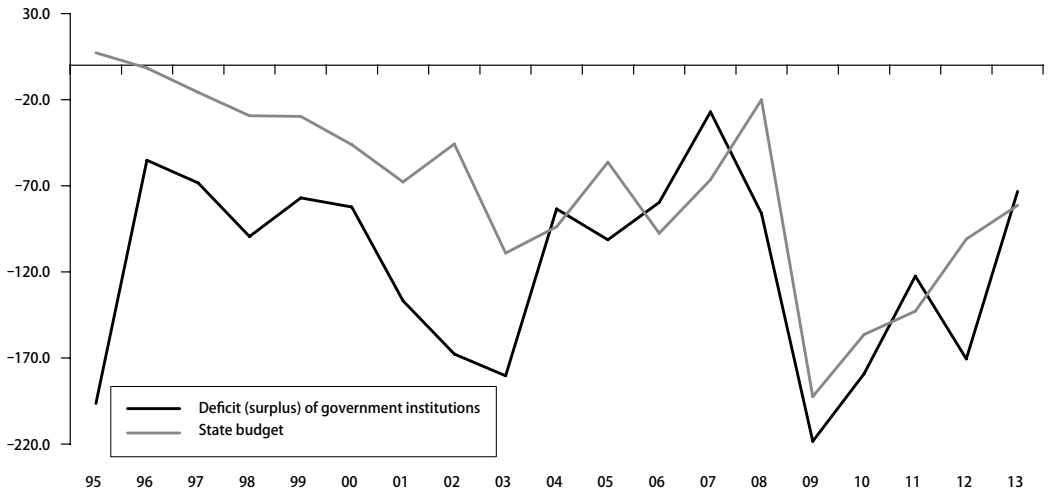
Source: CZSO, MoF

Concerning debt, differences in accounting principle and financial transactions have no relevance. But, state debt and government debt differ from each other, as in the previous case of deficit/surplus, due to different delimitation of units. Maastricht debt takes into account not only debt of the State (debt of central budgetary organisations – ministries and central offices), but also debts of state funds, semi-budgetary organizations, public universities and other central government institutions, municipalities and regions, health insurance companies managing public health insurance, etc. Maastricht debt further includes called guarantees or imputed debt resulting from financial leasing, e.g. renting of military equipment on leasing (case of aircrafts Gripen).

Indicators of government deficit and debts can be also affected by so-called rerouting of stock and flows in case of public companies acting on behalf of government. Rerouting can be the case of units raising funds (in form of debt) on the financial markets to pursue government policy (social aims, promotion of economic activity, etc.) or which can benefit from guarantees granted by the government. If the financial risk is borne by the government, these debts are rerouted to the government accounts with an impact on the Maastricht debt.[11]

The amounts of the consolidated government debt and the state debts in the Czech Republic are shown in the following chart.

2 GOVERNMENT VS. PUBLIC

In this section we proceed to clarification of the differences between the terms "government" and "public" which are more commonly confused. As a main source of this confusion we find inconvenient

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[11] As an example can be given the statistical treatment of financial assistance provided by the European Financial Stability Facility (EFSF). The EFSF raised funds via bond emission, these debts are then rerouted to national governments. The Czech Republic have not yet participated in this mechanism.

Figure 2 The government debt for EDP purposes, the state debt, the Czech Republic (billions CZK)
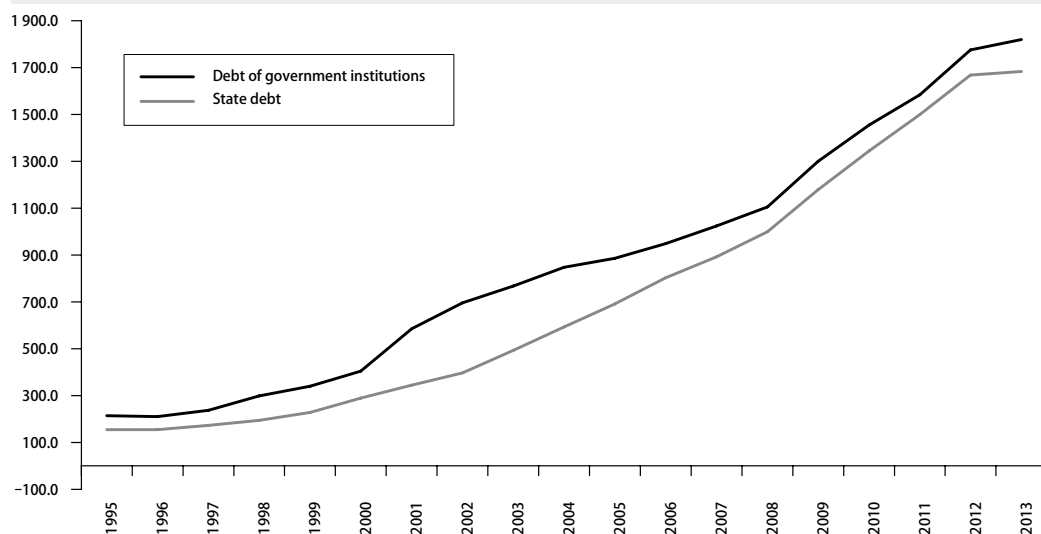
translation of the Regulation 3605/93 on the application of the Protocol on the excessive deficit procedure (as amended, especially No 479/2009). In the Czech version of the Regulation, the terms "government deficit" and "government debt" are expressed as "veřejný" whose English equivalent is "public"; subsequently, the term "veřejný" is defined as related to units classified in the general government sector. Due to this translation, the term "veřejný" in the Czech version delimits an area which is understood as "vládní" and permanently used in the Czech national accounts.

As a direct consequence, the term "veřejný" is usually used by many institutions or media to denote the sphere of the economy which is marked as "vládní" in the national accounts and in the EDP notifications; from the national accounts point of view, the sector termed "veřejný" covers wider range of institutions. National accounts indicators for public sector cover not only government units, but all units controlled by the government in terms of majority or because of an influence of the government on corporate policy (strategy) of a unit.[12]

As examples of non-financial public corporations can be mentioned public transport companies, hospitals or theatres which can have form of stock companies, limited companies or some semi-budgetary institutions operating on the market basis. There are also public banks (Czech National Bank – CNB, Czech-Moravian Guarantee and Development Bank – CMZRB) in the Czech Republic, as well as public insurance companies (Export Guarantee and Insurance Corporation – EGAP; Insurance Company of General Health Insurance Company (ICoGHIC) – Pojišťovna VZP, Health Insurance Company – Vitalitas) and other public financial institutions. All these institutions are classified in the public sector.[13]

The following schema provides an overview indicating the differences between public and government sector. For completeness, we should mention two important things. First, it should be recalled that public sector is defined within the borders of the economy; shares in non-resident units are not taken into

[12] Public sector is newly explicitly defined in the methodology (see par. 20.303 in the ESA2010); the same definition of public sector is applied also in the methodology GFS 2001.
[13] Classification of units can be found on web site of the Ministry of Finance (database ARES).

accounts. Second, if government exerts an influence on non-profit institutions, this unit is then classified as government institutions. As mentioned above, to assess the influence of government on behaviour of any units does not cover only quantitative criteria (majority of shares) but also qualitative criteria which are focused on other institutional influence as ability to approve or to dismiss key personnel, etc.[14]

Table 1   Delimitation of public and general government sector in the national accounts, the relation to the government deficit and debt (2012)

PUBLIC SECTOR (Sector of public institutional units)		
Sub-sector of public non-financial corporations	**Sub-sector of public financial corporations**	**General government sector**
Market producers: state companies, some central and local semibudgetary institutions, joint-stock companies (e.g. České dráhy, ČEZ, ČSA, DP hl.m.Prahy, etc.) and other limited company	ČNB, ČMZRB, IMOB Company, Galileo Real, EGAP, Insurance Company of General HIC,HIC – Vitalitas, public holding companies, etc.	Central and local budgetary and semi-budgetary organizations, SGAFF, RIA, Prisko, public universities and public research institutions, some public nonfinancial corporations classified as non-market, non-profit institutions and health insurance companies, etc.
		Government deficit/surplus and government debt (Maastricht) for EDP purposes

Source: CZSO

Within the classification of units into the institutional sectors / subsectors, above all, it is determined whether unit is private or public and whether the public entity is a market or non-market producer.

Criteria for classification to institutional sectors should be at least briefly described. Legal form of the public entity is not decisive for the classification. Nevertheless, newly founded joint-stock companies or limited companies and similar units are expected to be established to make a profit, i.e. they are considered to be market producers. In most cases, these units are classified to public corporations subsector (but taking into account also the qualitative criteria). Concerning semi-budgetary organizations, it is assumed that they are established as non-market and therefore they are classified to the general government sector, and later it is examined if all criteria are met.

At the same time, the qualitative criteria are assessed; they consider e.g. whether production is sold primarily to corporations and households or to government institutions. It should be assessed whether a unit operates in the competitive environment, whether right to dispose of an asset is limited to some extent (the case of roads, railway, etc.), to check the financial resources (public or private) or to analyze whether a government unit bears risk linked to business.

The quantitative criterion consists in the assessment the rate at which the costs are covered by sales. For this purpose, total production costs are calculated as sum intermediate consumption (ESA code P.21), compensation of employees (D.1), depreciation of fixed capital (K.1, respectively P.51c) and other taxes on production (D.29), financed from own sources (from sales excluding tax on products and including subsidies on products – P.11). In the revised manual (ESA2010), the definition of total costs is further extended by net interest (D.41) due to the fact that some highly indebted public companies can escape the debt statistics.

Total value of output (numerator in the formula) includes sales of market and non-market output (P.11 + P.131). Definition of sales (output) in the ESA 2010 is unchanged, i.e. it includes sales excluding taxes on products and, on the contrary, including subsidies on products. Because output for own use (P.12)

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[14] See par. 2.28 in the ESA 2010.

is not involved in the numerator, to keep both numerator and denominator comparable, it is necessary to exclude the value of output for own use also from denominator (part of costs included in intermediate consumption). As a result of this procedure, public unit is classified as public corporation if the resulting coefficient is higher than 0.5 (and if they also correspond to the quality criteria).

A quantitative criterion is not generally relevant for financial institutions. The reason is that, in these cases, main source of profit is financial activity which mostly does not directly affect output. According to ESA95, public financial institutions listed on the MFI list were without exception classified in the sector of financial institutions.[15] But, revised methodology ESA2010 brought about an important change concerning classification. If a public financial institution does not bear risk but risk is transferred to the government, then this unit should be classified within government sector regardless of banking licence.[16]

At the end of this section it is worth to point out that the attention of users (especially of international institutions) has been increasingly focused on the public sector indicators as defined in the national accounts. The main reason is that indicators of public sphere can give an idea on potential threats for government finances. Institutional arrangement between government and public institution can give rise to requirements for recapitalisation, debt assumption or called guarantees which can negatively affect government indicators. Increasing demand for these broader indicators has been met by the CZSO with publication of Public sector accounts (PSA), which is treated as a satellite account.[17]

Time series of public sector indicators is currently available for period 2009–2011, nevertheless, further development of the PSA is one of the CZSO priorities. Following table illustrates the differences in the net borrowing/lending item as calculated for the EDP purposes and in the PSA in ESA95.

Table 2 Net lending/borrowing, government sector accounts vs. Public sector accounts, Czech Republic, 2009–2011 (bill. CZK)

	2009	2010	2011
Government sector B.9	−217 412	−180 720	−124 552
Public sector accounts B.9	−184 739	−166 370	−113 981

Source: CZSO

Lower level of deficit/surplus reflects mainly the fact, that B.9 as calculated in the PSA is (positively) affected by activities of the market producers indicated in the Table 1.

3 THREE STEPS TO DEFICIT/SURPLUS AND DEBT

As mentioned above, there are important differences between public sector, government sector and the "state". For the EDP purposes, we are talking about the indicators (deficit/surplus and debt) for the sector of government institutions. In the process of compilation of government deficit and debt, it is necessary to make the following steps: a) to delimit *the general government sector* (code S.13), i.e. to define non-market units under control of government, which have an influence on government deficit/surplus and government debt; this issue was discussed in previous chapter;

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[15] From 2001 to 2006, the Czech Consolidation Agency (CKA) used to be classified in the government sector in the Czech Republic. Qualitative criteria were applied in this case even if the Agency had a banking licence; but at the time of reclassification, the Agency lost the licence.

[16] Whithin the revision process, the attention was paid mainly to the public banks. The question of reclassification of public bank to government sector was still open at the time of completation of this text.

[17] In the metodology ESA95, the public sector was not explicitly defined, nevertheless, the methodology provided a basis for the compilation of the PSA. PSA has an important position in analysis of potential government deficit a debt risk.

b) to delimit *revenue and expenditure* (or resources and use) having an impact on government deficit and to specify the methodology of their calculation;

c) to define the *government debt components* and to specify the methodology of the calculation.

3.1 Revenues and expenditures influencing government deficit (surplus)

As stated above, revenues and expenditures having impact on the government deficit/surplus (the item net borrowing/lending (B.9) in the national accounts) are defined in the manual ESA2010. The process of compilation reflects the national specifics concerning the nature and the level of detail of data sources. In the Czech Republic, the starting point within the central government institutions is the working balance of the State budget calculated on the cash basis and within the local government institutions it is working balance of budget of local budgetary organisations on the cash basis balance of the classes 5 and 6 of the Budgetary System.

During the transition from the state budget to central government deficit (and also from municipality budget to local government deficit), it is necessary to make many steps. The most important are the following:

- elimination of financial transactions (sale of financial assets, provision of loans, etc.),
- elimination of EU funds if final beneficiary is non-government unit,
- inclusion of extra-budgetary funds, which are not included within revenue of the state budget (or local budgets) – e.g. revenue from dividends of some privatized units.

Moreover, it is necessary to count in economic results of units which are not directly linked to the state budget, i.e. sate funds, local budgetary organizations, semi-budgetary organisations, non-profit institutions, health-care insurance companies and other non-market producers classified in general government sector.

Primary data for all institutions considered as government units are then methodologically adjusted to the national accounting methodology. First of all, accrual principle is applied to flows as taxes, interests or social contributions. Among others adjustment we can mention treatment of financial leasing as loan, adjustment of commercial insurance, estimation of indirectly measured financial service paid by government institutions (FISIM), etc. Because final data should be on consolidated basis, it is further necessary to eliminate mutual relations within government sector. Thus, final data represents pure relation of government units to other economic sectors. Consolidation is carried out, in compliance with the ESA methodology, for interests, other current transfers and capital transfers.

In the following paragraphs, we briefly analyze the structure of government revenues and expenditures having impact on the item B.9. ***Sources of current revenues*** are mainly taxes representing about 47% (in period from 2008 to 2012) of all revenues. Final aggregate of total taxes is calculated on the base of time-adjusted method; time adjustment is different for different types of taxes. Share of social contributions (quasi-taxes) reached in the same period almost 40%; aggregate of social contributions is also based on the time-adjusted method. Among the other revenue types belong revenues from market and non-market production, whose share achieved to approximately 6.5%. It is mainly revenue associated with the lease of assets of government institutions, but also for instance revenue from tolls, highway vignettes, administrative fees or revenue from tuition fees.

Other revenues reached more than 7%; in particular property income (profit shares, dividends, and interest), other current transfers and capital revenue. Other current transfers include e.g. claims from insurance companies, the humanitarian assistance in case of natural disasters and accidental revenue in the form of returned subsidies and other. Capital revenues are made up of investment grants from abroad (excluding investment grants from EU, intended for non-government units), revenue from the sale of tangible and intangible non-financial assets (e.g. dwellings, licences), or gifts.

The structure of ***government expenditure*** is more volatile compared to the revenue structure. The development and amount of expenditure will also participate in current and capital expenditures.

Figure 3 Structure of government revenues (% of GDP), Czech Republic, 2008–2012[18]
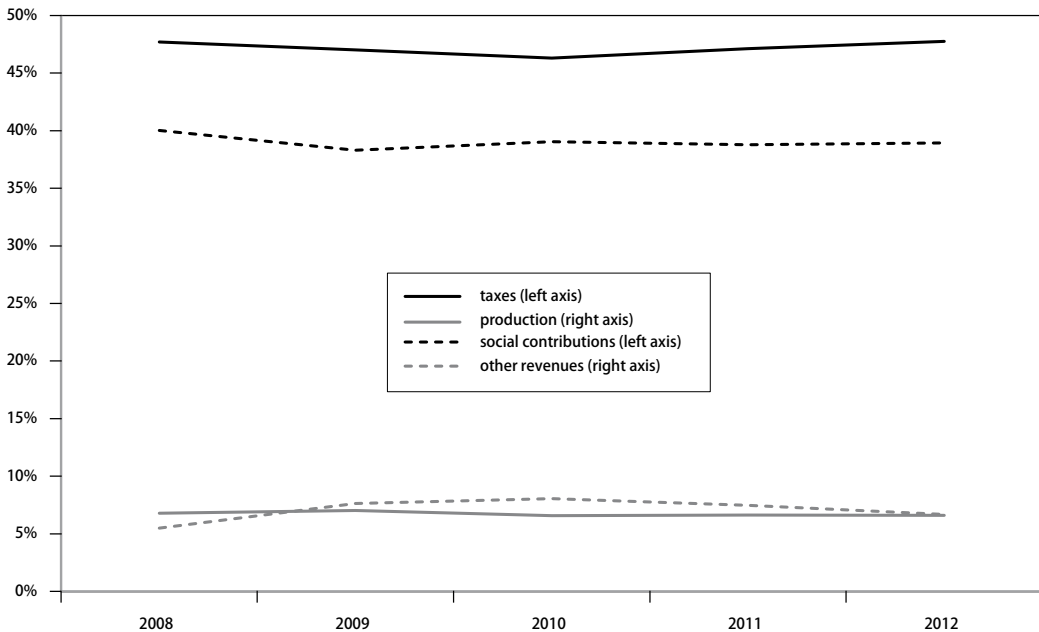
Source: CZSO

From among current expenditures there are especially expenditures in cash and social benefits in-kind paid from social and health insurance and social benefits assistances provided under the state social support. From 2008 to 2012, the social benefits represented about 45% of total expenditure. About 30% of government expenditure is in the form of purchases of products and services (intermediate consumption) and wages including employers' contributions to social, health and compulsory accident insurance (compensation of employees). More than 2% of the expenditure includes property income, mainly interest on government debt.

The amount of the investment shows to be the most volatile component of expenditure; it is related to a significant share of mandatory expenditure and the economic cycle. In general terms, investment (capital) expenditures fluctuated about 10% from total expenditure. A segment of other expenses includes both paid grants and expenses related e.g. to transfers free of charge, corrections of EU grants, but also debt forgiveness or restitution. It is therefore (also at the time) a very unstable and unpredictable item of total government expenditure.

A special attention will be paid to the government consumption and investment expenditures due to their supposed position in government stabilisation policy. However, the government consumption is not explicitly shown as a part of government expenditures. The reason is that government consumption is derived from other types of expenditures as a sum of other non-market production (intermediate consumption, compensation of employees, consumption of fixed capital and net taxes) and market production purchased by government from market producers for households (notably health-care service).[19]

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[18] Due to rounding, the sum can not be equal to 100.
[19] For more detailed analysis, see Pulpanova (2013).

Figure 4 Structure of government expenditures (% of GDP), Czech Republic, 2008–2012

Legend:
- social transfers (left axis)
- intermediate consumption and wages (left axis)
- property income (right axis)
- investments (right axis)
- other (right axis)
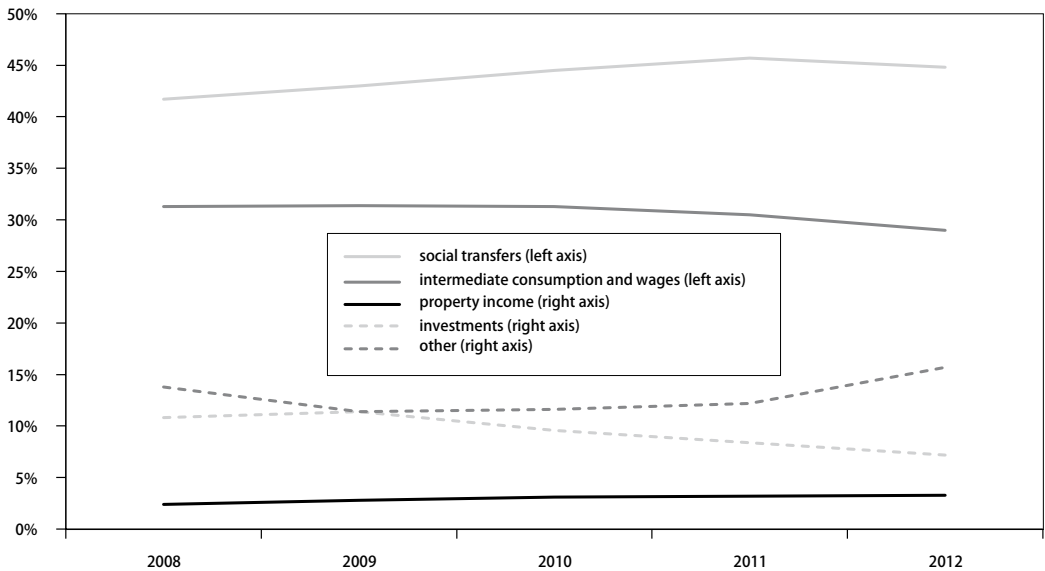
Source: CZSO

Final consumption expenditure includes individual and collective consumption expenditures of government, whereas the production of consumer goods is either the result of the productive activities of the general government sector or any sector of the market producers. In case of government production, goods and services produced by government units are recorded as if they are subsequently demanded by government. If these goods are consumed by individual households, then this fact is recorded as natural social transfers provided to households (actual households consumption).

Gross fixed capital formation (investments) of the government is another key indicator with direct influence on business cycle and productive capacity of the economy. From compilation point of view, this aggregate belongs to the most difficult ones. The investment expenditures are naturally not identical with the change in the stock of government assets; there is the need to eliminate other influence on the stock such as transfers of assets in the form of capital injections, asset valuation changes and other volume changes. Furthermore, the situation is complicated by different concepts of small long-term intangible and tangible fixed assets and absolute freedom entities to include or not to include interests accrued at a time of acceptance into the purchase price of the property if it is financed by debt instruments.

Level of government investments will be changed in the revision due to methodological changes.[20] First, ESA2010 contains the expansion of the asset boundary towards to results of research and development activities (intellectual property). In case of non-market producers, the result is a reduction in consumption expenditures with corresponding increase in investment expenditures. Second, the expenditures of government on weapons systems are newly recognized as capital formation; thus this change also brings a "switch" between consumption and investment expenditures.

According to the revised ESA methodology and the amendment of the EDP regulation, it is no longer required to make specific adjustment of deficit/surplus by interest on swaps (IRS) and transactions

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[20] Overview of key changes is can be found in the Manual on the Changes between ESA 95 and ESA 2010 (2013).

under forward rate agreements (FRA). These transactions are treated only as financial transactions. The reason for the adjustment was the effort to eliminate the incentive to substitute deficit and debt by debt managers. The revised methodology therefore requires recording (also for the purposes of notification) the amount of interest in compliance with conditions prevailing (in view of the borrower) at a time of debt issuance (cost of borrowed capital) without affecting subsequent hedging transactions.

Nominal level of government revenues and expenditures can be further influenced by rerouting, as already mentioned above. There are cases where a government intervention takes the form of forced transactions between two non-government organizations and the flows do not "flow" through government accounts, even though they resulted from the implementation of government policy. Examples are obligatory payments in the form of support for renewable energy resources paid within the price for electrical energy, compulsory payments paid by banks to the Deposit Insurance Fund or some transactions carried out by the CMZRB on behalf of the government.

Rerouting payments relate also to payments between government units. For instance, payments from the State budget to the health instance companies for persons insured by the State are rerouted through households' accounts (not through transfer within government) in form of social assistance benefits. However, rerouting of flows does not affect the balance, of course, affects the nominal level of the aggregates.

At the end of the chapter it is worthy to mention, that revised ESA and the MGDD does not make any difference between B.9 in the sector accounts and for the EDP purposes.

3.2 Government debt

Debts of general government sector became the central topic of analytics and politicians. However, the nature of the indicator is often poorly understood. Before we proceed to the detailed description we should briefly recall the difference between state debt and government debt. Government debt represents broader concept than "state debt"; in case of government debt, also indebtedness of other central government units, municipalities or semi-budgetary institutions is taken into consideration.

Government debt has further two basic features. Firstly, government debt is compiled on gross basis, i.e. as a sum of debt financial instruments on the liability side of the balance sheet. Secondly, debt is presented on consolidated basis, i.e. value of government debt financial instruments held by government as assets is not taken into account; in other words, debt incurred and, at the same time, "held" by another units classified in the sector of government institutions is mutually consolidated, i.e. debts of this nature are not shown in debt statistics.

According to current methodology, debt for EDP purposes is obtained as a sum of following instruments on the liability side of balance sheet:

a) *currency and deposits (AF.2)* – in the Czech Republic, it was the case of Czech Consolidation Agency (classified in S.13 in period from 2001 to 2006) which was closed down on 31 December 2006; issuance of currency or receiving of deposits by government institution is quite common practice across Europe, especially due to coins issued by the ministries;

b) *debt securities (AF.33 according to ESA95, AF.3 in the manual ESA2010)* – bills of exchange and bond of all maturities; it concerns not only treasury bills and state bonds, but also bonds issued by Railway Infrastructure Administrating (RIA) , municipalities or previous transformation institutions or by the National property Fund;

c) *loans (AF.4)* – this item contains mainly received bank loans, repayable financial assistances, assumed debts, called guarantees or loans result from financial leasing; also trade credits irrevocably transferred by suppliers to a financial institution are classified as loans, the same holds true for trade credits as defined in par. 20.132 in ESA 2010.

As it is evident, definition of government debt for the EDP purposes does not include all instruments being classified as liabilities in the government sector accounts. It is also evident that debt for EDP

purposes does not include especially derivatives or trade credits. Currently, the debate is concentrated mainly on trade credits. In some countries, amount of these liabilities (i.e. loans) is quite significant and can be treated as kind of debt. But at the same time, primary data on trade credit are of different quality across countries. At the moment, an inclusion of trade credits into Maastricht debt is proposed after five year "trial" period.

4 ISSUE OF DEBT VALUATION

Way of the debt instruments evaluation makes an important difference between information provided by the sector government accounts and the debt for the EDP purposes ("Maastricht debt"). On the one hand, the ESA requires to value assets and liabilities on the base of market prices; market value of debt then represents theoretical amount of financial resources needed to buy back all debt instruments from the market. On the other hand, Maastricht debt is presented in nominal value, i.e. as a sum of funds that the debtor is obliged to repay at maturity. It is worth to mention, that also interests accrued are not part of the Maastricht debt, main reason is questionable comparability of calculation method across countries.[21]

Another key difference is the treatment of cross currency swaps (CCS) contracted for elimination of currency risk. Since national accounts are compiled in domestic currency, there is the need to convert foreign currency debt to domestic currency. While the ESA requires using market exchange rate prevailing at the market, for the EDP purposes it is required to use exchange rate agreed in the swap contract (contractual rate). As a result, in the sector accounts (ESA95) CCS used for hedging of existing debt are shown separately under the item AF.34 (AF.7 according to new ESA2010). But for EDP purposes, CCSs are part of the item securities other than shares (AF.33, AF.3

Figure 5 State debt on nominal and on market basis, Czech Republic
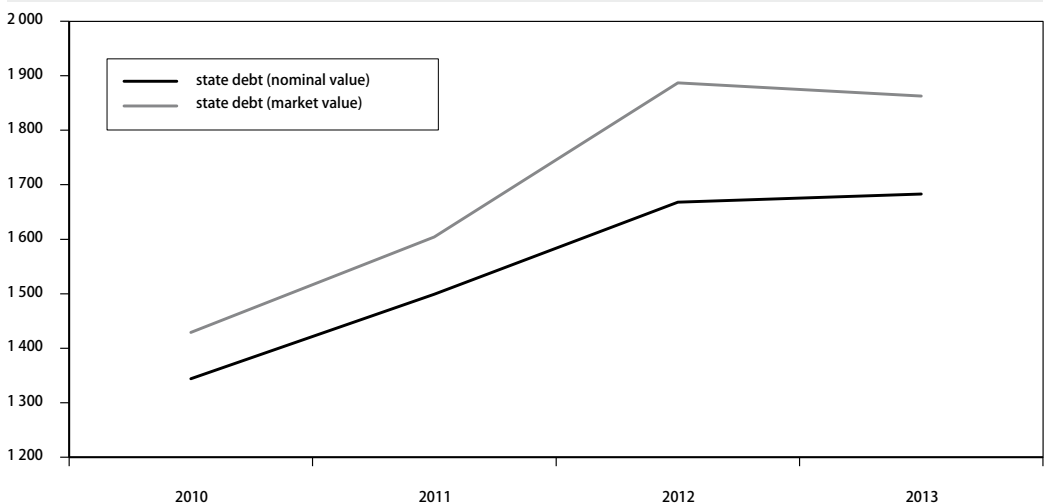
Source: CZSO, MoF

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[21] Nominal value equals the contractually agreed amount that the government will have to refund to creditors at maturity. For instance, the GFSM (government statistics standard of the IMF), this method of valuation is known as "face value". This means, in particular, that the government debt is not affected by changes in market yields, and excludes unpaid accrued interest. However, indicators of GFS (assets and liabilities) transmitted to the IMF by MoF are recorded in nominal value and also in face value.

respectively) which is included in the Maastricht debt. Thus, foreign currency debt is converted into domestic currency at exchange rate fixed in derivative contract.

Different ways of valuation indicates that value of debt in ESA and for EDP procedure must deviate to some extent. These differences have been so far caused mainly by accrued interests and different treatment of CCS. Within the revision of ESA, CZSO implemented into accounts an estimation of market value of the state debt which is generally based on the number of issued bonds and its prices quoted at the market. As a result, government debt in sector government accounts (ESA) reaches higher level than that for the EDP purposes. Due to lack of information, these adjustments have not yet been applied to debt of municipalities which are recorded de facto at nominal value in the sector accounts and also in the EDP tables.

Following chart indicates the extent of differences between the State debt valued at nominal value and at market prices.

Valuation of public debt in the PSA is based on rules for the sector accounts (ESA), i.e. on the market basis. Currently published data on public debt will be revised in line with the revision of the state (market) debt in the sector accounts.

5 RELATION BETWEEN DEFICIT AND DEBT

Relation between deficit and change in debt is described by the stock-flow adjustments (SFA). Due to the fact that SFA includes also statistical discrepancy, it is also an element representing the quality of statistics closely monitored by Eurostat (it is the element resulting from quality of accounting and statistical data sources). Thus, the relation between deficit and debt is not straightforward; leaving aside the case of statistical discrepancy, following factors come into play between the change in government debt and the government deficit/surplus:

- *operation with financial assets and liabilities* – it concerns pure financial transactions having no relation to government deficit or surplus;
- *other capital transfers, payable, which do not linked with debt instruments (e.g. forgiveness of receivables or money restitutions);*
- *other changes in volume and in prices* – among other, this group covers factors as changes in sector classification, exchange rate changes or error corrections.

It is evident that change in government debt is not automatically linked to any need to finance the government deficit. In other words, deficit is not necessarily financed by issue of debt instrument or any rise in debt is not inevitably result of deficit financing. As an example we can mention the situation when government institutions issue bonds because of existing risk of worsening market condition and show concurring expectations that it will be necessary to issue bonds in future to finance coming deficits. In such case, emission of bond is not linked to deficit at the time of issuance. Another example is reclassification of units between non-government sector (especially public) and government that can cause a rise in debt.

Since such situation occurs very frequently, the gross nature of debt does not offer fully reliable information on economic behaviour of government, on its short-term solvency or its access to the financial markets. Rise in debt on the liability side can be fully matched by change in the amount of assets owned by the government, as it is indicated in the examples mentioned above. The European Commission has thus opened the discussion on potential publication of *"net government debt"*; in this kind of indicator, value of debt is adjusted by appropriate value of assets.[22]

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[22] Definition of assets remains open. First proposed option is to deduct from the Maastricht debt the value of corresponding assets on the asset side of government sector, i.e. currency and deposits, debt securities and loans. Problem with valuation of loans, possibly deviating accross countries, can be overcome by the second option, i.e. to take into account only currency and deposits and debt securities held by government institutions.

Advantage of the indicator of "net debt" is supposedly higher ability to show borrowing need of government or its ability to finance deficit without need to issue debt instruments. Even if this indicator could be analytically helpful, many obstacles remain. Main point here is the way how assets are valued, especially assets not traded at the market. Different approaches across countries can be very harmful for international comparability of final data. Simultaneously, the range of factors affecting the debt over time would be widened by factors having impact on the value of assets (interest rate, market prices, etc.); this can make, on the contrary, analysis of debt more complicated. Anyway, the methodology of net debt calculation has not been fully harmonised yet.

CONCLUSION

CZSO compiles and publishes the indicators for both the public and government sector (not only for the units under the State budget). Indicators for the government sector are then key subjects of the Excessive Deficit Procedure. The main aim of the paper was to clarify the nature of the fiscal indicators provided by the national accounts which are often mistakenly understood. We explained, from the perspective of the national accounts, the differences between the concept of public and government sector, and between the concepts of the government and the state.

As was described above, "public sector" is broader concept covering not only government institutions but also public financial and non-financial corporations being under control of government units. Indicators of "public sector" are getting more attention due to inclusion of possible financial threats for the government finance. Thus, the clarification of the terms "veřejný" and "vládní" in the Czech legal system is becoming more important due to possible linkage to the legal documents concerning budgetary discipline, or accounting acts or decrees.

Government statistics undergoes important changes due to ongoing revision related to the implementation of revised methodology ESA. Most important methodological changes lead to reclassification of particular government expenditures as investments and to treating expenditures on interest rate swaps as financial transactions. Within the revision the CZSO also implemented changes having impact on the level of government aggregates as described in the previous sections. Among the most important issues being still under discussion we could finally mention the inclusion of trade credits in the government (Maastricht) debt and publication of net government debt.

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Application of Data Envelopment Analysis to Measure Cost, Revenue and Profit Efficiency

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Abstract

The literature analysing efficiency of financial institutions has enveloped rapidly over the last years. Most studies have focused on the input side analysing input technical and cost efficiency. Only few studies have examined the output side evaluating output technical and revenue efficiency. We know that both sides are relevant when evaluating efficiency of financial institutions. Therefore the primary purpose of this paper is to review a number of approaches for efficiency measurement. In particular, the concepts of cost, revenue and profit functions are discussed. We apply Data Envelopment Analysis (DEA) to a sample of Slovak and Czech commercial banks during years 2009–2013 comparing the efficiencies by either minimizing cost or maximizing revenue and profit. The results showed that the level of average revenue efficiency was the highest and the average profit efficiency was the lowest one. As can be seen the Czech banks were more cost, revenue and profit efficient than Slovak ones during the whole analysed period.

Keywords	JEL code
Commercial banks, Cost efficiency, Revenue efficiency, Profit efficiency, DEA models	*C14, C61, G21*

INTRODUCTION

Efficiency of banks and other financial institutions is very frequently discussed topic. Efficiency of banking system is one of the most important issues in the financial market as efficiency of banks can affect the stability of banking industry and thus the effectiveness of whole monetary system (Yilmaz, 2013).

In modern society there exists number of approaches how to define efficiency. Our definition is based on the study of Farrell (1957), who proposed that the efficiency of a firm consists of two components: technical efficiency and allocative efficiency. Technical efficiency reflects the ability of a firm to obtain maximal output from a given set of inputs. On the other hand, allocative efficiency reflects the ability of a firm to use the inputs in optimal proportions, given their prices and the production technology. These two types of efficiency are then combined into an overall economic efficiency, which can be examined

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from the perspective of input or output based models. Then, we can talk about overall cost efficiency (input perspective) or overall revenue efficiency (output perspective).

Farrell paper led to development of many approaches to measuring the input and output efficiency. Greatest importance was assigned to a Stochastic Frontier Approach (SFA), created by Aigner, Lovell and Schmidt (1977); and Data Envelopment Analysis (DEA) developed by Charnes, Cooper and Rhodes (1978).

The conventional banking theories assume that banks earn profits by purchasing transactions deposits from the depositors at a low interest rate, then reselling those funds to the borrowers at higher interest rate, based on its comparative advantage at gathering information and underwriting risk (Santos, 2000). In other words, commercial banks make profits from spread between the interest rate received from borrowers and interest rate paid to depositors (Bader et all, 2008).

Using DEA we can assess the banks´ profitability from a different perspective. According Bader (2008) profit efficiency indicates how well a bank is predicted to perform in term of profit relative to other banks in the same period for producing the same set of outputs. We can also define cost efficiency and revenue efficiency. Cost efficiency gives a measure of how close a bank´s cost is to what a best-practice bank´s cost would be for producing the same bundle of output under the same conditions. Revenue efficiency indicates how well a bank is predicted to perform in terms of revenue relative to other banks in the same period for producing the same set of outputs.

Most studies have focused on the input side, estimating cost efficiency (Berger, Hunter and Timme (1993); Resti (1997)). Only few studies have examined the output side evaluating revenue and profit efficiency (Maudos and all (2002); Bader and all (2008)). We know that both sides are relevant when evaluating efficiency of financial institutions. Therefore this paper deals with DEA method and describes its application in measuring cost, revenue and profit efficiency.

The structure of the paper is as follows. The review of relevant literature is described in section 1. Used methodology is discussed in detail in the section 2. Section 3 contains the practical application of methods for measuring cost, revenue and profit efficiency of Slovak and Czech commercial banks during years 2009–2013 using the R software. Finally, the paper ends with some concluding remarks.

1 LITERATURE REVIEW

Data envelopment analysis (DEA) is a non-parametric mathematical (linear) programming approach to frontier estimation. The basic DEA model developed by Charnes, Cooper and Rhodes (1978) was based on the assumption of constant return to scale. This basic model has been modified by Banker, Charnes and Cooper (1984) and based on the assumption of variable return to scale. Both these DEA models have been created in both forms – the input and output oriented. Basic models are discussed in works of many authors and applied in many areas.

Sherman and Gorld (1985) applied DEA to banking as the first. They used DEA analysis to evaluate operating efficiency of 14 saving bank branches. As the result of analysis they not only measured the level of efficiency, but also defined how to eliminate inefficiency by adjusting input and output of inefficient bank branches. Motivated by the DEA results, management indicated that the service outputs and the resources used to provide these would be further evaluated as distinct from the liquidity issues.

For example, Pastor and col. (1997) analysed efficiency of banks in US and in selected countries of Europe. For comparison of different European and US banking systems they used the value added approach. They found out, that France, Spain and Belgium appeared as the countries with the most efficient banking systems, whereas the UK, Austria and Germany show the lowest efficiency levels.

On the other hand, Casu and Molyneux (2003) in their study used the intermediation approach to evaluate efficiency of 750 selected European banks. Overall, the results showed relatively low average efficiency scores, nevertheless, it was possible to detect a slight improvement in the efficiency levels through time.

In the case of using DEA in evaluating banks within a banking sector was DEA analysis used in evaluating the efficiency in Turkish banking system. Yilmaz and col. (2013) measured efficiency of 30 Turkish commercial banks between 2007 and 2010, while the intermediation approach was used. In their study they compared the efficiency of foreign and domestic banks and they found out, that the domestic banks were more efficient in all evaluated years.

In case of Indian banking sector was DEA used by Karimzadeh (2012). In this study was examined the efficiency of 8 major commercial banks during 2000–2010. The results suggest that the mean overall efficiency was 100% in 2000, decreasing to 98% in 2002, and remained unstable from 2003 to 2009 with fluctuating in percentage till 2010–2011, which reached 100% again. The increase of efficiency contributed positively to many economic and financial reforms, which were implemented during the evaluated period, IT innovation, competition, better supervision, and enlarged investment in new information technology.

In the Slovak Republic as well as in the Czech Republic DEA models have been used to measure efficiency of financial institutions for example in works of Stavárek (2006), Jablonský and Grmanová (2009); Stavárek and Řepková (2012). Moreover, DEA was used to measure efficiency in other areas. For example Dlouhý, Jablonský and Novosádová used DEA to measure efficiency of hospitals. They analysed 22 Czech acute-care hospitals with constant return to scale model and variable return to scale model. Also Koróny and Gavurová (2013) used DEA analysis as indicator of eight Slovak regions with one day healthcare during 2009–2011. They separately evaluated efficiency from the viewpoint of junior patients and from the viewpoint of patients over 18 years. DEA models can be also used to measure efficiency of education. Lima (2013) employed DEA to briefly describe some evidence on functioning and dynamics of labour markets and to evaluate efficiency of use of knowledge as strategy to increase the growth in PIGS economies. Jeck and Sudzina (2009) applied DEA models directly to evaluate relative efficiency of faculties of Slovak universities. Another application area is evaluating of efficiency of public road transport. Kráľ and Roháčová (2013) used an input oriented slack-based model under variable return to scale to measure efficiency of transport companies in the Slovak Republic.

2 METHODOLOGY

In this paper we discuss some popular extensions of basic DEA models. If price data are available then it is possible to measure allocative, technical efficiency as well as overall cost, revenue and profit efficiency. To calculate these main types of efficiency, a set of linear programs should be solved.

The input-oriented DEA model under the assumption of variable return to scale can be used for calculation of input-oriented technical efficiency and cost efficiency. Input-oriented model under the assumption of variable return to scale is often termed as BCC model, which can be written in the following form (Dlouhý et all, 2007):

$$\min \quad \theta_q \tag{1}$$

$$\text{s.t.} \quad \sum_{j=1}^{n} x_{ij} \lambda \leq \theta_q x_{iq} \qquad i = 1, 2, \ldots, m,$$

$$\sum_{j=1}^{n} y_{rj} \lambda_j \geq y_{rq} \qquad r = 1, 2, \ldots, s,$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0 \qquad j = 1, 2, \ldots, n.$$

Where θ_q is input-oriented technical efficiency (TE_q) of Decision Making Unit (DMU_q) in the input-oriented DEA model, y_{rq} is produced amounts of rth output ($r = 1,2,\ldots,s$) for DMU_q, x_{iq} is consumed

amounts of ith input ($i = 1,2,...,m$) for DMU_q, y_{rj} is produced amounts of rth output ($r = 1,2,...,s$) for DMU_j ($j = 1, 2,...,n$), x_{ij} is consumed amounts of ith input ($i = 1,2,...,m$) for DMU_j ($j = 1, 2,...,n$), λ_j is weight assigned to the DMU_j ($j = 1,2,...,n$).

To calculate cost efficiency is necessary to solve the following cost minimisation DEA model (Coelli and all, 2005):

$$\min \quad \sum_{i=1}^{m} w_{iq} x^*_{iq} \tag{2}$$

$$\text{s.t.} \quad \sum_{j=1}^{n} x_{ij} \lambda_j \leq x^*_{iq} \qquad i = 1, 2,...,m,$$

$$\sum_{j=1}^{n} y_{rj} \lambda_j \geq y_{rq} \qquad r = 1, 2,...,s,$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0 \qquad j = 1, 2,...,n.$$

Where wiq is a vector of input prices of DMU_q and x^*_{iq} is the cost minimising vector of input quantities for DMU_q, given the input prices w_{iq} and the output levels y_{rq}.

The overall cost efficiency (CE_q) is defined as the ratio of minimum cost of producing the outputs to observed cost of producing the outputs for the DMU_q (Coelli and all, 2005):

$$CE_q = \frac{\sum_{i=1}^{m} w_{iq} x^*_{iq}}{\sum_{i=1}^{m} w_{iq} x_{iq}} . \tag{3}$$

The overall cost efficiency can be expressed as a product of technical and allocative efficiency measures. Therefore, the allocative efficiency of the DMU_q can be calculated as ratio of overall cost efficiency (CE_q) to input-oriented technical efficiency (TE_q). These three measures (technical, allocative and overall cost efficiency) can take values ranging from zero to one, where a value of one in case of TE, AE and CE indicates full efficiency. If production unit is fully technically efficient ($TE_q = 1$) and displays allocative efficiency ($AE_q = 1$); it is also overall cost efficient ($CE_q = 1$). This production unit uses minimum amount of inputs for producing of given outputs, while the proportion of inputs will guarantee the minimum possible costs. The production unit which is technically efficient ($TE_q = 1$) but does not demonstrate allocative efficiency ($AE_q<1$) is not also overall cost efficient ($CE_q<1$). This production unit uses minimum amount of inputs for producing the given outputs, but the proportion of inputs will not guarantee the minimum possible costs. The production unit which reaches allocative efficiency ($AE_q = 1$), but does not reach technical efficiency ($TE_q<1$) cannot be marked as overall cost efficient ($CE_q<1$). The proportion of inputs will guarantee the minimum possible costs, but this combination of inputs is not minimal for a producing of given outputs. If the production unit fails to demonstrate any of these three types of efficiency *(TE_q<1; AE_q<1; CE_q<1)*, then the value of overall cost efficiency can be interpreted as a potential costs saving that can be achieved if the production unit uses the inputs in optimal combination. Potential costs saving can be calculated by subtracting the value of overall cost efficiency from the number one.

The output-oriented DEA model under the assumption of variable return to scale can be used for calculation of output-oriented technical efficiency and revenue efficiency. Output-oriented model under the assumption of variable return to scale can be written in the following form (Dlouhý et all, 2007):

$$\text{max} \quad \phi_q \tag{4}$$

$$\text{s.t.} \quad \sum_{j=1}^{n} x_{ij} \lambda_j \leq x_{iq} \qquad i = 1, 2,...,m,$$

$$\sum_{j=1}^{n} x_{rj} \lambda_j \geq \phi_q y_{rq} \qquad r = 1, 2,...,s,$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0 \qquad j = 1, 2,...,n.$$

Where ϕ_q is output-oriented technical efficiency (TE_q) of DMU_q in the output-oriented DEA model.

To calculate revenue efficiency the following revenue maximisation DEA problem is necessary to solve (Coelli and all, 2005):

$$\text{max} \quad \sum_{r=1}^{s} p_{rq} y_{rq}^* \tag{5}$$

$$\text{s.t.} \quad \sum_{j=1}^{n} x_{ij} \lambda_j \leq x_{iq} \qquad i = 1, 2,...,m,$$

$$\sum_{j=1}^{n} y_{rj} \lambda_j \geq y_{rq}^* \qquad r = 1, 2,...,s,$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0 \qquad j = 1, 2,...,n.$$

Where p_{rq} is a vector of output prices of DMU_q and x_{rq}^* is the revenue maximising vector of output quantities for DMU_q, given the output prices p_{rq} and the input levels x_{iq}.

The overall revenue efficiency (RE_q) is defined as the ratio of observed revenue to maximum revenue for the DMU_q (Coelli et all, 2005):

$$RE_q = \frac{\sum_{r=1}^{s} p_{rq} y_{rq}}{\sum_{r=1}^{s} p_{rq} y_{rq}^*} . \tag{6}$$

The overall revenue efficiency can be expressed as a product of technical and allocative efficiency measures. Therefore, the allocative efficiency of the DMU_q can be calculated as the ratio of revenue efficiency (RE_q) to output-oriented technical efficiency (TE_q) of the DMU_q. These three measures (technical, allocative and overall revenue efficiency) can take values ranging from zero to one, where a value of one in case of TE, AE and RE indicates full efficiency. If the production unit is fully technically efficient ($TE_q = 1$) and displays allocative efficiency ($AE_q = 1$); it is also overall revenue efficient ($RE_q = 1$). This production unit achieve the maximum possible outputs at given inputs, while the proportion of outputs will guarantee the maximum possible revenues. If the production unit is technically efficient ($TE_q = 1$) but doesn't demonstrate allocative efficiency ($AE_q<1$), it isn't also overall revenue efficient ($RE_q<1$). This production unit achieves the maximum possible outputs using a given inputs, but the proportion of inputs will not guarantee the maximum possible revenues. If the production unit fails to demonstrate any of these three types of efficiency ($TE_q<1$; $AE_q<1$; $RE_q<1$), then the value of overall revenue efficiency can be interpreted as potential revenue increasing that can be achieved if the production unit uses

the outputs in optimal combination. Potential revenues increasing can be calculated by subtracting the value of overall revenue efficiency from the number one.

If we have access to price data on both inputs and outputs, then the profit efficiency can also be calculated. The profit maximisation DEA problem is specified as follows (Coelli and all, 2005):

$$\max \quad \sum_{r=1}^{s} p_{rq} y_{rq}^* - \sum_{i=1}^{m} w_{iq} x_{iq}^* \tag{7}$$

$$\text{s.t.} \quad \sum_{j=1}^{n} y_{rj} \lambda_j \geq y_{rq}^* \qquad r = 1, 2, ..., s,$$

$$\sum_{j=1}^{n} x_{ij} \lambda_j \leq x_{iq}^* \qquad i = 1, 2, ..., m,$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0 \qquad j = 1, 2, ..., n.$$

Where all notations used comply with previous definition.

The overall profit efficiency (PE_q) can be defined as the ratio of observed profit to maximum profit for the DMU_q (Coelli and all, 2005):

$$PE_q = \frac{\sum_{r=1}^{s} p_{rq} y_{rq} - \sum_{i=1}^{m} w_{iq} x_{iq}}{\sum_{r=1}^{s} p_{rq} y_{rq}^* - \sum_{i=1}^{m} w_{iq} x_{iq}^*}. \tag{8}$$

However, this measure need not be bounded by zero and one. It could be negative if a profit is negative, or it could be undefined if maximum profit is zero. (Coelli et all, 2005). The value of overall profit efficiency can be interpreted as potential profit increasing that can be achieved if the production unit uses the inputs and outputs in optimal combination.

3 EMPIRICAL ANALYSIS AND RESULTS

This section describes practical application of methods for measuring cost, revenue and profit efficiency of Slovak and Czech commercial banks during years 2009–2013 using the R software. R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS and can be downloaded on the web page: <http://www.r-project.org>. R is very much a vehicle for newly developing methods of interactive data analysis. It is developing fast, and has been extended by a large collection of packages. However, most programs written in R are essentially ephemeral, written for a single piece of data analysis. One of packages is a package "Benchmarking", prepared by Bogetoft and Otto (2013). Bogetoft and Otto (2011) in their work used software R for calculating efficiency not only for DEA models, but also for SFA models. The package "Benchmarking" contains methods to estimate technologies and measure efficiency using DEA while supporting different technology assumptions (Free disposability hull, Variable return to scale, Constant return to scale, Decreasing return to scale, Increasing return to scale), and using different efficiency measures (input based, output based, hyperbolic graph, additive, super, directional).

The study evaluates a cross-country level data of 18 large commercial banks (8 from Slovakia and 10 banks from Czech Republic) for the period 2009–2013 compiled from the database BankScope. To evaluate banks the intermediation approach which was suggested by Sealey and Lindley (1977) was used. This approach views bank as an intermediary of financial services and assumes that banks collect funds (deposits and purchases funds) with the assistance of labour and capital and transform them into

loans and other assets. For each bank in each country in the sample it was necessary to select inputs, outputs, input prices and output prices. All input and output variables, selected types of costs and revenues are measured in thousands of EUR.

We consider three inputs, namely, deposits (x_1), number of employees (x_2) and fixed assets (x_3). Each of these inputs generates costs, referred to total interest expenses, personnel expenses and other operating expenses. Therefore, we can easily calculate prices for each input as a ratio of relevant cost

Table 1 Descriptive statistics on variables used for efficiency measurement

| Variable		Year	Minimum	Maximum	Average	Standard deviation
Total deposits (in EUR th)	x_1	2013	806369	25857283	7388564	8171782
		2012	717820	26058434	7208081	8215899
		2011	755524	26752814	7077829	8315440
		2010	663341	25250387	6746347	7974709
		2009	686719	23991794	6444349	7569328
Number of employees	x_2	2013	182	10760	3024	3055
		2012	170	10661	3012	3050
		2011	155	10711	2984	3092
		2010	114	10722	2982	3101
		2009	119	10865	2993	3190
Fixed assets (in EUR th)	x_3	2013	2279	580467	107031	145827
		2012	2260	597311	114601	153821
		2011	1752	639199	114962	155821
		2010	1338	581616	115710	146707
		2009	553	572025	114949	147297
Total loans (in EUR th)	y_1	2013	921392	18728106	5940969	5933283
		2012	779792	19072432	5858226	6045909
		2011	764764	17591450	5548703	5694316
		2010	566647	17175586	5185611	5321655
		2009	328280	16806925	4938354	5054287
Other earning assets (in EUR th)	y_2	2013	224204	17834056	3962460	5300869
		2012	223040	16847694	3700826	4903676
		2011	183478	17520681	3712726	5158410
		2010	195900	17926955	3696638	4942729
		2009	138570	15962431	3525830	4708079
Price of deposits	w_1	2013	0.00593	0.02915	0.01223	0.00579
		2012	0.00642	0.02498	0.01265	0.00533
		2011	0.00486	0.02669	0.01217	0.00575
		2010	0.00035	0.02762	0.01291	0.00588
		2009	0.00412	0.03948	0.01735	0.00752
Price of labour	w_2	2013	25.64516	59.93252	33.85554	8.43658
		2012	24.22452	40.19036	31.77743	5.35486
		2011	23.39632	43.22487	31.30455	5.65688
		2010	18.34522	37.97383	28.96051	5.20046
		2009	19.07984	38.85767	28.41732	5.49254
Price of physical capital	w_3	2013	0.45587	10.77854	2.48491	2.97297
		2012	0.46007	11.66216	2.42749	3.08905
		2011	0.46091	13.21868	2.01414	2.77587
		2010	0.43249	13.74011	1.85727	2.91354
		2009	0.57547	22.89933	2.47004	4.99914
Price of loans	p_1	2013	0.03702	0.10545	0.05658	0.02085
		2012	0.03860	0.14682	0.06084	0.02742
		2011	0.03893	0.14352	0.06195	0.02627
		2010	0.03293	0.11864	0.06090	0.01962
		2009	0.03983	0.09434	0.06366	0.01422
Price of other earning assets	p_2	2013	0.01325	0.04651	0.02856	0.00969
		2012	0.00774	0.06139	0.03128	0.01397
		2011	0.00850	0.05497	0.03170	0.01204
		2010	0.00748	0.06217	0.03081	0.01369
		2009	0.01374	0.29068	0.06023	0.06017

Source: Author´s calculations

to selected input. The price of deposits (w_1) can be calculated as the ratio of total interest expenses to total deposits; price of labour (w_2) as the ratio of personnel expenses to number of employees; and price of physical capital (w_3) as the ratio of other operating expenses to value of fixed assets. On the output side we consider two types of outputs: total loans (y_1) and other earning assets (y_2), which refer to non-lending activities. The income generated by first output is interest income, so the output price (p_1) is defined as the ratio of interest income to value of loans. The second output generates other interest income, therefore consider price for this output (p_2) as the ratio of other interest income to other earning assets. We report descriptive statistics of these variables in Table 1.

To solve the cost minimization problem using R, we first load the data from MS Excel file that must be saved in CSV (Comma-separated values) format. The solution of the cost minimisation DEA model requires using the procedure *cost.opt* from the Benchmarking package. This command estimates the optimal input vector that minimizes cost in the context of the DEA technology. The part of the command is to define which variables will act as inputs (the matrix of inputs, *x*), outputs (the matrix of outputs, *y*), input prices (as a matrix, *w*) and used technology (variable return to scale "*vrs*") of applied model. To calculate overall cost efficiency, we have to find the actual costs and the optimal costs. By dividing these values we obtain overall cost efficiency of evaluated production units. Analogically, we can use R to calculate the revenue or profit maximisation problem and to calculate overall revenue efficiency, or overall profit efficiency.

Figure 1 shows the development of average cost, revenue and profit efficiency of Slovak and Czech commercial banks during years 2009–2013. It is obvious that commercial banks showed most revenue efficiency, while the average revenue efficiency increased gradually in the analysed period. On the other hand commercial banks recorded the lowest profit efficiency, while the average profit efficiency decreased gradually in the analysed period.

Figure 1 Average cost, revenue and profit efficiency of commercial banks in Slovakia and the Czech Republic
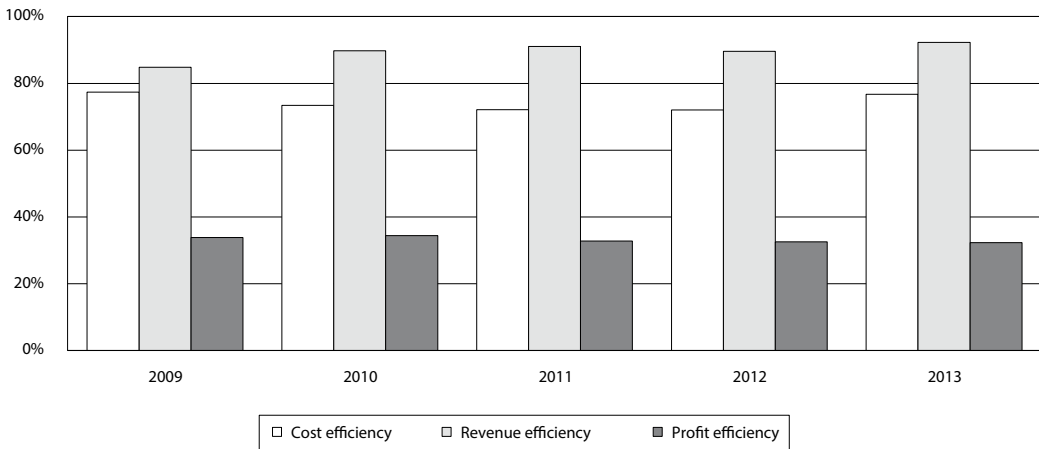
Source: Author´s calculations

Table 2 reports minimum, maximum and average values on all three kinds of estimated scores (cost, revenue and profit efficiency) in whole sample and particularly in case of Slovak and Czech banks.

Table 2 Cost, revenue and profit efficiency

			2009	2010	2011	2012	2013
Cost efficiency	SR	Min	35.96%	31.21%	37.56%	44.90%	40.20%
		Max	80.77%	75.30%	61.57%	67.45%	73.74%
		Average	55.85%	54.49%	52.36%	54.87%	58.60%
	CR	Min	71.72%	36.14%	52.07%	47.16%	52.96%
		Max	100.00%	100.00%	100.00%	100.00%	100.00%
		Average	94.64%	88.51%	87.90%	85.80%	91.20%
	SR+CR	Min	35.96%	31.21%	37.56%	44.90%	40.20%
		Max	100.00%	100.00%	100.00%	100.00%	100.00%
		Average	77.40%	73.39%	72.10%	72.05%	76.71%
Revenue efficiency	SR	Min	40.28%	47.22%	61.71%	59.29%	68.22%
		Max	95.06%	100.00%	100.00%	94.25%	95.03%
		Average	72.12%	80.50%	85.83%	80.79%	84.83%
	CR	Min	77.80%	88.64%	78.53%	87.29%	90.27%
		Max	100.00%	100.00%	100.00%	100.00%	100.00%
		Average	95.01%	97.16%	95.23%	96.61%	98.15%
	SR+CR	Min	40.28%	47.22%	61.71%	59.29%	68.22%
		Max	100.00%	100.00%	100.00%	100.00%	100.00%
		Average	84.84%	89.75%	91.05%	89.58%	92.23%
Profit efficiency	SR	Min	0.89%	0.06%	1.21%	0.87%	0.48%
		Max	31.69%	28.42%	26.08%	23.94%	26.88%
		Average	11.56%	10.79%	10.35%	9.21%	9.64%
	CR	Min	1.42%	1.46%	-0.63%	0.86%	0.80%
		Max	100.00%	100.00%	100.00%	100.00%	100.00%
		Average	51.59%	53.35%	50.79%	51.19%	50.48%
	SR+CR	Min	0.89%	0.06%	-0.63%	0.86%	0.48%
		Max	100.00%	100.00%	100.00%	100.00%	100.00%
		Average	33.80%	34.44%	32.82%	32.53%	32.33%

Source: Author´s calculations

Results show that, on average, commercial banks were the most revenue efficient. In the whole analysing sample, the average revenue efficiency increased from value 84.84% in 2009 to value 92.23% in 2013. It indicates that on average banks could have increased their revenues by 15.16% at the beginning of analysed period and only by 7.77% at the end of analysed period. The minimum average value was reached in 2009, the maximum average value in 2013. When we look on the average revenue efficiency according countries then can be seen that the average revenue efficiency moved from value 72.12% to 84.83% in case of Slovakia; and from value 95.01% to 98.15% in case of Czech Republic. It indicates that Czech banks were more revenue efficient as the Slovak ones, which means that the level of potential revenues increasing was in case of Slovak banks higher.

The results of revenue efficiency can be illustrated on the example of an individual bank. Consider Bank 1 in 2013. This bank reached value of output-oriented technical efficiency equal to one. It indicates that Bank 1 was technical efficient, which means this bank produced the maximum possible outputs using a given inputs. When we look at the level of revenue efficiency of Bank 1 we found out, that the level of revenue efficiency was not equal to one (RE = 0.9503). This means, that Bank 1 achieved the maximum possible outputs using a given inputs, but the proportion of outputs did not guarantee the maximum possible revenues. So there existed the space for potential revenue increasing in case of Bank 1. When we looked at revenue of Bank 1 we can see, that the observed value of revenue was 528 500 th EUR and optimal value of revenue was 556 140.72 th EUR. It indicates that Bank 1 should increase its revenues by 4.97%. This potential revenue increasing in case of Bank 1 could be achieved by decreasing total loans to optimal value equal to 7 467 055 th EUR and by increasing of other earning assets to 4 912 368.4 th EUR, while maintaining a given output prices. This optimal combination of outputs allowed Bank 1 to achieve maximum revenue and shift on efficiency frontier.

The different development can be seen in case of cost efficiency. The minimum average value was reached in 2012 (72.05%), the maximum average value in 2009 (77.40%). Results show that the average cost efficiency decreased from value 77.40% in 2009 to value 72.05% in 2012 which can be a result of financial crisis. In last year the average cost efficiency increased to value 76.71%. It indicates that on average banks could save 22.60% of their costs at the beginning and 23.29% at the end of analysed period. When we look at the average cost efficiency according countries then it can be seen that the average cost efficiency moved from value 55.85% to 58.60% in case of Slovakia; and from value 94.64% to 91.20% in case of Czech Republic. It indicates that Czech banks were more cost efficient as the Slovak ones, which means that the level of potential costs savings was in case of Czech banks lower.

The results of cost efficiency can be also illustrated on the example of Bank 1 in 2013. This bank reached value of input-oriented technical efficiency equal to one, so Bank 1 was technical efficient, which means that the bank used minimum amount of inputs for producing of given outputs. When we look at the level of cost efficiency of Bank 1 we found out, that the level of cost efficiency was not equal to one (CE = 0.5652). Bank 1 used minimum amount of inputs for producing of given outputs, but the proportion of inputs did not guarantee the minimum possible costs. It means that there existed the space for potential cost saving in case of Bank 1. When we looked at cost of Bank 1 we can see, that the observed value of cost was 332 100 th EUR and optimal value of cost was 187 687.48 th EUR. It indicates that Bank 1 should use only 56.52% of its cost, so Bank 1 could decrease its cost by 43.48%. This potential cost saving achieved Bank 1 by increasing total deposits to optimal value equal to 8 012 383 th EUR, by reducing number of employees to 2121 and by reducing fixed assets to 48 034.852 th EUR, while maintaining a given input prices. This optimal combination of inputs allowed Bank 1 to achieve minimum cost and shift on efficiency frontier.

The lowest values were reached in case of profit efficiency, when the values moved from 33.80% in 2009 to 32.33% in 2013. The minimum average value was reached in 2013, the maximum average value in 2010 (34.44%). When we look at the average profit efficiency according countries then can be seen that the average profit efficiency moved from value 11.56% to 9.64% in case of Slovakia; and from value 51.59% to 50.48% in case of Czech Republic. It indicates that Czech banks were more profit efficient as the Slovak ones. The value of overall profit efficiency can be interpreted as potential profit increasing that can be achieved if the production unit uses the inputs and outputs in optimal combination. So we can conclude that the level of potential profit increasing was in case of Slovak banks higher. In case of profit efficiency the level could not be bounded by zero and one. It could be negative if profit is negative. This fact can be seen in case of profit efficiency of Czech banks in 2011, when minimum value in the sample was –0.63%.

CONCLUSION

Efficiency of banks and other financial institutions is very frequently discussed topic in literature. Most studies have focused on the input side, estimating cost efficiency, with fewer contributions dealing with revenue and profit efficiency. As we know that both sides are relevant when evaluating efficiency of financial institutions, we were dealing with DEA method and described its application in measuring cost, revenue and profit efficiency.

Results indicate that, on average, commercial banks in Slovakia and Czech Republic were the most revenue efficient, when the average revenue efficiency increased from value 84.84% in 2009 to value 92.23% in 2013. The different development can be seen in case of cost efficiency, when the average cost efficiency decreased from value 77.40% in 2009 to value 72.05% in 2012, and in last year increased to value 76.71%. The lowest values were reached in profit efficiency, when the values moved from 33.80% in 2009 to 32.33% in 2013. When we look at the average efficiency according to countries then we can conclude that the Czech banks were more cost, revenue and profit efficient than the Slovak ones during the whole analysed period. It indicates that the level of potential costs savings, potential revenue increasing and potential revenue increasing was in case of Slovak banks higher.

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Skills and Educational Mismatch in the Czech Republic: Comparison of Different Approaches Applied on PIAAC Data[1]

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Abstract

This paper aims to explain both related and different concepts of educational and skill mismatches. In the first part a clear distinction between skill and educational mismatch is made and advantages and disadvantages of using each approach are listed. An overview of meanings and characteristics of different types of mismatch is provided as well. This part of the paper deals also with potential causes of mismatches in the labour market as well as consequences of mismatches. Next section offers the information on measures of educational and skill mismatches and a new approach for measuring skill mismatch is introduced. Due to recently published results from PIAAC survey containing measures of skills and also information about qualifications, educational as well as skill mismatches can be investigated and several methods of their measurement can be compared. The comparison is drawn in relation to the distribution of mismatches among different demographic groups.

Keywords	JEL code
Education, skills, mismatch, labour market, PIAAC	*I21, I25, J23, J24*

INTRODUCTION

This article focuses on currently broadly discussed topic of mismatches on the labour market. Mainly due to an increasing global competition, rapid demographic change and huge technological progress this topic becomes more urgent. In the past, most of the studies dealt with educational mismatches,

but recently released data of the Programme for the International Assessment of Adult Competencies (PIAAC) allow us to investigate also skill mismatches. Even though these concepts are interrelated, and overlap to a certain extent, there are some fundamental differences. They are described in the first part of this paper and pros and cons of particular concepts are listed. This part of the paper also presents a summary of existing literature on topic of mismatches and deals in detail namely with the implications and causes of mismatches.

The second part of this paper concentrates on methodological approaches for measurement of mismatches. When measuring the educational mismatch, subjective, objective or statistical approaches can be applied. Measurement of skill mismatches is based on two approaches, i.e. approach based on self-assessment of workers and on frequency of use of skills in the job. The main contribution of this article subsists in introduction of a new method to address the latter approach. It comes from original methodology developed by Krahn and Lowe (1998) which was slightly modified. New method is described in detail in methodological part.

Last section of this paper measures the incidence of both educational and skill mismatch in the Czech Republic. Empirical data used in this paper come from a first wave of the Programme for the International Assessment of Adult Competencies (PIAAC) carried out by OECD in 24 countries. Measuring educational and skills mismatch was an important part of PIAAC[4] and several different approaches were taken. Therefore we can compare the results of different estimates of the scope of mismatch and try to reveal their strengths and weaknesses. There are several studies comparing levels of educational or skills mismatch internationally. Where comparable methodology can be ensured, our results are interpreted in relation to the situation in other countries where the analyses are available.

1 DISTINGUISHING MISMATCH RELATED CONCEPTS

In recent years there has been a growing interest in phenomenon of mismatches in the labour market and their effects. In the past, literature has dealt mainly with education mismatches (e.g. Duncan and Hofmann, 1981, Sicherman, 1991, Green, McIntosh and Vignoles, 1999, Hartog, 2000) rather than skills mismatches (e.g. Allen and van der Velden, 2001, Green and MacIntosh, 2007). This was caused particularly by the lack of data to address the latter. Still, large-scale surveys such as IALS, ALL and from the latest PIAAC containing measures of skills were carried out, which enabled the investigation of skill mismatches. Although educational and skill mismatches are related concepts, and they both measure discrepancy between skill supply and demand on the labour market, they should be clearly distinguished. It is mainly due to the fact that they lead to a different type of analyses and implications.

Educational mismatch[5] (or qualification mismatch) refers to a situation when the educational qualifications held by the worker differ from those perceived to be required either by the employer or worker for performance of tasks associated with his/her job adequately. In order to compare worker´s qualification and the qualification requirements for the job, four categories of qualifications were derived from PIAAC survey. Answers on highest level of formal education according to classification ISCED 97 were aggregated into four levels i.e. elementary education, secondary education without school-leaving exam, secondary education with school-leaving exam and tertiary education.

Three alternative categories can be then distinguished, namely overeducation (or over-qualification), undereducation (under-qualification) and educational match (qualification match). Educational mismatch has an advantage of being easier to measure and broader in its coverage of "skills", but has also a disadvantage of being much less precise than skill mismatch. It is mainly due to the fact, that even though

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[4] Detailed information on PIAAC survey can be found in OECD (2013c).
[5] In this paper we investigate vertical dimension of educational mismatch. Horizontal dimension refers to situation when graduates are matched to occupation outside their own educational domain (Heijke, Meng, Ris, 2002).

education (or qualification) has been used extensively in the literature as a proxy for skills, it does not have to be good skills indicator. Firstly, it does not reflect the existence of skill heterogeneity within education-al classes and secondly it does not take account of the possibility for skill gain or loss over the lifespan.

Skill mismatch, in contrast to educational mismatch, is more direct concept of measuring mismatch-es on the labour market. It refers to the situation when level of the actual workers´ skills differs from the level necessary to perform required job tasks successfully. Skill mismatch is more precise measurement than educational mismatch and thus in the last years there was a noticeable shift from focus on education mismatch to skill mismatch (Mavromaras at al., 2010). Still, literature on skill mismatch is rather limited mainly due to the lack of quality data and difficulty of identifying good measures of skills. Determin-ing which skills should be measured is a complex and difficult task. Many scholars are concerned with the diversity of human skills and determined so–called core competencies or key competencies (Rychen, Salganik, 2003). Nevertheless, it is clear that core competencies form a general skills background only and that in every occupation there are also other specific skills that one needs to acquire in order to make up the professional domain of particular occupation.

Similarly to education mismatch, in the measures of the skill mismatch there are typically three al-ternative categories that can be distinguished. Over-skilling (or skill surplus or skill underutilization) is the situation when worker´s skills exceed those required by his/her job; under-skilling (or skill deficit) is the situation when the worker´s skills are inadequate to the requirements of his/her job and the re-quired-skilled workers are the ones with adequate skills for the job. When analyzing skills or educational mismatches several approaches, which will be further discussed in methodological section, can be adopted.

2 BIBLIOGRAPHY
2.1 The implications of mismatch

For several years overeducation has been receiving significantly more attention than undereducation, due to the concern, that it may have been caused by sharp expansion of tertiary education. Duncan and Hoffman (1981) analyzed overeducation and identified the rate of overeducation of 42% in the US in 1976. To date, a growing interest has been monitored resulting in numerous similar studies in more than 20 countries. Metaanalysis of 25 studies by Groot and Maassen van den Brink (2000) showed that overeducation decreased from 29%, on average, in 1970s to 21% in 1990s. Such a situation can be ex-plained by technology change that helped to sustain the demand for skilled labor in face of rising supply (Krueger, 1993, Acemoglu, 1999). Nevertheless, Galasi (2008) found that overeducation in Europe has risen again in last decade, which implies that education expansion is faster than technological progress. The expansion of tertiary education in Eastern European countries is a possible cause of this pattern. But such a conclusion is very limited and many aspects such as great differences among countries, economic cycle, system of education, etc., have to be taken into consideration when interpreting the results. Some authors (e.g. McGuinness, 2006) even report that the rate of overeducation is stable over time and no significant changes can be observed. While in the past the focus was put on the overeducation, recent years have witnessed growing interest in skill underutilization, because of its negative consequences for individuals and the economy as whole.

The implications and consequences of mismatch can be distinguished at three following levels: at individual level, at firm level and at aggregate level. Below are listed some of these implications that are broadly recognized and confirmed in several studies.

At the *individual level* it influences mainly job satisfaction and has also strong impact on wages and job mobility. Several studies have explored a linkage between job satisfaction and education or skill mismatch (Tsang, 1987, Battuu at al., 2000). Over-qualified workers were found to be less satisfied in their jobs than well-matched workers with the same qualifications (Verhaest and Omey, 2006). The same effect was found to be caused by skill underutilization (over-skilling), which leads to reduction

of a job satisfaction. On the other hand Allen, Levels and van der Velden (2013) identified mismatch also as a positive issue, because namely undereducation may be up to a point at least challenging and satisfying.

Another negative implication of mismatch was found by Krahn and Lowe (1998). They discovered that lack of use of some skills (for example due to overskilling) leads to "use it or lose it" effect, which means that skills can be lost if they are not used or further developed. Wage penalties connected with mismatch were firstly described by Sicherman (1991). It was found that mismatch workers suffer from substantial wage penalties in comparison with properly matched workers. Overeducated workers were paid less than if they were matched, but more than their matched co-workers with the lower qualification level. Secondly, undereducated workers were found to be paid more than if they were matched, but less than their matched co-workers with the higher qualification level. These results have been confirmed in a large number of subsequent studies. Effects of mismatch were also discovered in relation to job mobility. Numbers of studies have found that overeducated workers are more mobile than well-matched workers with the same education (Hersch, 1991). Again, it is necessary to remind, that only certain domains of skills are measured, and that the importance of these skills vary widely within different occupations.

At the *firm level*, hiring overeducated workers can be a deliberate strategy to benefit from extra skills in the long term, despite negative impacts in the short term. On the other hand, according to Sichermann (1991), the undereducated are paid less than their matched co-workers which means that employing the undereducated may result in some productivity penalties (accepting the earnings reflect worker´s marginal product). Mismatch also increases on-the-job search and turnovers, and may increase firms´ expenditures.

At the *aggregate level* mismatch is considered to cause unemployment and increase unemployment persistence (Jackman et al, 1991). Other studies confirmed relation between mismatch and GDP. Reduction in productivity leads also to reduction of GDP. At the aggregate level, high rate of overeducation may be interpreted also as an over-investment in formal education or that educational system is ineffective in providing skills needed for the labour market. To limit these negative consequences it is necessary to identify the main causes of mismatch and design effective strategy to address them.

2.2 The causes of mismatch

It is broadly accepted fact that mismatch arises from the situation where there is heterogeneity both at the supply – experience, skills, and the diverse qualifications offered by individuals to potential employers – and demand side of the labour market – skills, experiences and the qualifications required to perform job tasks properly. There are numbers of hypotheses why mismatch occurs. In general, the existence of mismatches can be explained by imperfections of the labour market caused by information asymmetry between employers and employees, incomplete information in the labour market, differences between people and transactions costs. Generally, the causes of mismatches exist at the individual as well as on the macro level.

There are numbers of theories that can help us to understand the labour market imperfections. At the *individual level*, educational mismatch can be for example explained through a fact that certain individuals may have low ability for their level of education in comparison with their peers. It results in situation where they will not be able to obtain a job commensurate with their education. Obviously, such an example is the case of overeducation. On the other hand, overeducation may also appear, when some individuals choose to accept a job for which they are overeducated because it offers them compensating advantages, such as less stress, or less commute to work, work time flexibility etc.

Another possibility is that employers actually prefer overeducated employees, because they are more productive and learn more quickly. For firms operating in rapidly changing markets, hiring overeducated or overskilled workers may be a strategy to avoid future expenditures and may serve as an insurance policy. Some studies (Crompton, 2002, Dekker et al, 2002) have also found that young people are more

likely to be overeducated because at the beginning of their career they are willing to accept jobs that do not reflect their qualifications. According to this theory, overeducation can be explained as temporary phenomena which should correct itself as the young people find the jobs that suit their skills better. Over a lifetime overeducation should thus decline with age. Skill mismatch may also appear when employers do not possess well developed hiring practices and hire workers with different skills than they require.

At the **aggregate level**, overeducation is linked with the expansion of tertiary education which is growing faster than the share of highly qualified jobs. The economic or technological changes on the labour market cannot be immediately reflected in the changes of educational system. This situation can lead to both undereducation and overeducation since educational system produces qualifications that are inadequate to those required on labour market.

Undereducation is most often connected with the technological development. Technological progress upgrades requirements on the qualifications and mainly older workers may not fulfill those new requirements and thus are classified as undereducated. But this situation does not mean that they have to be underskilled. It is necessary to take non-formal education and skill development activities undertook by individuals since they have been hired into account. The rate of mismatch is also strongly related to economic cycle. During economic recession it can be more difficult to find an appropriate job and people may accept a job which does not suit their education or skills. Especially the rate of overeducation and overskilling is increasing mainly due to a combination of low number of vacancies and pressure on the supply side.

Causes of mismatches mentioned above do not represent a complete list of causes but are presented as an example of how different sources can cause the mismatch on the labour market. Some of the causes are described in more detail in separate theories, such as Human capital theory (Schultz, 1961, Becker, 1964), Technological change theory (Romer, 1990), Career mobility theory (Sicherman and Galor, 1991), Search theory, Signaling theory, Job competition theory or Labour market segmentation theory (see Desjardins, Rubenson, 2011).

3 METHODOLOGY – APPROACHES TO MEASURE MISMATCHES
3.1 Educational mismatches

The measurement of educational mismatches varies widely. Verhaest and Omey (2006) for example distinguish four major approaches to measurement of educational mismatches, whereas in most of the studies three measures of mismatch can be found. For example Cedefop (2010) distinguishes:

- **Subjective** method based on self-reported respondent´s assessment of match between his or her education and tasks required in job. Verhaest and Omey (2006) further distinguished direct self-assessment and indirect self-assessment method. While using direct self-assessment method respondents are being posed the question whether they feel over- or under- educated for their job or their education is just appropriate (*'Do you have a level of education which is according to your own opinion too high, too low or appropriate for your job?'*). Indirect self-assessment means that respondents evaluate appropriate level of education for their job or necessary qualification required for obtaining it. Under- and over-education is determined by comparing declared educational level with respondent´s actual educational attainment.

- **Objective** (normative) method based on expert evaluation of required qualification for specific job. Proper level of education for particular occupation can be for instance determined by using ISCO classification. In the Czech Republic occupational descriptions such as those in the National Register of Occupations (Národní soustava povolání – NSP) can be used as benchmark for determining appropriate educational levels in job analyses.

- **Statistical** (empirical) method uses data on educational distribution within specific occupation. The majority of studies using this approach labels respondent as "mismatched" in case that his or her

education (expressed by years spent by education) differs by more than one standard deviation from mean level of education in occupation (s)he performs (e.g. Verdugo and Verdugo, 1989).

All the approaches have several limitations. The main weakness of subjective approaches is that respondent´s opinion on required education may be different from employer´s point of view and doesn´t have to reflect current situation on the labour market. When applying objective methods researchers have to deal with an issue of level of disaggregation of occupations. The broader the definition of the occupation, the more heterogeneous workers it includes and the possibility to derive one single educational level for all of them is limited. In this paper, the character of PIAAC data enable us to easily measure educational mismatch by using subjective methods of direct and indirect self-assessment.

3.2 Skill mismatches

When measuring skill mismatches, two main approaches are typically applied. First approach labels workers as matched or mismatched according to self-evaluation of their skills and of the level of skills one need in the job they perform. The second approach compares workers specific skills with the frequency in which these skills are performed at work and uses some technique of skills measurement.

The first approach measures skill mismatch through subjective self-assessment of workers. Respondents are asked whether they use their skills in the job sufficiently or not, or in other words if their skills match the requirements of their job. This direct self-reported approach was used for example in HILDA survey (Household Income and Labour Dynamics in Australia) where employees evaluated their attitude towards the statement of *"I use many of my skills and abilities in my current job"* on seven point scale. Those who disagreed with the statement were labeled as overskilled and reversely, those who agreed were labeled as underskilled (Mavromaras, McGuinnes and Wooden, 2007). Subjective assessment by workers has been used in many studies, although it has several disadvantages. Firstly, workers may not possess all the information to assess skills properly and secondly, they might exaggerate their own abilities or requirements of the job. Detailed investigation of problems related to self-assessment in measuring skills can be found in Allen, Van der Velden (2005).

Two questions in PIAAC survey enabled us to perform skills mismatch analysis using subjective methods. Their exact wording was: *"Do you feel that you have the skills to cope with more demanding duties than those you are required to perform in your current job?"* and *"Do you feel that you need further training in order to cope well with your present duties?".*

Second, the most developed approach of skills mismatch measurement derives the demand for skills on the labour market from the frequency that individuals perform skills related tasks at their workplace. By relating skills level of an individual with his job´s requirements on skills used we can find out whether one´s skills are appropriate, insufficient or underutilized for his or her job. Aggregation allows us to derive the extent of skills match and mismatch in the population. When applying this approach we have to keep in mind possible sources of bias. Firstly, frequency of skills use measured by questionnaires cannot possibly reflect all the dimensions of work performance and only several items can be used as representatives of numeracy or literacy use at work. For example PIAAC used 6 specific items to measure frequency of numeracy related tasks at work (see Figure 2). Moreover, tests of skills such as numeracy or literacy can only cover certain features of overall skills which doesn´t necessarily match skills demanded on the labour market. All objections against this approach can be summarized briefly: Particular skills level and frequency of performing certain tasks on the workplace both measured by questionnaire do not necessarily correspond with the supply of skills and the demand for them in the labour market.

The original methodology for relating skills use and skills level was developed by Krahn and Lowe in 1998 on IALS data. In their analysis they created 4 categories of skills use and equally 4 categories of skills level and compared the combination of these categories for an individual. In the analysis of ALLS data (OECD, 2005) their method has been slightly modified. The median value of skills utilization

in the whole economy was used as a borderline between high and low skill use and the level of skills above the value of 2 was considered as high skills. As an outcome four possible categories of skills level/ skills use combination were created:

- Low-skill match (skills level 1 or 2 and skills utilization below the median level),
- High-skill match (skills level above 2 and skills utilization above the median level),
- Deficit mismatch (skills level 1 or 2 and skills utilization above the median level),
- Surplus mismatch (skills level above 2 and skills utilization below the median level).

In this paper, we build up on Krahn and Lowe´s methodology of measurement of skills mismatch described in final report of ALLS survey (OECD, 2005) and we further develop it. Reasons for modifying the original methodology are the following: firstly, it is a respect to respondents located very close to the median value of skills use. Median as a decisive point leads to the situation when even subtle difference on the scale of skills use may cause major difference in respondent´s classification as matched/ mismatched. Consequently, differences between some of the workers labeled as matched and mismatched can be negligible. That´s why we considered the share of mismatched workers derived from this approach as overstated and decided to take up more apparent criteria of skills mismatch described below. As a minor modification we decided to take up different method of distinguishing between high and low level of skills. Instead of using skills level 3 as a borderline of high skills achievement we decided to work with percentiles as an expression of individual´s relative position on the skills scale. As a result, both skills and skills use are evaluated using the same measure, which is the position of individual in relation to others.

We consider the outcomes of newly developed methodology as an appropriate estimate of the share of skills mismatch in the Czech labour market. However, since 2005 when Krahn and Lowe introduced their methodology, it has been applied in several studies. Outcomes of these papers can be related to results from PIAAC study in the Czech Republic and provide us a broader context for our results. Krahn and Lowe´s original methodology thus appeared to be more suitable for international and intertemporal comparison. This is the reason why we decided to use it as an alternative measure of skills mismatch in this paper. Differences in the extent of skills mismatched derived from two methods will be discussed and their weak and strong sides will be pointed out.

4 RESULTS FROM PIAAC – SHARE OF SKILLS MATCH/MISMATCH AND EDUCATION MISMATCH IN POPULATION, INTERNATIONAL COMPARISON AND DISTRIBUTION OF MISMATCH AMONG DEMOGRAPHIC GROUPS
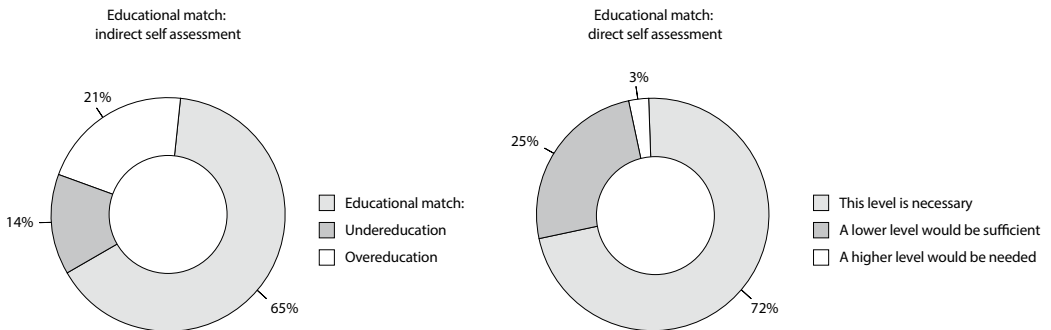### 4.1 Educational mismatch

In PIAAC, two approaches were applied in order to measure the scope of educational mismatch. Indirect self-assessment is first of them. More specifically, question with following wording: *"Still talking about your current job: If applying today, what would be the usual qualifications, if any, that someone would need to GET this type of job?„* was posed in the PIAAC questionnaire. Declared level of required education was related to respondent´s actual educational level and three possible categories were derived:[6]

- *educational match* – in case when required education was in accordance with actual qualification,
- *overqualification* – in case respondent´s actual education was higher than qualification required for his/her job,
- *underqualification* – in case respondent´s actual education was lower than qualification required for his/her job.

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[6] For the purposes of our analysis, we were working with four qualification levels that are commonly used in the Czech educational system. Levels of education we used were namely: elementary education, secondary education without school-leaving exam, secondary education with school-leaving exam and tertiary education.

Secondly, direct self-assessment method was applied by asking a question of *"Thinking about whether this qualification is necessary for doing your job satisfactorily, which of the following statements would be most true?"*. Respondents were supposed to subjectively assess whether their educational level is satisfactory for their job and they could choose between three answers *"This level is necessary"*, *"A lower level would be sufficient"* or *"A higher level would be needed"*.

Figure 1 Distribution of educational match and mismatch measured by indirect and direct self-assessment method

Source: PIAAC data

Figure 1 shows the distribution of educational match and mismatch and enable us to compare the outcomes of two different methods. According to the indirect self-assessment method jobs of 65% of workers are matched with education of their holders, the educational attainment of 35% doesn´t correspond to the level their job would require. More specifically, 21% of population is overqualified and qualification level of 14% is lower than their job would require. The comparability with direct self-assessment method seems to be rather limited. The main difference emerges from negligible share of underqualified population derived from the direct self-assessment method. Obviously, it is rather rare to directly state that higher level of education would be needed for somebody´s own job. When asking indirectly, the share of undereducated is 11 p.p. higher. The difference probably sources from the different perception of "qualification someone would need to get this job now" and "qualification necessary for doing the job satisfactorily". While the former expression is closely connected to formal requirement of employer, the latter one rather reflects evaluation of own abilities. The share of overqualified workers derived from direct as well as indirect method differs only slightly.

Meta-analysis of 25 studies focused on the scope of under/overeducation by Groot and Van der Brink (2000) estimates the average overeducation rate measured by self-reporting method of 28.6% and undereducation rate of 15.5%. Rates of educational mismatch in the Czech Republic derived from indirect self-assessment method do not seem to be exceptional. Groot and Van der Brink (2000) state that subjective methods based on self-assessment bring the highest estimates of overeducation rates. Presumably, future research based on objective and statistical methods applied on Czech data would bring lower shares of overeducated workers in the Czech population.

4.2 Skills mismatch
Skills mismatch measurement enables us to examine the scope of discrepancy between the skills offered by workers on the labour market and skills required by employers. The goal of this analysis

is to find an answer to the question of how many workers have insufficient skills for the job they perform and how many of them are overskilled for their jobs. As we stated above, we will use two methods of finding an answer to this question in this paper. We start with more sophisticated and analytically demanding method based on the frequency of use of skills in the job and in the next section we try to compare it with subjective method of skills self-assessment.[7]
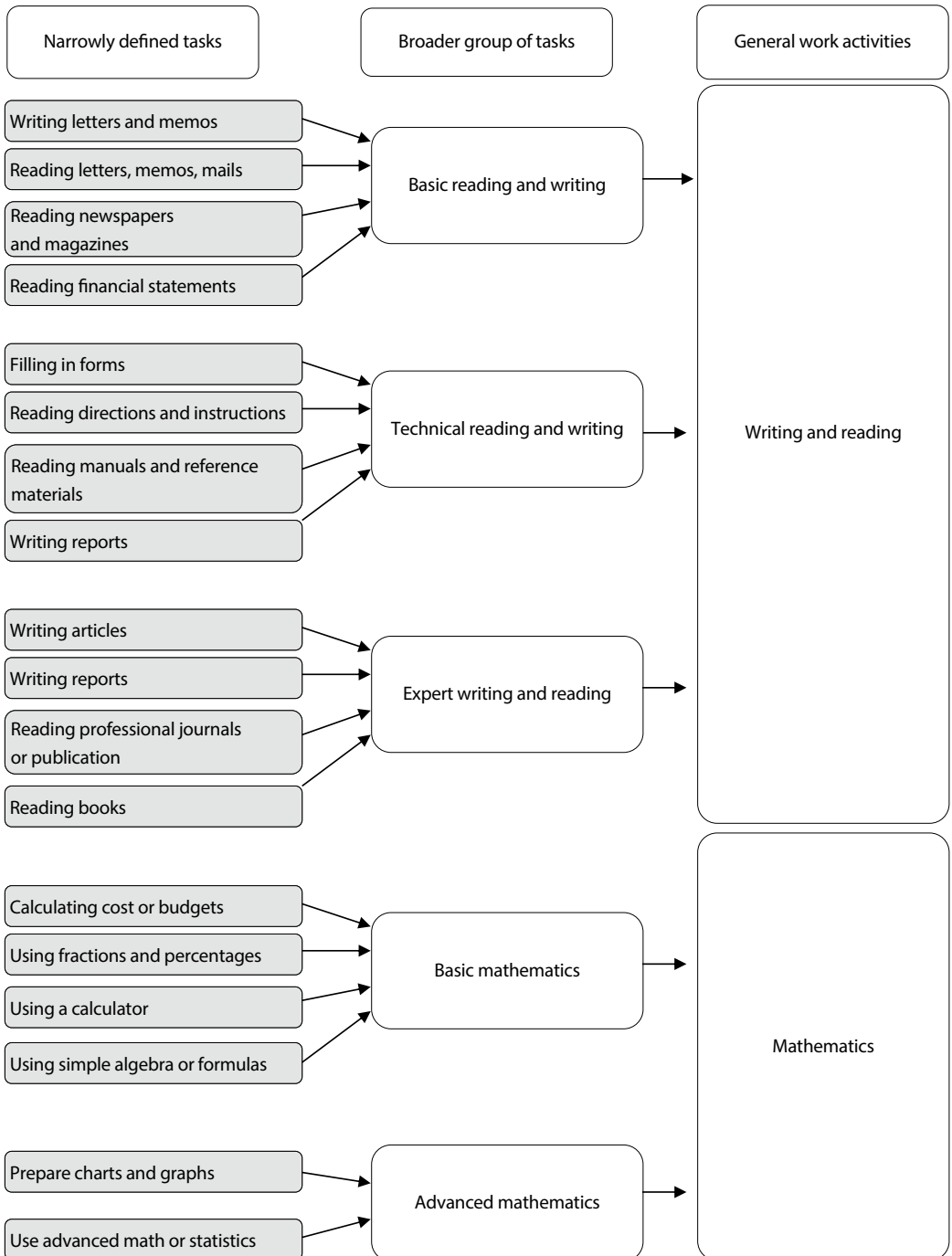
The PIAAC dataset provides us with assessment of three domains of skills demanded on the labour market – literacy skills, numeracy skills and skills of problem solving in technology rich environment. According to OECD (2013b) literacy is defined as: *"the ability to understand, evaluate, use and engage with written texts to participate in society, to achieve one´s goal, and to develop one´s knowledge and potential. Literacy encompasses a range of skills from decoding of written words and sentences to the comprehension, interpretation, and evaluation of complex texts"*. Similarly, numeracy is described as: *"the ability to access, use, interpret and communicate mathematical information and ideas in order to engage in and manage the mathematical demands of a range of situations in adult life"*. Last domain of cognitive skills, problem solving in technology rich environment is defined as: *"the ability to use digital technology, communications tools and network to acquire and evaluate information, communicate with others and perform practical tasks"*. An individual´s score on the skills scale was derived using adaptive testing based on item response theory. For the purpose of this analysis, only the data on literacy and numeracy skills were used. The reason behind excluding scores of problem solving in technology rich environment was non-random distribution of missing data.[8]

Our strategy for direct measuring of skills mismatch was to compare individual´s skills level with extent of use of this skill in his/her job as a proxy for skills requirements of the employers. Respondents were asked to evaluate the frequency in which they need to perform narrowly defined set of activities in their job. Activities that are relevant to measured skills and reflect their use were examined in this analysis. For this purpose, two scales reflecting the frequency of tasks performed at workplace were created. The final scale was created in two steps. At the beginning there were data on frequency of narrowly defined tasks (such as writing reports, using calculator). Frequency of tasks was measured on 5 point scale ranging from "never" to "every day". Firstly, factor analysis was performed and broader groups of tasks (i.e. simple mathematics, technical reading) were created according to its outcome. Every individual can be assigned with a value (factor score) that indicates his or her relative position on the scale of frequency of performing these broader groups of tasks. Weighted average of factor scores was used in order to determine individual´s position on related general work activities scale (mathematics, reading and writing). The contribution of individual activities to the development of related skills is not identical. That is why partial correlation coefficients expressing the connection of groups of tasks and related skill were used as a weight for determining the final position on the general work activities scales. The more the specific group of tasks was related to corresponding skills, the more weight it was assigned. Both scales, the one reflecting skills use and the other one reflecting skills level, were transformed into percentiles scale in order to express performance of individual in relation to others.

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[7] These two methods don´t cover all the possibilities of skills mismatch analysis on PIAAC data. As a methodological innovation, OECD (2013a) took up a combination of subjective and statistical method in order to determine the level of skills mismatch. Skills level of workers who considered themselves as appropriately skilled in each country and occupational group were taken as a benchmark. Workers whose skills level was below this border were labeled as underskilled and workers whose skills were above were considered overskilled.

[8] Test of performance in problem solving in technology rich environment were taken up only by respondents who agreed on taking computer assisted test and reported they had at least some computer experience. In the Czech data 75% of respondents went through problem solving in technology-rich environment assessment.

Figure 2 A schema of composition of skills use scale

Narrowly defined tasks	Broader group of tasks	General work activities

- Writing letters and memos
- Reading letters, memos, mails
- Reading newspapers and magazines
- Reading financial statements

→ Basic reading and writing →

- Filling in forms
- Reading directions and instructions
- Reading manuals and reference materials
- Writing reports

→ Technical reading and writing → Writing and reading

- Writing articles
- Writing reports
- Reading professional journals or publication
- Reading books

→ Expert writing and reading →

- Calculating cost or budgets
- Using fractions and percentages
- Using a calculator
- Using simple algebra or formulas

→ Basic mathematics →

Mathematics

- Prepare charts and graphs
- Use advanced math or statistics

→ Advanced mathematics →

Source: Own construction

The method described above has several pros and cons. Weighted average of factor scores may seem a complicated way of determining the level of skills use. Another disadvantage is limited possibility of conducting international comparison due to the assumption that the results of factor analysis would differ among countries. However, we consider outcomes of this method as very precise way how to determine the level an individual uses reading, writing and mathematics on workplace. Some other author´s approach (e.g. Allen, Levels and Van der Velden, 2013) was to compute simple mean of items that measure skills use. This method doesn´t reflect unequal importance of measured tasks for indicating skills use and for example results in assigning the same weight to reading emails and writing articles for the evaluation of literacy use. This is why we decided to use more complicated method described above.

Another step was distinguishing three possible categories of skills and skills use combination. For the definition of mismatch the value of 40th and 60th percentile on both scales was crucial (see Figure 3).

1) **Matched** workers whose level of skill use is in accordance with the level of related skills. It concerns both situation of an individual who possesses low level of skills and performs a job where he or she just rarely use them, as well as of high-skilled professional who makes use of this skills on a daily basis.

2) **Overskilled** workers have more skills than their job demands. It describes a situation when someone´s skills are above the level of 60% of the population but when it comes to skills use, at least 60% of the population uses them more often on their workplace.

3) **Underskilled** workers have insufficient skills for performing their jobs. Individuals labeled as underskilled showed poorer performance in skills test than 60% of the population while their position on skill use scale ranks them among 40% of most frequent users.

An analysis based on newly developed methodology leads us to the conclusion that both literacy and numeracy mismatch concerns approximately one fifth of the Czech workforce (20.8% in case of numeracy and 21.8% for literacy). In the domain of literacy, 10.9% of the Czechs can be described as underskilled, in case of numeracy, skill deficit value over 9% is slightly less of a problem. This concept of skills mismatch will be elaborated in the following chapter, where we will take a closer look at the distribution of mismatch among various demographic groups.

In the previous chapter, we argued why we consider methodology used in this paper as the most appropriate for measuring skills mismatch. However, results for Krahn and Lowe´s methodology (2005) applied on PIAAC data will be introduced in order to perceive the extent of skills mismatch in the Czech Republic in broader context. Results are described in Figure 5.
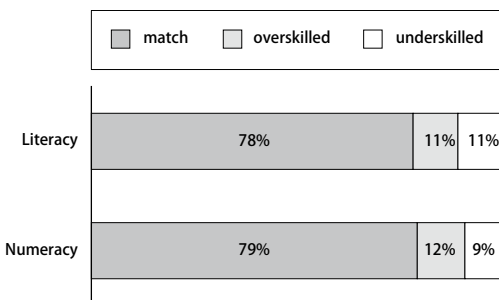
As expected, the extent of mismatch based on Krahn and Lowe´s methodology was

Figure 3 Determination of categories of match mismatch
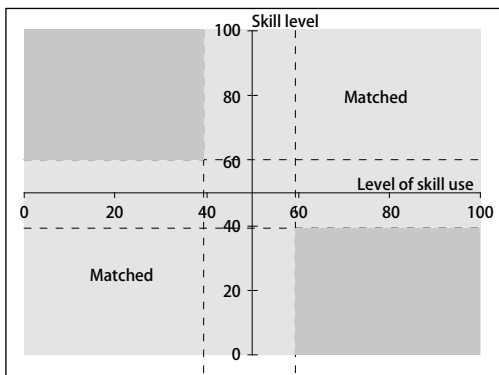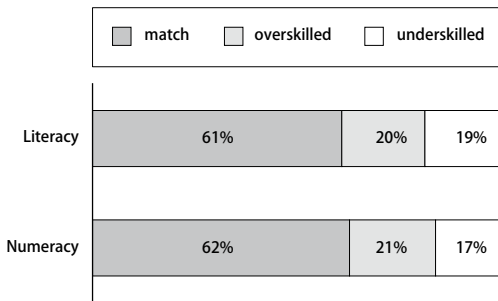

Source:

Figure 4 Distribution of skills match and mismatch in literacy and numeracy

Source: PIAAC data analyzed by the method developed in this article

Figure 5 Distribution of skills match and mismatch in numeracy and literacy according to Krahn and Lowe´s methodology


Source: PIAAC data analyzed by Krahn and Lowe´s methodology

higher reaching 37.6% in case of numeracy and 39.5% in literacy. Share of overskilled in literacy and numeracy is comparable; skills deficits are moderately higher in literacy. These results can be related to Desjardin´s and Rubenson´s (2011) work who applied the very same method of skills mismatch calculation on 9 countries participating in ALL survey.[9] Literacy and numeracy mismatch turned out to be a widespread phenomenon in all participating countries. In case of literacy the proportion of skills deficit ranged among 9 and 29% in literacy, in case of numeracy the range was from 6 to 20%. Skills surplus ranged from 12 to 32% in literacy and from 17 to 46 in numeracy. The scope of underskilled as well as overskilled workers in the Czech Republic derived from PIAAC survey doesn't seem to be exceptional in the international context and in both measured domains of skills represents values close to the average. When reading outcomes of skills mismatch analysis based on Krahn and Lowe´s methodology, we should keep in mind that significant part of respondents labeled as mismatched can in fact be only slightly deviated from the median values. In the methodology developed for this article the criterion of mismatch is stricter and just respondents, whose job is in severe discrepancy with their skills, are labeled as mismatched.

From PIAAC data we can directly compare how the extent of skills mismatch differs when we use analytically less demanding approach of subjective self-assessment (later in a text referred as subjective method). Figure 6 shows the extent of subjective skills surplus based on the answers on the question *"Do you feel that you have the skills to cope with more demanding duties than those you are required to perform in your current job?"*. 83% of respondents did agree with this statement in PIAAC and could be considered overskilled according to subjective measures.

**Figure 6** Subjective assessment of skills surplus and deficit
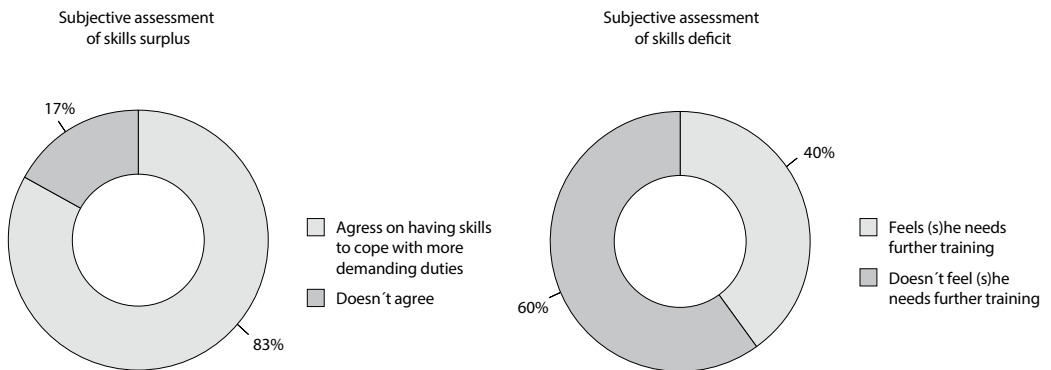
Source: PIAAC data

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[9]   Measurement of skills use in ALL and PIAAC surveys was not identical, but both approaches were very similar and therefore we consider their comparison as appropriate. Different approach of determining skills use scale has to be considered as well.

On the other hand, 40% of respondents agreed that they *"Feel they need further training in order to cope well with their present duties"*. That would indicate that 40% of population feel underskilled for the job they do.

The inconsistence of two methods of skills mismatch measurement is obvious. According to subjective approach only 9.6% of population feel appropriately skilled for their job. On the other hand, 32.5% stated they have skills to cope with more demanding duties in their job, but at the same time they would need further training to cope with their present duties. It can be the case of workers who feel confident about one domain of their work related skills, but realize insufficiencies in others. Manager who is fully competent in work with information technologies but lacks foreign language skills can be a good example of this phenomenon. These results indicate that subjective measurement of generally defined skills brings results whose benefit for skills mismatch analysis is questionable. Any comparison with outcomes of method based on frequency of skills use is hardly feasible and these methods cannot be considered as substitutes.

Figure 7 Subjective measurement of skills mismatch

Subjective measurement
of skills match

10%

7%

32%

overskilled and underskille
overskilled
underskilled
matched

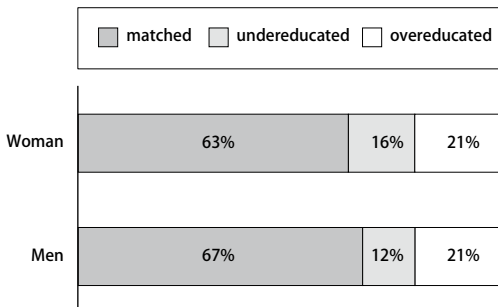51%
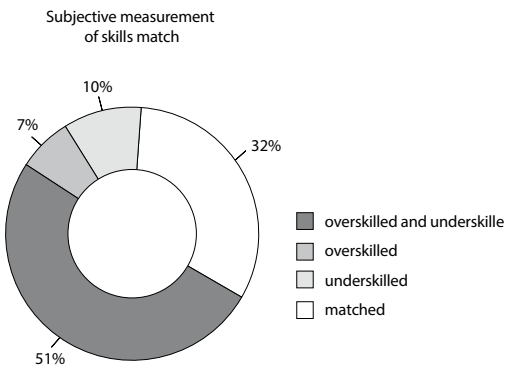
Source: PIAAC data

4.3 Distribution of educational and skills mismatch among demographic groups

This chapter will take a closer look at demographic determinants of skills and educational mismatch. Factors of age and gender will be examined.

According to Groot and Van den Brink´s meta-analysis, women are more likely to be overeducated, while undereducation is more frequent among male workers. There are several theoretical explanations for this pattern originating in Frank´s theory of differential overqualification (1978). Frank suggested that women are in greater risk of being overqualified because family´s decision to relocate is usually based on husband´s carrier. As a result, women accept jobs that are available, although not suitable for their qualification level. Explanations more appropriate for modern labour market concern invisible barriers for women´s advancement and gender stereotypes (see more in Luksyte, Spitzmueller, 2011). However, such a hypothesis cannot be confirmed when using indirect self-assessment method on PIAAC data from the Czech Republic. The share of overeducated men and women in the population is equal, i.e. 21%. On the contrary, 15.6% of women as opposed to 12.3% of men have lower qualification than their job would require (Figure 8). One possible explanation of unexpected patterns in the Czech data can be noticeably lower share of part-time jobs on total employment. Whereas in the EU 27 there is 31.5% of the population employed in part-time jobs, in the Czech Republic it is only 9.1% (LFS data), which is more than three times less than the EU average. Part-time jobs can be very often occupied by employers whose skills are not fully utilized. It is mainly due to a fact that they prefer such a situation and benefit from work time flexibility, or less commute to work, or because they simply need to harmonize family and working life. As a result of unavailability of flexible contracts on the labour market, activity rates of women in younger age groups are lower in the Czech Republic. In EU the rate of economic activity of women in age category 30–34 is 77.7%, in the Czech Republic it is only 64.7% (LFS data). For Czech women, parenting is connected with a switch to inactivity, whereas women in other countries stay at the labour market and contribute to increase of shares of overeducated.

Figure 8 Distribution of educational mismatch by gender using indirect self-assessment method
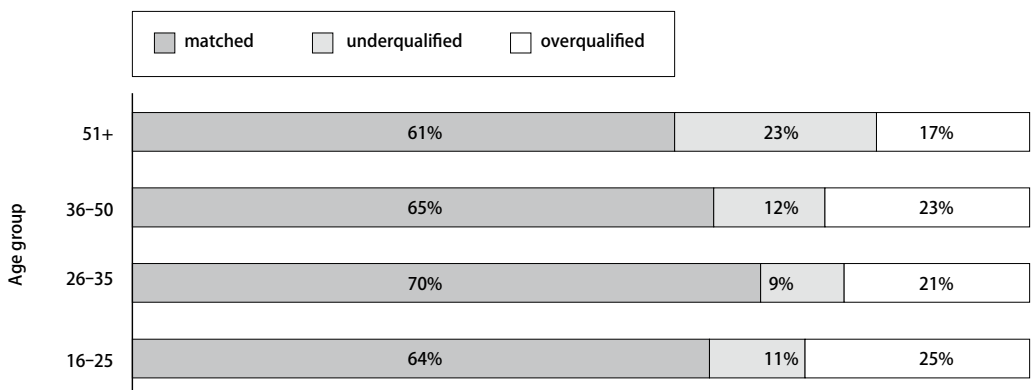
matched   undereducated   overeducated

Woman	63%	16%	21%
Men	67%	12%	21%

Source: PIAAC data

Surprisingly, there are also no gender differences in direct self-assessment of educational mismatch. It is equally one quarter of men and women that assume that lower level of education would be sufficient for their job and three percent of men as well as women that think they would need higher level of education for their job. Therefore, Figure 1 illustrating the direct self-assessment of educational mismatch in the entire population is identical with separate figures for men and women.

When we turn our attention to relation of underqualification and overqualification to age, Czech results are in line with internationally validated hypotheses (Quintini, 2011). Youth were more likely to be overeducated and older workers were more often underqualified. Growing educational level of the population provides us with an explanation why underqualification is a phenomenon closely related to older age groups. In accordance with that almost one quarter of workers in the youngest age group in our data has higher education then their work would require. When searching for a job young people may often face difficulties related to their lack of work experiences and therefore they may start their carriers taking up jobs that are less suitable for their skills and education. Temporary and usually unqualified student´s jobs may also contribute to high share of overqualified in the working population in this age group.

Figure 9 Distribution of educational mismatch by age using indirect self-assessment method

matched   underqualified   overqualified

Age group	matched	underqualified	overqualified
51+	61%	23%	17%
36–50	65%	12%	23%
26–35	70%	9%	21%
16–25	64%	11%	25%

Source: PIAAC data

When assessing educational match directly (Figure 10), less than 4% of older workers consider themselves as underqualified. Once again perceived employer´s requirements do not correspond with evaluation of own abilities. Although respondents were aware that they wouldn´t comply with educational requirements of the employers, most of them believe they cope with their working duties satisfactorily even without additional formal qualification level.

Figure 10 Distribution of educational mismatch measured by direct self-assessment
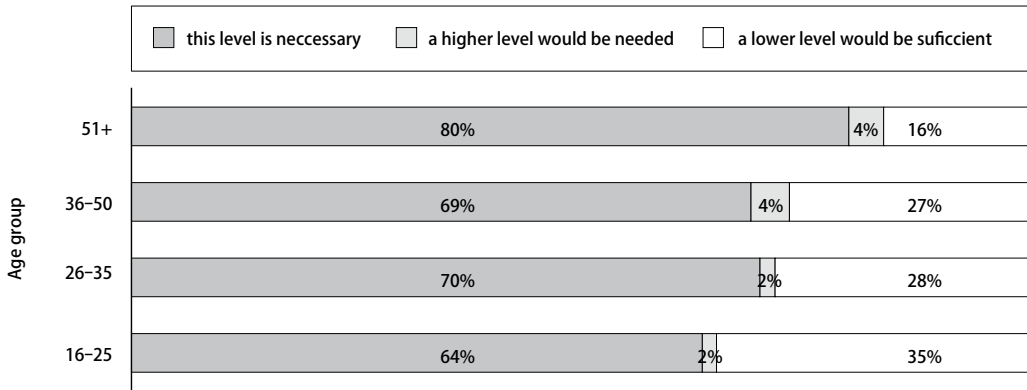
Source: PIAAC data

Available studies on educational and skills mismatch predominantly agree that women show an increased tendency to have skill as well as educational surplus while men more often lack sufficient skills and qualification for the job they perform. Above, we could see that our data did not confirm such a pattern in case of educational mismatch. Figure 11 shows us that Czech data are inconsistent with results of previous studies in the domain of skills mismatch as well. Although the differences were subtle (3.5 p.p. in literacy and 2.1 p.p. in numeracy), men were more likely to fall into the category of overskilled. The proportion of men and women lacking numeracy skills for satisfactory performance in their jobs was comparable (the share of men exceeds the share of women by 0.5 p.p.), the deficit of literacy skills was slightly more frequent among women (difference of 1.9 p.p.). A higher share of women working in professions requiring more literacy skills may be an explanation.

Figure 11 Skills mismatch distribution by gender
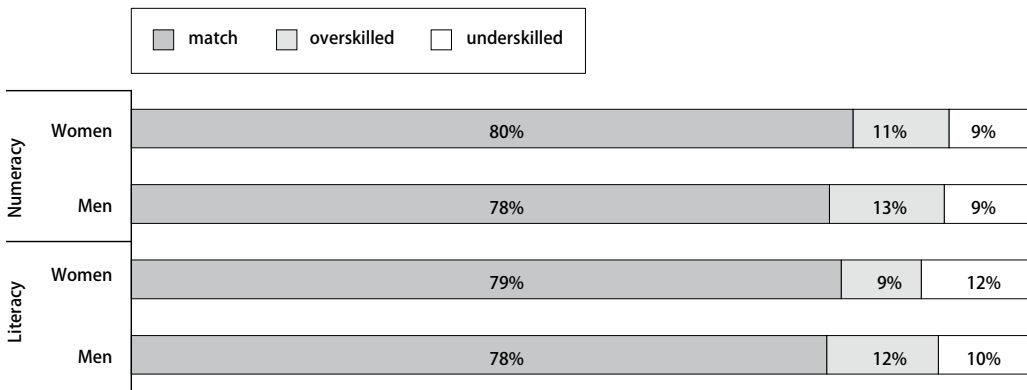
Source: PIAAC data analyzed by method developed in this article

In order to find out whether discrepancies with theoretically expected patterns are caused by different methodological approach of skills mismatch measurement or less usual situation on the Czech labour market we will proceed to direct comparison with Desjardin and Rubenson´s (2011) study that we mentioned earlier in this paper. According to Desjardin and Rubenson´s analysis of international data there was a significant predominance of women among overskilled workers in all countries they studied. On average, the share of overskilled women is 9% higher than that of men in case of literacy and 7% higher in numeracy. To provide comparable results we have to work with Krahn and Lowe´s methodology of skills mismatch identification. Results shown in Figure 12 confirm the same pattern of gender distribution of skills mismatch that we have revealed above. In contrast to other studies, men in the Czech Republic have higher probability of being overskilled in both numeracy and literacy than women. Results of educational and skills mismatch analysis point out to very similar phenomenon. Apparently, women are more likely to have a job that makes full use of their skills. We also haven´t found any evidence that women work in jobs requiring lower qualification level than the one they have achieved, more frequently than men. Analyses indicate that underutilization of women's workforce skills and qualification is not an issue in the Czech Republic. However, considering results of Desjardin and Rubenson´s analysis, gender based differences in skills mismatch distribution in the Czech Republic are less significant.
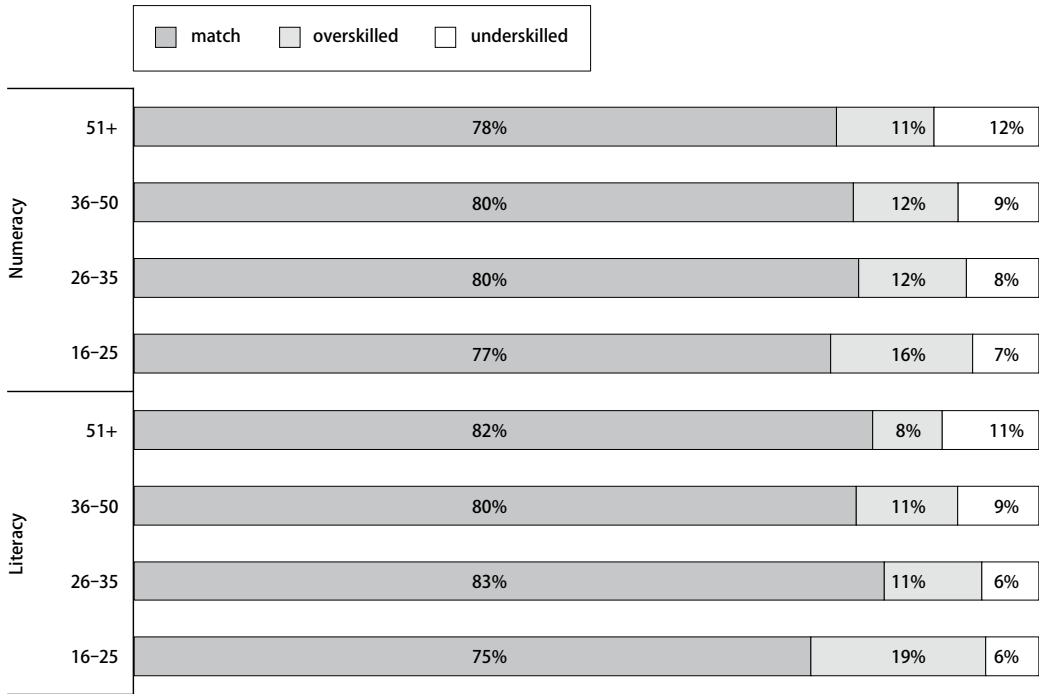
Figure 12 Skills mismatch distribution by gender according to Krahn and Lowe´s methodology
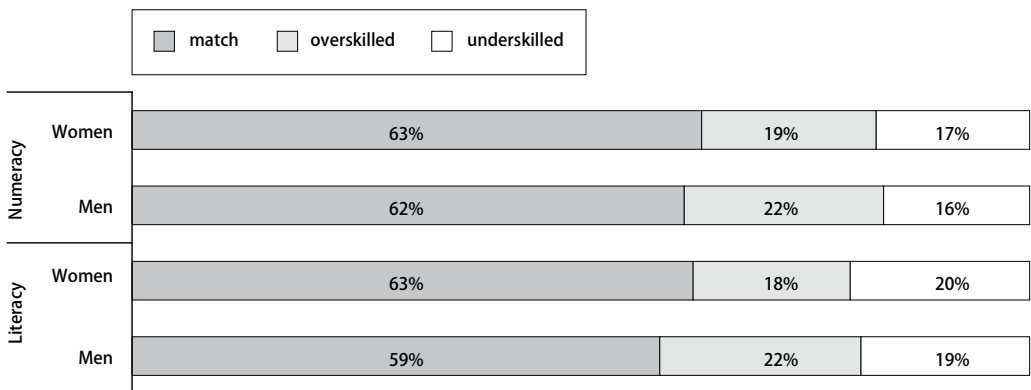
Source: PIAAC data analyzed by Krahn and Lowe´s methodology

Age is the second characteristic that we investigated in relation to skills mismatch. Figure 13 shows results of this analysis. We can observe clear relation of young age and both numeracy and literacy skills surplus. In literacy, the differences are especially significant. In this domain, the share of overskilled in the age group under 25 is more than two times higher than among workers in the age group of 51–65. This difference stems from significant positive deviation from average skills surplus incidence among young people rather than from negative deviation of older workers. Consequently, the share of workers with literacy skills deficit increases with age. 11% of workers among 51–65 years lack literacy skills that their workplace requires. Part of the explanation can be provided by a general trend of age related skills decrease. According to the results of PIAAC study (OECD, 2013a) older adults score is lower on the literacy scale than any other age group. However, high incidence of skills surplus among young people also reflects difficulties they face while searching for job that suits their skills. Young people, regardless of their skills, take up less qualified workplaces to gain some experience, which can later help

Figure 13 Distribution of skills mismatch by age

Source: PIAAC data analyzed by methodology developed in this paper

Figure 14 Distribution of skills mismatch by age according to Krahn and Lowe´s methodology
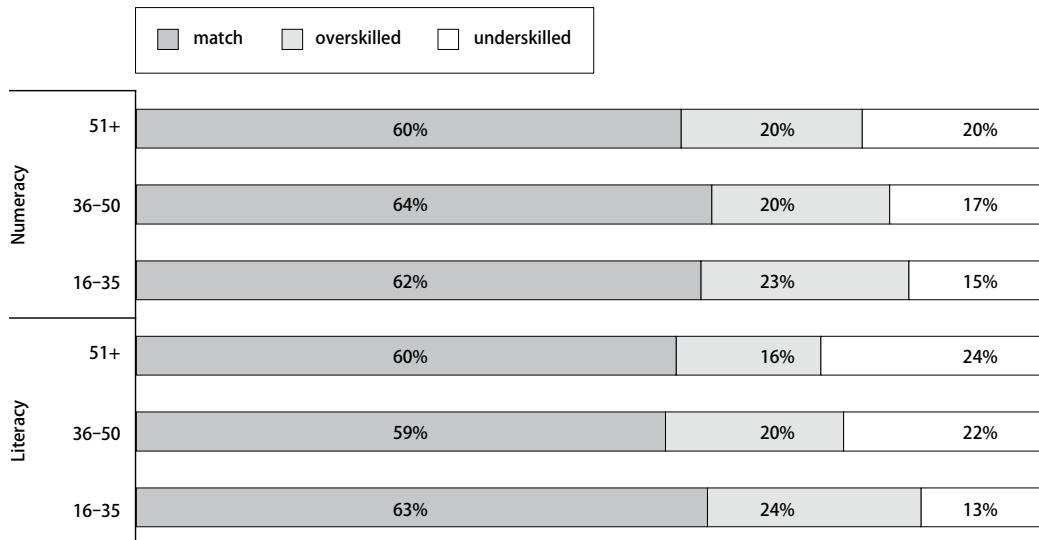
Source: PIAAC data analyzed by Krahn and Lowe´s methodology

them to find a way to job that fits their skills better. Interestingly, in case of numeracy there is less clear evidence of relation of age and skills deficit incidence.

The pattern of highest probability of young people to fall into the category of overskilled has also been identified in all countries under focus of Desjardin and Rubenson´s study (2011). What might be interesting is the comparison of the difference in the share of overskilled between the youngest and the oldest age group. In Desjardin and Rubenson´s (2011) study there was in average 10% higher share of overskilled in literacy in the age group from 16 to 35 years than among workers from 50 to 65 years. The average difference for numeracy was 4%. When we used Krahn and Lowe´s methodology, we concluded that in the Czech Republic differences in the share of overskilled in the youngest and the oldest age groups were also more distinct in case of literacy (7.6 p.p.) than in numeracy (3.2 p.p.). Results are shown in Figure 14.

CONCLUSION

Skill and educational mismatch refer to the situations when workplaces are occupied by workers with insufficient or inappropriate skills or when workers skills are not fully employed which may lead to their atrophy. Their incidence and extent signalize persisting inefficiencies on the labour market. Existing academic literature suggests that skills and educational mismatches influence not only economy as a whole, but are also strongly related to individuals´ job satisfaction, wage and mobility (Tsang, 1987, Sicherman, 1991, Hersch, 1991). Skill mismatch should thus be of concern of all citizens, workers´ associations but mainly to those responsible for policy making. In this paper we discussed methodological approaches to measurement of mismatches and applied traditional as well as alternative methods in order to estimate the incidence of skills and educational mismatches on the Czech labour market. We build up on Krahn and Lowe´s work and developed and applied new method of measuring the extent of skills mismatches for the purposes of this paper. The advantage of our method is that it expresses both levels of skills and of skills use as a position of individual in relation to the rest of the workforce. Inconsistencies between actual skills and skills usage on workplace can therefore be easily captured by confronting these levels. The level of skills use was determined by using sophisticated and empirically grounded method of aggregation of narrowly defined work tasks into broadly defined work activities that have direct connection with the level of individual´s skills.

Our results indicate that 35% of the Czech population attained different educational level than their work would require. Overeducation, i.e. situation when individuals had higher education than employer would demand, was more frequent than undereducation. However, the outcomes of measurement of educational mismatch depend on the methodology applied. Direct and indirect self-assessment methods provide us with very different estimates of the share of educationally mismatched workers. The results of these two methods diverge especially in estimates of undereducation rates. Measurement of the scope of educational mismatch in the Czech Republic by methods not suitable for PIAAC data and therefore not used in this paper would be an interesting suggestion for future research.

In the domain of skills we found approximately one fifth of the Czech population mismatched in literacy and very similar share in numeracy. In the Czech labour market employers do not take fully advantage of literacy skills of 10.9% and numeracy skills of 11.6% of workers. At the same time, 10.9% of workers lack sufficient literacy skills which negatively affect their working performance. The same is true for 9.2% of the working population in case of numeracy. It also turned out that measuring skills mismatch by using subjective self-assessment can hardly be considered as substitute to the method based on the frequency of skills use. It is attested to the fact that individuals, when asked to assess the sufficiency of their skills, refer to specific rather than generic skills.

Distribution of mismatch is not equal among different demographic groups. Young age is strongly connected with the incidence of both educational and skill surpluses. This result brings us back

to the reflection that there are many other factors on the labour market but skills that matter. When hiring new workers, employers consider applicants´ education and skills as well as work experience, motivation, personality and many other characteristics. Young workers often lack work experiences and therefore the appropriate level of skills does not always have to be sufficient for being hired for a qualified job. The outcome that we have found surprising is that there is no gender difference in the distribution of labour market mismatches. This finding is rather unusual in academic literature dealing with this issue and suggests that conditions for finding suitable job are not very different for men and women in the Czech Republic and women skills are not underutilized.

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ANNEX

Table A1 Summary of results of measuring educational mismatch

	Educational mismatch		
Indirect self-assessment	**Educational match**	**Undereducation**	**Overeducation**
Total	65.1%	13.9%	21%
Women	63.4%	15.6%	21.1%
Men	66.7%	12.3%	21%
Age group:			
16–25	64.4%	10.6%	24.9%
26–35	70.0%	9.3%	20.7%
36–50	64.8%	12.4%	22.8%
51–65	60.5%	22.5%	17.1%
Direct self-assessment	**This level is necessary**	**A higher level would be needed**	**A lower level would be sufficient**
Total	71.4%	3.2%	25.4%
Women	71.7%	3.2%	25.1%
Men	71.1%	3.2%	25.7%
Age group:			
16–25	63.6%	1.6%	34.8%
26–35	70%	1.7%	28.3%
36–50	69%	4.3%	26.7%
51–65	79.9%	3.9%	16.2%

Source: : Own calculations, PIAAC

Table A2 Summary of results of measuring skill mismatch

Skill mismatch

New methodology	Match		Overskilled		Underskilled	
	Numeracy	Literacy	Numeracy	Literacy	Numeracy	Literacy
Total	79.2%	78.2%	11.6%	10.9%	9.2%	10.9%
Women	80.4%	79.1%	10.7%	8.9%	8.9%	12.0%
Men	77.7%	77.5%	12.8%	12.4%	9.4%	10.1%
Age group:						
16–25	77.0%	75.0%	16.0%	19.0%	7.0%	6.0%
26–35	80.0%	83.0%	12.0%	11.0%	8.0%	6.0%
36–50	80.0%	80.0%	12.0%	11.0%	9.0%	9.0%
51–65	78.0%	82.0%	11.0%	8.0%	12.0%	11.0%
Krahn and Lowe´s methodology	Match		Overskilled		Underskilled	
	Numeracy	Literacy	Numeracy	Literacy	Numeracy	Literacy
Total	62.4%	60.5%	20.9%	20.2%	16.7%	19.3%
Women	63.4%	62.5%	19.4%	17.5%	17.1%	20.0%
Men	61.5%	58.8%	22.2%	22.4%	16.3%	18.8%
Age group:						
16–35	62.4%	63.1%	23.0%	23.6%	14.6%	13.2%
36–50	63.6%	58.5%	19.7%	19.7%	16.7%	21.8%
51–65	60.2%	59.7%	20.0%	16.0%	19.7%	24.3%

Source: Own calculations, PIAAC

Italian Methods and Practices Regarding the LFS: Case of Response Rate and Response Burden

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Abstract

Data users and stakeholders judge the success of a survey by its response rate. According to the measures of the American Association for Public Opinion Research (AAPOR, 2011) and following the Eurostat's standard (EUROSTAT, 2005), the Italian Institute of Statistics (ISTAT) applied a number of best practices to increase the households response rate – and, consequently, confidence in data quality - such as: planning a well-structured and a possibly short questionnaire, sending advance letters to sample households to inform them of the pending survey, giving standard survey introductions to well-trained interviewers, and monitoring data collection at all stages of the fieldwork. The focus on high response rates has many consequences. One is a high burden placed on respondents when a survey repeatedly contacts sample households, as ISTAT Labour Force Survey, and the other is the pressure on interviewing staff to spend time and resources to increase their response rates and not to accept a non-interview.

Keywords	JEL code
Response rate, interview burden on respondents, panel surveys	*C83, C80*

INTRODUCTION

As the demand for statistics is growing and becoming more diversified, in response to social and economic developments, there is also an increasing pressure on National Statistical Institutes (NSIs) to reduce the burden on respondents related to statistical surveys. The need for moderating the burden on respondents is embodied in the principle 9 of the European Statistics Code of Practice: *"The reporting burden is proportionate to the needs of the users and is not excessive for respondents. The statistical authorities monitor the response burden and set targets for its reduction over time"* (Eurostat, 2005).

The NSIs most common way to measure the burden on respondents has so far been to estimate the response propensities (Fisher and Kydoniefs, 2001). Response rates are used as a measure of data quality and efficient data collection operations because conventional wisdom presumes that higher

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response rate provides more accurate results (Babbie, 1990; Rea and Parker, 1997), and response rates are often used to evaluate survey data quality (Atrostic et al., 2001; Biemer and Lyberg, 2003). However, it is generally acknowledged now that high response rate does not automatically lead to lower nonresponse bias and, thus, better quality. Therefore, many survey methodologists question the use of the response rate as a measure of nonresponse bias (Groves, 2006; Groves and Peytcheva, 2008).

Often low levels of nonresponse cannot ensure high quality. On the contrary, high response rates can even mask measurement error, coverage error, and item nonresponse problems. Biemer (2003) notes that *"there has been much focus on response rates in surveys, and some surveys with low response rates have been discontinued on the basis of the response rate without evaluating the bias."* In addition, insight in the differences in the characteristics of respondents and nonrespondents must accompany response rates to understand nonresponse bias and the impact of a given response rate on the accuracy of survey estimates. Studies indicate that the behaviour displayed in the recruitment for the survey influences the respondent's behaviour in answering or participating in the survey (Groves and Couper, 1998; Groves and Heeringa 2006; Couper et al., 1997; Couper, 2000; Stoop, 2005). E.g. when people are reluctant to participate because they are not interested, they may adopt satisficing behaviour, instead of a conscientious attitude.

In cross-sectional surveys, obtaining a completed interview requires locating the respondent, successfully making contact, and achieving cooperation. Failure at any one of these tasks will result in inability to complete an interview. In panel surveys, the process is the same; however it must be repeated at each round. Lepkowski and Couper (2002) theorize that a respondent's overall response propensity for any given round is a function of their propensities for location, contact and cooperation conditional upon respondent characteristics, survey design features, organizational efforts and experience during prior rounds of interviewing. Each of these tasks requires different kinds of effort on the part of the interviewer and NSI's survey organization. Locating respondents who have moved can involve conducting internet or public record searches, contacting former neighbours and relatives, or knocking on doors of possible new residencies. Contacting effort may include phone calls, in-person visits. Furthermore, if a respondent has relocated, these efforts are wasted if it is not immediately apparent that the respondent has moved. Refusal conversion efforts can involve re-contacting respondents, providing monetary incentives, and sometimes sending interviewers with a specialty in refusal conversion from outside of the area. Reducing these efforts would reduce the likelihood that people participate in a survey and increase attrition in panel surveys (Merce, 2012).

In general, NSIs need to understand the costs and benefits associated with the response rates they achieve. Which level of efforts and respondent burden are associated with achieving those rates and do these extra efforts improve the quality of survey estimates? The paper outlines how ISTAT organizes, conducts and analyses response burden in the case of survey, repeatedly contacts sample households, like the Italian Labour Force Survey (IT LFS) where each household in the sample is surveyed over a limited period of time. It deals with ISTAT practices regarding the following: an appropriate sampling method, more intensive use of data on the process of asking and answering questions[2] (Couper and Lyberg; 2005; Kreuter et al, 2010), and a control of longitudinal burden on survey participation concerning the request for participation in a survey and the subsequent decision (e.g., if the household in question agrees to participate, the subsequent answering behaviour when filling in the questionnaire).

1 A BRIEF OVERVIEW ON THE IT LFS SAMPLING METHOD
A priority for NSIs is to reduce the response burden. One reason for this is the assumption that a too high response burden may result in lower data quality and higher costs for data collection.

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[2]   For example, how long the interviews took, how many times there were contacts with each interviewee or attempts to contact the interviewee, the reluctance of the interviewee, and the mode of communication (Couper, 2000).

The first practices of NSIs in the area of statistical burden reduction are an appropriate sampling method and a better control of sample size. The IT LFS complements traditional survey data on labour market activity and income with an additional dimension: the changes experienced by individuals over time. It is a sample survey with a cross-sectional design and a longitudinal follow-up. Its sample design is a two stage sampling with stratification of the primary units. The primary sampling units (PSU) are the municipalities and the final sampling units (FSU) are the households, randomly selected from the registry offices in all the municipalities drawn at the first stage. Stratification of PSUs is carried out in each NUTS-3 domain and it is based on the population of the municipalities, so in each NUTS 3 domain, large municipalities, with population over a given threshold (also called auto-representative municipalities), are always included in the sample; smaller municipalities (not auto-representative) are grouped in strata, then one municipality in each stratum is selected with probability proportional to the population. With reference to the sampling method of FSUs, households are randomly selected from the registry offices in all the municipalities drawn at the first stage. As shown in figure 1, FSUs are rotated according to a 2–(2)–2 rotation scheme where households participate for two consecutive quarters, and then they temporally exit for the following two quarters, and finally come back to the sample for other two consecutive quarters (Trivellato and Torelli, 1989).

Figure 1 Rotating panel design of the IT LFS

Year	Q	Mounth	Rotation groups and wave									
2011	4	October	A4	B3			E2	F1				
2012	1	January		B4	C3			F2	G1			
2012	2	April			C4	D3			G2	H1		
2012	3	July				D4	E3			H2	I1	
2012	4	October					E4	F3			I2	L1
2013	1	January						F4	G3			L2	M1

Source: Trivellato and Torelli (1989)

Therefore, 50% of the households, interviewed in a quarter, are re-interviewed after three months, 50% after twelve months, 25% after nine and fifteen months. According to the rotation scheme, all the members of the households, who were interviewed in different time periods, can be matched in order to obtain longitudinal data. In particular, individual records can be matched to produce 12-month and 3-month longitudinal data which is almost 50% of the total sample. As a result, each household is included in four waves of the survey in a period of 15 months. Every year about 71 000 households are drawn from the registry offices of about 1 100 municipalities and this new sample is gradually introduced as the first wave rotation group in each quarter. Similar data are also available from other labour force surveys in developed countries (in fact, the scheme adopted in Italy closely resembles the Current Population Survey carried out in the U.S.) and data like these have actually been used to estimate transition models to employment.

Although a statistical burden is implicit from the sample design with its panel structure, this rotating panel design is a way that potentially reduces its burden on respondents. As the size of the sample has

a direct impact on the statistical burden, a new sample of PSUs, instead, is available as long as a new stratification is introduced in the sample design. In 2004, stratification for the new continuous LFS was introduced.

The list of municipalities has always been the same from one year to another except for the fact that every year some replacements were necessary. The main reason for PSU's substitution is due to the depletion of the list of households in the registry office: almost all the FSUs were already selected in the previous years and an additional inclusion of the PSU in the sample would have meant an increased statistical burden on FSUs and consequently a greater risk of nonresponse. The criterion used until 2011 for substitution was to identify municipalities with high risk (more than 75%) of drawing a household already selected in the previous occasions. In 2012 a new stratification of the municipalities was made, to take into account the updated information on their population. Consequently, a new selection of the PSUs has been done and newly selected municipalities entered in the sample in the third quarter of 2012.

Since 2013 a random rotation of the sample municipalities has been introduced in order to avoid any discretion in the replacement of PSUs. This rotation concerns in particular the strata with the smallest municipalities, in particular where more than 50% of the municipalities in the stratum do not have sufficient demographic size for the selection, or the strata where the maximum number of the registered households is below a threshold or where the minimum number of the registered households is below a threshold.

2 USE OF DATA IN THE PROCESS OF ASKING AND ANSWERING QUESTIONS

There is no consensus on how to define response burden, although it is quite well known that one can distinguish between *"perceived response burden"* and *"actual response burden"* (Jones, 2011; Stoop, 2005). The first one is the subjective burden differing from one individual to another and the second should be the real burden which in principle could be measured. Clearly, the measurement of perceived burden is out of scope of official statistics. Thus, only the actual burden can be the basis for the quantification of response burden. The actual burden can be measured by the time required to perform the task of completing a survey. Other factors such as questionnaire length, density of sampling, cognitive load required by completing the survey, and the layout and interface of the reporting format have been suggested to affect the strain on the respondent unit.

In literature, similar concepts are respondent burden, response fatigue, and subject burden. Increased response burden has been proposed to result in lower response rates, reduced completion, and reduced data quality. Response burden may be particularly problematic in demographic groups such as the severely ill, older individuals, and children. A strong focus has been put on questionnaire length, and, consequently, potential response burden is frequently a rationale for reducing the number of items in existing questionnaires and is also driving development of questionnaires with a minimum of items.

Heberlein and Baumgartner (1978) present several factors that were found to influence response rates to mailed questionnaires. They have found that response burden, approximated by the number of pages (or questionnaire length), shows a significant influence on response rate. However, they do not further differentiate the response burden by accounting for the complexity of the posed questions. They also find that other factors, such as the saliency of the survey content and incentives given to the respondents, all have an influence on the response rate (for a description of the so called leverage-saliency theory, see Groves et al., 2000). However, the degree of this effect and its influence on the actual response rates that are the subject of discussion in the present paper are difficult to quantify.

3 A DIFFERENT DATA COLLECTION MODE

IT LFS data are collected by the combination of both computer assisted personal (CAPI) and telephone (CATI) interviewing. CAPI is usually used for the first interview, whereas CATI for subsequent interviews. Households without a telephone and non-Italian households are interviewed always by CAPI. Mode switching can be an effective way of enhancing response, although its actual effect depends on the initial single mode design. For instance, sometime NSIs have been unsuccessful to date

in enhancing the response of previously single mode CAPI or CATI surveys by adding the web as the first mode in a consecutive mixed mode design (Wetzels et al., 2007). Computer assisted interviewing reduces the interview burden for the respondents. It presents interviewers with screen of questions to be asked, with the software guiding the interviewer and respondent thought the interview. Inapplicable questions are skipped automatically based on prior response patterns and preload information. Wording for probes are suggested when a respondent provided a response that was out of range for a given item (Bergamasco et al., 2004; ISTAT, 2006). Various performance indicators are also estimated to measure process quality and data collection effort in the CAPI/CATI system. However, the difference between telephone and face to face modes highlight the need for different performance indicators. Thus, CATI data collection indicators are often not directly applicable to face to face interviews. To this end, ISTAT has fixed for both, CAPI and CATI, a number of rules on the interview management, transmission and execution, which have to be strictly observed. Figure 2 details some IT LFS performance indicators based on CAPI/CATI system for the final sample units (FSU).

Figure 2 The performance indicators in the CAPI/CATI system

Indcators
% of assigned of FSU on theorical sample
% of CAPI FSUs on total assigned FSUs
% of CAPI FSUs on theoretical sample
% of CAPI validated FSUs on assigned FSUs
% of CAPI validated FSUs on theoretical sample
% of CAPI validated FSUs on assigned FSUs
% of CAPI validated FSUs on validated FSUs
% of CAPI distributed FSUs on assigned FSUs
% of CAPI distributed FSUs on validated FSUs
% of CAPI distributed FSUs on theoretical sample
% of CAPI FSUs with at least one contact attempt on distributed FSUs
% of CAPI FSUs with at least one contact attempt on theoretical sample
% of CATI FSUs on total assigned FSUs
% of CATI FSUs on theoretical sample
% of CATI FSUs with at least one contact attempt on assigned FSUs
% of CATI FSUs with at least one contact attempt on theoretical sample
% of CAPI FSUs on distributed FSUs
% of CAPI interviews (base households) on distributed FSUs
% of CAPI interviews (replacing households) on distributed FSUs
% of CATI interviews on assigned FSUs
% of CATI interviews (base households) on assigned FSUs
% of CATI interviews (replacing households) on assigned FSUs
% of CAPI and CATI interviews on theoretical sample (completeness rate)
% of CAPI and CATI interviews (base households) on theoretical sample (fidelity rate)
% of CAPI and CATI interviews (replacing households) on theoretical sample (infidelity rate)

Source: ISTAT (2006)

In LFS, ISTAT calculate and monitor mode-specific response rates (e.g., Lima and Ranaldi, 2012). Given the sequential nature of IT LFS data collection, the response rates in the early mode (CAPI) drive the subsequent mode (CATI and CAPI). The interviewing success in both modes defines the survey's non-response universe (Table 1). Hence, this paper focuses on the response rates and burden associated with CAPI/CATI system.

Table 1 Rates of nonresponse by survey mode (Annual average – IT LFS 2011)

Survey Mode	Response	Non-response
CAPI	80.4	19.6
CATI	93.5	6.5
Total	88.9	11.1

Source: Author's computation

ISTAT managers analyse not only the survey's response rates across the country and regularly monitor mode-specific response rates, but also the efforts to maintain these rates. This paper focuses on some additional metrics that can help us understand the burden placed on survey respondents in the data collection process.

4 THE ADVANCE LETTER

In order to motivate householders to participate in IT LFS, ISTAT has sent an advance letter (a letter to announce a forthcoming survey) by its President and explained to them that the survey is of national importance and that from the information collected will ultimately benefit all Italians. The idea is that respondents who understand the purpose of the statistics are more motivated to respond (De Leeuw et al., 2007). In general, NSIs consider the letter as an opportunity to explain what the survey is about, why it is important for the respondent to participate, and how and why the respondent was selected, underlining the survey organization's authority (Cialdini, 2001). Moreover, it gives interviewers a point of reference, and is a source of confidence for them in the initial contact (Becks, 2008). Advance letters might be able to increase response rates – given a response burden – because they intend to make participation more attractive. In surveys that could be more burdensome for respondents (e.g. involving diary keeping) the respondent believes that answering is important for the society and, thus, decides to participate (Groves et al., 2000). On the contrary, experiments with advance letters have shown that minor adjustments to the content of the letter can affect the response rate (e.g., Luiten, 2013; Campanelli, Klaassen and Beukenhorst, 2008; White, Martin, Benneth and Freeth, 1997).

Kanuk and Berenson (1975) also found an improvement in response rate when special delivery was implemented. However, they have found no significant relationship between personalization of advance letters and response rate, and that a cover letter may reduce response rates if the respondents disagree with the aims of the survey. In this sense, an advance letter could be a vehicle for applying socio-psychological theories in order to be as persuasive as possible towards respondents (Cialdini, 2001). Analysis of the effect of advance letters on response rates by survey mode and waves on IT LFS data (see Table 2 for the 1st quarter 2011) shows a significant difference between households in terms of either response rate between those who had received a letter and those who had not (89.9% vs. 80.8%, respectively).

Clear differences emerged also in terms of wave: while for later waves the difference in response rates between who has received the advance letter and who has not, is quite moderate. In the first wave this

Table 2 Response Rate with and without advance letter by different survey mode and wave in IT LFS (1st quarter 2011)

Survey mode	Advance letter	Wave 1	Wave 2-4	Total
Total	Yes	87.3	91.2	89.9
	No	67.0	89.6	80.8
CAPI	Yes	88.9	91.5	90.1
	No	67.5	91.1	76.5
CATI	Yes	86.7	95.3	92.8
	No	66.5	89.2	82.7

Source: Author's computation

discrepancy is on average larger showing more than 20 percentage points of difference (87.3% vs 67.0% for the total).

5 THE OPTIMAL NUMBER OF CALL ATTEMPTS

The NSIs' focus on response rates has many consequences. One is an increased burden placed on survey respondents when they have to complete a questionnaire several times, as in IT LFS. The sequential mixed mode survey may include receipt of numerous contact attempts by phone and in-person visits. In telephone surveys, double-digit call attempts are common in an effort to increase response rates. Relentless pursuit of a respondent through repeated personal visit attempts is not unusual in some surveys. Another consequence is the pressure on interviewing staff to spend time and money to increase their response rates and not to accept a non-interview. This pressure to obtain high response rates can result in interviewer's error and even falsification. Such behaviour of the interviewer might be perceived by a household respondent as stalking (Poe, 2011). Having considered the number of contact attempts as a sign of respondent reluctance, a good recommendation is to collect and analyse detailed contact record data. Such information could help to understand reasons for nonresponse and whether certain interventions might be appropriate. The IT LFS contact history instrument (CHI) provides a resource to understand the potential respondent burden associated with the response rates achieved, including information such as number of contacts, interim outcomes, reasons for refusals, date and time of contact attempt, and demographics of refusal and contact households. In addition, it includes additional detail about the reasons for noncontacts and non interviews by contact attempt.

It is easy to derive from CHI alternative statistics like contact rates, cooperation rates, and refusal rates from the full breakout of final outcomes (see for detailed descriptions and definitions AAPOR, 2011). All of these metrics could tell us much more than the response rate alone.

Figure 3 shows the relationship between the response rates obtained in the 2011 IT LFS operation and the associated number of contact attempts by modelling the "time to resolution" of each sampling units and the number of attempts until a response see, for more details, Lima and Ranaldi, 2012). In the 1st quarter 2011, the final IT LFS CATI response rates have consistently been around 94%.

The response rates in Figure 3 are estimated as ratios of the number of completed interviews after each round of contact attempts relative to the total eligible universe (RR2 in AAPOR 2011). They focus on the ratio of completed interviews to eligible cases. A useful tool to review the full distribution of interviewer outcomes is to include the proportion of cases classified as ineligible. A sample unit is eligible if the name corresponds to the selected household and if it is a private household having usual residence in the municipality. On the contrary, the eligibility is unknown when it is not possible to collect sufficient information for a proper classification: for example, in CAPI no contacts are made, no one at home and no other information available is collected during the fieldwork period; in CATI a sample unit is unreachable due to telephone number.

Figure 3 Response rate by number of call attempts for wave 1 and waves 2–4 – CATI IT LFS (1st quarter 2011)

wave 1   wave 2–4
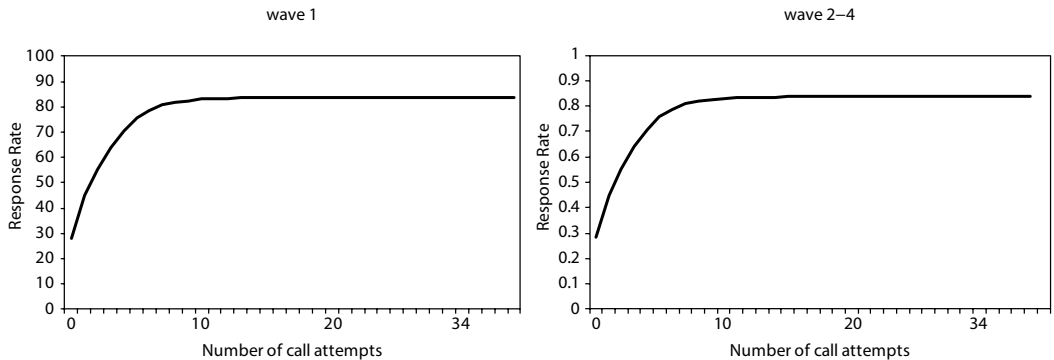
Source: Author's estimation

To estimate the eligibility rate in IT LFS a continued-contacting approach is used, based on the CHI and the number of different attempts of contact through an automatic procedure, regardless of whether contact is made.

This makes call record data particularly useful for nonresponse analyses and nonresponse adjustments.

The *"contact attempts"* in Figure 3 comprise any form of attempt to contact the sample household. This could include a successful contact leading to an interview, a refusal, or a request for a call back - until each unit is resolved leading to a response or to a nonresponse – or many forms of noncontact. In different attempts to contact the sampling units (the household is the basic sampling unit), all the telephone numbers are dialled with a justifiable *"random censoring"* calling rules of call attempts for a given phone number that is the end of the fieldwork period.

The *"maximum number of planned contact attempts reached"* concerns the cases where all attempts foreseen were made, but without managing to contact the household and, thus, to collect the necessary information to establish if the unit is eligible. So, a case with 15 call attempts resulting in *"no answer"* or *"busy"* outcomes could be classified as non-contacted unit after 15 attempts. In the case of a telephone number attempted 16 times with the first 15 attempts resulting in *"no answer"* or *"busy"* outcomes, the 16th call results in a refusal.

Here a broad definition of *"respondent burden"* is used, i.e. the sum of all contact attempts. It is hard to know which forms of attempted contacts a respondent would perceive as burdensome. In fact, a core issue is the definition of the optimal number of contact attempts that the interviewer may make with a sample unit: abandoning contact attempts prematurely (people who are hard to contact for the LFS are workers and travellers, see also Lynn et al., 2002), or allowing a relatively high noncontact rate will introduce bias in the estimation of the response rate and of the eligibility rate. Recently, high respondent burden and repeated contact attempts to obtain high response rates have been criticized (Martinsson and Riedel, 2014). NSIs' fieldwork organizations generally prescribe a minimum number of contact attempts before writing off a survey unit as a non-respondent unit. This number will be lower for CAPI than for CATI surveys, because of differences in the costs of contact attempts in the various modes. Sometimes in CATI, no rules to determine the excess of attempts are set and the contact attempts have to continue up to the end of the data collection period.

Often, CATI fieldwork organizations do not permit unlimited contact attempts, because at some point the costs of additional approaches will no longer outweigh the benefits in terms of bias reduction of marginal improvement in response. Moreover, the number of visits determines not only the contact rate, but also the quality of the data: there are differences between the people you reach immediately and those you find only after several visits (Luiten, 2013).

Given the large sample size in the IT LFS, even a low percentage of cases with high numbers of contact attempts can represent a notable universe of respondents that may feel harassed by the survey's repeated contact efforts. To give you a sense of scale, look at the universe of sample units in the 2011 CATI operation that are ultimately determined to be survey-eligible units. This universe includes sample cases that are able to be interviewed and those that could not be interviewed. Table 3 shows that interviewers resolved about 43% of these units after 1 or 2 CATI contact attempts.

Table 3 CATI IT LFS Contact Attempts (1st quarter 2011)

Total CATI Contact Attempts	Percent of eligible*	Estimed respondent units
1 or 2	43.38	17.92
3 or 5	24.06	9.94
6 or 9	11.71	4.84
10 or 15	6.13	2.53
more 16	5.86	2..42

* The eligibility rate is estimated by the SAM method in Brick et al. (1997, 2002).
Source: Author's computation

In contrast, we estimate[3] that just over 6% (about 2 500 individuals) involved 10 or 15 CATI contact attempts.

In the waves following the first one, there are the highest numbers of call attempts. This is not surprising, given the greater number of call-backs that are normally for the CATI IT LFS. The bulk of cases (about 80% of sample units) are a respondent household at the 10th attempt and after the 20th call attempt there are only 2% of unsolved units. As in earlier studies we found no association between the difficulty of making contact and response rate (see for example Lepowski et al., 2002; Stoop, 2005). The highest households' response propensity in IT LFS, may not consist exclusively of cases with the highest number of call attempts. So other ways are necessary to try to identify cumulative respondent burden, considering earlier contact attempts in other modes. Our future research intends to look more closely at how to acknowledge this burden in any metric and how to utilize previous burden in developing CATI stopping rules.

7 THE TIME SPENT ON THE INTERVIEW

Computer-aided collection is an important factor in reducing NSIs' interview times: automatically filtering questions, according to the interviewee's previous responses or known characteristics, means that the interviewer will not waste time by asking non-applicable questions or questions that have already been

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[3] See Lima and Ranaldi (2012).

answered in the previous waves. In fact, dependent interviewing in the successive waves of the survey enables to avoid re-asking questions about the individual's characteristics and to just identify changes (for example about educational levels or qualifications). The European Council Regulation No. 1897/00 allows to conduct interviews following the first one asking the sampling person to confirm the information given in the previous interview. Consequently, when the labour status and/or other characteristics of the respondent have not changed substantially, we are able to reduce the time of interview.

The IT LFS computer-aided collection realises a "confirmation questionnaire", in which the confirmation questions are the fundamental nodes of interview flow. If the status of the respondent has not been changed, all information regarding a sub-flow of the questionnaire depends on certain confirmation questions that are automatically registered and skipped (Grassia et al., 2004). It turns out that the burden of completing a survey does not affect the propensity that a respondent will agree to participate in the survey at a later time point (Figures 4 and 5).

Figure 4   Response times by participation of people to labour market. CAPI (Median in minutes, year 2011)
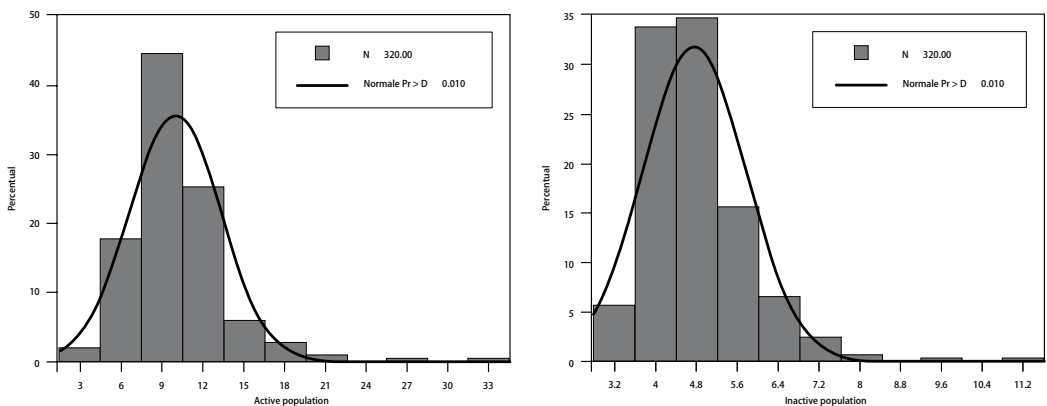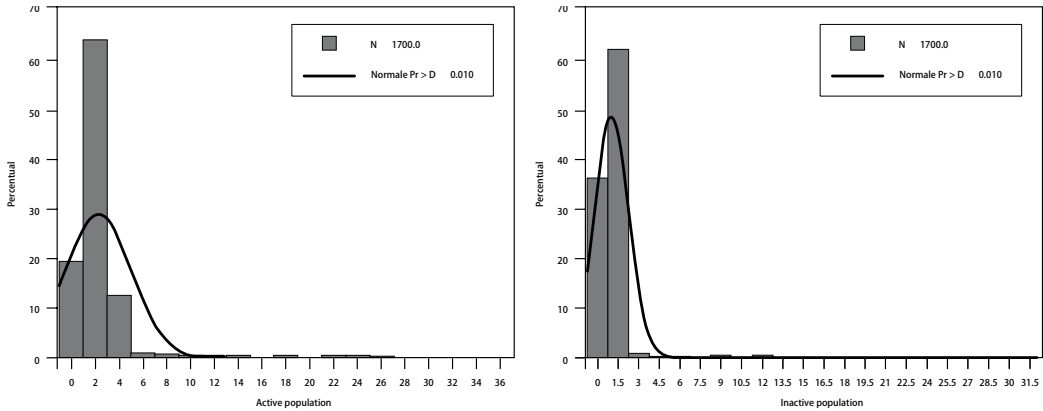

Source: Author's computation

Time passes quickly if the topic is interesting and the respondent feels that he/she is competent to answer the questions posed, while it feels longer if the respondent does not understand the point of the questions or feels incompetent (EUROSTAT, 2007). In 2011, for CAPI individual questionnaires the successful attempts (the outcome code indicates a response) have a length ranging from a few minutes to 33 minutes. The extreme cases should be excluded from further studies using other available paradata. For CATI, telephone attempts tend to be shorter and have lower variance in duration compared to personal visits: It is not surprising given that in general during the IT LFS data collection, CAPI is used for the first interviews while CATI is used for the confirmation interviews following the first wave. Moreover, the modalities of approaching the households, the rules that fix the assignment of the final outcome codes to the households and the management of the contacts with the households differ, depending on the survey mode and the family wave. So, since the first interview is long, the CAPI visits take a long time. The CATI interviews are only to pick up a confirm of information collected in the previous wave. Therefore they are much shorter. The big difference between CAPI and CATI in time to respond is between *"inactive"* and *"active"* (Figure 4 and 5).

The slowest questionnaire to fill in is for the active people: about 60% has a median of 10 minutes in CAPI, while the bulk of CATI interview takes less than 6 minutes.

Source: Author's computation

For the inactive people, about 80% of interviews take under 6 minutes in CAPI and less than 1.5 minute in CATI. Based on the above analyses, it also becomes clear that, in this way, the NSIs traditional response burden indicator *"time spent"* (not the time use itself but the perception of time and effort that is likely to affect response quality) may not be the best response burden indicator in IT LFS.

8 LONGITUDINAL SURVEY PARTICIPATION

In the IT LFS questionnaire, the interviewer, after finishing the household interview, has to answer the following two questions in Figure 6. The aim is to obtain an evaluation of the longitudinal component of response burden, approximated by the willingness to respond. Although clever sampling designs and dependent interviewing reduce the time the respondent has to spend on the survey, it is possible that: a) the households' perception of a low response burden may give rise to an atmosphere

Figure 6   Questions about Perceived Response Burden in the IT LFS

Question 1. How was the availability of the household to the interview?

- Always little   1|_|
- Little at the beginning, better then   2|_|
- Good at the beginning, little then   3|_|
- Enough   4|_|
- Good   5|_|
- Excellent   6|_|

Question 2. Is the household available for further interviews in the coming months?

- Not at all available   1|_|
- Little available   2|_|
- Indifferent   3|_|
- Enough available   4|_|
- Very available   5|_|

Source: ISTAT Contact history form

of motivation and willingness to respond, as well as to the quality of their response, and b) the lower response rate in subsequent inte views in the coming months could be explained by monitoring facets of survey climate over time and during the previous interview.

When analysing the answers to the above questions, ISTAT monitor changes over the *"life cycle"* phase of households (the final sample unit) or, in other cases, measures differences on a matter of a suitable group of households (the reference population or cohort of individuals). Here it is proposed a measurement in longitudinal evaluation of burden on survey participation of Italian households on a cohort of individuals who differ with respect to the perception of availability to the interview and for recall waves.

The group consists of about 18 000 households, who share the common characteristic of having been interviewed in the first quarter 2011 for the first time and respond to the re-interviews at the subsequent waves until the second quarter 2012. The aim is to see whether they develop the outcome of interest (that is, the availability for further interviews). The longitudinal response burden is based on two questions filled by the interviewer, as soon as closed the IT LFS interview (Figure 6), to evaluate the cohort's respondent availability to be contacted again for possible future surveys.

Table 4 displays estimated odds ratios and relative risks with their 95% confidence intervals: There is a positive association between availability and response but it is not statistically significant because all 95% confidence intervals cover unity.

With respect to the patterns of attrition, this analysis has assumed that rules governing the level of effort expended do not differ by wave. In fact, wave 1 exhibits the highest risk of attrition, followed by a levelling off and gradual reduction in risk between wave 2 and 4. However, given the disproportionate level of nonresponse that occurs in wave 1, it may be worthwhile to investigate the patterns of attrition for wave 1 and subsequent waves since rules governing the level of effort differ by waves.

Table 4 Odds ratios, relative risk and 95% confidence intervals (1st 2011–2nd 2012)

Event by wave	Odd Ratio	95% CI	Relative Risk	95% CI
Interview in wave 2 and availability at wave 1	1.85	1.57–2.18	1.07*	1.05–1.10
Interview in wave 3 and availability at wave 2	2.42	1.97–2.97	1.10*	1.07–1.14
Interview in wave 4 and availability at wave 3	0.26	0.21–0.31	0.95*	1.97–2.97

Source: Author's computation

CONCLUSION

As all NSIs, ISTAT has features that managed response burdens including sending an advance letter, using a mixed-mode collection data and measuring how long the interviews were. Three new proposals how to-further lower response burden have recently been tested for IT LFS. The first proposal, which is the rotating panel design and the control of sample selection with the PSUs' substitution, proved to be an effective way to reduce the response burden of households. The estimation of the optimal number of call attempts with a continued-contacting approach according to the Survival Analysis Method, which is to define a threshold along the continuum of contact attempts, also reduces the response burden. The second proposal is the analysis of interview duration as a measure of the pressure on interviewing staff to spend time and resources to increase their response rates and not to accept a non-interview, which could be useful to include the interviewer in the model, as the duration depends on both interviewer and respondent.

The last proposal concerning the evaluation of the longitudinal burden on survey participation to the interview and for recall waves, also reduces the response burden, but it came with some risks.

It is based on the questions about the interviewing process filled by the interviewer. It has not been decided yet whether this proposal will be implemented in the survey production.

In the future, the next step will be improved tools to identify new performance measures related to the measure of burden on respondents for example, a strategy for optimizing the sampling and collection processes at the household level, which is the actual survey respondent, by minimizing overlap of LFS respondents with other household surveys. In this way, we propose a monitoring of burden on respondents from a wider point view, and not limited to a specific survey.

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Statistické Úsudky – New Textbook on Statistical Induction in Czech Language

Ondřej Vozár[1] | *Czech Statistical Office, Prague, Czech Republic*

MALÁ, I. *Statistické úsudky* (Statistical Judgments). 1st edition, Prague: Professional Publishing, 2013. ISBN 978-80-7431-127-7.

The book deals successfully with the difficult task to present principles of statistical induction to university students with limited mathematical curriculum. Regarding the prerequisites in probability it consistently refers to the textbook Pravděpodobnost[2] (Probability) by Luboš Marek reviewed in the January 2014 issue of this journal. These books make up a self-contained series of the textbooks for undergraduates to master the principles of mathematical statistics. The reviewed book is intended for anyone with knowledge of the basics of calculus, matrix algebra and fundamental principles of probability and statistics.[3]

It consists of seven chapters, the last chapter includes basic statistical tables and formulae for confidence intervals and tests of hypotheses.

The first chapter introduces basic concepts of the random sample, statistics, distributions of sample statistics and basic limit theorems. The next three chapters make the core of the textbook, they are very adequate, all the derivations and explanations are worked out in detail, many gaps common in standard textbooks are filled in.

The second chapter Principles of Point Estimation Theory provides a very clear exposition to the fundamental properties of point estimators and introduces the main approaches to the construction of the point estimator (moment method, plug-in method using quantiles, maximum likelihood method). The author also includes a multivariate case – estimators of a vector of random parameters.

The next chapter Interval Estimation introduces the concept of interval estimators both for one-sample and two-sample setting. All special cases are carefully worked out in detail to facilitate the understanding of the construction of corresponding confidence intervals.

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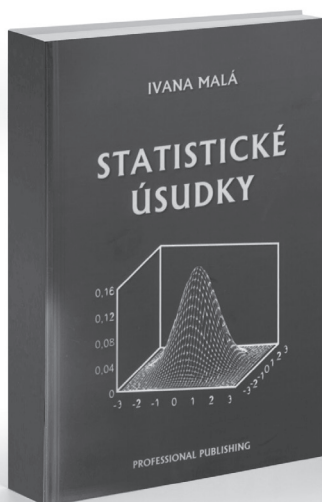
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[2] Marek, L. *Pravděpodobnost* (Probability). 1st edition, Prague: Professional Publishing, 2012, ISBN 978-80-7431-087-4.

[3] For example from well-established introductory textbook by Hindls, R. et al.: Statistika pro ekonomy (Statistics for Economists). 8th edition, Prague: Professional Publishing, 2007, ISBN 978-80-86946-43.6.

The fourth chapter Testing of Hypotheses presents the idea behind the testing of statistical hypotheses. Selected tests of hypotheses in parametric settings are presented and heuristics of their construction are given.

The fifth chapter Distribution of Order Statistics explains the distribution of order statistics, range of a sample, characteristics of variability based on order statistics (median absolute deviation, Gini mean difference among others) and empirical distribution function.

The sixth chapter Selected nonparametric tests differs from the previous chapters, because it provides only basics of the classical nonparametric tests and goodness-of-fit tests. This chapter deserves to be extended in both the scope of the non-parametric tests (for example kernel density estimators) and the motivation, heuristics and derivation of these tests.

The approach of the presentation is well chosen and shows a long-time pedagogical experience in teaching statistical induction to students with limited mathematical background. The author avoids using the traditional structure "definition – theorem – (mostly omitted) proof" that is usually discouraging for students at the intermediate level. Instead, most of the concepts are defined, explained and then the methods and heuristics behind them are derived step-by-step in the text. Many worked out theoretical examples help reader to grasp how to construct the confidence intervals and study theoretical properties of the estimators. Also numerical examples and graphs are provided to learn how to apply these methods and techniques to real data. A very good exercise book for this purpose is Statistika v příkladech[4] (Statistics in Examples), which uses MS Excel as statistical software. MS Excel is a good choice for intermediate students of economic faculties, because it is often required in subjects applying statistics.

The only weak point is that there are not enough theoretical examples. Adding more theoretical examples and also extending the sixth chapter would further improve the quality of the text.

The publication provides a very lucid introduction to statistical induction at the intermediate level for students of economic faculties, professionals in practice or long-distance students. It fills in the existing gap between elementary and advanced (with higher mathematical level) textbooks in the Czech statistical literature. Having said that I can recommend this book, as it represents a progress in this field.

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[4] Marek, L. et al. *Statistika v příkladech* (Statistics in Examples). 1st edition, Prague: Professional Publishing, 2013, ISBN 978-80-7431-118-5.

Activities of the Departments of Statistics at the University of Economics in 2013

Prokop Závodský[1] | *University of Economics, Prague, Czech Republic*

This report was prepared in cooperation with members of the three statistical departments of the Faculty of Informatics and Statistics (FIS). It is based on similar fact sheets published in *Statistika* more or less regularly in the years 1985–2010. It could not, of course, exhaust all major activities of these departments; therefore we refer to the continuously updated information which will be available on the websites of individual departments.[2]

1. Department of Statistics and Probability (KSTP), Department of Economic Statistics (KEST) and Department of Demography (KDEM) were established at the beginning of the academic year 1990–1991 from the former Department of Statistics, founded already in 1952. Within the reorganisation of the University of Economics, a new Faculty of Informatics and Statistics was established on 1 August 1991 with the three statistical departments incorporated.

The position of Head of the Department of Statistics and Probability holds prof. Richard Hindls, his deputies are: prof. Hana Řezanková, doc. Dagmar Blatná and RNDr. Ivana Malá. Doc. Markéta Arltová is Secretary of the Department. The Department employs (at the beginning of the summer semester 2013/14) a total of 19 internal teachers, of which 3 professors, 5 associate professors, 8 assistant professors and three assistants. 3 teachers work part-time and the other two are occupied with their academic functions. The average age of employees is 46.8 years (in the average values weighted by the size of the load). In the teaching participate 12 PhD students and 9 external staff members (including external PhD students).

Head of the Department of Economic Statistics is doc. Jakub Fischer, the function of Secretary performs Ing. Kristýna Vltavská. The team consists of 6 internal staff members (one professor, one associate professor, three assistant professors and one researcher), three of whom hold academic positions and three more are working only part-time. The average age is 40.7 years. In the teaching also 2 PhD students and 2 external teachers take part.

Head of the Department of Demography is doc. Jitka Langhamrová, Secretary is RNDr. Tomáš Fiala. The total of demographers working in the department is 6 (one professor, two associate professors and three assistant professors), 4 of which only part-time. The average age is 55.6 years. Involved in the teaching are also 8 PhD students and one external teacher. Each of the three departments provides help to the others as needed.

Results of habilitation and professional appointment at the University management in the field of statistics include in the past year only one item – based on the habilitation paper *Analysis of the Development and Modelling of Wage and Income Distribution Using Lognormal Curves,*

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[2] <http://kstp.vse,cz>, <http://kest.vse.cz>, <http://kdem.vse.cz>.

Application of the Method of L-Moments was Ing. Diana Bílková with effect from 1 November 2013 appointed Associate Professor.

2. Last year, statisticians also held at the University a number of important academic functions. Prof. Ing. Richard Hindls, CSc., dr. h. c., was already the eighth year Rector of the University of Economics (till 31 January 2014). The function of Vice-Rector for Science and Research held prof. Ing. Stanislava Hronová, CSc., dr. h. c. Vice-Rector for Strategy was doc. Ing. Jakub Fischer, PhD. The Bursar is already since 2007 Ing. Libor Svoboda, in the 1980's and 1990's member of the Department of Statistics.

Dean of the Faculty of Informatics and Statistics is doc. RNDr. Luboš Marek, CSc. On 4 December 2013 he was unanimously elected by the Academic Senate for a further period ending 28 February 2018. Vice-Dean for Pedagogical Activities is prof. Ing. Josef Arlt, CSc., Vice-Dean for International Relationships and Development is Ing. Petr Mazouch, PhD.

Statistics is in the Academic Senate of the University of Economics represented by prof. Ing. Hana Řezanková, CSc., who is also in the chair of the Academic Senate of FIS, other faculty members of the Senate are doc. Ing. Dagmar Blatná, CSc., doc. Ing. Jitka Langhamrová, CSc., and Ing. Jaroslav Sixta, PhD.

The Scientific Board of the University consisted in the last year of prof. Hindls, prof. Hronová, doc. Fischer and doc. Marek. The Scientific Board of the Faculty consisted of prof. Arlt, prof. Hindls, prof. Hronová, prof. Řezanková, prof. Seger, doc. Fischer, doc. Langhamrová, doc. Marek and Ing. Mazouch.

3. On 19 February 2014 celebrated her 60th birthday prof. Ing. Stanislava Hronová, CSc., dr. h. c., developing since 1978 at the University primarily economic statistics and national accounts. She is author or co-author of many dozens of important monographs, textbooks, scientific articles etc. with a considerable acclaim abroad, where she received not only a honorary doctorate, but also *Palmes Académiques*, a high state prize in science and education, granted by the French Prime Minister.

24 September will mark the 70th birthday of doc. Ing. Dagmar Blatná, CSc., who has been working at the University since 1991; the last two decades as Deputy Head of Department. In the field of statistical methodology she focuses on nonparametric and robust methods.

On 28 October will reach the same age Ing. Prokop Závodský, CSc., who publishes papers particularly in the field of history of statistics and economic university education.

Let us recall also anniversaries of personalities who have made contributions to the development of statistics at the University. On 31 May there will be 100 years since the birth of prof. Ing. Benedikt Korda, DrSc. (†2010), a leading representative of statistics in the 1950's (Head of Department in the years 1955–1959, briefly dean of the former Faculty of Statistics). In 1959, he founded at the University a department and study field dealing with econometrics and operations research.

It is needless to introduce prof. Ing. Lubomír Cyhelský, DrSc., who will be 85 on 12 October, to our statistical community. He formed the Department of Statistics at the University, where he has been working full 50 years, of which 28 years as its head. For his outstanding contributions to statistics he became last year the first ever laureate of the Prize of the President of the Czech Statistical Office and of the Rector of the University of Economics.

On 15 November, Faculty of Informatics and Statistics commemorate the 85th anniversary of the birth of its first Dean, prof. Ing. Jiří Likeš, DrSc., and on 25 November, unfortunately, the 20th anniversary of his death. The name of this internationally recognized scientist bears, since 2008, one of the largest auditoriums of the University.

4. In the academic year 2013/14 at FIS newly recruited students began studying bachelor programmes: Statistics and Econometrics (22 students), Statistical Methods in Economics (33 students) and Social-economic Demography (52 students). The total amount for Bachelor Study these subjects enrolled 269

students (53 + 86 + 130). The master study field of Statistical and Insurance Engineering enrols 67 students, the field of Economic Demography 49. Last 3 students are completing the previous five-year Master's degree in Statistical and Insurance Engineering.

For students of other disciplines provide statistical departments teaching of 4 minor specialisations: Analysis of Socio-economic Data, Demographic and Social Analysis, Quantitative Analysis and Insurance Engineering.

In 2013, 28 Statisticians, 4 with honours, received an engineering degree at the University.

5. The number of students of the Doctoral Study in statistics is currently (at the beginning of the summer semester of the academic year 2013/14) 47 (12 of which have interrupted studies) – 19 full-time and 28 in combined form. Trainers from Department of Statistics lead 29 PhD students, trainers from Department of Economical Statistics 9 and Department of Demography also 9. In 2013, two PhD students defended their dissertations and were awarded PhD in the field of statistics.

6. In 2013 ended the 24th specialized statistical four-semester course for university graduates. It was attended by 11 students, mostly from the Czech Statistical Office. In September, the 25th run was launched, with 12 students taking part. Lecturers are mostly professors and associate professors of the statistical departments of the University of Economics.

7. Grant projects dealt with in the past year:

Agency, the solvers and team members from statistical departments, *project name*, the period.

Ministry of Education (research plan), prof. Hindls (along with prof. Hronová and doc. Fischer), *Methods of extracting knowledge from data and their use in economic decision-making*, 2007–2013.

GA CR (Project Excellence), prof. Arlt (along with doc. Arltová and doc. Marek), *DYME – Dynamic Models in Economics*, 2012–2018.

GA CR (postdoctoral grant), Mgr. Bašta, *Modelling financial and economic time series – Application and comparison of wavelet and traditional methods*, 2012–2014.

GA CR, Doc. Fischer (along with prof. Hindls, prof. Hronová, Ing . Sixta, Ing. Vltavská, Ing. Musil and Ing. Zeman), *Regionalisation of estimated GDP using expenditure approach*, 2013–2015.

GA CR, co-researcher Ing . Mazouch (along with Ing . Zimmermann) *Generational mortality tables Czech Republic: data, biometric features, trends*, 2012–2016.

GA CR (postdoctoral grant), RNDr. Pechholdová, *Analysis of co morbidity in the Czech Republic using multiple causes of death*, 2013–2015.

TA CR co-researcher doc. Fischer (along with Ing. Duspivová, Ing. Mazouch, Ing. Vltavská, Ing. Zelený, *Effect of the Institute of minimum wages on socio-economic development of the Czech Republic*, 2012–2013.

FRVŠ, Mgr. Pastorek, *Introduction to the theory of descriptive statistics using the programming language Visual Basic for Application – Innovation of the exercise in the field Statistics 1*, 2013.

IGS University of Economics, Ing. Löster, *Evaluating the results of cluster analysis in economic tasks,* 2013.

IGS University of Economics, Mgr. Pastorek, *Data driven Bayesian and self-organizing algorithms for in-depth data analysis*, 2013.

IGS University of Economics, Ing . Vltavská, *Use of DSGE models in the national accounts*, 2013–2014.

IGS University of Economics, Ing. Mazouch (along with Ing. Švarcová), *Quantification of the impact of educational policy of the last decade in the light of the results of the 2011 census*, 2013–2014.

IGS University of Economics, doc. Fischer (along with Ing. Helman, Ing. Hudrlíková, Ing. Mazouch, Ing. Petkovová and Ing. Zeman) *Design and Verification of Indicators of Sustainable Development of the CR and its regions*, 2012–2013.

IGS University of Economics, Ing. Čabla, *Surveyed length of unemployment before and during the crisis*, 2012–2013.

IGS University of Economics, Ing. Dotlačilová, *Mortality and aging of the Czech population*, 2013–2014.

IGS University of Economics, members of the research team of FIS Ing. Závodský and Ing. Šimpach, *Economic, political and social circumstances of the establishment of the University of Economics in Prague*, 2012–2013.

8. Statisticians from the University worked in the past year in the program committees of international conferences:

Application of Mathematics and Statistics in Economy (AMSE), Gerlachov (Slovakia) – prof. Hindls and Prof. Hronová;

International Days of Statistics and Economics (MSED), Prague – prof. Řezanková, doc. Langhamrová, Ing. Löster;

Reproduction of Human Capital (RELIK), Prague – doc. Langhamrová, prof. Pavlík, doc. Průša, Ing. Löster;

Applied Informatics Econometrics Statistics Accounting (AIESA), Bratislava – doc. Marek;

In five other program committees of international conferences worked prof. Řezanková, in three others doc. Fischer and in one doc. Langhamrová.

9. In the past year, statisticians of the University published following book monographs and textbooks:

HEBÁK, P., JAROŠOVÁ, E., PECÁKOVÁ, I., PLAŠIL, M., ŘEZANKOVÁ, H., VILIKUS, O., VLACH, P. *Statistické myšlení a nástroje analýzy dat* (Statistical thinking and data analysis tools). Prague: Informatorium, 877 p.[3]

MALÁ, I. *Statistické úsudky* (Statistical judgments). Prague: Professional Publishing, 260 p.

MAREK, L., PECÁKOVÁ, I., VRABEC, M., LÖSTER, T., ČABLA, A. *Statistika v příkladech* (Statistics in examples). Prague: Professional Publishing, 403 p.

For students, also following University textbooks were brought out:

ŘEZANKOVÁ, H., LÖSTER, T. *Základy statistiky* (Fundamentals of statistics). Prague: Oeconomica, 96 p.

LANGHAMROVÁ, J., ŠIMPACH, O. *Základy demografie* (Fundamentals of demography). Prague: Oeconomica, 121 p.

Furthermore, members of the three statistical departments (including PhD students) published 76 peer-reviewed articles (21 in journals registered in the database Web of Science and Scopus), 92 articles in proceedings of international conferences (including 7 from conferences monitored CPCI) and 49 other publications.

10. Prof. Hindls, prof. Hronová, prof. Řezanková, prof. Pavlík, doc. Marek and doc. Průša are (often many years) members of scientific boards of a total of 15 leading Czech and Slovak universities , respectively their faculties.

Among other important functions of the University statisticians let us mention at least the following: Vice-Chairman of the Czech Statistical Council is prof. Hindls. Doc. Fischer is the Charmain of the Council of Universities, where doc. Langhamrová represents the Faculty, prof. Arlt is member of the Accreditation Commission of the Czech Republic, prof. Hronová is member of the Council for Research, Development and Innovation (advisory body of the Government of the Czech Republic) and member of the Council for Development Strategy and of the National Technical Library.

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[3] During the preparations of this sofar largest publication in the history of statistics at the University, prof. Hebák and further authors belonged to the University staff.

Statisticians from the University are also members of the editorial boards of major scientific and professional journals. These are *Statistika: Statistics and Economy Journal* (prof. Hronová – Editor in chief, prof. Hindls, prof. Řezanková, doc. Fischer and doc. Marek), *Politická ekonomie* (prof. Hindls – Chairman of the Editorial Board, prof. Hronová and doc. Marek), *Prague Economic Papers* (prof. Hindls – Chairman of the Editorial Board, prof. Arlt – Chairman of the Executive Board and Ing. Sixta), *Acta Oeconomica Pragensia* (doc. Arltová – Editor, prof. Hronová, doc. Pecáková, doc. Průša and RNDr. Malá), *Demografie* (prof. Pavlík, doc. Arltová, doc. Langhamrová, RNDr. Fiala and Ing. Miskolczi), *Fórum sociální politiky*) (doc. Průša – Chairman of the Editorial Board, doc. Langhamrová), *Forum Statisticum Slovacum* prof. Řezanková), *Journal of Economic and Social Research* (Slovakia – doc. Fischer), *Silesian Statistical Revue* (Poland – prof. Hronová) and 5 other titles.

11. Finally, let us at least selectively mention activities of University statisticians in Czech and international scientific societies. Prof. Arlt and doc. Fischer are members of the International Statistical Institute (ISI), others work in its sections – especially in the International Association for Statistical Education (IASE – prof. Hindls, prof. Hronová, doc. Fischer) and the International Association for Statistical Computing (IASC – prof. Řezanková and doc. Marek).

Prof. Hronová is member of the Steering Committee of the Association de Comptabilité Nationale in Paris, Ing. Sixta for the International Input-Output Association (IIOA) in Vienna, prof. Pavlík in the European Association for Population Studies (EAPS) in The Hague, doc. Langhamrová, RNDr. Pechholdová, RNDr. Fiala, Ing. Miskolczi, Ing. Dotlačilová and Ing. Šimpach in the International Union for the Scientific Study of Population (IUSSP) in Paris etc.

Most members of the statistical departments are active in the Czech Statistical Society (prof. Řezanková – President, Ing. Löster – Bursar, doc. Blatná – Committee Members), many also in the Czech Demographic Society (doc. Langhamrová – Vice-Chairman). A lot of statisticians from the University operate also in other scientific societies: in the Czech Economic Society (doc. Fischer member of the Board and Executive Committee), in the Czech Econometric Society, in the Society for the History of Science and Technology, in the Association of Czech Mathematicians and Physicists, in the Czech Geographical Society, in the Czech Political Science Society, the Slovak Statistical and Demographic Society and in other societies.

Applications of Mathematics and Statistics in Economy – AMSE 2014

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On 28 and 29 August 2014, already the 17th international conference called *Applications of Mathematics and Statistics in Economy* (*AMSE*) took place in Jerzmanowice near Cracow. The conference was organized by the Department of Statistics of the Wroclaw University of Economics. More than 50 experts from the Czech Republic, Slovakia, and Poland participated in the conference representing the University of Economics, Prague, Matej Bel University in Banska Bystrica, University of Žilina, Wroclaw University of Economics, University of Economics in Katowice, and Cracow University of Economics.

It was already the 17th conference on the topic. In 1998, when it took place for the first time, representatives of departments of statistics from the Faculty of Informatics and Statistics of the University of Economics, Prague and the Department of Applied Informatics of the Faculty of Economics of the Matej Bel University in Banska Bystrica agreed to deepen cooperation of the mentioned workplaces. Thus, besides personal professional contacts among members of the statistical departments, a tradition of alternating in organisation of international conferences of the same or a similar topic was founded. In 2000, also Polish statisticians were invited, because economic issues to cope with are similar in the Czech Republic, Slovakia, and Poland. The invitation of Polish colleagues from the Wroclaw University of Economics (with statistical workplaces of which there were already very good relationships for a long time among statistical departments of the University of Economics, Prague) was just a natural consequence of the further development policy regarding thematic orientation of the conferences, because information exchange among experts from Central European countries was and is very challenging. The conference was gradually developing both as for its programme as well as regarding its participants (a higher share of postgraduate students) and it became a "natural" part of professional contacts of experts from statistical departments from the mentioned universities and, naturally, also a place of regular friendly meetings.

Conference papers delivered this year were split to eight thematic groups: Macroeconomic Issues, Application of Statistical Methods in Economics, Insurance and Retirement System, Time Series Analysis Methods, Health Care Issues, Financial Markets and Risk Measurement, Expenditures and Welfare of Households, Microeconomic Issues. Meetings took place in two sections. For AMSE 2014 programme visit: <*www.amse.ue.wroc.pl*>.

The tradition of alternating organisation (Slovakia – Poland – Czech Republic) continues and thus the 18th AMSE conference (organisers of which are statistical departments of the University of Economics, Prague) in September 2015 will take place in the Czech Republic, in a picturesque environment of the town of Jindřichův Hradec.

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Recent Publications and Events

New Publications of the Czech Statistical Office

Farm structure survey 2013. Prague: CZSO, 2014.

Příjmy a životní podmínky domácností v roce 2013 (Household Income and Living Conditions 2013). Prague: CZSO, 2014.

Other Selected Publications

HEBÁK, P. et al. *Statistické myšlení a nástroje analýzy dat* (Statistical thinking and data analysis tools). Prague: Informatorium, 2013.

PAVELKA, T. *Minimální mzda v České republice a její srovnání v rámci členských států Evropské unie* (The minimum wage in the Czech Republic and its comparison between the EU Member States). Prague: Národohodpodářský ústav Josefa Hlávky, 2014.

The Oxford Handbook of Bayesian Econometrics. Oxford University Press, 2013.

Conferences

The **European Conference on Quality in Official Statistics (Q2014)** was held in **Vienna, Austria** between **3–5 June 2014**. The main topics of the conference was to cover specific ESS governance related issues like the organisation of the second round of peer reviews within the European Statistical System, quality aspects of policy relevant indicators as well as quality assurance in the implementation of the ESS Vision. More information available at: *http://www.q2014.at/home.html*.

The **Conference Accounts of Society – National Accounts at the Service of Economic and Monetary Policy Making** took place in **Luxembourg** during **12–13 June 2014**. The ESA 2010 is a major development in measuring National Accounts aggregates in a harmonised way in Europe and brings a number of significant improvements compared to the past. On this occasion Eurostat decided to organise and host this international conference with high-profile speakers from European Countries, non-European Countries and from the European Commission. The aim was to highlight the importance of National Accounts for economic and monetary policy making and for society in general. More information available at: *http://accounts-of-society.eu*.

The **8th International Days of Statistics and Economics MSED 2014 Conference** was held between **11–13 September 2014** at the University of Economics, **Prague, Czech Republic**. The aim of the conference was to present and discuss current problems of Statistics, Demography, Economics and Management and their mutual interconnection. More information available at: *msed.vse.cz*.

The **15th Conference of the Association de Comptabilité Nationale** will take place in **Paris, France** during **19–21 November 2014**. More information available at: *http://www.insee.fr*.

The **60th World Statistics Congress ISI 2015** will be held between **26–31 July 2015** in **Rio de Janeiro, Brazil**. The congress will bring together members of the statistical community to present, discuss, promote and disseminate research and best practice in every field of Statistics and its applications. More information available at: *http://www.isi2015.ibge.gov.br*.

Papers

We publish articles focused at theoretical and applied statistics, mathematical and statistical methods, conception of official (state) statistics, statistical education, applied economics and econometrics, economic, social and environmental analyses, economic indicators, social and environmental issues in terms of statistics or economics, and regional development issues.

The journal of *Statistika* has the following sections:
The *Analyses* section publishes high quality, complex, and advanced analyses based on the official statistics data focused on economic, environmental, and social spheres. Papers shall have up to 12,000 words or up to twenty (20) 1.5-spaced pages.

The *Methodology* section gives space for the discussion on potential approaches to the statistical description of social, economic, and environmental phenomena, development of indicators, estimation issues, etc. Papers shall have up to 12,000 words or up to twenty (20) 1.5-spaced pages.

The *Book Review* section brings reviews of recent books in the field of the official statistics. Reviews shall have up to 600 words or one (1) 1.5-spaced page.

In the *Information* section we publish informative (descriptive) texts. The maximum range of information is 6 000 words or up to 10 1.5-spaced pages.

Language

The submission language is English only. Authors are expected to refer to a native language speaker in case they are not sure of language quality of their papers.

Recommended Paper Structure

Title (e.g. On Laconic and Informative Titles) — Authors and Contacts — Abstract (max. 160 words) — Keywords (max. 6 words / phrases) — JEL classification code — Introduction — … — Conclusion — Annex — Acknowledgments — References — Tables and Figures

Authors and Contacts

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Main Text Format

Times 12 (main text), 1.5 spacing between lines. Page numbers in the lower right-hand corner. *Italics* can be used in the text if necessary. *Do not* use **bold** or underline in the text. Paper parts numbering: 1, 1.1, 1.2, etc.

Headings

1 FIRST-LEVEL HEADING (Times New Roman 12, bold)
1.1 Second-level heading (Times New Roman 12, bold)
1.1.1 Third-level heading (Times New Roman 12, bold italic)

Footnotes

Footnotes should be used sparingly. Do not use endnotes. Do not use footnotes for citing references (except headings).

References in the Text

Place reference in the text enclosing authors' names and the year of the reference, e.g. "White (2009) points out that…", "… recent literature (Atkinson et Black, 2010a, 2010b, 2011, Chase et al., 2011, pp. 12–14) conclude…". Note the use of alphabetical order. Include page numbers if appropriate.

List of References

Arrange list of references alphabetically. Use the following reference styles: [for a book] HICKS, J. *Value and Capital: An inquiry into some fundamental principles of economic theory.* Oxford: Clarendon Press, 1939. [for chapter in an edited book] DASGUPTA, P. et al. Intergenerational Equity, Social Discount Rates and Global Warming. In PORTNEY, P., WEYANT, J., eds. *Discounting and Intergenerational Equity.* Washington, D.C.: Resources for the Future, 1999. [for a journal] HRONOVÁ, S., HINDLS, R., ČABLA, A. Conjunctural Evolution of the Czech Economy. *Statistika, Economy and Statistics Journal,* 2011, 3 (September), pp. 4–17. [for an online source] CZECH COAL. *Annual Report and Financial Statement 2007* [online]. Prague: Czech Coal, 2008. [cit. 20.9.2008]. <http://www.czechcoal.cz/cs/ur/zprava/ur2007cz.pdf>.

Tables

Provide each table on a separate page. Indicate position of the table by placing in the text "insert Table 1 about here". Number tables in the order of appearance Table 1, Table 2, etc. Each table should be titled (e.g. Table 1 Self-explanatory title). Refer to tables using their numbers (e.g. see Table 1, Table A1 in the Annex). Try to break one large table into several smaller tables, whenever possible. Separate thousands with a space (e.g. 1 528 000) and decimal points with a dot (e.g. 1.0). Specify the data source below the tables.

Figures

Figure is any graphical object other than table. Attach each figure as a separate file. Indicate position of the figure by placing in the text "insert Figure 1 about here". Number figures in the order of appearance Figure 1, Figure 2, etc. Each figure should be titled (e.g. Figure 1 Self-explanatory title). Refer to figures using their numbers (e.g. see Figure 1, Figure A1 in the Annex).

Figures should be accompanied by the *.xls, *.xlsx table with the source data. Please provide cartograms in the vector format. Other graphic objects should be provided in *.tif, *.jpg, *.eps formats. Do not supply low-resolution files optimized for the screen use. Specify the source below the figures.

Formulas

Formulas should be prepared in formula editor in the same text format (Times 12) as the main text.

Paper Submission

Please email your papers in *.doc, *.docx or *.pdf formats to statistika.journal@czso.cz. All papers are subject to double-blind peer review procedure. You will be informed by our managing editor about all necessary details and terms.

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