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CONTENTS

ANALYSES

- 4 Stanislava Hronová, Richard Hindls**
Czech Households in the Years of Crises
- 24 Jaroslav Kahoun, Jaroslav Sixta**
Regional GDP Compilation: Production, Income and Expenditure Approach
- 37 Lenka Hudrliková, Kristýna Vltavská**
Competitiveness and Labour Productivity in Context of Composite Indicators
- 46 Ondřej Nývlt**
The Models of Estimated Development of Labour Market in the Czech Republic up to 2050
- 56 Oto Potluka, Jan Brůha, Ondřej Vozár, Martin Špaček, Jakub Loun**
The Impact of Subsidies on Czech Firms
- 63 Rita Lima**
More Money in Education Makes Economy Best?

BOOK REVIEW

- 85 Stanislava Hronová**
Top-quality and Useful Guide through Statistical Methods and Excel Applications

INFORMATION

- 87 Prokop Závodský**
60th Anniversary of Statistics at the University of Economics in Prague
- 97** Publications, Conferences

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Journal of Statistika | Czech Statistical Office | Na padesátém 81 | 100 82 Prague 10 | Czech Republic
e-mail: statistika.journal@czso.cz | web: www.czso.cz/statistika_journal

Czech Households in the Years of Crises¹

Stanislava Hronová² | *University of Economics, Prague, Czech Republic*

Richard Hindls³ | *University of Economics, Prague, Czech Republic*

Abstract

Generally, households are, from the viewpoint of macroeconomic data, among the last to feel the impact of an economic crisis, as a rule. After two years (2010 and 2011) of the GDP's positive growth rates, the Czech economy went down again in 2012. This article shows the households' response to such turbulences. Long time series enable us to compare the households' behaviour in the period 2009 through 2012 with that of the late 1990s.

Keywords

Households, economic crisis, indebtedness of households, consumption by households

JEL code

E21, C82

INTRODUCTION

The economic behaviour of households is implied by their specific role within the national economy. In fact, households (represented by the sector of households in the system of national accounts) comprise a subject whose main economic function is that of consumption (and production by small-scale entrepreneurs included in this sector); and the main sources of income are the labour costs (or gain from sales of products and services generated by them). This formulation has its consequences. The households enter the process of redistribution of income as a subject which pays less than it gets (the households must, first of all, pay taxes on production and imports, income taxes, and social contributions; on the other hand they get wages and social benefits, as well as other types of income). They thus, in the form of disposable income, create resources sufficient for covering their immediate needs (in the sense of the final consumption expenditure), at the same time ensuring saving. In other words, the households form a sector that should ensure resources sufficient for national saving and also sufficient free resources in the economy, so that the deficit consistently achieved by the general government is alleviated and the country's deficit with respect to abroad is reduced. From the viewpoint of free domestic financial resources, the role of households is very important within the framework the national economy as a whole.

It is usual in the years of economic growth that the final consumption expenditure and investments by the households grow, also thanks to a broad array of consumer and mortgage loans typically offered in growth years. In consequence, their saving rate and financial saving rate go down (and those rates are,

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² Nám. W. Churchilla 4, 130 67 Prague 3, Czech Republic. E-mail: hronova@vse.cz.

³ Nám. W. Churchilla 4, 130 67 Prague 3, Czech Republic. E-mail: hindls@vse.cz.

for Czech households, among the lowest in Europe anyway⁴). It is therefore difficult for the households to fulfil their role as a generator of free financial means to cover the deficit of the general government and non-financial corporations. Under such conditions, a quick growth of households' consumption has serious macroeconomic consequences. The households do not create sufficient resources and cover part of their consumption and investments from loans. The indebtedness of households (in the form of loans) thus grows and, in combination with the low saving rate and financial saving rate, it can lead to insolvency and inability to meet their obligations.

The years of recession and crisis that follow those of economic growth bring about a turn in the households' behaviour, marked by a careful attitude towards consumption and low interest in investments and long-term loans. This turn, however, does not occur instantaneously. Usually the consequences of the crisis first hit non-financial and financial corporations, as well as the general government;⁵ the households respond with a certain delay.⁶ Simultaneously the households should, in the years of crises, reduce their non-financial and financial investments and try to place their resources in low-risk assets. This article should help us explain the way in which these general propositions revealed themselves in the economic crisis that hit (not only) the Czech economy in the years 2008 and 2009; the Czech economy has not yet coped with the consequences of that crisis. Moreover, long time series enable us to compare the households' behaviour in the period 2009 through 2012 with that of the late 1990s.

1 NATIONAL-ECONOMY RELATIONSHIPS

From the viewpoint of economic cycles, the development of the Czech economy after 1989 can be classified as irregular. After the attenuation implied by the changeover to a market economy in the early 1990s, followed by a quick growth in the years 1995 and 1996, the first "post-revolution" crisis came; the latter was caused by internal factors: unsolved or outstanding problems of privatisation, slow restructuring of industry, uncertainty in the banking sector, and the strict anti-inflation policy. The year 2000 brought a turn towards growth in economic development, starting the most successful period of the Czech economy. In the first seven years of the 21st century the Czech economy achieved very high rates of growth, even in comparison with the EU member states. A characteristic sign of that period was a gradual improvement in foreign trade, together with high rates of production in construction and general industry, with the subsequent increase of both domestic and foreign investments – the latter were mainly focused on support of exports.

This boom was terminated in the Czech Republic by the coming worldwide financial crisis and the following economic and fiscal recession in the years 2008 through 2010, and 2010 through 2012. Due to the drop in industrial and construction production in 2009, investments were decreased into fixed assets, and consequently imports and exports went down as well. Despite those facts the Czech economy was able to preserve a positive balance of trade and of services even with a falling scope and dynamics of foreign trade and moderate strengthening of the CZK exchange rate. Negative aspects were reflected in a slowdown and, eventually, a drop in the final consumption expenditure by households (cf. Table 1). The rate of their growing indebtedness was also slowed down. A decrease in the economic activity and the connected increase of unemployment rate brought about an increase of the public debt and focus of

⁴ Cf. HRONOVÁ, HINDLS (2008).

⁵ A question whether the first and foremost affected sector will be that of non-financial corporations or the general government depends on many aspects, mainly the causes of the respective crisis. See CZESANY (2002) for a more detailed treatment of this problem.

⁶ The fact that this tendency is generally reflected in the final consumption expenditure by households and the general government was proven by a test of significance of changes carried out in a group of 33 developed countries. For more details, cf. HINDLS, HRONOVÁ (2012).

the economic policy exclusively on the budget responsibility,⁷ with only a temporary stimulation of the economy and a collapse back to the crisis.

Table 1 Year-to-year growth rates of selected indices (in %)

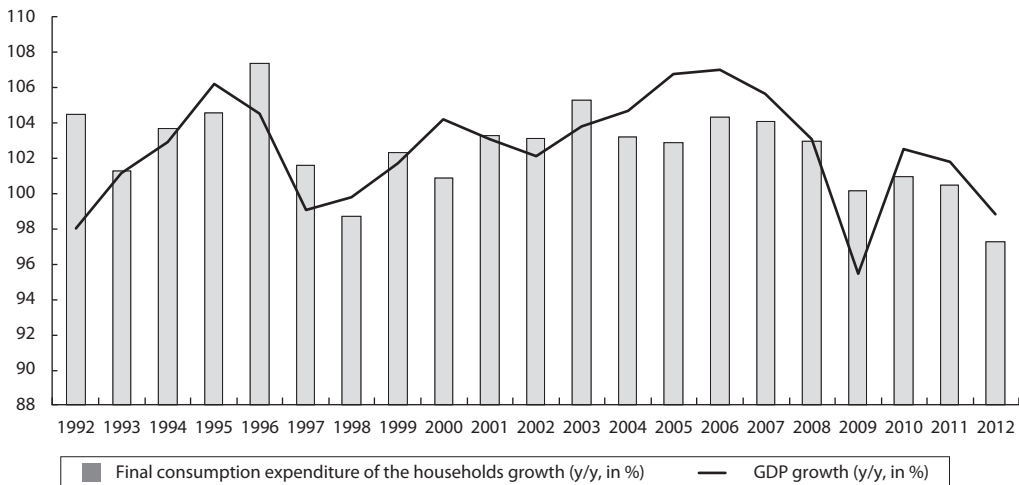
	1996/95	1997/96	1998/97	1999/98	2008/07	2009/08	2010/09	2011/10	2012/11
GDP	4.5	-0.9	-0.2	1.7	3.1	-4.5	2.5	1.8	-1.2
GFCF	9.1	-6.5	-1.0	-2.1	4.1	-11.0	1.0	0.4	-2.7
FCE-h	7.4	1.6	-1.3	2.3	3.0	0.2	1.0	0.5	-2.7

Source: www.czso.cz

Explanations: GDP – Gross Domestic Product, GFCF – Gross Fixed Capital Formation, FCE-h – Final Consumption Expenditure by Households.

The data shown in Table 1 confirm the proposition made in the Introduction: a crisis first hits the manufacturing industries, causing a drop in their investments, subsequently the general government, and households in the end. The households respond with a certain delay by reducing their consumption (the so-called consumer smoothing), and their reduced demand puts off a turn to growth. Having a more detailed look at the years of the crisis, the decrease of economic growth was reflected in slumping final consumption expenditure by households (with the average year-to-year increase by 0.5% in the years 2009 through 2011), and a decrease of the latter in 2012 (by 2.2%). A similar situation can be recognised in the crisis of the late 1990s: after a year-to-year increase in the final consumption expenditure by households by 1.6% in 1997 (while the GDP went down by 9%), it also decreased by 1.3% in 1998. We must, however, keep in mind that both causes and evolutions of the crises in the late 1990s and in the period 2009 through 2012 were different from each other. Households' response to internal economic problems was, in the uncertain years of the economic transformation, faster than it was to the external signals of the crisis after the boom of 2000. The year-to-year evolution of the final consumption expenditure by households in the context of the overall economic development is shown in Figure 1.

Figure 1 Evolution of final consumption expenditure by households and GDP (constant prices)



Source: www.czso.cz

⁷ That is, keeping the public debt below 3% GDP.

Not only households are subject to booms and crises. Different positions held within the national economy by different sectors is, especially in the years of crises, seen from their different results of economic activities, that is, net lending or net borrowing. Czech non-financial corporations coped with the 2009 crisis with a positive result and the same was true for households as a whole; hence the general government bore the full weight of the economic crisis (cf. Table 2). We can further see that the economic behaviour of small-scale entrepreneurs considered as a component of the household sector, if measured by the outcome registered on the national accounts, is different from both the behaviour of households as consumers and that of non-financial corporations.

Table 2 Net lending/borrowing of sectors and total economy (bln. CZK, current prices)

	1996	1997	1998	2008	2009	2010	2011	2012
Non-financial corporations	-151.2	-141.4	-73.5	-33.6	81.8	-20.5	-45.6	-6.6
Households	70.6	59.5	48.2	11.8	65.5	44.1	48.7	76.4
- as entrepreneurs	-	-	-	-	-20.7	-3.9	19.8	n.a.
- as consumers	-	-	-	-	86.2	48.0	28.9	n.a.
General government	-55.2	-68.2	-99.5	-85.0	-217.4	-180.7	-124.6	-167.9
Total economy	-108.3	-97.9	-35.0	-76.1	-45.0	-110.6	-61.0	-53.5

Source: www.czso.cz

Explanations: cp – current prices.

In our present analysis we will therefore consider not only the data valid for the households sector as a whole (in a wider context and as a longer time series), but also the data subdivided between the groups of entrepreneurs and consumers – even though the time series for the subdivided data is shorter, it can provide us with valuable information. Data offered by the CZSO (Czech Statistical Office) from the period 1990 through 2012 for the non-financial accounts of the households sector as a whole (accounts for balance sheets and other changes in assets) is only available up to 2011. Indices for the consumer and entrepreneur sub-sectors⁸ are only available for the period 2009 through 2011. Even that short time series will help us understand differences in the subgroups' behaviour during the period full of setbacks and the effects of the recession and crisis on the economic results of these important subgroups in the households sector. Last but not least, we would like to emphasise the importance of long-term observing and recording the indices for the sub-sectors of entrepreneurs and consumers in the households sector; this importance is implied by the observed differences in these two subgroups' economic behaviour.

2 HOUSEHOLDS' INCOME AND EXPENDITURE

When evaluating the economic behaviour of the households sector as a whole in the years of crisis we should distinguish between the different roles and behaviour types of households as entrepreneurs and as consumers, i.e., sub-sectors of the households sector.⁹ The main economic function of small-scale entrepreneurs is production of goods and services and the dominant index is added value and its structure, while for households as consumers the main economic function is consumption covered from

⁸ CZSO publishes the household subgroups' data according to their economic functions (production vs. consumption) and considers them as sub-sectors. In other words, a household sub-sector of entrepreneurs (S.141) and consumers (S.142) are distinguished. Even though this terminology is not correct according to the official classification of institutional sectors (S.141 are S.142 sub-sectors of employers, i.e., entrepreneurs including self-employed persons), we will use this terminology in this text (both in words and codes).

⁹ In the conditions of the Czech Republic entrepreneurs, i.e., physical persons running their businesses on the basis of trade licences are meant.

their disposable income. Creation of disposable income and its use for consumption is the focus of the analysis of the households' behaviour as consumers. Small-scale entrepreneurs do not have any final consumption and their disposable income is equal to the amount of saving to be used for investments. For households as consumers, the saving amount equals the difference between their disposable income and their final consumption.

The structure of disposable income for the households sector as a whole only insignificantly varies in time; the main component consists of wages and salaries and the most dynamic component (from the viewpoint of time evolution) is property income. The drop of economic activities in the years of crisis and the growing unemployment rate should reduce the proportion of wages and salaries, income from enterprise and current taxes (especially physical persons' and legal entities' income taxes) and social contributions, while the social benefit proportion, or rather the balance of social income, should grow. The time evolution of net disposable income is shown in Table 3.

Table 3 Structure of net disposable income (% NDI)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Wages and salaries	57.9	59.5	60.7	62.1	62.7	62.7	63.3	62.8	59.7	60.4	61.9
Net operating surplus	4.3	4.3	4.4	4.4	4.4	4.4	4.3	4.6	5.1	4.8	3.9
Mixed income	25.1	24.7	24.7	24.3	23.1	22.4	22.3	20.9	20.8	20.5	20.2
Balance of property income	7.8	6.9	6.6	6.6	7.4	7.7	7.1	7.1	6.8	6.4	6.7
Balance of social incomes ¹⁾	13.3	13.3	13.0	12.3	11.9	11.7	12.4	12.5	14.8	15.0	15.1
Balance of other incomes	0.1	0.0	-0.2	-0.3	-0.3	-0.3	-0.6	-0.3	-0.1	-0.3	-0.4
Current taxes	-8.4	-8.7	-9.3	-9.5	-9.1	-8.6	-8.9	-7.6	-7.1	-6.9	-7.4
NDI	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

¹⁾ Social benefits – Social contributions.

Source: www.czso.cz, our own calculations

The data in Table 3 show that after the crisis beginning in 2009, significant changes in the households' disposable income occurred. The decreasing wages in 2009 show that employers in all sectors rather quickly responded to the external signals of the coming crisis¹⁰ and substantially reduced their expenses, which was seen in the year-to-year drop by 2.5% of wages obtained by households, expressed in current prices (!). On the other hand, households as consumers compensated for the lower income from wages by profits from market activities (provision of housing services). However, we must emphasise that this value of operating surplus does not fully reflect the real surplus of households as implied by the provision of housing services because it includes the hypothetical profit considered part of the imputed rent.¹¹

The mixed income is the result of the general (operational) activity of the small-scale entrepreneurs in the sub-sector of households, in which not only the income from enterprise, but also the income from labour is included. After a slowdown in 2008, the mixed income grew in 2009 (but slower than the net disposable income); then it went down significantly, similar to the operating surplus of consumers, even in current prices. The evolution of the proportion of property income and current taxes must, however, be analysed with respect to different results in both sub-sectors. The balance of social income is only rel-

¹⁰ More details on this problem can be found in HRONOVÁ, HINDLS (2012).

¹¹ The provision of housing services is the dominant market activity carried out by households as consumers and as such it enters the value of market production. The provision of housing services to oneself is part of their production for their own final consumption as expressed in the value of the so-called imputed rent. The operating surplus in the households sector is then "profit" from the activities of households as consumers, in which both the real profit generated by market activities (especially the provision of housing services) is included, and also the hypothetical profit (especially from the provision of housing services to oneself).

evant for the consumer sub-sector, but it depends on the development of the social contributions, whose amount depends on the level of wages and employment, in addition to social benefits, whose amount always grows when the level of economic activities decreases.

Table 4 Selected indices from the entrepreneur and consumer sub-sectors (bln. CZK, current prices)

	2009		2010		2011	
	S.141	S.142	S.141	S.142	S.141	S.142
Net operating surplus	–	101.0	–	97.1	–	77.0
Mixed income	383.8	32.4	376.7	32.9	367.9	35.0
Wages and salaries, receivable	–	1 193.1	–	1 209.9	–	1 238.0
Property income - balance	–382.4	519.3	–369.8	499.0	–333.0	466.9
– property income, receivable	4.0	533.4	3.7	515.6	1.5	483.2
– property income, payable	386.4	14.1	373.5	16.6	334.5	16.4
– of it: withdrawals from income of quasi-corporations	382.2	–	368.4	–	330.4	–
Primary income	1.4	1 845.7	6.9	1 839.0	34.9	1 816.9
Current taxes	12.7	128.3	5.7	131.5	7.9	140.1
Social contributions	12.3	241.1	14.1	242.2	14.5	249.4
Social benefits	0.1	535.8	0.1	541.9	0.1	552.0
Net disposable income (for S.141 also saving)	–10.4	2 008.3	1.7	2 001.2	27.0	1 971.4

Source: www.czso.cz

Explanations: S.141 – Households as entrepreneurs, S.142 – Households as consumers.

The data shown in Table 4 indicate high amounts of income from ownership “paid” by entrepreneurs and obtained by consumers. A withdrawal from income of quasi-corporations is the reason for such high amounts compensated within the framework of the households sector.¹² This index represents the income actually drawn by entrepreneurs for their own use from the created profit (mixed income) in the corporations they own. The difference between the values of the mixed income and the withdrawal from income of quasi-corporations is the amount entrepreneurs are willing to preserve from their profit to invest into the enterprise. Together with the balance of other ownership income (interest and rent) it makes up the entrepreneurs’ primary income. This increase of amounts not withdrawn by entrepreneurs for their own use is also the reason for the significant increase in primary income and, consequently, the net lending (cf. Table 2). In this context we can say that entrepreneurs limited their own consumption in favour of (both financial and non-financial) investments.

A significant difference between the economic behaviour of the sub-sectors of the households sector is, in a concentrated way, apparent in the result of the distribution process, i.e., the amount of disposable income. In 2009 (a year of crisis) entrepreneurs generated a negative value of disposable income, and consequently also that of saving; while in 2011, thanks to the increased primary income and a decrease in current taxes (as related to the decrease in mixed income) they were able to generate means for self-financing of investments in an amount of more than 27 bln. CZK. They were thus able to revert the negative effect of the attenuated economic activities (a decrease in the added value after 2009) at the stage of the distribution of income, which is the least favourable from the entrepreneurs’ viewpoint.

In the consumer sub-sector, both the primary and disposable income values in current prices go down, and the real disposable income is substantially reduced (by 1% in 2010 and by 2% in 2011). The primary income of the consumer sub-sector did not go down because of a decrease in the income from labour, dividend or interest balance, but its relationship to the outcome of economic activities, i.e., a drop in the

¹² Entrepreneurs “transfer” this amount from their mixed income in favour of consumers.

operating surplus (by 20 bln. CZK in 2001) and a smaller value of the withdrawal from the income of quasi-corporations (by 38 bln. CZK in 2011). The reasons for the decrease in the operating surplus of the consumer sub-sector can especially be looked for in the growing expenses on normal maintenance of apartments, which – despite small fluctuations of production¹³ – meant a drop in the added value by 22 bln. CZK in 2001 as compared with 2009.

The disposable income of the consumer sub-sector is to be used on the final consumption in the sense of the final consumption expenditure. From the macroeconomic viewpoint the households' consumption is expressed by the index of the final consumption expenditure by households, which includes the value of goods and services (both short- and long-term consumption except for houses and apartments) purchased by households, and also contains a part of unpaid consumption (especially the value of agricultural self-supply and housing services provided to the owners themselves). Entrepreneurs neither have final consumption nor participate in the redistribution of income in kind – hence their disposable income equals the amount of saving.

The data recorded on the accounts of generation of income and distribution of income in the entrepreneur and consumer sub-sectors simultaneously show that the proportions of these sub-sectors in the values of the selected indices vary substantially in the process of redistribution. While entrepreneurs' proportion (for illustration we will consider the data of 2010; similar values would be valid for the other years) in the net value added is four-fifths, this proportion is just two per cent with respect to the primary and disposable income values and one-quarter for the volume of investments. Of course, it has its consequences for interpretation of the values concerning the households' economic behaviour. In other words, with respect to the primary income the account of the households sector is rather that of consumers, or the data of the households sector do (from the level of primary income) provide reliable information about the behaviour of households as consumers.

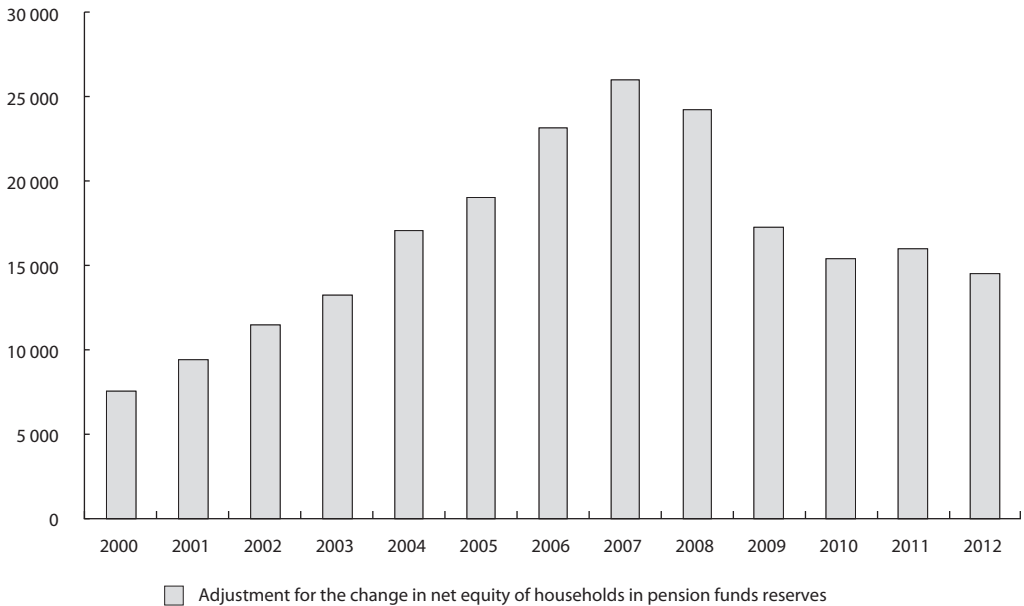
The final consumption expenditure by households was by 63.3% higher in 2012 than in 2000 that is, by only 0.7 percentage points less than the net disposable income. In the 2005 constant prices¹⁴ the final consumption expenditure in the same period was higher by 23.7%. A careful approach of households to consumption in the years of crisis is seen from the reduced demand regarding the volume (with a decrease in the final consumption expenditure value by 2.7% in constant prices in 2012 – cf. Table 1). This is a natural response not only to the economically uncertain environment, but also to a faster growth of prices in the consumption area – the relatively low inflation rate (below 2%), valid until then, went up and exceeded 3%. In consequence of these factors, the year-to-year evolution of the final consumption expenditure by households in current prices went down (by 0.5%); it was the first decrease of this value since 1990.¹⁵

Generally, the value of saving is equal to a difference between the disposable income and the final consumption expenditure. In the case of household consumers, the amount of saving is also affected by the adjustment for the change in net equity of households' proportion in pension funds reserves, expressing the increase of the household saving with the pension funds. The latter value is given by the amount saved by households to pension fund accounts plus the amount paid in additional pensions. This item is not very often followed but it has, in recent years, become another indication of the worsening situation of households in the years of crisis. Figure 2 shows the time evolution of this index in current prices.

¹³ Let us recall that the production in the consumer sub-sector contains the imputed rent as its main component.

¹⁴ Let us recall that it is not expressed in the standard constant prices, but the prices of the previous year chained (chain-linked) with respect to the year 2005 base amount.

¹⁵ The authors are aware of the difficulties in comparing with the 1990s, when the inflation rate was substantially higher than that valid in recent years.

Figure 2 Adjustment for the change in net equity of households in pension funds reserves (mil. CZK, current prices)

Source: www.czso.cz

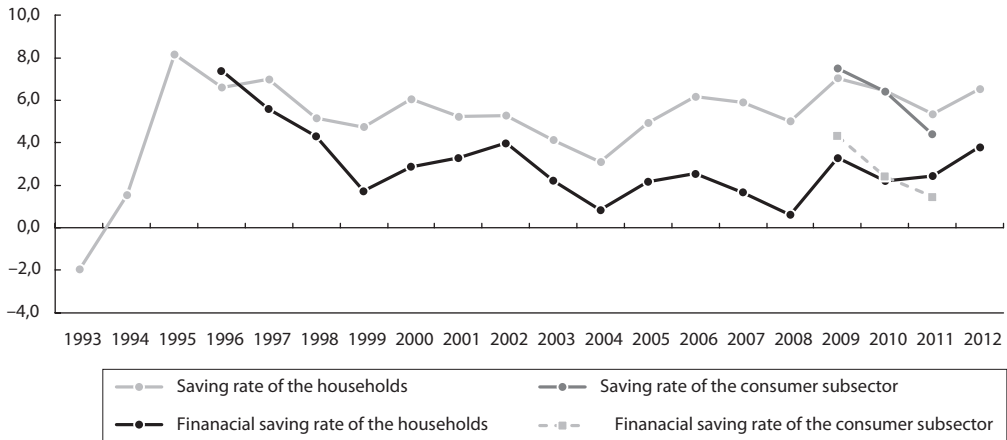
Here we can clearly see that in the years of prosperity households were focused on saving for old age and had free money to put into that type of tied-up saving, while in the years of stagnation and crisis they restrict saving with the pension funds and (it is an index based on balance) draw more of their saving from the pension funds.¹⁶ This is a natural consequence of an aging population and the growing unemployment rate which elderly people solve by retiring. Even though the evolution of the household saving with the pension funds strongly indicate changes of the economic behaviour of households, we have to keep in mind that this kind of saving is marked with a low level of liquidity – hence it cannot be included in the total amount of saving usable for non-financial investments, but a priori it is considered financial investments included in the net lending but not usable as financial resources for capital formation.

A high proportion of the final consumption expenditure by households in the created net disposable income is the reason for a low level of the saving rate of Czech households.¹⁷ The consumer's decreasing disposable income and growing final consumption led to a drop in the 2011 net saving to nearly one-half the rate it was in 2009. A high level of investments, especially in 2010, caused a drop of the consumer sub-sector's net lending first by 44.3%, and subsequently by 39.8% (cf. Table 2); hence the level of financial saving rate also went down¹⁸ (cf. Figure 3).

¹⁶ This tendency complies with the data from the Association of Pension Funds of the Czech Republic (www.apfcr.cz). The received contributions plus added gain and minus paid benefits were lower by one-third in 2012 in comparison with 2007 while the total number of participants in additional pension insurance programmes was higher.

¹⁷ The saving rate (gross, i.e., the ratio of the gross saving with respect to the gross of disposable income) on a long-term basis was about 14% to 16% in the eurozone countries, and 12% to 14% after 2009 (cf. Eurostat; the gross saving rate of the Czech households is around 10%).

¹⁸ Ratio of net lending/borrowing with respect to net disposable income.

Figure 3 Saving rate and financial saving rate (% NDI)

Source: www.czso.cz, our own calculations

Note: The financial saving rate values in the years 1993 (23.6%) and 1995 (27.8%) were influenced by the privatisation process – households obtained assets from the state worth more than 130 bln. CZK within the framework of voucher privatisation. The net lending value, and consequently the financial saving rate of the household in those years cannot therefore be compared with the remaining years. The same is true for the net borrowing of the general government and high values of the government (public) debt in the mentioned years.

The crisis in the period 2009 through 2011 hence definitely led to worsening results of consumers' economic behaviour. The situation was opposite for the entrepreneurs; their economic activities were attenuated in 2009 with a negative value of the saving amounting to 10.4 bln. CZK. In consequence their net borrowings was 20.7 bln. CZK. On the other hand, the above-mentioned decrease of withdrawal from the income of quasi-corporations and increase in their saving in 2011 led to a surplus (net lending) amount of 19.8 bln. CZK while the investments were moderately increased.

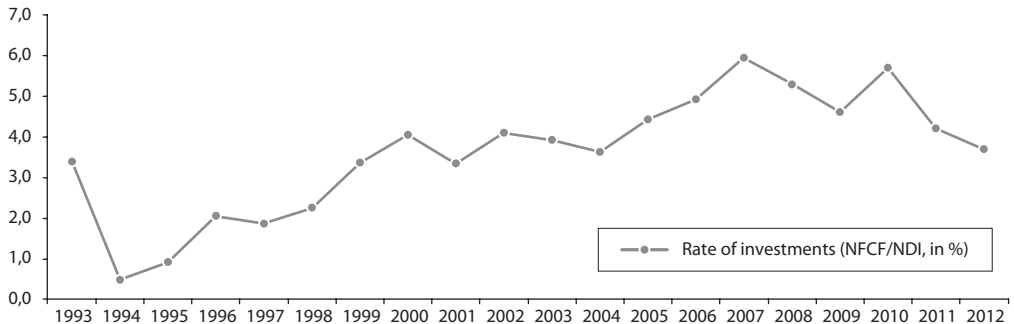
The data in Figure 3 indicates a significant drop in the (net) saving rate of households as consumers in comparison with the same index for the households sector as a whole and illustrates the data on evolution of the disposable income in both sub-sectors shown in Table 4.

3 NON-FINANCIAL INVESTMENTS BY HOUSEHOLDS

Saving and the balance of capital transfers represent the main source for financing of investments (with the reservation made above about the households' saving with pension funds). The level of investment activities, similar to the consumption, is an index showing the evolution of the economic cycle; in other words, a decrease in economic activities in the national economy as a whole is reflected in a decrease of investments in all sectors, including that of households (in the case of households as consumers, only investments into housing and valuables are considered¹⁹).

In the case of households, the level of investment activities is expressed in the rate of investments defined as a ratio of the fixed capital formation to the disposable income; for both of these indices we can consider both "gross" and "net" values. Since our present study refers to the net disposable income, we are using the "net" rate of investments here, i.e., a ratio of the net fixed capital formation to the net disposable income. Data on the net rate of investments is depicted in Figure 4.

¹⁹ Households as consumers, in compliance with the definition of final consumption, consume all articles of the short- and long-term consumption at the time of the purchase; hence they do not have any goods in stock and the investments into fixed capital are represented by purchase of houses and apartments.

Figure 4 Rate of investments (% NDI)

Source: www.czso.cz, our own calculations

Explanations: NFCF – Net Fixed Capital Formation, NDI – Net Disposable Income.

This value can be used for both the households-as-consumers sub-sector and the households sector as a whole.²⁰ For the households-as-entrepreneurs sector this value is not suitable – we must consider an index for the investment level corresponding to the fact that the economic behaviour of households as entrepreneurs is similar to that of non-financial corporations, in which we measure the gross fixed capital formation with respect to the gross value added. Data of the investment indices for both mentioned sub-sectors is shown in Table 5. Even though the values of these indices cannot be directly compared, we can see that the economic behaviour is different for each of the sub-sectors.

Table 5 Investment rates in the consumer and entrepreneur sub-sectors (%)

	2009		2010		2011	
	S.141	S.142	S.141	S.142	S.141	S.142
Net rate of investments (NFCF/NDI)	–	4.3	–	5.3	–	3.7
Gross rate of investments (GFCF/GVA)	8.4	–	8.9	–	9.9	–

Source: www.czso.cz, our own calculations

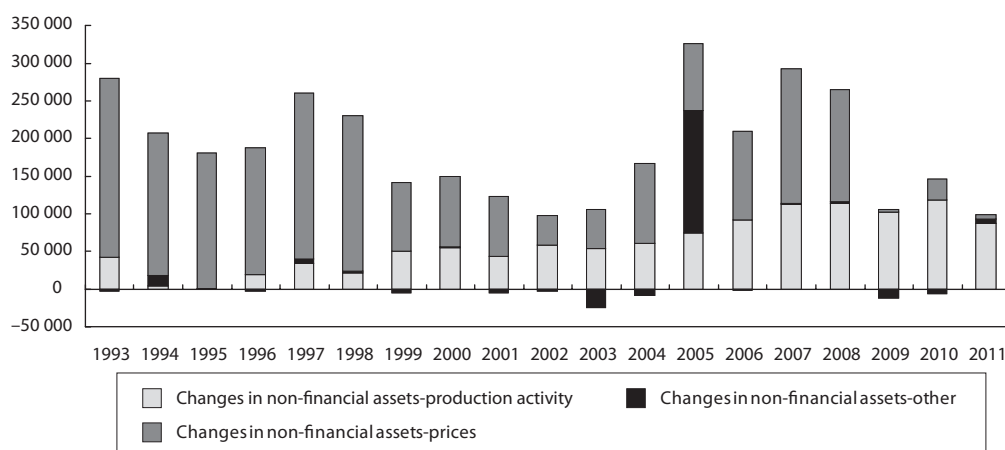
Explanations: NFCF – Net Fixed Capital Formation, NDI – Net Disposable Income, GFCF – Gross Fixed Capital Formation, GVA – Gross Value Added; S.141 – Households as entrepreneurs, S.142 – Households as consumers.

The data in Figure 4 and Table 5 show a significant growth in households' investments after 2004 with a peak in 2007. It was a period of a high demand for real property; together with the higher availability of mortgage loans on the market, it led to a sharp increase in household indebtedness (a year-to-year increase was 90.5 bln. CZK, i.e., 71.5% in 2007). In response to high prices of real property and high interest rates on mortgage loans, households restricted their investments in housing in 2008 and 2009 (with the corresponding year-to-year drop in the gross fixed capital formation by 3.5% in 2009). The indication of recovery in 2010 increased the volume of investments, especially in the consumer sub-sector (by 14.4% in current prices); however, a sharp decrease even below the level of 2009 followed. On the other hand, entrepreneurs in the households sector did not go in this direction, as is shown by the growing rate of their investments.

²⁰ The consumer sub-sector's proportion in the total value of the gross fixed capital formation of the entire households sector is higher than three-quarters on a long-term basis.

Non-financial investments of households represent a basic general factor for the growth of their non-financial assets, in addition to the price evolution and other (formal or random) factors. Based on the data in the accumulation account, we can see that the increase in the volume of non-financial assets was the dominant factor – paradoxically – after 2009, which was a year of crisis (in Figure 5, these changes, taken over from the non-financial asset purchase account, are marked “Changes in non-financial assets – production activity”). Until then, the dominant factor supporting the growing non-financial assets of households was the time evolution of prices (marked as “Changes in non-financial assets – prices”, taken over from the revaluation account). Having in mind that most non-financial investments of households take place in the consumer sub-sector and such investments are exclusively represented by purchase of houses and apartments, the data in Figure 5 clearly shows the growth of prices of the real property purchased by households.

Figure 5 Breakdown of the non-financial asset increment (mil. CZK, current prices)



Source: www.czso.cz, our own calculations

Note: A substantial proportion in the so-called other changes in 2005 (marked as “Changes in non-financial assets – other” in Figure 5, taken over from the account of other changes in the asset volume) was caused by a change in the methodology according to which the prices of land property are calculated.

Summing up our view on the non-financial operations in the households sector in the year of crisis, we can say that the general drop in economic activities in 2009 immediately hit the entrepreneur sub-sector; in the consumer sub-sector it occurred with a time lag – as late as 2011. In 2012, the (net) rate of investments by households went down, but both the rate of saving and the rate of financial saving went up. We do not have the data for sub-sectors yet but we can expect that, due to the stagnation of disposable income in 2012, the rate of investments were likely to go down again in consequence of cautious approach of consumers, which has a negative impact on the economic growth.

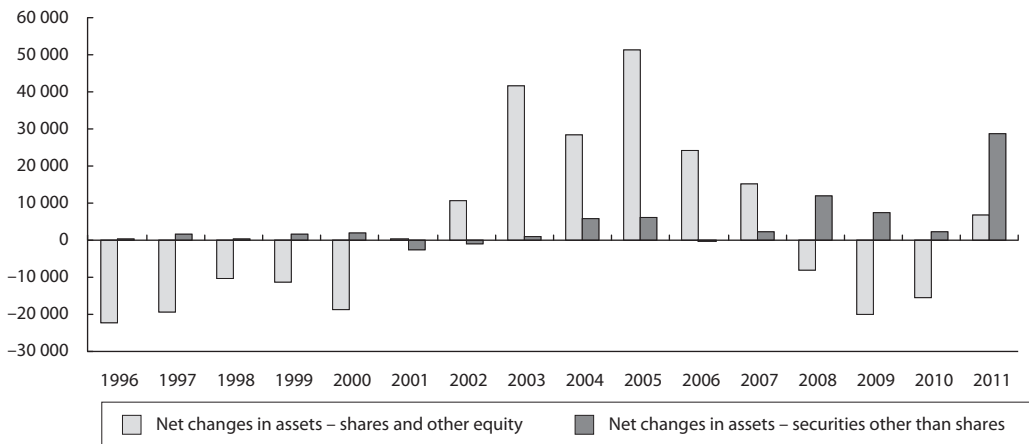
4 HOUSEHOLDS’ FINANCIAL INVESTMENTS AND DEBTS²¹

The conclusions implied by our analysis of the data on the households’ non-financial account should be appropriately reflected in the values of financial transactions and changes in households’ assets. The caution in consumption and general economic decision-making should lead to increased financial assets held by households, especially in the form of currency and securities and, to a lesser extent, in that of shares and other equities.

²¹ Data on the financial account are available only up to 2011.

The data shown in Figure 6 unambiguously demonstrate that, under uncertain economic circumstances, households focus on saving their free financial means in less risky assets and try to get rid of shares and other equities, even though the latter's prices go down. Conversely, in the boom times and under growing prices of shares and other equities households invest into assets that are more risky but yield higher gains. In the area of financial assets households respond to changes in the economic environment instantaneously, not with a time lag (while a delay occurs in the consumption changes). However, the two periods of crises in question cannot be mutually compared with respect to the net purchase of shares and other equities on the one hand and securities other than shares on the other hand. In the late 1990s households were exclusively getting rid of shares obtained "for free" within the voucher privatisation. This means they obtained shares not on the basis of real financial investments but in consequence of fundamental changes in the Czech economy during its transformation and selling shares to investment companies was advantageous for households under those circumstances. High interest rates on deposits²² supported by the strict anti-inflation policy of the Czech National Bank and a very limited offer of securities led households to saving their means on term deposits in banks.

Figure 6 Net change in households receivables in the form of shares and other equities (mil. CZK, current prices)



Source: www.czso.cz

Note: The data in this Figure deliberately starts in 1996: in 1993 and 1995 households obtained, within the voucher privatisation, shares with values higher than 130 bln. CZK in both of the mentioned years. Hence reference to those values would deform a proper view of the financial investments by households (cf. the note at Figure 3).

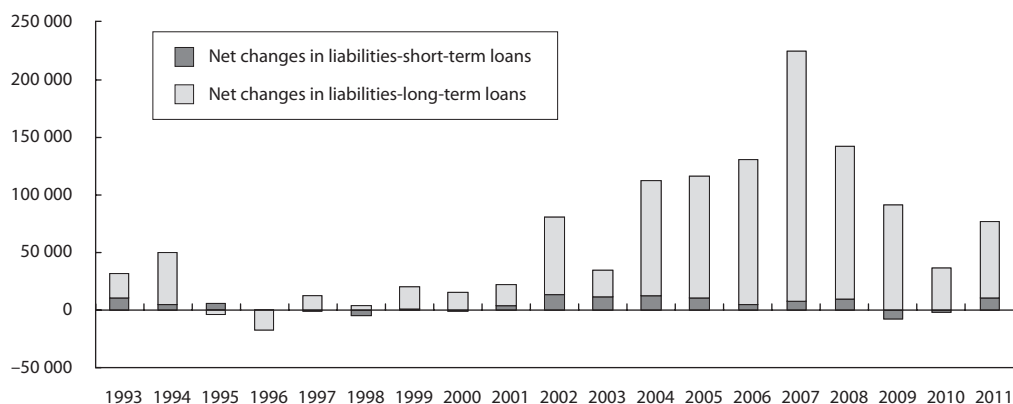
Conversely, in the years of crisis after 2008 households were getting rid of shares and other equities due to negative news from both foreign and domestic capital markets, and preferred investments into securities – especially the special-issue of government bonds in 2011. A positive increment in the value of shares and other equities in 2011 could be viewed as an expression of a quick response to a change in the economic environment households showed in the area of financial assets. In connection with the tendency of households to get rid of risky assets in the form of shares and other equities, we have to mention that the dividend households obtained from their holding of the shares and other equities was stable around 95 bln. CZK from 2005 to 2011, with an exception of 2008, in which the dividend amounted to 106 bln. CZK.

²² Banks offered interest rates of up to 30% p.a.

In the years of economic growth the development on the capital market was positive as well, and households substantially invested into shares, which yield a higher gain than bonds, and households' saving with banks were also growing due to favourable interest rates on the saving.

From the viewpoint of liabilities, loans represent the most important item. The data shown in Figure 7 reflects not only the time evolution of demand for long-term (mortgage) loans attached to the boom of demand for real property, but also a quick response of households to the worsening economic conditions connected with the coming crisis. The period of 1995 through 1999 is characterised the cautious approach taken by households – they paid up even more on loans than they borrowed. This fact was caused by excessively high interest rates. The latter only went down after the crisis of 1997 and 1998, namely, as late as 2001. This decrease caused a down-tide in term deposits and inspired the Czech households to boldness in borrowing money. The increase in the value of long-term loans was helped by relaxed conditions for provision of mortgage loans as well as favourable interest rates in the years of the economic boom. Together with the growing prices of real property due to the high demand for new and old apartments, this led to a year-to-year net increase in the loan liabilities by 71.6% in 2007. The economic crisis understandably caused a lower demand for loans, especially long-term ones. Annual net increments of indebtedness²³ in the form of loans for the households sector are shown in Figure 7.²⁴

Figure 7 Net change in the liabilities in the form of loans (mil. CZK, current prices)



Source: www.czso.cz

Viewing the financial transaction data from the viewpoint of sub-sectors, we have to observe that consumers represent the subject dominant for both assets and liabilities. This observation is valid for both currency and deposits on the one hand, and net purchase of securities²⁵ and loans on the other hand. Figures 6 and 7 hence substantially reflect the economic behaviour of consumers. For loans we can, however, observe a certain difference between the sub-sectors: entrepreneurs tried to reduce their indebtedness, while consumers still borrowed more than they repaid; this was specifically true for long-term loans.

²³ It is a net increment, i.e., a difference between the obtained loans and instalments paid on them.

²⁴ Similar to the net change of liabilities in the form of shares and other equities and securities, these two periods of crises are not mutually comparable due to principally different conditions from the viewpoint of loans (in the 1990s the circumstances were marked by a non-existent or very limited offer of mortgage loans, high interest rates, and worries about the future).

²⁵ For example, net purchase of securities by consumers amounted to 28.2 bln. CZK in 2011, while for entrepreneurs this value was only 20 mil. CZK.

5 EQUITY AND INDEBTEDNESS AND THEIR CHANGES FOR HOUSEHOLDS

On the one hand, economic growth leads households to an effort to invest money into financial and non-financial assets; on the other hand it inspires them to “boldness to get into debt”. Hence it is a natural phenomenon that when expenditure incurred on consumption and investments was growing, so likewise was the volume of both short- and long-term loans, as well as the overall indebtedness of households. On the other hand, the amounts invested by households into shares, equities and other securities were also growing. Their overall net financial equity was growing, but slower than their liabilities.

Household expenditures on consumption grew 3.2-times in the period from 1993 to 2011, while investments into housing grew three times. This growth of consumption and investments together with a massive support to consumer loans and, later, mortgage loans and the stable economic situation after 2000 led to an unprecedented growth in the annual volume of loans received and the growing indebtedness of households in the form of loans. Data in Table 6 speaks about the changes brought about to the structure of assets and liabilities due to the focus of Czech households on consumption and investments. Interest in houses and apartments owned by their users and the growing prices of real property, led to an 8.5 percentage-point increase in the proportion of owner-occupied houses and apartments.

Regarding financial assets, we can say that the Czech households gradually increased their proportion in the financial assets in the national economy as a whole in favour of deposits and securities; conversely (as already referred to above) their demand for investments into shares and other equities was going down.

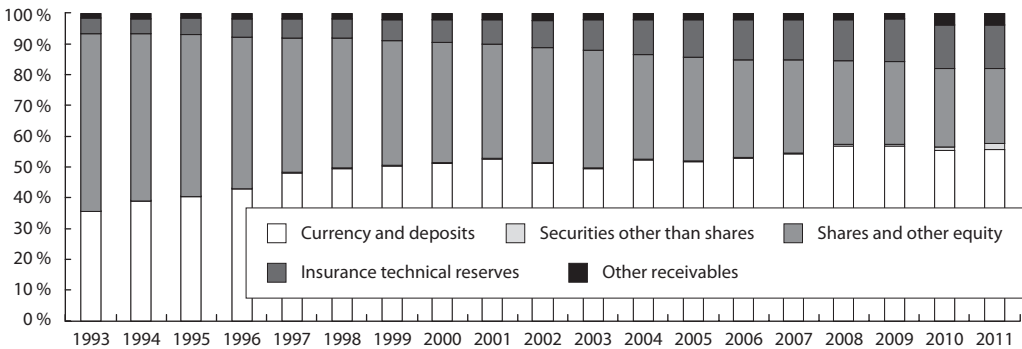
Table 6 Proportions of households' assets and liabilities in the national-economy values of the same indices (%)

	2000	2007	2011
Non-financial assets	21.1	22.1	22.8
– dwellings	72.9	78.3	81.4
– other building and structures	1.3	1.7	1.8
– machinery and equipment	8.7	7.6	7.9
Financial assets	19.8	20.6	22.4
– currency and deposits	36.9	44.0	46.9
– securities other than shares	0.8	0.4	3.0
– shares and other equity	40.2	27.2	26.8
– insurance technical reserves	88.8	84.8	86.3
Total assets	20.6	21.5	22.6
Liabilities	2.7	6.0	7.2
– loans	9.3	31.1	36.3
Net worth	33.7	35.7	37.3

Source: www.czso.cz

The main components of households' financial assets are currency and deposits, which make up more than one-half of such financial assets. The situation before 1998, when shares and equities prevailed, had been caused by the voucher privatisation (cf. the note at Figures 6 and 3), and a relatively small amount of saving at the beginning stages of the economic transformation. Figure 8 shows the structure of households' financial equity in the relevant period.

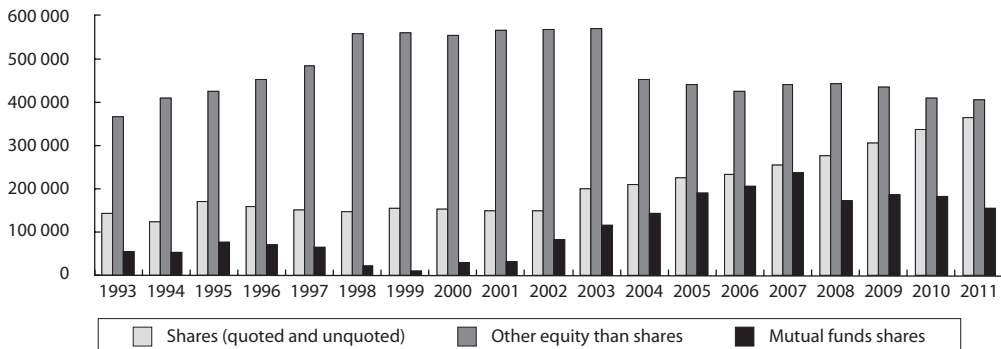
Figure 8 Structure of households' financial assets (as of the end of the year)



Source: www.czso.cz

The proportion of shares and other equities in the financial assets of households was going down but the volume of the households' financial assets tied up in shares and other equities was growing for the entire relevant period with moderate drops in years 2004, 2008, and 2011 (the overall increase in 2011 as compared with 1993 was 63.6%, achieving a value of 926 bln. CZK). This observation covers a very uneven development of this financial asset item owned by households. The time evolution of households' assets tied up in shares (both quoted and unquoted) was growing until 2003 (peaking for the 1990s in 1995, with subsequent decrease); assets tied in equity other than shares and in mutual fund shares was continually growing until 2003; then a decrease came and continued until 2011, in which the level was at 71% of the value of 2003. The value of assets tied up in mutual fund shares went sharply down after 1995, with the bottom in 1999 (with 11.2 bln. CZK) and the subsequent top in 2007 (at 238 bln. CZK). The evolution in the crisis after 2007 meant a substantial decrease in the proportion of the value in mutual fund shares as compared with regular shares (this decrease was by 34.5% in 2011 against 2007). The fastest growing item of the households' financial assets was given by saving with insurance companies and pension funds: this value grew more than 11 times in the relevant period, achieving 542 bln. CZK (as the net equity of households in life insurance reserves and in pension funds reserves). The overall increase of the financial assets owned by households was nearly four times in the period from 1993 to 2011 (doubled as compared with 2000, mainly thanks to the growth in currency and deposits) with more than 3,823 bln. CZK at the end of 2011.

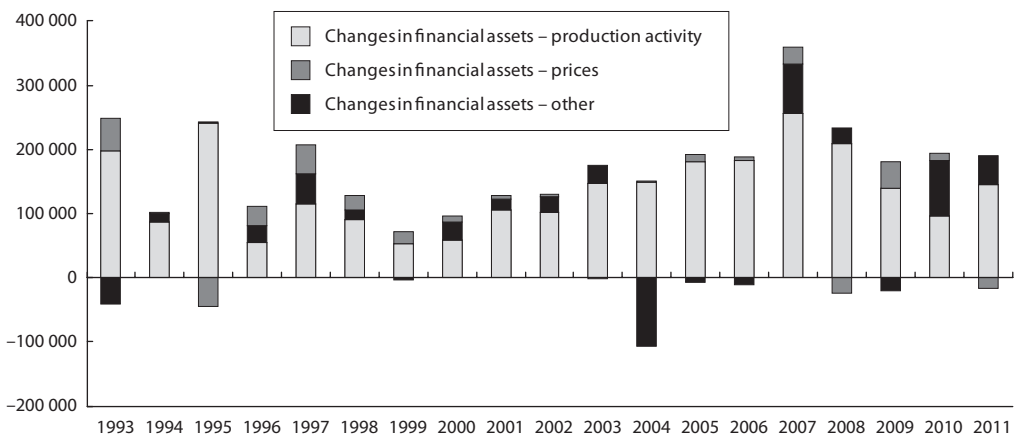
Figure 9 Time evolution of assets tied up in shares and other equities as of the end of the year (mil. CZK, current prices)



Source: www.czso.cz

We can consider the households' financial asset values (in an analogy to non-financial assets) as a compound of several components: that implied by economic production (marked as "Changes in financial assets – production" in Figure 10 and taken over from the financial account); that implied by the price evolution (in Figure 10 marked as "Changes in financial assets – prices", taken over from the revaluation account); and that caused by random and formal changes ("Changes in financial assets – other" in Figure 10 and taken over from the account of other changes in the asset values). The data in Figure 10 demonstrate that, in the years of economic boom, those factors of the asset growth prevail which are generated by economic activities;²⁶ conversely, in the years of crises factors not immediately related to economic activities have a larger influence (in other words, households get poorer or richer regardless of their economic activities). This is implied not only by changing prices (of shares and other securities), but also random and extraordinary effects – loss of property, forfeitures, etc.

Figure 10 Breakdown of the total change in financial asset value (mil. CZK, current prices)



Source: www.czso.cz

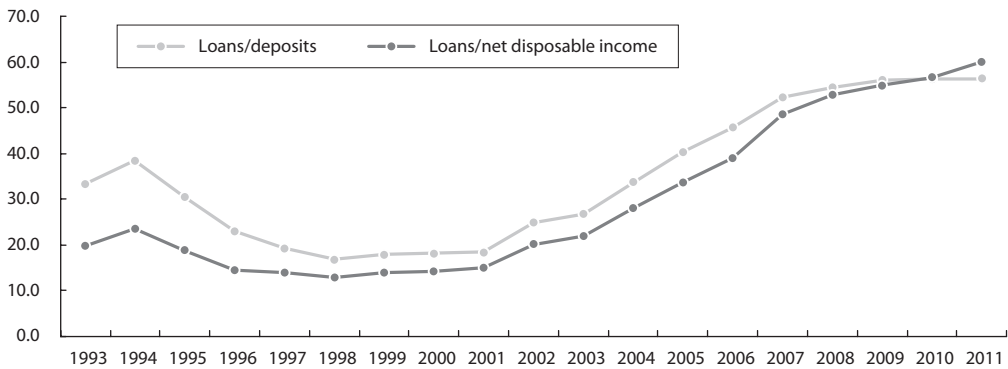
The proportion of households' indebtedness in the form of loans in the same item of the national economy as a whole grew from less than one-tenth in 2000 to more than one-third, despite the "traditional" high level of indebtedness of the Czech non-financial corporations (cf. Table 6). The higher proportion of households in the net worth of the national economy is mainly caused by a decrease of the said proportion for the general government (from 38.0% in 2000 to 30.0% in 2011).

Financial liabilities of households went up 7.3-times from 1993 (five times with respect to 2000) and the fastest growing component was that of loans. The net financial worth of households thus grew 1.5-times (as compared with 2000), and its value as of the end of 2011 amounted to 2,494 bln. CZK. The data in Figure 11 demonstrates a sharp increase of the indebtedness of households; in comparison with 2000, the proportion of loans in the total value of indebtedness grew more than four times, and that of deposits three times. Years of economic booms are accompanied by even dangerously high rates of households' indebtedness – from 2002 to 2007 the indebtedness in the form of loans grew by 36% a year on average. The signs of the economic crisis slowed down the willingness of households to accept new debts. The proportion of loans in deposits was at a standstill, proportion of loans in the net disposable income was growing due to

²⁶ In this context we must exclude from our evaluation the years 1993 and 1995, in which households obtained shares within the framework of the voucher privatisation – cf. the notes at Figure 6 and 3.

the slowdown of the net disposable income's growth from 2008 to 2010, and decrease of the latter in 2011. Although the crisis period slowed down the growth of indebtedness, the indebtedness in the form of loans (especially long-term ones) grew faster than the equity in the form of deposits. The indebtedness in the form of loans grew faster also than the disposable income, which is the resource of means to be incurred on final consumption. The data in Figure 11 shows the relative indices for indebtedness.

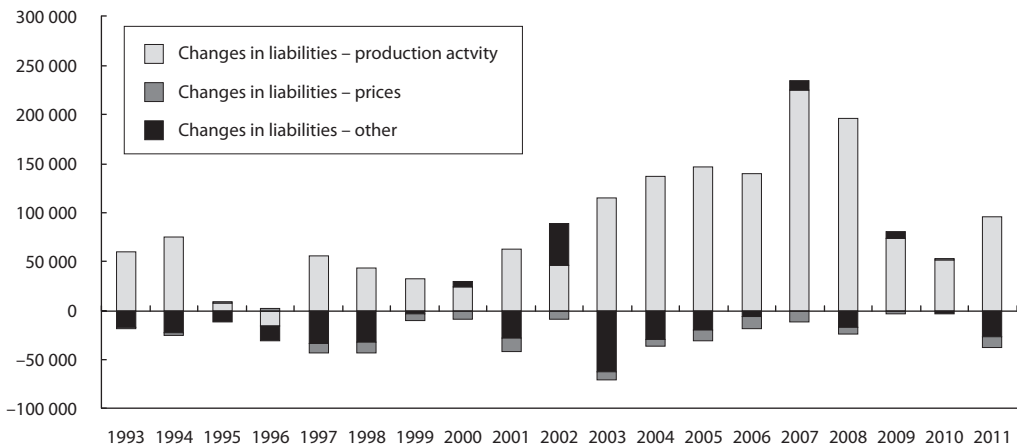
Figure 11 Rates of indebtedness of Czech households (%)



Source: www.czso.cz, our own calculations

Similar to financial assets, we can break down the financial liabilities into three components: that implied by economic production (marked as “Changes in liabilities – production” in Figure 12 and taken over from the financial account); that implied by the price evolution (in Figure 12 marked as “Changes in liabilities – prices”, taken over from the revaluation account); and that caused by random and formal changes (“Changes in liabilities – other” in Figure 12 and taken over from the account of other changes in the liability values).

Figure 12 Breakdown of the total change in the liabilities value (mil. CZK, current prices)



Source: www.czso.cz, our own calculations

This breakdown of the total increment of the liability value shows that the principal influence on the growing indebtedness of households was implied by the necessity to provide financial resources on economic activities (for households this means especially consumption and investments into housing); other factors (price variations, and random and formal changes) have rather positive effects of helping the liability values go down. It also indicates (in a way analogous to non-financial assets illustrated in Figure 5) that households' behaviour was different in both boom and crisis periods. High interest rates on loans, low saving of households depreciated by a significant growth of prices, and overall uncertainty about the future development of the Czech economy in the 1990s were factors that limited willingness of households to accept new debts. As an apparent paradox, this fact was most distinctive in the years of fast growth (1995 and 1996; compare Figure 5 with Figure 12). It was undoubtedly the instability of the banking sector that caused this very cautious behaviour of households.²⁷ The boom years from 2003 to 2007 conversely brought a massive growth of households' indebtedness, caused by demand for real property. In the crisis years of 1997 and 1998, demand for loans and real property grew, but in 2009 the households responded by an immediate drop of demand for (in particular) loans even though the prices of real property came to a standstill. The response to the coming economic and financial crisis was practically instantaneous in 2009, similar to the situation concerning financial and non-financial assets owned by households.

CONCLUSIONS

Economic behaviour of households is rather strongly affected by phases of the economic cycle. Years of booms bring about boldness of households in consumption and investments, supported by their willingness to accept new debts. The coming crisis causes a quick response by households, with decreasing demand for loans on the one hand and risky financial assets on the other hand. Response in consumption was, however, delayed and occurred after a time lag of about two to three years.

Since 1990, Czech households have been subject to two crises, each of which had different causes and resulted in different effects on the economic behaviour of those households. The reasons for the crisis in 1997 and 1998 were internal; namely, hasty economic transformation and problematical voucher privatisation, inconsistent restructuring of industry, severely restrictive anti-inflation policy of the central bank, and instability of the banking sector. From the viewpoint of the householders, the crisis came somewhat unexpectedly when they were in a quite unfavourable economic situation (their saving were deteriorated by a high inflation rate and the values of their financial and non-financial assets were low) and their economic activity had been attenuated (householders were worried about the future and the interest rates on loans were high; hence the households tried to reduce their indebtedness and – with a non-existent capital market – saved their financial means on bank deposits; moreover, they were getting rid of shares obtained within the voucher privatisation). All these circumstances led to a quick response: households lowered their financial and non-financial investments as well as consumption (a year-to-year drop in the final consumption expenditure by households occurred already in 1998).

The crash of the economic boom of the Czech economy in 2009 was caused by the financial and economic crisis “imported” from the developed world. The Czech economy as a whole, in that number the households, “had time” to make preparations. The high rates of economic growth before 2009, growing living standard, easy access to long-term loans on housing, and a wide offer of short-term loans were factors contributing to expansive economic behaviour of households – the final consumption expenditure was growing at the same (and in some years an even higher) rate as the disposable income (consequently

²⁷ In the years 1995 and 1996, five banks were placed into receivership, four of them lost their banking licences, and bankruptcy proceedings were pending for two banks, out of the total number of 53 banks as of the end of 1996. Cf. Bank supervision in the Czech Republic in 1996. CNB 1997.

households' saving rate was very low), indebtedness was growing by one-third every year, and households did not hesitate to invest into risky financial assets (shares and other equities).

When the symptoms of the economic crisis coming from abroad became apparent, the Czech households responded by lowering their debts as early as in 2008, which led to a slowdown of the indebtedness rate, sale of shares and other equities, focus on securities, and lowering of investments into real property. In the area of non-financial and financial investments and liabilities, the response of the Czech households was also very quick. The whole period of 2009 through 2011 was marked with a cautious approach to debts and risky financial investments (but in the area of non-financial investments the households responded positively to the indication of recovery in 2010, although this value went down again in 2011 due to the prevailing recession). The households were less interested in real property and invested free financial means mainly into securities and deposits.

The response in the area of consumption was "classically" delayed in comparison with the 1990s. In 2009, the final consumption expenditure by households stopped and in 2010 and 2011 it grew moderately. A real drop in the final consumption expenditure by households came as late as 2012, i.e., three years after the drop in GDP. In 2009, the first substantial changes occurred (after a long period) in the structure of disposable income (with a decrease in the proportion of wages and salaries, as well as mixed income, paid current taxes, and an increase in the balance of social income).

The analysis carried out showed that if an economic crisis is coming slowly (which is the usual situation) the households respond more or less instantaneously by caution in the area of investments and debts; self-imposed restrictions on consumption come with a time lag, that is, only after households feel the impact of all negative economic factors, such as the prevailing unemployment rate and standstill or falling wages, and the households do not see a solution. These conclusions imply certain recommendations for the economic policy. The households' willingness to at least keep their consumption on the existing level can obviously be supported by strengthening the atmosphere of trust in the economy and the entire society. Households are willing to invest their free financial means accumulated after the years of boom into non-risky financial assets, especially securities issued by the government.

References

- CZESANY, S. Monitoring and analysis of the economic cycle (In Czech: Monitorování a analýza hospodářského cyklu). *Politická ekonomie*, 2002, Vol. 50, No. 2, pp. 184–207. ISSN 0032-3233.
- Households in the Czech Republic: income, consumption, saving and debts, 1993 through 2012 (In Czech: Domácnosti v ČR: příjmy, spotřeba, úspory a dluhy 1993–2012). Prague: Czech Statistical Office, 2013.
- HÁJEK, M. Economic growth in the Czech Republic and new member states of the EU in the period 1995 through 2006 (In Czech: Ekonomický růst v České republice a nových členských zemích Evropské unie v období 1995–2006). *Politická ekonomie*, 2008, Vol. 56, No. 4, pp. 435–448. ISSN 0032-3233.
- HINDLS, R., HRONOVÁ, S. Reflection of the economic developments in selected countries in the structure of final consumption expenditure (In Czech: Odras ekonomického vývoje vybraných zemí ve struktuře výdajů na konečnou spotřebu). *Politická ekonomie* 2012, Vol. 60, No. 4, pp. 425–442. ISSN 0032-3233.
- HRONOVÁ, S., HINDLS, R. Economic behaviour of the households sector in the Czech Republic – consumption and indebtedness (In Czech: Ekonomické chování sektoru domácností ČR – spotřeba a zadluženost). *Statistika*, 2008, Vol. 88, No. 3, pp. 189–204. ISSN 0322-788X.
- HRONOVÁ, S., HINDLS, R. Economic Crises in the Results of the Non-Financial Corporations Sector in the Czech Republic. *Statistika*, 2012, Vol. 90, No. 3, pp. 4–19. ISSN 0322-788X.

- HRONOVÁ, S., FISCHER, J., HINDLS, R., SIXTA, J. System of national accounts – a tool for describing the global economy (In Czech: Národní účetnictví – nástroj popisu globální ekonomiky). 1st edition. Prague: C. H. Beck, 2009. ISBN 978-80-7400-153-6.
- JANÁČEK, K. Strange behaviour of consumption during the transformation (In Czech: Podivné chování spotřeby v průběhu transformace). *Politická ekonomie*, 1999, Vol. 47, No. 5, pp. 579–586. ISSN 0032-3233.
- SPĚVÁČEK, V. Growth and stability of the Czech economy in the years 2001 through 2011 (In Czech: Růst a stabilita české ekonomiky v letech 2001–2011). *Politická ekonomie*, 2013, Vol. 61, No. 1, pp. 24–46. ISSN 0032-3233.
- SINGER, M. A Comparison of the Rates of Growth of Post-Transformation Economies: What Can(Not) Be Expected From GDP? *Prague Economic Papers*, 2013, Vol. 12, No. 1, pp. 3–27. ISSN 1210-0455.

Regional GDP Compilation: Production, Income and Expenditure Approach¹

Jaroslav Kahoun² | *Czech Statistical Office, Prague, Czech Republic*

Jaroslav Sixta³ | *University of Economics in Prague, Czech Republic*

Abstract

Regional gross domestic product (GDP) per capita is one of the key indicators describing the level of regional economic disparities in individual countries. Besides it is used for international comparison as indicator for distribution of structural funds in the European Union. The aim of this article is to analyse possible methods of regional allocation of GDP on the basis of existing rules within the EU and in the Czech Republic. The scale of rules allows application of different methods and offers more varieties of conceptual approaches to regional allocation of GDP. First of all either income or production method is used exclusively for each industry in different countries differently, depending on data availability. Subsequently, possibility of expenditure approach is added. In cases of all methods there exist weaknesses, e.g. regional distribution of revenues or operating surpluses in cases of multi-regional companies and different methods of allocation mean a distinct regional view of overall economic performance.

Keywords

Regional accounts, regional GDP, gross value added

JEL code

E01, R11, R12

INTRODUCTION

Regional gross domestic product per capita is the most commonly used indicator for the comparison of regional disparities in economic performance. Analysis of regional disparities with particular emphasis on the specifics in differences between GDP and disposable income of households and their evaluation of development in time were made in some earlier studies (see e.g. Kahoun, 2010 or Chlad, Kahoun, 2011). Presented paper is aimed more at methodological issues in definition of regional GDP rather than comparing it with other indicators or its limited representativeness. It is aimed mainly at the methods of calculation of regional GDP, existing and conceptual approaches to regional GDP based on regional accounts experience in the Czech Republic and the applicable rules within the EU. The starting point for this study is the assumption that the methods of regional allocation of GDP have more varieties of conceptual

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² Czech Statistical Office, Na padesátém 81, 100 82 Prague 10, Czech Republic. E-mail: jaroslav.kahoun@czso.cz.

³ University of Economics, Nám. W. Churchilla 4, 130 67 Prague, Czech Republic. Author is also working at the Czech Statistical Office. E-mail: jaroslav.sixta@czso.cz.

approaches (mainly in regionalization of income and production items of gross value added) that can be used in different countries differently but can also in the same country offer a distinct regional view of overall economic performance. In the first two parts the general procedures used in the compilation of regional GDP and other indicators of regional accounts are briefly described together with description of current methodology of GVA allocation in the Czech Republic. There are definitions of individual methods used to regionalization of GVA: bottom-up, pseudo-bottom-up, top-down and mixed method. Main part of the article is aimed at analysis of income approach of regional allocation of GVA and at conceptual problems in regional allocation of operating surpluses in cases of multi-regional companies. Experimental regional calculation of all items of income approach for the Czech Republic is then presented in this article together with analysis of regional importance of operating surplus, compensation of employees and consumption of fixed capital. It is supplemented in final part of the article by description of possible regional allocation of GDP by expenditure method (mainly household final consumption).

1 GENERAL RULES FOR ALLOCATION OF REGIONAL GDP

For the calculation of macroeconomic indicators at the regional level there are not sufficient data for institutional units (legal entities), which are normally used in the compilation of national accounts. The information for individual local units is needed (respectively for separate units of enterprises). Since the data for local units are often not available, the statistics of regional accounts use some specific approaches for regional allocation of GDP (see Chlad, 2008). Methods of regionalization of national accounts indicators which are allowed in standard ESA 1995 (European System of Accounts) are the following:

- *bottom-up method* – is based on the necessary information about local units which are resident in the region (e.g. indicators of output and intermediate consumption for the calculation of GVA), the calculation procedure then follows the procedure used in the national accounts;
- *top-down method* – is based on the aggregates of national accounts data that are divided via the keys which are closely related to indicators measured (e.g. value added based on the structure of compensation of employees);
- *pseudo-bottom-up method* – aggregates are formed as an estimate for the local units from the institutional unit level or activity unit level (similar to top-down method but applied from the lowest level);
- *pseudo-top-down method* – the national data is allocated to regions according to the relative but not too closely related indicators;
- *mixed method* – it is a combination of several approaches and is common practice in most of EU countries.

For estimates of regional gross domestic product there is theoretically possible to apply three basic approaches as well as at the national level: production approach, income approach and expenditure approach (see ESA 1995).

Production approach measures the regional gross domestic product at market prices as the sum of gross value added at basic prices and taxes on products without the subsidies. Gross value added at basic prices is calculated as the difference between output at basic prices and intermediate consumption at purchase prices. Indicators of sales, activation and expenses are in the Czech Republic and very often also in other countries available only for the institutional units as a whole. On the other hand, almost no problem means breakdown of intermediate consumption because the costs of each activity and the local unit are usually well known. Major complication can arise with determination of the value of production of some local units. An important limitation of the multi-regional organizations is the problematic valuation of output per local unit in a typical case when the administrative unit of the company is located in one region and the entire manufacturing business activity is located in other region (problem of regional allocation of common sales).

Table 1 Regional GDP compilation by the production approach

Regional GDP by the production approach	Process of regionalization	Weaknesses
= Regional production	Regional information about sales of products and services, sales of goods for resale minus costs of goods sold, changes in inventory of own production and production for own final use	The problem is the valuation of production for the local unit in a multi-regional organizations (e.g. corporate headquarters, local units performing only administrative activity)
- Regional intermediate consumption	Regional information on material consumption, energy consumption and expenses for services incurred in making production	Usually not
+ Regional net taxes on products (not available by industries)	The usual procedure is the regionalization in the proportion of total regional GVA	Usually not

Source: Own construction

Income approach determines the regional gross domestic product at market prices through aggregation of variables in the generation of income account – compensation of employees, gross operating surplus and taxes on production and imports (without subsidies) in the regional breakdown. Information regarding employment and compensation of employees by industry is often available at regional level. This information is used for estimation of gross value added by industry either directly by income method or through the production approach. The information on gross operating surplus (including mixed income) appears to be the greatest weakness of the regional allocation of GDP by income approach. Gross operating surplus is generally not available broken down by region. Information on gross operating surplus of market producers can be derived from business surveys but usually it is not done even at national level in national accounts. Breakdown by institutional sectors and regions is usually not available in most of countries in the EU. This indicator complicates the use of the income approach for estimation of the regional gross domestic product.

Taxes on production and imports (excluding subsidies) consist of *taxes on products* (excluding subsidies) and *other taxes on production* (excluding subsidies). An allocation of taxes on products (excluding subsidies) is subject to a uniform methodology of the ESA which allows allocation of the regional structure in proportion of total regional gross value added. For other taxes on production (excluding the subsidy) data may be theoretically available by industry from business surveys or surveys based on a kind of tax or subsidy in detailed breakdown. These data may be the key for the allocation into regions or if not available the allocation can be done in the proportion of total regional GVA.

The expenditure approach is not commonly used for measurement of the regional gross domestic product in the EU countries due to the lack of information. Example of the lack of direct information is the intra-regional breakdown of exports and imports and final consumption is also disputable in terms of availability of regional data. To-date, official statistical authorities in the EU countries refused to do it with respect to the costs.

Actually, the problem of regional expenditures may be solved even with existing data sources. The key difficulties lie in the subjective and model based approaches that have to be used. It is very crucially connected with the responsible and qualified work with a lot of different data sources usually providing different results.

Table 2 Regional GDP compilation by the income approach

Regional GDP by the income approach	Process of regionalization	Weaknesses
= Regional compensation of employees paid by resident local units	Information is typically available in a breakdown by the local units and regions	Usually not
+ Regional operating surplus and mixed income, net	Auxiliary keys for regionalization (in the structure of related indicators)	Represents the biggest problem of the income approach – the issue of recording of operating surpluses in the headquarters of the companies / local units
+ Regional consumption of fixed capital	Information can be theoretically treated by local units and regions	In many countries there are no data in the regional breakdown
+ Net taxes on production and imports (taxes less subsidies)	Information can be theoretically treated or allocated in the proportion of total regional GVA	In most of countries there are no data in the regional breakdown

Source: Own construction

Table 3 Regional GDP compilation by the expenditure approach

Regional GDP by expenditure approach	Process of regionalization	Weaknesses
= Regional final consumption of households	Information from surveys in households, alternatively information from administrative sources	In many countries there are no data in the regional breakdown (the problem of representativeness of the samples)
+ Regional government expenditure	Information from administrative sources	In many countries there are no data in the relevant regional division
+ Gross capital formation (investment plus change in inventories)	The information is usually available or can be broken down by local units and regions	Need to estimate regional changes in inventories
+ Regional net exports	Information on intra-regional imports and exports	It constitutes the largest problem of the expenditure approach – the main reason why the EU countries do not use this approach

Source: Own construction

2 CALCULATION OF THE REGIONAL GVA AND GDP⁴ IN THE CZECH REPUBLIC (PRODUCTION APPROACH)

Calculation of regional gross value added in the Czech Republic is made on basis of production approach for sectors of non-financial corporations and enterprises in the sector of households (see Kahoun, 2009). Regional indicators of output and intermediate consumption are derived from the same data sources used to calculation at the national level. The calculation is broken down in the details of two-digit NACE level and a special approach of regionalization is applied to some methodological adjustments of national accounts: imputed rent, consumption of fixed capital in government sector (especially roads, highways, local roads and rail routes) and also for individual household construction and part of the illegal activities.

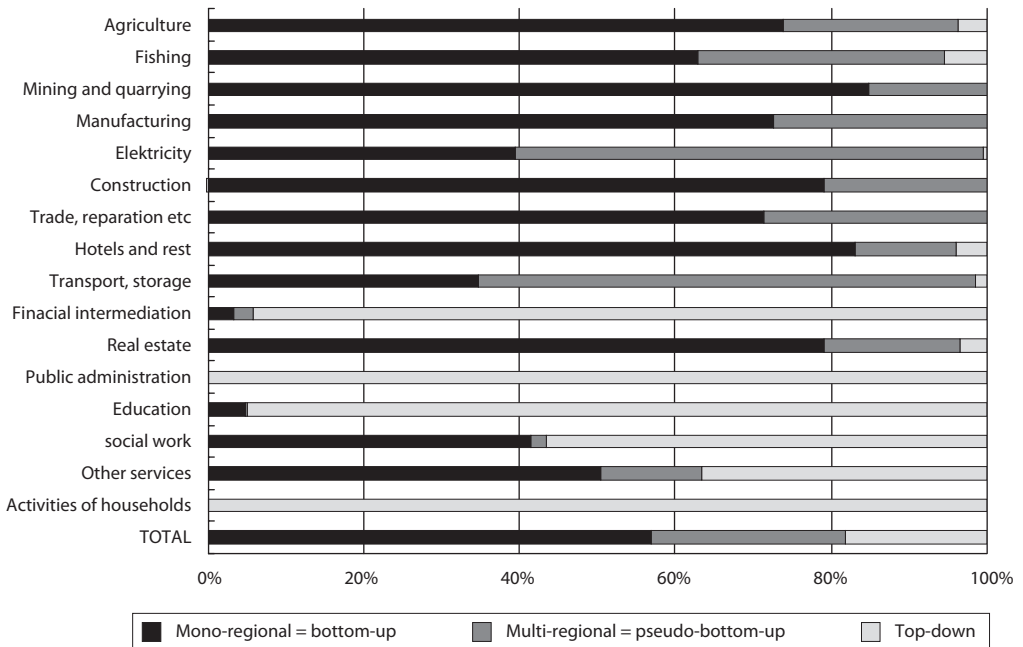
The prevailing approach for the production method is the pseudo-bottom-up process of regionalization. This procedure is based on estimates of activity data for the local unit by scheduling data for individual companies. This is similar to top-down method but not on the national level but on aggregated data for a single multi-regional institutional unit. The obtained data are then aggregated to get regional total sum in the same way as in the classical bottom-up method.

The method of pseudo-bottom-up is used for gross value added of major institutional sectors: non-financial enterprises (S.11) and households (S.14). The allocation of regional gross value added for other organizations (financial institutions, government institutions and non-profit institutions – S.12, S.13 and S.15) is done on basis of wages and salaries broken down by types of survey and required industry-regional breakdown. The structure of the wages and salaries is used as the key for top-down method of regional allocation of the remaining recorded gross value added in the national accounts (more specifically the value before methodological and other adjustments made in the final compilation of national accounts). Net top-down method based only on wages and salaries in this way is applied on 13.3 % of total national GVA in 2011.

After summarization of all the regional observed values there exists still more than one tenth of the gross value added from national accounts that remains not distributed. It is a part of the methodological adjustments of national accounts (excluding imputed rent and consumption of fixed capital for the government sector) and adjustments for exhaustiveness of the economy – includes the deliberate misrepresentation, underground economy, majority of illegal economy, units not subject to identification, etc. These data are regionally allocated according to the structure of total official regional gross value added in each sector. These estimates are mostly done at the national level without the possibility of the currently available and quality regional data. Estimates even at a national level are lacking a high degree of data accuracy. Ratios of bottom-up, pseudo-bottom-up and top-down methods of regional allocation of GVA before adjustment to National Accounts values (above mentioned) are presented in Figure 1.

Across industries there are noticeable differences in approaches to regional allocation of GVA (see Figure 1) which is caused by different approaches to the institutional sectors and different shares of institutional sectors in each industry (top-down method is used for government, financial institutions and non-profit institutions sectors and bottom-up is used for sectors of non-financial enterprises and households). While in the manufacturing, mining or energy industry almost exclusively bottom-up method is used (as well as in trade and construction), in industry of public administration and industry of financial intermediation almost exclusively top-down method is used. In total for the reference year 2006, around 49 per cent of GVA was regionalised by pure bottom-up method, almost 22 per cent by pure pseudo-bottom-up method, 9 per cent of total GVA falls on industry structure (grossing-up to National Accounts, ideal brake-force distribution for each region) and 21 per cent of total GVA (the rest) was estimated according to top-down methods.

⁴ Regional structures of GDP and GVA are the same. The difference between GDP and GVA (i.e. net taxes and subsidies on products) is allocated proportionally to the total GVA. Therefore, this chapter deals only with compilation of regional GVA.

Figure 1 Regionalisation methods of GVA according to industries in % (NACE Rev. 1)

Note: Percentage shows ratios of methods of regionalisation on total values of GVA before methodological adjustments and adjustments to National Accounts values.

Source: Czech Statistical Office, Regional GVA Inventory 2009 <http://apl.czso.cz/pll/rocnka/rocnka.indexnu_reg>

3 REGIONAL GVA AND GDP⁵ BY INCOME APPROACH

As it was already mentioned above, the calculation of regional GVA in the Czech Republic is carried out in the prevailing production method. The regional GVA of local units of multi-regional organizations (the organizations with activity in multiple regions) is based on the structure of the total wages and salaries paid by these organizations in various regions. The production method of calculation is therefore influenced by a key indicator of income method, i.e. compensation of employees. This mix of approaches is relatively consistent because compensation of employees constitutes the largest share of gross value added and they are easily detectable by the regions while the best quality identifiable data from Structural Business Survey are indicators characterizing the production method, respectively production and intermediate consumption (but not for local units). In regional accounts it is therefore necessary to find the key for the allocation of GVA for multi-regional organizations – those are the structures of wages and salaries.

An alternative approach would be to calculate the regional gross value added directly by the income approach but excluding compensation of employees it would be necessary to work with information about regional consumption of fixed capital and especially with regional operating surplus which is another important pillar of the income measurement of gross value added.

The following experimental calculation of income components of regional gross value added is made on the example of data from regional accounts of the Czech Republic for the year 2011. Assuming that the balance of production and income approaches must be balanced, *the operating surplus and mixed*

⁵ Regional structures of GDP and GVA are the same. Therefore, this chapter deals only with compilation of regional GVA.

income is equal to the difference between the total GVA established by production method and the remaining components of the income approach (compensation of employees, consumption of fixed capital and net other taxes on production and imports).

Formula for regional calculation of operating surplus and mixed income:

$$B.2n + B.3n = B.1g - D.1 - K.1 - (D.29 - D.39),$$

where:

B.2n + B.3n – regional net operating surplus and mixed income,

B.1g – regional gross value added established by production method,

D.1 – compensation of employees paid by regional resident local units,

K.1 – regional consumption of fixed capital,

D.29 – D.39 – regional net other taxes on production and imports (taxes less subsidies).

While the regional gross added value is known from regional accounts as well as compensation of employees (their regional structures make part of the obligatory data in EUROSTAT transmission programme from EU member states), there is necessary to estimate regional consumption of fixed capital and regional net taxes on production and imports.

Consumption of fixed capital (CFC) based on local units (or in regional breakdown) is not directly measured in the Czech Republic and its regional values are practically not available with current data sources. Because of these reasons it is necessary to find the appropriate key for the regional distribution of national values by top-down method (for details of methodology of CFC calculation at national level see Sixta, 2007). The traditional available statistical indicator of regional accounts is gross fixed capital formation (GFCF) – for its regionalization Czech statistics uses traditional data on regional acquisitions of tangible and intangible assets in structural business survey.

In the years 2002–2004 also a specific section on total fixed assets by region existed in the structural business survey. Fixed assets data from 2004 and their regular update on newly acquired assets and depreciation of assets until 2011 can therefore serve as the basis for the experimental calculation in this article (depreciated can be only these assets that were acquired in the past and the regional structure of total fixed assets should be very close to the regional structure of the estimated indicator). Resulted values of regional fixed assets in 2011 are therefore used as weights for the regional distribution of consumption of fixed capital from national accounts for 2011. Moreover, there was made the comparison of the regional structure of total fixed assets based on methods mentioned above with the total cumulative regional values of investments from 1993 to 2008 for which data are available in surveys (it was based on the assumption that the regional structure of consumption of fixed capital is very close to the regional structures of historical accumulated values of assets acquired or sum of GFCF) and the results indicated very similar regional structures in case of both aggregates.

Special approach is applied on CFC for dwellings where the key for distribution is estimated from the value of dwellings as a result of regional price per m² multiplied by regional area of flats in 2001 Census with updating of data on new housing construction and depreciation until 2011. Special approach is applied also on CFC for roads, highways, local roads and railways based on length of different types of routes in the regions.

Another relatively small item that has to be estimated by top-down method is *net other taxes on production* that are directly part of GVA (*D.29 – D.39*). In this case we can choose an equivalent procedure that is recommended by EUROSTAT for the production method in case of net taxes on products (*D.21 – D.31*). This recommendation allows the regional allocation of net taxes on products in the structure of the total gross value added in the regions (the shares of regional gross value added on the total national values). This procedure is allowed due to the fact that in the most countries regional data on taxes on

products is usually not available and in the case of taxes on production and imports it is usually the same in most countries (as well as in the Czech Republic). However, regional allocation of net other taxes on production is done for each sector separately and, therefore, the resulting regional structure offers a different view in comparison with total GVA (due to the importance of subsidies in each sector – the largest part of subsidies is concentrated in the agricultural sector what significantly reduce the share of the capital of Prague in comparison with other regions).

The remaining value to a total gross value added is *net operating surplus* (including mixed income). Table 4 shows the absolute amount of individual income components of gross value added in the regions NUTS 3 in the Czech Republic based on above mentioned experimental methodology (the regional structure in percentage is then showed in Table 5 in Chapter 3.1).

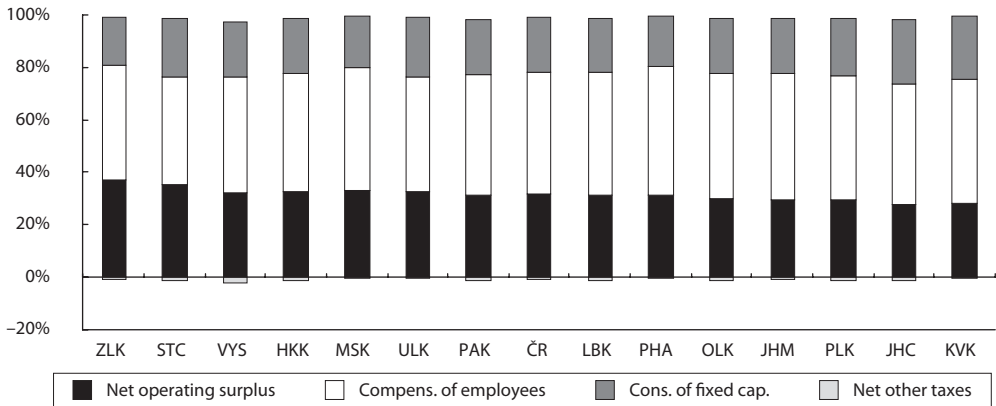
Table 4 The estimated values of the income components of the regional gross value added in million CZK, year 2011

Regions of the Czech Republic, year 2011	Compensation of employees D.1	Consumption of fixed capital K.1	Net other taxes D.29 – D.39	GVA B.1g	Net operating surplus B.2n
Česká republika	1 625 776	731 127	-30 244	3 444 465	1 117 806
Hlavní město Praha	421 870	165 884	-2 834	856 706	271 786
Středočeský kraj	157 563	85 768	-4 393	373 662	134 724
Jihočeský kraj	82 794	44 948	-2 434	175 632	50 324
Plzeňský kraj	81 954	37 661	-2 015	168 107	50 507
Karlovarský kraj	34 165	17 074	-305	71 116	20 182
Ústecký kraj	96 270	49 807	-1 226	216 366	71 515
Liberecký kraj	53 151	23 067	-1 381	110 413	35 576
Královéhradecký kraj	72 428	33 972	-1 926	157 382	52 907
Pardubický kraj	65 456	30 168	-2 109	138 484	44 969
Vysočina	64 718	31 275	-3 337	139 874	47 218
Jihomoravský kraj	176 462	76 666	-3 653	357 805	108 331
Olomoucký kraj	79 100	35 113	-1 920	162 035	49 742
Zlínský kraj	72 516	30 516	-1 128	163 939	62 035
Moravskoslezský kraj	167 329	69 207	-1 584	352 944	117 991

Source: Czech Statistical Office, own calculation (experimental)

Figure 2 shows a structure of gross value added broken down by individual components in ranking according to the shares of operating surplus on gross value added in 2011. The results logically indicate relatively higher share of operating surplus in regions with either lower share of compensation of employees or lower share of consumption of fixed capital (Zlínský, Středočeský and Vysočina). Especially historically lower level of wages and salaries can strengthen the share of operating surplus if region is economically successful at present. On the other side historically higher level of wages and salaries can be limitation for operating surplus at present (Praha, Jihomoravský) especially if the region is in phase of economic downturn (Karlovarský).

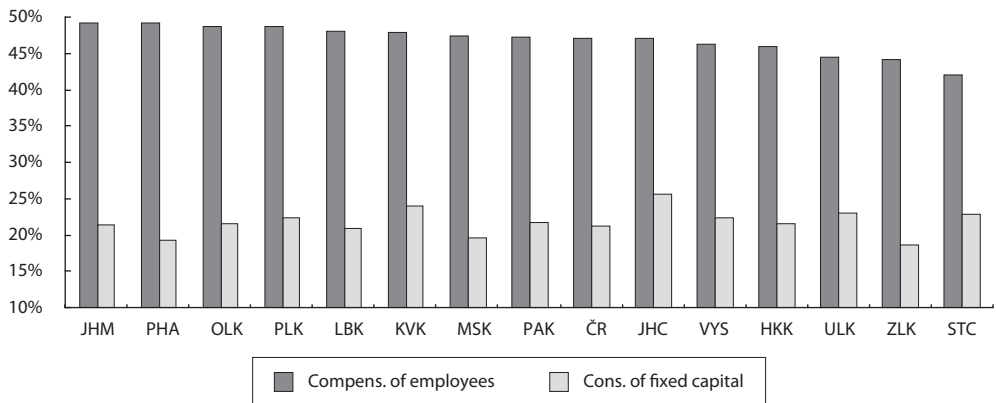
Figure 2 Structure of gross value added in regions – items of the income approach in %, year 2011



Note: Ranking by the estimated share of the operating surplus on GVA.
 Source: Czech Statistical Office, own calculation

Figure 3 shows the regions ranking according to the shares of compensation of employees in the gross value added and in comparison with the proportion of consumption of fixed capital to gross value added (second column). These two factors can be considered as labour and capital parts of GVA as they reflect the influence and involvement of these two factors of productivity in regional GVA (for more about factor productivity at national level, see e. g. Fischer, Sixta, 2009). Ranking of regions in the Figure 3 is, to a certain extent, reverse to the previous Figure 2 since regions with a high share of operating surplus (sort criteria in Figure 2) account often for a smaller share of compensation of employees. The importance of capital over wages can be expected in industrial regions and smaller in regions dominated by services (Přaha). High proportion of consumption of fixed capital is in regions Karlovarský, Ústecký, Jihočeský. The specifically high level of CFC in the region South Bohemia (Jihočeský) reflects the capital adequacy in energy industry (Temelin nuclear power plant) and similar effect plays an important role in the region Vysočina (Dukovany nuclear power plant).

Figure 3 Comparison of the shares of compensation of employees and consumption of fixed capital on regional GVA (“labour” and “capital” part of the gross value added), year 2011



Note: Ranking by the share of compensation of employees on GVA.
 Source: Czech Statistical Office, own calculation

3.1 The problem of regional allocation of the operating surplus

In Table 5 in the last column the regional structure of the net operating surplus is indicated as it is based on the assumption of the balance between income and production method (the result of previous experimental calculation). Production method is, in this case, regarded as decisive for the total amount of gross value added. Nevertheless, in case of production method it is necessary to take into account the fact that the calculation of regional gross value added for multi-regional organization by pseudo-bottom-up method is based on the regional structures of wages and salaries of individual companies (because of limited data sources). This means that remaining items of the income calculation of GDP (above mentioned) are theoretically for multi-regional organization also distributed in the structure of wages and salaries (i.e. including their operating surpluses). This is pretty simplistic and made purely with regard to the absence of the necessary regional data. Moreover the operating surpluses are expected to be more important just in cases of multi-regional organizations (electricity companies, banks, telecommunication operators etc.) and also in technology-intensive regions (see Ženka, Čadil, 2009).

An alternative procedure of calculating of GDP could therefore be the allocation of income components of gross value added separately even with a rough approximation of regional structures of operating surplus, capital consumption and other indicators. The fundamental problem remains in finding a key for regional allocation of operating surplus. It makes the further progress in this direction difficult and, therefore, the calculation of regional GDP by income approach in most countries is not realized or if so, then only in a smaller part of the gross value added.

Table 5 Regional estimated structures of the income components of GDP in % of national GVA, year 2011

Regions of the Czech Republic, year 2011	Compensation of employees D.1	Consumption of fixed capital K.1	Net other taxes D.29-D.39	GVA B.1g	Net operating surplus B.2n
Česká republika	100.0	100.0	100.0	100.0	100.0
Hlavní město Praha	25.9	22.7	9.4	24.9	24.3
Středočeský kraj	9.7	11.7	14.5	10.8	12.1
Jihočeský kraj	5.1	6.1	8.0	5.1	4.5
Plzeňský kraj	5.0	5.2	6.7	4.9	4.5
Karlovarský kraj	2.1	2.3	1.0	2.1	1.8
Ústecký kraj	5.9	6.8	4.1	6.3	6.4
Liberecký kraj	3.3	3.2	4.6	3.2	3.2
Královéhradecký kraj	4.5	4.6	6.4	4.6	4.7
Pardubický kraj	4.0	4.1	7.0	4.0	4.0
Vysočina	4.0	4.3	11.0	4.1	4.2
Jihomoravský kraj	10.9	10.5	12.1	10.4	9.7
Olomoucký kraj	4.9	4.8	6.3	4.7	4.4
Zlínský kraj	4.5	4.2	3.7	4.8	5.5
Moravskoslezský kraj	10.3	9.5	5.2	10.2	10.6

Source: Czech Statistical Office, own calculation (experimental)

4 REGIONAL GDP BY EXPENDITURE APPROACH

Regional expenditure approach should be mainly connected with household consumption and gross fixed capital formation. Government consumption and NPISH consumption expenditures are from the most important part (non-market output) identical with production approach. The only remaining issue is social benefits in kind covering mainly government expenditures on health and social issues. The issue of interregional export and import may be set aside. The key advantage of expenditure method is not computation of GDP but the comparison of domestic final demand with resources (disposable income). Therefore, net export can be obtained as a balancing item between production and expenditure approach. Comparison of ratios of individual components of expenditure approach on regional GDP (final consumption of households, final consumption of government as well as net export) can then provide a completely new and useful view on regional economic disparities and drivers of economic development in the regions.

In case of GFCF the data are normally available for regions NUTS 3 and NUTS 2 in regional accounts published by the Czech Statistical Office. As the most important task it is necessary to find the suitable indicator for regional distribution of household final consumption expenditure (for each group of CZ-COICOP based on annual national accounts data). In cases where regional data are not available from administrative or other data sources, household budget survey can be used as a primary source. "Cash expenditure per capita" are the part of household budget survey for the Czech Republic published by regions NUTS 2 and the distribution of values from the NUTS 2 to NUTS 3 level can be done e. g. by the number of inhabitants in NUTS 3 regions. Demographic and other supporting indicators could be also

Table 6 Regional experimental calculation of household final consumption (HFCE) and disposable income of households (DIH)

Regions of the Czech Republic, 2009	Regional structure of HFCE in %	Regional structure of DIH in %	Regional HFCE per capita in % of national HFCE per capita	Regional DIH per capita in % of national DIH per capita
Česká republika	100.0	100.0	100.0	100.0
Hlavní město Praha	15.5	15.2	130.7	128.3
Středočeský kraj	12.5	12.7	106.1	107.7
Jihočeský kraj	5.7	5.8	93.3	96.1
Plzeňský kraj	5.1	5.3	93.5	98.2
Karlovarský kraj	2.6	2.7	89.8	90.5
Ústecký kraj	7.3	7.2	91.0	89.9
Liberecký kraj	3.8	3.9	91.8	93.5
Královéhradecký kraj	5.0	5.2	94.3	98.5
Pardubický kraj	4.6	4.7	93.7	94.9
Kraj Vysočina	4.5	4.7	91.4	94.9
Jihomoravský kraj	11.2	10.8	102.4	98.5
Olomoucký kraj	5.7	5.6	93.9	92.2
Zlínský kraj	5.4	5.3	95.3	93.8
Moravskoslezský kraj	11.1	10.9	93.1	91.6

Source: HFCE – experimental calculation (see Kramulová, Musil, 2013), DIH – official data of Czech Statistical Office

used in cases where for some groups of CZ-COICOP sufficiently large sample of households do not exist in household budget survey at regional level. The limited reliability of samples in household budget survey is unfortunately the problem in general and it is the complication for using of expenditure method not only at regional level. Social benefits in kind can be regionally allocated predominantly according to the physical or value indicators from the hospitals or value indicators from health insurance companies.

Table 6 shows the comparison of regional household consumption expenditures based on experimental calculation of experts from University of Economics in Prague with regional disposable income. Comparison of regional disposable income and household consumption in household sector leads to the description of living conditions of households. This is far away from qualitative indicators given by e.g. SILC. Analysis of disposable income in relation with consumption should lead to more reliable results. It also shows the potential of the region from the perspectives of savings. In the experimental calculation higher share of region on national disposable income than on consumption (it means higher savings) was reported mostly in the Bohemian regions (Středočeský, Jihočeský, Plzeňský, Královéhradecký, Vysočina) while in the Moravian regions except Vysočina as well as in region Praha and Ústecký the share of region on disposable income was lower than on final consumption.

CONCLUSION

The issue of regional allocation of gross value added and GDP has its bottlenecks mainly due to inability to capture all transactions between regions but still existing needs to identify all the characteristics required for the calculation of GDP whether by production, income or expenditure approach. In all cases for the calculation of regional GDP there is necessary to implement certain approximations, simplification and auxiliary keys and in all countries there is a choice of several different processes which is allowed in accounting standard ESA 1995 (or newly ESA 2010). The usual procedure in the majority of EU countries (applicable even in the Czech Republic) is the calculation of regional GVA by production method because the most identifiable data from statistical surveys are indicators characterizing the production method – i.e. the revenue and intermediate consumption for which it is necessary only to find some regional key for the allocation of data for multi-regional organizations (usually wages and salaries or number of employees, if the question on the revenues and expenses is not proceeding directly by the local units). In some countries the income approach is used as a basic especially where reliable data on the regional capital consumption are available. The example of experimental calculation of regional gross value added by income approach for the Czech Republic was illustrated in this article. There was indicated not only the regional structure of the income components of gross value added but also conceptual problems connected with estimation of the regional operating surplus. The same and even greater problems arise even in the case of application of expenditure approach how it is described in the final part of the article (especially for indicator of net export and complicated determination of reliable data source for distribution of household final consumption). These problems lead to the conclusion that the production method (despite the difficulties associated with the allocation of revenues to local businesses and the units carrying out only administrative activities of enterprises) is the most feasible procedure for calculation of regional GDP in the Czech Republic. Production method implemented in the Czech Republic calculates the total regional gross value added for uni-regional organizations in equivalent procedure as in the national accounts. This is relatively minor inaccuracy in comparison with the income approach that tackles with the problems of limited data sources for direct calculation of the regional consumption of fixed capital and both conceptual and data limitations for the calculation of regional operating surpluses and even more in comparison with the expenditure approach that tackles with problems related to limited data sources in its most important item, i.e. final consumption and finally with inability of direct measurement of net export.

References

- BAS DE VET, ALGERA, S., EDING, G. *Multi-regional units in the Regional Accounts*, Statistics Netherlands and University of Groningen, 1999.
- CZSO. *Regional Accounts, database 1995–2011*. Prague: Czech Statistical Office, 2013. <http://apl.czso.cz/pll/rocenka/rocenka.indexnu_reg>.
- CZSO. *Regional GVA Inventory (in English): Methodological description of GVA compilation for EUROSTAT*, Prague: Czech Statistical Office, 2009. <http://apl.czso.cz/pll/rocenka/rocenka.indexnu_reg>.
- EUROPEAN COMMISSION. *European System of Accounts ESA 1995*. Luxembourg: EUROSTAT, 1996.
- EUROSTAT. *Regional Accounts Methods – Gross Value Added and Gross Fixed Capital Formation by Activity, Statistical Manual*. Luxembourg: EUROSTAT, 1995.
- FISCHER, J., SIXTA, J. K propočtu souhrnné produktivity faktorů (To the calculation of total factor productivity), *Politická ekonomie*, 2009, N. 4, pp. 544–554. ISSN 0032-3233.
- HRONOVÁ, S., HINDLS, R., FISCHER, J., SIXTA, J. *Národní účetnictví – Nástroj popisu globální ekonomiky* (National Accounting – tool for description of the global economy). Prague: C. H. Beck, 2009. ISBN 978-80-7400-153-6.
- HRONOVÁ, S., HINDLS, R. *Národní účetnictví – koncept a analýzy* (National Accounting – concept and analysis). Prague: C. H. Beck, 2000. ISBN 80-7179-235-7.
- CHLAD, M. Regionální aspekty makroekonomických ukazatelů – faktory je ovlivňující. 1. část (Regional aspects of macroeconomic indicators – influencing factors. Part 1). *Statistika*, 2008, N. 5, pp. 393–413. ISSN 0322-788X.
- CHLAD, M. Regionální aspekty makroekonomických ukazatelů – agregáty regionálních účtů. 2. část (Regional aspects of macroeconomic indicators – aggregate regional accounts. Part 2). *Statistika*, 2008, N. 6, pp. 483–502. ISSN 0322-788X.
- CHLAD, M., KAHOUN, J. Factors Influencing the Rating of Regional Economic Performance or Reasons why Prague has Become the 6th Best Economically Performing Region of the EU. *Statistika*, 2011, N. 2, pp. 4–23. ISSN 0322-788X.
- JÍLEK, J. Regionální statistika a postupy jejího zavádění v ČR (Regional statistics and the procedures for its implementation in the Czech Republic). *Statistika*, 2000, N. 1, pp. 20–35. ISSN 0322-788X.
- KAHOUN, J. Metoda výpočtu regionálního HDP v České republice (The method of calculation of regional GDP in the Czech Republic). *Statistika*, 2009, N. 6, pp. 518–530. ISSN 0322-788X.
- KAHOUN, J. Regionální disparity v ČR – HDP versus disponibilní důchod (Regional disparities in the Czech Republic – GDP versus disposable income). *Ekonomické listy CES VŠEM*, 2010, N. 3, pp. 17–28. ISSN 1804-4166.
- KAHOUN, J. Regionální hrubý domácí produkt: důchodový a produkční přístup (Regional gross domestic product: Retirement and production approach). *CES VŠEM: Working paper*, 2011, N. 3. ISSN 1801-2728.
- KAHOUN, J. Ukazatele regionální konkurenceschopnosti v České republice (Indicators of regional competitiveness in the Czech Republic). *CES VŠEM: Working Paper*, 2007, N. 5. ISSN 1801-2728.
- KRAMULOVÁ, J., MUSIL, P. Experimentální odhad výdajové metody regionálního HDP v ČR (Experimental estimate of the expenditure approach of regional GDP in the Czech Republic), *Politická ekonomie*, 2013, in print, N. 6/2013.
- SIXTA, J. Development of Input-Output Tables in the Czech Republic. *Statistika*, 2013, N. 2, pp. 4–14. ISSN 0322-788X.
- SIXTA, J. Odhady spotřeby fixního kapitálu (Estimates of consumption of fixed capital). *Statistika*, 2007, N. 2, pp. 156–163. ISSN 0322-788X.
- ŽENKA, J., ČADIL, V. Regional distribution of technology-intensive manufacturing industries in the Czech Republic with an accent on risk of delocalisation. *Prague Economic Papers*, 2009, N. 1, pp. 61–77. ISSN 1210-0455.

Competitiveness and Labour Productivity in Context of Composite Indicators¹

Lenka Hudrliková² | *University of Economics, Prague, Czech Republic*

Kristýna Vltavská³ | *University of Economics; Czech Statistical Office, Prague, Czech Republic*

Abstract

The productivity measurement constitutes an important part of economic analysis. It is always connected to a competitiveness analysis of a country. Labour productivity represents one of the most suitable measurements for compiling the composite indicators which measure multidimensional concepts that single indicators are unable to capture. In the first part, this paper identifies global competitiveness index and global competitiveness index as two main competitiveness composite indicators. After that the methodological issues of composite indicators and labour productivity is discussed. Finally, using the regression analysis this paper investigates composite indicators along with the labour productivity of EU members in the period between the years 2010 and 2011 to identify whether the composite indicators are necessary in the competitiveness analyses.

Keywords

Composite indicator, global competitiveness index, labour productivity, world competitiveness index

JEL code

J24, O47

INTRODUCTION

Measuring competitiveness represents a very popular part of economic analyses. However, it is not a new concept. Economic analysis always looked for an opportunity to evaluate the efficiency of an economy. The difference lies only in the terminology used. Nowadays, one can use labour productivity or several composite indicators for that purpose. Ranking countries by composite indicators is becoming more and more popular because the indicators illustrate a complex view on some issues that cannot be captured by a single indicator. For this purpose it is necessary to choose from several definition of competitiveness. One of them is given by the World Economic Forum which describes competitiveness as the “set of institutions, policies and factors that determine the level of productivity of a country” (WEF, 2011).

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² University of Economics, Faculty of Informatics and Statistics, nám. W. Churchilla 4, 130 67 Prague 3, Czech Republic.

³ University of Economics, Faculty of Informatics and Statistics, nám. W. Churchilla 4, 130 67 Prague 3; Czech Statistical Office, Na padesátém 81, 100 82 Prague 10, Czech Republic. Corresponding author: e-mail: kristyna.vltavska@vse.cz, phone: (+420)224095451.

Another definition states: “Competitiveness should be seen as a basic means to raise the standard of living, provide jobs to the unemployed and eradicate poverty.” (Competitiveness Advisory Group, 1995b). Another definition of competitiveness claims: “Competitiveness implies elements of productivity, efficiency and profitability. But it is not an end itself or a target. It is a powerful means to achieve rising living standards and increasing social welfare – a tool for achieving targets. Globally, by increasing productivity and efficiency in the context of international specialization, competitiveness provides the basis for raising peoples’ earnings in a non-inflationary way.” (Competitiveness Advisory Group, 1995a).

On the other hand, labour productivity represents a revealing indicator that offers dynamic measures of economic growth, competitiveness and living standards. It helps to explain the principal economic foundations that are necessary for economic growth and social development (OECD, 2001). Porter and Ketels give another definition adopted by several authors: “A nation’s standard of living is determined by the productivity of its economy, which is measured by the value of its goods and services produced per unit of the nation’s human, capital and natural resources. Productivity depends both on the value of a nation’s products and services, measured by the prices they can command in open markets, and the efficiency with which they can be produced. True competitiveness, then, is measured by productivity. Productivity allows a nation to support high wages, a strong currency and attractive returns to capital and with them a high standard of living.” (Porter and Ketels, 2003).

Apparently there is a very strong relationship between productivity and competitiveness. Productivity can be measured by one single index. Competitiveness can be evaluated by composite indicator (hereafter: CI). The main question remains whether we need an index for measuring competitiveness. This index has to be a composite indicator which means certain ambiguity in its construction (Freudenberg, 2003). The selection of indicators is an initial and questionable step. It takes a lot of time and effort to gather all necessary data. If one indicator is unavailable, the whole indicator is ruined or data imputation has to be done. It brings more uncertainty into the CI. Weighting and aggregation system have an essential effect on outcome of composite indicators. The issues such as (non)compensability among individual indicators and interpretation of weights as coefficients of importance are discussed in (Munda & Nardo, 2005). There are multiple methods for the purpose of weighting and aggregation. This part in constructing of the CI is the most discussed and criticized by opponents of CIs. Composite indicators may send a misleading message if it is poorly constructed or misinterpreted. If one dimension is ignored, it may lead to wrong or simplistic policy conclusions. It could be a target of the political disputes and speculation. To conclude, in the construction of composite indicators many subjective choices have to be made. Taking into account the disadvantages of composite indicators of competitiveness the question arises whether the measure of labour productivity is sufficient.

In this paper we select the most appropriate competitiveness composite indicators and analyze them along with common used measure of competitiveness – labour productivity. We work with the hypothesis that competitiveness provides a condition for higher productivity and we examine the necessity of using the composite indicators in competitiveness analysis instead of commonly used labour productivity measurement. In this paper we carry out the analysis of labour productivity and composite indicators of competitiveness on the national (macroeconomic) level of the chosen countries in the period between the years 2010 and 2011. The selection of the countries was based on availability of the dataset.

1 METHODOLOGY

For the analysis we assume the labour productivity this to be the ratio of output over input used. As the input, one can use the hours worked, total number of employees or labour services which reflect the quality of labour force. As the output variable, gross value added is recommended instead of gross domestic product because gross value added excludes taxes. In this analysis, we chose to use gross domestic product per hour worked as a measure of labour productivity. It is because hours worked is a better

indicator as people work different hours per week in different countries. The composite indicators are compiled in US dollars and the gross value added is not published in the US dollars (only the national currency is available in the OECD database) that is why we use gross domestic product in US dollars in PPP (constant prices) as the output of the production function.⁴

There are two well-known composite indicators which focus on assessing competitiveness of a country – Global Competitiveness Index and World Competitiveness Index. We employ them in this analysis because of their correlation with the productivity measurement. There are more analyses and concepts, e.g. the European Competitiveness Index created by the University of Wales Institute, The Atlas of Regional Competitiveness – Eurochambers or country specific or regional indices (Annoni & Kozovska, 2010).

The Global Competitiveness Index (hereafter: GCI) has been annually published in the Global Competitiveness Report by the World Economic Forum. We decided to use the GCI because it captures the complexity of the phenomenon of national competitiveness, which can be improved only through an array of reforms in different areas that affect the longer-term productivity of a country (Sala-i-Martin et al, 2011).

The index aims to assess the foundations for strong competitiveness and in this way provides a ranking. GCI merges over 100 indicators which describe 12 major pillars of competitiveness (see Table 1).

Table 1 12 pillars of GCI

Institution	Higher Education and Training	Technological Readiness
Infrastructure	Goods Market Efficiency	Market Size
Macro-economy	Labour Market Efficiency	Business Sophistication
Health and Primary Education	Financial Market Sophistication	Innovation

Source: WEF (2011)

The computation of the GCI is based on successive aggregations of scores from the most disaggregated level i.e. individual indicators all the way up to the overall score. Twelve pillars named in Table 1 are compiled into three sub-indices: Basic Requirements, Efficiency Enhancers and Innovation Factors. The sub-indices are weighted not equally for every country. Weights to the sub-indices are assigned according to the country's development. The World Economic Forum published a comprehensive report with a fully described methodology (WEF, 2011). It included detailed evaluation of each country in terms of its score of indicators, weights etc.

The Labour Market Efficiency pillar contains measures of productivity. Labour Market Efficiency has 17% in the category of efficiency enhancer, irrespective of the country's stage of development. The weight put on each of the three sub-indices (category) is flexible. The sub-index called Efficiency Enhancer could comprise from 35 to 50% of the overall index. Therefore, Labour Market Efficiency could receive a ratio from 5.95% to 8.50%, depending on each country's stage of development.

The World Competitiveness Index (hereafter: WCI) is annually published in the World Competitiveness Yearbook. The purpose of WCI is analysing and ranking the ability of countries to provide an environment that sustains the competitiveness of enterprises (IMD). The competitiveness of enterprises is crucial for using the definition of competitiveness. It is believed that the wealth of nations is created by enterprises (private or public = state-owned).

⁴ Input and output variables to the productivity function are discussed in Vltavská, Sixta (2011).

WCI consists of four underlying pillars. Each of these four pillars gathers five sub-indices which describe different aspects of competitiveness (see Table 2).

Table 2 4 pillars of WCI

Economic Performance	Government Efficiency	Business Efficiency	Infrastructure
Domestic Economy	Public Finance	Productivity & Efficiency	Basic Infrastructure
International Trade	Fiscal Policy	Labour Market	Technological Infrastructure
International Investment	Institutional Framework	Finance	Scientific Infrastructure
Employment	Business Legislation	Management Practices	Health and Environment
Prices	Societal Framework	Attitudes and Values	Education

Source: IMD (2011)

The sub-scores of each sub-index are aggregated in order to obtain the score. Each index, independently of the number of variables it contains, is assigned an equal weight of 5% of the overall score. Simply 4 pillars \times 5 sub-factors \times 5% = 100. We can conclude Labour Market has 5% and Productivity and Efficiency 5% in the overall score. These two pillars are in some way related to productivity. We have to notice that results are influenced by the normalization method (z-score). WCI is compiled from more than 300 indicators; 70 from them are in the pillar called Business Efficiency. Due to this fact we are not able to find out the contribution of individual indicators such as labour productivity.

The drawback of WCI is the data demands. The World Competitiveness Index comprises 329 criteria. About two-thirds of the data used are hard statistics; the rest is the survey data. Hard data are taken from international or national organizations, private institutes and partners. Survey data are drawn from our annual Executive Opinion Survey (4 200 respondents). Note that the indicators are strongly correlated. Therefore their actual individual weight as a coefficient of importance can be different (IMD, 2011).

The usage of the assessment of business environment or a nation, supporting international investment decision or evaluating the impact of various public policies are the advantages of the composite indicators mentioned.

For quantitative analysis of relationship between indicators we used Spearman correlation coefficient and Kendall's tau, and a linear regression model. Several linear regression models were tested. The dependent variable represents labour productivity as a measured output of the economy and the competitiveness composite indicators as the explanatory variables. This can be expressed by following formula:

$$LP_{2011} = a + b \times CCI_t \text{ or } LP_{2011} = b \times CCI_t, \quad (1)$$

where LP_{2011} stands for labour productivity in 2011, CCI_t stands for competitiveness composite indicator (either WCI or GCI) in time t (where $t = 2008, 2009, 2010, 2011$).

2 RESULTS

Firstly, it is necessary to examine if there is a correlation between the World Competitiveness Index, the Global Competitiveness Index and labour productivity. As we work with rankings we use Spearman's correlation coefficient⁵ (Table 3).

⁵ For more information see Hindls et al (2004).

Table 3 Spearman's rho and Kendall's tau b (correlation matrices)

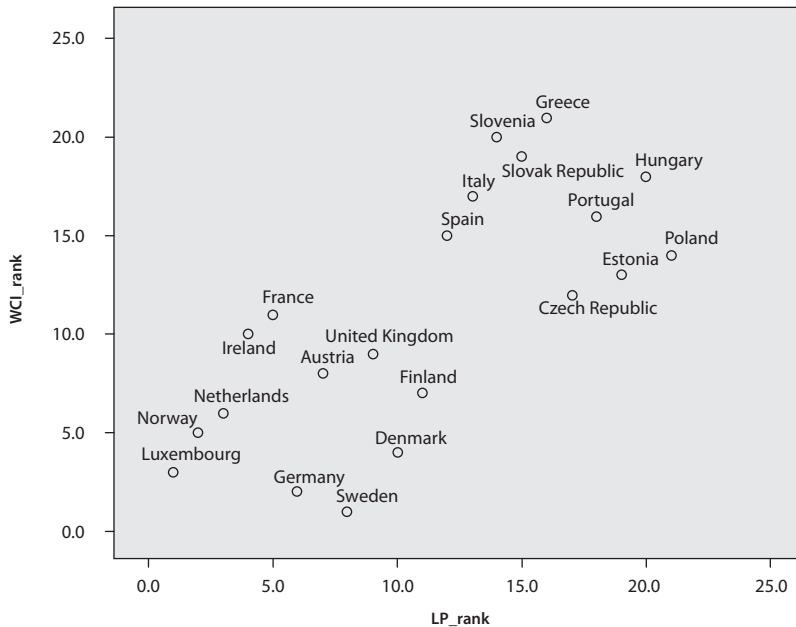
	WCI	GCI	LP		WCI	GCI	LP
WCI	1.000	0.923**	0.719**	WCI	1.000	0.794**	0.505**
GCI	0.923**	1.000	0.660**	GCI	0.794**	1.000	0.411**
LP	0.719**	0.660**	1.000	LP	0.505**	0.411**	1.000

** Correlation is significant at the 0.01 level (2-tailed).
 Source: Authors' computations

Correlations between competitiveness indicators are close to one, which means strong positive correlation between these two composite indicators. Even if the correlation between competitiveness indicators and labour productivity is smaller, it is significant at the 0.01 level.

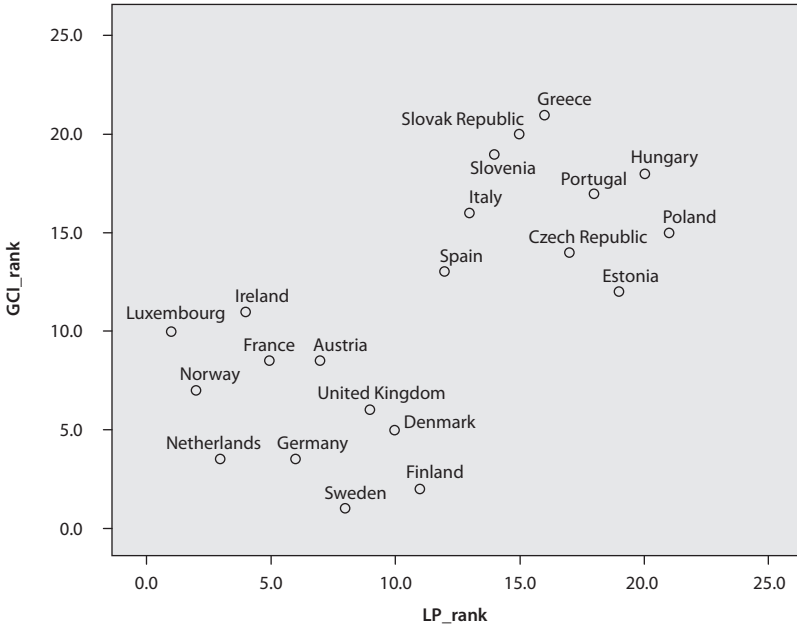
The correlations between two indicators among the countries used are displayed in the following figures (Figure 1 and 2). Spider graph (Figure 3) shows the overall correlation between all the indicators used. Figure 1 shows the relationship between labour productivity and WCI. There is clear difference between new member states from the Central and Eastern Europe and long-term member countries. Figure 2 shows the relationship between labour productivity and GCI. One can see that the countries are rather clustered into two groups according to their productivity level and global competitiveness. The gap between the two groups implies that there is a clear distinction between counties with high and low level of competitiveness and productivity. For majority of countries there is difference in their ranking according to labour productivity and composite indicators; however they are still in a same group which means that the shift in ranking is not significant. A country on a line means the same place in ranking according to both indicators. Figure 1 shows differences between the new and long-term EU member states.

Figure 1 WCI and labour productivity – ranking



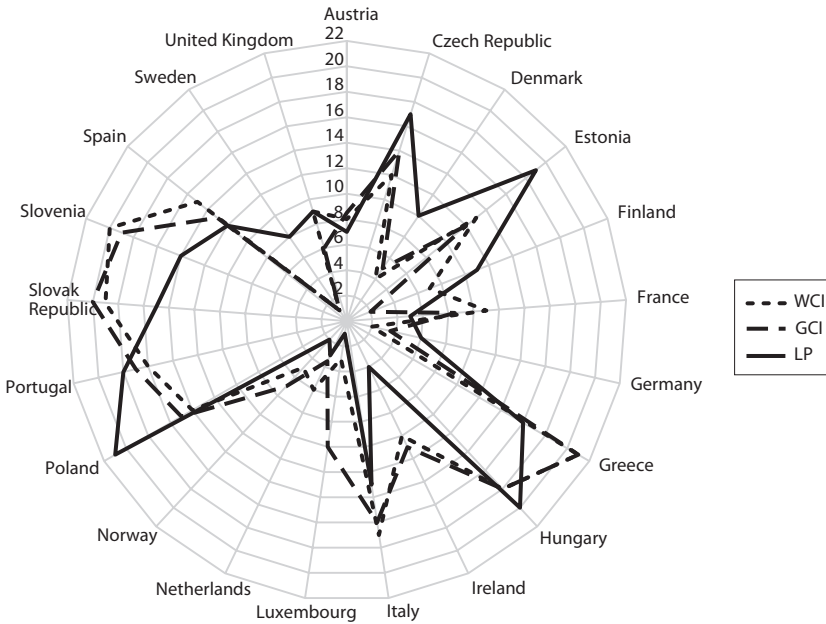
Source: Authors' computations

Figure 2 GCI and labour productivity – ranking



Source: Authors' computations

Figure 3 Spider graph



Source: Authors' computations

Figure 3 depicts the summary of all the indices used. Overlapping points mean that a country ranks the same places.

The hypothesis that competitiveness provides a condition for higher productivity was tested by means of linear regression of cross sectional data. Labour productivity was considered to be a dependent variable because it measures output of an economy and the WCI and GCI aim to assess input (conditions for economic growth). The predictors were the WCI and/or the GCI in 2011 and the previous years. Different models were tested. The GCI was not found to be a good predictor. This parameter was statistically insignificant in all tested models. The WCI can be used as a predictor. The model with one WCI predictor in 2010 is considered to be suitable.

Table 4 Linear regression model

		coefficient	t	Sig.
intercept model	intercept	-10.009	-1.111	0.281
	WCI 2010	0.694	5.560	0.000
no-intercept model	WCI 2010	0.558	22.809	0.000

Source: Authors' computations

For the model with an intercept, the R-square equals 0.619, without an intercept the R-square equals 0.963. Note that for a regression through the origin (the no-intercept model), the R-square measures the proportion of the variability in the dependent variable about the origin explained by regression. This cannot be compared to the R-square for models which include an intercept. It indicates that the measure of competitiveness is a predictor for a level of labour productivity in the following year. However GCI did not confirm that statement. GCI is an insignificant predictor for labour productivity, even if we take lags into account.

Table 5 Year-on-year changes in %

Year	WCI			GCI			LP		
	08/09	09/10	10/11	08/09	09/10	10/11	08/09	09/10	10/11
Austria	5.69	6.04	-2.93	-1.91	-0.78	0.98	-0.19	2.18	0.45
Czech Republic	7.24	-1.96	8.48	1.08	-2.14	-1.09	-1.55	1.64	0.59
Denmark	9.41	-6.71	0.97	-2.15	-2.56	1.50	-1.79	3.86	1.26
Estonia	-10.16	0.11	8.98	-2.36	1.10	0.22	2.54	5.80	-1.09
Finland	17.79	-9.47	5.47	-1.27	-1.10	1.86	-5.20	3.12	1.48
France	3.12	9.26	-4.00	-1.72	0.00	0.19	-0.57	1.35	1.35
Germany	11.74	-0.93	6.16	-1.65	0.37	0.37	-2.52	1.82	1.65
Greece	4.14	3.00	-0.81	-1.70	-1.24	-1.75	-4.85	-3.34	-2.67
Hungary	1.86	0.38	8.86	0.00	2.61	0.69	-3.60	0.95	0.37
Ireland	-0.88	1.54	-1.33	-3.01	-2.07	0.63	4.40	4.03	3.27
Italy	10.95	8.18	11.41	-0.92	1.39	1.37	-2.21	2.41	0.08
Luxembourg	2.22	0.69	-0.45	2.27	1.81	-0.40	-1.30	1.00	-1.00
Netherlands	9.05	-2.40	0.07	-1.66	0.19	1.50	-2.41	2.23	0.23
Norway	8.91	3.91	-4.08	-0.96	-0.58	0.78	0.38	0.40	-0.52
Poland	12.39	19.57	3.69	1.17	4.16	-1.11	2.17	3.65	3.76
Portugal	14.51	-8.78	11.72	-1.57	-0.45	0.46	-0.16	3.69	0.78
Slovak Republic	7.66	-20.06	14.68	-2.05	-1.39	-1.41	-2.33	4.40	2.24
Slovenia	11.63	-24.67	16.82	1.11	-2.86	-2.71	-6.15	3.15	3.88
Spain	0.58	1.56	13.49	-2.75	-2.18	1.11	2.51	1.98	1.36
Sweden	9.77	0.41	3.49	-0.36	0.91	0.90	-2.21	3.87	1.32
United Kingdom	5.79	0.97	4.52	-2.08	1.16	2.67	-2.01	2.23	-0.44

Source: Authors' computations

Inspired by the regression outcome we focused on year-on-year changes (see Table 5). If we compare the results for competitiveness indicators and those for labour productivity, we can see that not even the same signs of the coefficients for each country were observed.

The one year time lag between the level of competitiveness and the level of productivity was not confirmed. We cannot observe the same evident trend for competitiveness and subsequently not even for productivity.

CONCLUSION

Making a decision about the level of competitiveness of a country could lead to a simplified conclusion. It is important to know what lies beneath the composite indicator. This paper examines the necessity of using the composite indicators in competitiveness analysis instead of commonly used labour productivity measurement. We chose two well-known composite indicators which relate to the productivity analysis – Global Competitiveness Index and World Competitiveness Index. In this paper we work with the hypothesis that competitiveness provides a condition for higher productivity. The results showed that there was strong positive correlation between composite indicators. Although the correlation between competitiveness indicators and labour productivity is smaller, it is significant at the 0.01 level. We considered labour productivity as a dependent variable because it measures output of an economy and World Competitiveness Index and Global Competitiveness Index aim to assess input as they are conditions for economic growth. The predictors were World Competitiveness Index and/or Global Competitiveness Index in 2011 and 2010. Global Competitiveness Index was not found to be a good predictor. This parameter was statistically insignificant in all models. On the other hand, World Competitiveness Index can be used as a predictor. The model with one World Competitiveness Index predictor in 2010 was considered to be suitable. In order to verify one year lag between a change of level of competitiveness indicators and labour productivity we observed year-on-year changes. Based on our results we cannot conclude that a higher level of competitiveness in one year brings about a higher level of labour productivity in the following year.

A composite indicator facilitates the ranking of countries on a multidimensional basis; nevertheless a conclusion based on a composite indicator could be easily misinterpreted. The most important is the soundness and transparency of a composite indicator. To understand and interpret the results, a deconstructing composite indicator is useful. A look at the separate indicators can help extend the analysis but cannot provide country rankings. A large number of underlying indicators causes ambiguities. It is not even clear which indicators are included let alone their contribution to the final score. Due to the complexity, composite indicators of competitiveness do not meet the requirement of transparency and understandability. The construction of composite indicators makes estimating the contribution of productivity basically impossible.

References

- ANNONI, P., KOZOVSKA, K. *EU Regional Competitiveness Index 2010*. JRC Scientific and Technical Reports, European Union Luxembourg: Publications Office of the European Union, 2010.
- Competitiveness Advisory Group. Enhancing European Competitiveness*. 1st Report to the President of Commission, the Prime Ministers and the Heads of State, 1995a.
- Competitiveness Advisory Group. Enhancing European Competitiveness*. 2nd Report to the President of Commission, the Prime Ministers and the Heads of State, 1995b.
- FREUDENBERG, M. *Composite Indicators of Country Performance: A Critical Assessment*. OECD Publishing, 2003.

- HINDLS, R., HRONOVÁ, S., SEGER, J. *Statistika pro ekonomy* (Statistics for Economists). 5. Vol. Prague: Professional publishing, 2004.
- IMD. *World Competitiveness Yearbook 2010/2011* [online]. Institute for Management Development, Lausanne, Switzerland, 2011. [cit. 5.5.2013]. <<http://www.worldcompetitiveness.com/OnLine/App/Index.htm>>.
- MUNDA, G., NARDO, M. *Non-compensatory Composite Indicators for Ranking Countries: A Defensible Setting*. EUR Report, Luxembourg: EC, 2005.
- NARDO, M., SAISANA, M., SALTELLI, A., TARANTOLA, S. *Tools for Composite Indicators Building*. European Commission, Ispra, 2005.
- OECD, JRC – EUROPEAN COMMISSION. *Handbook on Constructing Composite Indicators*. Methodology and User Guide, Brussels: OECD, 2008.
- OECD. *Measuring Productivity*. Paris: OECD, 2001.
- PORTER, M. E., KETELS, C. H. M. *UK Competitiveness: Moving to the Next Stage*. Institute of Strategy and Competitiveness, Harvard Business School: DTI Economics paper No. 3, 2003.
- SALTELLI, A., MUNDA, G., NARDO, M. *From Complexity to Multidimensionality: the Role of Composite Indicators for Advocacy of EU Reform*. *Tijdschrift voor Economie en Management*, 51(3), 2006.
- VLTAVSKÁ, K., SIXTA, J. The Possibilities to Estimate Labour Productivity and Total Factor Productivity for Czech Regions. *Statistika*, 2011, Vol. 4, pp. 35–44.
- WEF. *The Global Competitiveness Report 2011–2012*. World Economic Forum, Geneva, Switzerland, 2011.

The Models of Estimated Development of Labour Market in the Czech Republic up to 2050

Ondřej Nývlt¹ | *University of Economics, Prague, Czech Republic*

Abstract

Population ageing will considerably influence economic and social structure of the population. The labour market will change completely. The lower number of persons in productive age and the rise of proportion of older age groups will speed up ageing after 2030. The future development of labour market will face a challenge of reduction of the negative initial demographic conditions. The main problem of the labour market in the Czech Republic is the exclusion of all groups of population due to the lack of flexible jobs, mainly part-time jobs (for example students, mothers with children and elderly people). The analysis shows a possible way of measuring these reserves on the labour market. The comparison with labour indicators (mainly specific employment rates by gender and age) of other European countries is the aim of this approach. This offers a possibility to construct the scenarios of the future development in the Czech Republic.

Keywords

Population ageing, labour force survey, economic status, labour market

JEL code

J1, J2, J6

INTRODUCTION

Population ageing will influence basic economic and social relations in society. Faster pace of ageing cannot be considered an accidental deviation. It is rather an expression of a new tendency (Koschin, 2005). Population ageing is a new challenge for the society in the 21st century. It changes the model of family patterns and it will be the test of individual societies how to manage the process of doubling the number of the seniors (Rychtaříková, 2011). Population ageing is defined as occurring when the proportion of population aged 65 and over is growing. In the Czech Republic, the demographic projection predicts a rising proportion of the third economic generation to 33.0% in 2060, with further possible increase showing a decreasing share of the first economic generation (people under 15/20 years of age) from 30% to 18%. Consequently, dependency indices reflect this situation and show increase in the economic burden on economically active people (Miskolczi and Langhamrová, 2011, Fiala and Langhamrová, 2007).

¹ University of Economics, nám. W. Churchilla 4, 130 67 Prague 3; Czech Statistical Office, Na padesátém 81, 100 82 Prague 10, Czech Republic. E-mail: ondrej.nyvlt@czso.cz.

Generally, it is possible to define basic demographic indicators characterising the potential of the labour market. Population ageing leads to growing number of persons in post-productive age, in quantitative expression the growing values of indicators of ageing index or economic dependency ratio. If there are not any unforeseeable demographic changes (the growth of fertility, the growth of intensity of migration or worsening of mortality conditions), the labour market will be shortly influenced by a decrease of productive part of the population.

The future development will focus on the reduction of negative initial demographic conditions. The main problem of the labour market in the Czech Republic is an exclusion of all groups of population due to the lack of flexible jobs, mainly part-time jobs (for example Mejstřík, 2005, Mejstřík and Nývt, 2006). This fact influences the potential of use of workforce. There are three main sources of the future use of workforce in the Czech Republic: students, mothers with children and elderly people. The lack of part-time jobs does not enable to balance the student or family life with work life. Mothers with children are affected by higher risk of unemployment. The lack of flexible jobs leads to a steep employment rate decline after the acquirement of statutory retirement age. Gradual transition from labour market to economically inactivity is a good step how to reduce the negative impact of population ageing.

Inflexible and not reformed, the labour market can significantly influence the rate of employment or unemployment primarily of young people. This problem is now very common in southern Europe. Labour market is considerably influenced by the social and economic system. Pension or parental leave (benefit) system belongs to basic factors, which have a great impact on participation in the labour market. For example, the system of parental leave can allow for a better reconciliation between family and work life for young mothers or fathers. The Czech Republic is characterised by a long full-time parental leave with tiny participation in the labour market.

1 DATA

Labour Force Survey (LFS) is the main data source for this analysis. LFS is performed in a continuous manner on the territory of the Czech Republic; the evaluation of results is carried out at respective calendar quarters (for example Employment and Unemployment in the Czech Republic, 2011). The aim is to inform about the level and structure of employment, unemployment and underemployment in the Czech Republic measured in compliance with international definitions and recommendations by the International Labour Organization (ILO). The definitions and contents of all Labour Force Survey indicators requested by Eurostat are fully applied and respected in the Czech Labour Force Survey (EU Labour Force Survey, Explanatory Notes, 2012).

For the purpose of the projection of employment the population projection is used. This population projection was a revised variant of the population projection of 2009 and was prepared only for the project “The Reserves on the Labour Market” (Population ageing in the Czech Republic, 2011). The revised version from the year 2011 is based on estimated development of fertility, mortality and migration in years 2009–2011.

2 POTENTIAL OF LABOUR MARKET AND ECONOMIC DEPENDENCY

It is possible to measure the potential of labour market from the demographic point of view as the comparison of the pre-productive and post-productive part of the population with the productive part of the population, generally it is this indicator defined as an economic dependency ratio.

$$\text{Economic dependency ratio}^1 = \frac{S_{0-14, 65+}}{S_{15-64}} \cdot 100, \quad (1)$$

where: $S_{0-14, 65+}$ Population aged 0–14 and 65+ years,
 S_{15-64} Population aged 15–64 years.

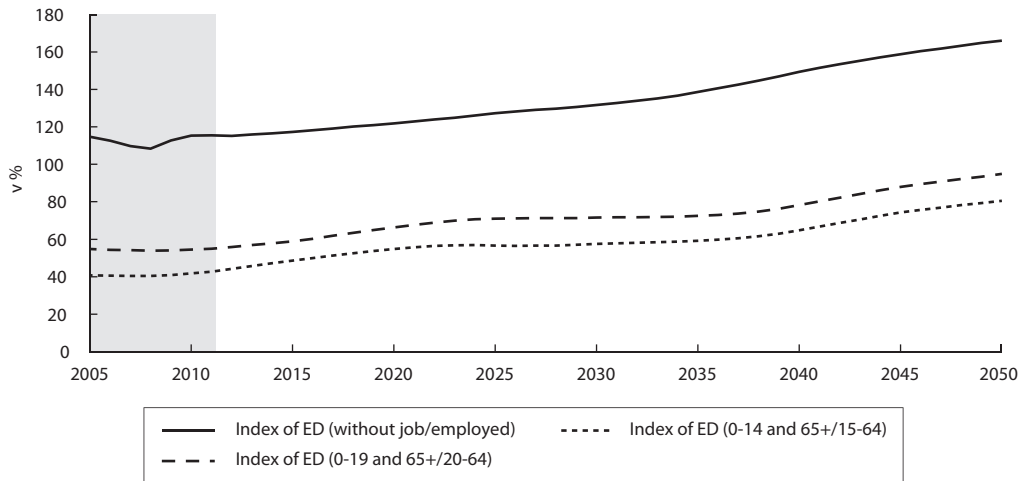
The other indicators are not directly working on the assumption of the ageing differentiation, but from the indicator of Labour status, if the person is employed, unemployed or economically inactive according to the International Labour Organization (ILO) definition. Primarily, we change the indicator economic dependency ratio so that in the numerator there will be substituted the pre-productive and post-productive part of population with the persons without a job. The productive part of the population then will be substituted with the employed persons.

$$\text{Economic dependency ratio}^2 = \frac{S^{\text{unempl} + \text{ec.inac}}}{S^{\text{emp}}} \cdot 100, \tag{2}$$

where: $S^{\text{unempl}, \text{ec.inac}}$ Unemployed (15+) and Economically inactive person (0+),
 S^{emp} Employed (15+).

The economic dependency ratio, which compares the pre-productive and post-productive part of the population with the productive part of population, amounted to 42.7% in the year 2011. This shows a very low ratio of economic dependency in the Czech Republic. It is also given a low number of persons aged 0–14 years. The economic dependency ratio will have slowly grown by the year 2030, but thereafter this variable grows very steeply. Then, in 2050, the economic dependency ratio should reach 80.5%, which is double in comparison with 2011. The age specification of the productive population is chosen widely, but the economic activity of a person at the age between 15–19 years has been very low during the last fifteen years. Therefore, the age specification of the productive part of the population to the age group 20–64 years is narrow. This indicator of economic dependency ratio was 54.6% in 2011, in the Czech Republic in 2050 it is expected to reach 94.8%. It shows more negative view of the labour market in the future.

Figure 1 Economic dependency ratios in the Czech Republic, 2005–2050



Source: Revised population projection CZSO 2009, CZSO-LFS

In the second option the labour specification substitutes the age (demographic) specification. In this case the variable Labour status is used, which divides the population into the employed (denominator) and the unemployed plus economically inactive persons (numerator). In this case the economic dependency ratio was 115.4% in 2011. If we compare the (labour) indicator with the (demographic) indicator we find considerable differences showing great reserves in the labour market. These reserves create an

unexploited potential of the labour market, how to face the adverse effect of population ageing. After 2012, the values are projected on the base of the same specific employment rates as in 2011. According to this simple method the economic dependency ratio should reach 166.0% already in 2050, which should have a great effect on the economic efficiency of the Czech Republic.

3 THE LABOUR MARKET IN THE CZECH REPUBLIC IN COMPARISON WITH OTHER EUROPEAN COUNTRIES

The employment rate is basic indicator expressing the level of employment when in numerator there is the number of employed persons and in denominator the population is 15 years old and over. However, it is a simple indicator which interpretation is relatively complicated and, in the first place, it is not suitable for finding the potential of workforce.

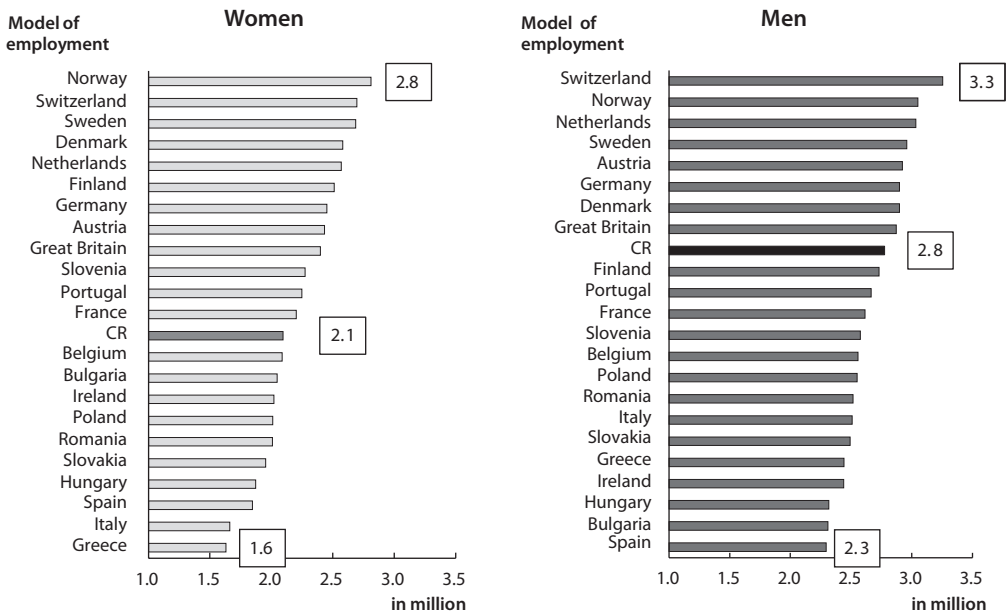
Assuming that we use a specific employment rate of individual European countries and the number of persons in specific age groups in the Czech Republic, the standardization (the same method as in indirectly standardized mortality – for example Pavlík, 1986) of the number of employed persons is suitable for the purpose of using the potential of workforce. This hypothetical numbers show how many persons would work in the Czech Republic, if there was the level of employment as in Sweden or Italy.

$$\text{Standardized number of employed persons in CR} = \sum_{i=1}^n \alpha_x^{emp.standard} \cdot S_x^{CR}, \tag{3}$$

where: $\alpha_x^{emp.standard}$ Specific rate of employment in the European countries by age groups,

S_x^{CR} Population by age groups in the Czech Republic.

Figure 2 Hypothetical number of employed persons in the Czech Republic on the condition of level of employment in individual European countries in 2011



Source: Eurostat- LFS, own calculations

We construct the hypothetical number of employed persons in the Czech Republic taking specific employment rate of individual selected European countries according to this formula and the population of the Czech Republic. If we rank European countries, there are very different models of the labour market among individual regions of Europe. Generally, southern Europe countries are characterised by bad working conditions in the labour market. This fact is given by combination of negative factors (high level of unemployment, unfavourable position of young people in the labour market, very low economic activity of women with children). On the other hand, western and northern Europe are characterised by a great participation of men and women on the labour market in the whole age group 20–64 years.

The Czech Republic has a relatively high male employment, mainly due to high male employment in the age group 30–49 years, which is the biggest in the whole Europe. In 2011, 2 777.3 thousand of men were employed in the Czech Republic, if we had had the level of employment as in Italy, it would have been only 2 296.2 thousand of employed men, on the other hand, in case of the Netherlands 3 033.9 thousand of employed men. Now, the Czech Republic is fortunately closer to Netherlands than Italy.

If we compare the employment of women, the situation in the Czech Republic is different. A low employment of women with young children and generally unfavourable reconciliation of family and work life (a very low proportion of part-time jobs) in the Czech Republic is different comparing to western and northern Europe. As a consequence of these factors only 2 095.1 thousand of women worked in the Czech Republic in 2011, but in case of Swedish employment 2 678.4 thousand of women would have worked in the Czech Republic, which is almost 600 thousand more.

4 THE MODEL OF THE LABOUR MARKET DEVELOPMENT UP TO 2050

The estimation of the future development can be the next step how to evaluate the situation on the labour market in the future. Following this purpose, we construct the projection of the employed persons on the basis of the population projection up to 2050. This projection takes into consideration different models of the labour market.

The first model is based on the assumption of the same level of employment as in 2011. The other methods use the gradual linear transition from start to end point. The start point is the year 2011, when the specific employment rates are known, and the end point is the year 2050.

Rate of increase (decrease) by age

$$= a_x^{CR,2011} + \left((t - 2011) \cdot \frac{a_x^{standard} - a_x^{CR,2011}}{2050 - 2011} \right), \quad (4)$$

where: t Year,
 $a_x^{CR,2011}$ Employment rate by age in the Czech Republic in 2011,
 $a_x^{standard}$ Model employment rate by age.

In the first model the level of the employment is fully dependent on the demographic development. It means that after dropping out the generations of the 1970's from the labour market, there will be a steep fall of the number of employed persons. This model assumes 4 millions of employed persons in the Czech Republic in 2050. While in year 2011: 46.6% of the whole population was employed, in 2030 still 44.1% was employed, in 2050 it was only 37.8%. If we use the gender criterion, then in 2050 there would be only 31.7% employed women from the whole population and 43.9% of men.

So, the second model considers the current Swedish employment as the end point for our model, and between the years 2011 and 2050 the model assumes a gradual linear transition between the start point (specific rates of employment in the Czech Republic in 2011) and the end point (specific rates of employ-

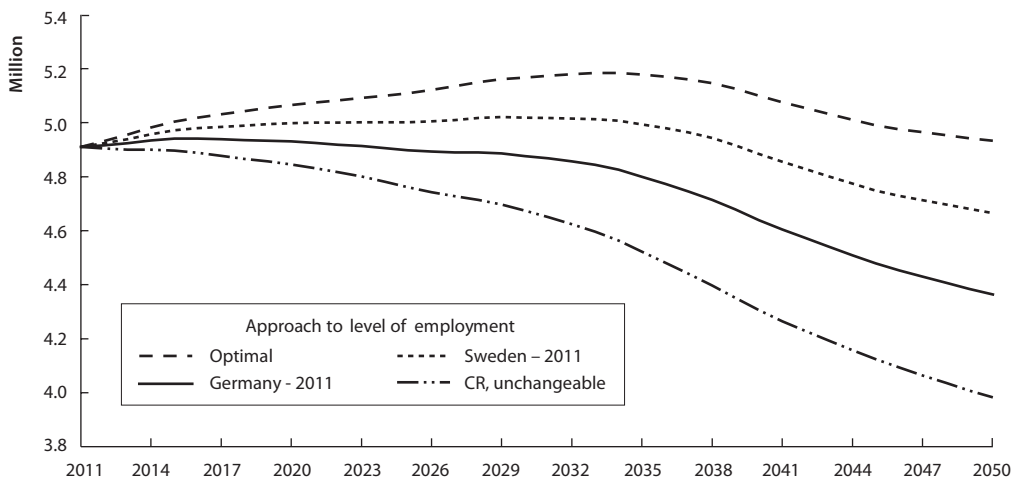
ment in Sweden in 2011). Generally, the northern European countries show a very high level of female employment as a result of the opportunity to use flexible jobs. Furthermore, there is a great participation of men on family duties. For these countries it is not unusual if a man is on parental leave, but for example in the Czech Republic the number of fathers on parental leave is absolutely insignificant. The good balance between student and work life is another factor that results in higher employment rate of young people and the relatively high level of employment of young people in social and health services.

In case of the Swedish model there is a rise of the number of employed persons up to 2030. After 2030 the number of employed persons slightly declines, the number of employed men declines more than the number of employed women. In consequence of this development, the share of employed persons on the whole population declines. According to the Swedish model there would work in year 2050 approximately 2 500 thousand men, which is about 300 thousand less than 2011. On the other hand, there would be about 50 thousand more employed women than 2011 in 2050 with 2 162.5 hundred working women.

The other model takes the Germany labour market into consideration. The Germany has a similar structure of labour market as the Czech Republic. It suggests, first of all, a relatively important position of industry in the national economy. In the current comparison of the Czech Republic and Germany, the Czech labour market has a lower level of employment men or women in young age groups. Furthermore, the pension age in the Czech Republic will be approaching the Germany pension age (now in Germany it is 67 years for men, 65 years for women). According to the German model, in 2050, the total number of employed persons would be 4 363.4 thousand persons, i.e. approximately 550 thousand persons less than in 2011. Relatively, in 2011 the share of employed persons of total population made 46.6%, in 2050 only 41.4%. Generally, it is relatively a significant decline, but not as dramatic as in case of the unchangeable level of employment in the Czech Republic.

The last model tries to find the optimal solution. The optimal solution does not mean the highest specific employment rate in all age groups. The optimal model is based on the assumption of the highest specific employment rate by gender and age groups, with the exception of age groups 15–19 years and people aged 65 years and older. The full employment is certainly not the optimal solution for young people below 20 years.

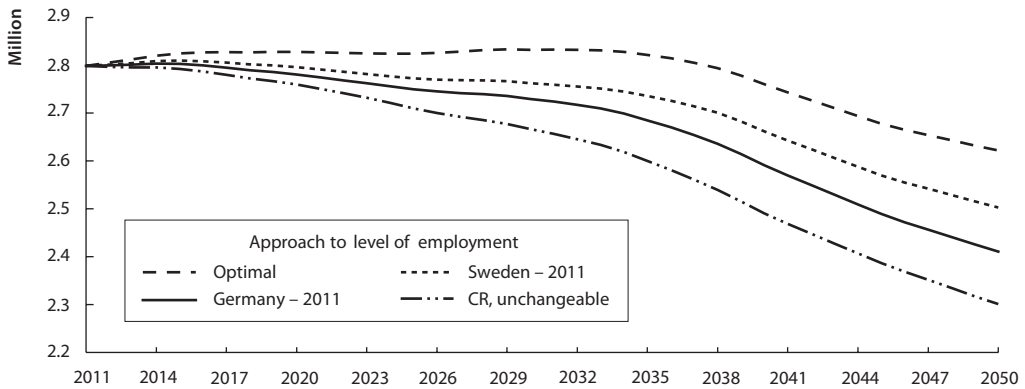
Figure 3 The estimated number of the employed persons in the Czech Republic according to the model situation, 2011–2050



Source: Revised projection of CZSO 2009, Eurostat-LFS, own calculations

For people aged 65 years and older a preferable solution is, that they wish to work from a nonfinancial reason. From this reason the optimal employment rate for age group 15–19 years is 40% for both genders, 9.3% for women and 6.0% for men aged 65 years and older. The difference is given by the high life expectancy of women. These employment rates are taken as average values of northern and western European countries. In other age groups the employment rate is given by the highest value in all states of the European Union (with the exception of the smallest ones – Luxembourg, Cyprus, Malta). This model characterises the maximum of flexible jobs, mainly part-time jobs.

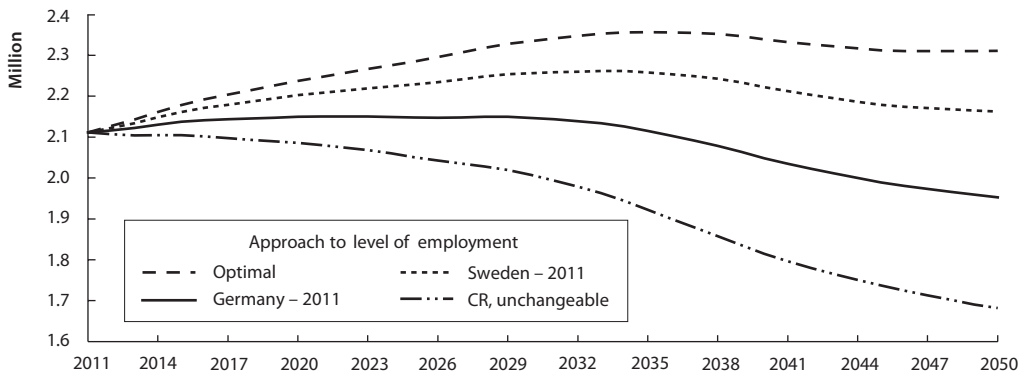
Figure 4 The estimated number of the employed men in the Czech Republic according to the model situation, 2011–2050



Source: Revised projection of CZSO 2009, Eurostat-LFS, own calculations

According to the optimal model, the level of the employment would rise up to 2035. The influence of dropping out the strong generation of the 1970's from the labour market would cause the decline of the employment level after 2035. As a result, the number of the employed persons is in the optimal model higher in 2050 (4 932.3 thousand) than in 2011 (4 910.5 thousand). The most significant is the difference in the women employment, in 2011 2 111.7 thousand of women worked, but in 2050 2 311.5 thousand, relatively in 2011 39.4% from the whole population of women, in 2050 already 43.6%.

Figure 5 The estimated number of the employed women in the Czech Republic according to the model situation, 2011–2050

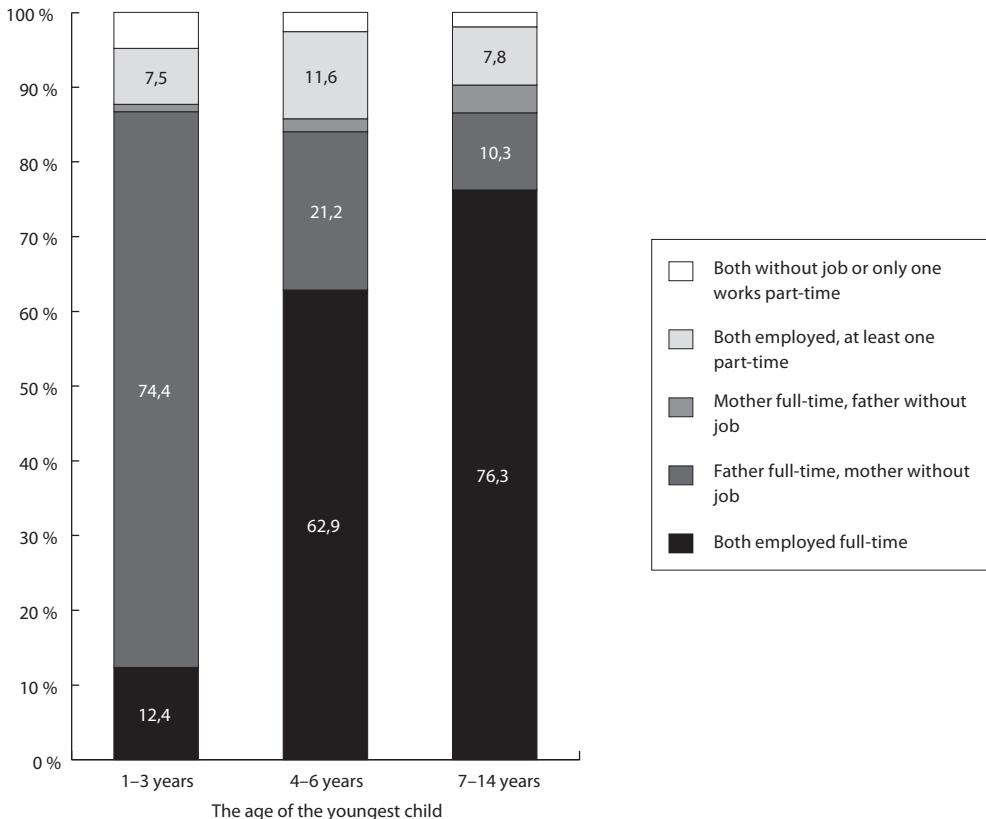


Source: Revised projection of CZSO 2009, Eurostat-LFS, own calculations

5 YOUNG WOMEN ON THE LABOUR MARKET

The labour market can be viewed not only from the perspective of an individual, but we can use the fact that Labour Force Survey is primarily a household survey. A household is defined as a housekeeping unit including all the individuals who have an economic interest in the given household. From this point of view we analyse the economic activity of individual parents in a complete family household or the father or mother in lone-parent family household (Bartoňová and Nývt, 2011). In the context of work-life balance it is important to analyse the flexibility of work arrangements of each individual parent, especially when mothers take advantage of opportunities for part-time work. The traditionally separated roles in family (mother in household with young children, father at full-time job), a long parental leave and a very low relative number of part-time jobs cause a very long break in the labour market for young mothers. Changing patterns of family life constitutes a qualitative break and provides an alternative basis for the development of a suitable policy (Hakim, 2003). Figure 6 shows that using part-time jobs for young mothers is very low. At the age of the youngest child from 4 to 6 years, when the opportunity for mother to take advantage of part-time jobs is the most suitable, only 11.6% one of a two-parent household works at least part-time. On the other hand, in 62.9% of two-parent household both parents work full time.

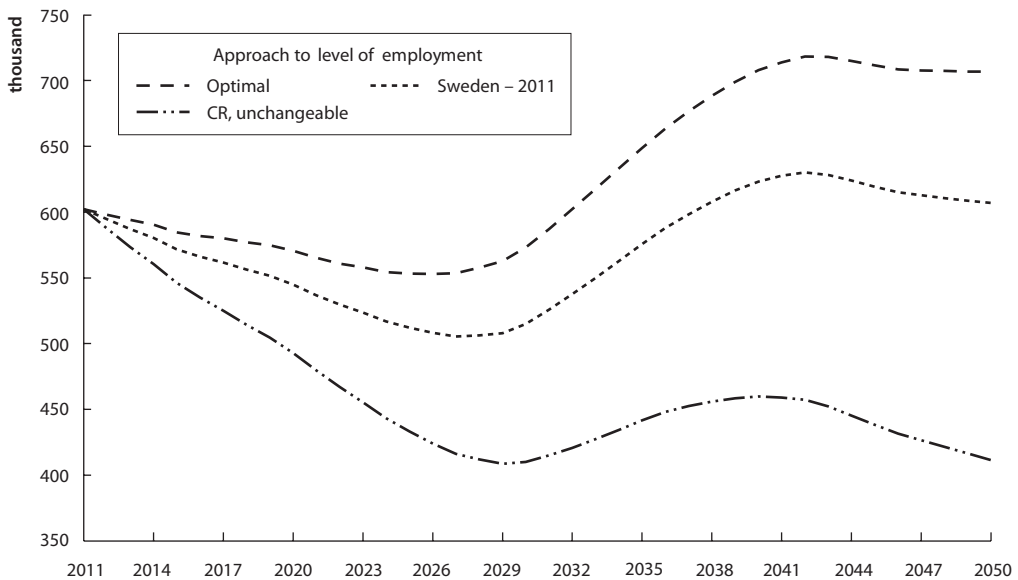
Figure 6 The participation of families on the labour market according to the age of the youngest child in the Czech Republic (average of years 2009–2011) %



Source: Labour Force Survey

The Czech Republic is characterised not only by unsuitable reconciliation between family and work life, but a low participation of students in the labour market as well. It means that from the point of view of students, there are great reserves on the labour market, mainly in comparison with developed countries of northern and western Europe. In comparison of the Swedish or Optimal model with the model of the unchangeable level of employment in the Czech Republic there are great differences. According to the optimal model it would be 706.7 thousand of employed women at age 15–34 years in 2050, according to the Swedish model it would be 603.5 thousand, according to the unchangeable level of employment only 411.6 thousand.

Figure 7 The estimated number of the employed women in age 15–34 years in the Czech Republic according to the model situation, 2011–2050



Source: Revised projection of CZSO 2009, Eurostat-LFS, own calculations

CONCLUSION

The Czech Republic has a specific position on the European labour market. The Czech labour market fully uses the potential of the middle aged persons, mainly men work full time. This group reaches the maximum limit of the employment rate. On the other hand, the lack of flexible jobs causes the decline of participation of persons who combine the care of family (children) and work life. The low number of flexible jobs makes it more difficult for elder people or people with health problems to find a suitable job. The demographic development shows, that the current policy of full-time jobs mainly for persons of middle age is unsustainable in future. The number of the employed persons will steeply decline without a higher participation of younger and older persons and younger mothers in productive age on the Czech labour market. If we raise the participation of these groups on the labour market, we can significantly reduce the negative impact of population ageing. But it is necessary to know that this situation is only possible if we spread the offer of flexible jobs, mainly part-time jobs. In this context it depends on a personal policy of particular companies. The role of state is important in creation of good conditions for participation of a larger number of employed persons on the labour market.

References

- BARTOŇOVÁ, D., NÝVLT, O. Rodinné domácnosti na trhu práce: vývoj ekonomické aktivity matek a otce z hlediska věku dětí (Family Households in the Labour Market: The Economic Activities of Mothers and Fathers by the Age of their Children). *Demography*, 2011, Vol. 53, No 3, pp. 215–222.
- CZSO. *Employment and Unemployment in the Czech Republic as Measured by the Labour Force Survey* [online]. Prague: Czech Statistical Office, 2012. <<http://www.czso.cz/eng/edicniplan.nsf/aktual/ep-3?opendocument#31>>.
- CZSO. *Population ageing in the Czech Republic – Reserves on the Labour Market* [online]. Prague: Czech Statistical Office, CERGE-EI, 2011. <http://www.czso.cz/csu/redakce.nsf/i/prezentace_a_tiskove_konference_zamestnanost_nezamestnanost_>.
- EU Labour Force Survey*. Explanatory Notes. Eurostat: European Commission, 2012.
- FIALA, T., LANGRAMROVÁ, J., PRŮŠA, L. Projection of the Human Capital of the Czech Republic and its Regions to 2050. *Demography*, 2011, Vol. 53, No 4, pp. 304–319.
- FIALA, T., LANGRAMROVÁ, J. Stárnutí populace – hrozba pro veřejné zdravotnictví? (The Ageing of the Population – A Threat to the Public Health-Care System?). *Demography*, 2007, Vol. 49, No 1, pp. 13–24.
- HAKIM, C. A new Approach to Explaining Fertility Patterns: Preference Theory. *Population and Development Review*, 2003, 8 (3), pp. 349–374.
- KOSCHIN, F. Naše populace stárne – užijeme se? (Our Population is Ageing – Are we Going to Earn an Living). *Demography*, 2005, Vol. 47, No 4, pp. 245–250.
- MEJSTRÍK, B. *Organizace práce a uspořádání pracovní doby* (Work Organization and Working Time Arrangements). Prague: Czech Statistical Office, 2005.
- MEJSTRÍK, B., NÝVLT, O. *Vztah rodinného a pracovního života* (Relations between Family and Work Life). Prague: Czech Statistical Office, 2006.
- MISKOLCZI, M., LANGRAMROVÁ, J. Dependency Ratios, Ageing and the Demographic Window in the Czech Republic. *Demography*, 2011, Vol. 53, No 4, pp. 333–343.
- PAVLÍK, Z., RYCHTAŘÍKOVÁ, J., ŠUBRTOVÁ, A. *Základy demografie* (Elements of Demography). Academia: Prague, 1986.
- RYCHTAŘÍKOVÁ, J. Demografické faktory stárnutí (Demographic Factors of Ageing). *Demography*, 2011, Vol. 53, No 2, pp. 97–108.

The Impact of Subsidies on Czech Firms

Oto Potluka¹ | *University of Economics, Prague, Czech Republic*

Jan Brůha² | *University of Economics, Prague, Czech Republic*

Ondřej Vozár³ | *Czech Statistical Office, Prague, Czech Republic*

Martin Špaček⁴ | *University of Economics, Prague, Czech Republic*

Jakub Loun⁵ | *University of Economics, Prague, Czech Republic*

Abstract

In the Czech Republic there has been invested a lot of money to the human capital through the European Social Fund. The Human Resources and Employment Operational Programme plays an important role by providing subsidies for the training of employees and an introduction of modern forms of management and human resource development.

This paper summarizes the application of the regression discontinuity method to test whether there is an impact of EU assistance on employment in supported firms in 2009. The estimations were conducted with a sample with 1 176 supported and 87 rejected applicants. The estimation results suggest that the impacts of the intervention on employment is positive and statistically significant. The employment change in supported firms was on average about 10–15 p.p. higher than in unsupported firms.

Keywords

Counterfactual impact evaluation, regression discontinuity design, European Social Fund, employment

JEL code

C13, J08

INTRODUCTION

The EU Cohesion Policy programming period 2007–2013 is in progress. The EU funding is oriented to improvement of the economic situation of the regions that are lagging behind.

Naturally, one starts to be interested in the actual impact of this policy, whether it has achieved its goals. Since, the policy has been in progress for several years, it is possible to conduct impact evaluations on already implemented projects.

¹ University of Economics, W. Churchill Sq. 4, 130 67 Prague 3, Czech Republic. Corresponding author: e-mail: potluka@vse.cz.

² University of Economics, W. Churchill Sq. 4, 130 67 Prague 3, Czech Republic.

³ Czech Statistical Office, Na Padesátém 81, 100 82 Prague 10, Czech Republic.

⁴ University of Economics, W. Churchill Sq. 4, 130 67 Prague 3, Czech Republic.

⁵ University of Economics, W. Churchill Sq. 4, 130 67 Prague 3, Czech Republic.

The nature of the policy program precludes the usage of the standard statistical techniques (such as regression analysis) for impact evaluation. The reason is that the selection of economic agents (firms) to the program is non-random and the assumptions usually made when applying standard statistical techniques, such as regression analysis, are typically violated. Therefore, the econometric and statistical community has proposed a bulk of methods, which can – under some assumptions – be applied for impact evaluation under the name Counterfactual Impact Evaluation (henceforth CIE). More details of information can be found in Morgan and Winship (2007) or Khandker et al (2010), who explain the reasons of failure of the standard techniques and overview the most common CIE approaches.

Until now, there have been just few impact evaluations of the EU Cohesion Policy using the methodology of the Counterfactual Impact Evaluation, for recent development see the example ASVAPP (2012), Pokorski (2011) or GEFRA, IAB (2010). To authors' best knowledge; there has not been such an impact evaluation study in the Czech Republic.

Our study employs the CIE approach to identify the impact of the European Social Fund (ESF) on the Czech companies. One of the aims of this study is to provide evidence about the impact of the intervention on employment in companies as the employment is a long-term objective of the EU strategies.

The study deals with the Human Resources and Employment Operational program (HREOP), support area 1.1 which is focused on investments in human capital in companies and development of systems that help to increase the flexibility of the workforce, increase their knowledge and skills. The aim of this intervention is to increase the adaptability of employees and employers (Ministry of Labour Affairs, 2012). It is therefore not directly targeted at the unemployed, but it helps to avoid potential unemployment. According to the Ministry of Labour Affairs (2012) the implementation of this intervention should help to develop professional knowledge, skills and competencies of employees and employers and expand potential for the application of more flexible forms of employment and introduce modern forms of management and human resource development.

In this paper we present results obtained by the application of one particular CIE technique – the regression discontinuity design (RDD) method on a data set of a supported and an unsupported firm applying for a grant of the HREOP. We present the results for the years 2008-2009 after the first year of the research project. The first part describes a selection of data and the selection process of applicants in the HREOP 1.1. The specification of the methodology and our final results follows.

1 DATA AND METHODOLOGY

1.1 Data

In the HREOP the selection process is based on the assigned point ratings of independent appraisal experts. Each project gets randomly its own two appraisal experts who assess the quality of the project application and who score it from 0 to 100 points according to specified criteria. There is a strict rule in the HREOP which does not allow support projects with a score less than 65 points. The selection mechanism of application works as follows:

- If both appraisal experts score the application less than 65 points, the project is rejected;
- If both appraisal experts score the application more than 65 points, the project is recommended for support;
- If one of the appraisal expert's score the application less than 65 points and the second one more than 65 points, the third appraisal expert assesses the application and according to his/her given score the project is rejected or accepted.

There is also the possibility that the cut-off point needed for obtaining the support could be above the 65 points in the case of the lack of allocated money. But it was not in the case of analyzed calls for proposals as there was enough money in studied call for proposals. Thus, all applications with more than 65 points are recommended to be supported.

Within the support area 1.1 we have analyzed three very similar types of calls for proposals together (Calls 35, 39 and 60). The following table shows the number of supported and rejected applications in particular calls.

Table 1 Calls 35, 39, 60 – The Size of the Data Sample

	Number of applications in the calls for proposals			CZSO data sample	
	Applications submitted	Applications supported	Applications rejected	Firms supported	Firms rejected
Call 35	1 802	1 064	738	896	55
Call 39	347	98	249	111	20
Call 60	462	182	280	169	12
Total	2 611	1 344	1 267	1 176	87

Source: Monit 7+, CZSO

We obtain data on Czech firms from the Czech Statistical Office (CZSO). CZSO do not collect data for each firm from our data sample, and therefore the size of the data sample decreases but it is still large enough. Information on applications is transformed to a data set on particular firms as some firms applied for the support more than once.

We prefer to work with official data rather than with the own firm's estimate. Indeed, Betcherman, Daysal and Pagés (2010) pointed out that when reporting results of support, companies have a tendency to overestimate the number of jobs created compared to the actual situation. Therefore, we use the indicator of employment measured independently with an annual periodicity (data by CZSO). By using the official data, we are able to solve this methodological pitfall.

1.2 Methodology

We have used the regression discontinuity design method to estimate the impact of the intervention on employment. The analysis focused on the immediate effect of intervention because the tests have been done on ongoing projects. The impact is tested as 2008 represents a pre-treatment period and 2009 the quasi post-treatment period.

The data used for our analysis are the data of the Czech Statistical Office on firms between 2008 and 2010. The data concern limited companies and joint stock companies which were suitable applicants for HREOP support.

The RDD method is based on the comparison of units (here companies' projects) with score points around a cut-off point, which determines the probability of receiving the treatment (here the support from the HREOP). The idea is based on the assumption that the distribution of the units in the neighbourhood around the cut-off point is almost random. If the cut-off value significantly influences whether the company receives the treatment, the treatment is for the firms in the neighbourhood around the cut-off point is almost random and is statistically valid to compare the outcomes of supported and unsupported firms from that neighbour.

There are two versions of the method: the sharp version, where all units below the cut-off point do not receive the treatment and all units above the cut-off do receive it and the fuzzy version where just the probability of receiving the treatment changes (from a small value to a large one). In the sharp version, the average causal effect is estimated as the difference in the mean values of the investigated indicator for units just above and those just below the cut-off value. In the fuzzy version, the average causal effect is estimated as the ratio of the above mentioned difference in the mean values of the indicators divided by the difference in probabilities of receiving the treatment around the cut-off.

Given some further assumption, it can be shown that the method has good internal validity, at least for the units around the cut-off points. One of the critical assumptions is that only the probability of receiving treatment and the indicator values change abruptly around the cut-off value. If there is another variable, which also changes abruptly at the cut-off value, then the identification of the treatment effect is not possible: in such a case, it would not be possible to identify, whether the change in the investigated indicator is due to the treatment or due to that variable.

There are various techniques for estimating the mean values of the investigated indicator around the cut-off value. The most common techniques include running two separate regressions of the indicators based on score points for units below and above the cut-off value. These regressions may be parametric (the indicator is regressed on few first powers of score points) or fully non-parametric. The fitted values based on the two regressions at the cut-off value are then compared⁶. In the fuzzy variant, the analogical regressions are estimated for probabilities of receiving the treatment. See Lee and Lemieux (2009) for further discussion and technical details of the method.

Given the selection process, in our case the cut-off point is at 65 score points. Since in our data all projects with an average score over 65 received support, whereas projects with an average score less than 65 did not receive support, it is possible to apply the one-way fuzzy version of the RDD model. We have also tested several variables (such as the size of companies, or its characteristics, such as dummy variables for NACE categories) and we have not found that any of these variables change abruptly around the cut-off points.

We have evaluated the impact of support on the following two indicators:

- Employment 1 – Percentage change in the number of employees as to fulltime jobs between 2008 and 2009, this variable (as well as the following one) is used to model the impact of support on employment;
- Employment 2 – Percentage change in the number of employees as the number of persons between 2008 and 2009.

RDD estimates the average impact of an aid in the border area of points needed to obtain support by differences of expected (mean) values of indicators for projects which score is closely above or below this border. We apply several methods to estimate the expected (mean) values in order to increase the robustness of our results. These methods are:

- Nonparametric regression (we used Watson-Nadaraya's estimator (Nadraya 1964), with a time smoothing window set up by cross-validation);
- Polynomial regression (tested with varying degrees of polynomials; to estimate the coefficients of polynomials, we used ordinary least squares method);
- Robust polynomial regression (we used robust regression to estimate the coefficients of polynomials, which is – unlike the ordinary least squares method - less sensitive to outlying observations);
- Semi-parametric estimation based on the fit of the generalized skew-normal distribution.

The first two methods are standard according to the econometric literature (e.g. Lee, Lemieux, 2009). We have used the third method because of the sensitivity of the polynomial regression model estimated by least squares method to outliers. The fourth method has been used because of its flexibility; see Ma and Genton (2004) for further details. Standard errors of estimations and p-values for all methods were approximated via bootstrap (Davison, Hinkley, 1997).

⁶ Alternatively to the parametric approach, one can run just one regression on the whole sample, and the regression model must include the dummy variable equal to one if the score points are above the cut-off and zero otherwise as well as the product of this dummy variable with all powers of score points. It can be shown that such approach can be then interpreted as the instrumental variable regression, see Lee and Limieux (2009).

2 RESULTS AND DISCUSSION

All methods have found significant effect of support on change in the number of employees. A reasonable estimate of the impact varies between 5 to 10 percentage points. The reader can see the summary of results for each method in Table 2.

Table 2 Results of all examined calls for proposals (35, 39, 60)

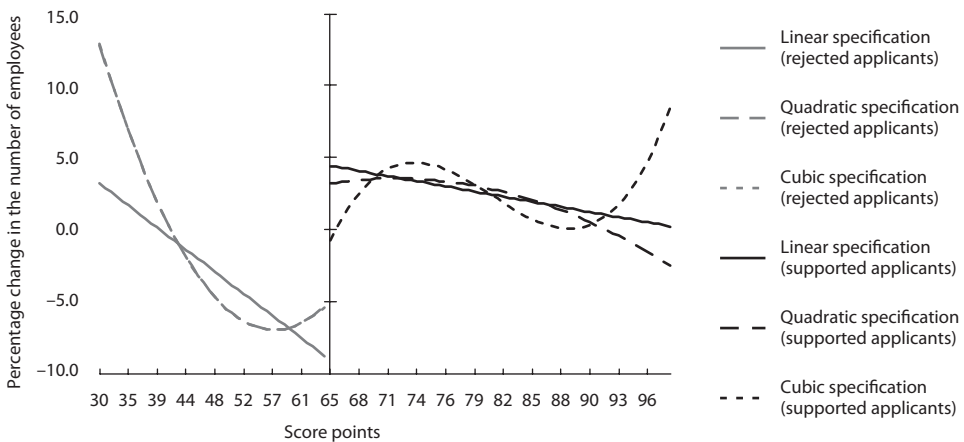
Method	Note	Indicator	
		Employment 1	Employment 2
Skewed normal distribution	linear	11.68***	12.34***
	linear and cubic	10.36**	4.52*
Nadaraya-Watson estimator	smoothing by cross-validation (CV)	8.89	9.80
	smoothing 5-times more than CV	10.74	13.28
	smoothing 5-times less than CV	8.42	7.19
Polynomial regression	linear	13.19***	14.05***
	quadratic	8.57*	12.73**
	cubic	4.59	9.71*
Robust polynomial regression	linear	7.88**	6.53*
	quadratic	6.71	6.99**
	cubic	6.05	4.61

Note: *** indicates significance at 1%, ** indicates significance at 5%, * indicates significance at 10%.
 Source: Monit 7+, CZSO, Own calculations

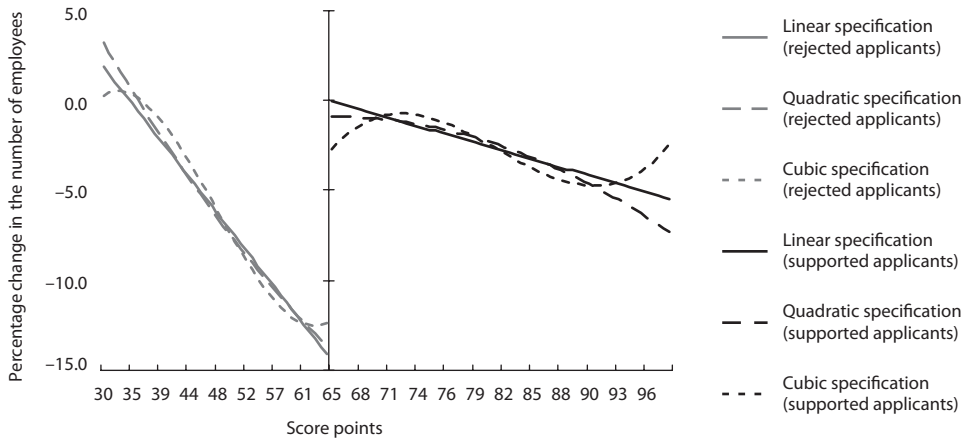
The average change in employment of supported firms has low correlation to the average number of points. On the other hand, unsupported firms with a few points have on average a smaller decline in employment than unsupported firms around the left border of 65 points. That suggests that the RDD model results should be taken into account only as a local and the results obtained by RDD cannot be extrapolated to the whole sample of firms. The method has high internal validity, but low external validity.

The following figures illustrate the estimation results for fitted polynomial curves. Estimated impact can be represented as the difference in the values of curves in the area of discontinuity (at the cut-off point of 65 points).

Figure 1 RDD estimation - number of employees as fulltime jobs



Source: Own calculations, CZSO, Monit7+

Figure 2 RDD estimation – number of employees as number of persons

Source: Own calculations, CZSO, Monit7+

CONCLUSIONS

The application of the RDD method on data of employment from the CZSO suggests the statistically significant results indicating a positive impact of subsidies of training in firms on employment. We have found the significant results for both indicators. The reasonable range of the impact is from 5 to 10 percentage points.

The average decline in employees as fulltime jobs was between 5 to 15% (and a slightly larger decline in the number of employees as number of persons) for unsupported firms from the left neighbourhood of 65 points. The average change in employment moves to zero for supported companies. It means that unsupported firms decreased their workforce by 7% of their employees unlike supported firms that were able to preserve the size of their workplaces, at least partially as the effect of the ESF subsidies, which is not a bad result given the macroeconomic recession in the 2008–2009 period.

Although the results seem positive, an important question remains whether the results are sustainable even after the end of the intervention. For example, Girma, Görg, Strobl and Walsh (2008) find that the supported jobs in Ireland usually last 4 years after receiving grant and then the effect disappears after it. Although the answer to that question would be of great importance for a long-term strategy of labour market policy, it cannot be answered now, as it has not leap enough time since the start of the implementation of the project. Nevertheless, we plan that it will be the subject of our future research.

ACKNOWLEDGMENT

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References

- ASVAPP. *Counterfactual Impact Evaluation of Enterprise Support: Lessons for Policy and Evaluation Design from Investment Subsidies in Italy* [online]. ASVAPP, February 2012. [cit. 30.3.2013]. <<http://www.prova.org/studi-e-analisi/ASVAPP%20INTERIM%20REPORT%20FOR%20CIE%20OF%20ENTERPRISE%20SUPPORT.pdf>>.

- BETCHERMAN, G., DAYSAL, N. M., PAGES, C. Do Employment Subsidies Work? Evidence from Regionally Targeted Subsidies in Turkey. *Labour Economics*, 2010, 17(4), pp. 710–722.
- DAVISON, C., HINKLEY, D. V. *Bootstrap Methods and their Application (Cambridge Series in Statistical and Probabilistic Mathematics)*. Cambridge University Press, 1997.
- GEFRA, IAP. *Ex Post Evaluation of Cohesion Policy Programmes 2000–2006 Financed by the European Regional Development Fund. Work Package 6c: Enterprise Support – an Exploratory Study Using Counterfactual Methods on Available Data from Germany* [online]. GEFRA and IAP, Final Report, July 2010. [cit. 24.4.2013]. <http://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/expost2006/wp6c_final_report_en.pdf>.
- GIRMA, S., GÖRG, H., STROBL, E., WALSCH, F. Creating Jobs through Public Subsidies: An Empirical Analysis. *Labour Economics*, 2008, Vol. 15, Issue 6 (December), pp. 1179–1199.
- KHANDKER, S. R., KOOLWAL, G. B., SAMAD, H. A. *Handbook on Impact Evaluation*. Washington D.C.: The World Bank, 2010.
- LEE, D., LEMIEUX, T. *Regression Discontinuity Designs in Economics*. NBER Working Paper 14723, Cambridge, February 2009.
- MA, Y., GENTON, M. G. Flexible Class of Skew-Symmetric Distributions. *Scandinavian Journal of Statistics*, 2004, Vol. 31, Issue 3 (September), pp. 459–468.
- MINISTRY OF LABOUR AFFAIRS OF THE CZECH REPUBLIC. *Human Resources and Employment Operational Program 2007–2013* [online]. Prague: Ministry of Labour Affairs of the Czech Republic, 2010. [cit. 5.4.2013]. <<http://www.esfcr.cz/file/5841/>>.
- MORGAN, S., WINSHIP, C. *Counterfactual and Causal Inference: Methods and Principles for Social Research*. Cambridge University Press, 2007.
- NADARAYA, E. *On Estimating Regression*. Society for Industrial and Applied Mathematics, Theory of Probability & Its Applications, 1964, Vol. 9, Issue 1, pp. 141–142.
- POKORSKI, J. *Towards Innovative Economy: Effects of Grants to Enterprises in Poland*. Polish Agency for Enterprise Development, 2011.

More Money in Education Makes Economy Best?¹

Rita Lima² | *Italian Institute of Statistics (ISTAT), Rome, Italy*

Abstract

This paper investigates the relationship between government expenditure on education and labour force participation rate over the period 1970–2010 in Mediterranean economies of Europe area, usually refer to PIGS economies. The study employs a Data Envelope Analysis (DEA) to briefly describe some evidence on functioning and dynamics of labour markets and to evaluate the efficiency of use of knowledge as strategy to increase the growth. The DEA results of PIGS are compared with DEA on three developed economies of Europe (UK, Netherlands and France). In addition, the paper uses a time series approach to investigate the long term relationship between human capital and its employability applying the vector autoregressive (VAR) method and the Granger-Causality test. It has been found that the investment in education could be a prerequisite for sustainable growth and make it easier to achieve societal objectives, especially in the weakest growing countries.

Keywords

Human capital, expenditure on education, data envelope analysis, granger-causality test, VAR

JEL code

C10, C13, C52, E24

INTRODUCTION

A recent study of the Organisation for Economic Co-operation and Development (OECD) demonstrated that return on growth is higher when it involves investing in people, in their education and training, in their requalification – in other words, in human capital (OCSE, 2013). The theory of *human capital* is rooted from the field of macroeconomic development theory (Schultz, 1993). Becker's (1993) in his book, *Human Capital: A Theoretical and Empirical Analysis with special reference to education*, argues that there are different kinds of capitals that include schooling, a computer training course, expenditures on medical care. Education deals with the improvement of “the whole person” including intellectual, character and psychomotor development. Human resources of any nation, rather than its physical capital and material resources ultimately determine the character and pace of its economic and social progress.

So, the belief, that education promotes growth has led governments of many developing countries to invest in the education sector. This is, also, the starting point of the Commission's Cohesion Policy Package (European Commission, 2012). Actually, many theories explicitly connect investment in human capital development with education, and the role of human capital in economic development, productivity growth, and innovation has frequently been cited as a justification for government subsidies for education and job skills training (Benhabib and Spiegel, 1994; Simkovic, 2012). Several studies based

¹ Views expressed herein are those of the author and do not necessarily respect those of ISTAT.

² Social and Environmental Statistics Department, Socio-economic Statistics Directorate, Viale Oceano Pacifico 171, 00144 Rome, Italy. E-mail: lima@istat.it.

on many economic growth theories and models demonstrated that human capital is the major source of productivity and it is a crucial factor for explaining differences in economic development between countries (see, for example, Romer, 1990; Gemmel, 1996; Barro et al., 1998; Buysse, 2002; Lima, 2009; Hussin et al., 2012): education increases wages (Becker, 1994) and reduces the risk of unemployment (Mincer, 1991), presumably by increasing labour productivity (Wise, 1975). Furthermore, in view of the present crisis, growth and jobs are considered the driving force behind the series of cohesion policy proposals for the next Europe 2020 strategy (Grimaccia and Lima, 2013). In fact, in the European Union (EU) for instance, it is argued that once in the labour market, the more educated have less than half the chance of being unemployed compared to the less educated (Psacharopoulos, 2007). It has also been observed that the incidence and duration of unemployment are also influenced by the level of education (Riddell and Song, 2011). In general, the knowledge trends in the OECD are leading to revisions in economic theories and models to fully establish and emphasize the role of knowledge in driving the economic success of these countries. Recently, several researches establish that the move towards a knowledge-based economy is an innovative and crucial element of economic growth theory that cannot be ignored, especially in the growth strategies of developing countries.

In particular, the term *knowledge-based economy* has emerged from a fuller recognition of the pivotal role that knowledge and technology play in economic growth, as embodied in human capital, innovations and technology (Juma and Awara, 2006). But this role is not new and has always been recognized in contemporary literature (OECD, 1996).

From an analytical perspective, “a *knowledge-based economy* refers to an economy in which the production, exchange, distribution and use of knowledge is the main driver of economic growth, employment generation and wealth creation” (Eliasson, 1990; McKeon and Weir, 2001). The same conclusions do not necessarily hold for a sub-sample of OECD countries (Englander and Gurney, 1994). The key problem, however, in the formalization and modelling of knowledge economy is a vague definition of human capital, which is a rather relative concept. Practically, the literature-based paper begins by defining the concepts of human capital in the richest possible specification, as a function of the quantity of schooling, the school resources, family background and other socio-economic factors, and ability. Overall education and training are considered the most important investment in human capital.

Consequently, it is fully in keeping with the capital concept as traditionally defined to say that expenditures on education, training, etc., are investment in capital. These are not simply costs but investment with valuable returns that can be calculated.

Having this in mind, this paper proposes a narrow approach that investigates, at a macroeconomic level, the impact of public expenditure on education (as a proxy of investment of human capital) on countries performance and the relationship with the activity rate (as an indicator of economic growth).

A Data Envelope Analysis (DEA, Cooper et al., 2002 and 2004) is conducted on Southern economies of Europe area (Italy, Spain, Portugal and Greece) for the period 1970–2010 to evaluate the efficiency of use of public expenditure on education, as strategy to increase the growth. These countries, usually, refer to the unfortunate acronym of PIGS economies due to their currently vulnerable economies, to high national budget deficits in relation to GDP, and high, or rising, government debt levels. DEA results are compared with a DEA analysis on three developed economies of Europe (UK, Netherlands and France).

Since DEA has mostly concentrated on level data and does not take into account the endogeneity of variables, the paper uses a time series approach applying the vector autoregressive (VAR) method and the Granger-Causality test as a powerful theory-driven method for investigating shock transmission among variables (Zellner, 1979; Zellner and Palm, 1974).

Following the introduction, the rest of the paper is split into five *sections*. *Section 1* briefly reports on some macroeconomic evidence regarding PIGS economies. *Section 2* describes the research hypotheses after a literature review on modelling the relationship between investment in human capital and activity

rate. *Section 3* presents the data characteristics. *Section 4* reports the DEA ranking results and outlines the applied results of the VAR methodology while *section 5* briefly concludes the paper.

1 EVIDENCE ON PIGS

PIGS refer to Portugal, Italy, Greece, and Spain. The name presents the negative connotations and is normally used to relate a history of facing economic difficulties, soaring unemployment, steady increase of government's debts and political instability (World Economic Forum, 2013; Thornton, 2012).

For 2012 some evidences are shown in Figure 1.

Portugal: While it's one of the smallest economies included in the original PIGS, Portugal's economic is of a mixed nature and functions in support of a high income country. The Global Competitiveness Report 2012–2013 edition placed Portugal in the 49th position out of 144 countries and territories (World Economic Forum, 2013).

The Financial Crisis of 2008 continues to severely affect the Portuguese economy and in 2012 the crisis has caused a wide range of domestic problems that are specifically related to slow-down economic growth (–3.2%), high unemployment (15.9%), as well as the excessive debt levels (123.6%) and inflation (2.8%), in the economy.

Italy: Italy's economy is divided into a developed industrial north, dominated by private companies, and a less-developed, highly subsidized, agricultural south.

Italy is the third-largest economy in the euro-zone, but its exceptionally high public debt and structural impediments to growth have rendered it vulnerable to scrutiny by financial markets. Public debt has been increasing steadily since 2007, topping 127.0% of GDP in 2012.

In the same year, economic growth and labour market conditions deteriorated, with growth at –2.4% and unemployment rising to 10.7%. Although the government has undertaken several economic reform initiatives, Italy's GDP is now 7% below its 2007 pre-crisis level and inflation rate is 3.3%.

Greece: As a result of the world financial crisis, in 2012 this country suffers from slow economic growth (–6.4%) and high unemployment (24.3%)-, but it differs in its economic structure compared to other European nations. Greece has a capitalist economy with a public sector accounting for about 40% of GDP and with per capita GDP about two-thirds that of the leading euro-zone economies. This in itself has limited Greece, to a certain extent, in its economic recovery, as the public sector is notorious for moving and reacting slowly.

Greece violated the EU's Growth and Stability Pact budget deficit criterion of no more than 3% of GDP from 2001 to 2006, but finally met that criterion in 2007–08, before exceeding it again in 2009, with the deficit reaching 15% of GDP.

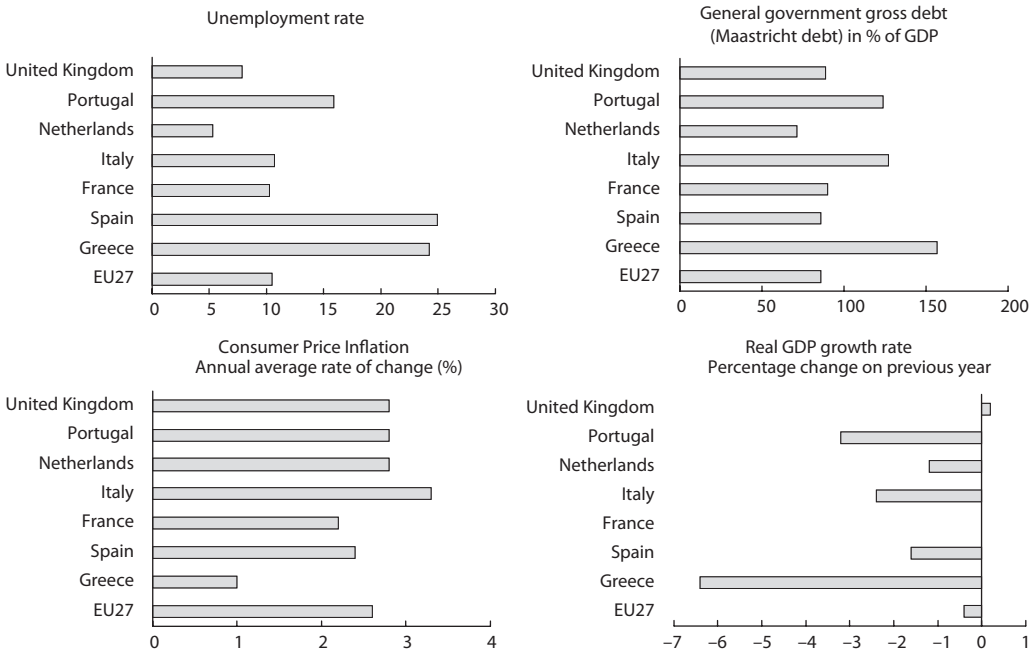
Spain: After almost 15 years of above average GDP growth, the Spanish economy began to slow-down in late 2007 and entered into a recession in the second quarter of 2008. GDP contracted by 3.7% in 2009, ending a 16-year growth trend, and by another 0.3% in 2010, before expanding moderately in 2011, making Spain the last major economy to emerge from the global recession.

Although Spain's the government's ongoing efforts to cut spending and introduce flexibility into the labour markets, in 2012 poor economic growth prospects (–1.4%), high unemployment (25.0%) and inflation (2.4%) remain a source of concern. Spain's public debt stood at 84.2% of GDP in 2012, still less than the Euro-zone average of 88% (Eurostat, 2012).

2 RESEARCH HYPOTHESES

It is widely acknowledged that, education is an important determinant factor of economic growth. Prominent classical and neoclassical economists such as Adam Smith, Romer, Lucas and Solow emphasized the contribution of education in developing their economic growth theories and models. The main theoretical approaches of modelling the linkages between education and economic performance are the neoclassi-

Figure 1 Macroeconomic metric (year 2012)



Source: Eurostat's online database, 2012

cal growth models of Robert Solow (1957) and the model of Romer (1990). Apart from the theoretical aspects, numerous empirical studies have focussed on the issue of education and economic development.

Most empirical research has confirmed the existence of a positive relationship between the initial stock of human capital and subsequent growth so that the term *'knowledge-based economy'* has emerged from a fuller recognition of the pivotal role that knowledge and technology play in economic growth, as embodied in human capital, innovations and technology (Juma and Awara, 2006). This role is not new and has always been recognized in contemporary literature (Schilirò, 2010; Eliasson 1987, 1990; OECD, 1996). Linking the positive effect of human capital improvement through education to employability, Fasih (2008) argued that education is critical in preparing individuals to enter the labour market, as well as equipping them with the skills to engage in lifelong learning experiences. Indeed, employability of human capital is extensively influenced by a number of socioeconomic, demographic, educational and labour market factors (Lima et al. 2006).

Many attempts have been made to find the adequate measures for this broad concept which is human capital. Since the work of Mankiw, Romer and Weil (1992) and Barro (1991), there has developed a large literature – Hanushek (1995), Temple (2001), Krueger and Lindahl (2001), Gemmel (1996), Benhabib and Spiegel (1992) – on the positive association between education quantity and economic growth. Education quantity is measured by schooling enrolment ratios (Mankiw, Romer and Weil 1992, Barro 1991, Levine and Renelt 1992), the average years of schooling (Hanushek and Woessmann 2008), adult literacy rate (Durlauf and Johnson 1995, Romer 1990), education spending (Baladacci et al., 2008). The relationship between schooling quality and economic growth is examined, also, in the work of Barro (1999), Hanushek and Kimko (2000), Hanushek and Kim (1995), Hanushek and Woessmann (2007). Biagi and Lucifora (2008) studied the impact of education on unemployment using data from Labour Force Surveys

for 10 European countries, and concluded that, controlling for a host of other factors (e.g., demographic variables or business cycle), higher educational attainment (measured by the share of those with more than primary education) reduces unemployment rates, both for less educated and (especially) for more educated groups. Further, according to Blondal et al. (2002), in most countries, years of schooling minimizes the risk of unemployment, and hence the employment rate among those with tertiary education attainment is higher than among groups with lower levels of attainment (Grimaccia and Lima, 2013).

However, overall, the empirical evidence is quite mixed. Some might say it has positive effect and vice versa, despite the general believe that individual educational achievement will lead to job opportunities and job creations and, at the same time, improve people's life.

About human capital formation, that entails spending on education, health and training, Lucas (1988) held the view that public spending on education promoted human capital, which in turn might contribute to economic growth. Some empirical studies support the view that efficient and sufficient spending on the education and health sectors fosters human capital formation and promotes economic growth (Schultz, 1961; Swaroop, 1996; Lee and Barro, 1997; Psacharopoulos and Patrinos, 2004; Gupta, Clements and Inchauste, 2004, Finardi et al, 2012). There are, also, papers such as Nurudeen and Usman (2010) where it is found that the impact of education expenditures on growth is negative. There are, however, studies that reveal a weak relationship between education quantity and growth – Bils and Klenow (2000) while Prichett (2001) finds no relation at all between schooling and economic growth. According to Blaug (1970) and Sheehan (1971), investment in education is just merely a consumption. This is due to the fact that investment in acquiring knowledge or skills is for individual interest only and does not contribute into the economic growth.

In addition, according to Ismail and Jajri (1998), education is considered as a long term investment that leads to a high production for a country in the future. In fact, economists argued that advanced education sector will certainly lead to a success of a country's economics and social development (Hanushek and Kim, 1995; Lee and Barro, 2001; Buysse, 2002).

Although the effect of human capital on economic growth is arguable according to the previous review, this paper will focus on the public resources invested in education, expressed as a fraction of GDP, to compare how much of their wealth different countries invest in education and to measure how these differences across countries have an impact on economic growth over the time in term of labour force participation rate. The labour force participation rate is chosen because it plays a key role in the study of the factors that determine the size and composition of a country's human resources and in making projections of the future supply of labour. Actually, it is used to formulate employment policies, to determine training needs and to calculate the expected working lives of populations and the rates of accession to, and retirement from economic activity – crucial information for the financial planning of social security systems.

Moreover, natural fluctuations in real economic growth unambiguously lead to relevant changes in labour force participation rate (Kitov and Kitov, 2008).

Here the following two hypotheses are formulated to assess the returns of public investments in education on differences countries' growth:

Hypothesis 1. *The contribution of public expenditure on education to economic growth is realized through employment creation, in term of activity rate, given that:*

- *The decline of employment is the worst effect of the recent economic crisis.*
- *People with lower education appear weaker in the labour market.*

Hypothesis 2. *The effect of public educational expenditure on economic growth, through employment creation in the short-term is smaller than that in the long-term, given that:*

- *The impact of education spending in promoting growth is not an instantaneous process.*
- *Spending on education initially leads to the development of human capital, which ultimately manifests itself in the form of economic growth.*

3 DATA CHARACTERISTICS

The empirical analysis is conducted for the period 1970 to 2010 and employs data on total public expenditure on education as % of gross domestic product and on labour force participation rate.

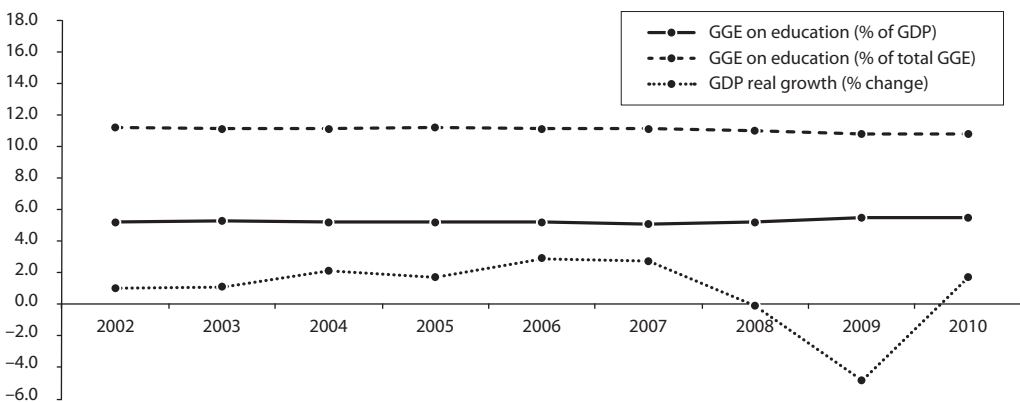
Data on total public expenditure on education (% of GDP) were taken from the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics database and from the for Economic Cooperation and Development (OECD) National Accounts data files. For Greece, data on labour force participation rate refer to Demekas and Kontolemis (1997), European Economy No. 60, 1995 and OECD Labour Force Statistics. For the other countries, data on labour force participation rate are based on figures mainly from national statistical agencies, but also from the Organization for Economic Cooperation and Development (OECD, StatExtracts database), the Statistical Office of the European Communities (EUROSTAT database), and from the U.S. Bureau of Labor (2013).

Total public expenditure on education as % of gross domestic product (EXE): Traditionally, the European education system is mainly financed by public means either by bearing directly the current and capital expenses of educational institutions or by supporting students and their families with scholarships and public loans as well as by transferring public subsidies for educational activities to private firms or non-profit organisations. Both types of transactions together are reported as total public expenditure on education. The proportion of public expenditures on primary, secondary and post-secondary non-tertiary education is above 90% of total expenditures on education in the vast majority of countries. In tertiary education the share of public sources is lower since household spending is more important, especially in Spain, Italy and UK (OCSE, 2013).

Since the crisis started, budget constraints threaten to compromise the input or investments made in the field of education. In the European Commission document ‘Education and Training Monitor 2012’ (European Commission, 2012) it is reported:

“...Between 2004 and 2010, GGE on education measured both as a share of GDP and as a share of total GGE was stable – reaching 5.5% and 10.8%, respectively. The average values in figure 2 are the results of different developments across Member States.

Figure 2 General Government Expenditure (GGE) on education and GDP real growth in EU27



Source: Eurostat's online database on Government finance statistics (general government expenditure by function)

Whereas in Greece, Germany, Romania, Bulgaria, Slovakia and Italy GGE on education is around 4% of GDP or less for all the years analysed, the spending in other Member States (such as Denmark, Sweden or Cyprus) is around double that figure (between 7 and 8%).

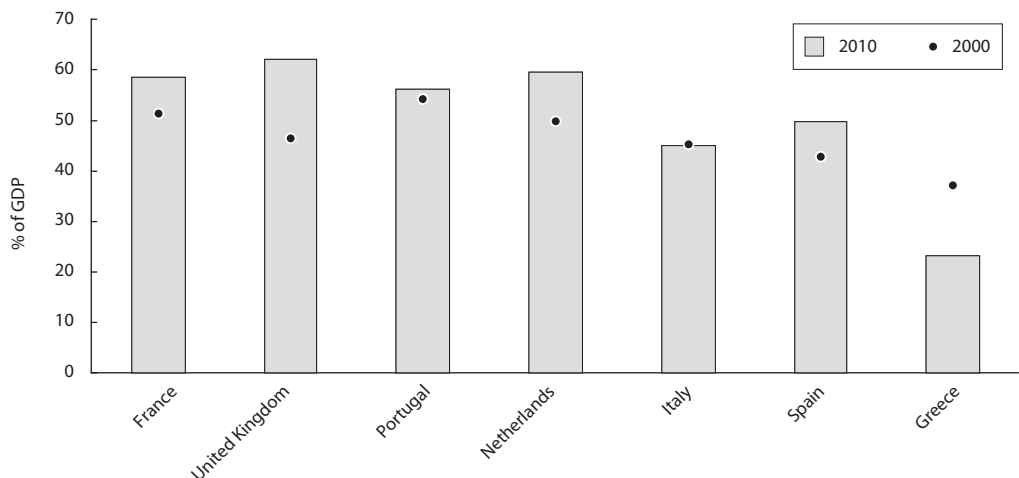
In 2009, nearly all European countries were in recession (i.e. their GDP decreased) and nearly all maintained or increased their public spending in education except Portugal and Romania. Not surprisingly, public expenditure on education as a share of GDP increased in countries which suffered for consecutive years of recession.

This shows that either public expenditure on education continued to increase or that it decreased at a slower pace than the GDP. For instance, in Ireland and Latvia, such a share stood at level above 5% and 6% respectively. In Greece, public expenditure on education remained close to 4% of GDP from 2008 onwards. Such a pattern is observed in nearly all the other countries that recorded two consecutive years of recession. This might also be explained by the time lag that exists in the orientation of public expenditure on education but also the will of policy-makers to go on investing in education systems as they are a key for recovery and future economic growth. When considering national account data, the EU-27 continued to invest in education despite the economic crisis. One third of European countries followed this trend and did not register any decrease in real public expenditure in education from 2007 onwards. However, several countries registered a drop in real public expenditure in education for one or several consecutive years. This occurred over three consecutive years in Italy (2008–2010) and Hungary (2007–2009) and during two consecutive years (2009 and 2010) in Bulgaria, Greece, Latvia, Romania and Iceland. However, the level of public expenditure remained higher in 2010 than that of 2000 in all these countries except Italy⁹.

In sum, in 2000 PIGS economies spent an average of 4.5% of GDP on education in all levels while UK, Netherlands and France an average of 4.9% of GDP (figure 3). Between 2009 and 2010 as a percentage of gross domestic product (GDP) fell by an average 3% in all sample countries. So in 2010, PIGS economies spent an average of 4.4% of GDP on education in all levels while UK, Netherlands and France an average of 6.0% of GDP (Figure 3).

Labour force participation rate (LAB): The labour force participation rate, also known as activity rates, plays a key role in the study of the factors determining the size and composition of a country's human resources and in making projections of the future supply of labour. It has undergone substantial changes, especially for the young, women and the elderly.

Figure 3 Total public expenditure on education (% of gross domestic product in 2000 and 2010), for all levels of education combined



Note: Countries are ranked in descending order of total public expenditure as % of GDP in 2010.

Source: OECD database and World Development Indicators (2013)

A variety of factors underlies these changes, in particular the following (Carone, 2005):

- *social factors*, such as longer schooling or change in the role of women in households;
- *demographic factors*, including the decline of fertility rates and modifications of the age structure;
- *institutional factors*, in particular early retirement schemes or changes in the age of retirement; and/or
- *economic factors*, such as the level of the rate of unemployment, the average income by household, the share of part-time employment in total employment other share of the services sector in the economy.

Even if each country has its own evolution of the labour force, (see table 2), some common “stylised facts” related to both recent trends and main determinants warrant attention (Carone, 2005).

Table 1 Total public expenditure on education (% of gross domestic product) from 1970 to 2010 (average of periods)

Period/Country	Spain	Greece	Portugal	Italy	UK	Netherlands	France
1970–1980	2.27	1.64	2.45	3.92	5.35	6.82	4.26
1980–1990	2.81	2.00	3.09	4.63	4.83	5.80	5.22
1990–2000	4.47	3.14	4.89	4.98	4.99	5.12	5.84
2000–2010	4.43	3.51	5.30	4.58	5.29	5.44	5.72

Source: Author’s computation on UNESCO database

Table 2 Labour force participation rate (15–64 years old) from 1970 to 2010 (average of periods)

Period/Country	Spain	Greece	Portugal	Italy	UK	Netherlands	France
1970–1980	62.26	60.72	67.90	54.91	77.02	56.69	67.10
1980–1990	75.12	62.69	68.45	58.62	76.14	60.29	66.98
1990–2000	63.60	62.85	69.04	58.78	76.34	70.12	69.29
2000–2010	71.34	67.56	73.16	61.96	76.41	76.10	71.47

Source: Author’s computation on Eurostat’s database

They can be summarised as follows:

- the participation rates of prime-age male workers (aged 25 to 54 years), at around 90%, remain the highest of all groups. In contrast, the participation rates of men aged 60 to 64 years have recorded a steady decline in the past thirty years, but there are signs of reversal in many countries;
- female participation rates have steadily increased over the past 25 years;
- the participation rates of young people (aged 15 to 24 years) have declined, mostly due to longer schooling; looking forward, current demographic changes (baby boom and decline in fertility rates) imply that the population of working-age is projected to decline substantially in coming decades, as large cohorts of people enter retirement and are replaced by smaller cohorts of young workers. The increasing share of older workers in the labour force could put downward pressure on the overall participation rate.

4 THE ANALYSIS

4.1 The data envelope analysis: the framework

To what extent does public expenditure on education (as proxy of human capital) impact on countries performance in promoting economic growth through higher employment rate (Hypothesis 1), a DEA is conducted.

DEA is a mathematical programming technique, originating from Farrell (1957) seminar work and popularised by Charnes, Cooper, and Rhodes (1978 and 1981) using a “data-oriented” approach for evaluating the performance of a set of peer entities called Decision-Making Units (DMUs) (Cooper 2011), which develops efficiency scores for all DMUs on a scale of zero to 100%, with units receiving 100% efficiency score being called efficient. The most common efficiency concept is *technical efficiency*: the conversion of physical inputs (such as the public expenditure on education) into outputs relative to best practice.

This technique is usually introduced as a non-parametric one, but in fact, it rests on the assumption of linearity (Chang, et al. 1991) and for the original models even in the more stringent assumption of proportionality. A full presentation of the method may be found in Coelli et al. (2005). Afonso and St. (2005 and 2006).

Here, an *input oriented* DEA model is estimated (Cooper et al., 2004).³

According to Charnes, Cooper and Rhodes (1981) a DMU is defined efficiency by reference to the orientation chosen as follow: “*In an input oriented model, a DMU is not efficient if it possible to decrease any input without augmenting any other input and without decreasing any output*”.

The aim of the paper is to evaluate the performance regarding the countries’ decision, which is based upon EXE, the government expenditure on education (or the input), on the most efficient use of knowledge as a strategy to increase the growth, in term of EMP, the labour force participation rate (or the output). Moreover, to test H1, the DEA is performed with CRS model or *constant returns to scale model*, which assumes proportionality between inputs and outputs (Charnes et al., 1978), and the results compared to the VRS model or *variable returns to scale model* (Banker et al., 1984). In detail, CRS reflects the fact that output will change by the same proportion as inputs are changed (e.g. a doubling of all inputs will double output); while VRS reflects the fact that it may get different levels of output due to reduced input.

Scale efficiency is then calculated as the ratio of the CRS efficiencies to the VRS efficiencies. Many DEA models are static in nature; that is to say, they contain data from a single time period. Some studies contain data for multiple time periods perform separate DEAs for each period. However, it is possible and sometimes beneficial to treat each DMU-time period combination as a distinct DMU in a single DEA.⁴

For each DMU, the DEA mathematical model (1) that maximizes the efficiency score, subject to all other DMUs having efficiencies less than or equal to one (2), is as follows:

$$Maxe_{j_0} = \frac{\sum_{r=1}^s y_{rj_0} \cdot u_r}{\sum_{i=1}^m x_{ij_0} \cdot v_i}, \tag{1}$$

subject to:

$$\frac{\sum_{r=1}^s y_{rj} \cdot u_r}{\sum_{i=1}^m x_{ij} \cdot v_i} \leq 1 \text{ for each DMU } j = 1, 2, \dots, n, \tag{2}$$

$$u_r, v_r \geq \epsilon,$$

³ An input-oriented model is a model where DMUs are deemed to produce a given amount of outputs with the smallest possible amount of inputs (inputs are controllable). It is calculated efficiency output over input and placed emphasis on reduction of inputs to improve efficiency. See Charnes, Cooper and Rhodes (1981).

⁴ For more on this technique, called window analysis, the interested reader is directed to Charnes, Clark, and Cooper (1981).

where:

- x_{ij} = the amount of the i th input at DMU j ,
- y_{rj} = the amount of the r th output from DMU j ,
- v_i = weight attached to input I ,
- u_r = weight attached to output r ,
- e_{j0} = the efficiency score,
- j_0 = the DMU under analysis.

4.2 The data envelope analysis: the framework

The estimated technical efficiency score are given for each country in Tables 3 and 4 along with the direction of return to scale.

An interesting point in the results is that some countries are found to be relatively more efficient than PIGS. For the period 1970 to 2010, under the assumption of VRS, it was found that average technical efficiency score for PIGS is 75.8%, which implies that on average countries could have used 242% fewer resources to produce the same amount of output. Under the CRS assumption, the average efficiency score is 64.0%, which is less than mean efficiency score under VRS assumption. For scale efficiency the average score is found to be 83.3%, which means that on average the actual scale of production has diverged from the most productive scale size by 16.7%. Only Spain is the country that is found to have unity scale efficiency score, which means it operates at most productive scale size.

Table 3 Efficiency report by country for the input-oriented DEA model. Period 1970–2010

Country	CRS MODEL		VRS MODEL			Scale efficiency
	Technical Efficiency Score	Peer	Technical Efficiency Score	Peer		
		SPAIN		SPAIN	UK	
SPAIN	100.00	1.00	100.00	1.00		1.00
FRANCE	76.54	0.95	80.78	1.00		0.95
ITALY	51.88	1.02	57.91	0.85	0.15	0.90
UK	58.72	1.15	100.00		1.00	0.59
GREECE	57.43	1.08	80.31	0.47	0.53	0.72
PORTUGAL	46.78	1.08	65.00	0.48	0.52	0.72
NETHERLANDS	43.26	1.11	67.51	0.23	0.77	0.64

Countries in bold are located on the efficiency frontier. Scale efficiency = CRS TE score/VRS TE score.
Source: Author's computation

Results are different for the period 2000–2010 (Table 4).

Table 4 Efficiency report by country for the input-oriented DEA model. Period 2000–2010

Country	CRS MODEL		VRS MODEL			Scale efficiency
	Technical Efficiency Score	Peer	Technical Efficiency Score	Peer		
		GREECE		UK	GREECE	
SPAIN	83.67	1.06	96.39	0.43	0.57	0.87
FRANCE	64.92	1.06	75.11	0.44	0.56	0.86
ITALY	70.29	0.92	76.64		1.00	0.92
UK	75.04	1.13	1.00	1.00		75.04
GREECE	100.00	1.00	1.00		1.00	100.00
PORTUGAL	71.72	1.08	87.48	0.63	0.37	0.82
NETHERLANDS	72.68	1.13	96.10	0.97	0.04	0.76

Countries in bold are located on the efficiency frontier. Scale efficiency = CRS TE score/VRS TE score.
Source: Author's computation

In this period, under the assumption of VRS, it was found that average technical efficiency score for PIGS is 65.4%, which implies that on an average countries could have used 34.6% fewer resources to produce the same amount of output. Under the CRS assumption, the average efficiency score is 81.4%, which is more than mean efficiency score under VRS assumption. For scale efficiency the average score is found to be 25.6%, which means that on average the actual scale of production has diverged from the most productive scale size by 74.3%. In this period DEA results show that Greece is the most efficient countries within PIGS, in line with Clements' investigations (2002).

4.2.1 Time series analysis

First of all, DEA is not a statistical method, one is not constrained in the type and the relations of the data used, as, for example, in regression techniques. Moreover, good quality data are needed because the DEA technique is sensitive to outliers and may be influenced by exogenous factors (Estache et al., 2007). Finally, due to non-stationary characteristic and dependencies with diverse macroeconomic variables, the use of historical data of LAB and EXE is not sufficient to derive accurate prediction of the future of LAB. So, further analysis is conducted for the period 1970 to 2010 with time series data.

To test hypothesis H2, the work follows a three step procedure (Toda and Yamamoto, 1995). In the first step, the stationarity properties of the data series are examined to determine the order of integration of LLAB and LEXE. To this end, tests for unit roots are carried out, using the by now well-known Augmented Dickey-Fuller (ADF) tests (Dickey, 1987; Dickey and Fuller, 1979) and Phillips-Perron (PP) tests (Phillips and Perron, 1988). Tests for unit roots in the logarithm of the series are followed by tests for unit roots in the first difference of the same series. In the second step, to model LAB (the dependent variable) with EXE (the independent variable) the causality dynamics between the variables are examined by carrying out the causality Wald tests and the Weak Exogeneity of Each Variables test (Granger, 1986). A simple definition of Granger Causality, in the case of two time-series variables, EXE and LAB is: "EXE is said to Granger-cause LAB if LAB can be better predicted using the histories of both EXE and LAB than it can by using the history of LAB alone".

We can test for the absence of Granger causality by estimating the following VAR model:

$$LAB_t = a_0 + a_1LAB_{t-1} + \dots + a_pLAB_{t-p} + b_1EXE_{t-1} + \dots + b_pEXE_{t-p} + u_t \tag{3}$$

$$EXE_t = c_0 + c_1EXE_{t-1} + \dots + c_pEXE_{t-p} + d_1LAB_{t-1} + \dots + d_pLAB_{t-p} + v_t \tag{4}$$

Then, testing $H_0: b_1=b_2=\dots=b_p=0$, against $H_A: \text{'Not } H_0\text{'}$, is a test that EXE *does not* Granger-cause LAB. In the third step, it is specified and estimated a VAR(p) (Juselius, 2007; Johansen, 1996).

A VAR(p) model for the (n x 1) vector Y_t can be written as:

$$Y_t = \varphi D_1 + \Pi_1 Y_{t-1} + \dots + \Pi_p Y_{t-p} + \varepsilon_t \quad t = 1; \dots; T; \tag{5}$$

D_t = deterministic terms.

The VAR(p) model is stable:

- if $\det(I_n - \Pi_1 z - \dots - \Pi_p z^p) = 0$ has all roots outside the complex unit circle;
- if there are roots on the unit circle then some or all of the variables in Y_t are I(1) and they may also be cointegrated;
- if Y_t is cointegrated then the VAR representation is not the most suitable representation for analysis because the cointegrating relations are not explicitly apparent.

The lag length for the VAR(p) model is determined using the most common Akaike Information Criteria (Akaike, 1974).

Consider a bivariate cointegrated VAR(1) model for $Y_t = (y_{1t}; y_{2t})$, where y_{1t} is $\log(\text{EXE})$ the log of the public expenditure on education and y_{2t} is $\log(\text{LAB})$ the log of the activity rate:

$$Y_t = \Pi_1 Y_{t-1} + \varepsilon_t.$$

If Y_t is cointegrated there exists a 2×1 vector $\beta = (\beta_1, \beta_2)'$ such that:

$$\beta' Y_t = \beta_1 y_{1t} + \beta_2 y_{2t} \approx I(0). \quad (6)$$

Using the normalization $\beta_1 = 1$ and $\beta_2 = -\beta$ the cointegrating relation becomes:

$$\beta' Y_t = y_{1t} - \beta y_{2t}. \quad (7)$$

Cointegration implies the existence of an error correction model (VECM) of the form:

$$\Delta Y_t = \Pi Y_{t-1} + \varepsilon_t, \quad (8)$$

$$\Pi = \Pi_1 - I_2, \quad (9)$$

that describes the dynamic behavior of y_{1t} and y_{2t} . The ECM links the long-run equilibrium relationship implied by cointegration that is:

$$y_{1t} = \beta y_{2t} + u_t, \quad (10)$$

with the short run dynamic adjustment mechanism that describes how the variables react when they move out of long-run equilibrium.

4.2.2 Results of econometric analysis

Time series analysis is performed by each country. The idea is to define the order of integration of the variables involved in the model under consideration. To this end, the variables are tested for unit roots in levels and in differences applying the ADF and the PP tests. By plotting time series, the first impression from graphs is that all series are trending upward with some fluctuations. On the basis of the results, all time series are non-stationary in nature with a unit root problem. However, their first difference series are found to be stationary indicating that time series are $I(1)$ at 1% level of significance. The analysis for the appropriate order of VAR model, according to the minimum AIC, shows lags order at one for all countries. The VAR model of order one can be expressed as follows:

$$Y_t = C + \Phi Y_{t-1} + \varepsilon_t, \quad (11)$$

where Y_t is a k by 1 observation vector, ε_t is a k by 1 white noise vector, C is a k by 1 vector of parameters, and Φ is a k by k matrix of first order autoregressive parameters.

The vector Y_t is $(\log(\text{EXE}_t), \log(\text{LAB}_t))$ and the knowledge-growth economy model can be written as:

$$\log(\text{EXE}_t) = c_1 + \Phi_{11} \log(\text{EXE}_{t-1}) + \Phi_{12} \log(\text{LAB}_{t-1}) \varepsilon_{1t}, \quad (12)$$

$$\log(\text{LAB}_t) = c_2 + \Phi_{21} \log(\text{EXE}_{t-1}) + \Phi_{22} \log(\text{LAB}_{t-1}) \varepsilon_{2t}. \quad (13)$$

Tests for unit root and the partial auto regression, cross correlation and canonical correlations for test the lag VAR models are omitted for the simple reason of saving space.

On the contrary, the Granger causality test and the Wald exogeneity tests are reported in Table 5 and Table 6.

The parameter estimates results show that constants are not significant at the 10% significance level in Greece, Spain and Portugal (Table 7).

The residual plot and their corresponding 95% confidence intervals in Figure 4 shows that prediction

Table 5 Granger causality test results

Country	Wald test statistic		
	Test	Chi-quadrato	Pr > ChiQuadr
France	1	1.44	0.2305
	2	1.29	0.2550
Greece	1	0.41	0.5199
	2	3.48	0.0621**
Italy	1	1.07	0.3001
	2	1.4	0.2369
Netherlands	1	2.26	0.1326
	2	1.4	0.2363
Portugal	1	0.26	0.6126
	2	4.32	0.0376*
Spain	1	1.82	0.1774
	2	6.24	0.0125*
UK	1	9.43	0.0021*
	2	7.89	0.005*

Test 1: Group 1 Variable: log(EXE) Group 2 Variable: log(LAB).

Test 2: Group 1 Variable: log(LAB) Group 2 Variable: log(EXE).

(*) and (**) denotes significance at the 0.05 and 0.10 significance level.

Source: Author's calculation

Table 6 Weak exogeneity test

Country	Weak esogeneity test			
	Variable	Chi-quadrato	DF	Pr > ChiQuadr
Greece	log(LAB)	3.24	1	0.0719**
	log(EXE)	1.88	1	0.1706
Portugal	log(LAB)	2.92	1	0.0873**
	log(EXE)	0.44	1	0.5095
Spain	log(LAB)	7.99	1	0.0047*
	log(EXE)	7.93	1	0.0049*
UK	log(LAB)	0.4	1	0.5294
	log(EXE)	1.09	1	0.2976

(*) and (**) denotes significance at the 0.05 and 0.10 significance level.

Source: Author's computation

errors from the model are all within two standard errors, except some cases before 2000: probably due to the quality of the data.

Table 8 shows the ten-year-ahead forecasts on a log of the activity rate, log(LAB), and a log of the total public expenditure on education as % of gross domestic product, log(EXE), and their corresponding 95%

Table 7 The VAR(1) model parameter estimates by country

Model Parameter Estimates						
Spain						
Equation	Parameter	Estimate	Standard Error	t value	Pr> t	Variable
LLAB	CONST1	0.07	0.12	0.55	0.58*	1
	Xlog0_1_1	0.03	0.01	3.47	0.00	logEXE(t)
	AR1_1_1	0.98	0.03	31.08	0.00	logLAB(t-1)
Portugal						
Equation	Parameter	Estimate	Standard Error	t value	Pr> t	Variable
log(LAB)	CONST1	0.35	0.26	1.36	0.18*	1
	Xlog0_1_1	0.01	0.01	1.99	0.05	logEXE(t)
	AR1_1_1	0.91	0.06	14.89	0.00	logLAB(t-1)
Greece						
Equation	Parameter	Estimate	Standard Error	t value	Pr> t	Variable
LLAB	CONST1	0.06	0.24	0.25	0.80*	1
	Xlog0_1_1	0.01	0.01	1.66	0.10*	logEXE(t)
	AR1_1_1	0.98	0.06	16.83	0.00	logLAB(t-1)

(*) denotes significance at the 0.10 significance level.

Source: Author's computation

confidence intervals. These results suggest that on average, Portugal, for example, is expected to have an activity rate equals to 74.5% in 2015.

Table 8 The VAR(1) model forecasts and their confidence limits by country

Forecasts						
Spain						
Variable	Obs	Time	Forecast	Standard Error	95% Confidence limits	
log(LAB)	42	2011	4.33	0.01	4.30	4.35
	43	2012	4.33	0.02	4.30	4.37
	44	2013	4.34	0.02	4.30	4.39
	45	2014	4.35	0.03	4.30	4.40
	46	2015	4.36	0.03	4.30	4.42
	47	2016	4.37	0.03	4.30	4.43
	48	2017	4.37	0.04	4.30	4.44
	49	2018	4.38	0.04	4.30	4.46
	50	2019	4.38	0.04	4.30	4.47
	51	2020	4.39	0.05	4.30	4.48
Portugal						
Variable	Obs	Time	Forecast	Standard Error	95% Confidence limits	
log(LAB)	42	2011	4.31	0.01	4.29	4.33
	43	2012	4.31	0.01	4.28	4.33
	44	2013	4.31	0.02	4.28	4.34
	45	2014	4.31	0.02	4.27	4.35

Table 8 The VAR(1) model forecasts and their confidence limits by country – continuation

Forecasts						
Portugal						
Variable	Obs	Time	Forecast	Standard Error	95% Confidence limits	
log(LAB)	46	2015	4.31	0.02	4.27	4.35
	47	2016	4.31	0.02	4.27	4.36
	48	2017	4.31	0.02	4.27	4.36
	49	2018	4.31	0.02	4.27	4.36
	50	2019	4.32	0.03	4.27	4.37
	51	2020	4.32	0.03	4.26	4.37
Greece						
Variable	Obs	Time	Forecast	Standard Error	95% Confidence limits	
log(LAB)	42	2011	4.26	0.01	4.24	4.29
	43	2012	4.27	0.02	4.23	4.30
	44	2013	4.27	0.02	4.22	4.31
	45	2014	4.27	0.03	4.21	4.32
	46	2015	4.27	0.03	4.21	4.33
	47	2016	4.27	0.04	4.20	4.34
	48	2017	4.27	0.04	4.20	4.35
	49	2018	4.27	0.04	4.19	4.35
	50	2019	4.27	0.04	4.19	4.36
	51	2020	4.28	0.05	4.18	4.37

Source: Author's computation

Note that the numbers in the forecast column in table 8 are in logarithm form. Table 9 shows the estimates of the long-run parameter and the adjustment coefficient of the VECM(1) model to capture the short-run deviation that might have occurred in estimation the long-run co-integration equation.

The long-term equilibrium relationship among the long-run relationship of the activity rate and total public expenditure on education conforms to the Hypothesis 2. Public expenditure on education plays a significant role in the activity rate but provides little answer when it comes to examine the short-run dynamics.

Table 9 Parameter Estimates for the VECM(1)

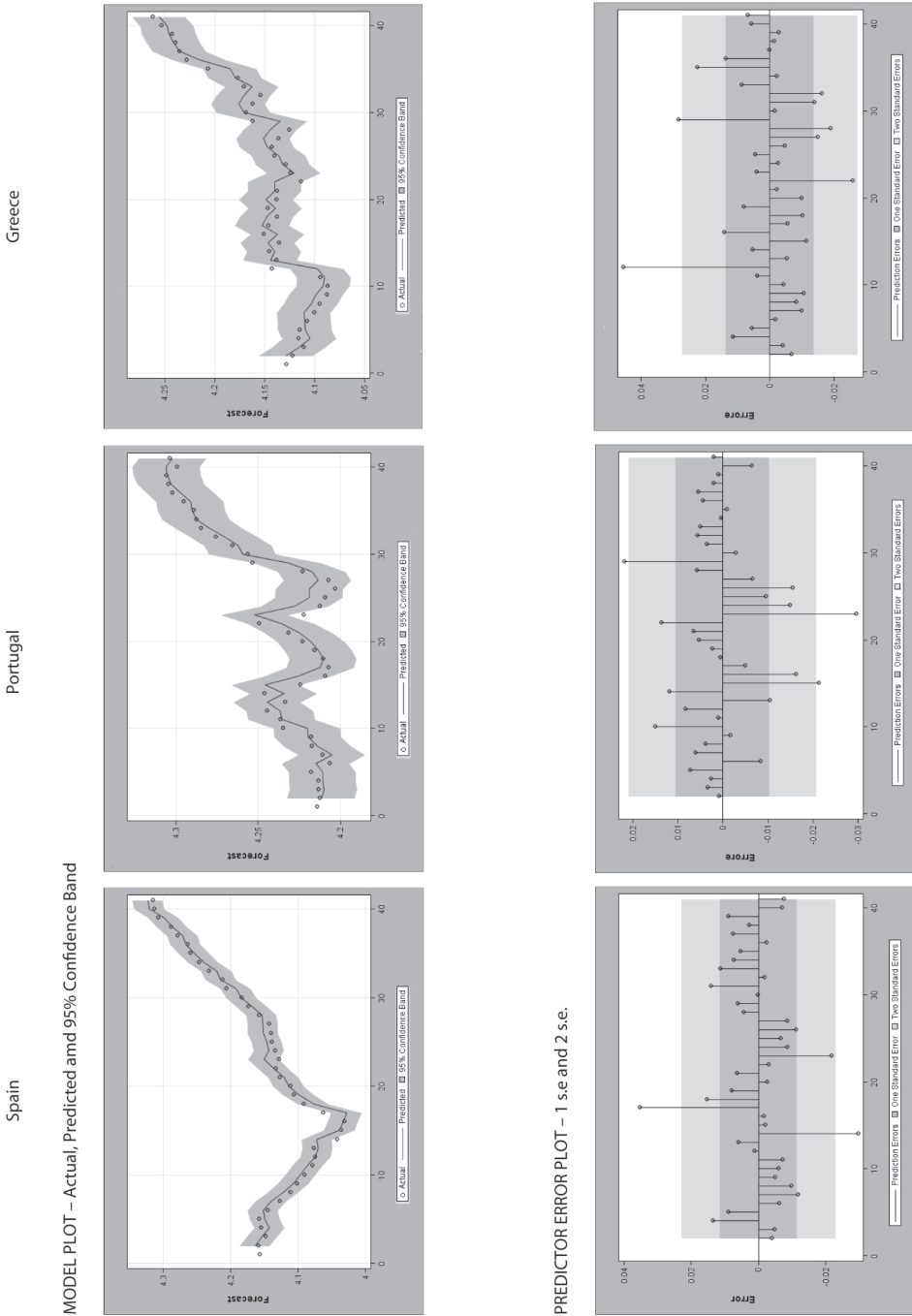
VECM Parameter Estimates								
Spain			Portugal			Greece		
Variable	Long-run parameter	Adjustment coeff.	Variable	Long-run parameter	Adjustment coeff.	Variable	Long-run parameter	Adjustment coeff.
log(LAB)	1	0.00	log(LAB)	1	-0.07	log(LAB)	1	-0.02
log(EXE)	-2.48	0.04	log(EXE)	-0.17	0.24	log(EXE)	-0.81	0.19

Long-term cointegrating relationship is estimated using Proc VARMAX in SAS 9.1, using lag order (P) = 1 in the estimation of cointegrating vector. Estimation Method: Maximum Likelihood Estimation. Cointegrated rank=1.

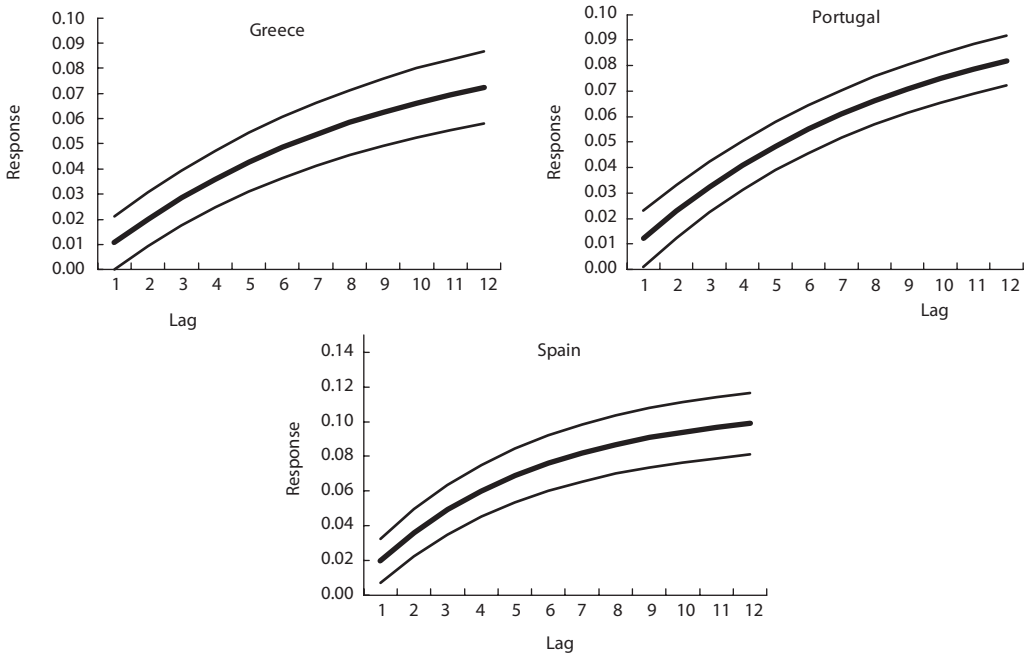
Source: Author's computation

The Spanish estimated cointegrating vector, for example, is $\hat{\beta} = (1; -2,48)'$ the long-run relationship between y_{1t} and y_{2t} is $y_{1t} = 2,48y_{2t}$. The first element of long-run parameter $\hat{\beta}$ is 1 since log(EXE) is specified as the normalized variable. So, a one percent increase in expenditure will cause activity rate to grow up by 2.48 percent in the long-term in Spain (Table 8). The effect of exchange rate in the short-term is smaller than that in the long-term.

Figure 4 Series and predicted errors plots (experimental) for labour force participation rate from 1970 to 2010



Source: Author's computation

Figure 5 Response to impulse in public expenditure on education with confidence limits in terms of lag

Source: Author's computation

The impact that a shock in public expenditure on education has on activity rate is in Figure 5 that shows the responses of $\log(\text{LAB})$ to a forecast error impulse in $\log(\text{EXE})$. According to the impulse response function, a public education expenditure shock has a positive increasing relationship with activity rate in all countries.

CONCLUSION

The starting points of this study are that:

- the decline of employment is the worst effect of the recent economic crisis;
- people with lower education appear weaker in the labour market, as OECD has very well shown and the difference is particularly marked between those who have attained upper secondary education and those who have not (OECD 2013);
- those who got more education from school are the ones who get more education also after school, during their work careers.

Therefore, the aim of this study is to go one step further and seek to investigate casual relation between the labour force participation rates with public expenditure in education in economies of the leading Southern European countries, usually refer to PIGS economies, and in economies of their neighbours (UK, Netherlands and France), using DEA method and annual time series data from 1970 to 2010. As indicated by the European Commission in the "Annual Growth Survey for 2013," the investment in education is particularly relevant for the promotion of growth and socioeconomic development.

DEA result leads to the conclusion that public education expenditure is used inefficiently for the most sample economies. In detail, it is found that in the period 1970–2010 Spain is the only country that is found to have unity scale efficiency score, which means it operates at most productive scale size. This could be con-

firmed by the percentage of (at least young) population with tertiary education (a common indicator for public expenditures' efficiency) that is higher in Spain than in many other European countries and the percentage of GDP devoted to labour market policies, the highest or among the highest levels in EU. Moreover, with the entrance of Spain at the EU and the global economic boom, the unemployment rate started to decrease until begging of the 90's (in 1996, the unemployment rate was again around 20%) and until the recent crisis, it reached a historical minimum in 2006/2007 with an unemployment rate of a bit over 8% (Eurostat statistics). This long lasting decrease of unemployment is partly attributed (see Congregado, Golpe, and van Stel. *Exploring the big jump in the Spanish unemployment rate: evidence on an 'added-worker' effect*. Economic Modelling, 28: 1099–1105. 2011) to the many new government policies, including fiscal and labour market reforms.

In the period 2000–2010, on the contrary, Greece results the most efficient countries. In Greece, given the substantially lower spending levels on education reflecting lower per capita income in this country, the employment rate for persons with upper secondary and post-secondary non-tertiary education level qualifications rose from 52.3% in 1992 to 61.2% in 2008, but it still remained far lower than the employment rate for persons with tertiary education, which was 82.1% in 2008. During 2000–2010, on the other side of the educational spectrum, persons with less than a high-school diploma did not experience rising employment rates, possibly a result of the economy shifting from agricultural activities to the more skill-intensive service sector. For the other countries, many causes for the inefficiencies are possible. The principal is in term of non-monetary determinates of education performance since, for example, greater national wealth or higher expenditure on education does not guarantee better student performance (see PISA 2009 Results: What Makes a School Successful?, Volume IV) and, furthermore, spending on education does not appear to depend directly on a country's living standard. In fact, both countries with a high GDP/capita countries with low GDP/capita allocate large share of their GDP to education (Mandl and et. 2008). Overall, here DEA is too simple to draw reasonable conclusions and efficiency may be not properly measured. In fact, the set of input and output variables selected for DEA analysis could be more exhaustive by adding a few relevant variables in the efficiency measure, which may make the results more robust.

Given the above limitations of DEA techniques together with the consideration that DEA doesn't show causality (good public policy is impossible without understanding causality), here some econometric tools are, also, employed. The paper proposes a study to examine stochastic characteristics of each time series by testing their stationarity using Augmented Dickey Fuller (ADF) test and the Granger causality test. The results indicate that there exists a long-run relationship between government expenditure on education and labour force participation rate only in Portugal, Greece and Spain, the poorest countries in PIGS. In addition, for these tree countries, the causality result reveals that government expenditure on education granger cause economic growth in terms of labour force participation rate. The impulse responses show that the increased public spending on education will increase activity rate in the short run. Also in the long run the impact of labour force participation rate on stock of human capital, particularly education, is positive. Hence, with reference to these countries it would seem possible to assert that by investing in people, we invest in growth. Therefore, only Italy differs somewhat from the rest of PIGS.

Italy, unlike other PIGS, has a dualistic economy that is the result of the coexistence of a highly developed area (the Northern Italy) that's similar to the economy of the Northern Europe, and of another area (the weak industrial structure of Italian Mezzogiorno) that's comparable to the poorest countries. Moreover, most Italian expenditure on labour market policy is allocated to passive policies (early pensions and unemployment benefits) rather than to ex ante policy for public job creations. Italy has a low employment rate (youth unemployment rates in Southern Italy are among the highest in Europe), together with low quote of people with Tertiary education attainment and low public expenditure on education.

Further investigations could be carried out taking into account individual country analyses since countries vary in terms of traditions and cultures (institutional settings, citizens' involvement, general aspects of political economy, etc.).

Finally, though with the right care of interpretation, this work seems to highlight how the causal link between public spending on education and activity rate is more relevant in low-income countries than in countries with high-income: This result would be confirmed by some of the theoretical assumptions of the so-called Wagner's law⁵ with reference to the so-called "superior" public goods – including 'Education and Culture', for which demand increases more than proportionally with respect to income. More specifically, although there are many other factors that could be taken into account, as well in order to improvise the model and getting better estimates, the policy implication of these findings is that any increase in public expenditure on education would have positive repercussions on economic growth in the low-income countries and it could be a key determinant of social cohesion and employability of human capital in term of labour force participation rate.

So any policy that contributes to lessen educational inequality (operating before the market) may be very important tool to reduce inequality, without generating market inefficiencies, and income inequality as well. Although there is an extensive literature on the public job creation, of course these results alone do not prove that the driving factor in growth is public education spending itself.

Nevertheless, the improvement of data quality and testing the influences of the environmental factors (such as climate, socio-economic background etc.) remain important issues for further research.

It definitely needs more in depth look on the structure of its investment and its gain, nation by nation: if money is the solution, the problem would already be solved. It would be very interesting to study not only how much is spending on education, but on what and its correlation is about resources (how much teacher salaries, how much class sizes, ect.).

And this is particularly difficult in the low-income countries where the efficacy of investments on education may have other practical constraints as, for example, widespread corruption and administrative bottlenecks.

References

- AFONSO, A., ST. AUBYN, M. Cross-country efficiency of secondary education provision: A semi-parametric analysis with non-discretionary inputs. *Economic Modelling*, 2006, 23 (3), pp. 476.
- AFONSO, A., ST. AUBYN, M. Non-parametric Approaches to educational and Health expenditures efficiency in OECD countries. *Journal of Applied Economics*, 2005, 8 (2), p. 227–246.
- AKAIKE, H. A new look at the statistical model identification. *IEEE Transactions on Automatic Control*, 1974, 19 (6), p. 716–723.
- BALDACCI, E., CLEMENTS, B., GUPTA, S., CUI, Q. Social Spending, Human Capital, and Growth in Developing Countries. *World Development*, 2008, 36, p. 1317–1341.
- BANKER, R. D., CHARNES, A., COOPER, W. W. Some models for estimating technical scale inefficiencies in data envelopment analysis. *Management Science*, 1984, Vol. 30, No. 9, p. 1078–1092, 0025–1909.
- BARRO R J. Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics*, 1991, 106, p. 407–443.
- BARRO, R. J. Human Capital and Growth in Cross Country Regressions. *Swedish Economic Policy Review*, 1999, 6, p. 237–77.

⁵ The basic Wagnerian assumption is that public expenditure grows continuously associated with the continuing growth in community output in developing countries. Moreover, public expenditure increases at a faster rate than the growth of community output. From this point of view, Wagner termed this as "[the] law of increasing expansion of public, and particularly state, activities' becomes for the fiscal economy the law of the increasing expansion of fiscal requirements...". Since then, this is well-known as the 'Wagner's Law'. From Wagner's suggestion, it is obvious that expansion of public expenditure mainly derives from the consequences of social progress of progressing countries. Those social progresses are as a result of long-run change. The law does not have any interest on short-run changes, as any of these changes, like financial stringency, would cause public expenditure not to be derived from what Wagner's law suggests, but from impermanent causes. See for more details GEMMELL, N. *The Growth of the Public Sector: Theories and International Evidence*, Aldershot: Edward Elgar, 1993.

- BARRO, R. J., SALA-I-MARTIN, X. *Economic Growth*, Mcgraw-Hill Advanced Series in Economics, 1998, ISBN 978-0-262-02459-4.
- BEASLEY, J. E. Comparing university departments. *Omega*, 1990, 18, p. 171–83.
- BECKER G. S. *Human Capital: A theoretical and empirical analysis, with special reference to education*. 3rd edition, NBER Books, National Bureau of Economic Research, Inc. Number beck 94–1, September 1994.
- BENHABIB, J., SPIEGEL, M. The Role of Human Capital in Economic Development: Evidence from Aggregate Cross Country Data. *Journal of Monetary Economics*, 1994, 34, p. 143–173.
- BIAGI, F., LUCIFORA, C. Demographic and education effects on unemployment in Europe. *Labour Economics*, October 2008, V. 15, Iss. 5, p. 1076–1101.
- BILS, M., KLENOW, P. Does Schooling Cause Growth? *American Economic Review*, 2000, 90, p. 1160–1183.
- BLAUG, M. *An Introduction to the Economics of Education*, London: Allen Lane The Penguin Books, 1970.
- BLONDAL, S., FIELD, S., GIROUARD, N. Investment in human capital through post-compulsory education and training: Selected efficiency and equity aspects. *OECD Economics Department Working Papers*, No. 333, Paris: OECD, 2002.
- BUYSSE, K. Human Capital and Growth in OECD Countries: The Role of Public Expenditure on Education. In *The Impact of Fiscal Policy*. Banca d'Italia, Research Department, Public Finance Workshop, Perugia, 21–23 March 2002.
- CARONE, G. Long-term labour force projections for the 25 EU Member States: A set of data for assessing the economic impact of ageing. *European Economy, Economic Papers*, 2005, Number 235.
- CHANG, K.-P., GUH, Y.-Y. Linear production functions and the data envelopment analysis. *European Journal of Operational Research*, 1991, 52, (2), p. 215–223.
- CHARNES, A., COOPER, W. W., RHODES, E. Evaluating program and managerial efficiency: an application of Data Envelopment Analysis to Program Follow Through. *Management Science*, 1981, 27, (6), p. 668–697.
- CHARNES, A., COOPER, W. W., RHODES, E. Measuring the Efficiency of Decision Making Units. *European Journal of Operational Research*, 1978, 2.6, p. 429–444.
- CLEMENTS, B. How Efficient is Education Spending in Europe? *European Review of Economics and Finance*, 2002, Vol. 1, 3 ff.
- COELLI, T. A guide to DEAP Version 2.1: A Data Envelopment Analysis (Computer) Program. *CEPA Working Paper*, 1996/08, University of New England, Australia.
- COELLI, T., RAO, P., O'DONELL, C., BATTESE, G. *An Introduction to Efficiency and Productivity Analysis*, 2nd edition, Boston: Kluwer, 2005.
- COOPER, W. W. (Ed.) *Handbook on DEA. DEA: History, Models and Interpretations*. New York: Springer, 2011.
- COOPER, W. W., SEIDORF, L. M., TONE, K. *Data Envelopment Analysis*. Boston: Kluwer Academic Publishers, 2002.
- COOPER, W. W., SEIFORD, L. M., ZHU, J. *Handbook on Data Envelopment Analysis*. Boston: Kluwer Academic Publishers, 2004.
- DEMEKAS, D. KONTOLEMIS. Labor Market Performance and Institutions in Greece. *South European Society and Politics*, 1997, Vol. 2, No. 2, p. 78–109.
- DICKEY, D., FULLER, W. Distribution of the estimators for autoregressive time series with a Unit Root. *J. the American Statistical Association*, 1979, 74 (366), p. 427–431.
- DICKEY, D. A., SEN, D. L. Symmetric Test for Second Differencing in Univariate Time Series. *Journal of Business and Economic Statistics*, 1987, 5, p. 463–473.
- DURLAUF, S., JOHNSON, P. Multiple Regimes and Cross-Country Growth Behaviour. *Journal of Applied Econometrics*, 1995, 10, p. 365–384.
- ELIASSON, G. The Knowledge-Based Information Economy. In ELIASSON, G., FÖLSTER, S. et al. *The Knowledge Based Information Economy*, Stockholm: IUI, 1990.
- ELIASSON, G. The Knowledge Base of an Individual Economy. In ELIASSON and RYAN. (Eds.) *The Human Factor in Economic and Technological Change*. OECD Educational Monograph, Series No. 3, Paris: OECD, 1987.
- ENGLANDER, A. S., GURNEY, A. OECD Productivity Growth, Medium-term Trends. *OECD Economic Studies*, 1994, Vol. 22, p. 111–129.
- ESTACHE, A., GONZALEZ, M., TRUJILLO, L. *Government Expenditures on Education, Health and Infrastructure. A Naïve Look at levels, outcomes and efficiency*. City University London, Department of Economics, Discussion Paper Series 07/03, 2007.

- EUROPEAN COMMISSION. *Education and Training Monitor 2012* [online]. 2012. <http://ec.europa.eu/education/lifelong-learning-policy/monitor12_en.htm>.
- EUROPEAN COMMISSION. *European Commission Cohesion Policy Proposals for 2014–2020* [online]. 2012. <<http://www.eib.org/epcc/ee/documents/factsheet-eccpp-en.pdf>>.
- EUROSTAT. *Tables, Graphs and Maps Interface (TGM) table* [online]. 2012. [cit. 2.4.2012, 20.11.2012]. <epp.eurostat.ec.europa.eu>.
- FARRELL, M. J. The measurement of productive efficiency. *Journal of Royal Statistical Society*, 1957, A, 120, p. 253–281.
- FASIH, T. *Linking Education Policy to Labor Market Outcomes*. The International Bank for Reconstruction and Development/ The World Bank, Washington DC, 2008.
- FINARDI, S., FISCHER, J., MAZOUCH, P. Private Rate of Return on Human Capital Investment in the Czech Republic: Differences by Study Fields. *Statistika*, 2012, Vol. 49, No. 1, p. 23–30. ISSN 0322-788X.
- GEMMEL, N. Evaluating the Impacts of Human Capital Stocks and Accumulation on Economic Growth: Some New Evidence. *Oxford Bulletin of Economics and Statistics*, 1996, 58, p. 9–28.
- GRANGER, C. W. J. Developments in the Study of Cointegrated Economics Variables. *Oxford Bulletin of Economics and Statistics*, 1986, 48, p. 213–28.
- GRIMACCIA, E., LIMA, R. *Public expenditure on education, education attainment and employment: a comparison among European*. XXVIII. Conference of the Italian Association of Labour Economists (AIEL), 2013, 27–28 Settembre, Rome.
- HANUSHEK, E. Interpreting Recent Research on Schooling in Developing Countries. *World Bank Research Observer*, 1995, 10, p. 227–246.
- HANUSHEK, E. A., KIMKO, D. D. Schooling Labour Force Quality, and the Growth of Nations. *American Economic Review*, 2000, 90, p. 1184–1208.
- HANUSHEK, E. A., KIM, D. Schooling Labour Force Quality and Economic Growth. *National Bureau of Economic Research Working Paper*, No. 5399, Cambridge, MA, 1995.
- HANUSHEK, E. A., WOESSMANN, L. The Role of Cognitive Skills in Economic Development. *Journal of Economic Literature*, 2008, 46, p. 607–668.
- HUSSIN, M. Y. M., MUHAMMAD, F., HUSSIN, M. F. A., RAZAK, A. A. Education Expenditure and Economic Growth: A Causal Analysis for Malaysia. *Journal of Economics and Sustainable Development* [online]. 2012, Vol. 3, No.7. <www.iiste.org>. ISSN 2222-1700 (Print). ISSN 2222-2855 (Online).
- ISMAIL, R., JAJRI, I. Human Capital and Economic Growth in Malaysia: A Simulation Model. *Kajian Malaysia*, 1998, 16(1&2), p. 78–88.
- JOHANSEN, S. *Likelihood Based Inference in Cointegrated Vector Autoregressive Models*. Oxford University Press, 1996.
- JUMA, AWARA. *Reinventing Growth: Technological Innovation and Economic Renewal in Africa*. London: The Smith Institute, 2006.
- JUSELIUS, K. *The Cointegrated VAR Model: Methodology and Applications*. Oxford University Press, 2007.
- KITOV, I., KITOV, O. *The driving force of labor force participation rate* [online]. MPRA Paper 8677, University Library of Munich, Germany, 2008. <<http://ideas.repec.org/p/pramprapa/8677.html>>.
- KRUEGER, A., LINDAHL, M. Education and Growth: Why and for Whom? *Journal of Economic Literature*, 2001, 39, p. 1101–1136.
- LEE, J. W., BARRO, R. J. Schooling Quality in a Cross-Section of Countries. *Economica*, 2001, Vol. 68, p. 465–80.
- LEVINE, R., RENELT, D. A Sensitivity Analysis of Cross-Country Growth Regressions. *American Economic Review*, 1992, 82 (4), p. 942–63.
- LIMA, R. *Is the Brain Drain Relevant in Measuring the Well-being of Society? A Focus on Regional Disparities*. Regional Studies Association – Winter Conference on Global Recession: Regional Impacts on Housing, Jobs, Health and Wellbeing, London, UK, 2009, Cod. ISBN 978-1-897721-37-7.
- LIMA, R., CUFFARO, M. *Measuring Social Capital By Survey Data: A Proposal*. XLIII. Riunione Scientifica Società Italiana di Statistica, Torino 14–16 giugno, 2006.

- LIMA, R., CUFFARO, M., CRACOLICI, F. *Il Capitale Sociale (nella sua relazione con il Capitale Umano): uno schema teorico di riferimento e una proposta di misura*. XXI. Convegno Nazionale di Economia del Lavoro, Udine, 14–15 settembre, 2006.
- MANDL, U., DIERX, A., ILZKOVITZ, F. *The effectiveness and efficiency of public spending*. Economic Paper 301, Brussels: European Commission Directorate-General for Economic and Financial Affairs Publications, 2008. ISBN 978-92-79-08226-9.
- MANKIW, N. G., ROMER, D., WEIL, D. A Contribution to the Empirics of Economic Growth. *Quarterly Journal of Economics*, 1992, 107, p. 407–437.
- MCKEON, R., WEIR, T. Preconditions for a knowledge-based economy. *B-HERT News*, 2001, No. 11, p. 4–5.
- MINCER, J. Education and Unemployment. *NBER Working Paper*, 1991, No. 3838.
- NURUDEEN, A., USMAN, A. Government Expenditure and Economic Growth in Nigeria, 1970–2008: A Disaggregated Analysis. *Business and Economics Journal*, 2010, Volume 2010: BEJ-4.
- OCSE. *Education at a Glance*. OCSE, 2013.
- OECD. *The Knowledge-based economy*. OECD/GD, 1996, (96) 102, p. 1–46.
- PHILLIPS, P. C. B., PERRON, P. Testing for a Unit Root in Time Series Regression. *Biometrika*, 1998, 75, p. 335–346.
- PSACHAROPOULOS, G. *The effects of Education on Employment, Wages and Productivity: an European perspective* [online]. Thematic Review Seminar of the European Employment Strategy (p. 1–37). European Expert Network on Economics of Education, 2007. [cit. 19.5.2012]. <http://pdf.mutuallearningemployment.net/pdf/thematic%20reviews%202007/TRSF_sept%2007/thematic_paper_psacharopoulosTRS%20F_EN.pdf>.
- PRICHETT, L. Where has All the Education Gone? *World Bank Economic Review*, 2001, 15, p. 367–391.
- RIDDELL, C. W., SONG, X. *The Impact of Education on Unemployment Incidence and Re-employment Success: Evidence from the U.S. Labour Market*. Bonn: Institute for the Study of Labor (IZA), Discussion Paper No. 5572, 2001.
- ROMER, P. *Human Capital and Growth: Theory and Evidence*. Carnegie-Rochester Conference Series on Public Policy, 1990, 32, p. 251–286.
- SCHILIRÒ, D. Investing in knowledge: knowledge, human capital and institutions for the long run growth. In ARENTSEN, M. J., ROSSUM, VAN W., STEENGE, A. E., CHELTENHAM, E. E. (Eds.) *Governance of Innovation*, 2010, p. 33–50.
- SCHLEICHER, A. *The economics of knowledge: why education is key for Europe success*. Brussels: Lisbon Council asbl, 2006.
- SHEEHAN. *Economics of Education*. London: Penguin Books, 1971.
- SIMKOVIC, M. Risk-Based Student Loans [online]. *Washington and Lee Law Review*, 2012, Vol. 70, No. 1, pp. 527. <www.ssrn.com/abstract=1941070>.
- SOLOW, R. M. Technical Change and the Aggregate Production Function. *Review of Economics and Statistics*, 1957, 39 (3), p. 312–320.
- TEMPLE, J. Growth Effects of Education and Social Capital in OECD Countries. *Economic Studies*, 2001, 33, p. 57–101.
- THORNTON, G. *The global economy in 2012: a rocky road to recovery* [online]. Grant Thornton International Business Report, 2012. <www.gti.org>.
- TODA, H. Y., YAMAMOTO, T. Statistical inferences in vector autoregressions with possibly integrated processes. *Journal of Econometrics*, 1995, 66, p. 225–250.
- UNESCO. *Education for All* [online]. Several years, Paris. <<http://portal.unesco.org/education/en>>.
- UNESCO. *Education Quality and Quantity*. UNESCO, 2002.
- U.S. BUREAU OF LABOR STATISTICS. *International Comparisons of Annual Labor Force Statistics, 1970–2012* [online]. 2013. <www.bls.gov/fls/flscomparefl.htm>.
- WISE, D. Academic Achievement and Job Performance. *American Economic Review*, American Economic Association, 1975, Vol. 65 (3), p. 350–66.
- WORLD ECONOMIC FORUM. *The Global Competiveness Index rankings*. World Economic Forum, 2013 (Retrieved 4.4.2013).
- ZELLNER, A. Statistical Analysis of Econometric Models. *Journal of the American Statistical Association*, 1979, 74 (367) September, p. 628–643.
- ZELLNER, A., PALM, F. Time Series Analysis and Simultaneous Equation Econometric Models. *Journal of Econometrics*, 1974, 2 (1) May, p. 17–54.

Top-Quality and Useful Guide through Statistical Methods and Excel Applications

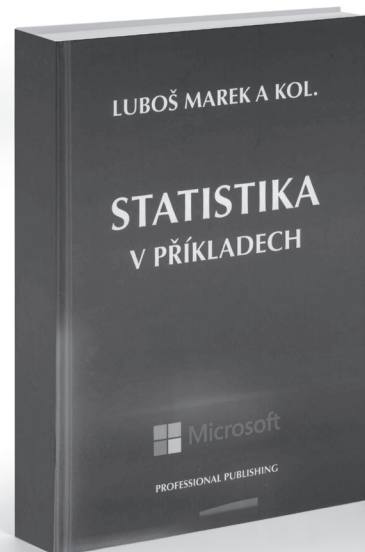
Stanislava Hronová¹ | *University of Economics, Prague, Czech Republic*

MAREK, L. et al. *Statistika v Příkladech*. 1st edition. Prague: Professional Publishing, 2013. ISBN 978-80-7431-118-5.

Bookshops specializing in technical literature started to offer this spring a new publication called *Statistics in examples* which is a joint work of a team of authors of the Department of Statistics and Probability of the University of Economics in Prague, headed by **Luboš Marek**.² The book is published by **Professional Publishing**.

Presented publication is a top-quality collection of examples of the areas covering fundamental statistical course for non-statistical studies at universities of economic specialization. Out of the area of social and economic issues suitable examples are selected. The book is divided into 8 application parts (Descriptive Statistics, Probability, Sample Surveys, Contingency Tables, Analysis of Variance, Regression and Correlation Analysis, Time series, Index Numbers). The work offers also not only inevitable statistical tables of distribution function of standard normal distribution and critical points of selected probability distributions but also very well prepared chapter presenting probability distributions in MS Excel. This chapter is in fact a brief and comprehensible manual providing for easy orientation in work with probability divisions in MS Excel.

I consider the choice of MS Excel with the aim to simplify the work with statistical data as beneficial since this application is available to any user of MS Windows. The relation of calculation corresponding to the use of basic statistical methods to special applications showed difficult for current users and prevented those who did not possess these applications to master modern methods of processing and data analysis. Good relation between the explanation of statistical methods and processes in Excel was



¹ Nám. W. Churchilla 4, 130 67 Prague 3, Czech Republic. E-mail: hronova@vse.cz.

² Other authors are the following: Iva Pecáková, Michal Vrabec, Tomáš Löster, and Adam Čabla.

significantly contributed to also by extension of statistical functions and quality changes in terminology in MS Excel version 10.

The concept of the book is based on experience of authors gained at the process of university teaching of basic statistical methods but also on the efforts to present processes, in compliance with the explanation³ what is the potential of statistical methods. Arrangement of chapter, applied examples, presentation of Excel tables – all these items show high technical and pedagogical erudition of the authors and make the assessed book a useful tool of knowledge. The concept of chapters is very valuable especially in terms of pedagogical application. Statistical methods are presented to readers in form of examples and the substance of the method is shown first as an “ordinary” calculation i.e. without the use of a (special function) in Excel. Only after the reader catches the substance of the method and selected processes with which he reached the correct result it is shown how the same task can be solved in Excel. I consider this approach pedagogically correct and very helpful.

The structure in form of thematic chapters and the use of Excel solutions enables the reader to gradually master basic statistical processes and to understand also more complex parts. Top-quality explanation of statistical methods by means of examples is completed by very good graphics not only in form of various functions (in parts devoted to Sampling and Time Series) but also in preprinted dialogue boxes in Excel. All these factors enhance read-ability and comprehensibility of presented publication. Minor shortcomings can be found perhaps in not always completely unified graphic form of tables (chapters Contingency tables and Regression and Correlation Analysis versus other chapters) or in sometimes excessive use of italics in the description of variables (chapter Sample Surveys).

Publication Statistics in Examples is undoubtedly a book of high quality designed both for students of economic universities and for professional in practice wishing to grasp problems related to the application of basic statistical methods. Assessing the technical, pedagogical, content and graphic aspects it corresponds to requirements put on modern publications.

³ The book dealing with thereof was compiled by Hindls, R., Hronová, S., Seger, J., and Fischer, J. is called: *Statistika pro ekonomy*. 8th edition, Prague: Professional Publishing, 2007. ISBN 978-80-86946-43-6.

60th Anniversary of Statistics at the University of Economics in Prague

Prokop Závodský¹ | *University of Economics, Prague, Czech Republic*

INTRODUCTION

Celebrations of the 60th anniversary of the birth of University of Economics in Prague (VŠE) this autumn is a good opportunity to mention the beginning of activities of statisticians at this university. The article² deals with the establishment of Statistical Department in historic relations and its development and activities in the first 15 years. We prepare other contributions extending the assessment of activities of statisticians at the University of Economics in the following decades and dealing with the latest work results of Statistical Departments at the University of Economics.

1 STATISTICAL STUDIES PRIOR TO THE ESTABLISHMENT OF THE UNIVERSITY OF ECONOMICS

Predecessor of statistical study branch at the University of Economics was a 4-semester statistical and insurance study developed at the University of Special Sciences (VŠSN) of the Technical University (ČVUT). **The teaching of probability theory and mathematical statistics (including insurance technique and also a number of economic subjects)** has been extended and gradually modernized in this branch of study, and especially since the 30th. An outstanding representative of this branch was since 1929 PhDr. Jaroslav Janko (1893–1965),³ developing also application of statistics in demography and socio-economic statistics.

The efforts to transform the above mentioned two year course (introduced as early as in the study year 1904/05) into full-time four-year university study of statistical and insurance engineering started as early as in the 30th, was, in 1946,⁴ crowned with success thanks to prof. Janko. Similarly, as in previous two year study, the students graduated in addition to difficult mathematical and statistical subjects also in practically aimed lessons and seminars. In the latter half of the study students could specialize in application of statistics in a) business practice, b) insurance and financial institutions, c) public administration. The first students successfully graduated in the spring 1947. Among the graduates were also the future representatives of statistics at the University of Economic: prof. Korda, prof. Cyhelský, prof. Likeš, prof. Walter, prof. Novák, doc. Hátle and others.⁵

¹ Nám. W. Churchilla 4, 130 67 Prague 3, Czech Republic. E-mail: zavodsky@vse.cz. Translation into English: Iva Říhová.

² Study was produced within the scientific and research activity of the Centre for History of the University of Economics. I am grateful for precious advice and information to prof. Hronová and those who remember the events described – to prof. Cyhelský and prof. Čermák.

³ J. Janko completed his habilitation in 1929 in the branch of insurance mathematics and mathematical statistics and two year later he was appointed as associate professor and in 1936 professor. For the whole time of existence of the inter-war Czechoslovak Statistical Society (1929–1939) Janko acted as a secretary.

⁴ Act No. 122 Sb., of 16 May 1946 regulating the statistical and insurance study.

⁵ After restructuring of this branch, some had to finish their studies elsewhere – see below.

At the Faculty of Natural Sciences of the Charles University (as early as from 1921) the cycles of lessons on insurance mathematics and statistics took place simultaneously. Emil Schönbaum (1882–1967) was in 20th–40th a representative of this branch. The above mentioned act was also this courses changed into a four year study, contrary to the University of Special Sciences (VŠSN) aimed more on theory and application in natural sciences. Some special lessons took place for both students of technology and university students (elsewhere in Czechoslovakia it was impossible then to reach qualification in statistics).

Historic predecessor of the University of Economic was the University of Business (VŠO) existing in 1919–1953 within the ČVUT. Statistics has been read here since the 30th by JUDr. Ing. Leopold Šauer (1901–1983).⁶ He published a number of remarkable works mostly aimed at the economic statistics using modern statistical methods.

In our country future national economists and financial specialists were traditionally taught at faculties of law (first three rectors of the University of Economics graduated there). At the Charles University statistics in addition to constitutional law was lectured by prof. Cyril Horáček jr. (1896–1990), who, however, did not contributed much to the development of the Czech statistics. The University of Political and Social Sciences (VŠPS),⁷ established in 1945 was from many aspects rather special and started teaching in the summer semester in 1946. Statistics and demography was lectured here by doc. Antonín Boháč (1882–1950) and prof. Jaromír Korčák (1895–1989).

Conditions for activities of universities in Czechoslovakia began to change dramatically with the start up of the communist regime in February 1948. Universities which did not enjoy confidence from totalitarian regime despite frequent reforms and drastic cleansings were deprived of their hundred year autonomy and were subject to command control.⁸ Simultaneously, longer than a decade of permanent changes in university organization began. Often a trial-and-error method⁹ was applied since neither resounding worship of Soviet samples usually did lead to a definite solution not mentioning disagreements between the communist bodies and officials. However, there existed a general agreement concerning the need to liquidate the University of Business which earlier “served the interests of bourgeoisie and trained devoted servants – helpers of exploiters”.¹⁰

In 1949 an opinion dominated saying that the education of elite communist cadres for economic management, public administration, diplomacy and for teaching of Marxism-Leninism should be concentrated in a new university, directly controlled in terms of ideology by cultural and propagational department of the Central Committee of the Communist Party of Czechoslovakia. This gave the birth in the school year 1949/50 to the University of Political and Economic Sciences (Vysoká škola politických a hospodářských věd – VŠPHV) along with Faculty of Economics, Faculty of Politics and Diplomacy and Faculty of Social Sciences.¹¹

University of Business (gradually reformed and in 1948 renamed to University of Economic Sciences, in 1951 then to the Faculty of Economic Sciences of the Czech Technical University) was (by the act mentioned in note 12, sec. 3) gradually liquidated (i. e. from the study year 1949/50 new students were not accepted) and definitively was closed down on 31 July 1953. Similarly, also the University

⁶ He habilitated in 1936, as an associate professor he was appointed in 1946, in 1947 professor.

⁷ It was composed of Political, Journalistic and Social Faculty.

⁸ Especially by Act No 58 Sb., dated 18 May 1950 regulating universities.

⁹ Under sec. 3 of Act mentioned in previous note a mere government decree was sufficient to control, cancel, divide or merge a university and faculty.

¹⁰ Compare Závodský, 1999, p. 54.

¹¹ Act No. 227 Sb., of 4 November 1949 regulating the establishment of the University of Political and Economic Sciences in Prague.

of Political and Social Sciences ceases to exist. Faculties of law which before 1948 enjoyed among the representatives of the Communist Party of Czechoslovakia the reputation of a stronghold of reaction, upon the short-cut of the period of study and their reform ceased to be centres of national economic science, Faculty of Law in Brno was in 1950 closed down completely.

As soon as two years after the birth of the University of Political and Economic Sciences (VŠPHV) criticism of this concept of economic studies was gaining strength. Bureaucracy in the management of national economy required thousands of “economists with Marxist education”,¹² while as late as in 1953 the first three hundred of graduates were supposed to leave the Faculty of Economics. In addition, only two year study of economic subjects (following previous joint basic subjects) did not provide the students with proper education, not mentioning necessary specialization.

Final decision was adopted in summer 1952. Uncommon concept of the University of Political and Economic Sciences (VŠPHV) was marked as a consequence of “saboteur” policy of Rudolf Slánský and his subversive centre. The then proposal of the State Committee for Universities (body of the Ministry of Education) concerning the establishment of an independent University of Economics with substantial extension of the Faculty of Economics of the VŠPHV¹³ was adopted. In addition, economic and engineering faculties were established at technical universities¹⁴ and faculty of economics and management at agricultural universities.

By the government decree dated 19 August 1952¹⁵ it was decided (this time well in advance) on establishment of University of Economics (VŠE, as of 1 September 1953) with 5 faculties: General-Economics Faculty, Faculty of Production and Economics, Faculty of Internal Trade,¹⁶ Faculty of Finance and Credit and Faculty of Statistics.¹⁷ For the whole study year 1952/53 new employees joined the Faculty of Economics of the University of Political and Economic Sciences (mostly young graduates of universities), new departments were founded, for separate future faculties new “representatives” were appointed, new political committees were constituted, and other similar things.

Let us go back to topical issues of fostering statistics at the Czech universities. Opinions concerning the concept of statistics and its place in the system of sciences has been different basically from the very beginning in world and Czech literature. Most often it referred to a dispute whether or not statistics is to be understood as methodological (universal) science, i.e. science of methods based on the theory of probability and applicable in various social and natural sciences¹⁸ or subject-matter science (material) in which the subject of research is an individual, society, economics and other similar things. Both these concepts co-existed long-term and outside the Soviet Union as its satellites and nobody felt the need to develop generally binding definition of statistics – discipline which during the whole XXth century went through a stormy process.

¹² The need was so urgent that at the turn of the 40th and 50th thousands of specialists were forced to leave due to political reasons their posts in economic sphere and state administration.

¹³ The entire VŠPHV was closed down, the remaining faculties were in a different way incorporated into Charles University.

¹⁴ Faculty of economics and engineering at the Czech Technical University acted in 1952–1960, and at the Technical University in Ostrava since 1953.

¹⁵ Government decree No. 40 Sb., of 19 August 1952 regulating other changes in organization of Universities, sec. 7.

¹⁶ As of 1 September 1953 included was the foreign trade branch, newly renamed as the Faculty of Internal and Foreign Trade, since 1 September 1959 the Faculty of Trade.

¹⁷ Gottwald’s thesis on basic law of the development in democratic countries which means to get closer and closer to the soviet model was then interpreted in the field of education as a need to establish narrowly specialized universities and faculties under the model of soviet institutions.

¹⁸ This concept is known e.g. from an important (first) Czech text-book of modern statistical methods written by Kohn, S. *Základy teorie statistické metody* (Basics of theory of statistical methods), 1929.

In the Soviet Union as early as since the 40th a discussion on the substance of statistics,¹⁹ took place as well as on its relation to mathematics, theory of probability and other similar things. The outcome was a binding resolution adopted in the spring 1954 saying that statistics (=social economic statistics) “is an independent social science investigating quantitative side of mass social phenomena in close relationship with their qualitative side.... Theoretical basis of statistics is historical materialism and Marxist-Leninist political economy”.²⁰ This was the source of claiming that statistics is a science of classes and parties and that the fight against bourgeois statistics is inevitable. Theory of probability and mathematical statistics were separated from statistics and as part of mathematics were included into natural sciences. Restricted use of these disciplines in statistics was admitted (and vice versa: statistical methods were used in natural sciences).

Opinions of soviet statisticians has become binding for us soon after 1948. The study of statistical and insurance engineering at the University of Special Sciences (VŠSN) showed in 1949 radical changes. First, by exclusion of insurance mathematics²¹ and “bourgeois pseudo-sciences” (econometrics, biometrics, psychometrics) it was transformed to statistical engineering²² and then divided into study of mathematical statistics whose representative was prof. Janko, and study of economic statistics headed by prof. Egermayer.²³ As of 1 September 1952 the Faculty of Special Sciences (change of the name into “faculty” took place a year earlier) was closed down.²⁴ Prof. Janko with his mathematical statistics was transferred to a new Faculty of Mathematics and Physics of the Charles University.²⁵ Students who in the study year 1951/52 finished the 2nd or 3rd years of economic statistics, left along with prof. Egermayer, for a new established Faculty of Economics and Engineering (FEI) of the Czech Technical University where they were enabled to finish their study under a special programme.²⁶ Students who in 1952 finished the 1st year of economic statistics, were transferred to the Faculty of Economics of the University of Political and Economic Sciences (VŠPHV).

Faculty of Economics like the whole University of Political and Economic Sciences (VŠPHV) was constituted gradually (in the study year 1949/50 there were only students of the first year). As “revolutionary” school it did not comply with academic established practice – it accepted mostly applicants without secondary education but properly screened and also teachers became, apart of some exceptions, fresh graduates of universities with required class origin. As a first Czech University the VŠPHV (in 1952) introduced also the distance study.

Teaching of statistics for different specializations at the University of Political and Economic Sciences (VŠPHV) was first provided by the Department of Finance and Credit where in 1951 the statistical division was established (the only member was Augustin Hlaváček), lectures were mostly by visiting teachers.²⁷ On the basis of university text-books and syllabus the initial level of teaching can be characterized as poor. Texts

¹⁹ There were no doubts about the importance of statistics in the system of sciences since under V. I. Lenin statistics were “one of the most powerful tools of social recognition”.

²⁰ Quoted from Egermayer, 1957, pp. 57–58.

²¹ Insurance mathematics showed as useless in the conditions of planned economy when there existed the only (state) insurance agency, insurance premium was generally rather overstated and the obtained surplus represented a constant income of the state budget.

²² Compare Herbst, Hlaváček, 1952.

²³ Prof. František Egermayer (1913–1989) habilitates at the Czech Technical University in 1946, the following year he was appointed a associate professor and director of the Institute of mathematical and applied statistics at the University of Special Sciences.

²⁴ Cited Government decree No. 40/1952 Sb., section 3.

²⁵ Here, the branch was linked with the study transferred here from the Faculty of Natural Sciences (see above) At the Faculty of Mathematics and Physics the “mathematical formalisms” were tolerated.

²⁶ After completion of studies (1954) statistical branch at Faculty of Economics and Engineering (FEI) again ceased to exist.

²⁷ Compare Cyhelský, 1992, pp. 4–5.

contained especially hastily translated texts of Soviet authors explaining merits of Lenin²⁸ and Stalin. The top of the theory of statistics was the Leninist method of classification (“grupirovka“), means²⁹ and simpler indexes.³⁰

An independent Statistical Department was established on 1 August 1952 managed externally by Ing. František Herbst.³¹ Besides both above mentioned also Ing. Lubomír Cyhelský³² joined the department. Since autumn 1952 the Faculty of Economics had 110 students of the first and second year of full-time study of statistics, from November also 13 distant student, and the establishment of the University of Economics had been under preparation. It was necessary to extend the Department of Statistics. Gradually the following teachers were accepted: Ing. Bohumil Řežníček, Ing. Benedikt Korda,³³ Ing. Eduard Link³⁴ and Ing. Jaromír Walter.³⁵ The teaching at the department was continuously contributed to by external teachers, e.g. by prof. Egermayer and especially RTDr. Ing. Jaroslav Hájek, who published here his first teaching study *Teorie výběrových šetření* (Theory of sample surveys, 1955).³⁶

2 AT THE FACULTY OF STATISTICS OF THE UNIVERSITY OF ECONOMICS

In the summer semester 1952/53 the Faculty of Economics was intensively preparing for the birth of the University of Economics. As a sample for the Faculty of Statistics was chosen the Moscow Institute of Economics and Statistics (MESI),³⁷ yet it was accepted that the conditions for Prague Faculty of Statistics are rather different. The Faculty was composed of two departments – Department of Statistics headed by doc. Link³⁸ and Department of Mathematics headed by doc. Ferdinand Veselý (1903–1958). As of 1 July 1953 doc. Link was charged by the Ministry of Universities to perform also the post of vice-rector of the University of Economics³⁹ and doc. Veselý by the post of dean of the Faculty of Statistics. In September Ing. Walters was appointed vice-dean.

At the beginning of the study year 1953/54 the department of statistics was extended by Ing. Ilja Novák,⁴⁰ Ing. Vladimír Roubíček,⁴¹ Ing. Jan Zelinka,⁴² Ing. Jan Vraný, and altogether the department employed the total of 10 statisticians (after the leave of Ing. Řežníček there were 9 persons) and their average age was, by the end

²⁸ Vastly cited polemic articles of Lenin on statistical issues in tsarist Russia (using measurement units) only little contributed to the understanding of statistical methods applicable in new conditions of the planned economy in Czechoslovakia.

²⁹ A curiosity of that time was the inclusion of “progressive mean“ among the average values. This referred to a mean calculated from values higher than the mean (arithmetic).

³⁰ Of similar character were two-volume university texts (101 + 47 pages) by F. Egermayer for the University of Political and Economic Sciences called *Základy statistiky* (Basics of statistics) published in 1951.

³¹ F. Herbst (1909–1977) was then the vice-chairman of the State Statistical Office.

³² L. Cyhelský (*1929) had just finished studies of economic statistics at the University of Special Sciences, but, at the same time, he acted over a year in the sphere of national economic balances of the State Statistical Office.

³³ B. Korda (1914–2010) graduated in 1951 from statistical engineering at the University of Special Sciences and came to the faculty from the Ministry of Fuel and Energetics.

³⁴ The eldest member of the department E. Link (1907–1970) so far worked as a statistician at the Ministry of Internal Trade and externally he taught economic statistics at the University of Politics and Social Science.

³⁵ J. Walter (1923–2001) graduated from statistical-insurance engineering (1945–1949), and, at the same time, he had worked since 1947 as an assistant to prof. Egermayer.

³⁶ RTDr. (or Dr. techn.) was doctor's degree of technical science, introduced in our country in 1901. Jaroslav Hájek (1926–1974) has become famous as the most distinguished Czech mathematical statistician.

³⁷ MESI was established in 1932 as obviously the first university in the world specialized in statistics – Moscow Institute of National Economy Records (MINCHU), named MESI from 1945.

³⁸ E. Link, B. Korda and F. Veselý were appointed “deputy readers“ – i.e. without habilitation. Candidature and habilitation in the future were expected.

³⁹ So far doc. Link had performed the post of pedagogical vice-dean of the Faculty of Economics.

⁴⁰ I. Novák (1927–2009) finished in 1951 statistical studies at the University of Special Sciences. He worked at the department of statistics a record time of 55 years.

⁴¹ V. Roubíček (1930–2005) joined the department as fresh graduate from statistical study at the University of Special Sciences/FEI.

⁴² J. Zelinka (1930–1994) also joined the department after graduation from statistical studies at the University of Special Sciences/FEI.

of 1953, 29.2 years (average age of a teacher at the University of Economics was then 30 years). The Faculty employed the total of 16 teachers of which none was professor nor habilitated docent.⁴³

For students of full-time and distance study only one branch of study existed at the faculty – statistics. Taken into account were later specializations: statistics of industry, statistics of trade, statistics of agriculture and mechanization of records (also the statistics of transport) but it showed purposeful taking into account only a few tens of students in a year. The Department of Statistics ensured the teaching of the theory of statistics and economic statistics for other faculties of the University of Economics – partly also with the help of external teachers (especially of branch statistics).

The programme of study was first composed by the model of MESI and soviet textbooks. In the following years students were provided with study texts prepared by members of the department. Their quality has been improving gradually, introduction chapters of quotations of communist classics became rare. A great emphasis was placed on elementary methods of descriptive statistics but gradually the explanation of regression analysis (so far it was called mathematical formalism) and sample surveys. This can be showed at the development of study texts *Soubor statí z teorie statistiky* (Set of papers from the theory of statistics),⁴⁴ through *Statistické metody* (Statistical methods),⁴⁵ up to the by a minister approved university textbook *Obecné metody statistiky. Učebnice* (General statistical methods. Textbook)⁴⁶ from 1959, which contains only explanation of rather extended choice of statistical methods and completely leaves out Marxists introduction or framework of a lecture. In introduction the methodological concept of statistics was defended as one of possible and reasonable⁴⁷ which a few years earlier would be qualified as outrageous heresy.⁴⁸

In the teaching of economic statistics first the soviet models were completely taken over, teaching was limited often to the description of the contents of lists of surveyed indicators without explanation of total aiming and mutual interrelations. In the next years the explanation gradually took place on more general level. As an example can serve mainly works of B. Korda, main representative of economic statistics at the department in the 50th out of which we can mention at least the monograph *Ekonomické indexy* (Economic indexes, Prague: ČSAV Publishers, edition Rozpravy ČSAV, 1954, p. 116) and more concise work *Měření produktivity práce* (Measurement of labour productivity, Prague: State Statistical Office, printed by SEVT, edition *Otázky statistiky*, 1957, p. 92). A wide team of authors of the members of department headed by B. Korda published in 1960 also the first book *Učebnice ekonomické statistiky* (Textbook of economic statistics, Prague: SNPL/SVTL, 1960, p. 434).

Let us return now to personal cast of the statistical department in the study year 1954/55. The main representative at the department were the following: doc. Korda who made his habilitation at the faculty and in the summer semester he took over the management of the department after doc. Link, Ing. Walter, in the next year mainly Ing. Cyhelský. A. Hlaváček⁴⁹ left the department and

⁴³ Dean Veselý did not even have a doctor's degree. For comparison – at the Department of Statistics of FEI there worked two professors.

⁴⁴ Written by the team of 5 authors from the Department of Statistics, Prague: SPN, 1954, p. 320.

⁴⁵ Authors of majority of texts were the following Novák, I., Korda, B., Walter, J., Prague: SPN, 1956, p. 382.

⁴⁶ A decisive share in the text belonged to I. Novák (edition included) and B. Korda, participation of other authors (mainly J. Walter) was substantially smaller. Prague: SNPL, 1959, p. 376.

⁴⁷ "Live-span of the concept of statistics as a methodical science cannot be denied, it is attested by the scope of works designed in the spirit of this concept." (quoted work, p. 11) "Enforcement of the concept of statistics exclusively as the subject-matter social science had then a consequence that mathematics was completely driven away and that the statistical methods were made flatter and this led in final consequences to a certain statistical primitivism." (quoted work, p. 12)

⁴⁸ Let us remind that, on the contrary, e.g. in the Soviet Union or GDR the text-books of basics of statistics usually contained up to the 80th wide explanation of Marxism Leninism as the basis for statistics.

⁴⁹ Work of A. Hlaváček (*1921, graduate of the University of Political and Social Science) was criticized at the department, Hlaváček then started to perform practical statistical tasks.

newly was accepted Ing. Jara Kaňoková⁵⁰ and Ing. Josef Kašpar.⁵¹ In the study year 1955/56 the department was strengthened by Ing. Václav Čermák⁵² and Ing. Luděk Rychetník.⁵³ Doc. Korda was appointed the dean of the faculty.

At that time the original ideas on fast development of the Faculty of Statistics following the soviet MESI model appeared to be unfeasible. Due to a little concern of central bodies (including State Statistical Office) for new graduates the higher directive number for enrolment in the branch exceeding 15 applicants were not reached and further activity of the faculty with two departments (with the total number of 19 internal teachers) and 159 students (this made approximately 8.3% of full-time students of the University of Economics and special forms of study was enabled only to individuals) the management assessed the University of Economics as non-economic and prosed that the faculty be closed down.⁵⁴ Provisional administration de iure of still existing Faculty of Statistics was from the study year 1956/57 committed to the Faculty of Economics where the Statistical Department was practically transferred along with its study branch. After years of complains and deferments the government decree of August 1959 decided to merge the existing Faculty of Finance and Credit, Faculty of Statistics and General-Economics Faculty into Faculty of Political Economy⁵⁵ which in 1968 was named Faculty of National Economy.

3 REVIEW OF FURTHER DEVELOPMENT

Liquidation of the Faculty of Statistics was only one of series of radical changes in organization of statistical studies at the University of Economics. Department of Statistics provided from the establishment of the University of Economics also the education with important use of computer technology. At the beginning of the study year 1959/60 from the Department of Statistics and independent Department of Computer and Organizational Technology, predecessor of today information centres, was separated and headed by doc. Link. Next year the study of application of computer technology was raised up to a independent branch named mechanization of national economy record while statistics became for one year only s specialization within this branch.

At the beginning of the study year 1959/60 another new department – of scientific programming dealing with econometrics and operational research⁵⁶ was separated. Also doc. Korda was transferred there as its manager followed by Ing. Zelinka and Ing. Rychetník. From the study year 1961/62 a new branch of economic and mathematical calculations was established and the students there specialized during their study in statistics or in mathematical methods in economy.⁵⁷ The number of students in the branch in the 60th was about 50 in a class, only smaller part of them was specialized, as a rule, in statistics.

⁵⁰ J. Kaňoková (1932–2006) graduated from statistical studies at the University of Special Sciences/FEI.

⁵¹ J. Kašpar (1928–1968) finished his studies at the University of Economic Sciences in Bratislava (predecessor of local University of Economics) in 1953.

⁵² V. Čermák (*1932) belonged to the first 33 graduates of the Faculty of Statistics who were on 2 March 1956 awarded an academic degree in Carolinum. I am sorry that the graduate economist Čermák with academic award and his other colleagues are referred to in this study for simplicity sake as engineers despite the fact that they were awarded this degree (backward) as late as in 1966. (Act No. 19 Sb., dated 16 March 1966 on Universities, sec. 57).

⁵³ L. Rychetník (*1933) was also a fresh graduate of statistics at the University of Economics.

⁵⁴ Compare Minutes No. 34 of the meeting of collegium of the rector held on 14 June 1955. Registry of the University of Economics.

⁵⁵ Government decree No. 58 Sb., dated 12 August 1959 on changes in organization of Universities, sec. 12. Merge took place in compliance with the general trend to repeatedly close down or merge many universities and faculties born at the beginning of the 50th.

⁵⁶ Since the econometrics was remembered by the approving comrades the rejected bourgeois pseudoscience, the department could obtain today name Department of Econometrics at more liberal atmosphere as late as in 1966.

⁵⁷ Statistics was excluded from the field of mechanization of national economic records.

After the leave of doc. Korda the department was headed in 1959–1961 by doc. Walter⁵⁸ and when doc. Walter followed doc Korda to his department, doc. Kašpar, a remarkable representative of economic statistics at the University of Economics in the 60th⁵⁹ became the head of the department. He became famous mainly by monograph *Typologie ekonomických veličin* (Typology of economic magnitudes),⁶⁰ in 1965–1966 he was vice-dean for scientific activity and then he left for New York where he worked in the statistical office of the OON. Due to his serious illness he was forced to return soon and in 1968 he died.

Since 1962 the development of the Department of Statistics had been connected for the whole 28 years with the name of its head – L. Cyhelský. In 1961 he habilitated, in 1969 he was awarded the professor degree and the degree of doctor of science (Dr.Sc.) was awarded to him in 1981. In 1966–1970 he took the post of vice-dean for scientific activity and on the distance study. He is an authors or co-author (often with J. Kaňoková and I. Novák) of major part of text-book of basics of statistic and descriptive statistics which were published thanks to the department (during fifty years they totalled – including study-books- about 50) as well as tens of specialized or popularizing articles. In 1979 he was elected member of the International Statistical Institute (ISI). At the University of Economics he read lessons for long 50 years (until 2002) and so far he co-operates with the department.

The scope of the article does not enable to describe systematically six decades of extensive activities of statisticians at the University of Economics. Let us summarize further development only in brief and let us end in 1968 when the University of Economics under the dramatic circumstances commemorated on 1st September the 15th anniversary of its establishment. In 1960–1964 many new members of staff was admitted to the department with experience from previous work: Ing. Jaroslav Jílek (1931–2007), Ing. Jiří Likeš (1929–1994), Ing. Jaroslav Hátle (1928–1987), Ing. Josef Kozák (1931–2005), Ing. Eduard Souček (*1935) and Ing. Jiřina Moravová (*1932). Out of young assistants who in these years joined the department let us mention Ing. Petr Hebák (*1940), Ing. Jana Kahounová (*1941), Ing. Jan Seger (*1938), Ing. Milan Matějka (*1938) and Ing. Jiří Hustopecký (*1940).

The growth of the department continues in the next years, until 1969 the department was joined gradually by the following persons: Ing. Jiří Kejkula (1943–1982), Ing. Pavel Berka (*1938), Ing. Jiří Žváček (*1943), Ing. Prokop Závodský (*1944) and graduate mathematician Felix Koschin (1946–2009).

From the half of 60th the department provided the students with all basic training in all basic statistical subjects – from descriptive statistics over the theory of probability and mathematic statistics, sample surveys, regression and correlation analysis, time-series analysis and prognostic methods, etc. to economic statistics, some branch statistics and demography. For majority of these subjects the students have at their disposal study texts and other were published continuously. Since the end of the 60th more often computer technology was used in teaching and in scientific activity of the department.

In international context J. Likeš is considered the most important statistician from the University of Economics since he is an author of a number of scientific texts published in prestigious foreign periodicals – from the area of mathematic statistics, theory of probability, design of experiments and their assessment and other similar things.⁶¹ At the University of Economics jointly with J. Hátle they

⁵⁸ In his scientific and pedagogical work he dealt with mainly applications of mathematic statistics in the area of economic phenomena and processes especially through sample surveys and statistics of consumption.

⁵⁹ In 1961 he was awarded an academic degree of associate professor (docent) on the basis of his habilitation work in previous year. In 1964 he became a member of the Czech delegation in standing committee of CMEA for statistics, etc.

⁶⁰ Prague: Research Institute of Statistics and Accountancy, 1968. English version was published in 1969.

⁶¹ In the database Web of Knowledge J. Likeš k has as of 1 March 2013 the total of 56 quotations (without quotations of his own works), most frequently (27times) the text Prediction of s-the ordered observation for the two-parameter exponential distribution (*Technometrics*, Vol. 16, 1974, pp. 241–244) is quoted.

provided for lessons of theory of probability and mathematical statistics and wrote, among other things, *Základy počtu pravděpodobnosti a matematické statistiky* (Basics of probability number and mathematical statistics, 1972, 2nd edition 1974). Let us also mention his (Likeš) *Navrhování průmyslových experimentů* (Design of industrial experiments, 1968) and *Základní statistické tabulky* (Basic statistical tables along with J. Laga, 1978, published in Moscow in Russian translation).

V. Čermák,⁶² author of numerous works of this field, devoted his time to the problems of sample surveys following J. Walter. Of his numerous works in this field let us mention an extensive monograph *Výběrové statistické zjišťování* (Sample surveys, Prague: SNTL/ALFA, 1980). Great attention had always been devoted at the Department of Statistics to the time series analysis and problems related to their prognostic application. The most remarkable specialist with international prestige was J. Kozák (at the beginning he developed especially the theory of sample surveys with applications in agriculture), author of numerous scientific works and study texts dealing with these issues – some in co-operation with J. Seger.

After the death of doc. Kašpar the main representative of economic statistics at the department became J. Jílek. As a co-author he contributed during the time to four basic text-books of economic statistics and published over two hundred of scientific and technical articles. Main attention was devoted to problems of production measurement, mainly system inclusion of interdisciplinary balances (habilitation in 1968).

Demographic statistics since the 50th at the department of statistics was developed by V. Roubíček. After his habilitation (in 1967) he managed to establish in the spring 1968 an independent laboratory of demography. This little but active work-place had during the following two decades changed six times its status and classification out of long-term employees, let us mention F. Koschin.

Out of many other activities of the department let us mention at least long-term co-operation with statistical office,⁶³ which was contributed to by majority of staff of the department, membership in editorial councils of technical periodicals – *Statistika* (prof. Cyhelský, doc. Jílek, doc. Novák, from statisticians from VŠE originated also a remarkable part of articles), *Demografie* (doc. Roubíček), collections *Statistická revue* etc. Prof. Cyhelský was a member of the State Statistical Council since its establishment in 1967.⁶⁴

Readers of *Statistika* journal taking interest in activity of statisticians at the University of Economics will find what they search for in some of next editions. Topical information about contemporary three statistical departments at the Economic University is available at these web-sites.⁶⁵

References

- CYHELSKÝ, L. Příprava vysokoškolsky vzdělaných ekonomicko-statistických specialistů v ČSSR v letech 1945–1985 (Preparation of economic-statistical specialists with university education in the CSSR in 1945–1985). *Statistika*, Vol. 22, 1985, No. 5, pp. 201–211.
- CYHELSKÝ, L. K čtyřicátému výročí založení katedry statistiky Vysoké školy ekonomické v Praze (40th Anniversary of establishment of the Department of Statistics at the University of Economics). *Informační bulletin České statistické společnosti*, Vol. 3, 1992, No. 2, pp. 4–7.
- EGERMAYER, F. *Sovětské názory na statistiku* (Soviet opinion on statistics). Prague: SÚS, nákladem SEVT (Knižnice SÚS: Otázky statistiky, No. 4/1957).

⁶² His other life-long specialization was the application of statistical methods in agriculture.

⁶³ Intentionally I do not mention precise name – statistical office during these 15 years was renamed 4times.

⁶⁴ Later he was a member of the Czech and Federal Statistical Council.

⁶⁵ <<http://kstp.vse.cz>>, <<http://kest.vse.cz>>, <<http://kdem.vse.cz>>. At the Faculty of Management of the University of Economics in Jindřichův Hradec the teaching of statistics is provided by the Department of exact methods: <<http://www.fm.vse.cz/o-fakulte/katedry/katedra-exaktnich-metod>>.

- EGERMAYER, F., WALTER, J. Statistická výuka na československých školách ekonomického zaměření (Statistical education at the Czechoslovak economic schools). *Statistika a demografie II*. Prague: ČSAV, 1961, pp. 9–32.
- HERBST, F. Statistika – nástroj budování socialismu (Statistics – tool of building of socialism). *Statistický obzor*, Vol. 30, 1950, No. 3–4, pp. 212–219.
- HERBST, F., HLAVÁČEK, A. O nové organizaci vysokoškolského studia statistiky v ČSR (On new organization of university study of statistics in the CSR). *Statistický obzor*, Vol. 32, 1952, No. 3–4, pp. 210–215.
- KEJKULA, J., ŽVÁČEK, J. *Facultas oeconomiae (statistická ročenka 1967)*. Prague: SPN, 1968. (In the years 1971–1989 more 10 statistical yearbook of the University of Economics and the Faculty of National Economy. Co-authors: KUDRNÁČOVÁ, Z., ZÁVODSKÝ, P.)
- Jiří Likeš (1929–1994)*. 2008. Prague: Oeconomica, 2008. ISBN 978-80-245-1414-7.
- O studiu statisticko-pojistného inženýrství* (Study of statistical insurance engineering). Prague: Spolek posluchačů inženýrství statisticko-pojistného, 1947.
- PRŮŠA, M. Třicet let katedry statistiky na Vysoké škole ekonomické v Praze (Thirty years of the Department of Statistics at the Economic University in Prague). *Statistical revue*, No. 8, 1984, pp. 348–359.
- ZÁVODSKÝ, P. Přehled vývoje vysokého ekonomického školství na našem území (Review of the development of economic education in the Czech Republic). In: 80 let vysokého ekonomického školství na území České republiky, *Acta oeconomica Pragensia*, Vol. 7, 1999, No. 5, pp. 22–86. ISSN 0572-3043.
- ZÁVODSKÝ, P. 50. výročí založení katedry statistiky VŠE (50th Anniversary of establishment of the Department of Statistics of the University of Economics). *Statistika*, Vol. 39, 2002, No. 8–9, pp. 326–332. ISSN 0322-788x.
- ZÁVODSKÝ, P. 60 let statistiky na Vysoké škole ekonomické v Praze (60th anniversary of statistics at the University of Economics). *Politická ekonomie*, Vol. 61, 2013, No. 4, pp. 367–387. ISSN 0032-3233.
- ZÁVODSKÝ, P., ŠIMPACH, O. Sixty Years of Teaching Statistics at the University of Economics in Prague. In: *International Days of Statistics and Economics at VŠE*, Prague 19.09.2013–21.09.2013. Prague: VŠE, 2013, pp. 1573–1582. ISBN 978-80-86175-87-4.
- Study programmes of ČVUT, VŠSN, VŠPS and VŠE in 1930–1970.

Archive sources

- Archives of the Capital of Prague – Fond of VŠPHV ad Fond of the University of political and social sciences
- Archives of the Czech Technical University – Fond of the University of Business
- Record office (archives) of the University of Economics
- Collection of documents of P. Závodský

Recent Publications and Events

New publications of the Czech Statistical Office

Analýza zahraničního obchodu ČR se zbožím v letech 1999 až 2012 (Analysis of the Czech foreign trade with goods in the years 1999–2012). Prague: CZSO, 2013.

Demographic Yearbook of the Czech Republic 2012. Prague: CZSO, 2013.

External Trade of the Czech Republic in 2012. Prague: CZSO, 2013.

Statistical Yearbook of the Czech Republic 2013. Prague: CZSO, 2013.

Tendence a faktory makroekonomického vývoje a kvality života v České republice v roce 2012 (Trends and factors of the macroeconomic development and quality of life in the Czech Republic in 2012). Prague: CZSO, 2013.

Životní podmínky v ČR 2012. Chudoba a sociální vyloučení (Living conditions in the Czech Republic 2012. Poverty and social exclusion). Prague: CZSO, 2013.

Other selected publications

DUPAČ, V., HUŠKOVÁ, M. *Pravděpodobnost a matematická statistika* (Probability and Mathematical Statistics). Prague: Karolinum, 2013.

EUROSTAT. *Eurostat regional yearbook 2013*. Luxembourg: EU, 2013.

KACZOR, P. *Trh práce, pracovní migrace a politika zaměstnanosti ČR po roce 2011* (Labor market, labor migration and employment policy of the Czech Republic after 2011). Prague: Oeconomica, University of Economics, 2013.

LANGHAMROVÁ, J., ŠIMPACH, O. *Základy demografie* (Introduction to Demography). Prague: Oeconomica, University of Economics, 2013.

MALÁ, I. *Statistické úsudky* (Statistical Inferences). Prague: Professional Publishing, 2013.

MELOUN, M., MILITKÝ, J. *Kompendium statistického zpracování dat* (Compendium of statistical data processing). Prague: Karolinum, 2012.

MLČOCH, L. *Ekonomie rodiny v proměnách času, institucí a hodnot* (Economics of families through the ages, institutions and values). Prague: Národohospodářský ústav Josefa Hlávky, 2013.

MoLSA. *Development of the Basic Living Standard Indicators in the Czech Republic 1993–2012*. Prague: Ministry of Labour and Social Affairs, 2013.

MoLSA. *Statistická ročenka trhu práce v ČR v roce 2012* (Statistical Yearbook of the Czech Labor Market in 2012). Prague: Ministry of Labour and Social Affairs, 2013.

PAVLÍK, J. *Sbírka příkladů z aplikované statistiky* (Collection of examples from applied statistics). Prague: VŠCHT, 2012.

ŘEZANKOVÁ, H., LÖSTER, T. *Základy statistiky* (Introduction to Statistics). Prague: Oeconomica, University of Economics, 2013.

UN. *Human Resources Management and Training. Compilation of Good Practices in Statistical Offices*. Geneva: UN, 2013.

Conferences

The 21st International Conference on Computational Statistics COMPSTAT 2014 will be held ***from 19th to 22nd of August 2014 at the International Conference Centre in Geneva, Switzerland.*** The conference aims at bringing together researchers and practitioners to discuss recent developments in computational methods, methodologies for data analysis and applications in statistics. More information available at: <http://compstat2014.org>.

The 60th World Statistics Congress ISI 2015 will take place during ***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.

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Authors and Contacts

Rudolf Novak*, Institution Name, Street, City, Country
Jonathan Davis, Institution Name, Street, City, Country
* Corresponding author: e-mail: rudolf.novak@domain-name.cz, phone: (+420) 111 222 333

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Place reference in the text enclosing authors' names and the year of the reference, e.g. "White (2009) points out

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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.

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Journal of Statistika | Czech Statistical Office
Na padesátém 81 | 100 82 Prague 10 | Czech Republic
e-mail: statistika.journal@czso.cz
web: www.czso.cz/statistika_journal

Managing Editor: Jiří Novotný

phone: (+420) 274 054 299

fax: (+420) 274 052 133

e-mail: statistika.journal@czso.cz

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phone: (+420) 234 035 200,

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