

AN ANALYSIS OF LABOUR PRODUCTIVITY IN CENTRAL AND EAST EUROPEAN COUNTRIES

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Abstract

The objective of this article is to analyse the labour productivity, or working efficiency of new European Union (EU) states, with emphasis on Estonia; and to compare them on the EU level. Industry, construction, trade and transport in Estonia have been viewed separately.

Labour market problems in Central and Eastern European countries have become more and more important. When the EU labour markets opened, some EU countries were forced to face the problem of partial workforce drain to richer countries with higher wages. In addition, on the one hand, Central and East European countries have quite high unemployment rates, and on the other, many vacant jobs – there is a lack of qualified workforce. Low salaries, among other reasons, force many people to go to work in rich countries, where wages are several times higher.

A number of proposals to increase labour productivity for both workers and entrepreneurs have been listed in the summary.

Keywords: Central and East European countries, Estonia, workforce, working efficiency, labour productivity, suggestions.

1. Introduction

Working efficiency in ten Central and East European countries (Bulgaria, the Czech Republic, Estonia, Ireland, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia and Slovakia) has been analysed. Former post-communist countries were selected for observation; new EU member states, Malta and Cyprus, have been excluded.

The main branches of the Estonian national economy in connection to the economic crisis have been analysed. Four major sectors of the economy with the greatest gross domestic product and largest number of employees will be observed: industry, construction, trade and transportation. The situations before the crisis, during the crisis and after the crisis will be viewed.

The growth of the entire economy, measured using gross domestic product (GDP), will be viewed as background. The main emphasis, however, is still on the three Baltic States, and on Estonian business in more detail.

2. Methodology

The techniques and labour market survey definitions used by the authors have been specified in OECD [1] and Eurostat (Methodological Notes. EU-LFS) [2].

Labour productivity is defined as GDP per hour worked. The measures of labour productivity are presented as indices and as rates of change. [1]

Labour productivity per hour worked is calculated as real output (deflated GDP measured in chain-linked volumes, reference year 2005) per unit of labour input (measured by the total number of hours worked). Measuring labour productivity per hour worked provides a better picture of productivity developments in the economy than labour productivity per person employed, as it eliminates differences in the full time/part time composition of the workforce across countries and years. [3]

Formulas of productivity measures [4]

	Productivity measures by net sales	Productivity measures by value added
Productivity of labour (thousand euros)	$\frac{\text{net sales} + \text{subsidies}}{\text{number of persons employed}}$	$\frac{\text{value added}}{\text{number of persons employed}}$
Productivity per hour (euros)	$\frac{\text{net sales} + \text{subsidies}}{\text{number of hours worked by employees}}$	$\frac{\text{value added}}{\text{number of hours worked by employees}}$

Labour productivity per person employed (on the basis of value added) – indicates how much value added is generated on average per person employed (is calculated as value added divided by the number of persons employed). [4]

Workforce productivity is the amount of goods and services that a worker produces in a given amount of time. It is one of several types of productivity that economists measure. Workforce productivity can be measured for a firm, a process, an industry, or a country. It is often referred to as *labour productivity* because it was originally studied only with respect to the work of laborers as opposed to managers or professionals.

The OECD defines it as "the ratio of a volume measure of output to a volume measure of input". [1] Volume measures of output are normally GDP or gross value added (GVA), expressed at constant prices i.e. adjusted for inflation. The three most commonly used measures of input are: hours worked; workforce jobs; and number of people in employment.

Workforce productivity can be *measured* in physical terms or in price terms.

- ✓ the intensity of labour-effort, and the quality of labour effort generally.
- ✓ the creative activity involved in producing technical innovations.
- ✓ the relative efficiency gains resulting from different systems of management, organization, co-ordination or engineering.
- ✓ the productive effects of some forms of labour on other forms of labour.

These aspects of productivity refer to the *qualitative* dimensions of labour input. If an organization is using labour much more intensely, one can assume it's due to greater labour productivity, since the output per labour-effort may be the same. This insight becomes particularly important when a large part of what is produced in an economy consists of services. Management may be very preoccupied with the productivity of employees, but the productivity gains of management itself is very difficult to prove. While labor productivity growth has been seen as a useful barometer of the U.S. economy's performance, recent research has examined why U.S. labor productivity rose during the recent downturn of 2008–2009, when U.S. gross domestic product plummeted. [5]

The validity of international comparisons of labour productivity can be limited by a number of measurement issues. The comparability of output measures can be negatively affected by the use of different valuations, which define the inclusion of taxes, margins, and costs, or different deflation indexes, which turn current output into constant output. [6] Labor input can be biased by different methods used to estimate average hours [7] or different methodologies used to estimate employed persons. [8] In addition, for level comparisons of labor productivity, output needs to be converted into a common currency. The preferred conversion factors are Purchasing Power Parities, but their accuracy can be negatively influenced by the limited representativeness of the goods and services compared and different aggregation methods. [9]

“*The factors affecting labour productivity* or the performance of individual work roles are of broadly the same type as those that affect the performance of manufacturing firms as a whole. They include: (1) physical-organic, location, and technological factors; (2) cultural belief-value and individual attitudinal, motivational and behavioural factors; (3) international influences – e.g. levels of innovativeness and efficiency on the part of the owners and managers of inward investing foreign companies; (4) managerial-organizational and wider economic and political-legal environments; (5) levels of flexibility in internal labour markets and the organization of work activities – e.g. the presence or absence of traditional craft demarcation lines and barriers to occupational entry; and (6) individual rewards and payment systems, and the effectiveness of personnel managers and others in recruiting, training, communicating with, and performance-motivating employees on the basis of pay and other incentives. The emergence of computers has been noted as a significant factor in increasing labor productivity in the late 1990s, by some, and as an insignificant factor by others, such as R.J. Gordon. Although computers have existed for most of the 20th century, some economic researchers have noted a lag in productivity growth caused by computers that didn't come until the late 1990s.” [10]

GDP is an indicator for a nation's economic situation and a measure of the economic activity. It reflects the total value of all goods and services produced. Expressing GDP in PPS (purchasing power standards) eliminates differences in price levels between countries, and calculations on a per head basis allows for the comparison of economies significantly different in absolute size. [11]

Economic growth is defined as a production increase of an output of a production process. In order to calculate GDP growth rate in constant prices, GDP in current prices is converted to the prices of the previous year and changes in volume are determined based on the level of the reference year. The calculation of the annual *growth rate* of GDP volume is intended to allow comparisons of the dynamics of economic development both over time and between economies of different sizes. For measuring the growth rate of GDP in terms of volumes, the GDP at current prices are valued in the prices of the previous year and the thus computed volume changes are imposed on the level of a reference year. Price changes therefore do not affect the growth rate of GDP. Accordingly, price movements will not inflate the growth rate. Code: tec00115 [12]

GDP per capita in constant prices constant prices GDP is found and the ratio of the average population. Often used in constant prices GDP as an indicator of the wealth of nations, as it reflects the average real income in this country. However, the tool does not provide a complete overview of economic well-being. For example, GDP does not reflect much of the unpaid work in households, nor does it take into account negative effects of economic activities, such as damage to the environment. GDP per capita in constant prices is based on rounded figures. [13]

GDP per person employed is intended to give an overall impression of the productivity of national economies expressed in relation to the EU-27 average. The volume index of GDP per capita in PPS is expressed in relation to the EU-27 average set to equal 100. If the index of a country is higher than 100, this country's level of GDP per head is higher than the EU average and vice versa. Basic figures are expressed in PPS, i.e. a common currency that eliminates the differences in price levels between countries allowing

meaningful volume comparisons of GDP between countries. The index, calculated from PPS figures and expressed with respect to EU27 = 100, is intended for cross-country comparisons rather than for temporal comparisons." [14]

3. Analysis

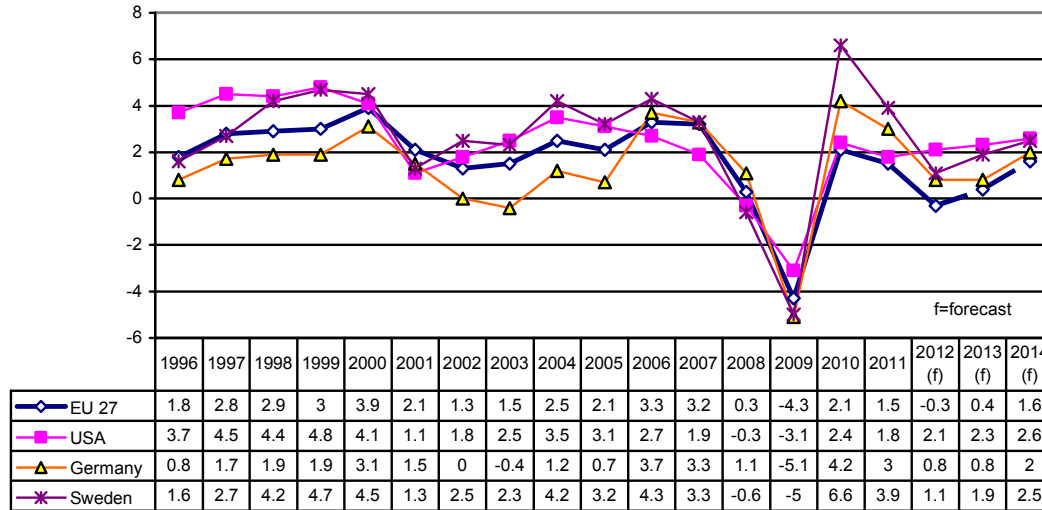


Figure 1. Real GDP growth rate – volume. Percentage change during the previous year. [12]

Figure shows the decline in GDP 2009th and economic growth in the coming years, particularly in the case of Sweden.

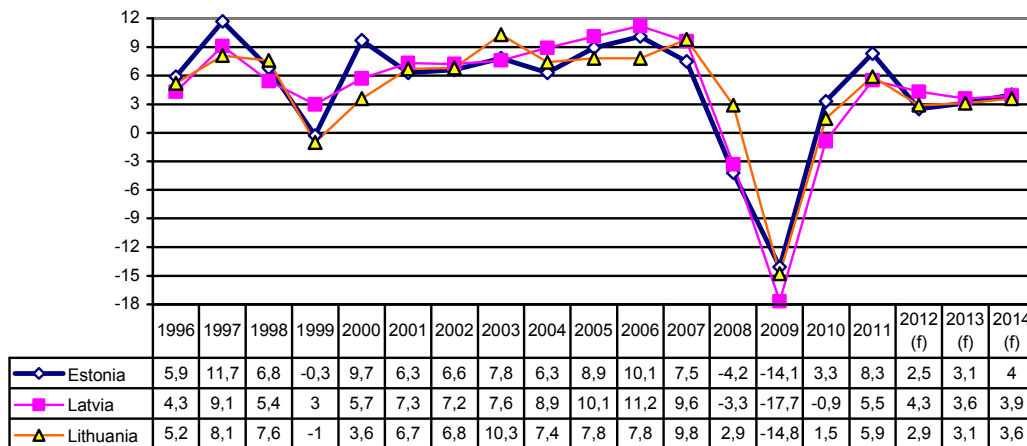


Figure 2. Real GDP growth rate – volume. Percentage change during the previous year. [12]

The trend line shows the cyclical development of the Estonian economy (GDP). In addition to the economic decline during the years 2008 – 2009, there was also a decline in 1999. If an annual real GDP increment of more than 10% can be considered excellent, then the result in 2009 (14.1%) was one of the largest in the world.

The development of the Estonian economy before and after the crisis was one of the fastest in the EC. Yet, the crisis led to a very deep recession, which was one of the greatest in the world, as well as in the EC, and lasted for nine quarters. Thus, the country covered two extremes. On the other hand, it also shows that the reforms carried out in the past were successful and established a base that enabled exiting the crisis

successfully. In particular, this meant creating favourable conditions for business. Again, GDP growth in 2011 and also 2012 are highest in the EC.

GDP per capita (PPP) is an important indicator of a state’s standard of living, which takes into account price level differences. The figure shows that the economy was the highest during the years 2007 - 2008. A larger or smaller recession took place in 2009, which is called the crisis year. In the following years economy grew. In 2011, the U.S., as well as the EU 27 as a whole, including Germany, Sweden, Latvia and Lithuania, reached a record level per capita. Finland and Estonia were short of the 2007 - 2008 level.

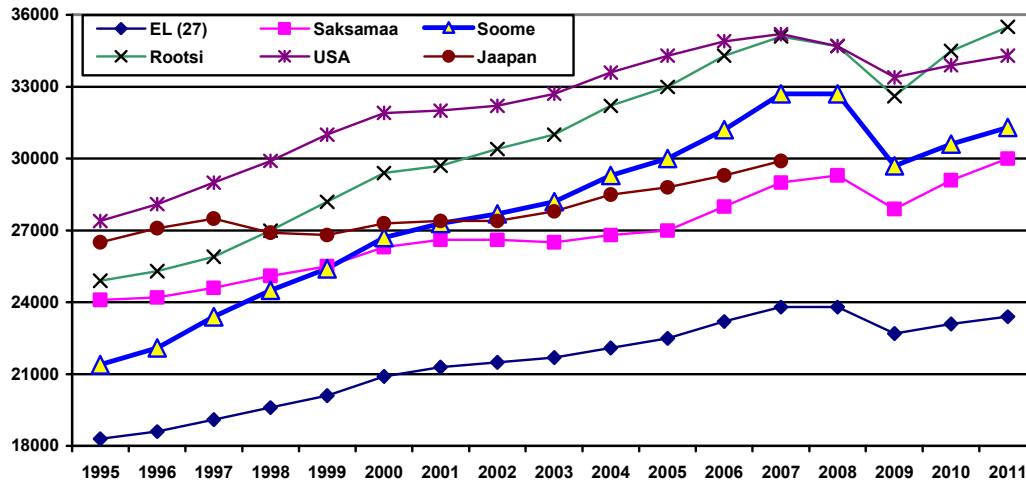


Figure 3. Real GDP per capita, EUR per inhabitant, 1995 – 2011 [13]

For generalization, GDP growth per capita in constant prices in all the considered countries was remarkable. It grew most in Finland and least in Japan. Also, growth in all of EU-27 was almost rectilinear. Between 1995 and 2007, GDP per capita in constant prices increased by 1.41 times in Sweden, 1.53 in Finland and 1.20 Germany. The economic crisis brought the levels down and in 2011, the U.S. and Germany alone managed to exceed pre-crisis levels. While the U.S. was best before the crisis, in 2007 - 2008 the levels of the U.S. and Sweden became more even, and after the crisis Sweden was firmly ahead. However, the level of Germany is now lower than those of Sweden and Finland.

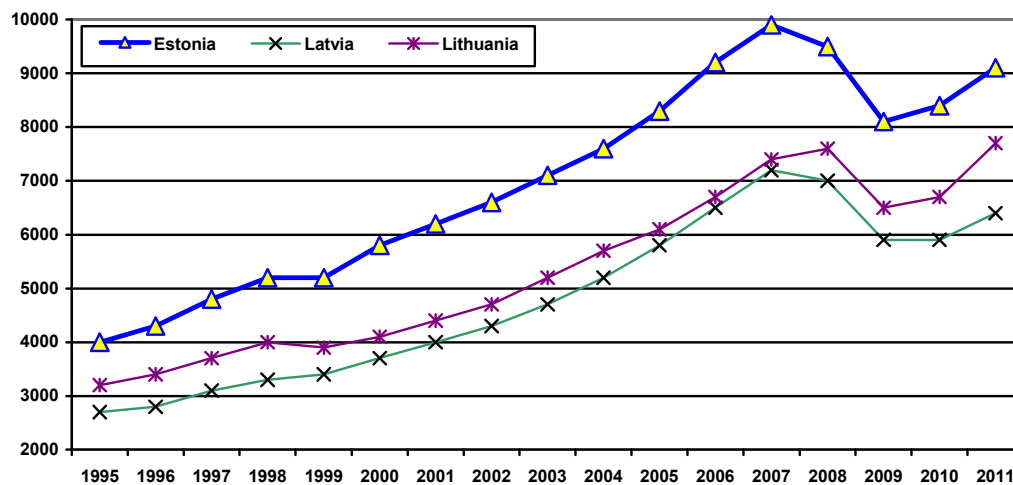


Figure 4. Real GDP per capita, EUR per inhabitant, 1995 – 2011 [13]

Between 1995 and 2007, GDP per capita in constant prices in Estonia increased by 2.48 times, by 2.31 times in Lithuania and 2.67 in Latvia. The economic crisis significantly brought down the levels and in 2011, Lithuania was the only country that managed to exceed pre-crisis levels, in fact, Estonia and Latvia were also short of the level of the year 2006.

Table 1. Labour productivity per employed person. Index (EU-27 = 100) [15]

	1995	1997	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Bulgaria	31.4	25.6	29.3	31.3	32.2	34.0	34.8	34.8	35.8	36.4	37.5	39.6	40.1	41.3	43.5
Czech	64.4	64.5	65.0	65.6	67.9	67.7	71.2	73.1	73.1	74.0	76.3	74.1	75.9	73.8	74.1
Estonia	34.1	40.0	43.5	47.2	48.4	51.3	55.0	57.7	60.8	62.4	66.7	65.8	65.5	69.3	67.6
Latvia	33.4	35.7	38.3	40.1	41.6	42.8	44.2	45.9	47.8	48.9	51.4	51.6	52.8	54.8	62.7
Lithuania	36.2	38.6	40.6	43.2	47.4	48.6	52.6	53.9	55.0	56.8	59.6	62.1	57.6	62.5	64.9
Hungary	55.0	56.4	56.4	57.1	61.5	64.8	66.0	67.1	67.7	67.8	66.6	70.7	71.8	70.1	70.8
Poland	46.0	49.6	54.3	55.5	56.3	59.0	60.3	61.9	61.8	61.2	62.3	62.4	65.6	66.8	68.8
Romania	..	..	23.4	23.7	25.7	29.4	31.3	34.6	36.1	39.7	43.4	49.2	49.2	48.9	51.1
Slovenia	66.7	73.6	77.0	76.1	76.2	77.6	79.0	81.6	83.3	83.4	83.2	83.8	81.5	80.5	81.8
Slovakia	50.2	54.6	56.9	58.4	60.8	62.9	63.8	65.8	68.8	71.7	76.4	79.8	79.7	81.5	80.3

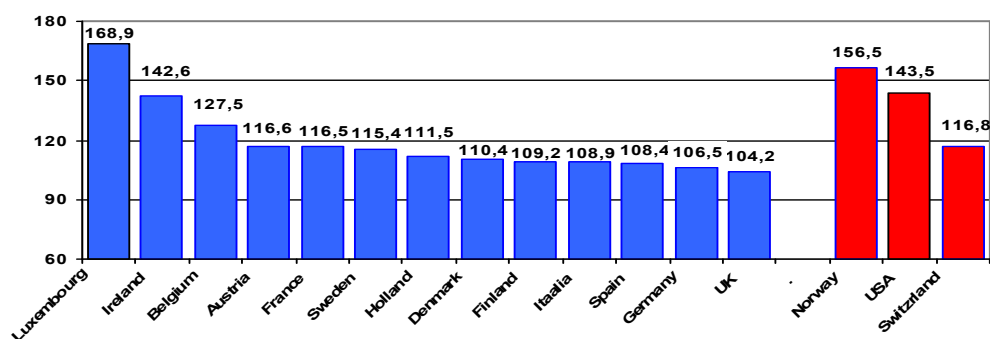


Figure 5. States with higher productivity > EL=100, 2011 [15]

Source: authors illustration

Luxembourg has highest productivity within the EU and also globally; Norway has the highest productivity outside the EU.

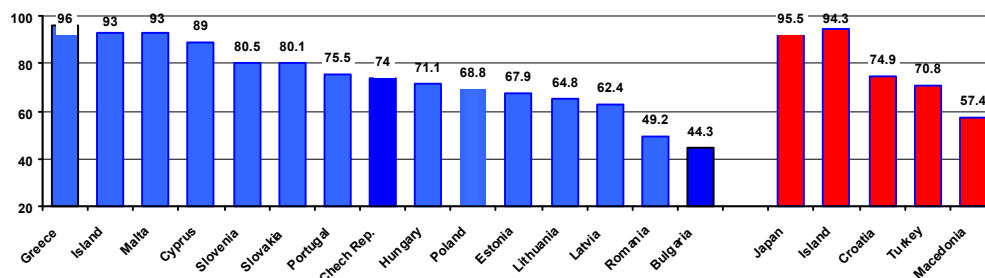


Figure 6. States with lower productivity < EL=100, 2011 [15]

Source: authors illustration

Post-socialist countries have lower productivity; however the levels of Malta and Cyprus are somewhat higher. The EU-15 state Portugal has somewhat higher productivity than Estonia. EU post-socialist states Slovenia, Slovakia, Hungary and the Czech Republic have even higher productivity. Of the EU candidate states, Estonia is exceeded by Croatia, while Turkey remains at the same level.

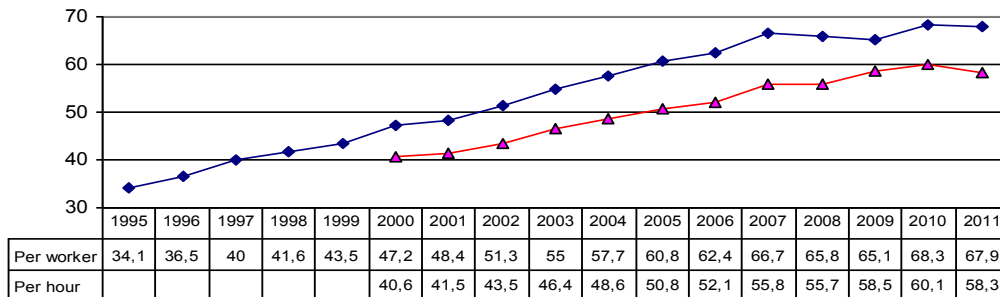


Figure 7. Productivity growth in Estonia (EU=100), 1995-2011 [15; 16]

Source: authors illustration

In Estonia yield per worker, i.e. productivity grew 2.0 times during the period under examination; however, it came to a pause during the economic crisis.

In contrast, in 2010 in Latvia, yield per one worker was 54.6% and 62.3% in Lithuania, similar to the EU-27 average. The indicator was highest among EU member states in Luxembourg (169.9), Ireland (136.9) and France (115.8) and lowest in Bulgaria (41.3) and Romania (48.8). Productivity was 1.5 times higher than the EU average in Norway (150.7) and the USA (143.5).

One working hour productivity displays a similar trend, having been highest in Luxembourg 187.1. Productivity in Estonia only amounts to 61.0%.

However, the prevailing trend is that regardless of growth in productivity elsewhere, the indicator rises noticeably quicker in Estonia and also other new EU accessions, than in veteran and wealthy EU-15 countries.

When analysing productivity in EU-27 (added value produced by one worker) by sectors of the economy and the size of companies, one cannot draw an equipollent (equal in force or effect) conclusion regarding productivity and the number of workers engaged in the company. It is conditioned by the particular sector of the economy. For instance, productivity among energy and water management companies is highest in small firms with up to 9 persons on payroll. On the other hand, for companies active in the lease of movable property, accommodation (housing) companies, and among all the sectors of the economy taken together as an entity, productivity is highest in big firms that employ 250 or more workers. Highest productivity among textile and habiliment (articles of clothing) firms can be noted in companies with 10 - 49 workers; the same can be said for timber companies with 50 – 249 workers [17].

A more detailed analysis of the productivity indicators of Estonian companies and the labour expenses in current prices, i.e. the predominant share constituted by salaries, is brought below.

In Estonia, productivity differs little for companies in the size of up to 249 workers. In 2003 and 2007 firms with 50 –99 workers boasted the largest productivity; in 2005 it was companies with up to 9 workers and for the rest of the surveyed period, companies with 100 – 249 workers dominated. Invariably, large companies with smaller productivity had 250 and more workers. This can be accounted for by the fact that smaller companies have larger flexibility in management, a smaller number of ancillary personnel and also because the workers of small companies are more likely to be “jacks of all trades” than in big companies. In big firms productivity is sapped, as a general rule, by large overheads.

Estonian labour productivity growth in 2010 was 4.6% and -1.7% in 2011.

Table 2. Labour productivity. Euro per hour worked. [3]

	1995	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Bulgaria	2.9	2.9	3.4	3.5	3.6	3.8	3.9	4.0	4.1	4.3	4.4	4.3	4.5	4.8
Czech	8.2	8.6	9.3	10.0	10.1	10.7	11.1	11.7	12.4	13.0	13.0	12.8	13.0	13.1
Estonia	:	:	7.0	7.4	7.7	8.2	8.7	9.2	9.7	10.3	10.0	10.3	10.9	10.8
Latvia	:	:	4.2	4.5	4.7	5.0	5.5	5.9	6.3	6.7	6.7	6.6	6.9	7.8
Lithuania	4.5	5.3	5.6	6.2	6.5	7.1	7.5	7.7	8.2	8.7	8.8	8.3	8.7	9.2
Hungary	7.8	8.1	8.4	8.9	9.2	9.7	10.2	10.7	11.1	11.1	11.3	11.0	11.1	11.2
Poland	5.2	6.0	6.9	7.2	7.5	7.9	8.2	8.4	8.6	8.8	8.9	9.1	9.5	9.8
Romania	:	:	3.0	3.2	3.8	4.0	4.4	4.6	4.9	5.2	5.6	5.3	5.3	:
Slovenia	:	:	15.4	15.9	16.0	16.5	17.0	18.2	19.3	20.1	20.1	18.9	19.5	20.2
Slovakia	6.6	7.7	8.2	8.5	9.2	9.8	10.1	10.4	11.0	11.8	12.1	11.8	12.3	12.6

In Norway, the indicator for euro per hour worked has grown from 49.3 thousand to 68.9 thousand during the years 1990 – 2011, from 29.8 to 44.4 in Sweden, from 25.7 to 40.0 in Finland, from 37.4 to 48.9 in Denmark, from 33.4 to 45.4 in France, from 31.2 to 42.3 in Germany, from 29.5 to 41.5 in the United States; and during the period from 1995 – 2011 from 25.3 to 31.9 in the EU (27 countries).

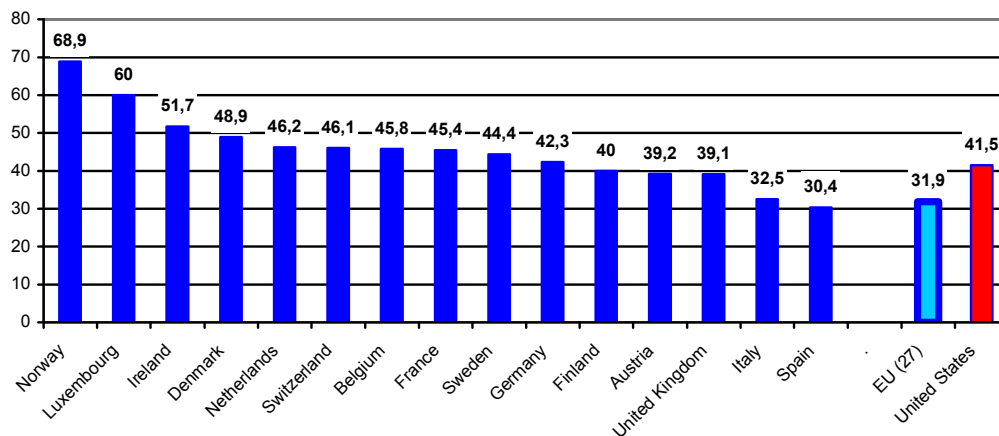


Figure 8. States with higher productivity, Euro per hour worked, 2011 [3]

Source: authors illustration

Norway and Luxembourg have highest productivity in Europe and also globally.

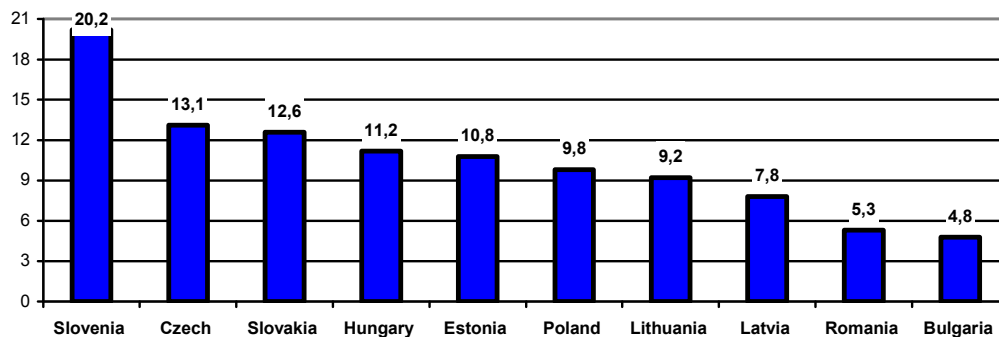


Figure 9. States with lower productivity, Euro per hour worked, < EL=100, 2011 [3]

Source: authors illustration

Table 3. Labour productivity per hour worked. Index, 2005=100 [16]

	2006	2007	2008	2009	2010	2011
EU (27 countries)	102.1	103.6	103.1	101.7	103.9	105.3
Bulgaria	103.4	106.6	110.2	107.0	112.8	119.9
Czech Republic	106.7	111.4	111.8	110.1	111.9	112.5
Estonia	105.0	112.1	108.9	111.7	118.2	116.9
Ireland	101.2	103.8	103.8	109.0	113.2	117.3
Latvia	106.9	114.6	114.7	111.9	117.3	133.6
Lithuania	106.7	112.8	115.0	107.5	113.9	119.8
Hungary	103.7	104.0	106.2	102.8	104.2	104.6
Poland	102.9	105.3	106.8	109.1	113.1	117.3
Romania	106.2	112.0	120.2	114.1	114.6	:
Slovenia	106.1	110.6	110.5	103.7	106.9	111.1
Slovakia	105.8	113.5	116.1	113.4	118.4	121.1

Compared to 2005, labour productivity per hour in all 10 of the new post-socialist EU countries has increased at a more rapid pace than the EU 27 average. Ireland had the greatest increase of the old EU member states (117.3) and Latvia among the new members (133.6). Hungary had the smallest growth (104.6) among new members, which was even lower than the EU 27 average. The level of Estonia among the new member states was average.

Table 4. Labour productivity per hour worked. Percentage change over previous year [3]

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
EU (27)	1.8	1.7	1.5	1.7	1.2	2.1	1.4	-0.5	-1.4	2.1	1.4
Bulgaria	4.2	4.4	3.1	2.6	3.9	3.4	3.1	3.4	-2.9	5.4	6.2
Czech Rep	7.8	1.6	5.2	4.4	4.6	6.7	4.4	0.4	-1.5	1.6	0.6
Estonia	5.9	5.0	6.1	5.8	6.0	5.0	6.8	-2.8	2.5	5.8	-1.1
Latvia	6.5	6.3	6.2	9.3	6.6	6.9	7.2	0.1	-2.4	4.8	13.8
Lithuania	11.8	4.8	8.9	6.0	1.7	6.7	5.7	1.9	-6.5	5.9	5.2
Hungary	5.9	4.0	5.2	5.2	4.3	3.7	0.3	2.2	-3.2	1.3	0.4
Poland	3.4	4.9	4.8	4.1	1.7	2.9	2.3	1.4	2.2	3.6	3.8
Romania	6.8	16.0	7.0	9.8	5.4	6.2	5.4	7.3	-5.1	-0.1	..
Slovenia	3.2	0.8	3.0	3.2	6.9	6.1	4.3	-0.1	-6.1	3.1	3.9
Slovakia	3.7	7.3	7.1	2.6	3.3	5.8	7.2	2.3	-2.3	4.4	2.2

Labour productivity grew for all countries until 2008. In 2008 some countries, including Estonia (-2.8), experienced a decline. In 2009, all countries, except Estonia and Poland were experiencing a decline. In 2011 hourly labour productivity only decreased in Estonia compared to the previous year.

Labour productivity in Estonia will be viewed in more detail below.

Table 5. Productivity indicators of Estonian companies in current prices, 2001-2012 [18]**Labour productivity per person employed on the basis of net sales, thousand euro**

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
I Q	10.8	11.1	12.3	13.6	15.2	17.6	20.6	21.2	18.5	20.8	25.2	27.1
II Q	12.2	12.9	13.4	15.2	17.3	20.2	23.4	23.4	20.4	24.0	27.6	29.3
III Q	12.3	12.8	14.0	15.4	18.2	21.0	23.6	24.0	20.8	25.2	28.1	29.7
IV Q	13.4	13.6	15.0	16.6	19.7	22.0	24.4	22.0	21.7	26.8	29.3	

Labour productivity per person employed on the basis of value added, thousand euro

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
I Q	2.1	2.4	2.5	2.7	3.4	4.0	4.2	3.2	3.5	4.3	4.7
II Q	2.5	2.6	2.8	3.3	3.9	4.7	4.6	3.7	4.1	5.0	5.4
III Q	2.5	2.7	2.8	3.4	4.2	4.7	4.6	3.5	4.4	5.0	5.4
IV Q	2.6	2.7	2.9	3.6	4.5	4.7	4.0	3.8	4.7	5.1	

From the second half of 2006, productivity per employed person in reference to sales revenues was over 20 thousand euros. A dramatic decline occurred in QI of 2009, which was followed by a slow growth, whereas QIII and QIV of 2010 were record-breakers. Admittedly, Estonia has made its exit from the economic crisis mainly along the intensive road, i.e. on account of productivity growth.

Productivity per employed person in reference to added net value has changed due to other regularities. As late as in QIV of 2010, Estonia reached the level of the three successful pre-crisis quarters of 2007. Whereas in QIV of 2010, the level was already 1.5 times higher than productivity in the deepest slump of the crisis in QI of 2009.

After the crisis, productivity recovered quicker in reference to sales revenue than in reference to added value, which is an indicator of the runaway selling prices after the crisis.

While the above analysis by quarters supports the assumption that during the period of the economic crisis changes take place extremely rapidly, as a consequence, an analysis with one year precision will not provide a correct picture of upcoming changes.

Table 6. Productivity per employed person for Estonian companies (thousand euros), 2005 – 2010 [19]

	2005	2006	2007	2008	2009	2010
By reference to sales revenue	72.1	81.2	92.2	93.6	81.2	95.6
By reference to value added	14.7	17.4	19.3	18.7	17.4	16.7

Sales revenue per employed person was 44.3 thousand euros in the first quarter of 2010, which is more than in the previous year but still falls short of the average of 2007 and 2008.

The productivity of the business sector in reference to added net value increased by 18% in 2010, while the companies' average labour expenses per employed persons remained at the level of 2009.

Based on sales revenue, labour productivity per employed person grew steadily for all companies until 2008, as did hourly productivity based on sales revenue, then a great decline of 13.2% and 10.0% respectively followed, which, on the other hand, is much smaller than the decline of total business output or real GDP. However, already in 2010, both indicators reached record levels.

The new Employment Contracts Act, which made labour relations more flexible, and the more effective unemployment insurance system also had great influence.

Table 7. The enterprises' added value and productivity measures, by indicator and economic activity of Estonia [19]

	2005	2006	2007	2008	2009	2010
Economic activities total						
Labour productivity per person employed on the basis of net sales, thousand euros	72.1	81.2	92.2	93.6	81.2	95.4
Hour productivity on the basis of net sales, euros	42.85	48.22	55.52	56.27	50.57	59.12
Labour productivity per person employed on the basis of value added, thousand euros	14.7	17.4	19.3	18.7	17.4	19.6
Hour productivity on the basis of value added, euros	8.71	10.33	11.64	11.21	10.84	12.13

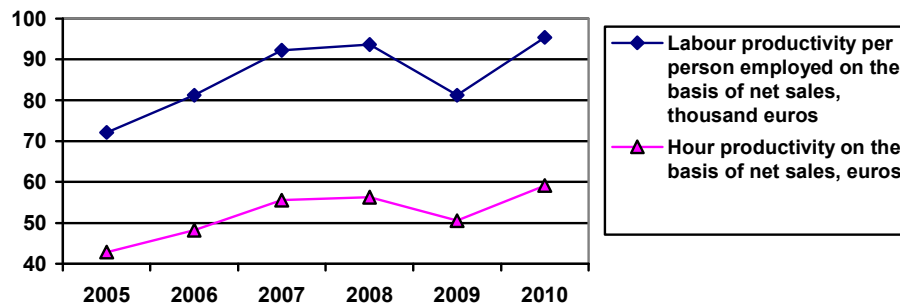


Figure 10. Labour productivity per employed person and hourly productivity based on net sales, 2005 – 2010 [19]

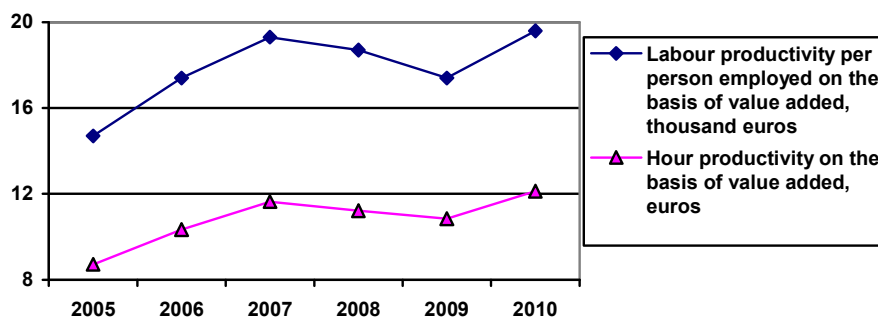


Figure 11. Labour productivity per employed person and hourly productivity based on added value, 2005 – 2010 [19]

A similar comment also holds for labour productivity and hourly productivity based on added value.

Still, in 2010 labour productivity per employed person based on sales revenue in smaller firms remained below the labour productivity of the pre-crisis years. However, growth was strong in large companies with 250 or more employees, where it grew to 103,500 euros (in comparison, the same indicator was only 64,600 euros in 2005). This also led to the sum of all companies achieving the greatest labour productivity in 2010.

Hourly productivity based on sales revenue in 2010 still remained low for companies with up to 20 employees, while larger companies already reached record levels. Again, large companies with 250 and more workers experienced a particularly large increase, where it grew to 61,150 euros (in comparison, the same indicator was 37,350 euros for such companies in 2005), amounting to an annual growth of 18.1%.

As a whole, labour productivity and hourly productivity based on added value reached record levels for all companies in 2010. SME still remained below the 2007 level and for companies with 10 to 19 employees, below the 2008 level. On the other hand, companies with more than 20 employees already reached record levels in 2010.

Table 7. Areas of economic activity in total of Estonia. [18]

	Labour productivity per person employed on the basis of net sales, thousand euros				Hour productivity on the basis of net sales, euros			
	IQ	IIQ	IIIQ	IVQ	IQ	IIQ	IIIQ	IVQ
2001	10.8	12.2	12.3	13.4	24.28	27.54	28.67	30.16
2002	11.1	12.9	12.8	13.6	25.88	29.72	30.49	31.00
2003	12.3	13.4	14.0	15.0	28.50	31.12	33.36	34.06
2004	13.6	15.2	15.4	16.6	31.25	35.15	36.56	36.94

2005	15.2	17.3	18.2	19.7	35.41	39.94	43.01	44.61
2006	17.6	20.2	21.0	22.0	40.39	47.17	49.47	50.43
2007	20.6	23.4	23.6	24.4	47.81	54.26	56.50	56.50
2008	21.2	23.4	24.0	22.0	49.40	55.16	57.52	52.02
2009	18.5	20.4	20.8	21.7	44.65	50.14	50.78	51.14
2010	20.8	24.0	25.2	26.8	50.26	57.97	61.41	62.54
2011	25.2	27.6	28.1	29.3	60.06	66.22	67.65	68.64
2012	27.0	29.2	..	..	63.56	69.08	..	..

	Labour productivity per person employed on the basis of value added, thousand euros				Hour productivity on the basis of value added, euros			
	IQ	IIQ	IIIQ	IVQ	IQ	IIQ	IIIQ	IVQ
2001	..	..	..	..	..	..	..	..
2002	2.1	2.5	2.5	2.6	4.92	5.69	5.94	5.82
2003	2.4	2.6	2.7	2.7	5.62	6.14	6.52	6.33
2004	2.5	2.8	2.8	2.9	5.75	6.52	6.71	6.33
2005	2.7	3.3	3.4	3.6	6.39	7.61	7.93	8.18
2006	3.4	3.9	4.2	4.5	7.73	9.08	9.91	10.35
2007	4.0	4.7	4.7	4.7	9.40	10.99	11.18	10.93
2008	4.2	4.6	4.6	4.0	9.84	10.93	11.06	9.52
2009	3.2	3.7	3.5	3.8	7.66	9.03	8.50	8.90
2010	3.5	4.1	4.4	4.7	8.52	9.81	10.81	10.89
2011	4.3	5.0	5.0	5.1	10.21	11.97	12.00	11.91
2012	4.7	5.3	..	..	10.97	12.64	..	..

Table 8. Labour productivity per employed person based on sales revenue, thousand euros [18]

	Manufacturing				Construction			
	IQ	IIQ	IIIQ	IVQ	IQ	IIQ	IIIQ	IVQ
2001	7.1	8.0	8.0	8.4	6.8	8.6	12.3	13.7
2002	7.7	9.0	8.9	9.0	8.2	11.3	14.2	15.1
2003	8.4	9.5	9.5	10.0	8.4	11.8	16.0	17.1
2004	9.2	10.8	10.6	11.2	11.8	14.2	17.0	18.2
2005	10.5	12.5	12.4	13.0	11.7	16.5	20.5	22.0
2006	12.1	14.3	14.2	15.0	14.1	19.7	24.4	23.8
2007	14.5	16.9	16.5	17.3	15.7	21.9	23.9	23.8
2008	16.3	18.2	17.9	16.5	15.2	20.1	21.8	20.9
2009	13.9	15.5	16.2	17.2	12.7	15.5	16.9	16.5
2010	17.3	20.7	21.7	24.5	10.5	15.7	19.0	17.9
2011	24.7	27.1	26.7	24.9	11.7	18.2	23.5	24.4
2012	24.8	26.7	..	..	15.2	20.7	..	..

	Transportation and storage				Wholesale and retail trade			
	IQ	IIQ	IIIQ	IVQ	IQ	IIQ	IIIQ	IVQ
2001	10.9	13.6	13.3	13.2	19.1	22.2	21.5	23.6

2002	12.5	15.6	13.2	13.0	20.1	23.9	24.0	25.1
2003	15.2	15.6	16.3	16.7	22.0	24.5	25.9	27.2
2004	16.2	17.6	18.1	17.9	25.6	29.7	29.1	31.2
2005	16.9	19.6	20.3	21.2	28.8	32.9	34.6	36.4
2006	20.8	24.1	24.7	24.0	32.8	39.1	39.7	41.2
2007	22.2	24.4	24.4	24.0	41.7	47.0	47.7	46.7
2008	21.7	23.7	23.8	23.1	42.1	46.7	48.3	39.1
2009	20.9	23.1	25.1	24.8	32.6	39.0	39.2	37.8
2010	24.6	28.7	30.7	29.6	35.7	43.9	45.6	46.0
2011	30.3	33.6	32.8	31.3	45.8	51.5	52.0	56.4
2012	33.7	36.2	..	..	49.6	56.2	..	..

Table 9. Hourly productivity based on sales revenue, euros Tunnitootlikkus müügitulu alusel, eurot [18]

	Manufacturing				Construction			
	IQ	IIQ	IIIQ	IVQ	IQ	IIQ	IIIQ	IVQ
2001	15.74	18.19	20.03	19.11	15.69	19.04	27.05	30.08
2002	18.21	21.41	22.94	21.28	19.94	25.50	31.89	34.70
2003	19.56	22.62	23.71	23.14	20.07	27.10	36.05	37.90
2004	21.03	25.12	25.88	24.67	28.19	32.79	37.77	39.82
2005	23.58	28.12	29.40	29.02	28.06	36.75	45.82	49.85
2006	26.91	32.40	33.87	33.68	32.47	44.35	54.01	53.05
2007	32.40	38.16	39.31	39.24	36.11	49.28	54.45	54.20
2008	36.49	41.29	42.05	37.64	35.85	46.78	50.49	49.85
2009	32.60	37.17	38.02	38.98	30.47	36.81	38.39	38.30
2010	39.05	46.86	50.77	54.15	25.31	36.65	43.89	41.44
2011	54.80	61.05	61.64	55.58	27.42	42.24	52.51	55.47
2012	54.66	59.88	..	..	35.05	46.55	..	..

	Transportation and storage				Wholesale and retail trade			
	IQ	IIQ	IIIQ	IVQ	IQ	IIQ	IIIQ	IVQ
2001	24.36	30.30	29.59	29.47	42.79	49.68	48.37	52.78
2002	26.20	34.51	29.66	27.99	45.31	53.37	54.84	55.28
2003	34.38	35.41	37.90	36.69	49.92	55.67	59.18	60.46
2004	35.92	36.81	41.10	38.09	57.33	67.81	66.92	68.64
2005	37.26	43.27	45.70	46.02	66.08	74.39	80.08	81.10
2006	45.06	53.37	52.54	52.22	75.22	91.65	92.42	93.31
2007	48.45	54.58	55.41	52.28	96.19	108.33	111.33	106.48
2008	48.19	53.49	54.39	50.87	95.04	107.18	111.65	88.90
2009	48.27	54.35	57.23	54.96	75.43	92.77	92.71	86.02
2010	56.16	65.64	70.54	65.35	83.93	104.66	108.15	104.29
2011	67.11	75.69	73.49	68.18	106.93	122.11	122.63	128.89
2012	73.71	81.62	..	..	116.12	132.88	..	..

Table 10. Labour productivity per employed person based on added value, thousand euros [18]
Töövilkajus hõivatatu kohta puhta lisandväärtuse alusel, tuhat eurot

	Manufacturing				Construction				Transportation and storage				Wholesale and retail trade			
	IQ	II Q	III Q	IV Q	IQ	II Q	III Q	IV Q	IQ	II Q	III Q	IV Q	IQ	II Q	III Q	IV Q
2002	1.9	2.4	2.2	2.2	1.6	2.1	2.6	2.7	2.9	3.3	3.6	2.6	2.0	2.4	2.3	2.6
2003	2.0	2.6	2.5	2.4	1.6	2.4	3.5	2.7	3.7	3.4	3.4	3.1	2.2	2.4	2.6	2.7
2004	2.1	2.7	2.6	2.6	2.2	2.8	3.5	3.9	3.3	3.5	3.1	2.0	2.3	2.8	2.8	2.8
2005	2.4	3.2	3.1	3.1	2.6	3.8	4.5	4.5	2.7	3.3	3.4	3.3	2.7	3.4	3.6	3.7
2006	2.8	3.5	3.3	3.6	3.2	4.9	6.1	6.0	3.1	3.3	4.5	4.7	3.3	4.2	4.6	4.9
2007	3.5	4.4	4.1	4.3	4.1	6.1	6.5	6.2	3.5	4.3	4.7	3.3	4.2	5.0	4.9	4.8
2008	4.0	4.6	4.3	3.6	3.6	5.1	4.9	4.2	4.2	4.4	5.8	3.9	4.3	4.8	4.7	3.5
2009	2.8	3.4	3.8	3.7	2.6	3.5	3.0	2.7	2.7	3.9	3.1	2.8	2.5	3.5	3.0	3.1
2010	3.9	4.6	4.8	5.3	1.9	2.9	4.0	3.5	2.7	3.7	5.5	4.6	2.8	3.9	3.9	4.0
2011	5.0	6.0	5.1	5.1	2.4	3.9	5.1	5.1	3.9	5.7	5.8	3.9	3.7	4.8	4.6	4.9
2012	4.9	5.8	..	..	3.7	5.1	..	..	4.5	6.0	..	..	4.0	5.2	..	..

Table 11. Hourly productivity based on added value, euros [18]

	Manufacturing				Construction				Transportation and storage				Wholesale and retail trade			
	IQ	II Q	III Q	IV Q	IQ	II Q	III Q	IV Q	IQ	II Q	III Q	IV Q	IQ	II Q	III Q	IV Q
2002	4.60	5.56	5.82	5.18	3.90	4.79	5.75	6.20	6.07	7.35	8.18	5.69	4.67	5.43	5.30	5.75
2003	4.86	6.01	6.14	5.62	3.83	5.50	7.80	5.94	8.31	7.67	7.86	6.84	4.86	5.62	5.82	6.07
2004	4.79	6.20	6.33	5.69	5.18	6.46	7.73	8.56	7.22	7.16	6.97	4.28	5.11	6.46	6.52	6.14
2005	5.43	7.16	7.22	6.84	6.26	8.56	9.97	10.16	5.94	7.35	7.67	7.16	6.26	7.73	8.24	8.24
2006	6.26	7.99	7.93	8.05	7.41	11.12	13.42	13.42	6.71	7.35	9.52	10.29	7.48	9.71	10.66	10.93
2007	7.8	10.0	9.7	9.6	9.0	13.0	14.0	14.0	7.6	9.6	10.0	7.2	9.7	11.0	11.0	10.0

7	6	03	8	5	52	80	83	12	1	5	86	9	8	6	3	86
200	8.9	10.	10.	8.1	8.	11.	11.	10.	9.3	9.9	13.	8.5	9.7	10.	10.	7.8
8	5	35	23	8	63	95	38	03	3	1	10	0	1	9	9	6
200	6.6	8.0	8.9	8.3	6.	8.2	6.8	6.2	6.3	9.1	7.0	6.1	5.8	8.3	7.1	7.1
9	6	4	0	6	22	9	7	4	1	2	1	3	3	5	9	6
201	8.8	10.	11.	11.	4.	6.8	9.3	8.1	6.1	8.5	12.	10.	6.5	9.2	9.1	9.0
0	5	44	22	61	51	6	4	2	4	4	66	09	3	5	6	2
201	11.	13.	11.	11.	5.	9.0	11.	11.	8.6	12.	12.	8.5	8.6	11.	10.	11.
1	12	52	75	47	73	5	47	63	2	88	92	9	1	3	8	29
201	10.	13.	..	..	8.	11.	..	..	9.8	13.	..	..	9.4	12.	..	..
2	75	08			52	51			8	44			1	3		

Table 12. Areas of economic activity in total (QII) [18]

	Total	Manufacturing	Construction	Transportation and storage	Wholesale and retail trade
2002	5,69	5,56	4,79	7,35	5,43
2003	6,14	6,01	5,50	7,67	5,62
2004	6,52	6,20	6,46	7,16	6,46
2005	7,61	7,16	8,56	7,35	7,73
2006	9,08	7,99	11,12	7,35	9,71
2007	10,99	10,03	13,80	9,65	11,63
2008	10,93	10,35	11,95	9,91	10,99
2009	9,03	8,04	8,29	9,12	8,35
2010	9,81	10,44	6,86	8,54	9,25
2011	11,97	13,52	9,05	12,88	11,33
2012	12,64	13,08	11,51	13,44	12,37

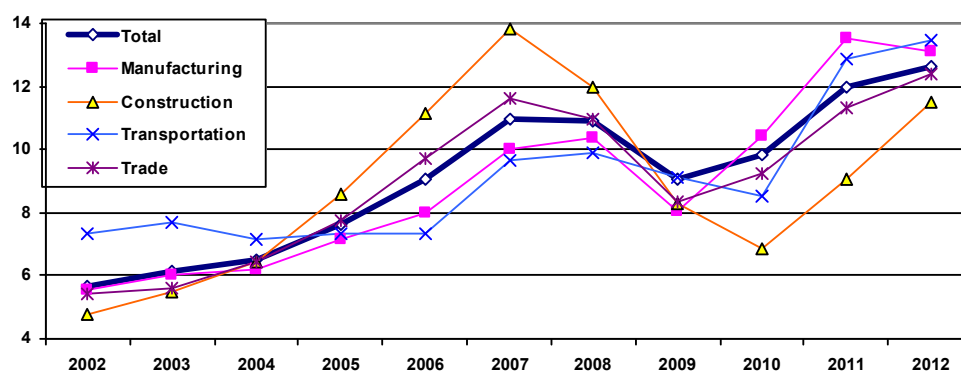


Figure 12. Hourly productivity based on added value, QII of 2002-2012, euros [18]

During the years 2002 – 2004, hourly productivity based on net added value in transportation was better than the Estonian average. The construction boom began and in 2008 raised hourly productivity in construction to a higher level than the state’s average; the difference was especially great in 2007. The following crisis, on the other hand brought the productivity of builders sharply below the average. Although the builders’ productivity grew significantly in 2011 and 2012, it remained lower than in other economic sectors.

While productivity in the processing industry remained lower than the average both before and during the crisis, it was the highest in 2010 and 2011. In 2012 however, productivity in transport slightly exceeded industry. Both one and the other were better by specific quarters in recent years, thus they were equal.

Productivity in the retail and wholesale trade during the years 2005 – 2008 was higher than the average and lower after the crisis.

As a rule, there were no significant differences in the productivity of different sectors of the economy before or after the crisis, excl. construction.

Taking into account this publication and the previous work of the authors [20; 21; 22; 23] have made the following conclusions and suggestions.

Conclusions and suggestions

Conclusions

1. Companies came out of the economic crisis by a surge of hiring professionals, engineers and customer service staff.
2. Companies were brought out of the economic crisis by the growth of labour productivity.
3. The importance of large companies, especially those with 250 and more employees, was decisive.
4. The new (supplemented) Employment Contracts Act also had a positive effect.

To increase labour productivity the following should be taken into account:

1. By the employee.
 - 1.1 Objective factors (different innate abilities, talents, working and living conditions),
 - 1.2 Subjective factors (self-realization, motivation, commitment, a desire to work better, ambition, education, qualification, a variety of mental and physical abilities, laziness, negligence, drunks, the courage to set high goals and the desire to strive for them).
2. By the employer (the company).
 - 2.1 Objective factors [better organization of work, using more efficient machinery and equipment, innovation, improving working conditions (lighting, noise, humidity, temperature, air composition, etc.), natural conditions, material possibilities],
 - 2.2 Subjective factors [moral (cheering, encouragement, etc.) and material incentives (salary, bonuses, bonus payments, etc.), creating conditions for up-skilling and re-training, the work environment (working collective, i.e. co-workers, etc.), not overly demanding, behaviour with the staff (guaranteeing human integrity, name-calling, etc.), taking internal tensions to the minimum, a desire to develop the company and increase its fame, the educational level and experiences (information capital) of the management leadership, the ambition of the company's management].
3. Several of the factors for raising mental and physical work productivity are different. Typically, an increase in the company's productivity depends more on the employees that do mental work (engineers, economists, etc.). It is important to establish an optimal relationship between the groups. The excellent drawings for a machine designed by an engineer will still usually be finished in metal by workers.
4. Each company, sector of the economy and region has its peculiarities, and taking these into account would increase labour efficiency.

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