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Chapter 5 The labour income share in the European Union

1. Introduction

1.1. Background

In recent years, the evolution of the labour income share has gained the attention of policy-makers, academics and commentators across the world.[1] This has happened in the context of a widespread perception that globalisation tilted the functional distribution of income in favour of capital and that technological progress has become biased against labour, especially against low-skilled workers. Indeed, after having peaked in the late 1970s and early 1980s, the labour income share started to decline in most European Union (EU) Member States and now stands at low levels by historical standards. At the same time, there was also a significant change in the distribution of the overall wage bill, characterised by a gradual fall in the share of unskilled workers and a steady rise in the share of skilled workers.

The socio-economic importance of these developments can hardly be underestimated as it involves issues of equity and economic efficiency, as well as macro-economic stability. Firstly, labour's share in gross domestic product provides a good indicator of the extent to which national income is distributed between capital and labour, and in recent years there has been a growing body of opinion that workers are not getting their fair share of the gains from technological progress and globalisation (Roach, 2006; Bernanke, 2007). As the labour income share – along with the unemployment rate, relative wages, the structure of ownership of assets, income taxes and benefits – determines the personal income distribution, then a clear understanding of the drivers of the labour income share is of particular relevance from the perspective of social cohesion (Checchi and Garcia-Penalosa, 2005)[2].

Secondly, the evolution of the labour income share also concerns issues of economic efficiency. If the labour income share is above its trend level there will be downward pressure on employment and wages to the point where equilibrium (between real wages and productivity) is restored. However, if real wages are not flexible enough downwards in the face of adverse shocks, then there will be higher employment and output volatility in the short to medium run and higher equilibrium unemployment in the medium to long run (due to a misalignment of real wages with labour productivity). Moreover, to the extent that the labour income share is perceived to be the result of the ongoing process of the international division of labour, pressures may arise to impose protectionist measures which may lead to a decrease in economic efficiency.

Thirdly, the dynamics of the labour income share also affects macroeconomic stability through, among other things, its impact on the composition of the tax base and the different components of aggregate demand. Indeed, given the different tax rates applied to labour income and capital income, a change in the distribution of factor income could have significant effects for fiscal revenue and thus also for the balance of a country's public finances. Moreover, as the marginal propensity to spend out of disposable labour income is higher than the marginal propensity to spend out of capital income, and investment decisions are, to a large extent, determined by the rate of return on capital, a shift in the allocation of gross domestic product between capital and labour can have important implications for the level and composition of domestic demand (Stockhammer et al., 2007). In addition, as the labour income share is also a measure of the extent to which real wages and productivity evolve together in an economy, its development can have important implications for an economy's international competitiveness.

1.2. Coverage of the chapter

This chapter explores the mechanisms underlying the recent evolution of the labour income share and considers possible policy responses in the context of social cohesion in the EU. This study does not intend to elaborate on the evolution of the labour income share in individual EU Member States, but will rather draw some general lessons by studying a diverse set of country experiences. Moreover, it will deal solely with the distribution of gross

1 Generally speaking, the labour income share measures the ratio of total labour compensation to gross domestic product. Synonyms for 'labour income share' include 'labour share' and 'wage share'.

2 In an empirical analysis covering 16 OECD countries over the period from 1960 until 1996, Checchi and Garcia-Penalosa (2005) find that the labour income share is a significant determinant of overall inequality patterns and that stronger unions, minimum wages and a more generous unemployment benefit tend to reduce income inequality through wage compression and through a reduction in the rewards to capital. Nevertheless, they also emphasise that their analysis is a static one and that more research is needed to examine the dynamic feedbacks between labour market institutions and capital formation.

domestic product between the production factors. This chapter does not therefore discuss personal income distribution, nor the allocation of the wage bill between wages and employment or the impact of some of the underlying drivers, such as technological progress and globalisation, on the size of gross domestic product.

The next section describes the evolution of the labour income share in the EU for the period from 1960 until 2006, and compares it with the evolution of the labour income share in the United States and Japan.[3] There it is highlighted that in most of the EU-15 countries the labour income share reached a peak in the second half of the 1970s and early 1980s, and subsequently declined towards levels that are below those that were attained before the first oil price shock.

Traditionally the evolution of the labour income share has been studied in the context of economic growth theory and in this literature the constancy of the labour income share has long been considered as one of the important regularities that characterises economic growth (Kaldor, 1963; Barro and Sala-i-Martin, 1995). However, as time progressed and the data clearly indicated that the labour income share was not evolving in a stable way, researchers started to test new hypotheses regarding the mechanisms that drive the labour income share (Blanchard, 1997; Bentolila and Saint-Paul, 2003; IMF, 2007), and it is this literature on which this chapter will build further.

In sections 3 to 5 it is investigated as to what extent the evolution of the labour income share can be seen as the outcome of the interaction between shocks, production technology, institutions, globalisation, and shifts in the skill (and sectoral) composition of the economy. First, the relationship between the nature of the production technology and the labour income share is examined. There, the analysis not only stresses the importance of the degree of substitutability between capital and labour and relative factor endowments, but also focuses on the effects of technological progress that is biased against (low-skilled) workers. Next, the impact of goods and labour market institutions is studied. Such institutions create rents in the goods market and affect the distribution of rents between labour and capital through their impact on the bargaining power of the production factors. Moreover, as these institutions also affect the adjustment costs in the labour market, it is also investigated as to what extent they affect the behaviour of the labour income share over the business cycle. Finally, the theoretical analysis concludes with a description of the transmission mechanisms through which globalisation affects the functional income distribution .

In section 6, a system of income share equations is estimated with data retrieved from various sources, including the recently released EU KLEMS database[4]. This data allows an estimate of the different drivers' impact on the income share of the low, medium and high-skilled workers, as well as on the income share of aggregate labour. Subsequently, the estimated system is used to gauge the contribution of the different drivers to the recent decline of the aggregate labour income share, and to the evolution of the income share of the different skill types.

Finally, the last section summarises the most important findings and draws some policy conclusions. The first annex to this chapter describes the data that is used in this chapter. The data sources include the Commission's AMECO database, the EU KLEMS database and the Bassanini and Duval (2006) database. The second annex derives some basic analytical results that should help to clarify the details of the impact of the drivers on the labour income share.

2. THE EVOLUTION OF THE LABOUR INCOME SHARE IN THE EU, 1960–2006

The labour income share is defined as the total compensation of labour divided by gross domestic product. However, the exact measurement of the nominator as well as the denominator is not always straightforward (Gollin, 2002; Gomme and Rupert, 2004; Krueger, 1999; Askenazy, 2003). Data for the compensation of employees is usually readily available for the EU Member States. However, data on the labour income of the self-employed has to be estimated as the national accounts record labour income of self-employed together with capital income of corporations and quasi-corporations. A common practice is to assume that the wage rates of employees and the self-employed are the same and adjust the labour income share accordingly[5]. Further adjustments to the cal-

3 It should also be noted that for the countries that have acceded to the European Union since 2004, the analysis will cover only the period ranging from the (mid-) 1990s to 2006.

4 See www.euklems.net/ for more details regarding this database.

5 The adjusted labour share is then calculated as $\frac{\frac{\text{compensation of employees}}{\text{number of employess}} \text{ total employment}}{\text{gross domestic employment at marquet price}} \times 100$, a measure which is readily available in the Commission's AMECO database as variable ALCD0. Askenazy (2003) notes that such an adjustment is implicitly based on the assumption that the composition of self-employed remains constant over time, which is not necessarily the case. For instance, a high proportion of self-employed was working in the agricultural sector in the 1960s compared with a high proportion of self-employed in the liberal professions (e.g. lawyers, medical doctors, etc.) in the 2000s.

culated labour income share could include adjustments to the value added of the financial sector[6], the measurement of capital income of the non-market producers[7], and the use of gross domestic product at current factor costs instead of gross domestic product at current market prices[8].

In this chapter, the labour income share is measured as the compensation of the total number of employed divided by gross domestic product at current market prices[9], whereby the wage bill of the self-employed is calculated under the assumption that the wage rate of the self-employed is equal to the wage rate of the employees. From now on we will refer to this 'adjusted labour income share' as the 'labour income share'. For the EU-15 Member States the labour share is available from 1960, while for the Member States that have acceded since 2004 the data is only available from the mid-1990s.

The following sections briefly review the trend and cyclical developments in the labour income share in the European Union, the United States and Japan. Special attention is also being paid to the development of the shares of the different skill types, though the latter is not only of interest to understand the evolution of the aggregate but also to study the issue from the perspective of social cohesion.

2.1. The labour income share in the EU, the US and Japan

Chart 1 (see page 240) and Table 1 (see page 240) illustrate the evolution of the labour income share in the EU-15 for the period ranging from 1960 until 2006[10]. After having increased during the 1960s and the first half of the 1970s with a peak of 69.9% of GDP in 1975, the labour income share began a gradual decline and reached a low of 57.8% of GDP in 2006, with the actual labour income share falling below its trend in recent years. The evolution of the labour income share in the EU-27 as of 1995 is also shown in Chart 1. Due to the relative small share of the new Member States' economies in the aggregate, the addition of the labour income share of the 12 new Member States does not alter the overall trend in a significant way.

Chart 2 shows the evolution of the labour income share in the United States. Compared with the EU, the American labour income share behaved in a more stable way, reaching a high of 65.9% of GDP in 1970 and a low of 60.9% of GDP in 2005. Moreover, the American labour income share also has a much lower coefficient of variation over the 1960–2006 period (Table 1 - see page 240). Nevertheless a formal statistical test shows that the hypothesis of a non-stationary labour income share could not be rejected at a high confidence level for the United States, as well as for the EU-15 and Japan.[11]

In Japan (Chart 3 - see page 240), the labour income share displayed a marked upward trend from the mid-1960s to the early 1970s, reaching a peak of 76% of GDP around 1975–1977, after which it started a noted fall until the mid-1990s, followed by a further decline towards a low of 60% of GDP in 2006. All in all, charts 1 to 3 show that the labour income share was the most stable in the United States, and that the difference between the highest and lowest level was largest in Japan.

It should be noted that although there is no consensus in the literature regarding the exact way to measure the labour income share, the finding of a hump-shaped profile for the (adjusted) labour income share in the EU over the period covered by our sample has also been documented by Bentolila and Saint Paul (2003), Blanchard (2006), BIS (2006), IMF (2005; 2007), OECD (2007), Orellana et al. (2005) and de Serres et al. (2002).

Before examining the likely forces behind this behaviour, we will have a closer look at the evolution of the labour income share in the different EU Member States and describe the evolution of the income shares of the different skill types of workers.

6 See for instance Askenazy (2003).

7 By construction, the national accounts do not allow for capital income of the non-market producers (including healthcare, education and administration), as the only sources of income are labour income and capital depreciation allowances. As a consequence, the inclusion of the public sector tends to increase the labour income share.

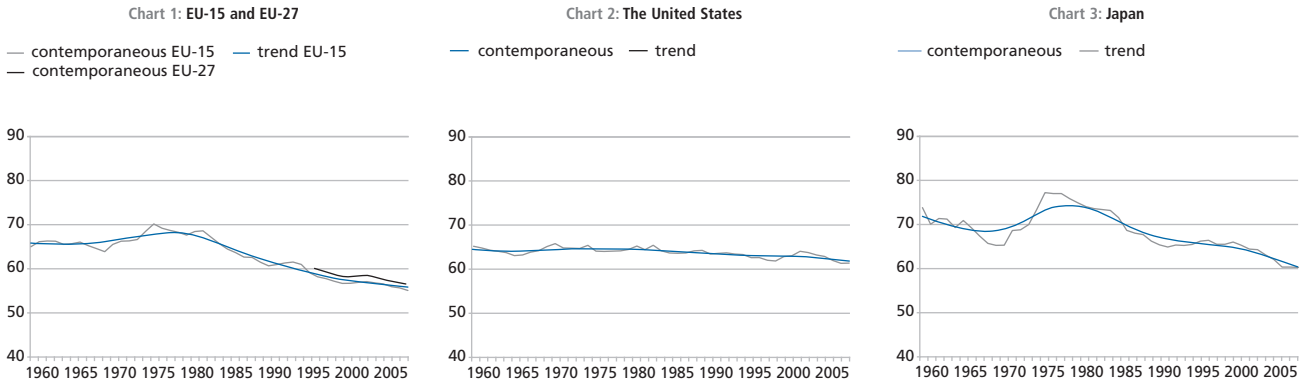
8 Gross domestic product at factor cost is not explicitly present in ESA 1995. However, gross domestic product at factor costs can easily be calculated as gross domestic product at market prices minus taxes on production and imports, plus subsidies. The adjusted labour share is then calculated as x 100, a measure that is readily available in the Commission's AMECO database as variable ALCD2.

9 By using gross domestic product at current market prices the analysis explicitly takes into account the fact that the government absorbs part of value added.

10 The labour income shares for EU-15 and EU-27 are calculated on the basis of the country aggregates of the different components in the nominator and denominator.

11 Column 8 of Table 1 shows t-student statistics for the Augmented Dickey-Fuller test, whereby the null hypothesis of non-stationarity (i.e. a unit root) is tested against the alternative hypothesis of stationarity. If the computed student-t statistic is smaller than the lower critical value for a particular number of observations, the null-hypothesis has to be rejected and the alternative hypothesis accepted. For the current sample size, the critical values at the 1%, 5% and 10% confidence level are respectively -4.17, -3.51 and -3.19.

Labour income share



Source: AMECO database and own calculations.

Table 1 - The labour income share in the EU-15 Member States – summary

	Average	Coefficient	Maximum		Minimum		ADF-	Fluctuations		
	1960–2006	of variation	share	year	share	year	t-value	synchron.	persistence	variability
Belgium	61.3	5.5	66.9	1981	55.2	1961	-1.49	-0.0	0.67	0.67
Denmark	59.1	3.1	62.9	1975	56.3	2005	-2.98	-0.5	0.34	0.47
Germany	61.6	4.1	66.1	1974	55.9	2006	-1.49	0.2	0.54	0.42
Greece	66.5	12.5	91.9	1960	57.0	2003	-3.50	-0.3	0.40	0.78
Spain	62.4	5.8	67.9	1976	54.5	2006	-2.68	-0.0	0.71	0.49
France	61.4	5.3	66.9	1981	56.7	1998	-1.62	-0.4	0.62	0.63
Ireland	62.1	12.1	71.2	1975	47.1	2002	-1.59	-0.5	0.45	0.54
Italy	62.5	8.5	69.7	1975	53.3	2000	-1.76	-0.5	0.43	0.64
Luxembourg	52.6	7.1	62.2	1977	46.4	1969	-2.20	-0.4	0.42	0.66
Netherlands	63.0	5.7	70.4	1975	56.7	2006	-2.09	-0.1	0.54	0.54
Austria	66.2	6.9	72.9	1978	55.8	2006	-1.52	-0.3	0.50	0.69
Portugal	67.0	9.4	87.9	1975	59.6	1969	-1.80	-0.2	0.60	1.14
Finland	62.5	8.0	70.3	1966	53.7	2000	-2.74	-0.2	0.57	0.55
Sweden	62.1	5.8	69.2	1977	55.4	1995	-2.77	-0.1	0.67	0.75
United Kingdom	65.3	2.8	72.2	1975	61.8	1997	-4.07	-0.2	0.61	0.70
EU-15	**64.2**	**5.6**	**69.9**	**1975**	**57.8**	**2006**	**-1.72**	**-0.1**	**0.65**	**0.51**
Japan	68.0	6.4	76.4	1975	60.2	2006	-1.77	-0.6	0.69	0.61
United States	63.7	1.8	65.9	1970	60.9	2005	-2.49	-0.1	0.53	0.34

Source: AMECO database and own calculations.
Note: Coefficient of variation: standard deviation of labour share divided by mean; maximum/minimum share: maximum/minimum value recorded for the share; maximum/minimum year: year in which the maximum/minimum was observed; ADF t-value: t-value for augmented Dickey-Fuller test (unit root test with constant and trend); fluctuations-synchron: correlation between trend-deviation in labour income share and trend-deviation in GDP; fluctuations-persistence: coefficient of auto-correlation; fluctuations-variability: standard deviation of fluctuations in labour income share divided by standard deviation of fluctuations in GDP.

2.2. The labour income share in the EU Member States

2.2.1 The EU-15

Chart 4 shows the evolution of the labour income share for the total economy in each of the 27 EU Member States.[12] The solid lines show the actual observations of the labour income share, while the dotted lines display the underlying trend. Table 1 summarises the main characteristics of the evolution of the labour share in each of the 15 Member States over the period from 1960 until 2006. Given the limited number of observations, Table 2 (see page 243) summarises the evolution of the labour income share in the new Member States for the period ranging from the mid-1990s until 2006.

Following an increase during the 1960s and especially in the early 1970s, the labour income share started to fall in most of the EU-15 from the second half of the 1970s until the early 1980s.[13] In six of the EU-15, the labour income share reached a peak in 1975[14], while in 11 Member States

12 Readers should take note of the fact that the scales of the graphs are not uniform.

13 Greece is an important exception to this rule, as its labour share fell from close to 90% in the early 1960s to about 60% in the early 1970s.

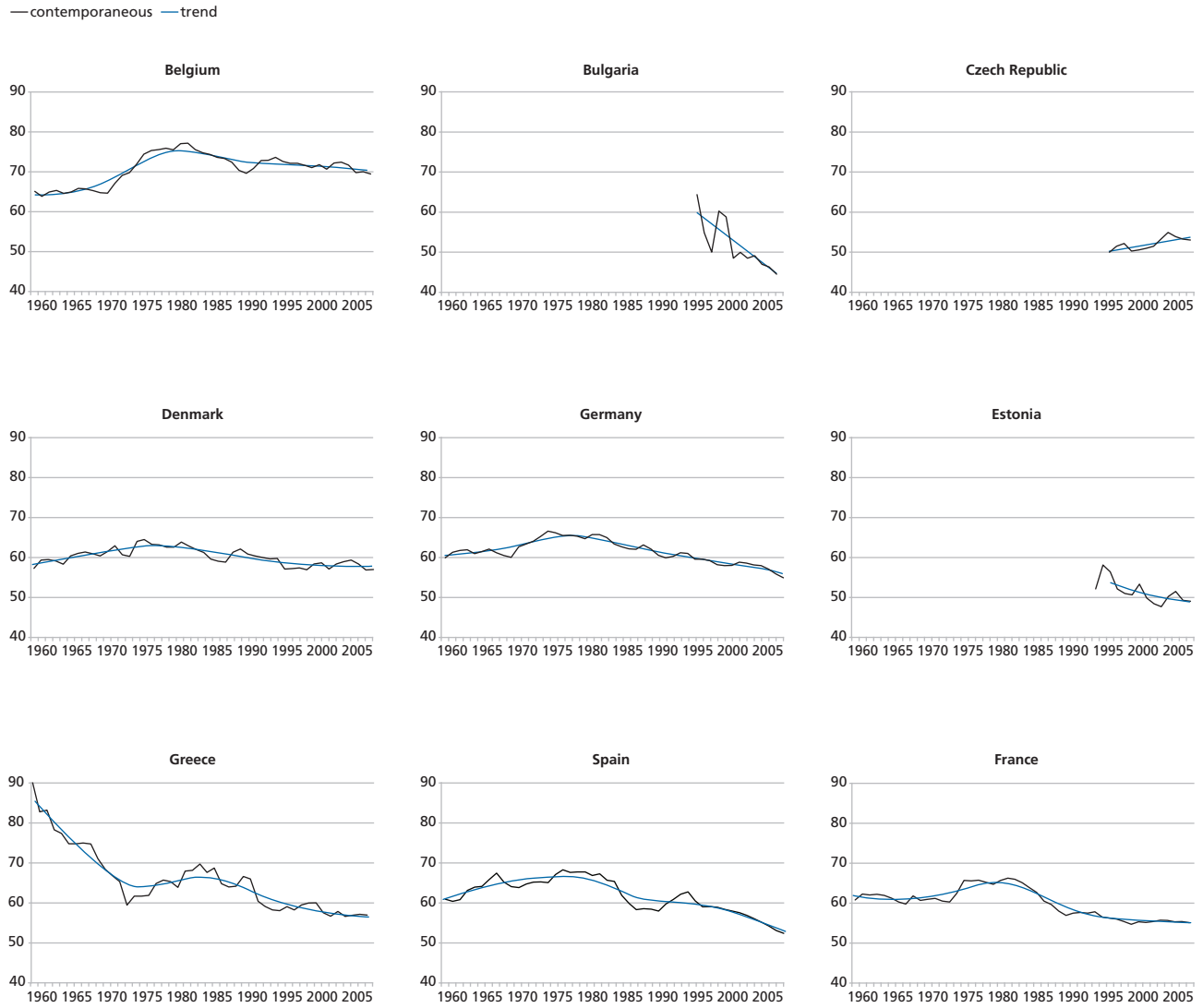
14 Denmark, Ireland, Italy, the Netherlands, Portugal and the United Kingdom.

it peaked between 1974 and 1978[15]. In Belgium and France, the labour share reached its peak in 1981, while in Finland the peak was reached in 1966 and in Greece in 1960. Subsequently, in most of the EU-15 the labour share decline had reached a low in the late 1990s to early 2000s which was, on the whole, lower than the levels reached in the 1960s or 1970s. Only in Belgium, Luxembourg and Portugal was the labour income share lower in the 1960s than in the 1990s or 2000s.

In recent years, the fall in the labour income share seems to have been levelling off in some Member States (e.g. France, Belgium and Finland) or even showing a rebound in others (e.g. Ireland and Italy). Nevertheless, some countries continue to experience a downward trend (e.g. Austria, the Netherlands, Greece and Spain).

Overall, the labour income share was not stable in most of the EU-15 over the period ranging from 1960 until 2006[16] and the differences between the lows and highs are quite notable. The smallest difference is recorded for Denmark, where the difference is just 6.6 percentage points, and the largest difference is recorded for Greece, where the difference is a significant 34.9 percentage points. In Portugal the difference between peak and trough amounts to 28.3 percentage points while in Ireland it reaches 24.1 percentage points. In the other EU-15 Member States, the differences were between 10.2 percentage points and 17.1 percentage points.

Chart 4: **Labour income share in Europe**



15 The six countries mentioned in footnote 14 plus Germany, Spain, Luxembourg, Austria and Sweden.

16 The statistics in the eighth column of Table 1 underline the non-stationarity of the labour income share in most of the EU-15. Notable exceptions are the United Kingdom and Greece for which the null hypothesis of non-stationarity (i.e. a unit root) could be rejected at a fairly high confidence level. Due to the lack of sufficient observations a unit root test could not be performed on the data of the new Member States.

Chart 4: Labour income share in Europe (continued)

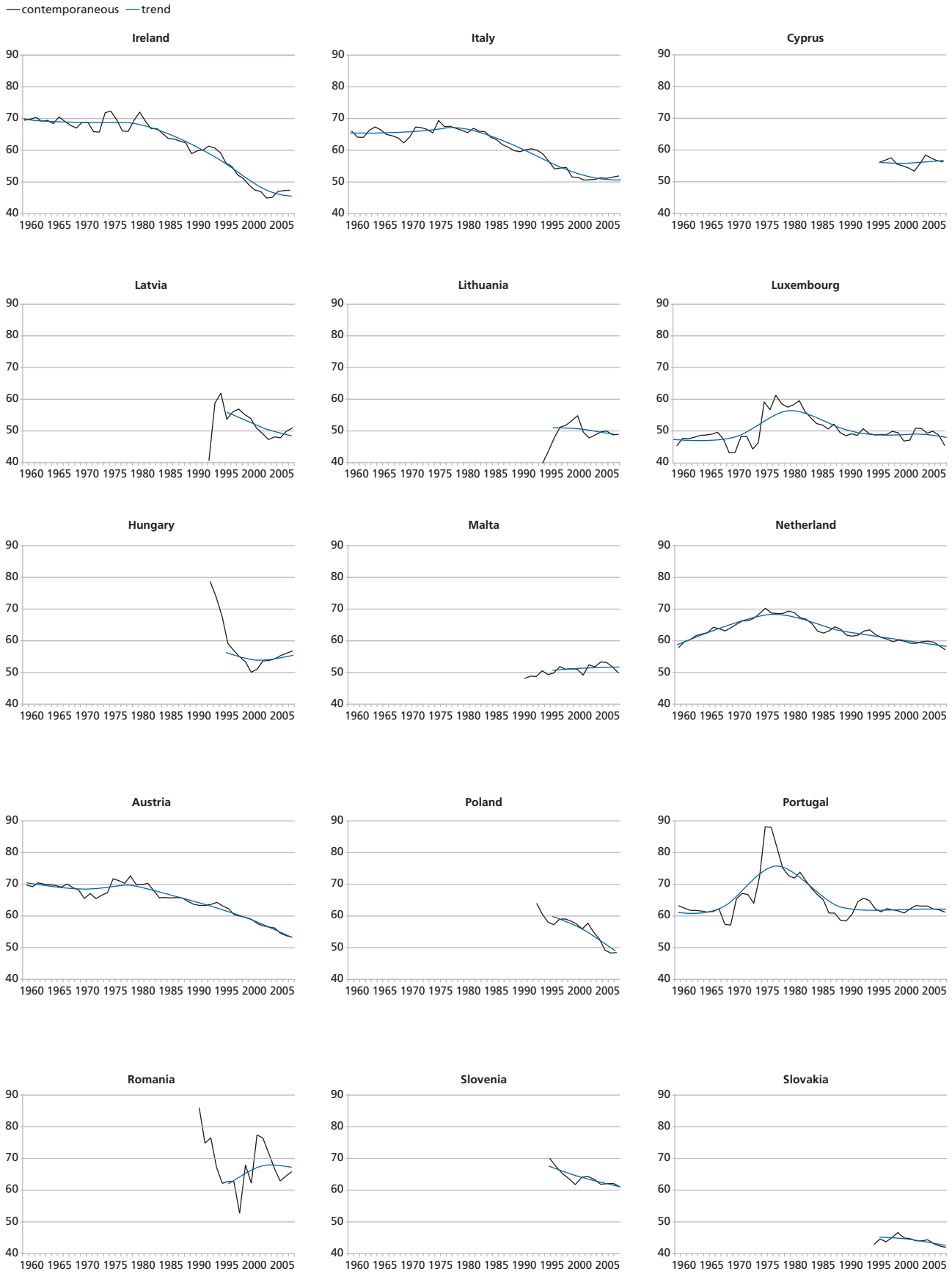
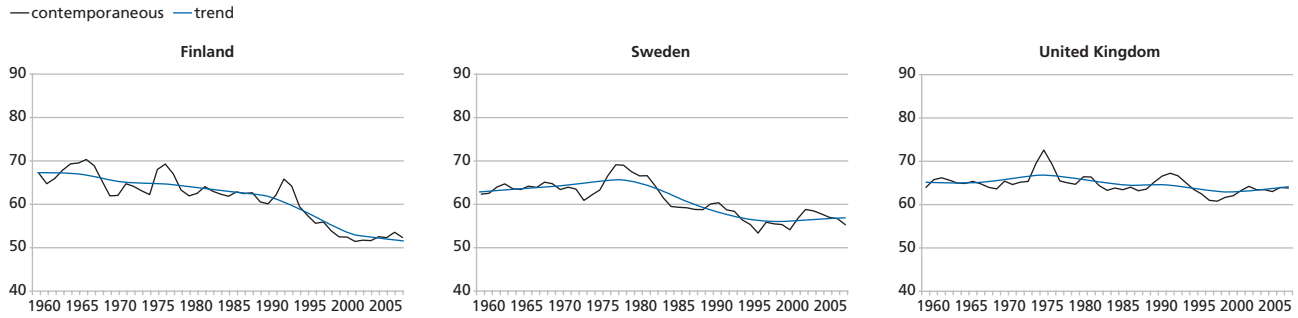


Chart 4: **Labour income share in Europe (continued)**



Source: AMECO database and own calculations.

2.2.2. The new Member States

In the new Member States, the income labour share has been on a downward trend since the mid-1990s, with the exception of the Czech Republic, Malta, Cyprus and Romania. The strongest variations in the labour income share are found in Latvia, Bulgaria, and Romania, while the weakest variations are found in Cyprus, the Czech Republic, Malta and Slovakia.

With the exception of the evolution in Cyprus and Malta, these developments occurred in countries undergoing deep structural transformations of their economies whereby, for instance, real wages have had to converge to meet productivity levels and the sectoral composition of the economies have had to adjust to the needs of a service-oriented, knowledge-based modern market economy.[17]

2.3. Wages, productivity and the labour income share

As an accounting exercise, the labour income share can be decomposed into the real wage and (the inverse of average) labour productivity[18]. When the real wage grows at a slower pace than labour productivity, the labour income share shows a decline, and vice versa. As we decompose labour productivity further, the evolution of the labour income share can be written in terms of the evolution of the real wage (in efficiency units), the capital-to-output ratio (i.e. the inverse of capital productivity) and the capital-to-labour (in efficiency units) ratio – whereby 'labour in efficiency units' refers to the fact that the labour stock has been aug-

Table 2 - **The labour income share in the new Member States**

	Average	Coefficient of variation	Maximum share	Maximum year	Minimum share	Minimum year
Bulgaria	51.1	10.9	62.2	1995	44.6	2006
Czech Republic	51.7	2.6	54.2	2003	49.9	1995
Estonia	51.5	5.0	57.4	1994	48.2	2002
Cyprus	57.2	2.2	59.3	2003	54.8	2001
Latvia	49.9	11.5	60.5	1994	37.6	1992
Lithuania	48.6	7.0	53.9	1999	40.4	1993
Hungary	55.4	9.6	68.3	1992	50.1	1999
Malta	51.0	2.8	53.3	2003	48.6	1990
Poland	55.5	7.3	62.5	1992	48.6	2005
Romania	68.2	10.5	84.1	1990	54.3	1997
Slovenia	64.4	3.6	69.8	1995	61.9	2006
Slovakia	44.3	2.8	46.9	1998	42.3	2006

Source: AMECO database and own calculations.
Note: Sample size: MT, RO: 1990–2006; LV, HU, PL: 1992–2006; EE, LT: 1993–2006; SK: 1994–2006; BG, CZ, CY, SI: 1995–2006.

17 Though measurement problems related to the assumptions regarding the renumeration of the self-employed may also account for some of the decline (Askenazy, 2003).

18 Let L be employment, W the nominal wage rate, Q value added and P the price level, then the labour share, LS, is defined as

$$LS = \frac{WL}{PQ} = \frac{W}{P}\frac{1}{\left(\frac{Q}{L}\right)}$$

i.e. the ratio of the real wage and (average) labour productivity, which shows that the labour share is also a measure of the real unit labour cost. Conventionally, the level of real unit labour costs is expressed relative to a base year, while the labour income share is expressed in levels.

mented by an index of technological progress[19].

Table 3 shows the annual growth rates of the labour income share and its components (in percent) in the EU-15 for the sub-periods ranging from 1960–1980 and from 1981–2006. During the first sub-period the labour income share was characterised by a steady increase in most of the EU-15, while the second sub-period was characterised by a decline in the indicator. Comparing the two sub-periods, it is striking to note that in the period ranging from 1981–2006 the real wage (measured in efficiency units) showed a negative average growth rate for all Member States, except for Portugal where it was slightly above zero, indicating that during this period its real wage growth did not keep up with technological progress. The strongest negative growth is recorded for Ireland, where the real wage (measured in efficiency units) decreased at an average annual rate of 2.62%, followed by Luxembourg, the Netherlands and Finland where the average annual decline is equal, respectively, to 1.64, 1.39 and 1.38%. At the same time, it should also be noted how the signs of the growth rates of the capital-to-output ratio and the capital-to-labour ratio varied across countries.

Due to a lack of data, Table 4 only shows average growth rates for the labour share, the real wage and (average) labour productivity for the countries that joined the EU in recent years, covering the period mid-1990s to 2006. In 7 of the 12 Member States the labour share showed a negative average growth rate, indicating that real wages grew more slowly than productivity over the reference period. Given the deep structural reforms that were still going on in these countries in the mid-1990s, the data in this table should be interpreted with caution as, for instance, specific results may be very sensitive to the choice of the starting year of the sample over which averages are taken.

Taken together, these different Member State experiences clearly show that changes in the real wage rate and the components of productivity cause changes in the labour income share that may differ significantly across countries and periods. This illustrates then that simply looking at the evolution of the components of the labour income share is not enough to understand the behaviour of the labour income share, and that a more thorough investigation of the issue is warranted. This examination will be tackled in the next section.

Table 3 - **Components of the labour income share by country: EU-15 (average annual growth rates)**

	Period 1960–1980				Period 1981–2006			
	Labour share	Real wage[1]	Capital-to-output ratio	(inverted) Capital-to-labour ratio[1]	Labour share	Real wage[1]	Capital-to-output ratio	(inverted) Capital-to-labour ratio[1]
Belgium	0.84	0.11	-0.83	1.56	-0.40	-0.40	-0.03	0.03
Denmark	0.48	0.03	-0.66	1.11	-0.39	-0.84	-0.59	1.05
Germany	0.40	NA	0.22	NA	-0.60	-1.08	-0.05	0.18
Greece	-1.76	-0.60	1.12	-2.28	-0.46	-0.31	0.70	-0.85
Spain	0.40	0.22	-0.59	0.76	-0.78	-0.59	0.57	-0.76
France	0.33	0.39	0.04	-0.10	-0.58	-0.66	0.14	-0.06
Ireland	0.16	1.17	1.18	-2.18	-1.40	-2.62	-1.29	2.51
Italy	-0.03	-0.04	-0.43	0.43	-0.76	-0.75	0.41	-0.42
Luxembourg	1.04	-0.26	-1.10	2.40	-0.80	-1.64	-0.88	1.72
Netherlands	0.91	0.82	0.47	-0.39	-0.75	-1.39	-0.32	0.96
Austria	0.01	0.21	-0.23	0.03	-0.89	-0.72	0.40	-0.57
Portugal	0.58	-0.44	-1.83	2.85	-0.55	-0.11	1.13	-1.58
Finland	-0.30	-0.12	0.01	-0.19	-0.58	-1.38	-0.92	1.72
Sweden	0.28	0.63	0.43	-0.78	-0.62	-0.99	-0.37	0.75
United Kingdom	0.17	0.13	-0.06	0.09	-0.14	-0.52	-0.65	1.04
Japan	0.02	-0.04	-0.28	0.34	-0.77	-0.47	0.76	-1.06
United States	0.00	-0.38	-0.69	1.07	-0.27	-0.51	-0.37	0.62

Source: AMECO database and own calculations.
Note: 1: Measured in efficiency units. Efficiency units are available for Germany as of 1991. Averages for Germany are averages of available data.

19 The equation in the previous footnote can be rewritten in terms of log growth rates as

$$d\ln(LS) = d\ln\left(\frac{W}{PA}\right) + d\ln\left(\frac{K}{Q}\right) - d\ln\left(\frac{K}{LA}\right)$$

where K is the capital stock and where A is an index of labour-augmenting technological progress which is calculated by dividing the Solow residual for each year by the contemporaneous share of labour and integrating it over time. See Blanchard (1997; 2006) who applies this type of adjustments to the real wage (and the capital-to-labour ratio) in order to take out the trend drift in wage growth that can be attributed to technological progress.
In this context, 'real wage in efficiency units' refers to the real wage divided by the index of technological progress, i.e., $\left(\frac{W}{PA}\right)$ while 'labour in efficiency units' refers to the labour stock augmented by the index of technological progress, i.e. L A.

Table 4 - **Components of the labour income share by country: the new Member States (average annual growth rates)**

	Labour share	Real wage	(Inverted) average labour productivity
Bulgaria	-3.03	-1.22	-1.79
Czech Republic	0.46	3.40	-2.94
Estonia	-1.24	6.08	-7.32
Cyprus	0.02	1.41	-1.39
Latvia	-1.80	4.60	-6.40
Lithuania	0.87	6.88	-6.01
Hungary	-1.00	2.51	-3.52
Malta	0.09	1.83	-1.74
Poland	-1.35	3.16	-4.51
Romania	0.43	4.69	-4.26
Slovenia	-1.09	2.72	-3.81
Slovakia	-0.19	4.11	-4.30

Source: AMECO database and own calculations.
Note: Sample size: MT, RO: 1990–2006; LV, HU, PL: 1992–2006; EE, LT: 1993–2006; SK: 1994–2006; BG, CZ, CY, SI: 1995–2006.

2.4. The cyclical behaviour of the labour income share

Charts 1 and Table 1 (see page 240) indicate that, where possible, a clear distinction should be made between transitory developments in the labour income share that are due to the business cycle or temporary shocks, and trend developments which are more likely to be caused by structural changes in the underlying drivers.

More precisely, the statistics in the third-to-last column of Table 1 show that, with the exception of Germany, the labour share behaved counter-cyclical, i.e. it rose above its trend value during an economic downturn and fell below its trend during an economic upswing[20]. In the EU, the strongest counter-cyclical behaviour is found in Denmark, Ireland and Italy, and the weakest in Belgium and Spain.

The penultimate column of Table 1 gives an indication of the degree with which a deviation from trend persists[21]. There we see that trend deviations show the highest persistence in Spain, Belgium and Sweden, and the lowest in Denmark, Greece, Ireland, Italy and Luxembourg.

The last column of Table 1 measures the degree of the relative volatility of the fluctuations in the labour income share by comparing them with the volatility of the fluctuations in output.[22] Clearly, in all Member States, except Portugal, the fluctuations in the labour share are less volatile than the fluctuations in output, with the least volatility in Germany and Denmark.

2.5. Skill composition of the wage bill

Using data available under the EU KLEMS research project[23], charts 5, 6 and 7 (see page 246) show the evolution of the different skill-types' share in the aggregate labour income in a representative set of EU Member States[24], the United States and Japan for the period 1980–2004.

These charts show that the share of the low-skilled in total labour compensation declined steadily in each of the regions. In the EU and Japan, for example, the share of the low-skilled was higher than the share of the high-skilled at the beginning of the reference period, but it fell below the share of the high-skilled by the early - 1990s in the EU and by the mid-1980s in Japan. In the United States, the share of the high-skilled was larger than the share of the low-skilled throughout the period and, furthermore, rising so that it approached a similar size to the share of the medium-skilled by the mid-2000s. In all three economic areas, the share of the medium-skilled was larger than the sum of the shares of the low and medium-skilled, except for the United States around the turn of the century.

The two principal findings from this section can be summarised as follows. Firstly, the aggregate labour income share was not stable over the past four decades. This was especially the case for the labour income share in continental Europe and Japan, and to a lesser extent for the labour income share in the Anglo-Saxon countries. There is a general consensus in the literature that, whichever degree of sophistication is used for the measurement of the labour income share, it started to decline in most EU Member States shortly after the first oil price shock and that it fell towards levels which are well below those attained in the1960s. Secondly, there was also an important change in the composition of the wage bill, with the share of the low-skilled showing a marked decline and the share of the high-skilled workers displaying a steady rise.

20 Counter-cyclical behaviour means that there is a negative correlation between the fluctuations in the labour income share and output.

21 The persistence of the trend deviation is measured by the regression coefficient rho in the equation

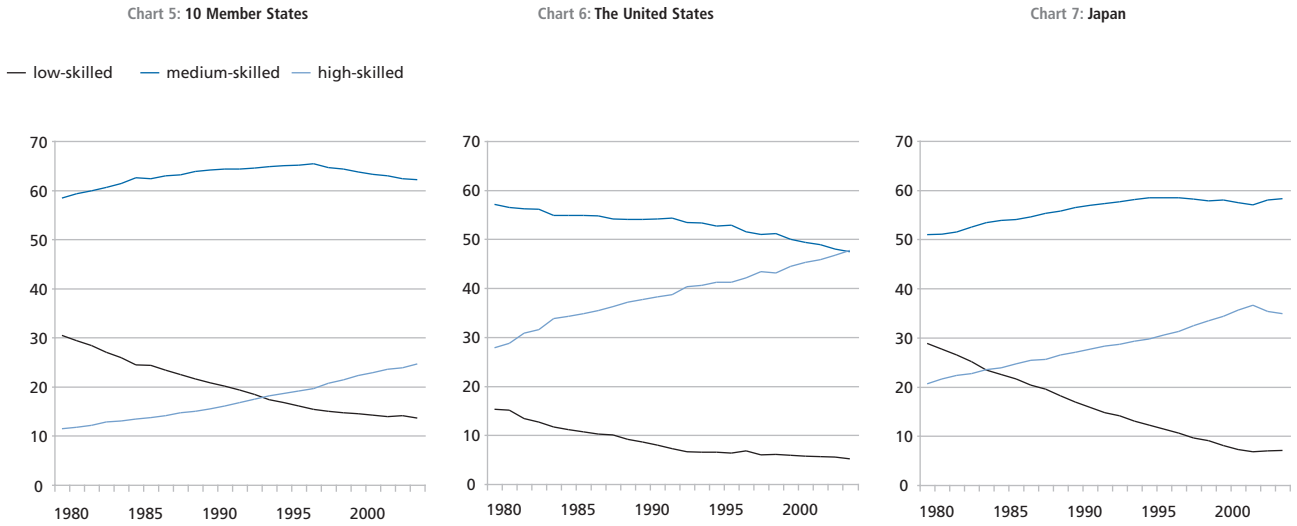
$(LS_t\text{-}LS\_trend_t) = rho\ (LS_{t-1}\text{-}LS\_trend_{t-1}) + u_t$

22 Volatility is measured by the standard deviation in the trend deviation of the variable.

23 The EU KLEMS research project is funded by the European Commission, Research Directorate General as part of the 5th Framework Programme, Priority 8, 'Policy Support and Anticipating Scientific and Technological Needs'. As such these data are not official data.

24 Charts 5, 6 and 7 show the aggregate for a select set of countries for which the data is available as of 1980. The 10 EU countries for which the data is available are Belgium, Denmark, Germany, Spain, France, Italy, the Netherlands, Austria, Finland and the United Kingdom. See Timmer et al. (2007) for the definition of the skill types in the Member States.

Share in total labour compensation



Source: EU KLEMS database and own calculations.

The subsequent analysis will explore to what extent technological progress, globalisation and changes in labour market institutions, as well as policies, contributed to these developments.

3. THE LABOUR INCOME SHARE AND THE PRODUCTION TECHNOLOGY

In an influential paper published in the early 1960s, Kaldor (1963) identified the constancy of the labour income share as one of the important empirical regularities characterising economic growth (in the United States).[25] This 'empirical fact' found its theoretical underpinning in the basic neo-classical growth model.

The basic neo-classical growth model assumes perfect competition in the goods and factor markets, no adjustment costs and, most importantly, a production technology with a unit elasticity of substitution between capital and labour. A unit substitution elasticity implies, for instance, that when the relative factor prices change the relative factor inputs change within the same proportion – but in the opposite direction. In this model, the labour income share is always at its natural level and this level is solely determined by the underlying parameters of the exogenous production technology[26]. As a consequence, in this model, (labour market) policies are unable to influence the labour income share.

As the basic neo-classical growth model is not capable of explaining the hump-shaped profile of the labour income share observed in most of the EU Member States over the last 40 years, researchers started to explore the implications of changes in the assumptions concerning, among other things, the value of the elasticity of substitution between labour and capital (Rowthorn, 1999), the nature of technological progress (Acemoglu, 1998; 2002; 2003), the degree of (international) competition in labour and goods markets (Blanchard and Giavazzi, 2003; Harrison, 2002; IMF, 2007), the sectoral composition of the economy (Serres et al., 2002), as well as the size of adjustment costs (Kessing, 2003).

As it seems unlikely that the relaxation of only one of these assumptions will be capable of providing a full explanation of the labour income share's behaviour over the past decades, the subsequent analysis will examine the impact of several of these issues. Firstly, it will be demonstrated how the qualitative nature of a change in the relative endowment of labour and capital and technological progress depends, to a large extent, on the size of the elasticity of substitution between capital and labour. Next, it will be examined how labour and product market institutions, as well as globalisation, affect the labour income share. Finally, a system of labour income share equations will be estimated in order to determine the empirical significance of the different drivers.

3.1. Factor substitution and the labour income share

The prediction of a constant labour income share is closely related to the assumption of a unitary elasticity of

25 Though a thorough criticism of this fact was already formulated by Solow (1958).

26 It should be noted that in this model the parameters of the production function may be subject to random shocks, giving rise to a volatile labour income share. Nevertheless, in such a stochastic environment, the basic policy implication of the neo-classical growth model should remain valid, i.e. polices cannot influence the labour income share. See also Annex B.

substitution between labour and capital. Once this elasticity takes a different value, the labour income share no longer remains constant when, for instance, relative factor endowments change. Moreover, the direction in which the labour income share responds to a change in relative factor endowments depends to a large extent on the size of the elasticity of substitution between labour and capital. When the elasticity of substitution between capital and labour is smaller (larger) than 1, the labour income share will increase (decrease) if the capital-to-labour ratio (measured in efficiency units) increases[27]. Indeed, when capital grows faster than labour, a change in relative prices is needed to absorb this shock, and this price adjustment will have to be larger the smaller the elasticity of substitution between capital and labour is[28]. As such, the price effect will dominate the quantity effect if the substitution elasticity is below 1 so that the labour income share increases. Alternatively, in the case of an elasticity of substitution larger than 1, the quantity effect will be stronger than the price effect and the labour income share will decrease when the capital-to-labour ratio increases. This shows, then, that both the capital-to-labour ratio and the elasticity of substitution between capital and labour are two important determinants of the distribution of gross domestic product.

Before investigating the empirical relevance of the capital-to-labour ratio for the evolution of the labour income share in a more systematic way, the following remarks can already be made. Firstly, several estimates of the elasticity of substitution are presented in the literature. Rowthorn (1999), for instance, reports (indirect) estimates for the substitution elasticity that are well below 1 for 19 countries[29]. Antras (2004) obtains estimates of the elasticity of substitution that are significantly below 1 if biased technical change is allowed for.

Secondly, if an elasticity of substitution lower than 1 is assumed, then the rise in the labour income share until the late 1970s (or early 1980s in some countries) should have been accompanied by an increase in the capital-to-labour ratio and a decline in the labour income share as of the mid-1980s with a decline in the capital-to-labour ratio. Alternatively, if an elasticity of substitution that is larger than 1 is assumed, then a declining capital-to-labour ratio until the late 1970s and a rising capital-to-labour ratio as of the mid-1980s would be expected.

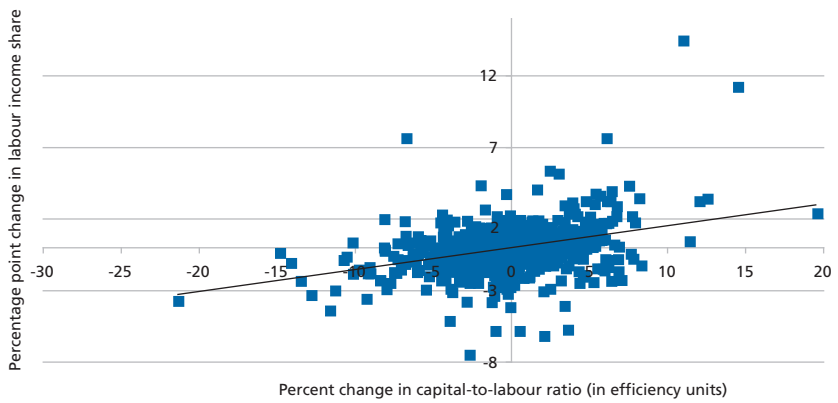
Chart 8 shows the correlation between the annual change in the capital-to-labour ratio (measured in efficiency units) and the labour income share. Although this chart shows some correlation, it should be clear from this first look at the data that the capital-to-labour ratio (measured in efficiency units) cannot be considered as the sole driver of the labour income share and that a further analysis of the issue is needed.

3.2. Direction of technological progress and labour income share

3.2.1. Capital and labour-augmenting technological progress

One popular interpretation of the facts described in the previous section is that the labour income share rose during the 1960s and 1970s because at that time technological progress was of a labour-augmenting nature (assuming an elasticity of substitution larger than 1), while the labour

Chart 8: **Labour income share vs. capital-to-labour ratio (in efficiency units)**



Source: AMECO database and own calculations.

27 See also Annex B.

28 In the case of a small open economy that faces an exogenous interest rate such a change in relative factor prices would then be carried by wages. See, for example, Cotis and Rignols (1998) for an illustration of the importance of the behaviour of an exogenous interest rate to explain the evolution of the labour income share in France.

29 Rowthorn (1999) estimates the substitution elasticity indirectly on the basis of the estimation of the labour demand functions while assuming that labour earns its marginal product. Other studies presenting estimates below 1 include Krusell et al. (2000). However, alternative estimation procedures find results that indicate that the elasticity of substitution may be higher than 1, see Duffy and Papgeoriou (2000) or Caballero and Hammour (1998). The latter estimate the substitution elasticity assuming a putty-clay aggregate production function so that only the capital-output ratio of new production units is considered. They obtain estimates for the substitution elasticity in France that are between 2.4 and 6.5.

income share fell during the 1980s and 1990s because technological progress became capital-augmenting in response to the inertia of real wages in order to adjust to higher oil prices (and other negative shocks).

In this context Acemoglu (2003) developed a model[30] that endogenises the direction of technological progress, and he shows that profit maximisation leads to technical change that is purely labour-augmenting in the long run. It is only when the economy deviates from its steady state that technological progress becomes capital-augmenting and pulls the labour income share back to its equilibrium. For example, if the user cost of capital increases exogenously, firms will have an incentive to reduce their investment in capital which leads to a fall in the labour income share – assuming a low substitution elasticity. Investment in capital can be reduced by directing spending towards research and development activities that augment the efficiency of the capital stock. This capital-augmenting research, which is an endogenous response to the exogenous increase in the user cost of capital, will then contribute to an increase in the labour income share up to the point where the labour income share is back to the level that was reached before the exogenous shock in the user cost of capital occurred. This model implies then that the economy has a self-equilibrating mechanism in the form of R&D spending that drives the labour income share back to its 'natural' level.

3.2.2. Technological progress, skill bias and labour income share

Charts 5, 6 and 7 (see page 246) show that in the EU, the United States and Japan the share of the low-skilled workers in the overall wage bill has been declining gradually since the early 1980s[31] and that the share of the high-skilled workers has been on a steady rise.

Two hypotheses have been presented in the literature to explain this phenomenon: one referring to globalisation and the other one to skill-biased technological progress (Feenstra, 2004; 2007). Focusing on technological progress[32], empirical research indicates that new technologies substitute for that unskilled labour characterised by repetitive routine tasks[33], while they complement skilled workers in their problem solving tasks[34]. See Krusell et al. (2000), Johnson (1997) and Autor et al. (1998; 2003) for (an overview of) estimates of substitution elasticities between capital and workers of different skill levels.

These different degrees of substitution between the different skill groups and capital imply that changes in the capital intensities of the production process can have quite different effects on the income shares of the various skill types. In reality, these differences can be so large that capital deepening effectively increases the income share of the skilled workers but lowers the share of the unskilled workers as the latter are substituted by capital, (Griliches, 1969), or have to accept lower wages[35].

Moreover, it should also be noted that the complementarity between capital and skills does not come by nature, but by design. Acemoglu (1998) derives this property in the context of a model where technologies are non-rival goods that can easily be used across different firms at low marginal cost so that profit-maximising firms have a strong incentive to develop technologies which complement the production factor that is most abundant. By applying this idea to the European and American context, it could be argued that with the strong, (policy-) induced increase in the supply of skilled labour in recent decades, technological progress became more complementary to skilled labour. This then caused a virtuous circle whereby higher labour productivity (and thus also higher wages for the skilled workers) created an additional increase in the supply of skilled labour, which in turn stimulated the further development of skill-complementary technologies.

Closely related to the change in the skill composition of labour income is the change in the sectoral composition of the economy. The behaviour of the aggregate labour income share can then be seen as reflecting changes in the underlying sectoral composition of aggregate output, whereby sectors with a lower than average labour income share, such as the information and communication technology (ICT) sector, have gained in importance in recent years (Serres et al., 2002; Lawless and Whelan, 2006).

4. The labour income share and institutions

The previous analysis assumed perfect competition in the goods and labour market so that the labour income share was solely determined by technological factors. If this assumption is abandoned, it should be noted that imperfect competition in the product market creates rents, which are distributed between capital and labour as a function of their

30 This model satisfies the standard assumptions of endogenous growth theory, though with the explicit assumption that capital can be accumulated asymptotically but human capital cannot because of the finite time of individuals to invest in human capital.

31 Period for which the first observations are available.

32 The impact of globalisation will be discussed in Section 5.

33 i.e. the substitution elasticity between capital and low-skilled labour is greater than 1.

34 i.e. the substitution elasticity between capital and high-skilled labour is smaller than 1.

35 If they accept less favourable working conditions, a fall in the labour income share does not necessarily follow.

relative bargaining power (Blanchard and Giavazzi, 2003). It may therefore be worthwhile to explore to what extent rents in the goods market and the bargaining process in the labour market have an impact on the evolution of the labour income share.

Moreover, as labour market institutions also affect the adjustment process over the business cycle, it may be of some importance to examine to what extent labour market institutions give rise to counter-cyclical fluctuations in the labour income share, as was described in Section 2.4.

4.1. Imperfect competition and the labour income share

Under imperfect competition, profit-maximising firms set their prices by charging a mark-up over the marginal cost of labour[36]. The size of this mark-up is to a large extent determined by the business cycle (Rotemberg and Woodford, 1999), and by regulations that affect competition (such as tariff barriers or standardisation measures) and entry costs.

In recent decades several major reforms have been introduced that reduce rents in the goods markets in the EU. These reforms include the further opening of domestic product and service markets under the Single Market Programme, and the introduction of the single currency enhancing price transparency across EMU (Economic and Monetary Union) Member States. As these measures increase competition in the goods market, they should have exerted upward pressure on the labour income share in the countries of the EU.[37] Indeed, in the case of imperfect competition in the goods market, a wedge is created between the real wage and the marginal productivity of labour. At the same time, output is lower than the level attained under perfect competition, but profits will be larger than under perfect competition. However, assuming that workers have no bargaining power, labour will lose out on its share in the profits and the labour income share will be lower than in the case of perfect competition. Increasing competition in the goods market will then lower the wedge between the real wage and marginal productivity of labour, so that the labour income share will increase. This result raises the question as to how the labour income share will behave if workers have some bargaining power.

In an imperfectly competitive labour market, workers and employers bargain over wages. The right-to-manage regime is generally considered to be the regime that captures bargaining practices in Europe fairly well (Layard et al., 2005).[38] Under this regime, bargaining proceeds in two stages. In the first stage the employees, usually represented by their trade unions, and employers bargain over the wage, and in the second stage the employers decide how many employees they will hire for the given wage. Under such a regime employees will be hired up to the point where the marginal labour productivity equals the real wage, and the size of the elasticity of substitution between capital and labour determines whether a fall in the bargaining power of employees leads to a decrease or increase in the labour income share (Bentolila and Saint Paul, 2003).

Although a reduction in the bargaining power of the workers leads to a decline in the real wage and, assuming an elasticity of substitution smaller than 1, to a decline in the labour income share in the short run, the long run effects may look different. Indeed, Blanchard and Giavazzi (2003) argue that as the labour income share falls and the profitability of capital increases, new firms will start to enter the market. Their entrance will increase competition, leading to a rise in total output as well as in the demand for labour and wages, which then causes a rebound in the labour income share.

Moreover, Acemoglu (2003) further underlines the complexity of these interactions by focusing on the endogeneity of the direction of technological progress, and he also relates the evolution of the labour income share to the evolution of the unemployment rate. His main point is that the strong bargaining power of trade unions in the 1970s allowed employees to resist downward pressures on real wages after the oil price shocks, leading initially to an increase in both the labour income share and the unemployment rate[39]. However, this development lowered the profitability of capital, so that it was accumulated at a slower pace and, more importantly, from the mid-1980s labour-saving technologies were introduced. As a result of this, the unemployment rate and the labour income share started to evolve in a different direction, whereby the unemployment rate continued to rise and the labour income share started to decline[40]. Nevertheless, as adjustment takes place and labour is reallocated between the production and R&D, the

36 Provided the absolute value of the demand elasticity is larger than 1.

37 Assuming perfect competition in the labour market. See also Section B.5 in Annex B.

38 Though Dumont et al. (2006) find empirical evidence allowing them to reject an efficient bargaining or right-to-manage framework in favour of a labour-hoarding framework.

39 Assuming a low substitution elasticity.

40 Alternatively, Blanchard (1997; 1998; 2006) refers to the reduced scope for labour hoarding, due to increased competition and higher corporate governance, to explain the decline in the labour income share and the simultaneous increase in the unemployment rate. However, he also points out that the resulting higher capital income share should improve the return on capital which will then in turn lead to a higher capital stock, and thus ultimately to a recovery of employment and the labour income share.

economy will ultimately return to its long-run balanced growth path.

A last point is that it should be noted that the bargaining power in the labour market is to a large extent determined by labour market institutions, such as unemployment benefits (relative to wages), and employment protection laws, but also by measures that affect capital mobility (Harrison, 2002) and the tax wedge. The latter acts as a disincentive to work and influences the attractiveness of work in the informal economy, thereby affecting the options of employees during the bargaining process.

Charts 9, 10 and 11 illustrate the correlation between annual percentage point changes in the labour income share and percent changes in some of the variables that determine the bargaining power of the employees.[41] These charts suggest that increases (decreases) in the trade union density are accompanied by increases (decreases) in the labour income change, that changes in unemployment benefits do not correlate with changes in the labour income share, and that changes in the tax wedge and the labour income share move in opposite directions.[42]

Furthermore, in addition to this suggestive evidence, there is also micro-econometric research, based on linked employer-employee data, which indicates that workers are capable of capturing rents accruing in profitable sectors. See Box 1.

These observations make it compelling to investigate in a more systematic way the empirical evidence regarding the link between the labour income share, and the determinants of bargaining power in the labour market and rents in the goods market. This will be done in Section 6 of this chapter.

Labour income share vs. trade union density, unemployment benefit replacement ratio and tax wedge

Chart 9: **Labour income share vs. trade union density**

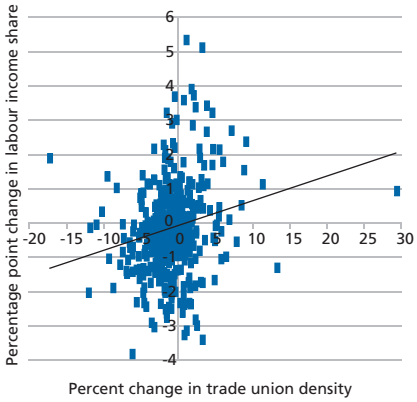


Chart 10: **Labour income share vs. unemployment benefit replacement ratio**

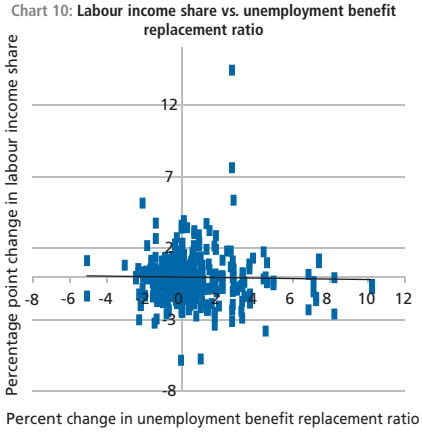
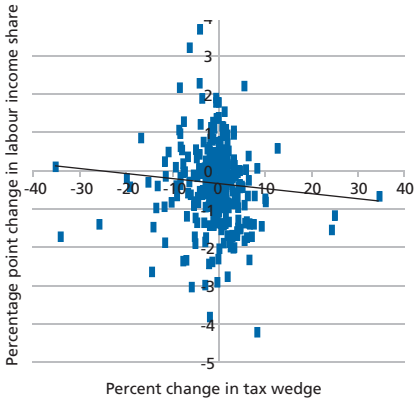


Chart 11: **Labour income share vs. taxe wedge**



Source: AMECO database, Bassanini and Duval (2006), and own calculations.

41 See Annex A for a description of the data underlying these and the following charts.

42 Nevertheless, here it should be stressed that – without further econometric analysis – such correlations do not allow us to make any firm statement about causal links between these indicators and the labour income share, as both may be driven by a third variable (including a common trend). Such an analysis will be provided in Section 6 of this chapter.

Box 1 – Inter-industry wage differentials and rent sharing

The empirical debate about the causes of earnings inequalities was reopened at the end of the 1980s in an article by Krueger and Summers (1988). These authors highlighted the fact that the structure of wages in the United States was not compatible with the competitive framework, according to which wage differentials at equilibrium were explained, either through differences in the quality of the labour force – measured in terms of productive capacity – or by so-called compensating differences. In other words, they showed that wage disparities persisted between agents with identical observed individual characteristics and working conditions, employed in different sectors. Since then, similar results have been obtained for many industrialised countries (Araï et al., 1996; Hartog et al., 1997, 2000; Lucifora, 1993; Vaïniomaki and Laaksonen, 1995).

Based on detailed matched worker-firm data for Belgium covering the period 1995–2002 and comprising data from the *Structure of Earnings Survey* and the *Structure of Business Survey*, Plasman et al. (2006) point to the existence of persistent but decreasing wage differentials among workers with the same observed characteristics and working conditions, employed in different sectors. The best paying industry over the period 1995–2002 was the electricity, gas, steam and hot water supply sector. Depending on the period considered, the average worker in this sector earns, all things being equal, between 27 and 31% more than the average worker in the whole economy. The hotel and restaurant sector is at the very bottom of the wage scale: the average worker's wage in this sector is, all things being equal, between 11 and 14% lower than that of the average worker in the economy.

These inter-industry wage differentials may of course derive from the fact that the unobserved quality of the labour force is not randomly distributed across sectors. In other words, high-paying industries might simply be those in which the unobserved quality of the labour force is highest. This potential explanation has been tested by Plasman et al. (2006) based on Martins' (2004a) methodology. The authors thus verified, based on quantile regressions, whether sectors with high average premiums pay even higher premiums to high-wage workers. Their empirical results show that unobserved ability only partially accounts for observed inter-industry wage differentials. Therefore it appears that the role of non-competitive forces should not be neglected.

The most natural non-competitive explanation for the existence of industry wage premiums is that they result from inter-sectoral variations in profits. This explanation has been investigated by Plasman et al. (2006) based on simple correlation coefficients and cross-sectional regressions. Their results show that industry wage premiums are significantly and positively correlated with industry profits, in all periods, both at the NACE two- and three-digit level. They thus support the hypothesis that industry wage premiums derive at least partly from the heterogeneity in sectoral profits.

The magnitude of rent sharing in the Belgian private sector and its contribution to observed inter-industry wage differentials has also been examined by Plasman et al. (2006). Their empirical results show firstly that individual gross hourly wages are significantly and positively related to firm profits-per-employee, even after controlling for group effects in the residuals, individual and firm characteristics, industry wage differentials and endogeneity of profits. The instrumented wage-profit elasticity estimated at the mean is equal to 0.063. However, workers at the top end of the wage distribution are found to obtain a significantly larger share of profits than those at the bottom of the wage distribution. Further results show that substantial wage differentials are still recorded between workers employed in different sectors after controlling for rent sharing. However, the proportion of significant industry wage premiums decreases from around 74 to 42%. The authors also find that dispersion in inter-industry wage differentials drops by almost one-third when profits are taken into account. These findings suggest that rent sharing accounts for a significant fraction of the inter-industry wage differentials.

Another empirical analysis of rent sharing can be found in Martins (2004b), who uses matched employer-employee panel data (*Quadros de Pessoal*, personnel records) from a subset of large firms based in Portugal, covering the period 1993–1995. He finds significant levels of rent sharing, indicating that workers who were to move from firms with 'low' profits to firms with 'high' profits would gain pay increases of about 15%. Moreover, when focusing only on firms with increasing levels of profits, the same pay increases grow to about 50%. The latter result may suggest that rent sharing exhibits some asymmetry: pay increases when profits increase while pay does not fall when profits decrease. Martins (2004b) also finds evidence that different groups of workers benefit differently from rent sharing. Men, more educated workers and more tenured workers tend to gain much more from their firms' rents than women, less educated workers and less tenure workers, respectively.

4.2. Other institutions and policies

Active labour market polices (ALMP) also affect the outcome of the labour income share. Active labour market policies are selective policies targeted at certain sub-groups in the labour market, and they include measures focused on training, public employment services and employment subsidies for specific groups of unemployed people or workers at risk of becoming unemployed. As such these policies have an impact on total employment and its composition, and thus also on the labour income share.

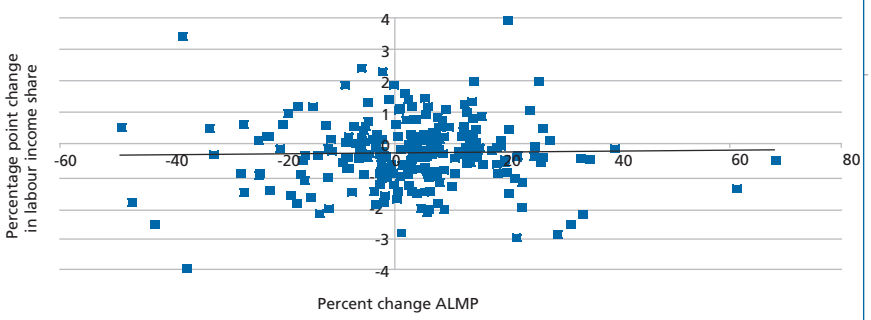
The effect of active labour market policies on the labour income share depends to a large extent on the elasticity of substitution between capital and labour, and, more importantly, on the effectiveness of these policies to allow workers to progress in their job and skill level, and enhance their complementarity with capital and the other production factors so that they no longer have to compete with a persistently cheaper capital stock, but can use it in their activities so that a further increase in the capital stock will lead to an increase in their labour income share.

If the elasticity of substitution between labour and capital is larger than 1, then an increase in employment leads to an increase in the labour share, on the basis that a high substitution elasticity allows for a smooth absorption of labour. By contrast, if the elasticity of substitution is smaller than 1, a policy-induced influx of workers into employment will lead to a decrease in the labour share. The previous section has already indicated that low-skilled workers have a high degree of substitutability with the other production factors, so it is to be expected that ALMPs will increase the income share of the low-skilled. Chart 12 shows the correlation between a change in the expenditures for ALMPs and the labour income share. Though the chart does not suggest a significant relationship between ALMP and the labour income share at the aggregate level, a more systematic investigation of the empirical link between ALMP and the labour income share, both at the aggregated level as well as the disaggregated level, will be made in Section 6.

The minimum wage may also affect the labour income share. In the case of a binding minimum wage, the wage will tend to be higher than the marginal productivity of labour, and labour will be able to extract a higher share from total revenues. Chart 13 shows the correlation between the annual changes in the labour income share and changes in the minimum wage for a selected group of countries where a statutory minimum wage exists. This chart suggests that the link between both variables is weak. Nevertheless, as such correlations are not controlled for the effects of third variables, a more systematic investigation of the link between the minimum wage and the labour income share will be carried out in Section 6.

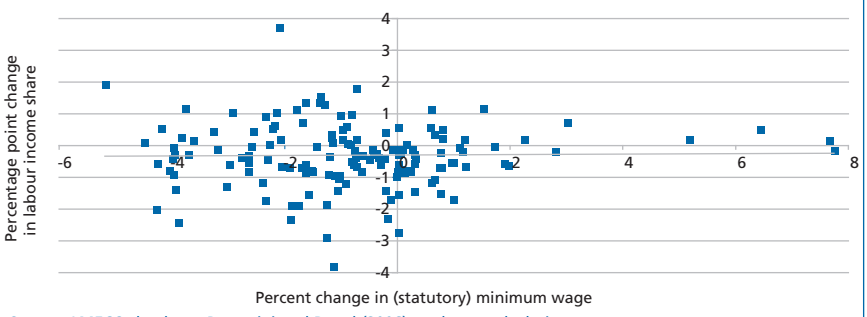
So far we have only considered the distribution of gross domestic product between labour and capital. However, a small part of gross domestic product (at market prices) accrues to the public sector in the form of indirect taxes (minus subsidies) imposed on production. In this chapter the share of the net indirect taxes is assumed to be exogenous. Nevertheless, changes in its size will induce a reallocation between labour and capital as both factors will try to mitigate part of the burden of an increased government take in value added. The empirical nature of these interactions will be established in Section 6.

Chart 12: **Labour income share vs. ALMP**



Source: AMECO database, Bassanini and Duval (2006), and own calculations.

Chart 13: **Labour income share vs.(statutory) minimum wage**



Source: AMECO database, Bassanini and Duval (2006), and own calculations.

4.3. A counter-cyclical labour income share

The evidence presented in Table 1 indicates that the labour income share behaves counter-cyclically over the business cycle. Labour hoarding may contribute to this behaviour as it causes labour demand to fall by less than output in downturns and rise by less than output during upswings, so that the labour income share, which is measured as the ratio of the two former variables, increases in a downturn and decreases in an upswing – provided that real wages do not move pro-cyclically over the business cycle.

Labour hoarding is to a large extent determined by adjustment costs, including hiring and firing costs. Part-time and fixed-term contracts are usually associated with lower hiring and firing costs, and give lower incentives to hoard labour. In addition, hiring and firing costs do not apply to the self-employed. Hence, to the extent that an economy has a low share of fixed-term and part-time employment, and a low share of self-employed, the labour income share will show a strong counter-cyclical pattern (Giammariolli et al., 2002). Imperfect information regarding the nature of the shocks that hit the economy (e.g. temporary or permanent) may reinforce the counter-cyclical effects of hiring and firing costs, as employers may seek to hoard labour in the face of a drop in aggregate demand that is perceived to be temporary. In a more formal setting, Kessing (2003) shows that with linear adjustment costs and a Cobb-Douglas technology, fluctuations in the labour income share are independent of the size of the shocks (in aggregate demand or wages) and depend only on the size of the adjustment costs (e.g. hiring and firing costs.)

Alternative mechanisms leading to counter-cyclical behaviour have been proposed in the literature. For instance, Gomme and Greenwood (1995) use a real business-cycle model to illustrate how the counter-cyclical behaviour of the labour income share reflects an optimal implicit contract between firms and employees, whereby firms cover workers against income fluctuations caused by the business cycle. In upswings the workers use part of their income to pay an 'insurance premium' to protect them against strong income fluctuations, and in downturns the firms add an insurance component to the workers' wage (by not cutting wages). In this way, labour income is to some degree protected against business cycle fluctuations, but is lower (than the trend income share) in upswings and higher in downturns. Firms are prepared to make such arrangements because they are less risk-averse than employees and they can monitor their employees so that they can distinguish between a loss in productivity caused by a downturn and a loss in productivity caused by, for instance, shirking. Young (2004) argues in the context of a real business cycle model that the counter-cyclical nature of the fluctuations in the labour share is due to exogenous, biased technological shocks.

Finally, it should also be noted that the counter-cyclical behaviour of the labour income share (caused by adjustment costs in the labour market) might be tempered by the cyclical behaviour of the price mark-up in the goods market. Indeed, Rotemberg and Woodford (1999) document that the price mark-up in the goods market behaves counter-cyclically, and the analysis in section 4.1 shows that a rise (fall) in the price mark-up exerts downward (upward) pressure on the labour income share. This implies that the effects stemming from a counter-cyclical mark-up in the goods market run in the opposite direction to the effects arising from the existence of adjustment costs in the labour market. Nevertheless, it is an empirical issue to determine the net outcome of these opposite effects.

5. The labour income share and globalisation

With the entrance of China, India, Brazil and the former Soviet-bloc (BRICs) into the world economy, the world supply of labour increased significantly – with estimates going as far as a quadrupling of the effective world supply of labour between 1980 and 2006 (IMF, 2007)[43]. As this increase in labour supply was not accompanied by a proportional increase in the world capital stock, the capital-to-labour ratio came under downward pressure across the world[44]; and to the extent that capital and labour are gross complements, this decline will have lowered the labour income share worldwide.

However, the importance of the impact of this increase in the global supply of labour on the labour income share in the developed world should not be exaggerated, as the data clearly indicates that the fall in the labour income share started well before the integration of the BRICs into the world economy. Nevertheless, to the extent that the entrance of the BRICs is responsible for the deterioration of the labour income share in Europe, a low global capital-to-labour ratio may persist for some time as it can only be restored through sustained investments in

43 This number takes also into account demographic developments in the world. Freeman (2006) estimates that with the entrance of China, India and the former Soviet-bloc, the supply of labour increased by 1.5 billion people worldwide, which is almost a doubling of the existing labour supply.

44 However, this overall decline in the capital-to-labour ratio should be qualified to the extent that, in effective terms, the increase will have been less pronounced as the new entrants possess relatively low skills.

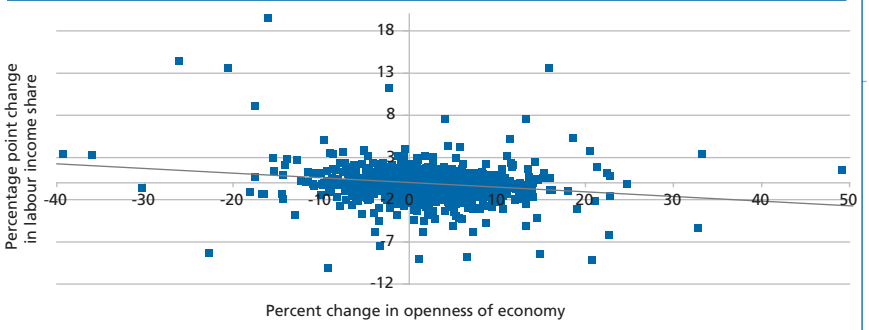
capital and through capital-augmenting technological progress.

Apart from the worldwide shift in the relative supply of labour and capital, the specific mechanisms through which globalisation affects the labour income share in EU Member States mainly include the imports of final goods and the outsourcing of the production of intermediate goods.

Traditional trade theory[45] predicts that when trade barriers lower, countries will specialise further in the areas of their comparative advantage (which are primarily determined by relative factor endowments) so that capital-abundant countries will export more capital-intensive goods, and labour-abundant countries will export more labour-intensive goods. In this process, factor prices converge across countries along with traded good prices, so that the price of a country's relatively abundant production factor increases and the price of the relatively scarce production factor falls. Hence, to the extent that a country is to be considered as capital-abundant, the labour income share will fall in the wake of further trade liberalisation – provided that the elasticity of substitution between capital and labour is smaller than one.[46]

Although the predictions of the traditional trade models are unambiguous, they can be qualified in several ways. Consider first, for instance, the assumption of perfect competition. In imperfect competitive labour markets, globalisation adversely affects the relative bargaining position of the least mobile production factor (Harrison, 2002). To the extent that the fixed costs of relocating are much larger for workers than for capital (in the medium term) and globalisation enhances capital mobility, the bargaining position of labour would deteriorate so that wages would fall (relative to the price of capital), leading to a further decrease in the labour income share[47].

Chart 14: **Labour income share vs. openness of economy**



Source: AMECO database, Bassanini and Duval (2006), and own calculations.

Furthermore, traditional trade models only consider international trade in final goods of different industries (usually two-sector, two-factor models), but the predictions of trade models become much richer once they distinguish between different skill types and the assumption is made that activities related to the different skill types within the same industry can be outsourced across the world (Feenstra 2004, 2007; Feenstra and Hanson, 1996). In traditional trade models, the demand for unskilled labour decreases in the developed countries because international trade causes a shift from low-skilled industries to high-skilled ones in these countries. However, once the outsourcing of activities within the same industry is allowed for, international trade will also create a shift away from low-skilled activities to high-skilled activities within that same industry. The expected effect on factor prices is then of the same nature as the effects of the movement of production factors between countries, thereby creating additional pressure on factor prices to converge worldwide.

Finally, it should be noted that although globalisation may reduce the labour income share in the Member States of the EU, this does not imply that globalisation would also lead to a decline in real wages or employment (of the low or high-skilled). Indeed, the further division of labour and increased opportunities to specialise in terms of technologies, products and markets, has the potential to enhance labour productivity, thereby creating room for non-inflationary wage increases, while at the same time supporting employment growth.

Graph 14 shows a negative correlation between the change in the indicator of the international openness of the economy[48] and the change in the labour income share for the EU, the United States and Japan over the period 1960–2006. However, as this correlation was not controlled for the effects of other variables it is clear that a more thorough investigation of the relation between these two variables is warranted.

45 See the Heckscher-Ohlin-Samuleson model which assumes, among other things, two countries, two sectors, two goods, perfect competition, as well as identical technologies and tastes across countries.

46 It remains an empirical issue to assess to what extent the EU Member States are capital-abundant countries and to determine the size of the elasticity of substitution between labour and capital in order to fully understand the impact of globalisation. Indeed, while the EU Member States may be capital-abundant in terms of low-skilled labour, they are probably labour-abundant in terms of high-skilled labour. Moreover, as both skill types are expected to have a different degree of substitutability with capital, an empirical analysis of the impact of globalisation on the labour income share should reflect these potential differences between skill types.

47 Under the assumption of a low substitution elasticity.

48 Openness of the economy is measured as the sum of exports plus imports divided by gross domestic product.

6. Some empirical results

6.1. A system of income share equations

The previous sections have identified several variables that affect the evolution of the labour income share. This section assesses their empirical significance by estimating a system of income share equations for low, medium and high-skilled labour[49]. Such a system of equations allows us to calculate how a change in one of the explanatory variables induces a shift in the distribution of gross domestic product between the different production factors, and it also allows us to interpret the decline of the labour income share in Europe.

Each of these equations includes the following explanatory variables:

- the capital-to-labour ratio (in efficiency units) (see Section 3.1)
- the ICT-intensity of the production process (see Section 3.2)
- variables affecting the rents in the goods market (see Section 4.1)
- variables affecting the relative bargaining power in the labour market (see Section 4.1)
- active labour market policies (see Section 4.2)
- the direct government take in value added (i.e. indirect taxes imposed on production minus subsides, see Section 4.2).

Rents are primarily determined by product market regulation and the openness of the economy, while the bargaining power of the trade unions is determined by, among other things, trade union density, unemployment benefits, and the openness of the economy (which affects both rents in the goods market and bargaining power in the labour market). Finally, in order to capture cyclical movements, the equations also include the output gap (see Section 4.3).

Data for these variables were retrieved from various sources and they are described in more detail in Annex A. The aggregate labour income share, the capital to labour ratio and openness of the economy are calculated with data available in the Commission's AMECO database. Shares in total labour compensation according to skill-type and the indicator for the use of ICT services are from the EU KLEMS database[50]. The labour income share per skill type is obtained by multiplying the share of the skill types in total labour compensation (EU KLEMS) with the aggregate labour income share (AMECO). Data for expenditures on active labour market policies (ALMP)[51], employment protection legislation (EPL), product market regulation (PMR), unemployment replacement ratio, trade union density, the tax wedge and (statutory) minimum wages[52] are from various OECD databases, and are readily available and documented in the Bassanini and Duval (2006) database.

Table 5 (see page 256) shows the point estimates for the income share of the three skill types as well as for the labour aggregate for 13 countries for the period 1983–2002[53]. Standard errors are shown between parentheses. Several robustness checks were performed, including a check on the sensitivity of the point estimates to the deletion of countries from the data pool (i.e. the United States, Japan and the United Kingdom)[54], the addition of country-specific trends[55] and the use of instrumental variables in order to deal with possible simultaneity biases[56].

49 IMF (2007) follows a similar strategy although there a distinction is made between skilled and unskilled sectors.

50 In EU KLEMS, capital input is measured as capital services, rather than stocks.

51 ALMP expenditures are calculated per unemployed person and in order to ensure cross-country comparability this indicator is expressed as a percentage of GDP per capita. See also Bassanini and Duval (2006).

52 Reliable minimum wage series exist only for countries where minimum wages are statutory; countries with statutory minimums during the whole sample period are Belgium, France, Japan, the Netherlands, Spain and the United States. For the other countries where minimum wages may be collectively negotiated but for which we do not have observations, the variable was set to zero.

53 These countries are Belgium, Denmark, Germany, Spain, France, Italy, the Netherlands, Austria, Finland, Sweden, the United Kingdom, the United States of America and Japan. The available data were pooled yielding an unbalanced dataset with 207 observations per equation. The equations have been estimated with least squares assuming fixed effects.

54 The sensitivity of the point estimates to the composition of the data pool was checked by deleting the non-European countries (i.e. the United States and Japan). This yielded a change in the sign of the parameter of only three variables, which are also not very significant in Table 5, i.e. the openness variable in the equation of the low and high-skilled, and the unemployment benefit variable in the equation of the high-skilled. An additional robustness check was made by deleting the United Kingdom from the pool, as it was the only country in the pool for which the null-hypothesis of a non-stationary labour income share could be rejected at a fairly high confidence level. Compared with the point estimates reported in Table 5, this deletion resulted in a change of the sign of two parameters, i.e. the one of the openness variable in the equation of the low-skilled workers and the one of the ALMP variable in the equation of the high-skilled workers.

55 Compared with the point estimates reported in Table 5, adding a country-specific trend changed the parameter value for only two variables, i.e. PMR in the equation of the medium-skilled and the openness variable in the equation of the high-skilled workers. In addition, there was a notable fall in the significance of the variable measuring ICT use in the equation of the high-skilled workers, as well as in the unemployment benefit variable in the equation of the low-skilled workers.

56 Estimation with instrumental variables changed the sign of three parameters, i.e. the parameter of the openness variable in the equation of the low-skilled workers, and the EPL variable and minimum wage variable in the high-skilled equation. The instruments are the lagged variables, and a country-specific trend and constant.

Table 5: **Estimation results of a system of equations**[1]

	Skill composition of labour			Total labour
	low-skilled	medium-skilled	high-skilled	
Constant	-32.577*** (5.213)	88.414*** (5.867)	45.863*** (2.742)	101.694*** (5.445)
Capital-labour ratio (in log)	-4.770*** (1.655)	8.900*** (1.862)	5.788*** (0.870)	9.917*** (1.728)
ICT use (in log)	-4.140*** (0.355)	1.587*** (0.399)	2.104*** (0.186)	-0.449 (0.370)
PMR (in log)	3.752*** (0.917)	0.111 (1.032)	-2.587*** (0.482)	1.276 (0.958)
Openness	0.003 (0.014)	-0.059*** (0.016)	0.004 (0.007)	-0.052*** (0.014)
Union density	-0.232*** (0.039)	0.190*** (0.044)	0.090*** (0.021)	0.048 (0.041)
UBenefit	-0.103*** (0.028)	-0.197*** (0.031)	-0.013 (0.015)	-0.312*** (0.029)
EPL (in log)	-2.071* (1.057)	-5.584*** (1.190)	3.060*** (0.556)	-4.595*** (1.104)
Labour tax wedge	-0.289*** (0.046)	0.042 (0.052)	-0.084*** (0.024)	-0.330*** (0.048)
Minimum wage	0.439*** (0.075)	-0.241*** (0.085)	-0.045 (0.040)	0.153* (0.079)
ALMP	0.056*** (0.010)	-0.057*** (0.011)	-0.005 (0.005)	-0.006 (0.010)
Output gap	-0.144*** (0.052)	0.220*** (0.059)	-0.031 (0.027)	0.045 (0.055)
Indirect tax share	0.178 (0.110)	-0.518*** (0.124)	0.260*** (0.058)	-0.080 (0.115)
Fixed country effects	Yes	Yes	Yes	Yes
Observations	207	207	207	207
R-squared	0.98	0.98	0.99	0.86

Source: EU KLEMS database, AMECO database and Bassanini and Duval (2006)
Note [1]: Standard errors are between brackets. One, two, and three asterisks indicate that the parameter is significant at the 10, 5, and 1% levels, respectively.

The point estimates in Table 5 illustrate that the impact of these drivers on the income shares of the different skill types may differ strongly. The key to interpreting these results is the scope for substitution between the different production factors. A case in point is the point estimates for the capital-to-labour ratio. The estimation results for this variable indicate that a rise in the capital-to-labour ratio raises the income share of the medium and high-skilled workers, but lowers the share of the low-skilled, thereby underlining the complementarity between capital and high and medium-skilled workers on the one hand, and the high degree of substitution between capital and low-skilled workers on the other. On balance, the impact on the high and medium-skilled workers dominates the impact on the low-skilled workers so that the parameter value of the capital-to-labour variable in the equation of the aggregate income share is larger than zero.[57]

An increase in the intensity at which ICT services are used in the production process[58] lowers the income share of the low-skilled, but raises the share of the medium and high-skilled workers. These results are in line with the results obtained for the capital-to-labour ratio. However, here the negative impact on the share of the low-skilled outweighs the positive impact on the share of the medium and high-skilled workers, so that on balance the intensity of ICT use has a negative impact on

57 The point estimates for the aggregate labour income share can be obtained either by adding the point estimates of the equations of the different skill types, or by estimating the equation of the labour aggregate directly. Estimating the aggregate labour income share equation directly, as was done for this exercise, has the advantage that it provides estimates for the standard errors in an easy way. Although the point estimates of the aggregate labour income share is equal to the sum of the point estimates of the different skill-types, the standard errors of the aggregate also captures the existence of co-variation between the impacts on the different skill types.

58 i.e. the use of ICT services per worker.

the aggregate labour income share – albeit not very significant.

Apart from these drivers which are directly related to the production technology, there are also market institutions that influence the evolution of the labour income share. In the product market, the degree of competition is, to a large extent, determined by the strictness of product market regulation (PMR) and the international openness of the economy[59]. The point estimates in Table 5 show that an increase in the strictness of PMR lowers the income share of the high-skilled workers and raises the income share of the low and medium-skilled workers – albeit not very significantly in the case of the medium-skilled workers. The net effect of an increase in the strictness of product market regulation on the aggregate labour income share is positive, but not very significant. Stricter PMR gives firms more power to increase their price mark-up over marginal costs. As profits accrue to capital (unless workers have a strong bargaining position) an increase in product market regulation will lead to a fall in the labour income share as is found for the high-skilled workers[60]. The fact that it rises for the low-skilled is somewhat puzzling, but could point towards the fact that PMR does not affect all sectors in the same way and that sectors have a different skill composition.

The bargaining power in the labour market is determined by several variables, including trade union density, unemployment benefit, employment protection legislation, the tax wedge and the openness of the economy. Point estimates are reported in Table 5 for each of these variables.

An increase in the density of trade union membership has a positive impact on the income share of the medium-skilled workers and to a smaller extent on the income share of the high-skilled workers, but it has a significant negative impact on the income share of the low-skilled workers. The former two effects dominate the latter so that the net effect on the total income share is positive – albeit not very significant. A higher trade union density increases the bargaining power of the workers which leads to higher unit wage rates. The outcome of this wage push on the income share of the different skill types is in line with the earlier described results, i.e. it yields an increase in the income shares of the medium and high-skilled (being complements to capital), and a decrease in the income share of the low-skilled (being substitutes to capital).

A rise in the unemployment benefit replacement ratio has a negative impact on the income share of all skill-types – albeit only significant for the low and medium-skilled workers. In view of the transmission mechanisms discussed earlier, and the idea that an increase in unemployment benefit increases the bargaining power of labour, it would be expected that an increase in the unemployment benefit would increase the labour income share of the medium and high-skilled workers and lower the income share of the low-skilled workers.

The strictness of EPL primarily has a significant negative effect on the income share of the medium-skilled workers and to a lesser extent on the income share of the low-skilled workers, while it has a significant positive effect on the share of the high-skilled. As the effect on the medium-skilled workers is by far the largest, the parameter of the EPL variable takes a negative value in the equation of the overall labour income share. Increases in EPL raise the bargaining power of employees, and thus also the wages of the workers. In line with earlier results, such wage hikes should then lead to a lower income share for the low-skilled workers and a higher income share for the high-skilled workers. The fact that in the equation of the medium-skilled workers the parameter has a significant negative value may indicate that EPL may also induce some other effects. Indeed, an alternative interpretation of EPL is that it provides job security to the individual jobholder, creating a kind of insurance contract between the employee and the employer for which the insurance premium is paid in the form of a lower wage, which then dampens the effect of the increased bargaining power.

The point estimates in Table 5 indicate that an increase in the labour tax wedge leads to a significant decline in the income share of the low and high-skilled, while the impact on the medium-skilled is not significant. In the equation of the aggregate labour income share the parameter value of the tax variable is negative and significant. An increase in the tax wedge acts as a disincentive to work or raises the attractiveness of working in the informal sector of the economy. As such it will reduce employment in the formal economy and should lead to a decrease in the income share of the low-skilled workers (with their relative high elasticity of substitution) and an increase in the income share of the high-skilled workers (with their relative low elasticity of substitution). The fact that it is not the case for the high-skilled workers may indicate that an additional transmission mechanism is operating.

The parameter of the variable measuring the openness of the economy has a significant negative value in the

59 The international openness of the economy also affects the bargaining position of labour in the labour market, and will be discussed below.

60 See also the analytical results in Annex B.

equation of the medium-skilled workers, and an insignificant positive value in the equation of the low and high-skilled workers. The negative effect in the share equation of the medium-skilled workers dominates so that an increase in the openness of the economy tends to decrease the total labour income share. In interpreting these results it should be remembered that an increase in the openness of the economy reduces the bargaining power of labour thereby putting downward pressure on wages (relative to the price of capital). Given the high degree of substitutability of low-skilled workers with capital (and the other skill types), a fall in the wage of the low-skilled will cause the income share of the low-skilled to increase. At the same time, the reduced bargaining power of labour will also decrease the wages of the medium-skilled workers, and, given their low degree of substitution with capital, this wage fall will induce a decrease in the income share of the medium-skilled workers.

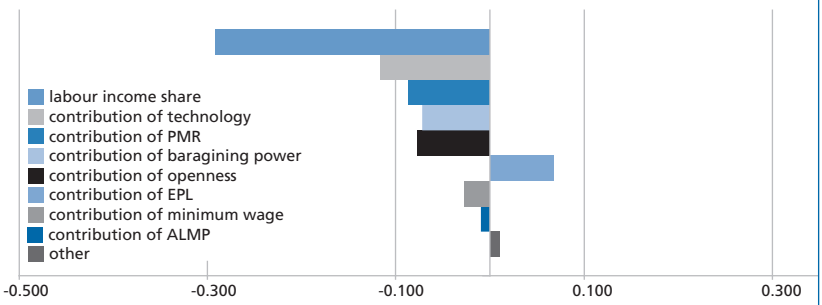
Focusing on the impact of ALMPs, the estimates indicate that the parameter value for this variable is greater than zero in the equation of the low-skilled and smaller than zero in the equation of the medium and high-skilled – albeit not significant for the latter. A main objective of ALMP is to activate well-targeted groups of unemployed people or people at risk of becoming unemployed, by giving them training that meets their needs, assist them in job searching, provide counselling and vocational guidance, etc. As such these measures primarily induce an increase in the employment of the low-skilled workers. Given the high degree of substitutability of the low-skilled with the other production factors, an increase in the employment of low-skilled can be absorbed without a big change in relative prices so that the income share of the low-skilled will rise. The point estimates indicate that it is primarily the share of the medium-skilled that will fall to compensate for the increase in the income share of the low-skilled. Nevertheless, as these two effects cancel each other out almost entirely, the net impact of ALMP on the aggregate labour income share is small.

The parameter value of the minimum wage variable is positive and very significant in the share equation of the low-skilled workers, while it is negative in the share equation of the medium and high-skilled workers. On balance, the value of this parameter is greater than zero in the share equation of aggregate labour. These point estimates indicate that a rise in the minimum wage increases the income share of the low-skilled, but that this happens at the expense of the medium and high-skilled workers and capital.[61]

In order to capture cyclical movements in the labour income share the output gap was added as an explanatory variable. The parameter associated with the output gap has a significant negative value in the equation of the low-skilled and a significant positive value in the equation of the medium-skilled workers, while the net impact of the output gap on the aggregate is positive.

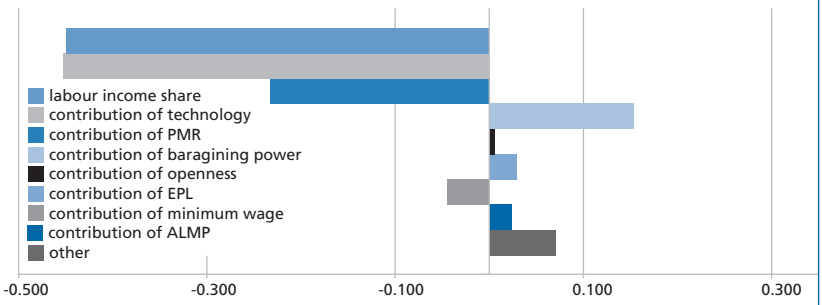
The parameter of net indirect taxes minus subsidies imposed on production has a significant negative value for the medium-skilled workers, an insignificant value for the low-skilled and a significant positive value for the high-skilled workers, indicating that it is primarily the medium-skilled workers who carry the burden of an increase in the government's share in

Chart 15: **Change in labour income share in EU-11: total (percentage points, annual averages)**



Note: EU-11 includes Belgium, Denmark, Germany, Spain, France, Italy, the Netherlands, Austria, Finland, Sweden and the United Kingdom.

Chart 16: **Change in labour income share in EU-11: low-skilled (percentage points, annual averages)**



Note: EU-11 includes Belgium, Denmark, Germany, Spain, France, Italy, the Netherlands, Austria, Finland, Sweden and the United Kingdom.

61 Estimating the equations with pooled data for the countries for which only the statutory minimum wage is available reduces the number of observations from 207 to 102, and affects mainly the sign of the parameter of the PMR and openness variables in the equation of the low-skilled workers, and of the unemployment benefit variable in the equation of the medium-skilled workers albeit that their significance is low.

62 i.e. the countries and the period for which all-explanatory variables are available. These countries are Belgium, Denmark, Germany, Spain, France, Italy, the Netherlands, Austria, Finland, Sweden and the United Kingdom. The annual growth rates are averages of the country growth rates weighted by the countries' share in aggregate GDP.

value added. Nevertheless, the net impact on the labour income share is not significant.

6.2. The contribution of the different drivers

Charts 15 to 18 summarise the previous results by showing the average annual contributions of the different drivers to the labour income share for a selected group of EU Member States between 1983 and 2002[62]. Chart 15 illustrates the results for the aggregate labour income share, while charts 16 to 18 show the results for the income share of the different skill types. 'Technology' covers the capital-to-labour ratio and the indicator measuring the ICT use per employee; 'bargaining power' includes union density, unemployment benefit replacement ratio and the tax wedge, while the openness of the economy and EPL are shown as separate variables. 'Other' covers the contribution of the output gap, the indirect taxes minus subsidies and the residual.[63]

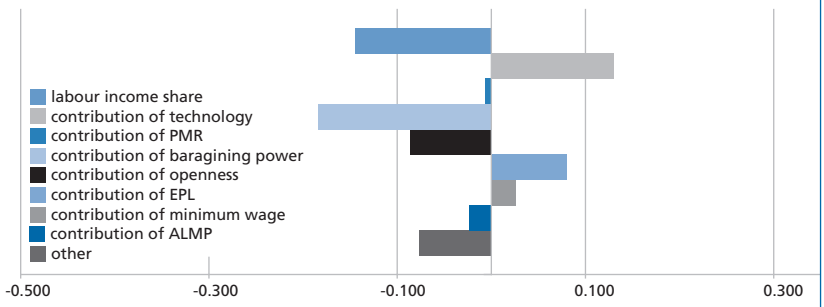
Chart 15 shows the results for the aggregate labour income share. At the aggregate level, technological progress has been the most important cause of the fall in the labour income share. However, the picture changes dramatically once a closer look is taken at the contribution of technological progress at the level of the different skill types. Comparing the charts for the different skill types, it is striking to note how in recent decades the income share of the high-skilled workers, and to a lesser extent the income share of the medium-skilled workers, has benefited in a marked way from technological progress, while the income share of the low-skilled workers has lost a substantial part due to technological progress. These results once again highlight the importance of the degree of substitution between the different labour types and capital.

The charts also show that the general decline in the strictness of product market regulation led to a fall in the total labour market income share. This overall negative contribution of PMR was primarily due to a strong fall in the income share of the low-skilled workers, while it had no impact on the income share of the medium-skilled workers and it increased the income share of the high-skilled workers in a notable way. The fall in the bargaining power of labour, measured here by the joint change in trade union density, the unemployment benefit replacement ratio and the tax wedge (which acts as a disincentive to work or raises the attractiveness of work in the informal sector of the economy), contributed to the overall decline in the labour income share. However, its distribution was not even: while the income share of the low-skilled workers increased, the income shares of the medium and high-skilled workers fell.

The further opening of the economy also played an important role in the decline of the labour income share, but to a lesser extent than technological progress and, in line with the earlier discussed point estimates, with most of the burden falling on the medium-skilled workers. Furthermore, the decrease in the strictness of EPL made a positive contribution to the overall labour income share. Also in line with the earlier discussed point estimates, it was primarily the income share of the low and medium-skilled workers which benefited from this deregulation, while the income share of the high-skilled declined somewhat.

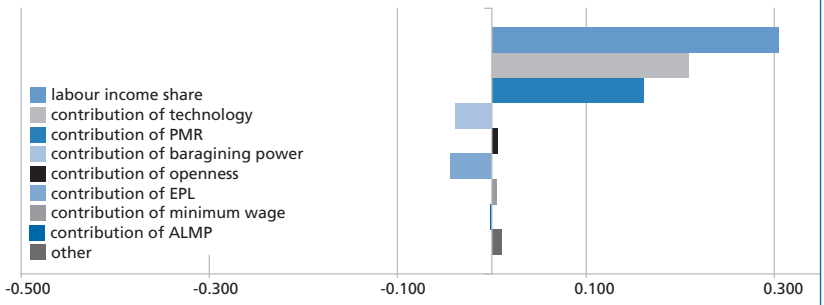
The charts show that the erosion of the minimum wage, measured by the decline in the ratio of the statutory minimum wage to the median wage, also contributed to the decline in the overall labour income share, and especially to the decline in the income share of the low-skilled workers.

Chart 17: **Change in labour income share in EU-11: medium-skilled (percentage points, annual averages)**



Note: EU-11 includes Belgium, Denmark, Germany, Spain, France, Italy, the Netherlands, Austria, Finland, Sweden and the United Kingdom.

Chart 18: **Change in labour income share in EU-11: high-skilled (percentage points, annual averages)**



Note: EU-11 includes Belgium, Denmark, Germany, Spain, France, Italy, the Netherlands, Austria, Finland, Sweden and the United Kingdom.

63 The equation was estimated in levels with fixed effects, implying that for each country the level values of the error terms sum up to zero over the sample. However, it should be noted that the first differences of the error terms do not necessarily add up to zero.

Finally, a modest increase in the labour income share of the low-skilled can be attributed to ALMP, while its impact on the aggregate labour income share is negligible.

7. CONCLUSIONS

The evolution of the labour income share involves issues of equity, economic efficiency as well as macroeconomic stability as it has, for example, an impact on personal income distribution and social cohesion, the direction of the adjustment in wages and employment, and the composition of aggregate demand.

This chapter illustrates how the labour income share in the EU started to decline around the second half of the 1970s and fell towards levels that are below those that were attained in the 1960s. In addition, the chapter also shows that the share of the low-skilled workers in the total wage bill fell gradually while the share of the high-skilled workers rose steadily. The rest of the chapter examines the drivers of these developments, both at a theoretical and empirical level.

A first result of the analysis is that the labour income share is not an invariant variable which is solely determined by the parameters of the production technology – as is predicted by the (basic) neo-classical growth model, but that capital deepening, technological progress, globalisation, labour and product market institutions and policies can have a significant impact on its evolution.

Another important result is that economic variables can have a significant different impact on the income share of the skilled and unskilled workers, and that the degree of substitution between the different production factors is at the heart of a clear understanding of the direction in which a change in an economic variable affects the labour income share. For instance, events that push up wages will lower the labour income share if the elasticity of substitution between labour and capital is high, and they will increase the labour income share if the substitution elasticity is low[64]. This insight is of particular interest when we look at the evolution of the income shares at the level of the different skill types, as it is found that capital and new technologies tend to substitute for low-skilled workers and tend to complement high-skilled workers.

A last major finding is that, for the period for which the data is available (i.e. from the mid-1980s to early 2000s), the estimation results clearly indicate that technological progress made the largest contribution to the fall in the aggregate labour income share, but that this loss was unevenly spread over the different skill types as the high-skilled workers were able to increase their share while the low-skilled workers lost income share as a result of technological progress. Globalisation also had a negative impact on the aggregate labour income share but to a lesser extent than technological progress, and its impact was primarily on the medium-skilled workers.

Following the insights of the theoretical and empirical analysis of this chapter, it is clear that in order to address any adverse developments in the distribution of gross domestic product between capital and labour and between the different skill types of labour, policy-makers have to vigorously pursue a well-balanced policy package. Macro-economic polices should be oriented towards stability and growth so that an economic environment is created that contributes to further capital deepening and technological progress. However, in order to realise the potential of the knowledge-based economy it is imperative that these policies are complemented by labour market polices that take into account the different responses of the different skill types, and, most importantly, by policies that a) allow the low-skilled to progress to a higher skill level so that the adverse effects, which stem from their high degree of substitutability with capital, can be mitigated, and b) address, at the same time, the social needs of the workers during this period of adjustment by providing them, for example, one-off, time-limited individual support that goes beyond passive measures[65].

In this context, policies based on flexicurity principles should be seen as the way forward to promote a fairer sharing of the returns from economic activity in the face of rapid technological progress and globalisation, without compromising on the issues of efficiency and stability.[66] Indeed, some degree of employment flexibility within a secure context should facilitate the creation of new jobs and the destruction of unproductive jobs, and facilitate the swift progression of workers to better rewarding jobs rather than keeping them trapped in low-skilled jobs, the income share of which is adversely impacted by capital deepening and technological progress.

64 This statement has to be qualified once we start to consider measures that drive a wedge between wages and the marginal productivity of labour.

65 At EU level, the European Globalisation Adjustment Fund (EGF) is a financial instrument aimed at cushioning the adverse effects of globalisation by providing one-off, time-limited individual support to workers who are severely and personally affected by globalisation-related redundancies. The EGF seeks to complement support provided by the employers and national authorities of the different Member States to workers in the form of job-search assistance, occupational guidance, tailor-made training and re-training, including IT skills and certification of acquired experience, outplacement assistance and entrepreneurship promotion or aid for self-employment, special time-limited measures, such as job-search allowances, mobility allowances or allowances to individuals participating in lifelong learning and training activities, measures to stimulate in particular disadvantaged or older workers, and measures to remain in or return to the labour market. For more details on the European Globalisation Adjustment Fund, see http://ec.europa.eu/employment_social/egf/index_en.html

66 See the recent EC Communication *Towards common principles of flexicurity: More and better jobs through flexibility and security* available at http://ec.europa.eu/employment_social/emplweb/news/news_en.cfm?id=263

Annex A – The data

Several sources were used to construct the database of this chapter.

The following variables were retrieved from the AMECO database (when available)[67]:

- adjusted labour income share, total economy (% GDP at market prices): ALCD0
- compensation of employees, total economy: UWCD
- total employment, persons: NETD
- employees, persons: NWTD
- gross domestic product at current market prices: UVGD
- net capital stock at 2000 prices, total economy: OKND
- exports of goods and services (national accounts) in current prices: UXGS
- imports of goods and services (national accounts) in current prices: UMGS
- total factor productivity: ZVGDF.

The following variables were retrieved (where available) from the EU KLEMS database[68]:

- high-skilled labour compensation (share in total labour compensation) LABHS
- medium-skilled labour compensation (share in total labour compensation) LABMS
- low-skilled labour compensation (share in total labour compensation) LABLS
- ICT-capital services, volume indices 1995 = 100, CAPIT_QI.

The policy variables are from different sources and are readily available in the Bassanini and Duval (2006) database, (B-D)[69]:

- The employment protection legislation indicator measures the strictness of employment protection legislation and allows for meaningful cardinal comparisons over time and across countries. The value of the EPL indicator ranges from 0 to 6, with a low score indicating a low level of labour market regulation. Variable EPL in B-D, see also OECD (2004).
- The product market regulation indicator measures regulatory impediments to product market competition in seven non-manufacturing industries (passenger air transport, railways passenger and freight services, road freight, gas, electricity, post and telecom). The value of the PMR indicator ranges between 0 and 6, with a low value indicating a low level of product market regulation. Variable REGREF in B-D, see also Conway et al. (2006).
- The unemployment replacement ratio measures the average of the unemployment benefit replacement rates covering two income groups (i.e. 100% and 67% of the average production worker earnings), three family types (i.e. single, with dependent spouse, with spouse in work), and three unemployment durations (i.e. first year, second and third years, and fourth and fifth years of unemployment). Variable ARR in B-D, see also the OECD Benefits and Wages Database.
- Trade union density measures the share of workers affiliated to a trade union. Variable UNDENS in B-D, see also OECD (2004).
- The tax wedge covers the wedge, expressed as a percentage of total labour cost, between the labour cost to the employer and the corresponding net take-home pay of the employee for a single-earner couple with two children receiving the average production worker wage. Variable TWCOUP in B-D, see also the OECD Taxing Wages Database.
- The expenditures on active labour market policies cover outlays for public employment services (PES) (placement, counselling and vocational guidance, job-search courses, assistance with displacement costs, administration of unemployment benefits, etc.), training (including unemployed adults and those at risk, and training for employed adults), youth measures (including special programmes concerning measures for unemployed and disadvantaged youth, support of apprenticeship and related forms of general youth training), subsidised employment and meas-

67 Available at http://ec.europa.eu/economy_finance/indicators/annual_macro_economic_database/ameco_en.htm

68 Available at www.euklems.net

69 Available at www.oecd.org/els/workingpapers See WP 35 in the list of working papers.

ures for the disabled. Here these expenditures are calculated per unemployed person and, in order to ensure cross-country comparability, this indicator is expressed as a percentage of GDP per capita. Variable ALMPU in B-D.

- The (statutory) minimum wages is measured as the ratio of statutory minimum wage to median wage. Reliable minimum wage series exist only for countries where minimum wages are statutory; countries with statutory minimums during the whole sample period are Belgium, France, Japan, the Netherlands, Spain and the United States. Variable RMINMED1 in B-D.

The openness of the economy is measured as the sum of exports plus imports divided by gross domestic product.

Trend labour income share is obtained by applying a Hodrick-Prescott filter to the historical series, with the smoothing parameter set equal to 100. The cyclical movement in the labour share is calculated by subtracting the trend labour income share from the historical series.

Data for Germany before re-unification have been extrapolated, based on data for West Germany using the information for the years when an overlap in the series for Germany and West Germany was available.

Annex B – Some basic analytical results on the labour income share

This annex recalls some basic analytical results regarding the determination of the labour income share. The emphasis of this annex is on presentational clarity rather than academic rigor. Readers who want to learn more about the technical details are referred to the papers listed in the reference section.

After defining the elasticity of substitution between labour and capital, some analytical results regarding the labour income share are derived. These results illustrate the importance of the size of the elasticity of substitution in order to gauge the impact of a change in one of the drivers of the labour income share. First some general results are derived in the context of perfect competition in the goods and labour market. Next, it is investigated as to how imperfect competition in the goods and labour market affect the labour income share. Table B.1 summarises the main qualitative results.

Table B.1: **Effects of an exogenous change in selected variables on the labour income share – summary**

	Capital-labour substitution elasticity			Equation
	$\sigma<1$	$\sigma>1$	$\sigma=1$	
Capital-to-labour ratio	+	-	0	B.12
Labour-augmenting technological progress	-	+	0	B.13
Real wage	+	-	0	B.16
Minimum wage (binding)	+	+	+	
User cost of capital	-	+	0	B.18
Product market regulation	-/+	-	-	B.29
Employment adjustment costs	-	-	-	B.33

B.1 The elasticity of substitution

The elasticity of substitution, σ, measures the percentage change in factor proportions due to a change in the marginal rate of technical substitution, i.e.

$$\text{(B.1)}\quad \sigma = \frac{d\ln\left(\frac{L}{K}\right)}{d\ln\left(\frac{f_K}{f_L}\right)} \geq 0,$$

where f_L and f_K are the first derivatives w.r.t. labour and capital of the production function f(L,K)[70].
Depending on the specific nature of the production function, the elasticity of substitution can take some specific values:

$\sigma=0$ in the case of no substitution (i.e. if Leontief production technology)
$\sigma=\infty$ in the case of perfect substitution (i.e. if no declining marginal factor productivity), and
$\sigma=1$ in the case of a Cobb-Douglas production function.

70 The elasticity of substitution is non-negative provided the production function is a quasi-concave function.

B.2 The labour income share

A widely used production function is the Constant Elasticity of Substitution (CES) production function, which reads as:

$$\text{(B.2)}\quad Q=\left[\alpha(AL)^{-\rho}+(1-\alpha)(BK)^{-\rho}\right]^{-\frac{1}{\rho}}$$

where A and B are indices of productive efficiency, while ρ is the substitution parameter and α is the distribution parameter. For the parameters of this production function it holds that $-1<\rho<\infty$ and that $0<\alpha<1$. Labour- and capital-augmenting technical progress is measured by an increase in respectively A and B[71].

For the CES production function, the elasticity of substitution between capital and labour, σ, is found to be[62]:

$$\text{(B.3)}\quad \sigma=\frac{1}{1+\rho}>0$$

Assume that firms are price takers in the factor market, paying the nominal wage rate, W, and the nominal user cost, USER, and price takers in the goods market, receiving a price, P, for their output, Q. Profit maximisation gives then the first order conditions[73] :

$$\text{(B.4)}\quad \frac{W}{P}=\frac{\partial Q}{\partial L}=\alpha A^{-\rho}\left(\frac{Q}{L}\right)^{1+\rho}$$

and

$$\text{(B.5)}\quad \frac{USER}{P}=\frac{\partial Q}{\partial K}=(1-\alpha)B^{-\rho}\left(\frac{Q}{K}\right)^{1+\rho}$$

Equations (B.4) and (B.5) allow writing the labour income share, LS, and capital income share, CS, as[64]:

$$\text{(B.6)}\quad LS=\left(\frac{W}{P}\right)\frac{L}{Q}=\left(\frac{\partial Q}{\partial L}\right)\frac{L}{Q}=\alpha A^{-\rho}\left(\frac{Q}{L}\right)^{1+\rho}\frac{L}{Q}=\alpha\left(\frac{Q}{AL}\right)^{\rho}=\alpha\left(\frac{Q}{AL}\right)^{\frac{1-\sigma}{\sigma}}$$

and

$$\text{(B.7)}\quad CS=\left(\frac{USER}{P}\right)\frac{K}{Q}=\left(\frac{\partial Q}{\partial K}\right)\frac{K}{Q}=(1-\alpha)B^{-\rho}\left(\frac{Q}{K}\right)^{1+\rho}\frac{K}{Q}=(1-\alpha)\left(\frac{Q}{BK}\right)^{\rho}=(1-\alpha)\left(\frac{Q}{BK}\right)^{\frac{1-\sigma}{\sigma}}$$

71 We make the distinction between labour- and capital-augmenting technological progress for analytical reasons. In empirical applications, the inclusion of both labour- and capital-augmenting technological progress poses problems of identification. Labour-augmenting technological progress is usually assumed in the literature. See Barro and Sala-i-Martin (1995).

72 Indeed, note that $\frac{\partial Q}{\partial L}=\alpha A^{-\rho}\left(\frac{Q}{L}\right)^{1+\rho}$ and $\frac{\partial Q}{\partial K}=(1-\alpha)B^{-\rho}\left(\frac{Q}{K}\right)^{1+\rho}$ so that

$$\frac{\left(\frac{\partial Q}{\partial L}\right)}{\left(\frac{\partial Q}{\partial K}\right)}=\frac{\alpha}{1-\alpha}\left(\frac{A}{B}\right)^{-\rho}\left(\frac{K}{L}\right)^{1+\rho}\quad\text{or}\quad\left(\frac{K}{L}\right)=\left(\frac{1-\alpha}{\alpha}\right)^{\frac{1}{1+\rho}}\left(\frac{A}{B}\right)^{\frac{\rho}{1+\rho}}\left[\frac{\left(\frac{\partial Q}{\partial L}\right)}{\left(\frac{\partial Q}{\partial K}\right)}\right]^{\frac{1}{1+\rho}}$$

73 Whereby it should be noted that equation (B.2) can be rewritten as:

$$Q^{-\rho}=\alpha(AL)^{-\rho}+(1-\alpha)(BK)^{-\rho}$$

Which reads on total differentiating as:

$$-\rho\, Q^{-\rho-1}dQ=-\rho\,\alpha A^{-\rho}L^{-\rho-1}dL-\rho(1-\alpha)B^{-\rho}K^{-\rho-1}dK$$

74 Using $\sigma=\frac{1}{1+\rho}$ so that $\rho=\frac{1-\sigma}{\sigma}$.

In the case of a Cobb-Douglas production function, i.e. $\sigma = 1$, equations (B.6) and (B.7) reduce to the following:

$$\text{(B.8)} \quad LS = \alpha$$

and

$$\text{(B.9)} \quad CS = (1-\alpha)$$

Equation (B.8) shows that in the case of a unitary elasticity of substitution the labour income share is constant[75]. Checking the adding-up condition for the shares (B.6) and (B.7) yields[76]:

$$\text{(B.10)} \quad LS + CS = \alpha\left(\frac{Q}{AL}\right)^{\rho} + (1-\alpha)\left(\frac{Q}{BK}\right)^{\rho} = Q^{\rho}\left[\alpha(AL)^{-\rho} + (1-\alpha)(BK)^{-\rho}\right] = Q^{\rho}Q^{-\rho} = 1$$

B.3 Factor endowments and the labour income share

Using equations (B.2) and (B.6) the labour income share can be written in terms of the capital-labour ratio as:

$$\text{(B.11)} \quad LS = \alpha\left(\frac{Q}{AL}\right)^{\rho} = \alpha\left(\frac{\left[\left[\alpha(AL)^{-\rho} + (1-\alpha)(BK)^{-\rho}\right]^{\frac{1}{\rho}}\right]}{AL}\right)^{\rho} = \alpha\left[\alpha + (1-\alpha)\left(\frac{BK}{AL}\right)^{-\rho}\right]^{-1} = \alpha\left[\alpha + (1-\alpha)\left(\frac{BK}{AL}\right)^{\frac{\sigma-1}{\sigma}}\right]^{-1}$$

$$= \frac{\alpha\left(\frac{BK}{AL}\right)^{\frac{1-\sigma}{\sigma}}}{\alpha\left(\frac{BK}{AL}\right)^{\frac{1-\sigma}{\sigma}} + (1-\alpha)}$$

The effect of a change in the capital-labour ratio on the labour income share is then equal to:

$$\text{(B.12)} \quad \frac{\partial LS}{\partial(K/L)} = \rho\alpha(1-\alpha)\left(\frac{Q}{AL}\right)^{2\rho}\left(\frac{B}{A}\right)^{-\rho}\left(\frac{K}{L}\right)^{-\rho-1} = \left(\frac{1-\sigma}{\sigma}\right)\alpha(1-\alpha)\left(\frac{Q}{AL}\right)^{2\left(\frac{1-\sigma}{\sigma}\right)}\left(\frac{BK}{AL}\right)^{-\left(\frac{1-\sigma}{\sigma}\right)}\left(\frac{K}{L}\right)^{-1} \begin{array}{ll} > 0 & \text{if } \sigma < 1 \\ < 0 & \text{if } \sigma > 1 \end{array}$$

and the effect of a change in the labour-augmenting productivity on the labour income share is equal to:

$$\text{(B.13)} \quad \frac{\partial LS}{\partial A} = \left(\frac{\sigma-1}{\sigma}\right)\alpha(1-\alpha)\left(\frac{Q}{AL}\right)^{2\left(\frac{1-\sigma}{\sigma}\right)}\left(\frac{BK}{AL}\right)^{-\left(\frac{1-\sigma}{\sigma}\right)}A^{-1} \begin{array}{ll} > 0 & \text{if } \sigma > 1 \\ < 0 & \text{if } \sigma < 1 \end{array}$$

Equation (B.11) allows us also to assess the impact of a change in the employment level, e.g. as a result of a transition from unemployment to employment, i.e.

$$\text{(B.14)} \quad \frac{\partial LS}{\partial L} = \left(\frac{\sigma-1}{\sigma}\right)\alpha(1-\alpha)\left(\frac{Q}{AL}\right)^{2\left(\frac{1-\sigma}{\sigma}\right)}\left(\frac{BK}{AL}\right)^{-\left(\frac{1-\sigma}{\sigma}\right)}L^{-1} \begin{array}{ll} > 0 & \text{if } \sigma > 1 \\ < 0 & \text{if } \sigma < 1 \end{array}$$

75 In empirical applications, this constancy of the labour share could be formulated as $LS_t = LS + u_t$ where u_t is a white noise random variable.

76 No indirect taxes minus subsidies are assumed.

B.4 Factor prices and the labour income share

Equation (B.4) allows writing the labour income share as a function of the real wage, i.e.:

$$\text{(B.15)}\quad LS = \frac{WL}{PQ} = \alpha^{\frac{1}{1+\rho}} A^{\frac{\rho}{1+\rho}} \left(\frac{W}{P}\right)^{\frac{\rho}{1+\rho}} = \alpha^{\sigma}\left(\frac{W}{P}\,\frac{1}{A}\right)^{(1-\sigma)}$$

The effect of a change in the real wage on the labour income share rate is then equal to:

$$\text{(B.16)}\quad \frac{\partial LS}{\partial (W/P)} = (1-\sigma)\ \alpha^{\sigma} A^{-(1-\sigma)}\left(\frac{W}{P}\right)^{-\sigma} \begin{array}{ll} > 0 & \text{if } \sigma < 1 \\ < 0 & \text{if } \sigma > 1 \end{array}$$

Similarly, one can derive from equation (B.5) that the capital share can be written in terms of the user cost of capital as:

$$\text{(B.17)}\quad CS = \frac{K\ USER}{PQ} = (1-\alpha)^{\frac{1}{1+\rho}} B^{\frac{\rho}{1+\rho}} \left(\frac{USER}{P}\right)^{\frac{\rho}{1+\rho}} = (1-\alpha)^{\sigma}\left(\frac{USER}{P}\,\frac{1}{B}\right)^{(1-\sigma)}$$

implying that a change in the user cost of capital has the following effect on the labour income share[77]:

$$\text{(B.18)}\quad \frac{\partial LS}{\partial (USER/P)} = (\sigma-1)\ (1-\alpha)^{\sigma} B^{-(1-\sigma)}\left(\frac{USER}{P}\right)^{-\sigma} \begin{array}{ll} > 0 & \text{if } \sigma > 1 \\ < 0 & \text{if } \sigma < 1 \end{array}$$

B.5 Imperfect competition in the goods market and the labour share

This section examines how imperfect competition in the goods market affects the labour income share.

Assume that there are N firms, i = 1, ….N, and that the production technology of firm i is in equation (B.2). Nominal wages, W, and the user cost, R, are given for each firm. Each firm faces a downward sloping demand function for its output, characterised by:

$$\text{(B.19)}\quad Q_i^d = AD\left(\frac{P_i}{P}\right)^{\eta}$$

where Q_i^d is demand for the output of firm i, AD is total real income, P_i is the price of output i, P is the general price level. The demand elasticity exceeds unity (in absolute terms), i.e. $\eta < -1$.

Firms choose the input mix and output prices in order to maximise their profits. Output prices are set with a view to clear the goods market, i.e. $Q_i^d = Q$. Profit maximisation implies then that:

$$\text{(B.20)}\quad \frac{\partial Q_i}{\partial L} = \frac{\eta}{1+\eta}\ \frac{W}{P_i}$$

$$\text{(B.21)}\quad \frac{\partial Q_i}{\partial K} = \frac{\eta}{1+\eta}\ \frac{USER}{P_i}$$

From equation (B.20), it follows that prices are set above the unit labour cost as:

$$\text{(B.22)}\quad P_i = \frac{\eta}{1+\eta}\frac{W}{\left(\frac{\partial Q_i}{\partial L}\right)} = \pi\frac{W}{\left(\frac{\partial Q_i}{\partial L}\right)}$$

with the price mark-up $\pi = \frac{\eta}{1+\eta} > 1$. The lower the competition in the goods market, the higher the value of π.

77 Remember that LS = 1 – CS.

Using equation (B.20), the labour income share can be written as:

$$\text{(B.23)} \quad LS = \frac{W\,L}{PQ} = \frac{1}{\pi}\left(\frac{\partial Q}{\partial L}\right)\frac{L}{Q} = \frac{1}{\pi}\alpha\left(\frac{Q}{A\,L}\right)^{\frac{1-\sigma}{\sigma}}$$

and the capital share as:

$$\text{(B.24)} \quad CS = \left(\frac{USER}{P}\right)\frac{K}{Q} = \frac{1}{\pi}\left(\frac{\partial Q}{\partial K}\right)\frac{K}{Q} = \frac{1}{\pi}(1-\alpha)\left(\frac{Q}{B\,K}\right)^{\frac{1-\sigma}{\sigma}}$$

Comparing equation (B.23) with equation (B.6) for the case of perfect competition in the goods market, the labour income share now also depends on the firm's scope to generate rents in the goods market.

Two remarks should be made here. First, note that in the case of imperfect competition:

$$\text{(B.25)} \quad LS + CS = \frac{1}{\pi}\alpha\left(\frac{Q}{A\,L}\right)^{\frac{1-\sigma}{\sigma}} + \frac{1}{\pi}(1-\alpha)\left(\frac{Q}{B\,K}\right)^{\frac{1-\sigma}{\sigma}} = \frac{1}{\pi}$$

i.e. $\left(1-\frac{1}{\pi}\right)$ measures the share of profits in total revenues. In the case of perfect competition in the labour market these profits accrue to the owners of the firm (by assumption also the owners of the capital).

Second, in the case that $\sigma = 1$, i.e. a Cobb-Douglas production technology, we get the labour share reduced to:

$$\text{(B.26)} \quad LS = \frac{1}{\pi}\alpha$$

and

$$\text{(B.27)} \quad CS = \frac{1}{\pi}(1-\alpha)$$

so that an increase in the mark-up, i.e. less competition in the goods market, always leads to a lower income share, i.e. :

$$\text{(B.28)} \quad \frac{\partial \ln(LS)}{\partial \pi} = -\frac{1}{\pi} < 0$$

Noting that in equilibrium Q_i^d = Q and that $\eta = \frac{\pi}{1-\pi} < -1$, equation (B.23) allows us to derive the impact of a change in the mark-up π for the case that $\sigma \neq 1$, i.e.:

$$\text{(B.29)} \quad \frac{\partial \ln(LS)}{\partial \pi} = \frac{\partial\left[-\ln(\pi) + \ln(\alpha) - \frac{1-\sigma}{\sigma}\ln\left(\frac{AD}{A\,L}\right) + \frac{\pi}{1-\pi}\frac{1-\sigma}{\sigma}\ln\left(\frac{P_i}{P}\right)\right]}{\partial \pi} = -\frac{1}{\pi} + \left[\frac{1}{1-\pi} + \frac{\pi}{(1-\pi)^2}\right]\frac{1-\sigma}{\sigma}\ln\left(\frac{P_i}{P}\right)$$

$$= -\frac{1}{\pi} + \frac{1-\sigma}{\sigma}\left[\frac{1}{1-\pi}\right]\left[\frac{1}{1-\pi}\ln\left(\frac{P_i}{P}\right)\right] = -\frac{1}{\pi} + \frac{1-\sigma}{\sigma}\left[\frac{1}{1-\pi}\right] w \qquad < 0 \quad \text{if } \sigma > \frac{\pi\,w}{1+\pi\,w-\pi} = \frac{\eta\,w}{1+\eta\,w}$$

$$> \quad \text{if } \sigma < \frac{\pi\,w}{1+\pi\,w-\pi} = \frac{\eta\,w}{1+\eta\,w}$$

where use has been made of equation (B.19) to define the logarithm of the share[78]:

$$w = \ln\left(\frac{Q_i}{AD}\frac{P_i}{P}\right) = (\eta+1)\ln\left(\frac{P_i}{P}\right) = \left(\frac{\pi}{1-\pi}+1\right)\ln\left(\frac{P_i}{P}\right) = \left(\frac{1}{1-\pi}\right)\ln\left(\frac{P_i}{P}\right) \leq 0$$

B.6 Imperfect competition in the labour market and the labour share

Here we derive some stylised results in the context of a simple model with imperfect competition in the labour market. First we have a look at the impact of adjustment costs in labour demand on the labour income share. Next we have a look at the impact of a change in the bargaining power on the labour income share.

B.6.1 Labour costs

For analytical clarity, assume that in each period all labour has to be re-hired and that this happens at a cost proportional to the wage so that the total labour cost is equal to

W C L with $c \geq 1$

The first order conditions under profit maximisation read then as[79]:

$$\text{(B.30)} \quad \frac{W}{P} = \frac{1}{C}\frac{\partial Q}{\partial L} = \frac{1}{C}\alpha A^{-\rho}\left(\frac{Q}{L}\right)^{\frac{1}{\sigma}}$$

$$\text{(B.31)} \quad \frac{USER}{P} = \frac{\partial Q}{\partial K} = (1-\alpha) B^{-\rho}\left(\frac{Q}{K}\right)^{\frac{1}{\sigma}}$$

The labour share is then equal to:

$$\text{(B.32)} \quad LS = \frac{W\,L}{PQ} = \frac{1}{C}\left(\frac{\partial Q}{\partial L}\right)\frac{L}{Q} = \frac{1}{C}\alpha\left(\frac{Q}{A\,L}\right)^{\frac{1-\sigma}{\sigma}}$$

The effect of a change in the labour adjustment cost is then found to be:

$$\text{(B.33)} \quad \frac{\partial LS}{\partial C} = -\frac{1}{C^2}\alpha\left(\frac{Q}{A\,L}\right)^{\frac{1-\sigma}{\sigma}} = -\frac{1}{C}LS < 0$$

78 Furthermore note that $-\frac{1}{\pi}+\frac{1-\sigma}{\sigma}\left[\frac{1}{1-\pi}\right] w < 0$ if $\frac{1-\sigma}{\sigma}\left[\frac{\pi}{1-\pi}\right] w < 1$ or if $\frac{1-\sigma}{\sigma} < \frac{1-\pi}{\pi w}$

or if $\frac{1}{\sigma} < \frac{1+\pi w-\pi}{\pi w}$ or if $\frac{\pi w}{1+\pi w-\pi} < \sigma$ or if $\sigma > \frac{\eta w}{1+\eta w}$ as $\pi = \frac{\eta}{1+\eta}$

79 No adjustment costs for capital are assumed.

B.6.2 Wage bargaining

Let workers and the employers bargain over the wage in a non-cooperative way, the wage is then of the form:

$$\text{(B.34)} \quad \frac{W}{P} = \gamma \frac{Q}{L} + (1-\gamma)\ \text{RESW}$$

where RESW is the reservation wage and the parameter $0 \le \gamma \le 1$, measures the bargaining power of the workers. (Cahuc and Zylberberg, 2004). When the workers have all the bargaining power, i.e. $\gamma = 1$, then total production Q is appropriated by the workers. When the workers have no bargaining power, i.e. $\gamma = 0$, the wage is equal to the reservation wage. The wage is a weighted average of the total product per employee and the reservation weight for a value for $\gamma = 1$, between 0 and 1.

Using equation (B.34) the labour income share can be written as:

$$\text{(B.35)} \quad LS = \frac{W\,L}{PQ} = \left(\gamma \frac{Q}{L} + (1-\gamma)\ \text{RESW}\right)\frac{L}{Q} = \gamma + (1-\gamma)\frac{\text{RESW}\ \ L}{Q}$$

which shows that

$$\text{(B.36)} \quad LS = 1 \quad \text{if} \quad \gamma = 1$$

and

$$\text{(B.37)} \quad LS = \frac{\text{RESW}\ \ L}{Q} \quad \text{if} \quad \gamma = 0$$

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