

Darvas, Zsolt

Research Report

Compositional effects on productivity, labour cost and export adjustments

Bruegel Policy Contribution, No. 2012/11

Provided in Cooperation with:

Bruegel, Brussels

Suggested Citation: Darvas, Zsolt (2012) : Compositional effects on productivity, labour cost and export adjustments, Bruegel Policy Contribution, No. 2012/11, Bruegel, Brussels

This Version is available at:

<https://hdl.handle.net/10419/72099>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

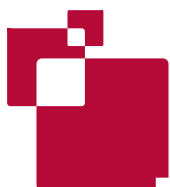
COMPOSITIONAL EFFECTS ON PRODUCTIVITY, LABOUR COST AND EXPORT ADJUSTMENTS

ZSOLT DARVAS

Highlights

- Sectoral shifts, such as shrinkage of low labour productivity and the low-wage construction sector, can lead to apparent increased aggregate average labour productivity and average wages, especially when capital intensity differs across sectors.
- For 11 main sectors and 13 manufacturing sub-sectors, we quantify the compositional effects on productivity, wages and unit labour costs (ULCs) based on real effective exchange rates (REER), for 24 EU countries.
- Compositional effects are greatest in Ireland, where the pharmaceutical sector drives the growth of output and productivity, but other sectors have suffered greatly and have not yet recovered.
- Our new ULC-REER measurements, which are free from compositional effects, correlate well with export performance.
- Among the countries facing the most severe external adjustment challenges, Lithuania, Portugal and Ireland have been the most successful based on five indicators, and Latvia, Estonia and Greece the least successful.
- There is evidence of downward wage flexibility in some countries, but wage cuts have corrected just a small fraction of pre-crisis wage rises and came with massive reductions in employment even in the business sector excluding construction and real estate, highlighting the difficulty of adjusting wages downward.

Zsolt Darvas (zsolt.darvas@bruegel.org) is a Research Fellow at Bruegel. Thanks are due to Dana Andreicut for excellent research assistance, Guntram Wolff for comments, and Alan Ahearne, Derry O'Brien, Fergal O'Brien and Philip Lane for valuable insights into the interpretation of Irish developments.



COMPOSITIONAL EFFECTS ON PRODUCTIVITY, LABOUR COST AND EXPORT ADJUSTMENTS

ZSOLT DARVAS, JUNE 2012

IN COUNTRIES FACING SEVERE MACROECONOMIC ADJUSTMENTS, domestic demand is typically constrained by fiscal adjustments, deleveraging of the private sector and limited credit supply. Under such circumstances exports should play a major role in the adjustment process. This necessitates improvements in competitiveness, which was generally lost during the good years before the crisis in those countries that face the most severe adjustment challenges.

Competitiveness could be improved through price and non-price factors. The main tools to improve non-price competitiveness are structural reforms, education, innovation and corporate governance improvements. Such improvements are indispensable in most countries, but take time.

Price (or cost) competitiveness can be improved through a depreciation of the real effective exchange rate (REER), which is usually measured by the unit labour cost (ULC) based REER. In turn, REER depreciation can occur through productivity improvements, nominal wage reductions, nominal effective exchange rate (NEER) depreciations and the ULC increases of trading partners. Domestic policymakers have no impact on the last item, and a severely limited one, if any, on the NEER. Therefore, productivity and the nominal wage should play a crucial role in the adjustment. Indeed, in some countries, such as Ireland, significant productivity improvements have occurred since the onset of the crisis, though average wage reductions were limited. The Irish ULC-REER, as measured by Eurostat against 36 trading partners, depreciated by 19 percent from 2008Q1 to 2011Q4, and by 17 percent against euro-area partners, which is influenced only by wage and productivity developments but not the nominal exchange rate.

However, based on Central Bank of Ireland (2011), Krugman (2011) has highlighted that composi-

tional changes may lie behind the fall in Irish unit labour costs. The Central Bank of Ireland's (2011) calculation indicated that about half of the decline in the Irish business sector average ULC relative to trading partners was related to compositional changes. The reason for this is that if, for example, low-wage and low-productivity construction workers are laid off in large numbers while high-productivity manufacturing workers keep their jobs, then both average wage and average productivity go up, even if there is no wage increase or productivity gain in any individual sector. With regard to ULC, the impact of compositional changes on productivity and wages can offset each other, yet Central Bank of Ireland (2011) found that the overall impact of compositional changes on Irish ULC was sizeable. This may relate to the very high capital intensity of certain Irish manufacturing sub-sectors.

While such compositional changes may blur the assessment of the genuine improvement in competitiveness, such changes are not 'bad' *per se*. For example, it is a benign development if high-productivity sectors grow faster than low-productivity sectors. But quantifying these compositional changes is crucial for assessing the adjustment that countries have achieved since the onset of the crisis and so that lessons from successful adjustments can be learned.

In this Policy Contribution, we assess the importance of the impact of sectoral changes on average labour productivity considering 11 main sectors and 13 manufacturing sub-sectors¹, in order to:

- Quantify the compositional effect on measured average productivity, average hourly labour compensation, unit labour costs and ULC-REERs;
- Calculate a new measure of ULC-REER, which is free from compositional effects, for the

1. In addition to compositional changes in various sectors, many other compositional changes can also occur. For example, if a firm hires young employees, then the average wage at the firm, as well as average labour productivity, can decline. In our paper we only consider the impacts of compositional changes resulting from changes in the composition of sectors.

- business sector excluding construction, real estate activities and agriculture;
- Calculate a new measure of ULC-REER for certain sectors, such as manufacturing;
 - Relate export performance since the onset of the crisis to various measures of REER;
 - Study the components of the ULC-REER and rank countries according to their success in adjusting.

We include 24 EU countries (Cyprus, Luxembourg and Malta are excluded due to missing data) for the period 2000Q1-2011Q4, although sectoral data for Romania is available only since 2008Q1.

In the next section we use the example of Ireland to describe our methodology, followed, in the third section, by the assessment of the compositional effect on average productivity, average hourly labour costs, and ULC-based REER for all countries in the sample. In the fourth section, we assess the

relationship between export performance and REERs. This is followed in the fifth section by the study of the components of ULC-REER changes, and a ranking of the countries according to their success in adjusting. Finally, we briefly conclude. The background paper to this publication (Darvas, 2012b) discusses the methodology and data sources in more detail and presents results for all 24 EU countries that we consider. The ULC-based REERs calculated in this paper are added to the dataset of Darvas (2012a), which is available at <http://www.bruegel.org/publications/publication-detail/publication/716-real-effective-exchange-rates-for-178-countries-a-new-database/> and will be irregularly updated.

THE IRISH EXAMPLE

We use data on 11 main sectors of the economy and 13 manufacturing sub-sectors (Tables 1 and 2). In addition to the total economy, we consider

Table 1: The 11 main sectors and their 2010 shares, labour productivity and compensation

Code	Business sector w.o. A.C.R.	Description	EU27				Ireland			
			GVA share (% of total)	Employment share (% of total)	GVA/employee (€000s per year)	Labour comp./employee (€000s per year)	GVA share (% of total)	Employment share (% of total)	GVA/employee (€000s per year)	Labour comp./employee (€000s per year)
A		Agriculture, forestry and fishing	1.7	5.4	15	4	1.7	4.6	29	6
C	X	Manufacturing	15.0	14.4	58	32	25.8	11.5	172	40
B,D,E	X	Industry ex. manufacturing, construction	3.9	1.6	122	38	2.3	1.7	105	46
F		Construction	6.4	7.1	44	24	3.2	6.5	37	34
G-I	X	Wholesale and retail trade, transport, accommodation and food service activities	19.1	24.3	39	22	14.8	26.2	43	29
J	X	Information and communication	4.7	2.7	84	45	2.6	3.0	50	46
K	X	Financial and insurance	5.8	2.7	104	55	10.4	5.0	159	65
L		Real estate	10.6	0.0	525	24	7.8	0.5	1168	27
M-N	X	Professional, scientific and technical activities; administrative and support services	9.9	11.3	43	26	8.7	8.7	77	30
O-Q		Public administration, defence, education, human health and social work activities	19.5	23.3	41	33	20.2	26.3	59	50
R-U	X	Arts, entertainment, recreation; other services; activities of households and extra-territorial organisations and bodies	3.5	6.2	28	17	2.5	5.0	38	25
		Total (All NACE activities)	100.0	100.0	49	27	100.0	100.0	76	38

Note: Business sector w.o. A.C.R. = Business sector excluding agriculture, construction and real estate activities. The category 'Other industry: Industry except manufacturing and construction' is calculated by us by subtracting 'Manufacturing' from 'Industry (except construction)', for which data is directly available from Eurostat and therefore this is the aggregate of B: Mining and quarrying; D: Electricity, gas, steam and air conditioning supply; and E: Water supply, sewerage, waste management and remediation. The shares in gross value added (GVA) were calculated on the basis of current price values. Total labour compensation is reported, which consists of: (a) gross wages and salaries paid in cash; (b) direct remuneration (pay) and bonuses; and (c) wages and salaries in kind (housing, company cars, meal vouchers, etc).

Table 2: The 13 manufacturing sub-sectors and their 2010 shares, labour productivity and compensation

Code	Short name for figures	Description	EU27				Ireland			
			GVA share (% of total)	Employment share (% of total)	GVA/employee (€000s per year)	Labour comp./employee (€000s per year)*	GVA share (% of total)	Employment share (% of total)	GVA/employee (€000s per year)	Labour comp./employee (€000s per year)
C10_12	Food	Food products, beverages, tobacco products	13.8	14.5	48	26	17.5	20.8	145	37
C13_15	Cloth	Textiles, apparel, leather & related products	4.0	7.2	29	18	0.5	3.0	29	17
C16_18	Wood	Wood, paper, printing	7.4	8.5	44	28	14.4	8.0	311	54
C19	Chemic/ Pharma	Coke and refined petroleum products	1.3	0.6	112	59	0.1	0.3	48	32
C20		Chemicals and chemical products	7.0	3.9	91	51	3.0	1.4	370	134
C21		Pharmaceutical products & preparations	4.5	1.8	129	53	39.6	15.3	447	29
C22_23	Plastic	Rubber and plastic products and other non-metallic mineral products	9.1	9.2	50	32	2.6	5.2	87	63
C24_25	Metal	Basic metals & fabricated metal products, except machinery and equipment	14.1	15.5	46	31	2.2	8.7	44	32
C26	Electric	Computer, electronic and optical products	4.3	4.4	50	42	11.0	11.9	159	71
C27		Electrical equipment	5.3	4.6	59	37	4.8	0.9	977	175
C28	Machine	Machinery and equipment n.e.c.	10.8	9.6	57	40	2.1	13.1	27	16
C29_30		Motor vehicles, trailers, semi-trailers and other transport equipment	9.4	9.4	51	42	1.1	1.8	99	77
C31_33	Other	Furniture, jewellery, musical instr., toys, repair/installation of machinery & eqpmt	9.0	10.6	43	29	1.2	9.7	21	21
C		Total – manufacturing	100.0	100.0	51	33	100.0	100.0	172	40

Note: * 2009 figures for EU19: for the EU27, labour compensation was not available for manufacturing sub-sectors and therefore we use the aggregate of 19 EU countries for which data was available for 2009 (data was missing for more countries for 2010). The shares in gross value added (GVA) were calculated on the basis of current price values. Total labour compensation is reported, which consists of: (a) gross wages and salaries paid in cash; (b) direct remuneration (pay) and bonuses; and (c) wages and salaries in kind (company products, housing, company cars, meal vouchers, crèches, etc).

the business sector without agriculture, construction and real estate activities (we call this aggregate '*Business sector w.o. A.C.R.*' in the figure legends to save space). As in Darvas and Pisani-Ferry (2011), construction is excluded because it is a highly labour-intensive and low-productivity sector that suffered heavily in some countries and can therefore distort aggregate productivity measures. Since the real estate sector also suffered in some countries and is not really relevant for competitiveness indicators, it is worthwhile to consider an aggregate without it. Agriculture is heavily subsidised and weather-dependent, which motivates our decision to exclude it.

It is interesting to observe that while manufacturing provides a very high share of gross added value in Ireland (25.8 percent), its share of employment is much lower (11.5 percent). As a consequence, annual gross added value per worker is rather high in Ireland: €172,000, while

it is just €58,000 per year in the EU27, where output and employment shares of manufacturing are almost equal (about 15 percent). While average labour productivity is much higher in Ireland, Irish manufacturing workers do not earn much more than their European peers (€40,000 in Ireland compared to €32,000 in the EU27). This suggests that Irish manufacturing is much more capital intensive than the EU average.

Table 2 shows that there are other significant differences within manufacturing. In the biggest Irish sector, pharmaceuticals, which had a 39.6 percent output share within manufacturing in 2010, one worker generated almost half a million euros per year – yet annual labour compensation amounted to €29,000 only. The EU27 average figures are €129,000/year for added value and €53,000 for labour compensation in this sector. There is an even more productive sector in Ireland, electrical equipment (accounting for 4.8 percent of output),

in which each worker generated almost a million euros per year, in contrast to €59,000 in the EU27. The very large differences in average labour productivity figures are again likely explained by differences in capital intensity².

When there are such extreme differences in capital intensity and therefore average labour productivity across sectors, as in Ireland, changes in the composition of the economy can lead to apparent gains in average unit labour costs, even if there is no change in ULC in any individual sector. The reason is that when, for example, a construction worker is laid off but all other workers keep their jobs, both total labour compensation and total output decline. However, the construction worker's compensation was broadly similar to the total economy average in Ireland, but

gross added value per worker was about half of the economy average. Therefore, the average wage remains broadly stable but average output per worker increases for the rest of the economy when a construction worker is laid off, even if there is no productivity gain in any individual sector.

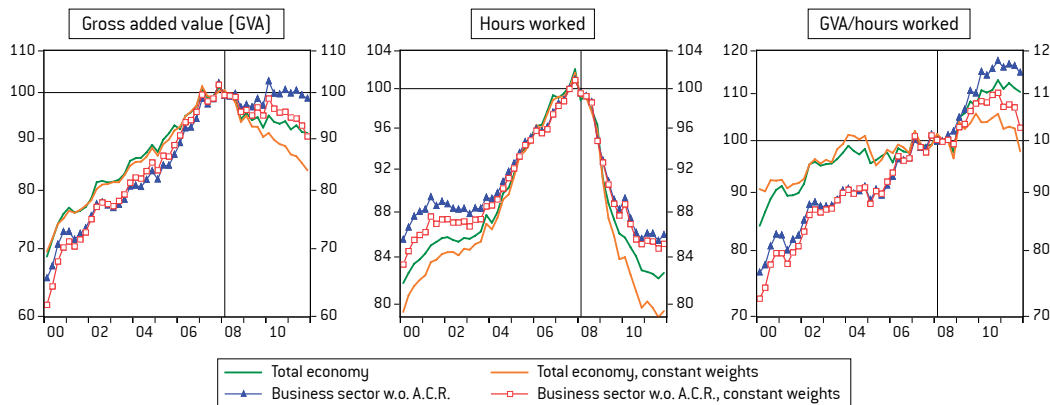
Inspired by Central Bank of Ireland (2011), we quantify the compositional effects by calculating fixed-weight aggregates for various indicators (eg output per worker, average wages, or unit labour costs). We derive the weights of the 13 manufacturing sub-sectors and the weights of the other 10 main sectors of the economy from the 2008Q1 composition of the economy. We also calculate fixed-weight aggregates for the manufacturing sector itself, and for the business sector excluding agriculture, construction and real estate.

Figure 1: Ireland, constant price output, hours worked, and labour productivity (2008Q1= 100*)

Panel A: main sectors



Panel B: economy-wide aggregates



Source: Bruegel. Note. A.C.R. stands for 'agriculture, construction and real estate activities' (see Table 1). * Since some of the indicators are noisy, we have calculated Hodrick-Prescott filtered values with smoothing parameter 1, a very low value (the standard smoothing parameter for quarterly data is 1600). We then normalised each series to the 2008Q1 value of the Hodrick-Prescott filtered values and therefore not all actual series showed have the 100 value in 2008Q1.

2. As Krugman (2011) phrased it neatly, workers in the Irish pharmaceutical sector "watch over very expensive machines that produce a lot of output".

Figure 1 shows that in Ireland only the manufacturing sector could increase production and productivity since 2008Q1 and that there are very significant compositional effects on productivity. As of 2011Q4 manufacturing productivity was 53 percent above the 2008Q1 value, which came from about 30 percent increase in output and almost 20 percent fall in labour input. However, if we use fixed intra-manufacturing weights, the improvement in productivity is 31 percent, which is, by the way, extraordinary considering the developments in other countries.

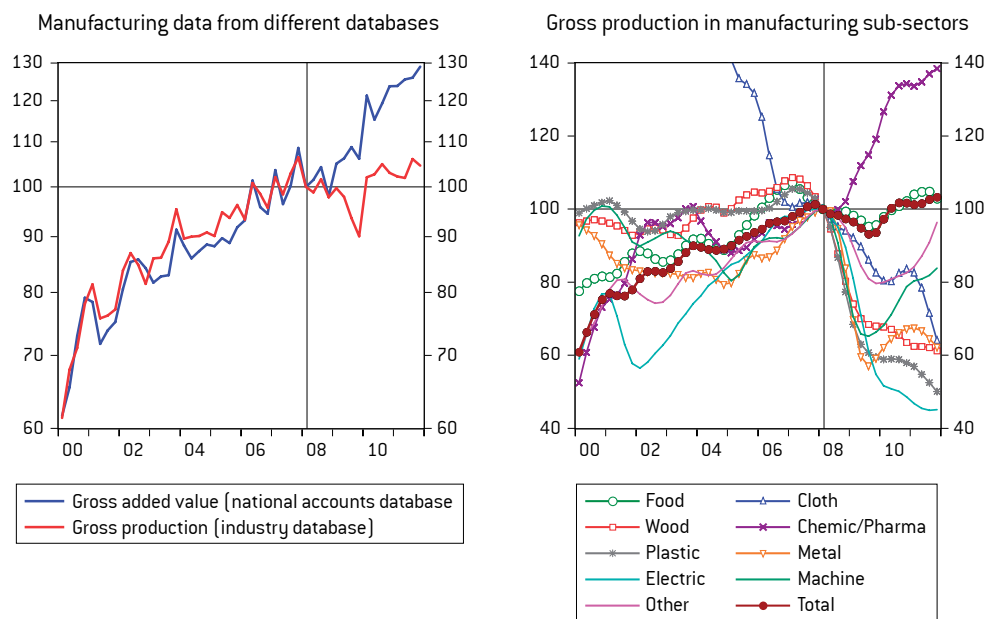
However, it is worth highlighting that Irish manufacturing has some features that are not apparent in most other countries. First, while gross added value at 2005 prices (as used by us) moved in parallel with gross production (at 2005 prices) during 2000-08, the two indicators severely diverged in 2009-11 (Figure 2). The cumulative growth of added value was almost 30 percent between 2008Q1 and 2011Q4, but gross production grew by 5 percent only (both at constant prices)³. A second salient feature is that there were marked differences in developments in manufacturing sub-sectors. The pharmaceutical industry has boomed since 2008, the output of

the food industry remained broadly stable, but all other manufacturing sub-sectors have suffered massively since 2008 and most have not yet started to recover (Figure 2).

The huge difference between gross added value and gross production could be related to certain factors, such as:

- Added value is much higher in the pharmaceutical sector than in the average of the rest of the manufacturing industry, which could contribute to the divergence between gross value added and gross production when the pharmaceutical sector is booming and other sectors are declining.
- There are some methodological differences between gross added value and industrial production statistics: the constant price gross added value is chain-linked, while industrial production data are fixed weight to a 2005 base. The chain-linked gross added value therefore gradually gives more weight to the booming pharmaceutical industry and less weight to the struggling other industries.
- The Irish manufacturing industry is dominated by multinational firms. Therefore, transfer pricing within a multinational group may have

Figure 2: Ireland, manufacturing production (2008Q1=100), 2000Q1-2011Q4



3. In Bulgaria and Slovakia the difference between gross output and gross production was similar to the Irish difference, but in all other EU countries we considered, the difference was significantly smaller (Darvas, 2012b).

Source: Bruegel. Note: since manufacturing sub-sector production indices are rather noisy, we have calculated Hodrick-Prescott filtered values with smoothing parameter 1, a very low value (the standard smoothing parameter for quarterly data is 1600) and report this filtered series on the right hand panel.

a decisive impact on reported added value and one cannot exclude the hypothesis that the accounting practices of multinationals have changed since 2008. If that is an important factor, then the reported constant price figures do not really measure the true volume developments.

- Deflators used for the two statistics may also differ (unfortunately, more recent values of sub-sector deflators are not publicly available), and the practices of multinationals may have a different impact on the deflators as well.

Productivity in other sectors of the Irish economy has not improved much (Figure 1)⁴: after some temporary increases, productivity levels in 2011Q4 were below the 2008Q1 levels. This could be explained by the mainly domestic focus of the main service sectors, since domestic demand has been weak. These sectors reduced labour inputs, but as they have faced sharper output falls, productivity performance has also been weak. The manufacturing sector, on the other hand, benefitted from the pick-up in global demand in 2010 and 2011 and several firms also carried out significant workplace change initiatives in 2008-09, which have likely yielded productivity gains⁵. Yet all in all, the pharmaceutical and chemical industries are the only sectors driving up Irish productivity, and since the pharmaceutical industry is highly capital-intensive, it is not surprising that the compositional effect is very large in Ireland.

As Panel B of Figure 1 indicates, the Irish business sector (excluding agriculture, construction and real estate) did not suffer much during the crisis: there was a mere 3 percent output decline, which had been reversed by early 2010, though there has been no growth since then. But if we use constant weights, output fell by about 10 percent by 2011. The compositional effect on hours worked is small and consequently the compositional effect on labour productivity is high. Business-sector productivity increased by 15 percent from 2008Q1 to 2011Q4, but if we use

constant weights, the improvement is only 3 percent and there was a rapid fall during the past one and half years. For the total economy, the gain in aggregate productivity was 10 percent during the same period, but if we use constant weights, it fell by 2 percent.

These very large compositional effects on productivity are to some extent compensated for by a compositional effect on average labour compensation in the total economy. But this effect is small in our business-sector aggregate, because it does not include the construction industry and the public sector (left-hand panel of Figure 3)⁶. Consequently, constant-weight unit labour costs declined less than the actual aggregate, and the real effective exchange rate also depreciated less when we use constant weights, since the compositional effects in trading partner countries were smaller than in Ireland. Yet while the impact of the compositional effect on Irish REER-ULCs is significant, it but does not change the overall pattern of the index. In the business sector, the cumulative change in the REER was an 18 percent decline when using the actual aggregate and a 14 percent decline when using constant-weight aggregates.

The right-hand panel of Figure 3 compares the REERs calculated by us to Eurostat's measure. While there are some methodological differences (see the note to Figure 3), our total economy REER-ULC and Eurostat's index closely track each other but only until early 2010, when they start to diverge. After early 2010 Eurostat's index suggests a continued real depreciation, while our index shows a turnaround and therefore appreciation. The main reason for the turnaround in our index is the turnaround in Irish productivity (see the right hand panel of Figure 1) and the turnaround in hourly labour compensation (left hand panel of Figure 3), leading to an upturn in ULC (middle panel of Figure 3).

Figure 3 also illustrates that the REER for the total economy and the business sector (excluding

4. Public administration shows an unusual pattern of a continuous decline in productivity during the whole period shown on Figure 1, which came about because of a fall in real output and some increase in labour input. The output of public administration is largely determined by wages and in most other countries public-sector productivity remained flat (Darvas, 2012b).

5. See the firm-level case studies presented in IBES (2010), which demonstrate a number of work-practice changes and efficiencies, such as reductions in staffing ratios; complete reengineering of production processes; elimination of more expensive shifts and reductions in overtime; substantial reductions in overheads and reductions in non-pay employee costs.

6. Note again that we consider only the compositional changes across the main sectors of the economy and manufacturing sub-sectors. Intra-firm changes can be also important. For example, when firm downsizing reduces the labour input of temporary, casual and younger workers, which are more likely to receive lower compensation levels, this would lead to increases in both average earnings and average productivity increase. But the latter could be higher, similar to the example we gave in the main text concerning lay-offs of construction workers.

All in all, the pharmaceutical and chemical industries are the only sectors driving up Irish productivity, and since the pharmaceutical industry is highly capital-intensive, it is not surprising that the compositional effect is very large in Ireland.'

agriculture construction and real estate) moved differently since 2008. Since the excluded sectors are not relevant for international competitiveness, this finding supports our goal of calculating REERs for an aggregate without the public sector and the excluded private sectors.

HOW SIGNIFICANT IS THE COMPOSITIONAL EFFECT?

Table 3 on the next page presents the answer to this question for the business sector without agriculture, construction and real estate, for all 24 EU countries we study. The composition effects are greatest in Ireland, Hungary⁷, the Czech Republic and the UK. Yet even in these cases the overall impacts of compositional effects on the REERs are limited.

The compositional effect on the REER-ULC also depends on the compositional effects in trading partners, which is well illustrated by the example of France, where there was virtually no compositional effect on domestic labour productivity and labour compensation. Yet due to the compositional effects in trading partner countries, the French REER using constant weights depreciated by 1.2 percent, even though the REER which is based on actual aggregates remained almost constant.

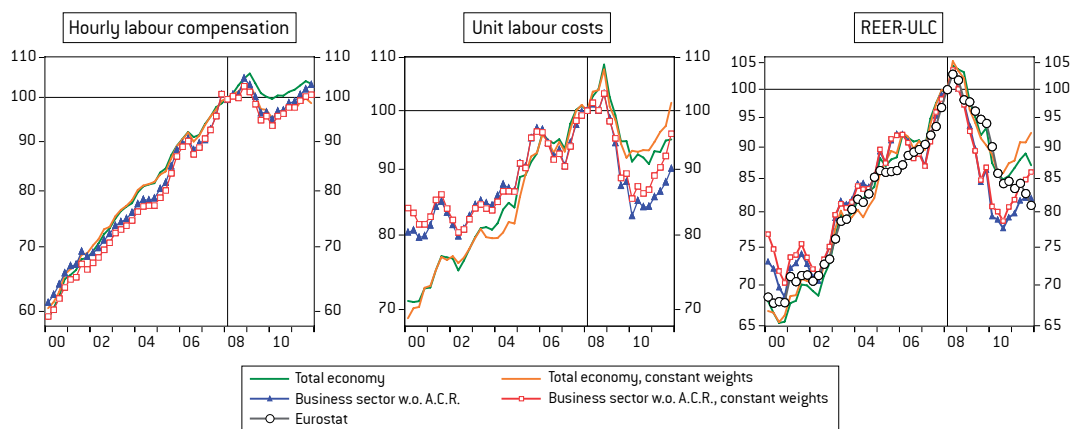
It is worth highlighting that the signal of compositional changes is not identical in all countries. For example in the cases of Finland and Lithuania the constant-weight REER depreciated by about 2.5 percent more than the REER using actual aggregates. Also, compositional changes are not large in all boom-bust countries. For example, in Spain, a country that experienced a similar boom-bust cycle in the construction industry to Ireland, constant-weight productivity has even increased slightly faster than actual aggregate productivity. The constant-weight REER has also depreciated slightly more (by 11.0 percent) than the REER using actual aggregates (11.5 percent).

Table 3 also shows that the intra-euro adjustment has started because Germany's REER remained stable, Ireland's and Spain's declined significantly.

DID REER DEPRECIATION HELP EXPORT ADJUSTMENT?

Current account adjustment is complex issue, which we shall study in another paper in detail. Here we only check if the new REERs we developed correlate well with export performance. Two main explanatory variables are almost always included in econometric studies of export performance: a measure of the demand for

Figure 3: Ireland, hourly and unit labour costs and the real effective exchange rate (2008Q1=100), 2000Q1-2011Q4



Source: Bruegel. Note: to calculate the REER, we consider 30 trading partners: the 23 EU countries for which we have sectoral data, plus Australia, Canada, Japan, Korea, New Zealand, Norway and the United States. Eurostat's REER considers 36 trading partners: 29 of the 30 countries we consider (Eurostat does not include South Korea), plus Cyprus, Malta, Luxembourg, Romania, Mexico, Switzerland and Turkey. Eurostat's REER uses GDP as the output measure, while we consider gross added value, and presumably Eurostat uses a different weighting matrix compared to what we use, which is based on Bayoumi, Lee and Jaewoo (2006).

7. In the case of Hungary, the large compositional effect on productivity and REER is the result of an unusual development of a single manufacturing sub-sector, C29 (manufacture of machinery and equipment not elsewhere classified). The added value at constant prices grew by a cumulative 179 percent between 2008 and 2010, raising the share of this sector from 5 percent of manufacturing added value to 17 percent, according to the available statistical data. Employment in this sector has even declined, by 11 percent, during this period.

Table 3: Impact of compositional changes on average productivity, labour compensation, and REER in the business sector excluding agriculture, construction and real estate (cumulative % change from 2008Q1 to 2011Q4)

	Gross value added per hour			Labour compensation per hour			REER-ULC		
	Aggregate	Const. w.	Comp. effect	Aggregate	Const. w.	Comp. effect	Aggregate	Const. w.	Comp. effect
Austria	3.7	2.1	1.5	12.3	12.4	-0.1	-0.1	0.1	-0.1
Belgium	1.1	0.6	0.5	9.2	9.6	-0.3	-0.4	-0.9	0.5
Bulgaria	15.8	12.4	3.1	42.2	40.3	1.3	13.6	14.6	-0.9
Czech Rep.	2.6	-1.9	4.6	0.6	1.6	-1.0	-7.9	-4.5	-3.6
Denmark	1.8	-1.6	3.5	6.2	6.4	-0.2	-4.1	-2.3	-1.9
Estonia	-1.0	-8.2	7.9	5.2	1.0	4.1	-2.3	-0.4	-1.9
Finland	-2.9	-1.4	-1.6	8.4	9.1	-0.6	2.3	-0.2	2.5
France	1.6	1.3	0.3	10.0	10.0	0.0	0.1	-1.2	1.3
Germany	-2.3	-3.1	0.9	6.3	6.8	-0.5	0.1	0.4	-0.3
Greece	-7.2	-6.0	-1.3	1.0	4.7	-3.5	0.1	-0.7	0.9
Hungary	-4.1	-11.7	8.7	5.3	4.0	1.2	-13.6	-8.3	-5.8
Ireland	15.1	2.5	12.3	3.7	1.1	2.6	-18.0	-14.0	-4.7
Italy	-1.8	-1.4	-0.5	5.2	6.4	-1.1	-1.5	-1.6	0.1
Latvia	3.0	0.5	2.5	-1.7	-2.5	0.8	-11.5	-11.4	-0.1
Lithuania	5.9	5.2	0.6	1.4	1.0	0.4	-9.8	-11.9	2.4
Netherlands	1.2	0.7	0.5	7.6	8.2	-0.5	-2.4	-2.8	0.4
Poland	12.0	7.1	4.6	22.6	21.2	1.2	-18.0	-17.2	-1.0
Portugal	2.0	0.2	1.8	8.4	7.4	1.0	-0.3	-1.9	1.7
Romania	11.5	9.1	2.2	29.4	26.6	2.2	-8.3	-7.3	-1.0
Slovakia	3.8	-0.2	4.0	5.2	5.0	0.3	4.2	6.2	-1.9
Slovenia	-0.7	-2.0	1.3	8.4	7.9	0.5	1.3	0.4	0.0
Spain	5.4	5.9	-0.5	2.7	3.9	-1.2	-10.5	-11.0	0.5
Sweden	1.4	0.6	0.8	4.2	4.6	-0.4	-3.2	-4.2	1.0
UK	-3.4	-6.3	3.0	12.8	12.1	0.7	-5.6	-3.0	-2.7

Source: Bruegel. Note: see Darvas (2012b) for details.

exports and a measure of relative prices. For the first variable, we calculated the weighted average of constant price imports of goods and services of 40 trading partners (using country-specific weights). The relative price variable is typically measured with a REER and we use our new measure for the business sector excluding agriculture, construction and real estate.

REER changes impact export performance with a lag and therefore relating the changes in both exports and REERs from 2008Q1 to 2011Q4 to each other would not reveal this dynamic relationship. Instead, we plot the change in exports (relative to foreign imports) from 2008Q1 to 2011Q4 against the average REER in 2008Q1-2011Q4 (relative to its 2008Q1 REER value). The rationale for this is that if, for example, the REER

depreciated in 2008Q1 and stayed constant afterward, then it could have had a greater impact on the export level in 2011Q4 than if the REER depreciated just a few quarters before 2011Q4. This is a simple representation of the relationship between exports and REERs; in our forthcoming econometric study we will present the results of a proper panel vector error correction model⁸.

Figure 4 suggests that there is a relationship: export performance was better in countries that could engineer a greater fall in the ULC-REER. Bulgaria seems to be an outlier, as her ULC-REER appreciated sharply, yet export growth (relative to the growth of foreign imports) was the third fastest among the countries we consider. The correlation coefficient between the two variables is -0.21, but if we exclude Bulgaria, the correlation is -0.49.

8. Our preliminary panel cointegration results confirmed that exports, foreign imports and REERs are cointegrated. That is, those countries had a better export growth performance relative to the import of trading partners in which the REER depreciated.

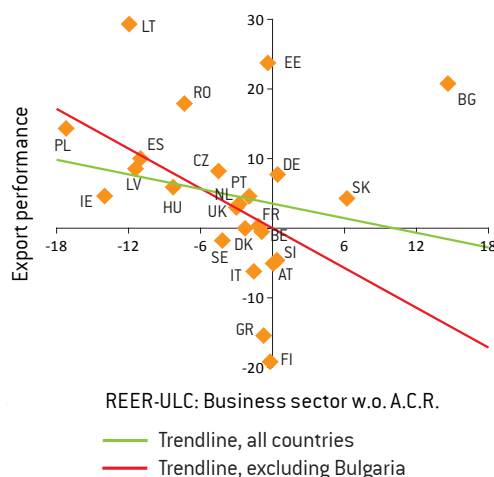
We did the same exercise with Eurostat's ULC-REER (calculated against 36 trading partners) and found that it correlates somewhat less with export performance than the REERs calculated by us: -0.16 when Bulgaria is included and -0.43 when Bulgaria is excluded.

Figure 4 also shows that the top five performers in terms of export growth are from the member states that joined the EU in 2004/07, and four of the other five countries for which we have data are also among the best performers (the exception is Slovenia). Among the EU15 countries, Spain is the best performer, followed by Germany, Ireland and Portugal. It is good news that the export sectors of Spain, Ireland and Portugal – three countries facing significant external adjustment challenges – perform rather well among the EU15 countries. However, it is worrying that Greece is the second worst performer among all countries in terms of exports. The worst performer is Finland, which is surprising since this country is usually thought to have a strong export sector.

WHICH COUNTRIES WERE MORE SUCCESSFUL?

The ultimate goals of economic policy should be growth and jobs, yet in countries facing the most

Figure 4: Gain in export market share, 2008Q1 to 2011Q4 [% change] vs the average REER during 2008Q1-2011Q4 [% deviation from the 2008Q1 value]



REER-ULC: Business sector w.o. A.C.R.

— Trendline, all countries

— Trendline, excluding Bulgaria

severe adjustment challenges, exports should play a strong role in delivering these goals. The depreciation of ULC-REER – which we found to be related to export performance in the previous section – is just a tool to achieve the goals. Consequently, we do not measure success by the downward REER adjustment, but rather the components of the REER that relate to the ultimate goals of growth and jobs. Productivity is central, but adverse social consequences arise when it increases due to layoffs, so we also consider separately production and employment. Unit labour costs can also be reduced by reducing wages, yet hourly wages need not fall if employment is increasing. Therefore, we do not consider wages directly but wage developments in connection with employment and working time. Reducing working time has presumably more benign social consequences than layoffs⁹. Because of the importance of exports in achieving a sustainable adjustment in countries with high foreign indebtedness, we also consider the developments in export market shares. To summarise, we consider those countries successful that could:

- 1 Increase production;
- 2 Improve productivity;
- 3 Keep people employed;
- 4 Reduce hourly labour compensation and cut working time instead of laying-off people, ie the ratio of employment to the product of average labour compensation and working time is high;
- 5 Increase export market share, ie increase exports relative to the weighted average of trading partners' imports.

For the first four indicators we consider the business sector excluding agriculture, construction and real estate, while for exports only the total economy data is available; yet most of exports are accomplished by our preferred aggregate of the business sector.

For each of the five indicators we rank the 24 countries according to both stability and growth:

- **Stability:** the magnitude of the maximum fall in the indicator after 2008Q1 (up to our most recent observation, 2011Q4; a smaller drop is better);

9. See Brenke, Rinne and Zimmermann (2011) for an assessment of reduced working time in Germany during the crisis.

Source: Bruegel. Note: Export performance is the measure of export market share – the ratio of the volume of export growth relative to the weighted average volume of import growth of 40 trading partners. The REER-ULC is calculated against 30 trading partners (see notes to Figure 3).

- Growth: growth of the indicator from 2008Q1 to 2011Q4 (higher growth is better).

One could argue that the output fall from 2008Q1 is not the best measure, because in some countries the output level in 2007 was excessive and therefore a fall was inevitable. However, the strength of this argument is weakened for our analysis since we consider the business sector excluding construction and real estate, and most of the excesses were related to the construction sector. Also, we consider five indicators, not just the output fall. Therefore, even if the pre-crisis excesses in construction-related activities had an impact on the output of non-construction activities, the economies could have adjusted by, for example, reducing wages and working time,

instead of laying off non-construction business sector workers. Improvements in productivity and gains in export market shares could have also reduced the adverse impact of the reversal of the pre-crisis construction booms.

Since some of the data is rather noisy, we use the Hodrick-Prescott-filtered values (with smoothing parameter 1, a very low value). We scale the cross-country values of the indicators on a 0-100 scale and average the values of stability and growth for each indicator. Finally, we average the five scores of the individual indicators in order to determine an overall score.

Detailed figures are presented in Darvas (2012b), here we only report the scores (Table 4).

Table 4: Ranking of countries according to stability and growth of five indicators

Rank	Country	Output score	Productivity score	Employment score	Exports/imports score	Employment/wage*working-time score	Overall score
1	Poland	100	89	100	86	71	89
2	Belgium	67	67	88	66	93	76
3	Germany	59	49	93	78	97	75
4	Austria	71	66	92	52	94	75
5	France	68	69	78	66	84	73
6	Czech Rep.	61	58	72	68	98	72
7	Netherlands	62	61	72	76	85	71
8	Sweden	62	46	78	65	90	68
9	Slovakia	70	52	73	55	87	68
10	Portugal	67	72	47	72	66	65
11	Lithuania	39	47	35	98	100	64
12	Ireland	72	81	12	79	75	64
13	Italy	52	54	74	44	89	63
14	UK	50	49	64	74	68	61
15	Spain	61	82	21	77	56	60
16	Romania	60	75	32	90	38	59
17	Bulgaria	81	91	27	91	0	58
18	Hungary	46	3	75	68	94	57
19	Denmark	48	46	39	65	65	52
20	Slovenia	47	43	50	46	68	51
21	Latvia	19	55	3	80	89	49
22	Estonia	13	8	30	88	87	45
23	Finland	38	35	58	0	66	39
24	Greece	14	39	21	18	75	33

Source: Bruegel. Note: The scores for the five indicators can be interpreted as the closeness to the best performer, whereby the best performer's score is 100 and the worst performer's score is 0. The score for each indicator is the average of the scores for stability and growth (business sector excluding agriculture, construction and real estate, except for exports, which is for the total economy). The overall score is the average of the five scores for the indicators. See more details in Darvas (2012b).

Concerning the overall score, Poland is clearly the top performer, followed by some usual suspects: Belgium, Germany Austria, France, the Czech Republic and the Netherlands, which have similar overall scores.

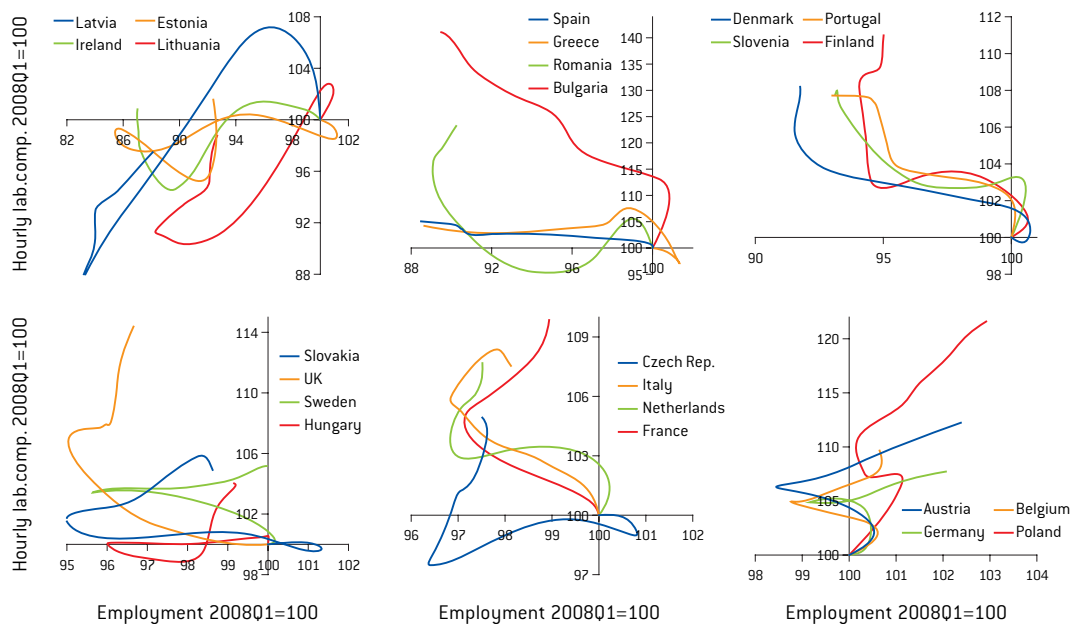
There are ten countries that faced the most severe external adjustment challenge: by having either more than 10 percent current account deficit before the crisis, or a net international investment position close to minus 100 percent of GDP, or both. Not surprisingly, these countries typically rank low, with Portugal, Lithuania and Ireland scoring the highest ranks of 10-12. Among these ten externally-pressured countries the three least successful countries so far were Latvia, Estonia and Greece at ranks 21, 22, and 24, respectively. The remaining four countries are in between: Spain (15), Romania (16), Bulgaria (17) and Hungary (18).

Quite surprisingly, Finland, a country which is generally regarded as having strong fundamentals, ranks very poorly in twenty-third position.

It is also instructive to look in more detail at the trade-off between reduced wages versus layoffs, especially for the assessment of downward wage rigidity. The dynamics of these two indicators do not necessarily move in parallel, eg wage falls (if any) might lag the fall in employment. We therefore plot the change in hourly labour compensation against the change in employment, both normalised as 2008Q1=100 (Figure 5): the 2008Q1 values are in the origin, while the 2011Q4 values are the end-points of the curves. We order the countries according to their maximum employment decline, and use constant-weight figures both for employment and hourly labour compensation, in order to limit the impact of compositional effects on the results.

There is evidence of downward wage flexibility in some countries. There are six countries in which hourly labour compensation fell by at least four percent from peak to trough: Latvia (17 percent), Lithuania (12 percent), Romania (10 percent), Ireland (7 percent), Estonia (5 percent) and Greece (4 percent). The three Baltic countries show a rather interesting picture, with hourly

Figure 5: Hourly labour compensation vs employment in the business sector excluding agriculture, construction and real estate (2008Q1=100, Hodrick-Prescott filtered series with smoothing parameter 1), 2008Q1-2011Q4



Note: hourly labour compensation is plotted against employment, both normalised as 2008Q1=100. Therefore, the 2008Q1 values are in the origin, and the last observation, 2011Q4, is the end point of the lines. Due to the short term volatility of especially the hourly labour compensation indicator, we Hodrick-Prescott filtered all series with smoothing parameter equal 1, a very low parameter. Fixed-weight aggregates are used. Countries are ordered according to the maximum of employment fall.

labour compensation starting to fall in 2008Q3 and starting to rise again in Latvia and Lithuania immediately when employment started to increase again; in Estonia, the dynamics were more complex.

However, labour compensation falls have just corrected a small fraction of pre-crisis wage rises, as shown by Figure 6. In Latvia, for example, wages fell to mid-2007 levels only, while the employment loss was enormous: employment fell by 17 percent from 2008Q1 and fell back to the level of employment in 2004¹⁰. In five of these six countries (the exception is Greece) wage declines were temporary, and have largely or even fully reversed, even though unemployment continues to be high. In the three Baltic countries, and to a lesser extent in Romania, employment started to recover, but in Ireland labour compensation increased without an increase in employment, and in Greece the decline in labour compensation does not continue, despite the continued fast decline in employment.

Also, when relating the employment performance to both wage falls and possible shortening of working-time, Lithuania ranks in distinguished first place among the 24 countries, but the other

countries exhibiting wage flexibility rank lower: Latvia (8), Estonia (10), Greece (14), Ireland (15) and Romania (23). These findings underline the difficulties with, and the pain caused by, nominal wage falls.

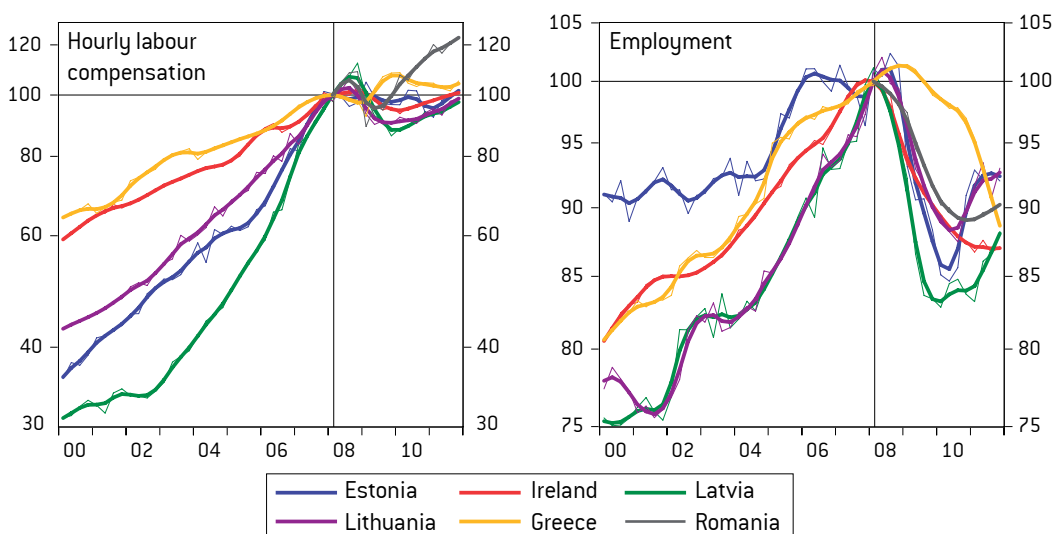
Turning to the other southern European countries facing severe adjustment challenges, in Spain wages remained broadly flat (or even increased slightly) despite the huge employment loss, and in Portugal wages have even increased by about a cumulative 8 percent since 2008Q1.

Bulgarian developments are puzzling, since hourly labour compensation rose by a cumulative 40 percent from 2008Q1 to 2011Q4 parallel with a huge, 12 percent, fall in employment.

CONCLUSIONS

By studying the impacts of compositional changes on labour productivity, hourly labour compensation, unit labour cost and the unit labour cost based real effective exchange rate (ULC-REER) in 11 main sectors of the economy and 13 manufacturing sub-sectors on, we reached a number of conclusions which have a relevance for policymakers.

Figure 6: Hourly labour compensation and employment in the six countries that witnessed significant labour compensation decline during the crisis (business sector excluding agriculture, construction and real estate; 2000Q1=100), 2000Q1-2011Q4



Source: Bruegel. Note: since time series for labour compensation are rather noisy, we have calculated Hodrick-Prescott filtered values with smoothing parameter 1, a very low value, and report both these filtered series (thick curves) and the original series (same colour thin curves). Fixed-weight aggregates are used.

10. As Darvas (2011) has shown, total economy employment fell below the level in 2000.

- 1 **The high importance of compositional changes on productivity.** In some countries the compositional effect on productivity is very significant. In Ireland, for example, the capital intensive pharmaceutical sector, which had a share of about 40 percent in the output of the manufacturing industry and about 10 percent in the total economy output in 2010, is almost the single sector driving Irish output growth and productivity increases¹¹. Most other manufacturing sub-sectors and the other main branches of the economy have not yet started to recover. The total economy productivity indicator masks these diverse sectoral developments. Effects are smaller in other countries, but they should be considered when assessing productivity developments in a country.
- 2 **The lower importance of compositional changes on average wages.** The compositional effect on productivity can be offset by the compositional effect on wages, yet for most countries we found a lower impact on wages than on productivity.
- 3 **The lower importance of compositional changes on real exchange rates.** Even if the compositional effect on wages just partially offsets the compositional effect on productivity, since compositional effects can have an impact on trading partners as well, the overall impact on real exchange rates is not that great. In Ireland, for example, our preferred measure of REER depreciated by 14 percent between 2008Q1 and 2011Q4 when we use fixed weights, which is still large even if it is smaller than the 18 percent depreciation when using actual aggregates. REER depreciation was also significant in Spain at 11 percent, while the German REER remained broadly stable, implying that intra-euro real exchange rates started to adjust.
- 4 **The importance of excluding the public sector, construction industry, real estate and agriculture from price competitiveness assessment.** These excluded sectors do not matter directly for a country's international price competitiveness¹², but for a number of countries, including Ireland, we found that they significantly impact the assessment of the total-economy REER.
- 5 **Export performance is related to REER developments.** We found that our new REER measure, which considers the business sector excluding the sectors listed in the previous point, is well related to export performance. This suggests that in countries facing large external adjustment needs, a depreciation of the REER can foster the adjustment process. In countries that are members of the monetary union or in countries with fixed exchange rates, domestic productivity improvements and nominal wage reductions (or at least slower wage increases than in trading partners) can foster the adjustment. In the EMU, ULC increases and a slower pace of fiscal consolidation in the 'core' countries could help the REER adjustment of the euro-area periphery, as argued by Merler and Pisani-Ferry (2012) and Wolff (2012). On the other hand, the euro's external exchange rate should also play an important role in the external adjustment process of euro-area periphery countries (as I will discuss in a forthcoming paper).
- 6 **Good news from the euro-area periphery: exports in Spain, Ireland and Portugal are performing well.** Among the EU15 countries, these three countries rank first, third and fourth for export performance between 2008Q1 and 2011Q4, which suggests that their external rebalancing process is not hopeless. Yet they outperform the euro-area core countries by just a small margin and therefore further REER adjustment is needed. And there is some bad news in this regard: Greek export performance has been very poor since 2008.
- 7 **Bad news from the euro-area periphery: massive employment losses.** While fixed-weight productivity increase in our preferred business sector aggregate was sizeable in Spain (an increase of about 6 percent between 2008Q1 and 2011Q4) and moderate in Ireland (2.5 percent increase), these came about by massive falls in business sector employment. Productivity improvements through massive layoffs have undesirable social consequences. Productivity was stagnant in Portugal and even declined by 6 percent in Greece, along with similarly adverse employment developments. Huge employment losses also characterised

11. Also, while all indicators suggest that the Irish pharmaceutical sector is booming, this sector is dominated by large multinational firms and intra-firm transfer pricing may not allow a proper assessment of real growth.

12. Yet they may matter indirectly if developments in these sectors influence the rest of the business sector.

the three Baltic countries. These developments suggests that the so called 'internal adjustment' (ie improvements in price competitiveness without relying on nominal exchange rate depreciation) is very painful, yet the example of the Baltics shows that after major losses, economic recovery could start in a fixed-exchange rate regime as well.

- 8 **There is some evidence of downward wage flexibility, but this did not prove to be sufficient for avoiding massive employment losses.** There are six countries in which hourly labour compensation fell by more than 4 percent (Estonia, Greece, Ireland, Latvia, Lithuania and Romania). Also, Lithuania ranks the best among the 24 EU countries when considering the trade-offs between employment, wages and working-time. However, these wage falls

have corrected just a small fraction of pre-crisis wage rises, they were accompanied by massive employment losses, and they were temporary and were largely or even fully reversed by 2011Q4, the end of our sample period. The exception is Greece, where after a 4 percent wage fall there was no more change in labour compensation during the past year, despite the rapidly declining employment level. In Spain, another country with a badly hit labour market, wages have not declined, and in Portugal wages have even increased during the past three years. These findings highlight the difficulty and pain in adjusting wages downward and augment the literature on downward wage rigidity¹³. These findings also call for supporting measures from core euro-area countries and for a weaker euro.

REFERENCES

- Bayoumi, Tamim, Jaewoo Lee and Sarma Jayanthi (2006) 'New Rates from New Weights', *IMF Staff Papers* 53(2): 272-305
- Bergin, Adele, Elish Kelly and Seamus McGuinness (2012) 'Explaining changes in earnings and labour costs during the recession', *Renewal Series*, Paper 9, Economic and Social Research Institute, Dublin
- Brenke, Karl, Ulf Rinne and Klaus F. Zimmermann (2011) 'Short-Time Work: The German Answer to the Great Recession', *Discussion Paper No. 8449*, CEPR
- Central Bank of Ireland (2011) 'Compositional effects in recent trends in Irish unit labour costs', Box A on pages 22-24 in *Quarterly Bulletin* 01, prepared by Derry O'Brien
- Darvas, Zsolt (2011) 'A tale of three countries: recovery after banking crises', *Policy Contribution* 2011/19, Bruegel
- Darvas, Zsolt (2012a) 'Real effective index for 178 countries: a new database', *Working Paper* 2012/06, Bruegel
- Darvas, Zsolt (2012b) 'Productivity, labour cost and export adjustment: background calculations', *Working Paper*, Bruegel, forthcoming
- Darvas, Zsolt and Jean Pisani-Ferry (2011) 'Europe's growth emergency', *Policy Contribution* 2011/13, Bruegel
- IBEC (2010) *Productivity and adjustment: A case study examination of the productivity performance of Irish firms, 2008-2010*, Irish Business and Employers Confederation
- Krugman, Paul (2011) 'Irish Competitiveness (Wonkish)', available at <http://krugman.blogs.nytimes.com/2011/12/19/irish-competitiveness-wonkish/>
- Merler, Silvia and Jean Pisani-Ferry (2012) 'The simple macroeconomics of North and South in EMU', *mimeo*, Bruegel
- Wolff, Guntram B. (2012) 'Arithmetic is absolute: euro-area adjustment', *Policy Contribution* 2012/09, Bruegel

13. See a nice survey of the literature in Bergin, Kelly and McGuinness (2012), who also present a detailed study of the Irish case.