- 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 and 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.

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.

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

			GVA share (% of total)	Employment share (% of total)	GVA/emplyoee (€000s per year)	Labour comp./employee (€000s per year)	GVA share (% of total)	Employment share (% of total)	GVA/emplyoee (€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, accomodation 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

Note: Business sector w.o. A.C.R. = Business sector excluding agriculture, construction and real estate activities. The category 'Other industry: Industry except

			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		Coke and refined petroleum products	1.3	0.6	112	59	0.1	0.3	48	32
C20	Chemic/ Pharma	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									

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),

...enerated almost a million ...st to €59,000 in the EU27. ...ces in average labour pro-...a n likely explained by dif-...nsity[2].

... extreme differences in ...therefore average labour ...tors, as in Ireland, changes ...the economy can lead to ...ge unit labour costs, even ... in ULC in any individual ...hat when, for example, a ...id off but all other workers ... al labour compensation ...decline. However, the ...ompensation was broadly ...my 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.
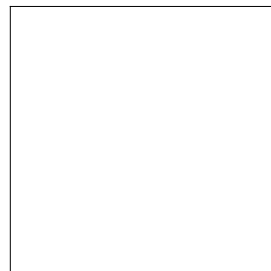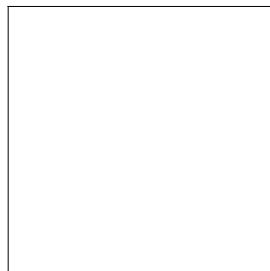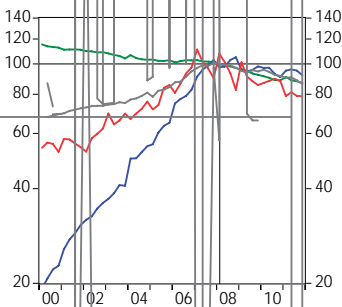
Figure 1 shows that in Ireland only the manufacturing sector could increase production and productivity since 2008Q1 and that there are very significant compositional effects on productivity. As of 2011Q4 manufacturing productivity was 53 percent above the 2008Q1 value, which came from about 30 percent 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 reminded 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
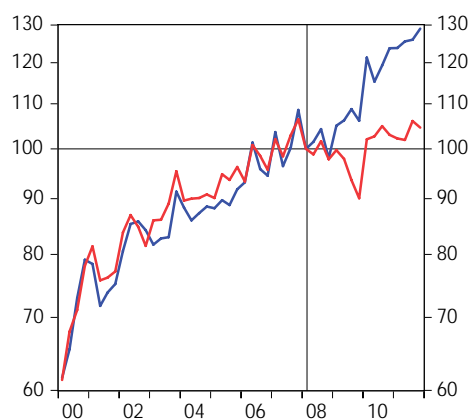
3. In Bulgaria and Slovakia the difference between gross output and gross production was similar to the Irish difference, but in all other EU countries we considered, the difference was significantly smaller (Darvas, 2012b).

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

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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.

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, Hungary[7], 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.
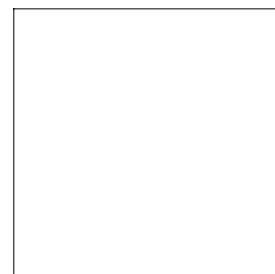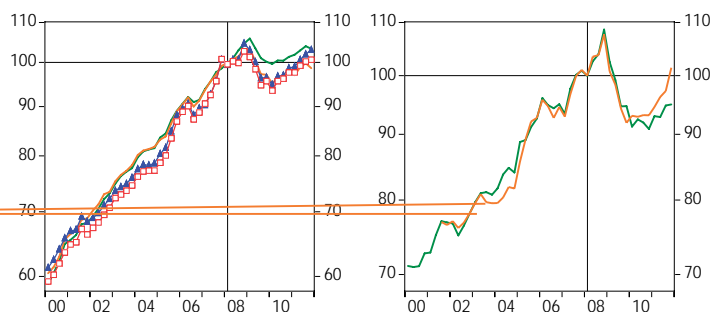
Austria	3.7	2.1	1.5	12.3	12.4	-0.1	-0.1	0.1	-0.1
Belgium	1.1	0.6	0.5	9.2	9.6	-0.3	-0.4	-0.9	0.5
Bulgaria	15.8	12.4	3.1	42.2	40.3	1.3	13.6	14.6	-0.9
Czech Rep.	2.6	-1.9	4.6	0.6	1.6	-1.0	-7.9	-4.5	-3.6
Denmark	1.8	-1.6	3.5	6.2	6.4	-0.2	-4.1	-2.3	-1.9
Estonia	-1.0	-8.2	7.9	5.2	1.0	4.1	-2.3	-0.4	-1.9
Finland	-2.9	-1.4	-1.6	8.4	9.1	-0.6	2.3	-0.2	

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.

The ultimate goals of economic policy should be growth and jobs, yet in countries facing the most 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 layoffs[9]. Because of the importance of exports in achieving a sustainable adjustment in countries with high

- 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 activates had an impact on the output of non-construction activities, the economies could have adjusted by, for example, reducing wages and working time,

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 c*0.15 mi.2(a)12.2(e)0((e)

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 2004[100]

1   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 increases[11]. 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 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   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   These excluded sectors do not matter directly for a country's international price competitiveness[12], but for a number of countries, including Ireland, we found that they significantly impact the assessment of the total-economy REER.

5   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

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 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,

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