

# Chapter 2

## Inflation Differentials in the Euro Area: A Survey

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### 2.1 Introduction

The objective of the European Central Bank (ECB) is price stability, which the ECB has defined as an inflation rate in the euro area in the medium run that is below but close to 2%. The ECB does not focus on inflation in individual countries in the euro area. However, several years after the launch of the euro, inflation differentials among euro area countries are still subject to much debate. After converging sharply in the 1990s, national inflation rates started to diverge again in 1999; since then, the standard deviation of the annual inflation rates among euro area members has fluctuated around 1%—a substantial figure (Angeloni & Ehrmann 2007).

Differences in inflation are not unusual in large currency areas. In fact, in the absence of the possibility of nominal exchange rate adjustment and the presence of low labour mobility, they play an important role as a macroeconomic adjustment mechanism in response to asymmetric shocks. Thus, inflation differentials in the European Economic and Monetary Union (EMU) can be seen as “the product of an equilibrating adjustment process... and, as such, are not only unavoidable, but also desirable” (European Central Bank 2005, p. 61). At the same time, they may be problematic because “political economy considerations arise because of the euro area’s institutional features. Inflation is unpopular, especially if it cannot be mitigated by a weaker exchange rate. National public opinion and politicians may misinterpret its causes and blame the currency instead. National differences also

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The views expressed in this chapter are those of the author and should not be attributed to De Nederlandsche Bank.

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make the interpretation of euro area indicators more challenging for the Governing Council of the European Central Bank (ECB), which is mandated to set monetary policy for the area as a whole” (Angeloni & Ehrmann 2007, p. 1).

Furthermore, even if an inflation objective of “close to 2%” seems high enough to forego deflation in the euro area as a whole, it is possible that deflation occurs in an individual country, depending on how large inflation differentials are in the monetary union. In case of significant inflation differentials within the euro area it is possible for some countries to experience deflation, even if the euro area as a whole does not. Deflation is widely perceived as being more harmful than inflation. Sibert (2003) argues that the redistribution due to unexpected deflation may be more costly than the redistribution resulting from unanticipated inflation. Defaults may occur and the resulting bankruptcies and restructurings destroy real wealth. The deterioration in debtors’ balance sheets brought about by unexpected deflation may thus lower both consumption and investment demand. Persistent deflation may turn into a deflationary spiral of falling prices, output, profits, and employment. With sticky wages, price declines cause real wages to rise, profit margins to fall, and employment to be cut back. This may set off a deflationary cycle.

In addition, inflation differentials can be harmful when they are caused by economic distortions (Beck, Hubrich, & Marcellino 2009). For example, structural inefficiencies in factor markets could affect production costs and, hence, lead to diverging goods prices in the countries concerned. This can have negative implications for the competitiveness of the high-inflation countries, particularly if the inflation differentials are long lasting. Harmful inflation differentials can also arise from rigidities in nominal wages and prices. Non-synchronised adjustments to shocks will lead to differences in inflation rates, which can lead to relative price distortions and thus inefficient allocations of households’ spending.

Finally, inflation differentials within the euro area may also have a destabilizing effect on monetary policymaking. Since short-term nominal interest rates are identical in the euro area, differences in inflation rates across member countries cause differences in real interest rates. As a consequence, member countries with relatively high inflation rates experience relatively low real interest rates, which will boost investment and consumption and thus aggregate demand, which, in turn, may lead to even higher inflation rates.<sup>1</sup>

This chapter discusses two issues. The first is what generates these inflation differences in the euro area? The second related issue is how (and how quickly) these inflation differences will subside and what the possible mechanisms behind such convergence could be. Finally, the chapter discusses possible policy options and implications of diverging inflation rates for the ECB and other policy makers.

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<sup>1</sup> However, what matters for investment and consumption decisions are ex ante measures of real interest rates, i.e., the difference between market interest rates and expectations for inflation developments over the relevant horizon. The dispersion across countries of ex ante measures of real interest rates is significantly lower than that of ex post measures (European Central Bank 2005).

## 2.2 Inflation in Countries in the Euro Area, 1999–2008

Inflation differentials in the euro area since the beginning of 1999 have been quite marked. Table 2.1 shows the annual inflation rate in the countries in the euro area. Most notably, Ireland, Spain, Greece and Portugal have been frequently at the top of the inflation league table, although Ireland more recently saw inflation differentials drop substantially and even occasionally had lower inflation than the euro area as a whole. Also price increases in the Netherlands in 2001/2002 were notably higher than average inflation in the euro area. In contrast, inflation in Germany and Austria has always been below the euro area average.

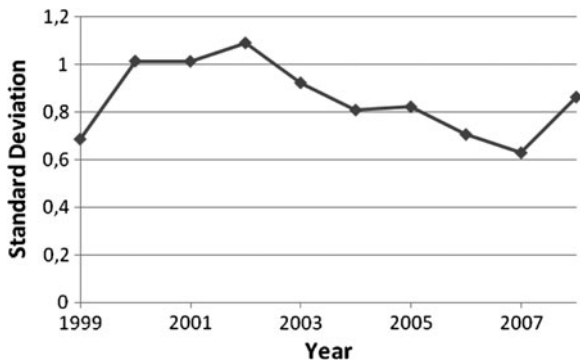
Figure 2.1 shows the degree of inflation dispersion in the euro area, measured in terms of the standard deviation. The figure shows that the standard deviation of the annual inflation rate (measured using HICP, the Harmonised Index of Consumer Prices) in the euro area has fluctuated around 1%. Before the start of the Economic and Monetary Union (EMU), the inflation dispersion in the founding countries of EMU decreased over time, especially during the second half of the 1990s. The non-weighted standard deviation declined from around 4% points at the beginning of the 1990s to about 1% point at the start of the monetary union (Angeloni & Ehrmann 2007). As Fig. 2.1 shows, since then the standard deviation initially declined, but more recently inflation dispersion slightly increased. This probably reflects the 2007/2008 enlargements of the euro area, as the new members had all an inflation rate above the euro area average since they became member of the currency union (see Table 2.1). Also differences in the transmission of shocks in commodity prices may play a role here.

**Table 2.1** Inflation differential vis-à-vis euro area (HICP based, % points) in countries in the euro area, 1999–2008

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Austria	-0.91	-0.86	-0.69	-1.05	-1.09	-0.20	-0.21	-0.68	-0.16	-0.52
Belgium	-0.30	-0.14	-0.54	-1.20	-0.88	-0.29	0.21	-0.03	-0.54	0.75
Cyprus										0.64
Finland	-0.12	0.13	-0.32	-0.74	-1.09	-2.01	-1.55	-1.10	-0.78	0.17
France	-0.87	-0.99	-1.20	-0.81	-0.22	0.19	-0.42	-0.46	-0.75	-0.58
Germany	-0.79	-1.42	-1.08	-1.40	-1.36	-0.36	-0.40	-0.59	-0.08	-0.99
Greece			0.67	1.17	1.05	0.88	1.16	0.94	0.63	0.49
Ireland	1.04	2.43	1.01	1.97	1.61	0.15	-0.14	0.33	0.51	-0.63
Italy	0.23	-0.24	-0.66	-0.14	0.42	0.12	-0.11	-0.15	-0.32	-0.24
Luxemburg	-0.41	0.96	-0.58	-0.69	0.15	1.08	1.44	0.59	0.29	0.35
Malta										0.94
Netherlands	0.60	-0.48	2.13	1.12	-0.15	-0.77	-0.82	-0.72	-0.78	-1.53
Slovenia									1.40	1.79
Spain	0.81	0.66	-0.15	0.84	0.71	0.90	1.06	1.19	0.48	0.39
Portugal	0.74	-0.02	1.43	0.93	0.87	0.36	-0.19	0.67	0.06	-1.09

Source: ECB

**Fig. 2.1** Inflation dispersion in the euro area (standard deviation), 1999–2008. Source: own calculations using data shown in Table 2.1



Whereas most empirical studies on inflation differentials in the euro area focus on country-level data, Beck et al. (2009) use a novel monthly dataset of regional inflation rates from six countries in the euro area, namely Austria, Germany, Finland, Italy, Portugal and Spain, over the period 1996–2004. These authors argue that the use of regional inflation data may be helpful for three reasons. First, the understanding of the behaviour of regionally disaggregated inflation rate series helps to better understand aggregate inflation. Second, the use of regional data makes it possible to disentangle the importance of national from purely regional factors for inflation. Third, as there is more heterogeneity at the regional than at the national level, the identification of the sources of inflation heterogeneity may be easier.

Beck et al. (2009) employ a factor model to decompose regional inflation rates into a common area-wide, a country-specific and an idiosyncratic regional component. They find that at least half of the variation in regional inflation rates is explained by one area-wide factor (see Table 2.2). This common area-wide factor can be related to the common monetary policy in the euro area and to external developments, such as oil price changes and changes in the euro exchange rate. The national factor explains on average 32% of observed inflation variations,

**Table 2.2** Variance in regional inflation differentials explained by euro area, national and regional factors

All regions						
Proportion of variance explained	48.46					
	Austria		Germany		Spain	
	National	Regional	National	Regional	National	Regional
Proportion of variance explained	30.36	21.18	37.11	14.43	26.88	24.66
	Finland		Italy		Portugal	
	National	Regional	National	Regional	National	Regional
Proportion of variance explained	48.80	2.74	28.73	22.81	34.78	16.76

Source: Beck et al. (2009)

**Table 2.3** Share of inflation differentials accounted for by area wide factors, 1993–2003

Overall	Services	Industrial	Energy	Proc. food	Unproc. food
0.66	0.58	0.67	0.52	0.65	0.42

Source: Altissimo et al. (2005)

although there are large differences across countries. The national factor is lowest in Spain (27%) and highest in Finland (49%). The remaining 18% of regional inflation differentials is due to regional elements. The authors also examine whether the estimated area wide and national factors have the same effects across all regions. They find that there is substantial heterogeneity in the effect of the euro area component within most nations, except in Spain and Portugal. There is also a lot of heterogeneity in the effect of the national component within nations.

Using factor analysis, Altissimo, Benigno, and Rodriguez Palenzuela (2005) have analysed to what extent five main subcomponents in the HICP, namely Services, Industrial Goods excluding Energy, Energy, Processed Food and Unprocessed Food, are driven by different reactions to area-wide factors or sectoral developments. The estimation period is 1993.01–2003.06. Table 2.3, which is reproduced from this study, shows the average across countries of the share of variance of the differentials accounted by common shocks, both for the HICP and for the subcomponents. The results show that the Energy and the Services sectors have the largest idiosyncratic components, while the Industrial Good excluding Energy and the Processed Food sectors have the lowest idiosyncratic components.

Figure 2.2 shows more recent figures on the contributions of the five main HICP segments to aggregate euro area inflation dispersion from 2005 to March 2009, measured as the covariance between inflation contributions of each sector and overall euro area inflation.<sup>2</sup>

The data show that euro area inflation differentials are mostly due to the energy component, whose contribution has considerably increased over time. Also the contribution of unprocessed food to inflation dispersion has increased during this period considered. On the other hand, the contribution from non-energy industrial goods has fallen since 2005, being particularly low in 2007 and 2009.

Following Rabanal (2009), the difference between inflation in country  $i$  and inflation in the rest of the euro area can be written as:

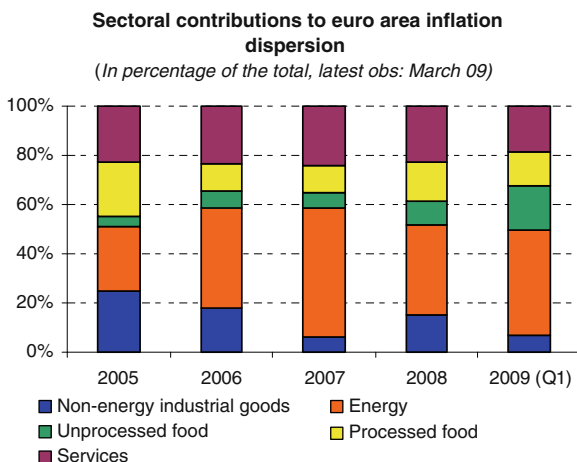
$$\Delta p_t - \Delta p_t^* = \Delta p_t^T - \Delta p_t^{T*} + (1 - \gamma^*)(\Delta p_t^{T*} - \Delta p_t^{N*}) - (1 - \gamma)(\Delta p_t^T - \Delta p_t^N) \quad (2.1)$$

where  $\Delta$  is the year-on-year difference operator;  $p_t, p_t^T, p_t^N$  are the natural logarithms of the consumer price index, its tradable component, and its non-tradable component for country  $i$ ;  $p_t^*, p_t^{T*}, p_t^{N*}$  are the same variables for the rest of the euro area, while  $\gamma$  and  $\gamma^*$  are the share of tradable goods in the price index in country  $i$

<sup>2</sup> The data refer to the current countries in the euro area. I am thankful to Lourdes Acedo-Montoya from the European Commission (DG ECFIN) for providing these data.

**Fig. 2.2** Sectoral contributions to euro area inflation dispersion, 2005–2009.

Source: European Commission



and in the rest of the euro area. As Eq. 2.1 shows, deviations from purchasing power parity can be explained by: (1) deviations from the law of one price for tradable goods and (2) movements of relative prices between tradable and non-tradable goods inside each country. As pointed out by Rabanal (2009), if the fraction of tradable goods in the consumer price index is the same across countries ( $\gamma = \gamma^*$ ), and the law of one price holds for tradable goods ( $\Delta p_t^{T*} = \Delta p_t^T$ ), then fluctuations in the inflation differential would be due to non-tradable inflation only. If the consumption basket differs across countries and there are deviations from the law of one price for tradable goods then fluctuations in the price of tradable goods will also matter.

Rabanal (2009) reports that the inflation differential between Spain and the rest of the euro area can largely be explained by the tradable component for most of the time since the start of the currency union. However, Altissimo et al. (2005) show that in a sectoral decomposition covering ten individual countries (all euro countries except for Greece and Luxemburg) between January 1990 to February 2004 most of the inflation differentials originate in the services category of the HICP, although in some periods also the energy category significantly contributed to overall dispersion. This suggests that the main source of dispersion in countries' inflation rates is in non-traded goods.

How does inflation dispersion in the euro area compare to inflation dispersion in the US? Beck et al. (2009) find a somewhat smaller degree of dispersion in regional inflation rates across US regions than across euro area regions. Moreover, regional US inflation rates exhibit slightly less persistence than euro area inflation rates. However, owner-occupied housing is included in the US CPI, but not in the European HICP. As argued by Remsperger (2003), this is important because there is hardly any other component where regionally divergent price developments have such a major impact as they do in housing. The interregional standard deviation of the changes in rents is greater than that of services, which, in turn, is larger than that of industrial goods (excluding energy). This suggests that an

appropriate coverage of owner-occupied housing would result in the measured divergence of inflation rates in the euro area being larger.

### 2.3 Explaining Inflation Differentials

Several factors have been invoked to explain the size and the dynamics of inflation differentials in EMU that we capture in five categories, namely (1) convergence, (2) business cycle differences, (3) asymmetric demand and supply shocks and asymmetric adjustment mechanisms to common shocks, (4) characteristics of domestic product, labour and other factor markets, and (5) wage and price rigidities. These explanations are not mutually exclusive. For instance, asymmetric shocks may not only lead to inflation differentials, but also to differences in business cycle synchronisation. Likewise, the impact of shocks on inflation differentials depends on wage and price rigidities. For expository purposes, however, we will distinguish between these categories.

First, inflation rates of countries in the currency union could initially diverge because of a “catch-up” mechanism from different price levels (*convergence*). If price levels differed initially across countries forming a monetary union, price level convergence will generate temporary inflation differentials. Increased market integration and price transparency associated with the adoption of a common currency reduce the scope for deviations from the law of one price. Honohan and Lane (2003) conclude that a considerable part of the inflation differentials in the euro area in the early years of EMU can be explained by price level convergence. These authors estimated a multivariate panel where the spreads of national inflation rates from the area average depend on proxies for the catch-up effect and on three macroeconomic variables: nominal exchange rate changes; the fiscal balance, and the output gap. Their point estimate implies that a country with a price level one-third below the European average would experience an additional 1%-point of inflation.

One reason why countries may have different inflation rates that has attracted much academic attention is the so-called Balassa–Samuelson effect. This effect hinges on differences in labour productivity growth between the tradable and non-tradable sector. If this growth is higher in the tradable sector, wages will tend to increase in that sector without leading to higher unit labour costs. However, in case of high labour mobility between sectors wages will also tend to increase in the non-tradable sector, where—given the lower average labour productivity growth—prices will exhibit higher average increases. Therefore, countries with a large difference between labour productivity growth rates in the tradable and non-tradable sectors will also experience a higher inflation rate.<sup>3</sup> The Balassa–Samuelson effect is

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<sup>3</sup> As pointed out by Rabanal (2009), the Balassa–Samuelson hypothesis could explain the higher inflation rate in the service sector (as a proxy for the non-tradable sector) than in the goods sector (as a proxy for the tradable sector).

often associated with the process of convergence in living standards across economies: countries that are in the process of catching-up normally display strong productivity growth in the tradable sector, while productivity developments in the non-tradable sector are normally more similar across countries (European Central Bank 2005).

However, there is evidence that the Balassa–Samuelson effect can provide only a partial explanation for euro area inflation differentials (see De Haan, Eijffinger, & Waller (2005) for a survey of older studies). As pointed out by the European Central Bank (2003), historically, catching-up has not always led to higher inflation or an appreciating nominal exchange rate, as the case of Ireland shows. Honohan and Lane (2003) argue that little if any of the Irish inflation deviation is due to the Balassa–Samuelson effect. According to these authors, Ireland's boom has been largely one of employment growth, and not exceptional productivity gains. Likewise, Rabanal (2009) concludes that the Balassa–Samuelson effect has not been an important source of inflation differentials between Spain and the rest of the euro area during the EMU period. Beck et al. (2009) argue that the Balassa–Samuelson effect implies a negative relationship between a region's initial income level and subsequent changes in the overall price level. They do not find much support for such a relationship.

Furthermore, some of the estimates of the Balassa–Samuelson effect are not in line with actual inflation after the start of the monetary union. For instance, Belgium and Finland are sometimes found to have high Balassa–Samuelson effects, but this is not confirmed by actual inflation differences. Conversely, in the beginning of the new century the Netherlands has had a higher inflation differential than predicted by the Balassa–Samuelson model (European Central Bank 2003a). Indeed, according to the European Central Bank (2005), differences in labour productivity trends across euro area countries contribute to inflation diversity, yet can only account for a relatively moderate share of inflation differentials.<sup>4</sup>

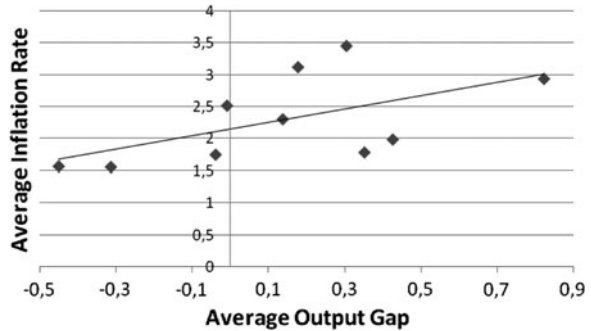
Second, *business cycle differences* among the countries in the euro area may contribute to inflation differentials. Countries with output above trend tend to have upward pressure on inflation, while countries with output below trend will experience downward pressure on inflation. Figure 2.3 plots the average inflation rate after the euro was adopted in each euro area country against its average output gap in the same period.<sup>5</sup> The figure suggests a positive relationship between the

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<sup>4</sup> It may be argued that the Balassa–Samuelson effect may be more relevant for the new EU member states. However, according to Égert and Podpiera (2008), for the Czech Republic, Hungary, Poland, and Slovakia the relevant literature over the past 5 years failed to quantify a sizable Balassa–Samuelson effect, with the average effect from 20 recent studies accounting at best for one-third of the actual real exchange rate appreciation of more than 30% from 1995 to 2006. However, Mihaljek and Klau (2008) conclude that the Balassa–Samuelson effects are clearly present and explain around 24% of inflation differentials vis-à-vis the euro area (about 1.2% points on average) in their sample of 11 countries in central and eastern Europe covering the period from the mid-1990s to the first quarter of 2008.

<sup>5</sup> Inflation data come from the ECB, while the output gap data come from EconStats. The data for Ireland and the Netherlands run to 2006 only.

**Fig. 2.3** Inflation and output gap, 1999–2008



average output gap and average inflation. Similarly, Honohan and Lane (2003) find that the effect of the output gap on inflation differentials is positive and statistically significant. In a more recent study, Andersson, Masuch, and Schiffbauer (2009) find that inflation differentials are primarily driven by different business cycle positions and to some extent by changes in product market regulations (to be discussed below). These authors use panel estimations for annual inflation differentials for a sample covering the period 1999–2006 and 12 euro area countries (excluding Slovenia, Cyprus, Malta and Slovakia).

Business cycles may be out of sync for various reasons. Remsperger (2003) argues that one reason may have been the nominal convergence process in the run-up to EMU. The elimination of the residual foreign exchange risk since the beginning of 1999 and the dwindling of the risk premia brought about a largely uniform long-term interest rate level. In some countries, this is likely to have generated a substantial cyclical stimulus. The fall in real interest rates in those countries with above-average inflation sustained upward pressure on prices in exactly those countries that already had relatively high inflation. An important factor was the rapid rise in property prices encouraged by the convergence of interest rates (Remsperger 2003). Indeed, Honohan and Lane (2003) report a fairly strong negative cross-sectional correlation between real interest rate declines in the run-up to EMU and commercial property inflation in 1995–2001 (the correlation is  $-0.67$ ).

The expansionary effects of real interest rate changes over time will probably be offset by the equilibrating effect of changes in national competitiveness triggered by an increase in inflation differentials (Angeloni and Ehrmann 2007). Owing to a real “appreciation”, countries with higher-than-average inflation rates suffer a loss in price competitiveness, while countries with relatively low inflation rates gain in price competitiveness. The consequence is that export demand in countries with higher inflation rates tends to decline, which has a dampening impact on price developments in those countries. Conversely, demand tends to increase in countries with lower inflation rates. However, the coolant effect of real appreciation through a loss of competitiveness is likely only to operate at a more gradual pace. Still, as pointed out by Remsperger (2003), especially in the euro area, where the regional labour markets, owing to different languages and social

security systems, are so far not very closely interlinked, short-term inflation differentials can help to stabilize output and the labour market through this “real exchange rate” effect.<sup>6</sup> Alternative adjustment mechanisms are high labour mobility, wage flexibility or a monetary union-wide fiscal transfer system. However, as pointed out by Beck et al. (2009), none of these mechanisms is very likely to play a role in EMU.<sup>7</sup>

Third, an important reason for continuing inflation differentials in the euro area consists in price reactions to constantly recurring *asymmetric supply and demand shocks*.<sup>8</sup> Relative prices should fluctuate across countries—for example, in response to asymmetric productivity shocks—when the countries’ consumption baskets are not identical; in a currency union, these fluctuations are necessarily reflected in inflation differentials (Duarte and Wolman 2008). Likewise, different national fiscal policy shocks can create or reinforce inflation differentials.

Also differences in the transmission mechanisms to common shocks could lead to inflation differentials. Different countries may be affected in different ways by the same shock due to differences in nominal rigidities (see below) or differences in their pattern of specialisation.<sup>9</sup> For another, they may react differently to common shocks because of differences in market structures.

One such common shock that may affect countries in the euro area differently and that has received quite some attention in the older literature is exchange rate shocks. The share of imported goods in private consumption and the strength of the pass-through effect determine the impact of exchange rate shocks on consumer prices. As discussed by De Haan et al. (2005), the pass-through of exchange rate changes into prices is not uniform across the countries in the euro area. Price developments may therefore differ in the medium term even with uniform shocks. One important factor influencing pass-through is the openness towards trading partners outside the euro area. In general, greater “extra-openness” should be reflected by a higher weight of extra-euro area goods in a country’s overall goods basket and, therefore, a stronger pass-through effect from exchange rate changes

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<sup>6</sup> This effect also occurs in relationship to countries outside the monetary union. Since the euro’s (flexible) nominal exchange rate against the currencies of such countries is geared to economic developments of the euro area as a whole, euro-area countries with an above-average inflation rate see their competitive position vis-à-vis non-euro-area countries decline, while euro-area countries with a below-average inflation rate see their competitive position improve (Rensperger 2003).

<sup>7</sup> Financial integration may provide for insurance against asymmetric shocks. If residents of the member countries of a monetary union hold monetary union-wide diversified portfolios the costs of asymmetric shocks will be born by all residents (Beck et al. 2009). However, as De Haan, Oosterloo, and Schoemaker (2009) show, despite substantial progress in financial integration in Europe, portfolios of many European financial institutions are still characterized by a high home bias.

<sup>8</sup> Asymmetric shocks and differences in the transmission of and the policy reaction to common shocks are, of course, among the driving forces of diverging business cycles.

<sup>9</sup> These factors can be related. According to the European Central Bank (2005), euro area energy and unprocessed food prices seem to change most frequently, while service prices appear to be modified less frequently.

on domestic prices. So, a member country that consumes imports from a non-member country will experience different inflationary pressures if the euro exchange rate depreciates as compared to a member country that conducts all its trade with other member countries (Hüfner & Schröder 2002). In addition to the direct impact of exchange rates on consumer prices, there may be a cyclical effect of exchange rate shocks via a change in the competitive position, which is also determined by an economy's degree of openness to countries outside the euro area. The econometric estimates of the inflation differentials of Honohan and Lane (2003) suggest a significant role for effective exchange rate changes. They estimate a multivariate panel where the spreads of national inflation rates from the area average depend on proxies for the catch-up effect and on three macroeconomic variables: nominal exchange rate changes; the fiscal balance, and the output gap. These authors conclude that a substantial part of the inflation divergence can be attributed to the euro exchange rate; euro area member countries are asymmetrically affected by changes in the euro exchange rate depending on their degree of external exposure. The point estimate of Honohan and Lane (2003) implies that a relative depreciation of 3.5% is associated with an additional 1% point of inflation. This is a quite a large effect. The Irish nominal effective exchange rate depreciated 11% during 1998–2000, while the French exchange rate weakened by only 4%. So, according to these estimates, differences in the effective exchange rates of Ireland and France led to an inflation differential of 2% points in this period. Angeloni and Ehrmann (2004) have shown that this conclusion is somewhat sensitive to the model specification, but Honohan and Lane (2004) have provided further evidence in support of their earlier thesis. However, the results of Angeloni and Ehrmann (2007), to be discussed in the following section, suggest a much smaller effect of the euro exchange rate on inflation differentials in the euro area. Also a recent study by Andersson et al. (2009) concludes that external factors such as differences in nominal effective exchange rates play only a minor role in explaining inflation differentials vis-à-vis the euro area.

The three sources of inflation differentials mentioned so far are probably not worrisome from a policy point of view (with a possible exception for fiscal policy differences), since they are either transitory (although potentially long lasting as will be discussed in the next section) or reflect the result of convergence or equilibrating dynamics. Beck et al. (2009) identify two other factors that can lead to undesirable economic outcomes. These factors are: (1) *characteristics of domestic product, labour and other factor markets*, and (2) *nominal wage and price rigidities*. The importance of these factors is generally examined in conjunction with (symmetric or a-symmetric) economic shocks.

If wages diverge across countries due to structural inefficiencies in labour markets, also production costs and therefore goods prices may diverge. Labour market institutions may play a role here. For instance, according to Calmfors and Driffill (1988) differences in labour market institutions can give rise to different inflation rate outcomes because economies with either strong centralisation or strong decentralisation of wage bargaining are better equipped to face supply shocks than economies with an intermediate degree of centralisation. Likewise, the presence of

**Table 2.4** Regression of mean inflation rates on mean economic structural variables

Variable	Area wide analysis		
	Estimate	Std. error	
<i>U</i>	−0.00679	0.005798	
<i>DULC</i>	−0.02321	0.036111	
<i>DP_HOUS</i>	0.227631	0.064476	
<i>DENS_D</i>	−0.01197	0.005862	
<i>SERV</i>	−0.00723	0.0034	
<i>DY</i>	0.002051	0.004318	
R-squared:	0.952	Obs.	66
Rbar-squared:	0.943		

Source: Beck et al. (2009)

rigidities affecting the price<sup>10</sup> and wage formation mechanism delays the necessary adjustment to shocks and gives rise to distortions in relative prices after such shocks, contributing to lasting inflation differentials. These differences can lead to relative price distortions and thus inefficient allocations of households' spending.

Beck et al. (2009) estimate a model explaining regional inflation differentials in which they take heterogeneity in product, labour and other factors markets into account. Table 2.4, which is copied from their paper, shows the results. The explanatory variables are the unemployment rate (*U*), the change in unit labour costs (*DULC*), change in rental costs (*DP\_HOUS*), the number of suppliers (*DENS\_D*), the percentage of services in gross value added (*SERV*), and growth of GDP per capita (*DY*). To capture the potential effects of labour market heterogeneity on inflation differentials, Beck et al. (2009) include average levels of unemployment (*U*) and average changes in unit labour costs (*DULC*) over 1995–2004. As proxy for the costs of non-traded input factors other than wages, they use the average year-on-year change in the COICOP (Classification of Individual Consumption by Purpose) index 'Housing, water, electricity, gas and other fuels' (*DP\_HOUS*). As nominal rigidities are associated with imperfect competition in the goods and labour markets, which in turn can be approximated by the number of suppliers, Beck et al. employ a measure of market density in the manufacturing and in the wholesale sectors (*DENS\_D*). As a proxy for differences in the production structure they use the relative sizes of the services sector (*SERV*), and to proxy business cycle movements, Beck et al. (2009) employ regional GDP per capita growth (*DY*). The latter variable is also their proxy for the Balassa–Samuelson effect that implies a negative relationship between income growth rates and inflation rates. As an alternative proxy they use average level of (log) per-capita income in 1995.

The results as shown in Table 2.4 suggest that labour market characteristics do not play an important role in explaining regional inflation differentials. The coefficients

<sup>10</sup> Evidence presented by Dhyne, Alvarez, Le Bihan, Veronese, Dias, Hoffmann, Jonker, Lünnemann, Rumler, and Vilmunen (2006) for the euro area suggests that prices are changed on average every 13 months.

of the unemployment rate and unit labour costs are insignificant. Also average per-capita income growth rate does not turn out to be significant. Likewise, using initial per-capita income instead of growth rates did not yield support for the Balassa–Samuelson effect. However, the results of Beck et al. (2009) lent support to the importance of the costs of non-wage input factors as the proxy for this variable (*DP\_HOUS*) is highly significant. Also the extent of competitiveness of the economy seems to play an important role for inflation differentials as the coefficient of the proxy for this variable (*DENS\_D*) is negative and significant at a 5% level. In other words, markets with more suppliers experience relatively lower inflation rates. The results of Beck et al. also suggest that the economic structure of a region significantly affects inflation differentials. The coefficient of the proxy for sectoral specialisation (*SERV*) is statistically significant. The authors conclude that the observed long-run differences in regional inflation rates do not reflect the response of integrated markets to economic shocks and are not the result of a convergence process in regional incomes but that they are caused by inefficiencies in factor markets and region-specific structural characteristics.

Using the OECD's index for product market regulations, Andersson et al. (2009) find that national differences in changes of product market regulations help explain inflation differentials in the euro area. In particular, an increase in product market regulations in a country relative to the euro area, *ceteris paribus*, leads to higher inflation relative to the euro area average.

Some other recent papers have examined inflation differentials in the euro area using general equilibrium multi-country models of the euro area. These studies will be discussed in the next section, which focuses on the persistence of inflation differentials.

## 2.4 Are Inflation Differentials Persistent?

Inflation differentials across European regions are not only quite large but also long lasting, not only across countries but also—to a lesser extent—within countries (see Table 2.5). The reported difference in the inflation rate between an average German

**Table 2.5** Inflation in European regions, 1996–2004

	1996–2004		1996–1998		1999–2004	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
All regions	2.18	0.63	1.89	0.61	2.26	0.70
Germany	1.35	0.15	1.21	0.21	1.31	0.20
Austria	1.62	0.1	1.19	0.17	1.73	0.11
Finland	1.41	0.09	1.07	0.05	1.60	0.13
Italy	2.26	0.22	2.13	0.33	2.22	0.22
Spain	2.87	0.22	2.45	0.25	3.06	0.24
Portugal	2.85	0.15	2.41	0.28	3.09	0.12

Source: Beck et al. (2009)

and an average Spanish region corresponds to a cumulative depreciation in the real exchange rate between an average German and an average Spanish region of around 15% over the sample period.

To examine whether there have been major changes in cross-regional inflation dynamics, Beck et al. (2009) split the sample into a ‘pre-EMU’ [1996(1)–1998(12)] and an ‘EMU’ [1999(1)–2004(10)] subsample. Two conclusions can be drawn. First, mean inflation rates are always lower in the ‘pre-EMU’ sub-period, probably reflecting the efforts of EU member states to meet the Maastricht convergence criteria. Second, inflation dispersion remains more or less stable across the two sub-periods. So, considerable inflation differentials across EMU regions continue to exist.

In the rest of this section we will discuss whether the various explanations for inflation differentials as discussed in the previous section, can also explain the persistence of inflation differentials.

As pointed out by Angeloni and Ehrmann (2007), nominal *convergence* could in principle account for both inflation differentials and their persistence. If imbalances in initial prices exist, it would probably take years before they are reabsorbed; until then, countries with lower initial price levels would systematically have above-average inflation rates. Furthermore, research for the US suggests that price level differences may be quite persistent in a monetary union. For instance, using consumer price data for nineteen US cities from 1918 to 1995, Cecchetti, Mark, and Sonora (2002) report that price level differences are large and persistent: annual inflation rates measured over ten-year periods can differ by as much as 1.55% points. Cecchetti et al. (2002) estimate the half-life of convergence to be 9 years, based on a panel of 15 cities from 1918 to 1995. Similarly, Parsley and Wei (1996) employ commodity level price data for 48 US cities from 1975 to 1992 and find persistent deviations from the law of one price for both traded and non-traded goods. The half-life of the price gap for tradable goods is roughly 4–5 quarters and 15 quarters for services.

Also *differences in business cycles* may be quite persistent, even in a monetary union. Two views have been put forward on this issue. In what we call the ‘optimistic view’, further economic and monetary integration will lead to less business cycle divergence. However, Krugman (1991) argues that in a further integrating Europe a similar concentration of industries may take place as in the US mainly because of economies of scale and scope. Due to this concentration process, sector-specific shocks may become region-specific shocks, thereby increasing the likelihood of asymmetric shocks and diverging business cycles. So, the ‘pessimistic view’ holds that business cycles in the euro may become more divergent in the future.

Various factors have been put forward that may affect business cycle synchronisation, ranging from trade relations (Frankel & Rose 1998), specialization (Imbs 2004), monetary integration (Fatás 1997), financial relations (Imbs 2006) and fiscal policy (Clark & van Wincoop 2001). However, “despite the theoretical and empirical analyses to date, it seems fair to say that there is no consensus on the important determinants of business cycle co-movement. The difficulty is that there

are many potential candidate explanations.” (Baxter and Kouparitsas 2005, p. 114). In their survey of the literature on business cycle synchronisation in Europe, De Haan, Inklaar, and Jong-A-Pin (2008, p. 266) conclude that “trade intensity is found to lead to more synchronisation. The trade relationships of the members of the European currency union are intense causing further synchronisation. However, the point estimates vary widely. Furthermore, the survey also showed that trade intensity only explains a fraction of business cycle correlations. The evidence for other factors affecting business cycle synchronisation is quite mixed. Although there are papers (like Inklaar, Jong-A-Pin, & De Haan 2008) suggesting that the well-known critique on EMU that a common monetary policy may not be equally good for all countries in the union (“one size does not fit all”), has lost force due to the economic and monetary integration process, others come to less optimistic conclusions.”

According to Beck et al. (2009), the existence of *nominal wage and price rigidities* can also result in high persistence in inflation rates. In case of wage and price stickiness, the adjustment to exogenous shocks takes a long time, and persistent inflation differentials across member states can arise. Typically, nominal rigidities are associated with imperfect competition in the goods and labour markets.<sup>11</sup> In the final part of this section we will discuss some recent research based on dynamic stochastic general equilibrium (DSGE) models. This research focuses on the importance of shocks (including monetary and fiscal policy shocks) in view of differences in wage and price inertia, and characteristics of domestic product, labour, and other factor markets across countries.

Campolmi and Faia (2004) build a dynamic general equilibrium model with two regions that form a currency union and that are characterised by a variety of frictions: matching frictions and wage rigidity in the labour market, monopolistic competition in product markets and adjustment costs on pricing. The authors examine the impact on inflation differentials of common monetary policy and technology shocks after they have calibrated the model using euro area country data. They report that labour and/or product market institutions (proxied by differences in demand elasticities and unemployment benefits, respectively) are able to generate significant and persistent inflation differentials in case of common monetary policy shocks and symmetric technology shocks. Campolmi and Faia (2004) also find that the sensitivity of inflation in response to monetary and technology shocks is higher under either lower ratios of unemployment benefits to real wages or higher demand elasticity.

Altissimo et al. (2005) present a stylized model of a monetary union comprised of two regions to gauge the relative contributions in explaining inflation differentials of innovations in the shocks and structural differences in the regional economies. In each of the two regions two productive sectors are assumed, a traded and a non-traded goods sector. Each region is specialised in the production of a distinct, non-overlapping bundle of traded goods. The law of one price holds for

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<sup>11</sup> In Sect. 2.5 we will discuss some recent research on labour market reform that aims to increase labour market flexibility.

each of the traded goods produced. Inflation differentials therefore arise in the model as a consequence of movements in the relative prices of non-traded goods. The authors conclude that inflation differentials are mainly driven by productivity shocks affecting the non-tradable sector. Symmetric sectoral productivity shocks (i.e., shocks that affect both sectors) in one country may generate sizeable inflation differentials. According to Altissimo et al. (2005), for plausible parameter values, a symmetric increase in productivity in one country has a negative and sizeable impact on the consumer price of the country relative to the rest of the area. They also find that government-purchase shock do not contribute significantly to inflation differentials.

The latter result is not in line with the findings of Duarte and Wolman (2008). These authors examine whether a regional government can affect the inflation differential relative to the union using a two-region model with both traded and non-traded goods, and with sticky prices. In each sector there are two types of firms, retailers and intermediate goods producers. There is an exogenous stream of government expenditures, and the regional fiscal authority has access to a labour income tax and can issue bonds to finance these expenditures. The model is driven by shocks to government expenditures and to productivity in the traded and non-traded goods sectors. Inflation differentials across regions arise from movements in the relative price of non-traded goods across countries and from price differentials for traded goods. Duarte and Wolman (2008) conclude that regional fiscal authorities do have the ability to affect their inflation differential. Specifically, by lowering the distortionary tax rate in response to a positive deviation of inflation from the union-wide average (and raising the tax rate in response to a negative deviation), a regional fiscal authority can decrease the volatility of its inflation differential in response to the shocks driving the model.

Andrés, Ortega, and Vallés (2008) use a two-country model with a common monetary policy. There are only traded goods. This is motivated by the authors arguing that inflation differentials in a monetary union are often assumed to stem mainly from the lack of competition in the non-traded sector but there is also evidence showing substantial differences among traded goods inflation rates. Each country produces differentiated goods traded in monopolistic competitive markets. Price discrimination across countries is possible due to differences in the degree of market competition. In the model, inflation reacts faster in countries with more competitive markets and with lower price adjustment costs. The model is calibrated so as to mimic the characteristics of the larger and less open euro area countries. The authors show that their model is able to generate substantial inflation differentials for reasonable parameter values. Small deviations in the degree of competition may be responsible for temporary inflation differentials up to 13 quarterly basis points when the economy is subject to a common monetary policy shock of an annual increase of 136 basis points. Small differences in the degree of nominal inertia also contribute to generating inflation differentials, but the relevance of this channel is less important. In case of regional (asymmetric) shocks, the elasticity of substitution between home produced and imported goods and the degree of openness also play a major role in producing sizeable inflation differentials.

Rabanal (2009) estimates a two-country, two-sector New Keynesian DSGE model of a currency union using Bayesian methods to explain inflation differentials between Spain and other euro area countries. His findings suggest that tradable sector productivity shocks explain about 65% of the variability of the inflation differential, while non-tradable sector technology shocks explain about 18% of the inflation differential. Demand shocks only explain 14% of inflation dispersion.

Finally, Angeloni and Ehrmann (2007) follow a different strategy than previous research that is based either on descriptive analyses, supported by correlation or regression results, or small calibrated models with microeconomic foundations. They argue that “Each of these lines of research alone is insufficient, we think. On the one hand descriptive analysis has probably reached a point of diminishing returns due to the scarcity of data. On the other, existing small micro-founded models, normally assuming two countries only, provide only partial answers.” (p. 2). Instead these authors have estimated a model that includes 12 countries, each represented by an aggregate demand and an aggregate supply equation. Inflation differentials across countries, originating from nation-specific shocks, cumulate into changes in external competitiveness, which give rise to international trade spill over effects. Their sample is 1998:I–2003:II. In the model, inflation differentials also cause different national short-term real interest rates, which affect domestic aggregate demand in each country differently. The two mechanisms balance each other in a dynamic equilibrium whose characteristics depend on the model’s parameter values. Angeloni and Ehrmann (2007) use the model to analyse inflation differentials, examining the contribution of the different sources of shocks to inflation differentials. Their results indicate that the main source of the differentials is given by national aggregate demand (or potential output) disturbances, followed by domestic cost-push disturbances. In contrast to the results of Honohan and Lane (2003, 2004), area-wide exchange rate shocks come third. According to Angeloni and Ehrmann, the euro exchange rate explains about one-third of the observed inflation differentials among euro area countries in 1998–2003. Angeloni and Ehrmann (2007) also conclude that inflation persistence potentially plays a central role in amplifying and perpetuating inflation differentials within the euro area.

## 2.5 Policy Implications

Ten years after, the launch of the euro, inflation differentials among countries in the euro area have not gone down. However, inflation differentials are a normal feature of any monetary union. Still, the evidence discussed in this chapter suggests that inflation differentials within EMU remain slightly larger and more persistent than those between regions of the United States. According to the European Central Bank (2005), “Inflation differentials across euro area countries may... reflect at least in part equilibrating changes in relative prices, which are an

unavoidable and also desirable manifestation of the gradual but ultimately far reaching structural transformations to which monetary integration and the single market process give rise.” The medium-term orientation of the ECB’s policies facilitates the necessary adjustment of relative prices across regions and sectors in the presence of asymmetric shocks (European Central Bank 2005). However, as this chapter has made clear, not all inflation differentials are due to these equilibrating or convergence processes.

Unfortunately, despite the research done to date, there is no clear consensus in the literature to what extent inflation differentials in the euro area are problematic. In part this is due to the fact that most recent research—Beck et al. (2009) and Angeloni and Ehrmann (2007) being clear exceptions—uses DSGE models that are all perfectly able to yield outcomes consistent with stylised facts, but that are very different in their explanation of these inflation differentials. Still, there is quite some evidence that structural differences in product and labour markets play some role in explaining inflation differentials. Beck et al. (2009) argue that to reduce long lasting, potentially damaging inflation differentials structural reforms in factor and product markets are therefore needed to avoid inappropriate price movements. Also various other researchers come to this conclusion. However, most empirical research to date suggests that EMU has not spurred labour market reform (see Box 2.1).

What else can policy makers do to counteract inflation differentials? The ECB focuses on inflation in the euro area as a whole. In May 2003, the Governing Council of the ECB clarified its price stability objective, explaining that it aims to maintain inflation rates “below but close to 2%” over the medium term. According to the European Central Bank (2005), the aim of maintaining the inflation rate close to the upper bound of its definition of price stability signals the ECB’s commitment to providing an adequate margin to guard against the risk of deflation in individual member countries. However, inflation differentials in the euro area cannot be affected by monetary policy directly, since there cannot be any regionally oriented monetary policy in a currency union.<sup>12</sup> Monetary policy in a currency union is uniform. However, Angeloni and Ehrmann (2007) also examine how this uniform monetary policy affects inflation dispersion and find an interesting result: minimising the deviations of area-wide inflation from its long-run level also helps keeping inflation differentials low. This result is in line with the findings of Beck et al. (2009). Their results suggest that the area-wide monetary policy can considerably contribute to regional inflation stabilization even though it cannot take regional developments into account when making its decisions.

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<sup>12</sup> Fendel and Frenkel (2009) examine whether inflation differentials have influenced the behaviour of the ECB since the launch of the euro. They hypothesise that the ECB may have been less restrictive than euro area wide developments would dictate thereby preventing deflation in the low inflation countries. Their Taylor rule model outcomes suggest an influence of inflation differentials on monetary policy in the euro area. With higher inflation divergence, the ECB was more reluctant to fight an overall inflation gap.

**Box 2.1** Has the euro led to more labour market flexibility?

It is a popular belief that a currency union will create more *labour market flexibility*. The argument is that in EMU monetary policy is no longer available to individual countries to respond to asymmetric shocks, which increases the incentives to undertake structural reform (Bean 1998). Such reforms are likely to increase the flexibility of the labour market and, therefore, make adjustments to asymmetric shocks easier. In addition, structural reforms are also claimed to reduce the natural rate of unemployment.

However, deregulating the labour market has high political costs. Labour market reform would include reductions in the level and duration of unemployment benefits, lower minimum wages, and possibly also reductions in employment protection. Politicians may be highly reluctant to pursue such policies because in the short run they may harm many voters. In addition, EMU might also reduce the incentives for governments to reform the labour market. Before the monetary union, a high inflation bias created an incentive for national policy makers to reform their labour market, because reform would reduce this bias. However, reform in any individual country in the monetary union is unlikely to affect the union-wide inflation bias and the country's incentive to reform is therefore smaller than before the start of the monetary union (Calmfors 2001). Furthermore, for most countries in the monetary union the delegation of monetary policy to the independent and conservative (i.e., inflation-averse) ECB has reduced the inflationary bias in comparison to the pre-monetary union situation. So, on theoretical grounds it is not clear whether the creation of the currency union will lead to more or less labour market reform.

Most empirical research to date suggests that EMU has not spurred labour market reform (see Leiner-Killingler, López Pérez, Stiegert, and Vitale (2007) for an extensive survey). Duval and Elmeskov (2006) estimated a probit model over the period 1994–2004 to examine the impact of the EMU on major reforms in the labour market. Their dependent variable is a binary variable capturing major reforms that refer to: unemployment benefit systems, labour taxes, employment protection legislation, product market regulation, and retirement schemes. The key explanatory variable is a dummy variable that takes the value 1 if a country has a sovereign monetary policy and 0 otherwise. Duval and Elmeskov (2006) find that participation in a fixed exchange rate regime hardly influences labour market reforms. Alesina, Ardagna, and Galasso (2008) have also examined the impact of the euro on structural product and labour market reform. They find that the adoption of the euro has been associated with an acceleration of the pace of structural reforms in the product market. In line with the results of Duval and Elmeskov (2006), Alesina et al. (2008) conclude that the adoption of the euro does not seem to have accelerated labour market reforms. The measures they use capture the degree of employment protection related to the firing decisions and the level of insurance provided to the unemployed. Similar findings are reported by Bednarek-Sekunda, Jong-A-Pin, and De Haan (2010). They differentiate between reform enhancing the capacity of an economy to adjust to economic shocks and reform aiming to increase long-run output. Based on a panel model and using OECD data on labour market reforms for 27 OECD countries over the period 1994–2004, these authors find that both types of labour market reform are driven by different variables. Most importantly, their results suggest that the EMU has had no effect on reform enhancing the economy's capacity to adjust to shocks, while most of their evidence for reform increasing long-run output suggests that the EMU has not affected this type of reform either.

In contrast, Bertola and Boeri (2002) report that the adoption of the euro accelerated the pace of labour market reforms in those countries that joined the euro area. Although the euro area countries started out with a higher level of labour market inflexibility, as measured by employment protection legislation and benefits for the unemployed, euro area countries implemented more reforms between 1997 and 2002 than between 1986 and 1996 compared to non-euro area countries. However, the analysis of Bertola and Boeri (2002) is based on the number of reforms, which is a poor indicator of reform efforts (Leiner-Killingler et al. 2007).

Some authors have argued in favour of a monetary policy that takes inflation differentials into account. For instance, Benigno (2004) argues that it is optimal only to target inflation in the euro area as whole when the regions in the monetary union share the same degree of nominal rigidity. As nominal rigidities differ across the countries in the euro area, a feasible first-best solution consists of an inflation targeting policy in which higher weight is given to the inflation in the region with higher degree of nominal rigidity. The intuition for this can be described as follows. If an economy has two sectors of equal size, but with a different degree of rigidity, the two sectors have to adjust in a similar way upon the occurrence of an aggregate shock. However, the rigid sector bears a higher cost than the flexible sector in its adjustment to that macroeconomic shock. The implied welfare loss for the currency union could therefore be reduced by giving the more rigid sector a higher weight than that based on its overall size (European Central Bank 2005). However, as Benigno acknowledges, this conclusion is not robust to model changes.

The European Central Bank (2005) has various practical objections to this proposal. Not only would there be enormous problems related to the appropriate measurement of the degree of nominal rigidity in the various sectors or regions, it would also be very difficult to determine the level at which such nominal rigidity should be measured. Furthermore, it would be possible that by assigning greater importance to a particular country or sector-specific developments, monetary policy would in practice be accommodating behavioural or structural inefficiencies, ultimately creating perverse incentives and hampering the necessary progress towards more market-based adjustment mechanisms. Also the communication of monetary policy (discussed in more detail in Chap. 5) would face considerable challenges, since its conduct would become significantly more complex and difficult to explain to the public.

The results of Beck et al. (2009) suggest that national policies are still very important for regional inflation rate dynamics despite the fact that monetary policy is no longer conducted at the national level. They suggest that the strong influence of the national factor very likely results both from nationally conducted fiscal policy and nationally determined labour market institutions. However, the literature is somewhat divided about the role of national *fiscal policy*. Whereas Altissimo et al. (2005) conclude that government-purchase shock do not contribute significantly to inflation differentials, Duarte and Wolman (2008) find that regional fiscal authorities do have the ability to affect their inflation differential. Also studies using panel models for inflation differentials (like Honohan & Lane 2003 and Andersson et al. 2009) come to different conclusions. It seems safe to conclude that sound government finances are crucial in order for individual countries to be able to let automatic stabilisers work fully without running the risk of excessively high deficits. Governments should prevent discretionary policy measures from acting pro-cyclically over the business cycle, thereby exacerbating divergence across countries after asymmetric shocks (European Central Bank 2005).

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