EUROPEAN CENTRAL BANK

WORKING PAPER SERIES

WORKING PAPER NO. 132

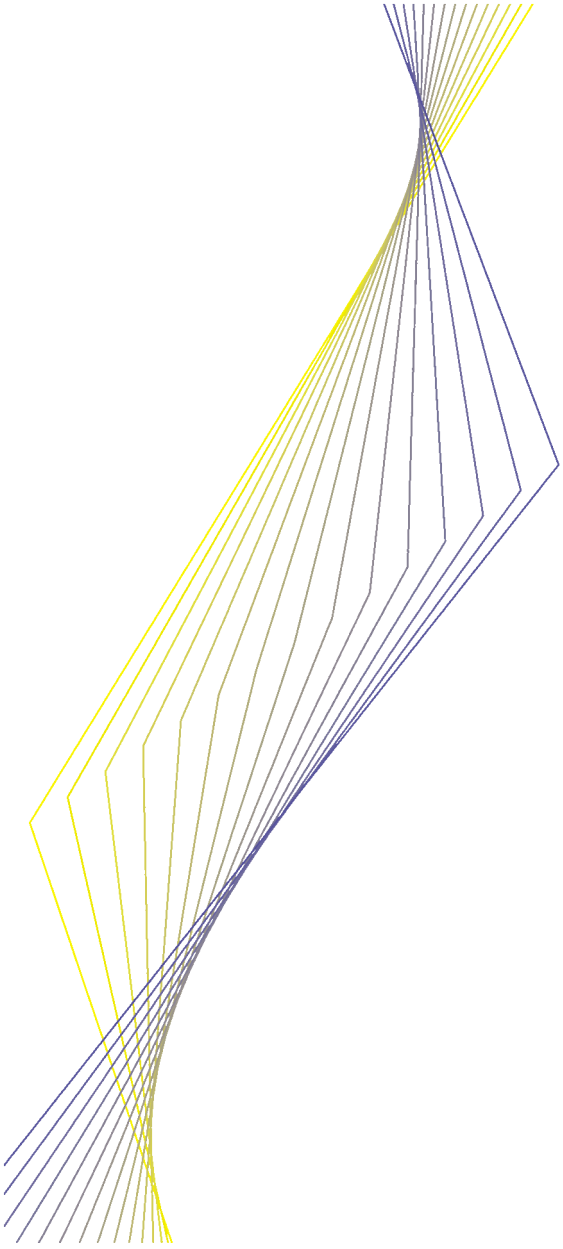
INFLATION DYNAMICS AND DUAL INFLATION IN ACCESSION COUNTRIES: A "NEW KEYNESIAN" PERSPECTIVE

BY OLGA ARRATIBEL, DIEGO RODRÍGUEZ-PALENZUELA AND CHRISTIAN THIMANN

March 2002

EUROPEAN CENTRAL BANK

WORKING PAPER SERIES



WORKING PAPER NO. 132

INFLATION DYNAMICS AND DUAL INFLATION IN ACCESSION COUNTRIES: A "NEW KEYNESIAN" PERSPECTIVE

BY OLGA ARRATIBEL, DIEGO RODRÍGUEZ-PALENZUELA AND CHRISTIAN THIMANN*

March 2002

* *European Central Bank. The views expressed in this paper are those of the authors and do not necessarily represent those of the European Central Bank.* *The authors are grateful to Mariagnese Branchi and Alistair Dieppe for their help in setting up the HICP database used in this paper; to Wendy Carlin, Gabriel Fagan, Pertti Haapparanta and participants in the BOFIT Workshop on Transition Economics, Helsinki, April 2001, for comments on a previous draft; and to an anonymous referee for detailed comments and valuable suggestions.*

Address	**Kaiserstrasse 29** **D-60311 Frankfurt am Main** **Germany**
Postal address	**Postfach 16 03 19** **D-60066 Frankfurt am Main** **Germany**
Telephone	**+49 69 1344 0**
Internet	**http://www.ecb.int**
Fax	**+49 69 1344 6000**
Telex	**411 144 ecb d**

ISSN 1561-0810

Contents

Abstract

This paper examines inflation dynamics in the current EU-accession countries in central and eastern Europe, focusing particularly on the determinants of "dual inflation", that is, diverging inflation rates for tradable and non-tradable goods. The paper draws on the recently published data for the Harmonised Index of Consumer Prices (HICP) of the accession countries and, indeed, finds evidence of "dual inflation" in these economies. To test empirically for underlying determinants, the paper borrows from the recently developed New Phillips curve literature. Overall, domestic factors have systematically a stronger impact upon non-tradable goods inflation whereas international factors have a stronger impact over tradable goods inflation. Furthermore, the results point to the possibly very different effects of exchange rate regimes over tradable and non-tradable goods inflation. On the whole, the findings suggest that the Balassa-Samuelson effect is not a prominent factor behind the current experience of "dual inflation" in these countries.

JEL Codes: E31, E58, F41, P24

Key words: Dual inflation, Central and Eastern European countries, Balassa-Samuelson effect, New Keynesian Phillips curve, exchange rate regimes.

Non-Technical Summary

Inflation rates in accession countries - the countries in central and eastern Europe negotiating access to the European Union - have fallen drastically in recent years, relative to the beginning of transition. While inflation rates in the earlier years of transition reached double or triple digits, they have fallen to single digits in 2001 in all countries but Romania; in several countries inflation currently stands below 5%. This strong decline has come as a result of the swift and decisive anchoring of monetary policy, the establishment of central banking strategies focused on fighting inflation and the pursuance of supporting policies conducive to macroeconomic stability. Despite currently low inflation rates, however, inflation continues to be an issue of key policy concern. This is partly due to the remaining risks of inflationary spikes and, most importantly, to the countries' prospect to join the EU and, later, the euro area, since inflation developments will be at the core of the assessment of convergence with the euro area.

This paper reviews inflation developments in central and eastern Europe, with a special focus on the different inflation behaviour followed by tradable and non-tradable goods (the so-called "dual inflation"). It also borrows from the "New Keynesian" literature to empirically test for the different factors driving tradable and non-tradable goods inflation dynamics in accession countries. To this aim, it uses the recently published data for the HICP of the accession countries.

It is found that for headline inflation, the main factors impacting inflation seem to be nominal wage growth, lagged inflation (therefore indicating a relatively large degree of inflation inertia), oil prices and fiscal policy. As expected, inflation in non-tradable goods has generally exceeded that of tradable goods, evidencing the existence of "dual inflation" in accession countries. More specifically, tradable inflation has been particularly affected by oil price, nominal wage growth and fiscal developments, whereas non-tradable inflation has been mainly impacted by wage and fiscal policy, price liberalisation and productivity developments. Indeed, price liberalisation, especially in utilities and the energy sector, has been one of the main driving forces for non-tradable inflation, as prices in these sectors had been often fixed far below cost-recovery levels. Hence, transition related factors still have an important bearing on inflation dynamics, especially in non-tradable sectors. Interestingly, the productivity growth in the manufacturing sector does not seem to impact significantly on inflation dynamics in the non-tradable sector. In the light of this evidence, it does not appear that productivity growth differences (and the so-called Balassa-Samuelson effect) have played, thus far, a major role in driving inflation dynamics in accession countries. In sum, the paper's empirical findings underline the importance of nominal wage growth moderation and fiscal policy consolidation for price stabilisation, as well as the impact of liberalisation-oriented reforms on lowering inflation, particularly in the non-tradable sector. Finally, the paper identifies a still high level of inflation inertia in accession countries and highlights the role of exchange rate developments in driving inflation outcomes.

1 Introduction

Inflation dynamics in accession countries – the countries in central and eastern Europe that are currently negotiating accession to the European Union[1] – have received prime attention of policy makers throughout the past decade of transition. At the outset of transition, annual inflation rates reached triple and double digits following the initial liberalisation of prices, thereby risking macroeconomic stability. After decisive policy action, the establishment of institutional frameworks and the anchoring of monetary policies, inflation rates declined rapidly and macroeconomic stability was achieved in the early 1990s in most countries. By 2001, annual inflation rates reached single digits in all accession countries with the exception of Romania.

Despite this remarkable progress, inflation dynamics in the accession countries continue to be a prime focus of macroeconomic policies and are likely to remain so in the years to come. The reason for this is, partly, that the accession countries' goal of applying for euro area membership over the medium term requires further nominal convergence in inflation rates with the euro area and, yet, furthering disinflation from upper single digits to lower single digits has turned out to be a difficult task for most accession countries. Indeed, a number of factors continue to adversely affect inflation in the accession countries, including ongoing price liberalisation, the need to catch up with the European Union (EU) in terms of real income levels, stubborn inflation expectations and pressures for fiscal spending stemming from the completion of the transition process and the harmonisation with EU standards.

This paper aims at shedding further light on the determinants of inflation dynamics in accession countries. To this end, it uses a new data set of harmonised inflation, which makes cross-country comparisons more reliable, and models inflation dynamics within the so-called New Phillips curve framework. This framework, as compared with the traditional Phillips curve approach, focuses more heavily on the role of inflation expectations, which are treated explicitly. The paper takes the combined sample of accession countries, which lends itself rather well to an empirical study of inflation dynamics, given broadly similar starting conditions one decade ago and sufficient variation in inflation dynamics thereafter to discern individual country experiences, economic patterns and policy choices. A leitmotif in the paper is, then, the distinction between tradable and non-tradable goods

[1] The accession countries referred to in this paper include the ten transition economies that are negotiating accession to the EU (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia). The two other countries that are also conducting negotiations (Cyprus and Malta) and Turkey, which formally also has the status of an accession country but has not yet started negotiations, have been excluded from the sample as different driving forces govern their inflation dynamics, given that these are not transition economies.

inflation and the analysis of the different factors underlying these two sets of variables.

The paper is organised as follows. Section 2 presents a broad overview of inflation dynamics in the accession countries and Section 3 recalls some of the findings on this issue in the literature. Section 4 discusses the split between inflation in tradable and non-tradable goods as well as key developments in "dual inflation". Section 5 presents the modelling framework and Section 6 describes the estimation of the inflation dynamics equation and the main results. Finally, Section 7 concludes the paper.

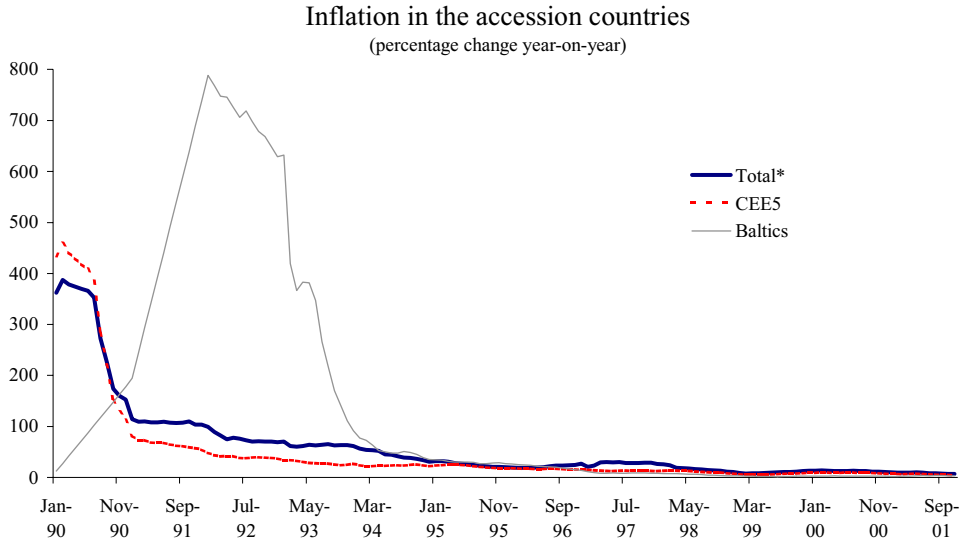
2 The overall picture

The picture presented by inflation dynamics in the accession countries from 1990 to 2001 tells the story of a rather turbulent period. It is the story of relatively successful attempts of macroeconomic stabilisation at the beginning of the 1990s, the setting up of new institutions and tasks, and the coping with internal and external crises as well as with fairly strong but highly volatile growth. Inflation dynamics also reveal different policy choices – in particular with regard to monetary policy strategies and the choice of exchange rate arrangements – and different policy responses to political or economic crises, both domestically and externally. Finally, inflation dynamics reveal the introduction of new products and dramatic qualitative changes, the effects of price and wage liberalisation in the transition to a market economy and significant changes in consumption patterns.

Although all these different factors have been at play to varying degrees and at varying times, they have contributed to a relatively overall similar picture of inflation dynamics in most accession countries from 1990 to 2001. In rather generic terms, this picture can be seen as broadly "L"-shaped, with high inflation rates at the outset of transition, a rapid disinflation process upon macroeconomic stabilisation in the early 1990s and, finally, a further gradual decline in inflation rates later thereafter (Table 1 and Figures 1-4). The surge in inflation at the outset of transition can be attributed mainly to the liberalisation of prices that had traditionally been fixed far below cost-recovery levels under the planned economy regime and to the difficulties faced throughout the overall macroeconomic stabilisation process. The three Baltic States, for instance, experienced a short period of hyperinflation after the collapse of the Soviet Union in 1992 and inflation rates reached around 1,000% that year. For the accession countries as a whole, this initial phase of transition shocks lasted until about 1994.

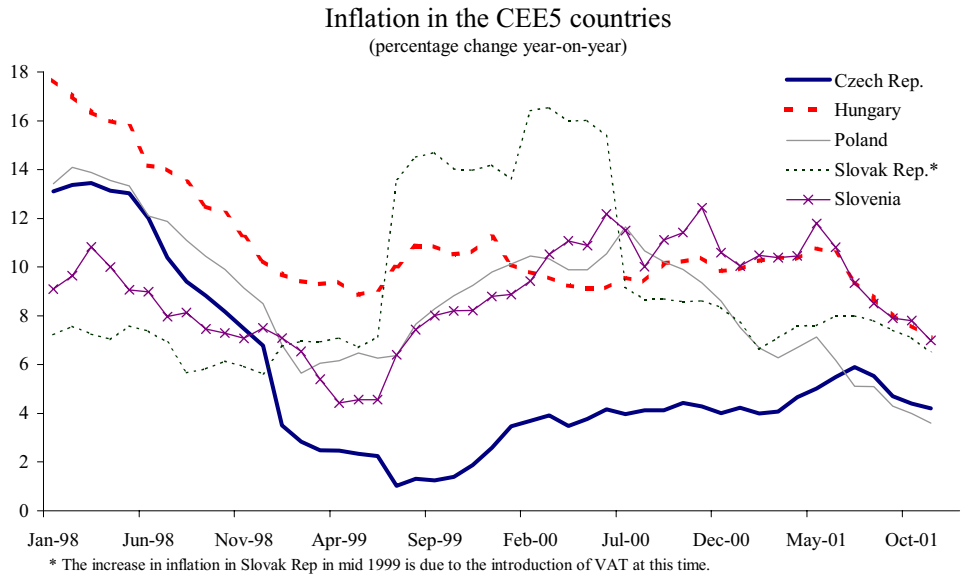
Thereafter, inflation rates gradually declined from annual changes of, on average, 20%-30% in 1995 to single-digit rates for most countries in 1999, and for all

Figure 1:



* Excluding Malta and Cyprus. Bulgaria excluded in 1997 and January 1998.
Source: IFS, EBRD, Planecon, IIF, Deutsche Bank Research and ECB staff calculations.

Figure 2:



* The increase in inflation in Slovak Rep in mid 1999 is due to the introduction of VAT at this time.
Source: IFS

Figure 3:

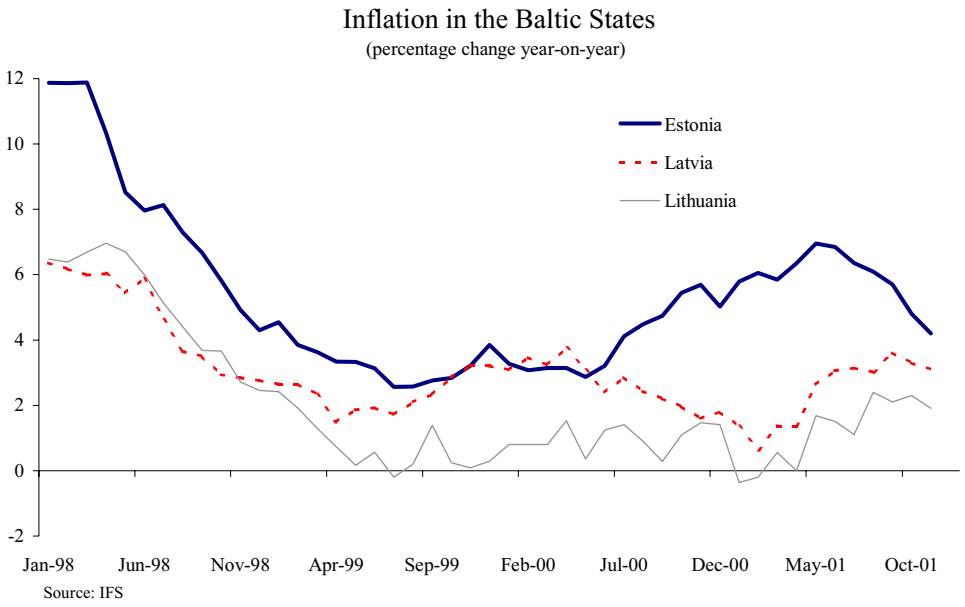
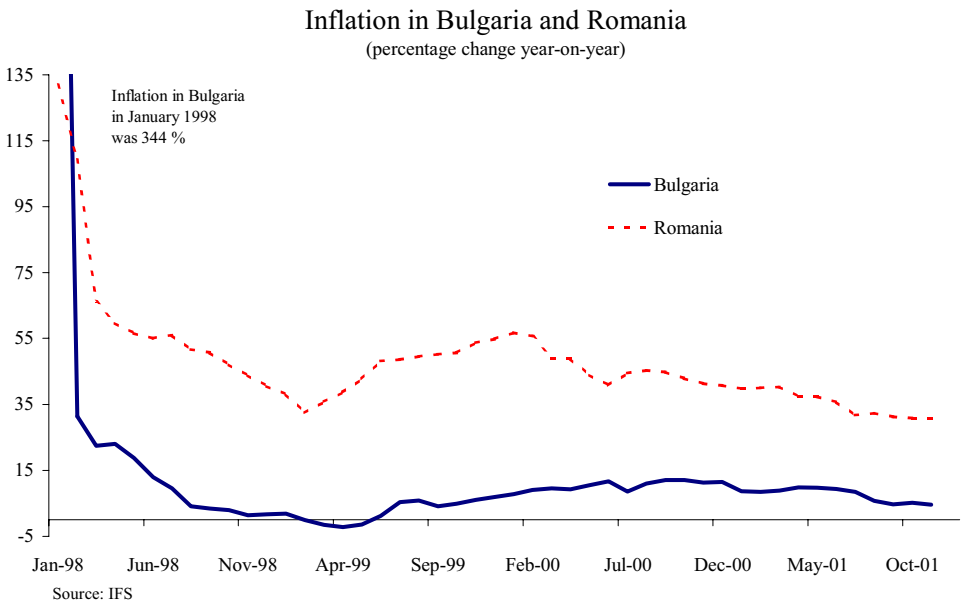


Figure 4:



countries except Romania in 2001. The decline in inflation over this period was largely due to the fading of the major transition-related shocks and, subsequently, to the stabilisation of the political and macroeconomic frameworks. Moreover, the dispersion in inflation rates between countries also declined, as domestic shocks lost relevance and business cycles became increasingly synchronised. The rather steep decline in inflation during 1998 and the first half of 1999, however, was partly attributable to the effects of the Asian and Russian crises, which led to a decline in oil prices, caused a severe recession in the Baltic States and pushed output growth below potential also in many other accession countries. Interestingly, inflation rates picked up quite significantly in the accession countries in 2000, once the above-mentioned factors had been reversed and oil prices and output growth started accelerating (incidentally also a strong rise in food prices – following adverse climate conditions – contributed to these developments). The pick-up of inflation rates in the years following the global emerging market crisis of 1998-99 was also due to lagged effects of the significant monetary policy loosening that had been implemented during the crisis years and that triggered a credit boom, including to households, in several accession countries. The tightening of policies in late 1999-2000 then led to a renewed decline in inflation rates in 2000 and 2001, ultimately helped also by the global slowdown and the renewed weakening of oil prices in 2001. By end-2001, inflation rates even declined to lower single digits in many countries (Figures 1-4).

Table 1: Inflation rates in accession countries (annual average in %) [1]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*
All countries	219.7	92.4	83.2	62.9	40.2	25.1	22.1	58.6	16.7	10.1	12.3	8.7
Baltics	13.2	184.8	1,011.1	230.3	53.6	32.3	22.1	9.3	5.7	1.8	2.2	3.1
CEE5	291.6	63.9	42.8	28.9	23.1	21.9	16.6	13.2	11.4	6.9	9.0	6.2
Southeast Europe	10.1	207.7	180.3	202.8	126.8	40.3	57.1	362.4	50.7	34.1	36.9	27.5
Bulgaria	26.3	333.5	82.0	73.0	96.3	62.0	123.0	1082.0	22.2	0.7	9.9	7.4
Czech Republic	10.8	56.7	11.2	20.8	10.0	9.1	8.8	8.5	10.7	2.1	3.9	4.7
Estonia	23.1	211.0	1,076.0	89.8	47.7	29.0	23.1	11.2	8.2	3.3	4.0	5.6
Hungary	28.9	35.0	23.0	22.5	18.8	28.2	23.6	18.3	14.3	10.0	9.8	9.2
Latvia	10.5	124.0	951.2	109.2	35.9	25.0	17.6	8.4	4.7	2.4	2.8	2.5
Lithuania	8.4	224.7	1,020.5	410.4	72.1	39.6	24.6	8.9	5.1	0.8	1.0	1.3
Poland	585.8	70.3	43.0	35.3	32.2	27.8	19.9	14.9	11.8	7.3	10.1	5.5
Romania	5.1	174.5	210.4	256.1	136.7	32.3	38.8	154.8	59.1	45.8	45.7	34.9
Slovak Republic	10.8	61.2	10.0	23.2	13.4	9.9	5.8	6.1	6.7	10.6	12.0	7.3
Slovenia	549.7	117.7	207.3	32.9	21.0	13.5	9.9	8.4	8.0	6.1	8.9	8.4
All countries												
–Volatility[2]	..	..	..	..	1.3	0.4	0.4	1.5	1.4	0.3	0.2	..
–Dispersion[3]	233.1	94.6	457.0	128.2	41.4	15.7	34.2	48.2	16.3	13.5	12.8	9.3

* Estimates

[1] Excluding Malta and Cyprus. 1997 data for group averages excludes Bulgaria.

[2] Percentage point deviation from 5-month centred moving average.

[3] Standard deviation of unweighted CPI changes.

At a country level, three groups of countries that have followed somewhat different inflation and disinflation paths can be distinguished: the five Central and Eastern European (CEE5) countries (i.e. the Czech Republic, Hungary, Poland, Slovakia and Slovenia), the three Baltic States, and the South-Eastern European (SEE) countries of Bulgaria and Romania. In the CEE5 countries, the L-shaped pattern is visible, but less pronounced. Inflation rates, although high at the beginning of transition, did not reach rates close to hyperinflation, and the subsequent inflation decline was also rather gradual. At the beginning of the transition, the CEE5 countries – with the exception of Slovenia – adopted an exchange rate peg that acted as a nominal anchor. Over time, these pegs were increasingly abandoned in favour of more flexible exchange rate regimes (Figure 5). Greater exchange rate flexibility was sought to provide policy-makers with more room for macroeconomic manoeuvre, to cope with domestic and external shocks as well as capital flows and, more recently, to advance disinflation further by allowing for some appreciation of the nominal exchange rate. In the Baltic States the L-shaped pattern is extremely pronounced, with hyperinflation at the outset of transition and a drastic and lasting disinflation process thereafter. This pattern was supported by the nominal anchoring of the exchange rate through currency board arrangements in Estonia and Lithuania, and a hard-peg in Latvia. The

Figure 5:

Exchange rate regimes in accession countries

	Currency board	Conventional peg	Narrow band	Tightly managed	Broad band	Managed float	Relatively free float	Main features
Czech Rep.		⇨ January-91			⇨ February-96	● May-97		Managed floating (euro is reference currency)
Hungary		⇨	⇨ March-95		● October-01			Pegged to euro (±15%)
Poland		⇨	⇨ May-91		⇨		● April-00	Relatively free floating
Slovakia		⇨ January-93			⇨ July-96	● October-98		Managed floating (euro is reference currency)
Slovenia				● 1992				Managed floating (euro is reference currency)
Estonia	● June-92							Pegged to euro/Deutsche Mark
Latvia		● February-94						Pegged to SDR (±1%)
Lithuania	● April-94							Pegged to euro since February 2002 (before US dollar)
Bulgaria	● July-97					⇦		Pegged to euro/Deutsche Mark
Romania			⇨	● August-92				Managed floating (US dollar is reference currency)
Cyprus		⇨ June-92			● January-01			Pegged to euro (±15%)
Malta		● January-71						Pegged to currency basket (56.8% euro)
	● current regime ⇨ ⇦ previous regimes							

Source: ECB

initially extremely high rates of inflation in the Baltic States also reflected the fact that these States were newly (re-)created economic areas that did not have central banks of their own at the outset of transition so that also the institutional frameworks had to be set up practically from scratch.

As for Bulgaria and Romania, they add "noise" to the general picture of inflation dynamics in the accession countries. The phase of disinflation since 1994 was interrupted by a currency crisis in Bulgaria and political crises in Romania in 1996 and 1997, periods during which inflation rates peaked briefly at around 2,000% and 200%, respectively. While the macroeconomic framework in Bulgaria was swiftly stabilised through the introduction of a currency board arrangement in 1997, macroeconomic stabilisation has yet to be fully achieved in Romania, where inflation rates have remained in a range of 30%-40% on average over the past few years.

Looking ahead, it is evident that risks of high inflation are banned in all countries except Romania. In 2000, average inflation rates in the accession countries stood at 11.8% (7.8% excluding Romania) and a further decline, partially attributable to a levelling off of oil prices and a global slowdown, to 8.8% (6.1%

excluding Romania) is estimated for 2001. The experience of the past few years has, however, suggested that inflation is still rather persistent and more sensitive to energy prices and cyclical conditions than in industrial countries.[2] Furthermore, domestic factors, including macroeconomic policies, ongoing liberalisation, wage policies and inflation expectations as well as factors attributable to ongoing price adjustments and the catching-up of prices and real incomes seem to put a floor on the short-term decline in inflation and may remain relevant for inflation over the medium term.

3 Related literature

The study of the determinants of inflation, both in theoretical and in empirical terms, has been one of the key issues of the macroeconomic literature. Numerous attempts have also been undertaken to explain the complex picture of inflation dynamics in accession countries during the last decade.

Institutional issues have been one of the main elements of attention of this literature, initiated by the seminal work of Barro and Gordon (1983) that stressed the time consistency problem associated with the conduct of monetary policy. Consequently, the institutional design of central banks has been studied extensively as a means of delivering optimal, or close to optimal, monetary rules that keep inflation at relatively low levels.[3] In this context, accession countries' central banks have adopted statutes that strengthen their independence from political bodies and their reputation of pursuing low-inflation policies (Cukierman, 1986). Also in search for credibility, most accession countries' central banks initially adopted fixed exchange rate arrangements to import the reputation needed to put inflation on a downward path (van der Haegen and Thimann, 2001).[4] Finally, anti-inflationary policies have benefited from institutional reforms that have improved the environment in which central bankers operate, thanks either to the restructuring and consolidation of the financial and banking systems (Wagner, 1998) or to stronger governance and institution building (Kolodko, 2000).

Notwithstanding the positive impact of institutional reforms, inflation dynamics in the accession countries have been severely affected by a number of factors

[2] Oil prices affect these countries more than industrial countries, due to a more energy-intensive production structure and more energy-consuming technologies in production, transportation and heating. This is reflected in a larger weight of energy-related products in the consumer price index (CPI).

[3] See, for instance, Rogoff (1985) for the solution of a delegation of monetary policy to a conservative central bank, Lohmann (1992) for the solution of a non-linear policy rule where the policy-maker retains the option to override the central bank or Svensson (1997) on the benefits of an inflation-targeting conservative central bank.

[4] In this context, Bénassy-Quéré and Révil (2000) borrow from literature on optimal currency areas to justify the choice of the euro as the anchor currency for the accession countries.

related to the transition from centrally planned to market economies (Cottarelli and Doyle, 1999). These factors have, in some cases, contributed to high inflation and complicated the conduct of monetary policy. For instance, according to Ghosh (1997), the so-called inflation tax has added to inflation, especially at the beginning of transition, given the limited capacity of governments in accession countries to levy or collect other taxes as well as to access financial markets. Even if not driven by fiscal purposes, monetary factors, in combination with strong growth in nominal wages, seem to be responsible for high inflation, mainly on account of nominal and real rigidities, such as backward looking indexation and large structural unemployment, that prevail in the labour markets of accession countries (Coorey et al., 1996). Finally, the higher inflation in the accession countries was also a consequence of price adjustments and transition reforms, such as privatisation, tax reforms, enterprise restructuring and financial sector liberalisation, particularly in the initial phase of transition when deep reforms and large-scale liberalisation were implemented (Koen and De Masi, 1997).

A different set of papers have borrowed from the original work by Balassa (1964) and Samuelson (1964) to explain the persistence of moderate inflation in the accession countries as a result of the process of convergence in real income and living standards. Specifically, in a world with high capital mobility, higher capital returns in fast-growing economies would lead to technological improvements and higher productivity growth, mainly in the tradable sector of the economy. With competitive labour markets, higher real wages in the tradable sector will add pressure on wages in the non-tradable sector, so that prices for non-tradable goods and services would rise as well. Without large productivity gains in the non-tradable sectors, higher real wages would lead to higher prices for this type of goods and, thus, to the presence of "dual inflation", a concept defined here as a higher rate of growth for prices in the non-tradable sector than in the tradable sector of the economy.

With regard to the application of these considerations to accession countries, however, several refinements may be necessary. First, for most accession countries, productivity in the services sector may also experience large gains as many segments of this sector have started developing only recently. Second, in the case of transition economies, industrial structures are likely to change fast, not only in terms of the composition of export goods, but also in terms of higher quality or added value improvements. In this case, the price of tradables in the accession countries would not remain constant, but would increase, so that "dual inflation" would not be observed. Finally, the assumption of wage equalisation across the labour market might not hold. Contrary to the experience of other developing countries, industrial workers in the accession countries are relatively highly qualified, so that it is less likely that non-qualified workers in the services sector may capture the higher real wages perceived in the industrial sector.

Price levels in most accession countries are still substantially lower than in the

EU, ranging from around 60% of the EU average in Slovenia to 21% of the EU average in Romania. The same applies to per capita real income levels that amount on average to 44% of the EU level in terms of purchasing power parity (PPP), and to 22% of the EU level in current exchange rate terms. The contribution of the so-called Balassa-Samuelson effect to inflation has, therefore, not been negligible. Depending on the study, this effect has been estimated in an interval of around 1 to 3 percentage points. For instance, Simon and Kovacs (1998) have estimated that the Balassa-Samuelson effect may explain around 1.9 percentage points of overall inflation in Hungary, while similar results, around 1.5 to 2.0 percentage points, have been found by Rother (2000) in the case of Slovenia. In a different study, Corker et al. (2000) have also provided evidence of a positive Balassa-Samuelson effect on inflation in the CEE5 countries and estimated it below a ceiling of 3 percentage points. These figures are in line with those found for some of the catching-up economies of the euro area, where the Balassa-Samuelson effect is estimated to have contributed around 1.5 percentage points to inflation in Spain in the period from 1985 to 1993 (Alberola-Ila and Tyrväinen, 1998) and 1.7 and 1.1 percentage points to that in Greece and Portugal, respectively, in the period from 1990 to 1996 (Swagel, 1999).

Undoubtedly, catching-up in price levels will require the maintenance of positive inflation differentials between the accession countries and the euro area in the foreseeable future. Yet, a large share of the inflation currently observed in accession countries would need to be attributed to factors other than the Balassa-Samuelson effect (Cipriani, 2000). Against this background, identifying the source of inflation in the accession countries is the key to the optimal choice of the monetary and exchange rate strategies to be implemented by policy-makers in the run-up to these countries' accession to the EU/euro area.

4 "Dual Inflation": inflation dynamics in tradable and non-tradable goods

"Dual inflation" is a phenomenon commonly observed in catching-up economies and, thus, in most accession countries. In this section, the Harmonised Index of Consumer Prices (HICP), which has recently become available for all the accession countries discussed in this paper, is used to test for evidence of "dual inflation" in accession countries. Although most of the series only start around the mid-1990s,[5] the HICPs constitute a unique set of information since they are homogeneous indicators for the comparison of inflation dynamics among accession countries as well as vis-à-vis the euro area.

For the purposes of this section, the twelve categories of goods and services

[5]The series start in 1995 for the Czech Republic, Estonia, Hungary, Lithuania, Romania, Slovakia and Slovenia, in 1996 for Bulgaria and Poland, and in 1998 for Latvia.

that compose the HICP have been classified to set up price indicators for tradable and non-tradable items.[6] As in other empirical studies, a first difficulty arises when trying to distinguish between tradable and non-tradable goods and services, as the different item categories included in the HICP cannot always be easily identified as tradables and non-tradables.[7] Following a careful examination of the HICP, however, the following categories can be constructed without much loss of accuracy:

- Tradables: composed of food and non-alcoholic beverages; alcoholic beverages and tobacco; clothing and footwear and furnishings; and household equipment and routine maintenance of the house.
- Non-tradables: composed of health; communication; recreation and culture; education; restaurants and hotels; and miscellaneous of goods and services.
- Items affected by energy: composed of housing, water, electricity, gas and other fuels; and transport.

A study of price developments across these categories reveals the following stylised facts:

- Non-tradable goods inflation has generally exceeded that of tradable goods (Figures 6 and 7). On average, the difference between non-tradable and tradable inflation over the past few years has been 4.9 percentage points in all accession countries; 3.1 percentage points in the CEE5 countries and 4.6 percentage points in the Baltic States (see Appendix I).
- Within tradables, food prices – which represent the largest share of the tradable index – have registered significantly lower inflation than the remaining components of this index. As for the remaining tradable goods (i.e. alcoholic beverages and tobacco, clothing and furnishing), they have also followed a disinflation path over time.

[6] These 12 categories are: (1) food and non-alcoholic beverages, (2) alcoholic beverages and tobacco, (3) clothing and footwear, (4) housing, water, electricity, gas and other fuels, (5) furnishings, household equipment and routine maintenance of the house, (6) health, (7) transport, (8) communication, (9) recreation and culture, (10) education, (11) restaurants and hotels, and (12) miscellaneous of goods and services.

[7] For instance, items that might *a priori* be considered as tradables (e.g. clothing) may include sub-components that are clearly non-tradable (e.g. cleaning, repair and hire of clothing). Obviously, if accession country HICPs were available at a more disaggregated level, a clear-cut distinction between tradable and non-tradable goods would be feasible. Unfortunately, this decomposition is not yet available for all accession countries and, when available, series only start in January 2001.

- With regard to the evolution of non-tradable goods prices across accession countries, a common pattern cannot be easily discerned. This may be partly due to the fact that prices of goods such as health as well as communication and education usually reflect deregulation and structural reforms that lead to up-and-down swings in inflation. For recreation and culture, inflation trends are less homogeneous across countries, probably on account of differences in consumption patterns and/or disposable income. The remaining items, i.e. restaurants and hotels as well as miscellaneous goods and services, display a slightly more homogeneous inflation path which is characterised by persistently high inflation.

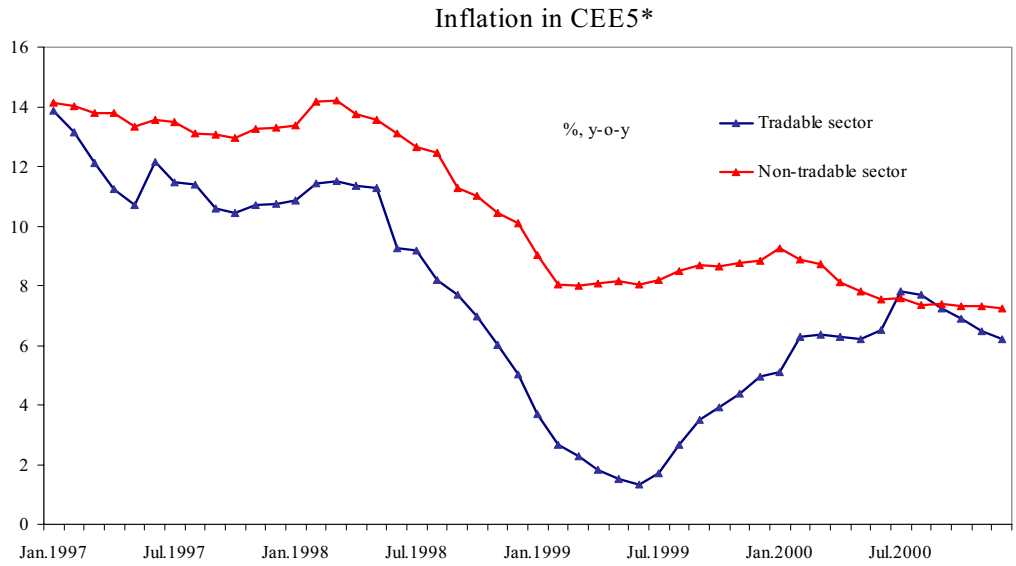
- Items affected by energy have been the most inflationary ones in many accession countries. Structural reforms and deregulation in these sectors, which had been heavily subsidised in the past and for which prices had been fixed far below cost-recovery levels, are the key to explaining consistently high inflation for prices of transport, water, electricity, gas and fuels in the accession countries.

- As for the weights of the HICP components, they reveal that the proportion of tradable goods and services in the consumer basket has decreased over time (see Appendix I). This evolution is somewhat related to the catching-up process since the weight of non-tradable goods and services in the consumer basket is likely to increase along with disposable income. Changes in the weight structure of the HICP will affect inflation trends; in particular, a rise in inflation might be observed due to the increasing weight of non-tradable goods and services.

As expected, "dual inflation" can be observed in accession countries. A further step in this paper consists of analysing whether the higher inflation in the non-tradable sector of the economy stems from the higher productivity growth in the tradable sector, as predicted by the Balassa-Samuelson framework. The typical examples for this phenomenon are the Japanese economy in the period from 1970 to 1990 and some South-East Asian economies during the 1980s and beginning of the 1990s (Ito et al., 1999). Unfortunately, in the case of the accession countries, long data series are not yet available, so that it is rather difficult to test for the existence of "dual inflation" in the sense predicted by the theory. In addition, the identification of the factors that have driven inflation in the accession countries is complicated further because, during the period under review, several countries have experienced a prolonged recession apart from the initial transition shock, registered hyper-inflationary episodes and/or suffered price distortions and relative price adjustments that have shadowed inflation trends.[8]

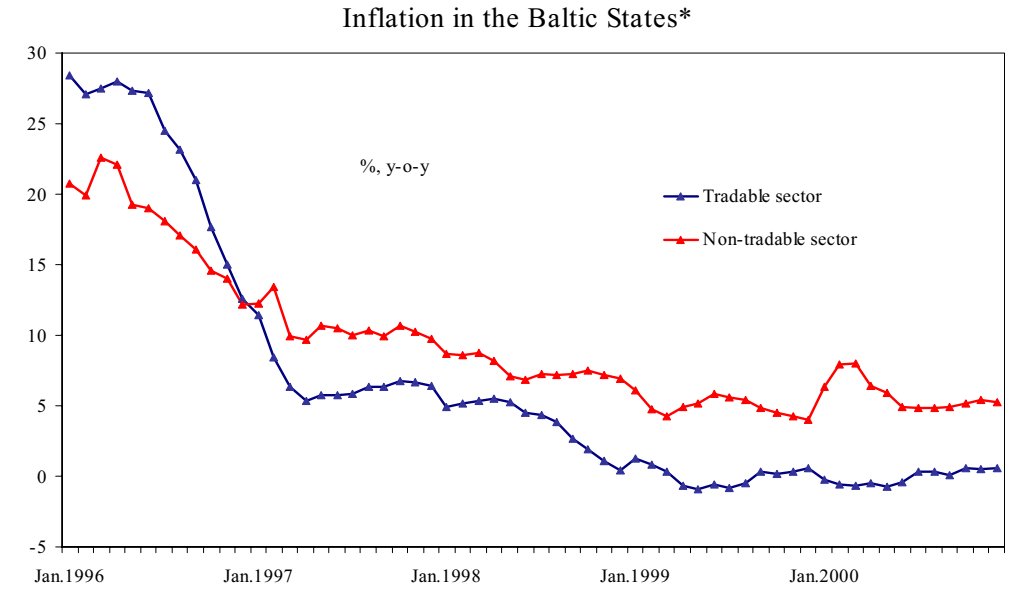
[8] Prolonged recessions after the years of the initial transition shock were experienced in Bul-

Figure 6:



* The Czech Republic, Hungary, Poland, Slovak Republic and Slovenia Source: Eurostat and ECB staff calculations.

Figure 7:



Source: Eurostat and ECB staff calculations. *In the period 1996-1999, Latvia has been excluded.

Moreover, a first glance at the data suggests that some of the assumptions of the Balassa-Samuelson framework may have not been met in the accession countries. The different pattern of "dual inflation" in Figures 6 and 7 is revealing in this sense. These charts suggest that the exchange rate arrangement may have played a role in driving the dynamics of tradable and non-tradable goods inflation. In the case of the Baltic States, for instance, the significantly higher inflation in the tradable sector at the beginning of the sample period, and the gradual disinflation process thereafter, may have been linked to the convergence of tradable good prices to international levels. The introduction of hard pegs at initially strongly undervalued exchange rates in Latvia and Lithuania in 1994 may, at the outset, have led to significantly higher inflation in the tradable goods sector than in the non-tradable goods sector of these economies. As time has gone by, tradable goods prices have probably converged to international levels. Only then did inflation in the tradable sector gradually decline, even reaching negative rates in mid-1999, and was surpassed by higher inflation in the non-tradable sector. As for the CEE5 countries, the adjustment of tradable goods prices to international levels may have taken place more gradually throughout the whole transition period, and also through the appreciation of nominal exchange rates. This would partly explain that inflation in the tradable goods sector has been systematically lower than in the non-tradable goods sector. The only exception would be the period from July to August 2000 when a deterioration of climatic conditions led to a severe picking-up of food prices in all CEE5 countries.

5 Modelling framework

In order to derive a formal framework to study inflation dynamics in our sample of accession countries, we draw extensively from the recently developed New Phillips curve literature.[9] In contrast to the traditional Phillips curve, this literature relates current inflation to expectations of future inflation. In its simpler form, the traditional Phillips curve relates current inflation to lagged inflation and a measure of the output gap. If we let π_t denote the level deviation of inflation from its long-run value in period t and $\hat{y}_t$ the output gap, defined as the difference between the logarithm of current output and the log of potential output, i.e. $\hat{y}_t = \log Y_t - \log Y_t^*$, a common specification of the traditional Phillips curve can

garia (1996-97), the Czech Republic and Romania (both 1997-99); periods of triple-digit inflation after the years of the initial transition shock were experienced in Bulgaria and Romania (both in 1997; see Table 1).

[9] For examples of this literature, see the references at the end of the paper and references thereupon. For a broader perspective over this literature, see Clarida et al. (1999) and Galí et al. (2001).

be given by:

$$\pi_t = \sum_{i=1}^{k} \theta_i \cdot \pi_{t-i} + \alpha \cdot \hat{y}_{t-i} + \epsilon_t, \tag{1}$$

where ϵ_t denotes a disturbance term and k is the number of periods in the past that affect the current inflation rate.

Drawbacks from this specification are that (1) is not derived from an explicit microeconomic framework and that the backward looking nature of (1) bodes ill with the rational expectations hypothesis. The coefficients in the traditional Phillips curve are therefore subject to the Lucas critique. A second limitation of the traditional approach, as argued for example by Galí et al. (2001), is its propensity to over-predict inflation in the 1990s, which is ultimately related to the backward looking nature of the traditional Phillips curve.

The papers under the heading of "New-Keynesian Phillips curve", by contrast, explicitly lay out fully-fledged dynamic general equilibrium models of the economy where price rigidities play a central role, and which are nevertheless relatively tractable.[10] In particular, this set of models yields a closed-form expression where inflation is a function of, first, expectations of future inflation, implying therefore that inflation dynamics are determined by forward looking expectations of future inflation and, second, the output gap (which turns out to be optimally proxied by a measure of real marginal costs[11]), to the extent determined by the proportion of producers that are able to set prices optimally at any point in time. In its simplest expression, the estimated equations are of the following form:

$$\pi_t = \beta \cdot E_t \pi_{t+1} + \lambda \cdot \hat{c}_t, \tag{2}$$

where β is the discount factor, E_t is the expectations operator at time t, and where $\lambda \cdot \hat{c}_t$ captures the inflationary impact of the changes in real marginal costs in the economy (in deviation from its steady state level). Hence, substituting recursively for future inflation in this equation, current inflation can be written as:

$$\pi_t = \lambda \cdot \hat{c}_t + \lambda \cdot \beta \cdot E_t \hat{c}_{t+1} + \lambda \cdot \beta^2 \cdot E_t \hat{c}_{t+2} + \lambda \cdot \beta^3 \cdot E_t \hat{c}_{t+3} + ...$$

[10] Some of the seminal contributions to the literature on staggering prices and/or wages can be found in Fischer (1977), Taylor (1979) and Calvo (1983).

[11] Real marginal costs, in turn, are typically approximated in this literature by real unit labour costs, i.e. unit labour costs deflated by the GDP deflator. This particular approximation to real aggregate marginal costs (and ultimately to the output gap) will not be available, due to data restrictions, in our sample of accession countries. In the following sections we confirm that conventional measures of the output gap (e.g. the difference between actual and HP-filtered output) do not perform well in our sample and we lay out our alternative approximation to real marginal costs, which is based on a set of structural and conjunctural indicators of economic overall efficiency and excess demand pressures.

i.e., that the deviation of inflation with respect to the steady-state level is determined by the current expectations of future developments in real marginal costs.

Galí and Gertler (1999) and Galí et al. (2001) have successfully estimated inflation equations within the New Phillips curve framework for the US and for the euro area, respectively. These papers estimate *hybrid* specifications of the New Phillips curve where forward looking expectations of inflation are combined with backward looking elements to model inflation dynamics. Such specifications can be obtained assuming that those producers who cannot set the price optimally will adjust prices following the price indexation rule: $P_t = (1 + \pi_{t-1})P_{t-1}$.[12] In its simplest form, the *hybrid* Phillips curve can be expressed as:

$$\pi_t = b \cdot E_t \pi_{t+1} + \gamma \cdot \pi_{t-1} + \ell \cdot \hat{c}_t, \tag{3}$$

where the parameter γ captures the backward looking factors affecting inflation.[13]

A prominent finding from these papers is that the forward looking component is considerably more important than the backward looking component for explaining current inflation in the economies under consideration. A second important finding is that real unit labour costs appear to capture a sizeable fraction of real marginal costs, whereas a measure of the output gap fails to act as a good proxy for real marginal costs.

No doubt, the New Phillips curve framework may be substantially extended by a more comprehensive modelling of real marginal costs as a function of additional factors, like an index of commodity prices and information on labour market institutions. However, the existing literature suggests that the analysis of inflation dynamics across countries is already significantly improved by the introduction of forward looking elements in the New Phillips curve specification.

In practice, the analysis of recent inflation dynamics in accession countries, based on the insights from the New Phillips curve literature, requires the introduction of two additional elements.[14] First, being small open economies, the price formation processes as well as the inflation dynamics in accession countries are likely to be subject to specific conditions, some of which are laid out in Clarida, Galí and Gertler (2001). Second, a considerable number of factors (e.g. the government deficit ratio, the exchange rate regime, the extent of structural reforms, etc.) that are known to affect inflation dynamics in most economies are likely to play also an important role in the case of accession countries. However, the precise form in which these factors affect inflation is not generally spelled out by theory and, hence, a specific interpretation of the theory is needed to accommodate these factors.

[12] See Christiano, Eichenbaum and Evans (2001) for additional details.

[13] And where b and ℓ reflect the changed interpretation of these coefficients in (3) relative to (2) due to the inclusion of lagged infllation in the former equation.

[14] These elements will be considered in more detail in sections 5.1 and 5.2, respectively.

5.1 Price formation in a small open economy

Consider the model of optimal monetary policy under price setting rigidities laid out in Clarida, Galí and Gertler (2001), henceforth CGG. This model describes the dynamics of the output gap ($\hat{y}_t$), consumer price inflation (π_t) and the real exchange rate ($s_t = e_t + p_t^* - p_t$)[15] as a function of, first, the nominal interest rate (r_t), which depends on monetary and exchange rate policy and the real interest rate (r_t^o), and second, the real exchange rate (s_t^o) that would be observed in the economy without price rigidities.[16] Specifically, a simplified version of CGG is:

$$\hat{y}_t = E_t\widehat{y}_{t+1} - \varphi \cdot (r_t - E_t\pi_{t+1} - r_t^o) \quad (4)$$

$$\pi_t = \beta \cdot E_t\pi_{t+1} + \lambda \cdot \hat{y}_t + u_t \quad (5)$$

$$s_t = \theta \cdot \widehat{y}_t + s_t^o \quad (6)$$

where φ, β, λ and θ are all non-negative parameters.

As discussed in CGG, equation (4) is a version of the IS curve that relates negatively the output gap to the current real interest rate (as higher interest rates reduce aggregate demand). Equation (5) corresponds to an aggregate supply curve. Increases in prices depend positively on the output gap (as tight product and labour markets exert upward pressure on prices), on cost-push factors u_t and on inflation expected next period as well as on lagged inflation. Finally, equation (6) relates positively the output gap to the real exchange rate.

We follow Galí and Gertler (1999) and Galí, Gertler and López-Salido (2001) an estimate a single equation in the system above, taken into account the endogeneity of the right-hand-side variables. Specifically, we estimate a *hybrid* version of equation (5), introducing lagged inflation as an additional explanatory variable and focusing on proxies for real marginal costs instead of conventional measures of the output gap.

$$\pi_t = b \cdot E_t\pi_{t+1} + \gamma \cdot \pi_{t-1} + \ell \cdot \hat{c} + u_t \quad (7)$$

The empirical implementation of equation (5) entails primarily the use of lead inflation (π_{t+1}) as a proxy for the expected inflation one period ahead, and the approximation of the output gap and cost-push factors by a number of observable characteristics.[17]

[15] Where e_t, p_t^*, p_t denote the logarithms of the nominal exchange rate, the level in the foreign price index and the level in domestic price index, respectively.

[16] For simplicity, steady state values have been introduced here as constants. See CGG for a more general treatment with time-varying steady state values.

[17] In Appendix II at the end of the paper we estimate equation (7) using direct estimates of the output gap (namely, an estimate based on the Hodrick-Prescott filter plus an alternative estimate of the output gap based on the estimates of potential output growth in accession countries in Fischer et al (1998)); results therein are in line with findings in Galí, Gertler and López-Salido (2001), which finds conventional estimates of the output gap of little use to estimate the New Phillips curve and which advocates for using proxies for real aggregate marginal costs rather than conventional measures of the output gap in this regard.

5.2 Factors affecting inflation dynamics

As derived in the previous equation, inflation in the small open economy is the result of four types of broad factors. First, those factors that determine future inflation expectations. Second, inflation inertia, captured by lagged inflation. Third, variables that affect real marginal costs, like the cyclical state of the economy and changes in potential output growth, the fiscal policy stance, and, last, cost-push shocks like innovations in energy prices and wage developments. However, theory does not indicate how to link precisely the observable factors affecting inflation in accession countries (like the government deficit, structural reforms or the prevailing exchange rate regime) to the more generic factors (i.e. expectations of future inflation and the output gap). In order to bridge the gap between the theoretical model and the observable factors, we follow a pragmatic approach based on the linear parameterisation of aggregate real marginal costs and expectations of inflation, in terms of the observable variables.

As regards expectations of next period's inflation, it is assumed, in line with the theoretical literature, that the prevailing exchange rate regime plays a central role in anchoring expectations of future inflation. To reflect the specific interaction between the exchange rate regime and price dynamics in a given country, we allow for the term related to future inflation expectations -i.e. the term b in equation (7)- in the inflation equation to vary as a function of the exchange rate regime. Specifically, the term related to the expectation of next period's inflation, $b \cdot E_t \pi_{t+1}$ is proxied by a term of the form $b \cdot REGIME_t \cdot \pi_{t+1}$, where $REGIME_t$ indicates (through a set of dummy variables) the exchange rate regime prevailing in a given country in a given year.

6 Estimation of the inflation dynamics equation

The following step consists of the estimation of the inflation dynamics equation. After explaining the data set used on the estimation, the results obtained for the equations for headline inflation, as well as for tradable and non-tradable goods inflation are presented.

6.1 Data and model

The descriptive statistics of the pooled data set are shown in Table 2.

Table 2: Descriptive statistics

Variable	Mean	Stand.dev.	Minimum	Maximum
Headline inflation	1.15	2.31	-0.03	30.75
Currency board	0.24	0.42	0.00	1.00
Exchange rate peg	0.15	0.36	0.00	1.00
Crawling peg	0.17	0.38	0.00	1.00
Inflation targeting	0.12	0.33	0.00	1.00
Floating exchange rate	0.30	0.45	0.00	1.00
Government deficit ratio	2.73	2.18	-2.20	6.70
Unemployment rate	9.23	4.05	1.90	19.20
Liberalisation index	3.17	0.29	2.46	3.68
Manufact. productivity growth	4.49	6.03	-14.90	14.10
GDP per capita	8,977	2,874	5,572	15,062
Oil price (USD, Brent barrel)	17.18	3.62	10.26	24.02
Nominal wage growth	1.42	1.34	-1.40	6.96
Euro area real GDP growth	0.50	0.40	-0.70	0.90
Terms of trade	100.47	4.72	91.93	112.79

The domestic HICP inflation rate is available from Eurostat at monthly frequencies. The real exchange rate is also observable monthly.[18] Regarding cost-push shocks, observable variables are the monthly price of oil (OIL), monthly nominal wage increases ($\Delta WAGE$), the annually observed terms of trade (TT), defined as the price level of imported goods over exported goods[19], and quarterly output developments in the euro area (Y^*).[20] Regarding variables related to potential output and the output gap, we include the quarterly government deficit to GDP ratio (DEF), the monthly unemployment rate (UNEMP) as percentage of the labour force, productivity growth in the manufacturing sector (PROD) [21], an index of cumulative transition and liberalisation (CUMLIB)[22], and the degree of real convergence, measured by per capita GDP in PPP terms (INCOME).[23]

Regarding the set up of monetary and exchange rate policy, we classify regimes in the following groups: (i) currency boards, (ii) fixed pegs, (iii) crawling pegs,

[18] Unless indicated otherwise, the source of the series is the IMF's International Financial Statistics.

[19] The measure of the terms of trade, as defined, is provided by the IMF's World Economic Outlook, at annual frequency only.

[20] This is taken from Fagan, Henry and Mestre (2001).

[21] The source for this variable is the EBRD Transition Report, which provides yearly measures of "Change in labour productivity in industry".

[22] This is computed as the unweighted average of EBRD's Transition Report indices of small-scale privatisation, large-scale privatisation, enterprise reform, competition policy, banking sector reform, and reform of non-banking financial institutions.

[23] The last three variables are observed annually. Note that data of different frequencies have been unavoidably pooled together.

(iv) floating rates, and (v) inflation-targeting regimes.[24]

The exact form in which each exchange rate and monetary policy regime affects inflation expectations, and hence inflation dynamics, is not fully spelled out from the theory. Galí and Monacelli (2000) show that, under optimal monetary policy and also under a standard Taylor rule, the rate of inflation is stationary in the steady state equilibrium, whereas under an exchange rate peg, it is the price levels that are stationary. This would indicate that inflation will converge more rapidly to the steady state under regimes that fix the nominal exchange rate than under regimes that let the nominal exchange rate float, to the extent that the former are perceived as credible. We therefore expect the coefficient b in the equation below to be smaller under fixed than under floating regimes.

In summary, we implement the estimation of the inflation dynamics equation (7) as follows:

$$\begin{aligned} \pi_{it} &= b(J) \cdot E_t \pi_{it+1} \cdot \xi_{it}(J) + g \cdot \pi_{it-1} + c_1 \cdot DEF_{it} + c_2 \cdot UNEMP_{it} \\ &\quad + c_3 \cdot CUMLIB_{it} + c_4 \cdot PROD_{it} + u_1 \cdot OIL_t \\ &\quad + u_2 \cdot \Delta WAGE_{it} + u_3 \cdot y_t^* + u_4 \cdot TT_{it} + u_5 \cdot INCOME_{it} + \varepsilon_{it} \end{aligned} \tag{8}$$

where J indicates exchange rate regimes.[25] $\xi_{it}(J)$ is a dummy variable indicating that in country i and period t the exchange rate/monetary policy regime is of type J. ε is an error term corresponding to unobservable cost-push factors. This forward looking equation of price formation is estimated in the first place for the HICP based headline inflation and, subsequently, for two of its sub-components, which approximate tradable and non-tradable goods.

6.2 Headline inflation

Given the modelling framework and the previous discussion, the following hypothesis will be considered:

1. The coefficient b relating inflation to expected inflation next period should be smaller when the prevailing exchange rate regime fixes the nominal exchange rate, since a credible fixed exchange rate acts as a nominal anchor.

2. An increase in the government deficit ratio expands the output gap and should, therefore, have a positive impact on inflation.

3. Unemployment correlates negatively and significantly with the output gap. Its effect on inflation is expected to be negative.

[24] For further details on the exchange rate regimes that have prevailed in accession countries, see Figure 5.

[25] I.e., J is an index of the set {"Currency Board", "Peg", "Crawling Peg", "Inflation Targeting", and "Floating"}.

4. Structural reforms associated with the transition to a market economy (e.g., privatisation, enterprise reform, implementation of competition policy, reform of the financial sector, etc.) increase overall efficiency in the economy and therefore imply lower real marginal costs for a given value of actual output. This would also be the case for observed productivity growth in the manufacturing sector. The impact of these factors on inflation is expected to be negative.[26]

5. Real convergence correlates with increases in potential output. Measures of real convergence like per capita GDP in PPP terms should impact negatively on inflation.

6. Regarding the proxies for cost-push factors, both oil prices and increases in nominal wages impact positively on inflation. Moreover, the terms of trade (price level of imports over price level of exports) are expected to have disinflationary effects. Finally, the effect of GDP growth in the euro area may be regarded as relatively less straightforward.[27]

The results of estimating equation (8) are given in Table 3. Note that, in order to have comparability across estimated effects, explanatory variables (with the exception of lead inflation and its interaction with the exchange rate regime) have been standardised. This implies that coefficients should be interpreted as an approximation to the inflationary impact, in standard deviation units, of an increase in the right-hand-side variable by one standard deviation.

Regarding the coefficient b related to one lead in inflation, we find that it is indeed only significant (and positive) for the floating exchange rate regime (which does not attempt to fix the nominal exchange rate) and overall that there seems to be an increasing pattern in the coefficients as we move from regimes more highly committed to fixed exchange rates to those with lower commitment. The coefficient is particularly high under floating regimes. Even in these cases, however, the magnitude of the coefficient is well below the value of 0.9 usually found in economies with stabilised inflation, as reported for the euro area in Galí, Gertler and López-Salido (2001) and for the US in Galí and Gertler (1999). The rapid disinflationary process experienced by accession countries during the sample period may explain the lower value of this coefficient in the sample period.

[26] There are other aspects of transition oriented reforms, such as taxation and price liberalisation, that may well have a positive impact on inflation. In the cumulative liberalisation index used in regressions price liberalisation is not included, so as to discriminate between inflationary aspects of freedom in price setting from the disinflationary medium-term effects of a well functioning market economy.

[27] Although the direct effect of output growth in the rest of the world on domestic inflation should in principle be positive, the net effect is less obvious when the endogenous effect of interest rates is taken into account. The latter are set-up optimally in the context of a stability oriented monetary policy. For a theoretical argument, see section 4 in Galí and Monacelli (2000).

As regards the factors affecting inflation, nominal wage growth is singled out as the factor with the biggest inflationary impact after lagged inflation, which turns out to be highly significant suggesting a relatively large degree of inflation inertia in accession countries. As for oil price and nominal wage increases, they both have sizeable effects on inflation. To a lesser extent, the government deficit ratio also has a positive inflationary effect, reflecting the important role of fiscal policy in the disinflation process.

Table 3: Estimation* of equation (8) for headline inflation[28]

Variable	Coefficient	t-statistic	p-value
CONSTANT	0.3522	7.3529	0.000
$\{\pi_{t+1}\cdot$ currency board$\}$	0.0419	0.0403	0.687
$\{\pi_{t+1}\cdot$ exch. rate peg$\}$	-0.1324	-1.0298	0.303
$\{\pi_{t+1}\cdot$ crawling peg$\}$	0.1385	1.3099	0.190
$\{\pi_{t+1}\cdot$ inflation targeting$\}$	0.1323	1.1526	0.249
$\{\pi_{t+1}\cdot$ floating exch. rate$\}$	0.4246	3.0002	0.002
π_{t-1}	0.3966	7.0811	0.000
Government deficit ratio	0.0860	2.2539	0.024
Unemployment rate	-0.0479	-2.0406	0.041
Liberalisation index	-0.0330	-0.8885	0.374
Growth in manufacturing productivity	-0.0218	-0.9878	0.323
GDP per capita	-0.0058	-0.3031	0.792
Oil price	0.1505	2.3335	0.020
Nominal wage growth	0.1754	5.2030	0.000
Euro area output growth	-0.1119	-0.7929	0.428
Terms of trade	-0.0540	-1.8258	0.068

*(Standard errors robust to heteroskedasticity and autocorrelation)

An additional factor with a significant impact on inflation is the unemployment rate, which has the expected negative effect on inflation. Finally, four factors are found not to have significant impact on inflation, namely, per capita GDP, the output growth rate in the euro area, the terms of trade, the growth in manufacturing productivity and the cumulative liberalisation index.

6.3 "Dual inflation": tradable versus non-tradable goods

Theories of international trade suggest that inflation dynamics in tradable and non-tradable goods are likely to behave differently. A decomposition of the price

[28] Method of Moments estimation, using Arellano and Bond (1997) software, "DPD". The instruments used are the lagged right-hand-side variables.

index according to whether goods are tradable may be approximated through the classification of the HICP categories. In particular, we classify the twelve categories of goods and services that compose the HICP in three non-overlapping groups, as described in Section 4, and calculate "inflation in non-tradable goods" (π^{nt}), "inflation in tradable goods" (π^{tr}) and "inflation in items particularly affected by energy prices" (π^{ener}), respectively.

We estimate the inflation dynamics equation separately for tradable and non-tradable goods. Theory, however, does not fully spell out the specific pattern that may be expected for inflation dynamics as a function of goods' tradability. In particular, models of open economies within the New Phillips curve (like Galí and Monacelli (2000) and CGG) have emphasised the distinction between prices of domestically produced goods (which include both tradable and non-tradable goods produced and consumed domestically) and goods produced abroad (which are a subset of tradable goods), but the theoretical literature has not developed to date two-sector models (corresponding to tradable and non-tradable goods) with price rigidities in the spirit of the New-Keynesian Phillips curve. Since developing a two-sector model of the economy to derive a *hybrid* Phillips curve is outside the scope of this paper, we limit ourselves to crudely approximate the specific inflation dynamics patterns of tradable versus non-tradable goods by broadly identifying the tradable good sector with an *open economy* (where prices in international markets have a sizeable impact on domestic prices) and the non-tradable goods sector with a relatively more *closed economy* (where external prices have a more limited impact on domestic prices).

In the context of the modelling framework of CGC, the broad identification of the tradable goods sector with a more open economy has the following implication for the specific features of inflation dynamics in the tradable goods sector relative to the non-tradable goods sector[29]: shocks to variables that are related to demand pressures and the output gap have a higher impact (in absolute value) on non-tradable goods than on tradable goods inflation.

Note that this theoretical insight is also intuitively appealing: tradable-goods sectors are typically characterised by being more competitive than non-tradable goods sectors, which are exposed to a lower extent to international markets. Being

[29]More formally, the term λ in (5) corresponds to λ_w in CGG, and it satisfies the following (adopting in what follows the notation in CGG) $\lambda_w = \delta\left[\phi + \sigma/\left(1 + w\left(\gamma\right)\right)\right]$, where γ is the degree of openness of the economy, w is the nominal wage, ϕ is the inverse of the labour supply elasticity, and σ the coefficient of the relative risk aversion related to leisure versus consumption. Moreover, the overall effect of openness on inflation can be seen from the equation: $\pi_t = \beta \cdot E_t \pi_{t+1} + \lambda_{w(\gamma)} E_t x_{t+1} - \delta\left(1 + \frac{1+w(\gamma)}{\sigma}\right) E_t\left(\Delta s_{t+1} - \Delta s_t^o\right) + u_t$ in CGG (where x_t denotes the ouput gap). It is easy to show that in the CGC setting: $w'\left(\gamma\right) > 0$ implying that $\lambda_w'\left(\gamma\right) < 0$, i.e., the impact of the output gap on inflation is lower in the open than in the closed economy and that the disinflationary impact of a real appreciation is greater in the open economy, *ceteris paribus*.

subject to a greater extent to the discipline of markets, tradable-goods sectors respond less to domestic cyclical variables.

Under the same procedure as above, we estimate equation 8, separately for tradable and non-tradable goods inflation. Note that the theory is here again silent about the specific effect that goods tradability may have on the different inflation autocorrelation coefficients that prevail under each monetary and exchange rate regime (i.e., the difference we may expect between $b^{nt}$and b^{tr}). A similar informal argument may be invoked here: given that tradable goods are pinned down to a greater extent by international markets and the law of one price, inflation dynamics in tradable goods sectors should be less dependent of the domestic exchange rate regime, relative to non-tradable goods.

In summary, the following hypothesis are derived from the discussion, where the super-indices "nt" and "t" over the coefficients refer to equation 8 applied to non-tradable and tradable goods inflation respectively:

1. Non-tradable goods are more sensitive to internal developments, particularly to those related to demand pressures and the output gap. Formally, for $k = 1, .., 4 : |c_k^{nt}| > |c_k^{tr}|$.

2. The same argument applies to cost-push factors: external developments (e.g. oil prices, terms of trade, output growth in the euro area) should affect relatively more tradable goods inflation, while domestic developments (e.g. nominal wage premia) and the level of per capita real income should affect relatively more non-tradable goods inflation, i.e. $|u_2^{nt}| > |u_2^{tr}|$ and $|u_5^{nt}| > |u_5^{tr}|$, while for $k = 1, 3, 4 : |u_k^{tr}| > |u_k^{nt}|$.

3. The coefficients associated to the different exchange rate regimes in the non-tradable goods equation are expected to be more heterogeneous than in the ones in the tradable goods equation (since tradable goods inflation dynamics are driven to a larger extent by international factors independent of exchange rate developments).

This set of hypothesis is contrasted with the estimation results from the non-tradable and tradable goods equations, which are shown in Table 4.

Table 4: Estimation* of equation (8) for non-tradable and tradable goods[30]

Variable	Tradable goods			Non-tradable goods		
	Coeff.	t-stat.	p-value	Coeff.	t-stat.	p-value
CONSTANT	0.1585	8.0637	0.000	0.4780	9.0832	0.000
$\{\pi_{t+1}\cdot$ currency board$\}$	0.1656	2.2473	0.024	-0.0142	-0.1830	0.855
$\{\pi_{t+1}\cdot$ peg$\}$	0.1686	3.1025	0.001	-0.1146	-3.5407	0.000
$\{\pi_{t+1}\cdot$ crawling peg$\}$	0.2725	8.0265	0.000	0.3533	8.2684	0.000
$\{\pi_{t+1}\cdot$ inflation target$\}$	0.3827	8.9589	0.000	0.8736	1.7366	0.082
$\{\pi_{t+1}\cdot$ floating$\}$	0.4588	7.5962	0.000	0.3319	9.2562	0.000
π_{t-1}	0.4331	7.8883	0.000	0.3262	7.3092	0.000
Government deficit ratio	0.0772	3.0368	0.002	0.1548	2.1030	0.035
Unemployment rate	-0.0269	-1.4931	0.135	-0.0901	-2.6348	0.008
Liberalisation index	-0.0151	-0.4623	0.644	-0.2449	-2.4357	0.040
Manufac. productivity	-0.0130	-0.6337	0.526	-0.0838	-1.9811	0.047
GDP per capita	0.0047	0.2745	0.783	0.0821	1.4853	0.137
Oil price	0.1263	2.6256	0.009	0.1412	1.0192	0.308
Nominal wage growth	0.0463	2.9362	0.003	0.3933	6.6762	0.000
Euro area output growth	-0.1113	-0.9040	0.366	-0.0504	-0.7536	0.451
Terms of trade	-0.0350	-1.2926	0.196	-0.0369	-1.6754	0.094

*(Standard errors robust to heteroskedasticity and autocorrelation)

Note first that the constant term estimated in the non-tradable goods inflation equation is considerably larger than the one for tradable goods, reflecting the smaller unconditional mean of inflation in the latter case. Overall, the general pattern that external developments impact relatively more tradable than non-tradable goods inflation seems to be found for the determinants of inflation. Moreover, the variables related to domestic developments have a stronger impact (in absolute value) on non-tradable goods inflation. These are the government deficit, the unemployment rate, the cumulative liberalisation index, the productivity growth in the manufacturing sector and nominal wage increases (which have, nevertheless, a much greater impact on non-tradable goods).

Reciprocally, factors that are found to have a greater impact on tradable goods inflation are the growth rate in the euro area (which is, however, not significant in any case) and oil prices (significant only for the case of tradable goods), which happen to be linked to international trade. The only exception to this would be the effect of the terms of trade, which appears insignificant for both tradable and non-tradable goods inflation.

[30]Method of Moments estimation, using Arellano and Bond (1997) software, "DPD". The instruments used are the lagged right-hand-side variables.

Apart from differences in magnitudes, in almost all cases, the separate estimation of tradable and non-tradable inflation equations reproduces the causality pattern observed in the case of headline inflation. Interestingly enough, nominal wage developments and fiscal policy remain central elements of price stabilisation, while liberalisation-oriented reforms have a sizeable effect, mainly through their impact on non-tradable goods inflation.

Regarding the specific effect of goods tradability on the coefficient b in equation 8, which is inversely related to the convergence rate of inflation to its steady state, the results in Table 4 suggest that exchange rate regimes have, indeed, a large impact on inflation dynamics and, moreover, that this impact seems to be markedly different in the case of tradable and non-tradable goods inflation. It should be noted, however, that the available models are not sufficiently developed to derive clear-cut predictions regarding the specific effects of exchange rate regimes on tradable and non-tradable goods inflation and that, in this regard, results in Table 4 should at best be seen as providing stylised facts on those effects. Taking into account that the estimated coefficient of lead inflation interacting with the exchange rate regime is inversely related to the convergence rate of inflation under that regime, the results in Table 4 suggest that regimes that tend to fix the exchange rate (i.e. currency boards and exchange rate pegs) tend to stabilise non-tradable goods inflation to a larger extent than tradable goods inflation. The opposite seems to be the case under the inflation targeting regime, which would appear to make non-tradable goods inflation particularly persistent. As regards the remaining exchange rate regimes (namely, the crawling peg and the floating rate regime), their effect seems to be relatively more symmetric for tradable and non-tradable goods inflation. It should be noted that the autocorrelation coefficients for one period ahead inflation associated to the different exchange rate regimes appear to be relatively more homogeneous in the case of the tradable goods inflation (where they remain in the range of 0.17 for the currency board to 0.46 for the case of the floating exchange rate) than for the case of non-tradable goods inflation (where they range from -0.01 in the case of the currency board to 0.87 in the case of inflation targeting). Finally, lagged inflation is found to have a somewhat larger effect on current inflation in the case of tradable goods.

Overall, Table 4 points to the relative insignificance of the so-called Balassa-Samuelson effect to account for inflation in EU accession countries. Although caution should be exerted when interpreting the results for manufacturing productivity given shortcomings in data quality, it is remarkable from Table 4 that growth in manufacturing productivity enters negatively and significantly so in the non-tradable good inflation equation.

7 Conclusions

Using the small open-economy model of Clarida, Galí and Gertler (2001) as an analytical benchmark, this paper finds evidence of the existence of "dual inflation" in accession countries. As suggested by literature on fast-growing economies, inflation in non-tradable goods happens to be significantly higher than inflation in tradable goods in "catching-up" economies like those of accession countries. Yet, the results reported here suggest that "dual inflation" arises primarily from the differences in market structure (i.e. the extent of competition) in tradable versus non-tradable goods sectors, rather than from higher labour productivity growth in the tradable than in the non-tradable sector; indeed, the paper points to a set of variables other than manufacturing productivity growth, that are relevant in the context of "dual inflation".

With regard to tradable goods, the following general pattern seems to emerge from the evidence: factors related primarily to domestic developments (like those impinging on the domestic output gap) have a stronger relative impact (in absolute terms) on non-tradable than on tradable goods inflation. Furthermore, in line with economic intuition, factors related to international trade (especially, oil price developments) tend to impact to a larger extent on tradable goods inflation. Although these findings do not necessarily imply that the law of one price holds for accession countries, it does suggest that inflation dynamics in tradable goods are limited by the need to preserve the competitiveness of the accession countries' economies. This is important because, although productivity growth may be higher in the tradable than in the non-tradable goods sector of the economy, real wage increases might be moderated by the need to preserve competitiveness. In this sense, the Balassa-Samuelson hypothesis should not always be considered the single leading factor behind instances of "dual inflation".

As for non-tradable goods, inflation dynamics seem to be largely affected by a wide range of variables. In particular, the role that transition-related factors still play to explain inflation dynamics in non-tradable sectors in accession countries is worth highlighting. In addition, the fact that the results reported are overall sensible and compatible with theoretical priors points to the adequacy of the New Phillips curve as a useful framework for the analysis of price formation and the modelling of inflation dynamics, also when applied to panel data and to components of the HICP. Finally, the productivity growth in the manufacturing sector does not seem to have been a significant variable explaining inflation dynamics in the non-tradable sector of accession countries thus far. Against this background, it is difficult to conclude that the instances of "dual inflation" in these economies are due to the Balassa-Samuelson effect.

All in all, the paper's empirical findings underline the importance of nominal wage growth and fiscal policy moderation for price stabilisation, as well as the

impact of liberalisation-oriented reforms on lowering inflation particularly in the non-tradable sector. Furthermore, the paper identifies a high level of inflation inertia in accession countries and highlights the role of exchange rate developments in driving inflation dynamics in accession countries. Although this may be expected, given that most accession countries can be characterised as small open economies, it gives an idea of how important the choice of monetary and exchange rate policies is for these countries.

References

[1] *Arellano, M. and S. Bond* (1997), "Dynamic Panel Data Estimation Using DPD98 for Gauss", mimeo, CEMFI.

[2] *Alberola-Ila, E. and T. Tyrväinen* (1998), "Is there scope for inflation differentials in EMU? An empirical evaluation of the Balassa-Samuelson model in EMU countries", Banco de España, Documento de trabajo No 9823.

[3] *Balassa, B.* (1964), "The purchasing power parity doctrine: a reappraisal", *Journal of Political Economy* 72, 584-96.

[4] *Barro, R. J. and D. Gordon* (1983), "A positive theory of monetary policy in a natural rate model", *Journal of Political Economy 91*, 4, 589-610.

[5] *Bénassy-Quéré, A. and A. Lahrèche-Révil* (2000), "The euro as a monetary anchor in the CEECs", *Open economies review 11*, 303-321.

[6] *Calvo, G. A.* (1983), "Staggered pricing in a utility-maximising framework", *Journal of Monetary Economics* 12, 383-396.

[7] *Christiano, L. J., M. Eichenbaum and C. L. Evans* (2001), "Nominal rigidities and the dynamic effects of a shock to monetary policy", NBER Working Paper Series 8403.

[8] *Cipriani, M.* (2000), "The Balassa-Samuelson effect in transition economies", IMF, mimeo.

[9] *Clarida, R., J. Galí and M. Gertler* (1999), "The Science of Monetary Policy: A New Keynesian Perspective", Journal of Economic Literature, Vol. 37, December 1999, pp. 1661-1707.

[10] *Clarida, R., J. Galí and M. Gertler* (2001), "Optimal Monetary Policy in Open versus Closed Economies: an Integrated Approach", mimeo, Princeton University, January 2001.

[11] *Coorey, S., M. Mecagni and E. Offerdal* (1996), "Disinflation in transition economies: The role of relative price adjustment", *IMF Working Paper*, December 1996.

[12] *Corker, R., C. Beaumont, R. van Elkan and D. Iakova* (2000), "Exchange rate regimes in selected advanced transition economies - Coping with transition, capital inflows and EU accession", IMF Policy Discussion Paper, May 2000.

[13] *Cottarelli, C and P. Doyle* (1999), "Disinflation in Transition", IMF Occasional Paper, Washington D.C., 1999.

[14] *Cukierman, A.* (1986), "Central bank behaviour and credibility – Some recent developments", *Federal Reserve Bank of St. Louis Review 68*, 5-17.

[15] *Fagan, G., J. Henry, and R. Mestre* (2001), "An area-wide model (AWM) for the euro area", January 2001, ECB Working Paper No. 42.

[16] *Fischer, S., R. Sahay and C. A. Vegh* (1998), "How far is Eastern Europe from Brussels?", IMF Working Paper/98/53, April 1998.

[17] *Galí, J. and M. Gertler* (1999), "Inflation Dynamics: A Structural Econometric Analysis", *Journal of Monetary Economics*, 44, 1999, pp. 195-222.

[18] *Galí, J., M. Gertler and J.D. López-Salido*, (2001) "European Inflation Dynamics", *European Economic review, forthcoming.*

[19] *Galí, J. and T. Monacelli* (2000), "Optimal Monetary Policy and Exchange rate Volatility in a Small Open Economy", mimeo, UPF, May 2000.

[20] *Ghosh, A. R.* (1997), "Inflation in transition economies: how much? and why?", *IMF Working Paper*, July 1997.

[21] *Ito, T. P. Isard and S. Symansky* (1999), "Economic growth and real exchange rate: an overview of the Balassa-Samuelson hypothesis in Asia" in *Changes in exchange rates in rapidly developing countries,* The University of Chicago Press.

[22] *Koen, V. and P. De Masi* (1997), "Prices in the transition: Ten stylised facts", *IMF Working Paper*, November 1997.

[23] *Kolodko, G.W.* (2000), "Globalization and catching-up: from recession to growth in transition economies", *IMF Working Paper*, June 2000.

[24] *Lohmann, S.* (1992), "The optimal degree of commitment: credibility versus flexibility", *American Economic Review* 82, 273-286.

[25] *Rogoff, K.* (1985), "The optimal degree of commitment to an intermediate monetary target", *Quarterly Journal of Economies 100*, 4, 1169-1190.

[26] *Rother, P.* (2000), "The impact of productivity differentials on inflation and the real exchange rate: an estimation of the Balassa-Samuelson effect in Slovenia", IMF Staff Country Report 00/56.

[27] *Samuelson, P. A.* (1964), "Theoretical notes on trade problems", *Review of Economics and Statistics* 46 (May): 145-54.

[28] *Simon, A. and M. A. Kovács* (1998), "Components of the real exchange rate in Hungary", NBH Working paper, 1998/3.

[29] *Svensson, L.* (1997), "Optimal inflation targets, 'conservative' central banks, and linear inflation contracts", *American Economic Review*, 41 (6).

[30] *Swagel, P.* (1999), "The contribution of the Balassa-Samuelson effect to inflation: cross-country evidence", IMF Staff country report No. 99/138.

[31] *van der Haegen, P. and C. Thimann* (2001), "Monetary policy challenges in transition and toward accession", in G. Tumpel-Gugerell et al. (eds), *Completing transition: the main challenges*, Springer publishers (Berlin), pp. 161-184.

[32] *Wagner, H.* (1998), "Central banking in transition countries", *IMF Working Paper*, August 1998.