SHORT PAPERS

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Driving Forces of Inflation in the New EU8 Countries

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1. Introduction

Headline inflation in most of the new EU8 members exceeded the Maastricht inflation criterion in 2004 (*Table 1*). With the new member states preparing for euro adoption, discussion of the determinants of inflation in these countries is getting increasing attention among policy makers. The question is of immediate importance for Estonia, Lithuania, and Slovenia – the first group set to join the euro zone in 2007 – but it is also relevant for the rest of the new EU8 countries, which intend to adopt the euro toward the end of the decade.

TABLE 1 New EU8 Countries: Nominal Convergence
(Data for 2004)

	Inflation	Energy	Liquid fuel
	(in percent)	Share in CPI basket (in percent)	
New EU8 member countries	**4.3**	14.0	4.8
Czech Republic	**2.8**	13.6	3.7
Estonia	**3.0**	14.9	6.6
Hungary	**6.8**	13.0	5.1
Latvia	**6.2**	12.9	3.2
Lithuania	**1.2**	14.0	4.3
Poland	**3.5**	14.9	4.3
Slovak Republic	**7.5**	16.0	3.6
Slovenia	**3.6**	12.5	7.8
Memorandum Items:			
Maastricht inflation criterion, 2004	**2.3**		
Euro area	**2.1**	8.4	4.5

Sources: Eurostat, IFS, and country authorities

This paper shows that a substantial part of headline inflation in the new EU8 countries is the result of common factors. However, idiosyncratic factors have also played a role in the inflation process. The country-specific

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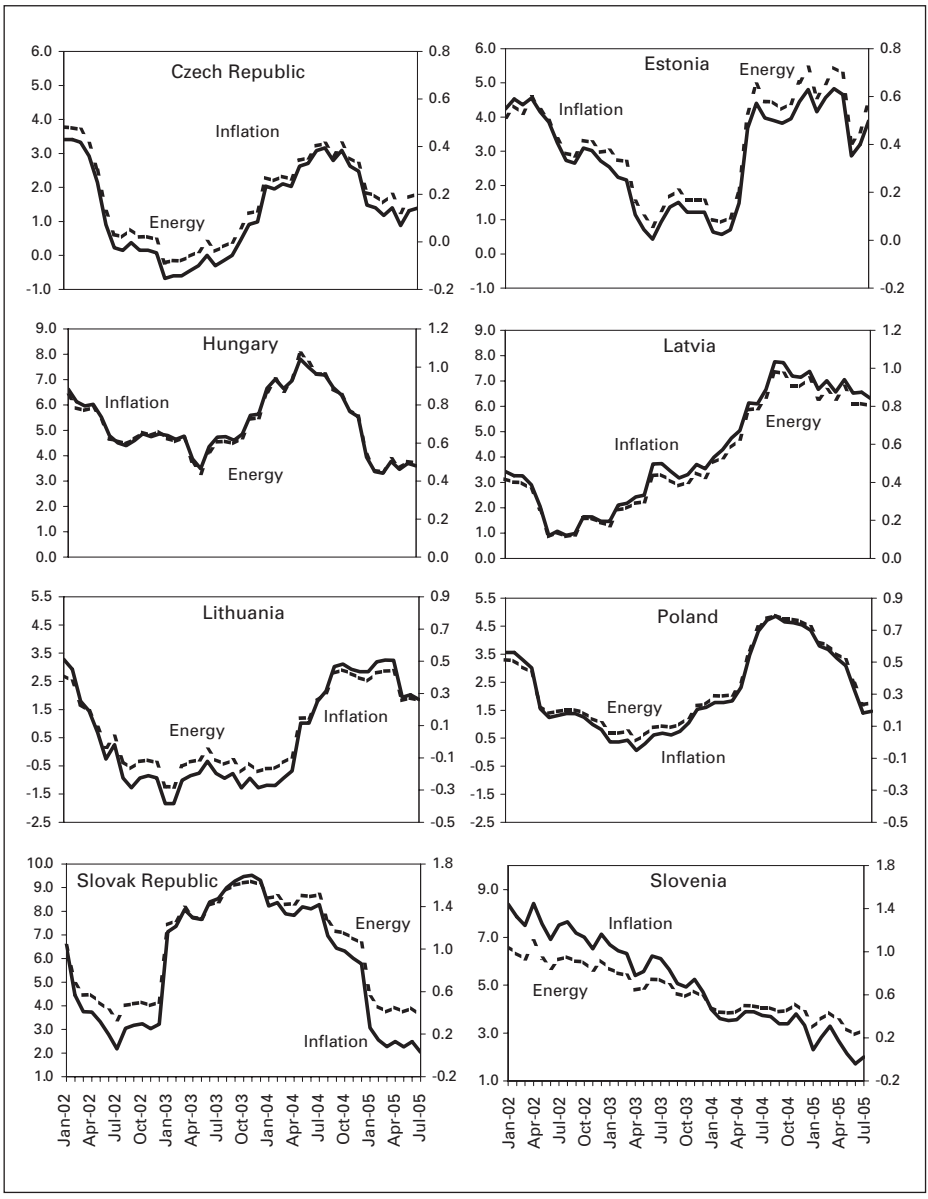
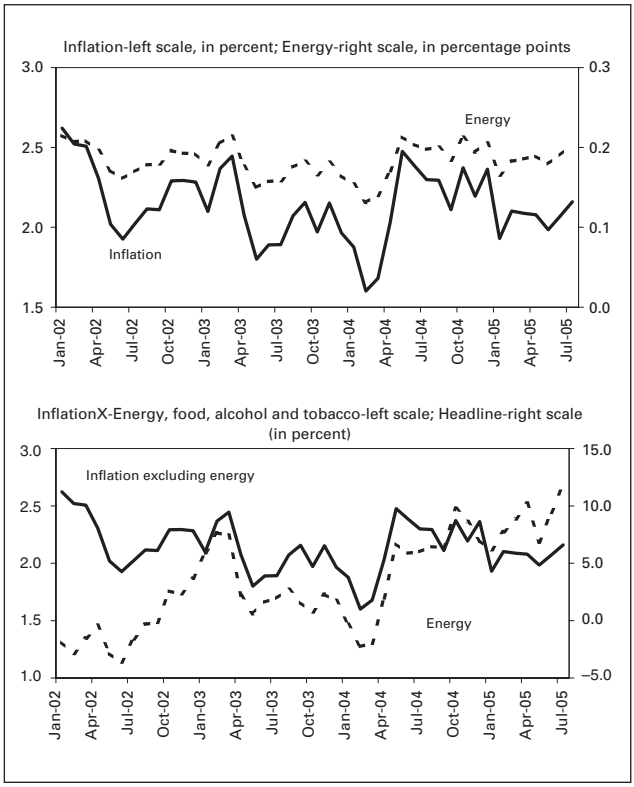
FIGURE 1 New EU8 Countries: Contribution of Energy to Inflation
(Inflation – left scale, in percent; Energy – right scale, in percentage points)



Sources: Fund staff calculation; Eurostat

factors are most likely related to the time path of administered price adjustments and increases of indirect taxes associated with EU accession, as well as the specific monetary conditions, pass-through from foreign prices, and market conditions in each country.

FIGURE 2 Euro Area: Energy and Inflation



Sources: Fund staff calculation; Eurostat

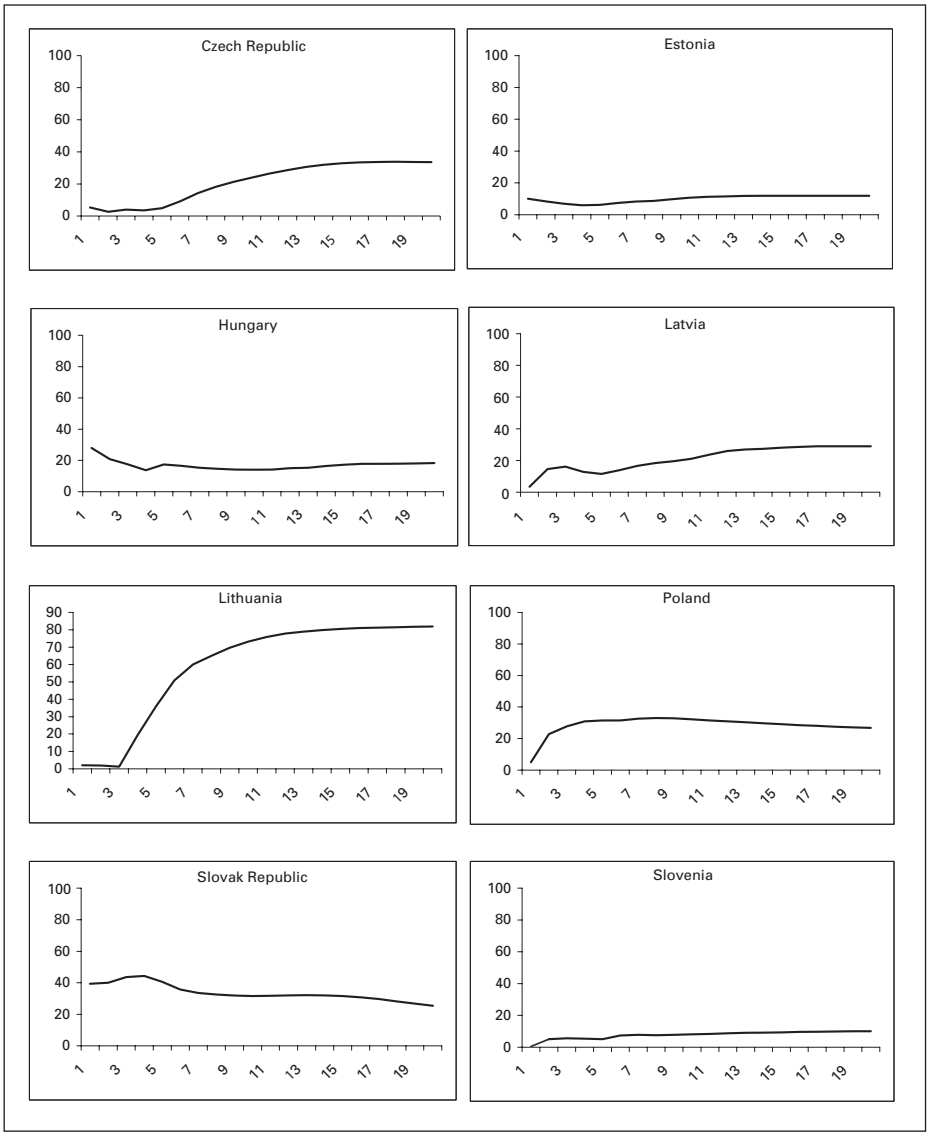
The remainder of the paper is organized as follows. Section 2 provides background information about inflation in the new EU8 members. Section 3 presents the data and the model. Section 4 discusses the estimation results. Section 5 presents some preliminary conclusions.

2. Inflation Background

The new EU8 countries are more energy intensive than the old members. On average, measured by the CPI weight of energy consumption, the new EU8 members consume about 50 percent more energy than the rest of the EU countries. Consequently, energy price shocks have a much more pronounced effect on headline inflation in the new EU8 members than in those countries already in the euro area (*Table 1*, *Figures 1, 2*).

Despite the similarities in energy intensity, the impact of energy shocks on core inflation (excluding energy) differs among the new EU8 countries. A bi-variate VAR analysis of energy and core inflation suggests that variation in energy prices explains more than $^{3}/_{4}$ of the variation of core inflation in Lithuania, about $^{1}/_{3}$ in the Czech Republic, Slovak Republic, and Po-

FIGURE 3 Variance Share of Core Inflation (Excluding Energy) Explained by Energy



Source: Fund staff calculation

land, about 15 percent in Hungary, and less than 10 percent in Estonia and Slovenia (*Figure 3*). These differences in the transmission of energy shocks to the underlying inflation most likely reflect different degrees of product--market competition and labor-market flexibility within the various countries. In this case, headline inflation will tend to return to its core level faster in the countries with the more flexible markets.

TABLE 2 New EU8 Countries: Effect of Energy on Core Inflation [a]

	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Slovak Republic	Slovenia
Energy(–1)	–0.04 (0.04)	–0.01 (0.03)	–0.07 (0.08)	–0.11 (0.06)	–0.04 (0.05)	0.17 (0.04)	0.00 (0.01)	0.04 (0.03)
Energy(–2)	0.08 (0.05)	0.00 (0.04)	0.04 (0.09)	0.13 (0.09)	0.02 (0.07)	–0.21 (0.05)	0.01 (0.01)	–0.09 (0.03)
Energy(–3)	–0.06 (0.05)	–0.01 (0.04)	–0.08 (0.10)	0.06 (0.09)	0.22 (0.06)	0.12 (0.06)	–0.02 (0.01)	0.04 (0.03)
Energy(–4)	0.05 (0.05)	0.04 (0.04)	0.26 (0.10)	–0.13 (0.09)	–0.02 (0.06)	–0.10 (0.06)	–0.02 (0.01)	0.01 (0.03)
Energy(–5)	0.05 (0.05)	–0.02 (0.04)	–0.32 (0.12)	–0.02 (0.10)	–0.05 (0.07)	0.08 (0.06)	0.01 (0.02)	0.06 (0.03)
Energy(–6)	–0.06 (0.04)	0.00 (0.03)	0.15 (0.09)	0.02 (0.07)	–0.01 (0.06)	–0.04 (0.04)	0.02 (0.01)	–0.04 (0.03)
Core(–1)	1.28 (0.16)	1.16 (0.21)	1.27 (0.23)	1.04 (0.18)	0.57 (0.21)	1.29 (0.10)	1.12 (0.14)	0.67 (0.16)
Core(–2)	–0.12 (0.27)	–0.24 (0.30)	–0.21 (0.35)	0.06 (0.28)	0.46 (0.24)	–0.27 (0.17)	–0.29 (0.21)	–0.10 (0.20)
Core(–3)	–0.46 (0.28)	–0.13 (0.34)	–0.08 (0.36)	–0.12 (0.26)	–0.23 (0.25)	–0.15 (0.17)	0.22 (0.21)	0.62 (0.22)
Core(–4)	0.39 (0.26)	0.38 (0.35)	–0.31 (0.38)	–0.01 (0.25)	0.00 (0.23)	0.00 (0.16)	0.11 (0.21)	–0.20 (0.21)
Core(–5)	–0.29 (0.25)	–0.62 (0.35)	0.69 (0.38)	–0.09 (0.26)	0.23 (0.23)	0.26 (0.16)	0.03 (0.21)	0.11 (0.22)
Core(–6)	0.06 (0.16)	0.27 (0.22)	–0.46 (0.23)	0.10 (0.17)	–0.18 (0.16)	–0.17 (0.09)	–0.38 (0.15)	–0.06 (0.18)
Constant	0.12 (0.08)	0.31 (0.21)	0.75 (0.50)	0.30 (0.18)	–0.81 (0.45)	–0.04 (0.12)	0.99 (0.31)	–0.63 (0.37)
Adjusted R^2	0.95	0.73	0.87	0.95	0.94	0.99	0.91	0.98

Note: [a] Standard errors in parentheses; year-on-year data.

Source: Fund staff calculations

3. The Data, Methodology, and the Models

The paper uses the four-digit level of Harmonized Index of Consumer Prices (HICP) data for the new EU8 members. The data panel consists of 695 cross-section series (HICP components). The sample period is January 2001–July 2005 – the longest common sample. Before the estimation of the variance-covariance matrix of the data and determination of the number of common factors driving the panel, the data were treated as follows: first, all outliers were removed; second, the remaining series were seasonally adjusted; and finally, two inflation measures were obtained – one based on year-on-year percent change and the other on month-on-month percent change of the seasonally adjusted HICP components.

Driving forces of inflation are analyzed using three different models. The common component of inflation in the new EU8 member states is estimated using the generalized dynamic factor model (GDFM).[1] The short--term effect of several macroeconomic variables (output, exchange rates, interest rates, and EU inflation) on headline inflation is assessed by regres-

TABLE 3 New EU8 Countries: Core and Headline Inflation – Cross Correlations (January 2002–July 2005)

	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Slovak Republic	Slovenia
	Inflation excluding energy, food, alcohol and tobacco							
Czech Republic	1.0							
Estonia	0.6	1.0						
Hungary	0.7	0.3	1.0					
Latvia	0.6	0.3	0.0	1.0				
Lithuania	0.7	0.8	0.1	0.8	1.0			
Poland	0.9	0.7	0.5	0.8	0.8	1.0		
Slovak Republic	0.1	–0.4	0.6	–0.1	–0.4	–0.1	1.0	
Slovenia	–0.2	0.1	0.3	–0.8	–0.4	–0.4	0.3	1.0
	Headline inflation							
Czech Republic	1.0							
Estonia	0.6	1.0						
Hungary	0.7	0.1	1.0					
Latvia	0.6	0.4	0.2	1.0				
Lithuania	0.7	0.8	0.1	0.7	1.0			
Poland	0.9	0.7	0.5	0.8	0.8	1.0		
Slovak Republic	–0.1	–0.6	0.5	0.0	–0.4	–0.1	1.0	
Slovenia	–0.2	–0.1	0.0	–0.8	–0.4	–0.4	0.0	1.0

Source: Fund staff calculations

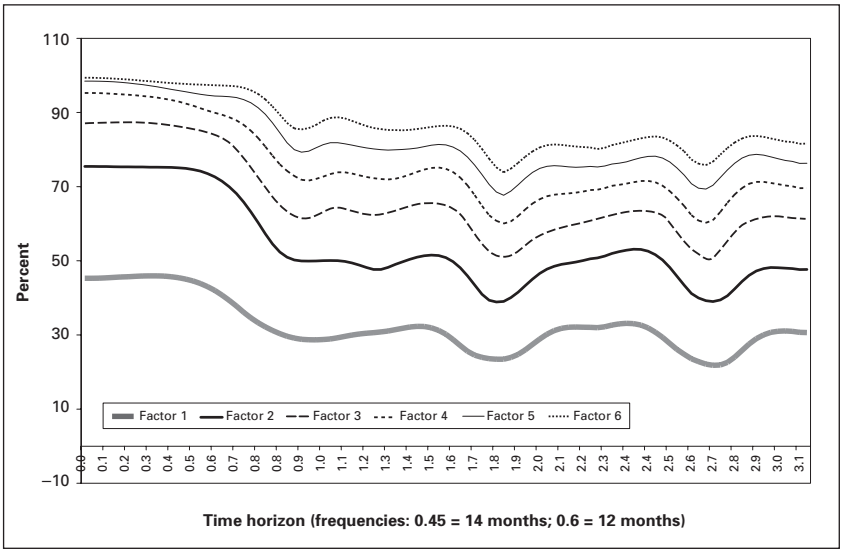
sing the idiosyncratic component obtained from the GDFM (see below) on these variables. Finally, the impact of energy prices on core inflation (excluding energy) is quantified estimating a bi-variate VAR for each country (*Table 2*).

The GDFM decomposes each time series on two sets of unobservable components – a common (principal) component, or underlying inflation, and an idiosyncratic, or transient, component. Underlying inflation is driven by a small number of shocks common to the entire data set, but each inflation component is allowed to react differently to the common shocks. The common component of inflation is driven by the underlying inflationary process and is persistent. The idiosyncratic component reflects temporary forces affecting specific sectors such as excise tax hikes or increases in administered prices. It also includes measurement errors. Although the idiosyncratic components do not affect inflation over the longer-term, they can play an important role in the short-term in explaining inflation.

The GDFM is an unobserved component model. Each process x_t^i is decomposed to the sum of two components – a common component f_t and an idiosyncratic component ε_t. The model assumes that the processes are stationary with zero mean. The $(q \times t)$ vector of common shocks f_t has mutually

[1] Forni et al. (2000), (2003) further extended the principal component analysis of the Stock and Watson's (1989) method by developing both a coincident and a leading indicator – the generalized dynamic factor model. The GDFM also allows for limited cross-correlation among idiosyncratic components.

FIGURE 4 Cumulative Variance Explained by First Six Common Factors



orthogonal components with zero mean and unit variance. The vector of idiosyncratic components ε_t is orthogonal to the vector of common components; however, the model allows for cross-correlation between the idiosyncratic components. The model is estimated using the one-side estimator proposed by Forni et al. (2003).

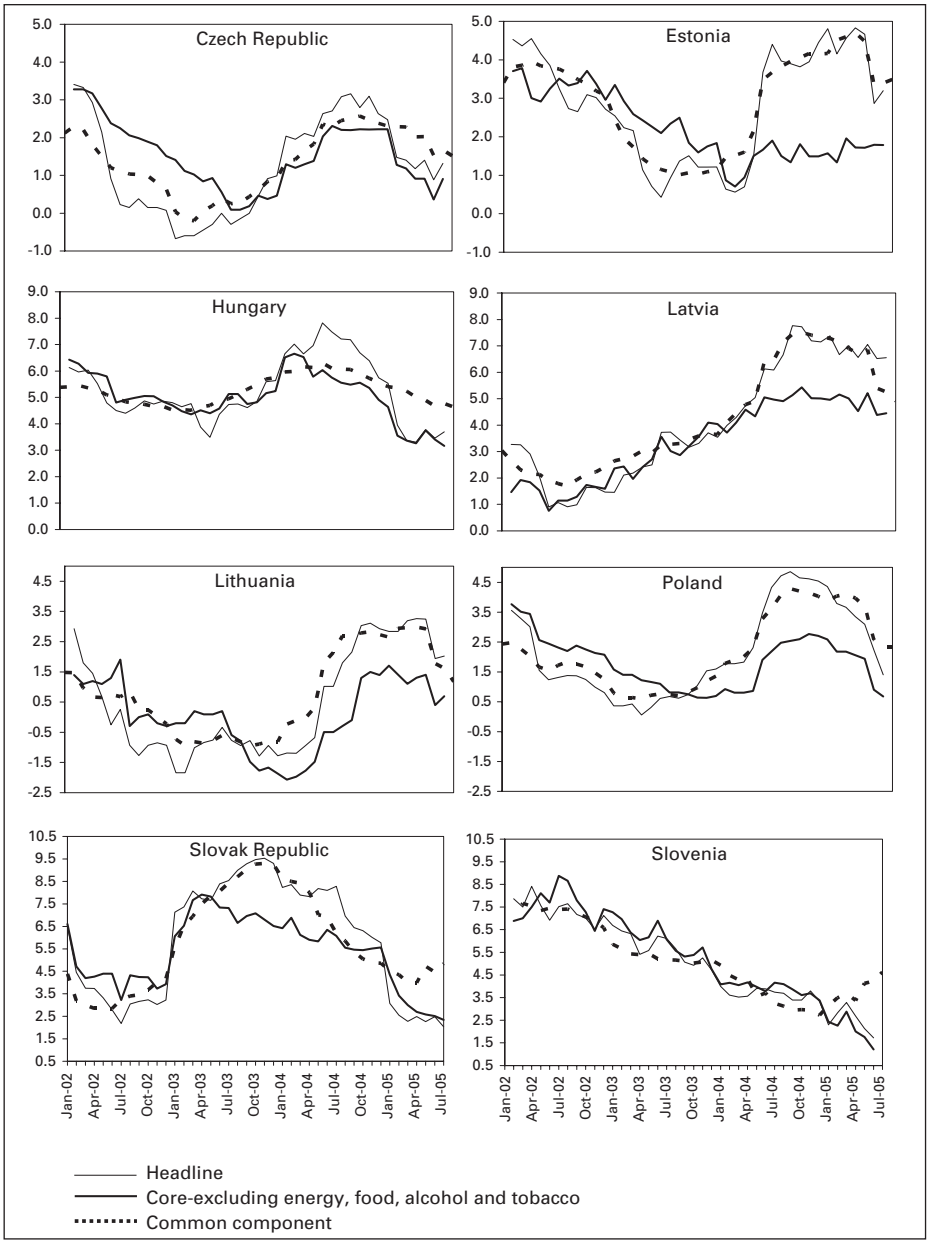
Cross-country correlation analysis suggests that a significant amount of the variation in inflation in the new EU8 countries is explained by common shocks (*Table 3*). Country-specific components, however, have also played a role, especially where the share of administratively regulated prices was significant (18 percent in the Czech Republic, 15 percent in Estonia, 14 percent in Latvia, and 22 percent in the Slovak Republic). In addition, there were various indirect tax adjustments related to EU accession that differed among the countries in the data set.

4. Discussion of the Results

GDFM results imply that common shocks explain about 80 percent of variability of the cross-section data over the medium term (*Figure 4*). Spectral decomposition of the data set suggests that the common component of inflation estimated using two dynamic factors has significant explanatory power. The common component of inflation explains about 80 percent of the variability of the cross-section data at a longer periodicity $[0, \pi/7]$ interval (over a year) and more than 50 percent at a shorter periodicity $[\pi/2, \pi]$ interval (less than a year).

Common component inflation performs better than a core measure (excluding energy, food, alcohol, and tobacco) in explaining headline inflation variability in most of the new EU8 countries (*Figure 5*).[2] Regression results

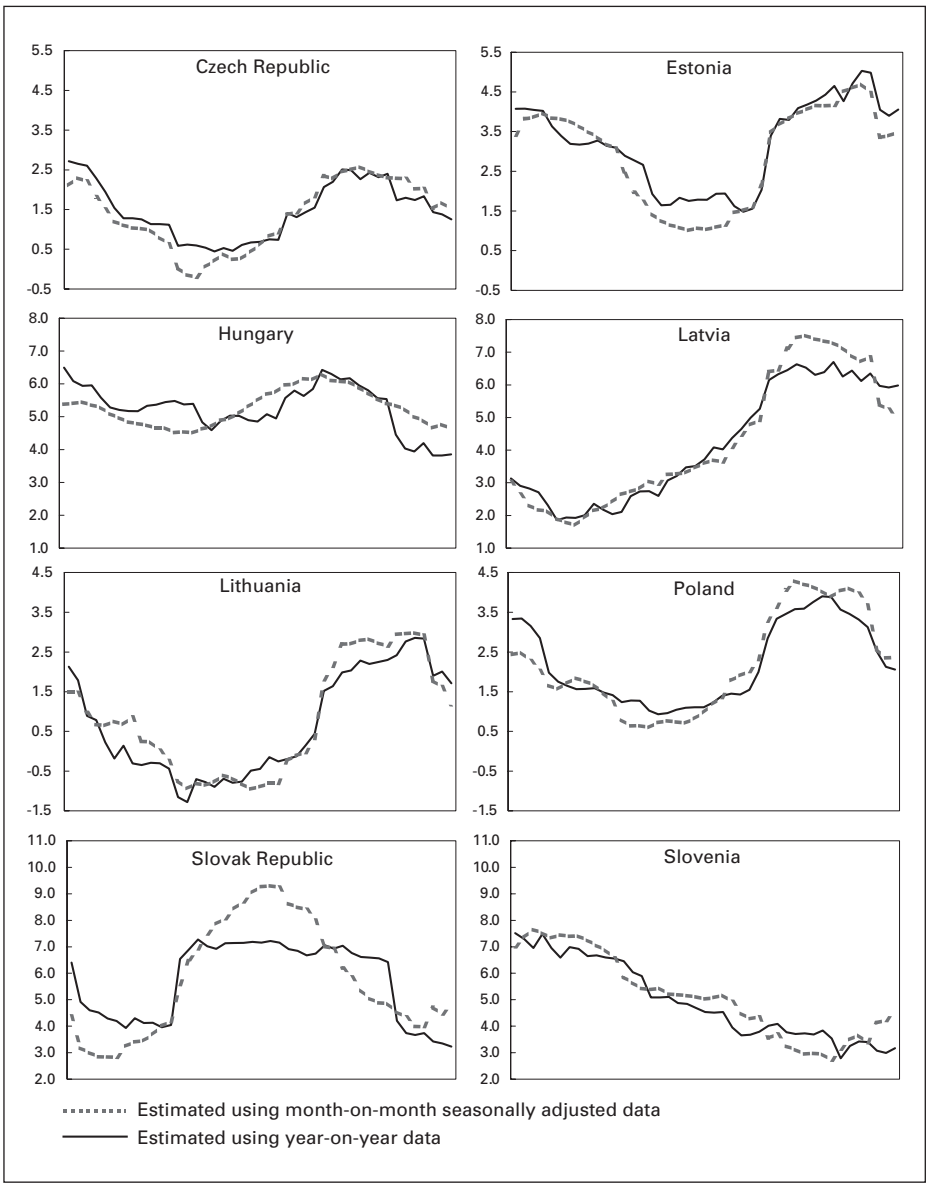
FIGURE 5 New EU8 Countries: Headline and Core Inflation
(Year-on-year, in percent)



Sources: Fund staff calculation; Eurostat

[2] The GDFM estimation was done using both year-on-year and seasonally adjusted monthly inflation. As can be seen from *Figure 6*, the results are qualitatively similar – the results discussed here are derived from year-on-year data.

FIGURE 6 New EU8 Countries: Common Component Inflation: Month-on-month versus Year-on-year Data (Two dynamic factors; year-on-year, in percent)



Source: Fund staff calculation

show that, with the exception of the Slovak Republic and Slovenia, the common component of inflation is a superior measure of underlying inflation in the sample countries. The share of headline inflation variance explained by

TABLE 4 Share of Inflation Variance Explained by Alternative Measures of Underlying Inflation (in percent)

	Core inflation (headline inflation excluding energy, food, alcohol and tobacco)	Common component
Czech Republic	43	82
Estonia	3	89
Hungary	69	71
Latvia	86	93
Lithuania	51	83
Poland	35	88
Slovak Republic	85	80
Slovenia	93	80

Source: Fund staff calculations

TABLE 5 New EU8 Countries: Determinants of Idiosyncratic Component [a]

	Constant	Industrial production	Retail sales	Exchange rate versus EURO	Exchange rate versus USD	Real long-term interest rate	EU inflation	Adjusted R^2
Czech Republic	–2.51 (1.60)	n.s.	0.36 (0.19)	–0.08 (0.02)	n.s.	–0.70 (0.12)	1.44 (0.63)	0.57
Estonia	–7.60 (1.06)	n.s.	0.06 (0.02)	n.s.	n.s.	–0.11 (0.05)	3.41 (0.47)	0.67
Hungary	–0.60 (0.95)	–0.05 (0.02)	n.s.	n.s.	n.s.	–0.84 (0.07)	1.15 (0.39)	0.82
Latvia	n.s.	n.s.	–0.08 (0.02)	0.08 (0.03)	0.10 (0.03)	–0.18 (0.03)	n.s.	0.58
Lithuania	n.s.	–0.04 (0.01)	n.s.	n.s.	0.08 (0.02)	n.s.	1.48 (0.44)	0.78
Poland	n.s.	–0.16 –0.03	n.s.	n.s.	0.12 –0.03	–0.42 –0.10	n.s.	0.65
Slovak Republic	–4.99 (2.27)	n.s.	–0.22 (0.04)	0.23 (0.11)	n.s.	–0.28 (0.09)	2.24 (1.07)	0.60
Slovenia	n.s.	n.s.	n.s.	0.39 (0.07)	n.s.	–1.19 (0.19)	1.10 (0.38)	0.78

Notes: [a] Dependent variable: Idiosyncratic component of inflation: defined as headline inflation minus principle component inflation.
Long-term interest rate in percent; the other variables y-o-y, in percent.
Standard errors in parenthesis.
Statistically significant variables reported; n.s. – not statistically significant at 1 percent, 5 percent, or 10 percent.

Source: Fund staff calculations

common component inflation is 80 percent or above, with the exception of Hungary where it is 71 percent (*Table 4*).

The idiosyncratic component is driven mainly by differences in monetary conditions in the sample countries. Monetary conditions, captured by the real long-term interest rate, are a significant determinant of the idio-

syncratic component. Real long-term interest rates have a significant negative effect on inflation for all countries in the sample. Also, in most countries, EU inflation has a significant and positive effect on inflation and in determining its deviation from the underlying level (*Table 5*).

5. Concluding Remarks

Our findings suggest several conclusions. First, a significant part of inflation in the new EU8 members is driven by common factors. Second, the proposed common component measure of inflation is a better estimator of underlying inflation than core inflation (i.e. headline inflation excluding energy, food, alcohol and tobacco). While further analysis is needed to determine if common component inflation fares better than other core measures of inflation in capturing the underlying inflation processes in the new EU8 countries, it has several appealing properties. First, this approach does not have the disadvantage of defining the core measure by excluding the elements which tend to underestimate the effect of supply shocks. Second, it overcomes the subjectivity implied in some other statistical approaches such as trimmed-means.

There are several areas where this study could be extended. First, the sample of countries could be enlarged to include the other EU countries. This would allow for a better decomposition of the common factor of inflation and the idiosyncratic component. Second, the estimated idiosyncratic and common components of inflation could be explicitly modeled to estimate the long- and short-run driving forces.

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SUMMARY

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Driving Forces of Inflation in New EU Countries

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Driving forces of inflation in the eight new EU member states from central and eastern Europe are analyzed using the generalized dynamic-factor model (GDFM) developed by Forni et al. The impact of various macroeconomic variables on inflation is estimated by regressing the GDFM idiosyncratic component on these variables; the importance of second-round and indirect effects from energy shocks is assessed using a bivariate VAR. The author's results suggest that, first, a significant part of inflation in the new members is driven by common factors, and, second, common component inflation is a better estimator of underlying inflation than a core inflation measure (i.e., headline inflation, excluding energy, food, alcohol, and tobacco).