The Relationship between Competition and Inflation

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This study supplements previous empirical work on the relationship between the average rate of inflation and competition by adding a new approach for estimating markups and investigating the annual rate of inflation, price variance and price levels.

Subject to certain qualifications, markups can be interpreted as indicators for competition intensity. Our calculation, conducted for 15 countries and 34 sectors, exhibits major differences between the sectors within one country and among the same sectors across various countries. The markups are used to produce estimates of the relationship between competition and inflation (average and annual rates), price levels and price variance. Although a significantly negative correlation with inflation and price variance is evident for the period from 1991 to 2005, competition loses its explanatory power for inflation rates when longer time spans are considered.

In terms of economic policy, this study confirms the findings of previous works which identify the intensification of competition as a temporary means of curbing price increases. A new finding from this study is the evidence for the inflation-stabilizing effect of intensified competition, which is caused by its negative correlation with price variance. The fact that no significant relation between price level and competition intensity was found may be attributable to insufficient data.

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This paper analyzes the supply-side triggers for inflation and continues a study conducted by Janger (2008) that attempted to obtain a current picture of competition intensity in Austria using highly disaggregated data. This study examines the general relationship between competition and inflation by analyzing international data on a less highly disaggregated level. Essentially, it is a nontechnical version of an article authored by Janger and Schmidt-Dengler (2010).

Increases in final consumer prices can either be caused by cost-push inflation or market power inflation. Cost-push inflation occurs when rising costs of production factors (labor, raw materials, etc.) are passed on to consumers via consumer prices. Market power inflation occurs when enterprises exploit monopoly positions or a lack of market competition, or when they collude with competitors to improve profit margins by raising prices (profit-push inflation). When compounded with cost-push effects, profit-push effects will precipitate wage-price spiral inflation: Inflation-induced wage hikes cause companies to raise prices, which in turn creates pressure for further wage increases. This study focuses on the possible influences exerted by market power inflation and competition intensity on price levels, annual and average inflation rates and price variance.

This study is organized as follows: Section 1 provides an overview of the literature on the topic of competition and inflation. Section 2 deals with the calculation of markups, which are subsequently used in section 3 to examine the connection between competition and inflation. Our conclusions are presented in section 4.

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1 Findings from Previous Literature on Competition and Inflation

Previous studies approach the relationship between competition and inflation from two directions. The first approach examines the effect of rising inflation on companies' market power. Empirical analyses identify a positive relationship between inflation and price dispersion, thereby constraining the information that consumers obtain from current prices (e.g. Chirinko and Fazzari, 2000). The magnitude of this effect depends on the size of search and information costs incurred. If search costs are high, demand elasticity will be low (since switching to another supplier involves substantial costs), which allows companies to raise their markups in an environment of increasing prices. If, by contrast, search costs are low and demand elasticity is high, price hikes are more likely to lead to a reduction in market power (Gwin and Taylor, 2004).

The second approach examines whether different levels of competition intensity may be responsible for varying rates of inflation across economic sectors or countries. According to the theoretical arguments proposed by Kydland and Prescott (1977) and Barro and Gordon (1983), impaired competition reduces the significance of price stability in monetary policy. In his research, Cavelaars (2003) uses this theory as a point of departure for his analysis of the connection between competition and inflation. In Cavelaars' paper, the average markup acts as a proxy variable for competition intensity and provides a significant explanatory variable for the average inflation rate observed in 21 countries in the period from 1988 to 2000. The markup is measured as the inverse of the wage share of GDP and thus does not account for capital costs. The results of Cavelaars' research are confirmed by Przybyla and Roma (2005) in their examination of 14 economic sectors and 8 EU countries over a longer time span (1980 to 2001).

This study adds to the literature by applying a markup that considers not only wages and capital costs but, in addition to average inflation, also examines the relation between competition and price levels, annual inflation and price variance.[2]

2 Markups as a Competition Indicator for Countries and Economic Sectors

2.1 The Calculation of Markups

A markup is defined as the difference between the marginal cost of an item and its selling price. The markup factor, μ, denotes the direct relationship between these values, while the Lerner index, B, measures the ratio of the difference between price and marginal costs to the price itself. In a perfect competition scenario, price P should equal marginal costs GK; consequently, the ratio should be either 1 (μ) or 0 (B).

$$\mu = GK/P$$
or
$$B = P - GK/P$$

In practice, however, prices often considerably exceed marginal costs. The scale of divergence between price and marginal costs is an indicator of the deviation of reality from perfect competition or the extent of market power. Markups are used frequently in empirical investigations to identify competition problems and can be analyzed along the value-added chain to examine competi-

[2] *Janger and Schmidt-Dengler (2010) also provide a theoretical derivation of these relationships.*

tion intensity on the basis of cost pass-through. However, such analyses require a sufficient amount of available price data at every level, from international commodity markets to producer and wholesale prices to consumer prices. These data are usually robust enough only for products with a short value-added chain, i.e. products with a fairly limited processing or product change, such as food production and retailing.

Due to a lack of information on marginal costs, markups must be approximated. At the sectoral level, the ratio of gross value added to personnel expenditure is a suitable proxy, for example. However, this method is quite simple and includes many limitations. This study uses the more comprehensive method developed by Röger (1995) for estimating markups, which allows consideration of labor, capital and other costs (e.g. energy, commodities and services).

Essentially, this method is based on calculating total factor productivity as a residual after deducting capital and labor contributions to growth from GDP growth in accordance with Solow (1957). Solow's method assumes perfect competition. Under conditions of imperfect competition, if markup B is not equal to 0, a different result is extrapolated for the residual (Hall, 1988). Röger (1995) demonstrates that under imperfect competition this productivity residual can be calculated from both the production and the dual cost functions. Therefore, the residual disappears when the cost function is subtracted from the production function and the markup can be calculated by using data on labor, capital and input costs. The

Calculation of Markups Following Röger's Methodology (1995)

This study estimates

$$\Delta y_{jt} = B_j \Delta x_{jt} + \varepsilon_{jt}$$

where

$$\Delta y_{jt} = (\Delta q_{jt} + \Delta p_{jt}) - \alpha_{jt}(\Delta n_{jt} + \Delta w_{jt}) - \beta_{jt}(\Delta p_{mjt} + \Delta m_{jt}) - (1 - \alpha_{jt} - \beta_{jt})(\Delta k_{jt} + \Delta r_{jt}) \text{ and}$$

$$\Delta x_{jt} = (\Delta q_{jt} + \Delta p_{jt}) - (\Delta k_{jt} + \Delta r_{jt})$$

in logarithmic form applying the least squares method. Index j represents the respective sector, q_{jt} denotes the real gross manufacturing output, p_{jt} is the corresponding price series, α is the share of total wages in the gross manufacturing output, n_{jt} represents labor performance, w_{jt} denotes hourly wages, β is the share of inputs in the gross manufacturing output, m_{jt} specifies input costs themselves (energy, materials and services), p_{mjt} indicates their prices, k_{jt} identifies real capital services and r_{jt} shows the user cost of capital. Other than the last item, all data are extracted from the EU KLEMS database (March 2008 release). The user cost of capital is estimated following the methodology adopted by Hall and Jorgenson (1967) using data from the European Commission's AMECO database:

$$r_t = P_I [(i - \pi_e + \delta)]$$

where P_I denotes the investment deflator, i - π_e the real long-term interest rate and δ the economic depreciation rate, which is taken as 8% in keeping with other studies. As no sector-specific data are available, the user cost of capital can only be calculated at the national level, which has little bearing on our analysis since variation across the sectors should be minimal. For additional details on the calculation procedure, see e.g. Annex 7 in Koszerek et al. (2007) and Janger and Schmidt-Dengler (2010).

estimation equation is described in detail in the box below (Calculation of Markups Following Röger's Methodology (1995)). The EU KLEMS dataset provides the required sectoral data for a relatively large longitudinal cross-section of countries (see Timmer et al., 2007, for a detailed description). This study calculates the markups for the observation periods from 1991 to 2005 and from 1980 to 1990 across 15 countries and 34 sectors. For methodological reasons, a markup that is constant over time has been assumed, i.e. price changes must be equal to changes in marginal costs.

2.2 Markups by Countries and Sectors

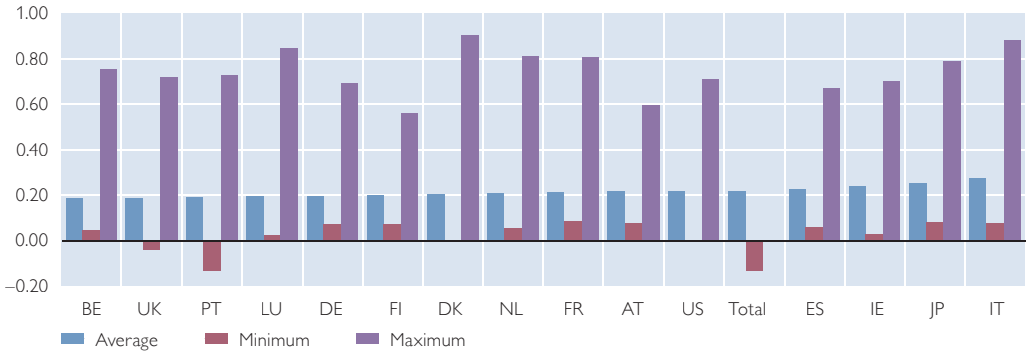
Charts 1 and 2 show a breakdown of markups by countries and industries. Table 2 in the appendix contains detailed descriptions of the respective sectors. The results are very similar to the calculations performed by Koszerek et al. (2007) and Christopoulou and Vermeulen (2008), who also use EU KLEMS data and Röger's methodology.

Perfect competition or a markup B of 0 are largely rejected; the negative figures in a few industries are caused by prices falling short of marginal costs.

Chart 1

Variations in Markups between and within Countries (1991–2005)

Gap between price and marginal costs relative to price

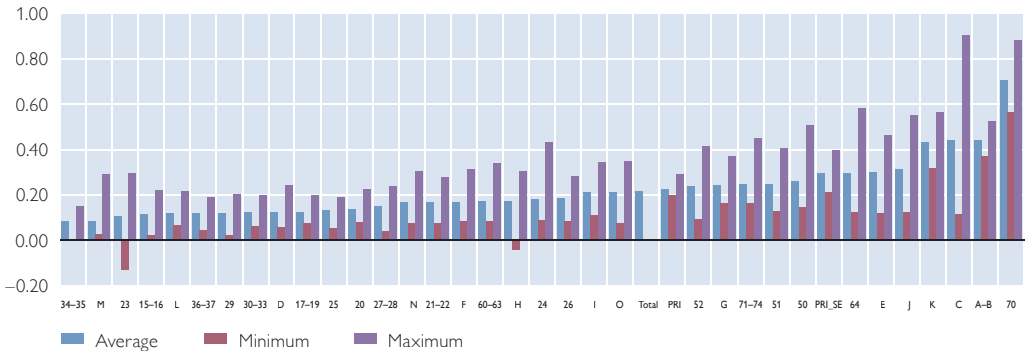


Source: EU KLEMS database, OeNB.

Chart 2

Markup Levels by Sectors (1991–2005)

Gap between price and marginal costs relative to price

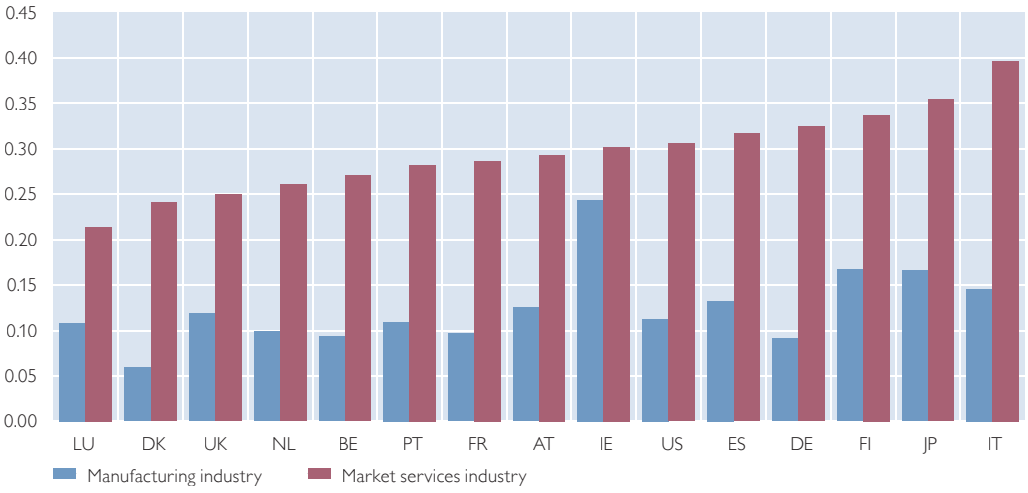


Source: EU KLEMS database, OeNB.

Chart 3

Comparison of Markups in the Manufacturing and Market Services Industries

Gap between price and marginal costs relative to price



Source: EU KLEMS database, OeNB.

Overall, differences at the country level are relatively minor, with Spain, Japan and Italy, whose competition intensity is generally regarded as low, exhibiting the highest markups. Within countries, however, major differences between individual industries can be observed, as is the case for the same industries in different countries. The manufacturing sector (sector D) exhibits considerably lower markups than does the market services industry (PRI_SE; services excluding public services). This difference may in part not only result from lower levels of competition intensity, but also from rising economies of scale. The relatively high results for the United States might be attributable to the large share of services in the national economy. Of note, Denmark, the United Kingdom and the Netherlands exhibit low markups for services. These three countries pursue an active policy to strengthen competition in the service sector through strong competition authorities and proactive competition policy frameworks (e.g. Janger, 2008).[3]

Compared with the period from 1991 to 2005, the changes in markups seen between 1980 and 1990 are within reasonable limits (chart 4), which makes the assumption of a constant markup seem plausible.

Markup developments must be interpreted with caution: partly because of methodological limitations and partly due to difficulties in interpreting markup levels.

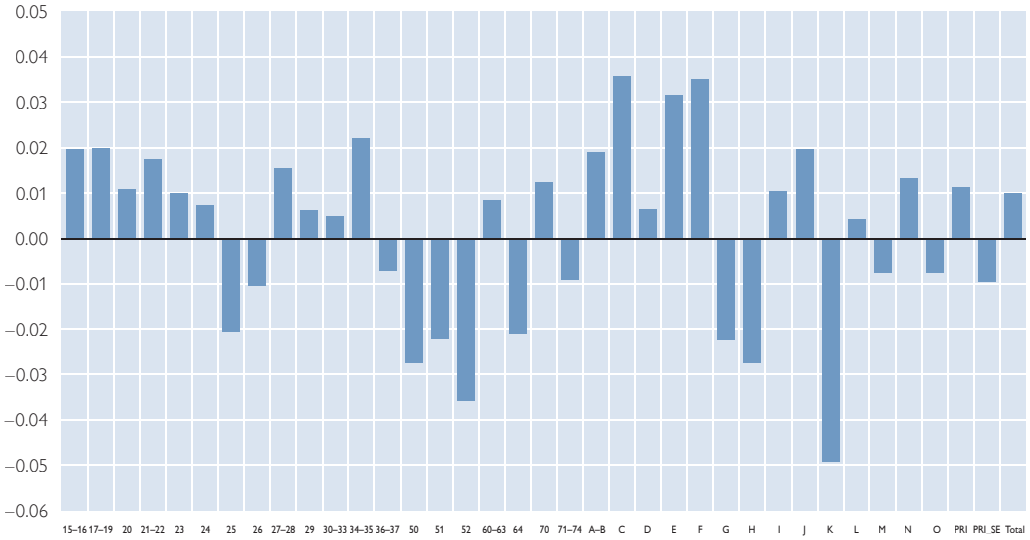
Methodological limitations include the assumption of both a constant markup and constant economies of scale, as well as the possibility of measurement errors in the data required for calculation. Christopoulou and Vermeulen (2008) apply different methods to correct the bias generated by a constant markup, although markups calculated in this manner are scarcely different from con-

[3] *Competition intensity is also relevant aside from its connection with inflation: Empirical studies have shown significant interaction between competition and productivity (e.g. Nicoletti and Scarpetta, 2003; Aghion and Griffith, 2005).*

Chart 4

Changes in Markups 1991–2005 vs. 1980–1990

Difference in percentage points



Source: OeNB.

stant markups. Increasing economies of scale would produce a downward bias of markups. An equal effect could also be caused by a number of measurement errors, while biases limited to the growth in the nominal gross manufacturing output and to nominal capital services would generate an upward bias. As data measurement errors are reduced, *a priori,* by using growth variables rather than levels in the calculation, the methodology utilized for this study appears to yield plausible results, particularly with regard to the lower limits for markup levels.

Are markups sufficient proxies for competition intensity? The literature frequently examines the correlation of markups with other competition indicators. Thus, a significantly positive correlation was found to occur between markups and the OECD's product market regulation indicators (Przybyla and Roma, 2005)[4], while a negative correlation was found with sectoral market entry rates, although not with concentration indicators (Oliveira Martins et al., 1996). Elevated markups can result from R&D efforts that justify temporary monopoly profits. Following the Röger method, Oliveira Martins et al. (1996) show that markups in R&D-intensive sectors are indeed higher. However, the considerable variation among markups in these sectors across all countries also points to other explanatory factors, such as competition intensity.[5]

Furthermore, this study examines the connection between markups and the Herfindahl index, a concentration ratio that originates from a database linked to the EU KLEMS database (O'Mahony et al., 2008), albeit for a limited number of sectors and years. As in Oliveira Martins et al. (1996), the

[4] *Markups calculated as inverse of the wage share of GDP.*

[5] *Markups may also be low because the workforce, possessing a high level of market power, succeeds in securing a large proportion of the economic rents, or because the owners' profit push is weak. However, especially with regard to the period from 1991 to 2005, these effects should be minor since the wage share of GDP has gone down in most countries while owners' profit expectations tended to climb.*

estimate does not yield a significant result. Yet this is hardly surprising since the relation between concentration and competition intensity is unclear. Rather, this relation also depends on demand elasticity (concentration only becomes problematic when there is little elasticity, i.e. when switching rates are low), a consideration for which no information is available that corresponds with the EU KLEMS dataset.

An additional estimate performed in this study reveals a significantly negative correlation (at a level of 1%) between a country's markup and the openness of its national economy and market size. A high degree of openness should strengthen competition intensity (import competition), while the size of a country's market impacts the number of suppliers from which consumers can choose and therefore influences demand elasticity.

The overall conclusion drawn from this study's discussion of markups relative to methodology and the quality of the markup as a proxy for competition is that markups should exhibit a relatively high, albeit imperfect correlation with the phenomenon of competition intensity and can therefore be regarded as a proxy for competition intensity. Consequently, markups are applied as explanatory variables in section 3.

3 Competition Intensity and Price Level, Inflation Rates and Price Variance

This study relates markups and competition intensity to three different, dependent variables: (1) price level, (2) annual and average inflation rates, and (3) price variance. The results are summarized in table 1. For ease of interpretation, the estimate does not use the actual value, *B*, but the value (*1–B*) denoted by *Comp*. As increasing markups reduce competition, the *Comp* value allows results to be read directly along the lines of "stronger competition leads to lower/higher inflation," etc.

3.1 Competition Intensity and Price Level

To determine the impact of competition intensity on the price level, we estimated the following regression equation in logarithmic form:

$$log\ P_{jt} = \alpha log\ \hat{c}_{jt} + \beta log\ \hat{C}omp_j + \eta_j + \eta_c + \upsilon_{jt}$$

where P_{jt} denotes the price level, $\hat{C}omp_j$ indicates competition intensity, η_j and η_c represent country- and sector-specific dummy variables, while υ_{jt} is an error term. The price level data do not stem from the EU KLEMS database but from the new GGDC Productivity Level Database (Inklaar and Timmer, 2008), which contains sectoral purchasing power parities for 1997. These are converted to comparative sectoral price levels using the annual average U.S. dollar exchange rate for 1997. Initially, the equation is estimated using control variables (subsection 3.2); then, these variables are replaced with dummy variables for countries and sectors.[6] As table 1 shows, the relationship is not significant despite the theoretically expected strong correlation between price level and competition intensity. However, it is very likely that the estimate suffers from a lack of data, as results are only available for one year, the cost data from the EU KLEMS database cannot

[6] *Since data are only available for one year, there are insufficient degrees of freedom present to enable a simultaneous estimate of dummy and control variables. The effect of control variables in the estimate with dummy variables is evaluated by regressing the results for countries' dummy variables on the control variables. This reveals a significant effect of openness (negative) and GDP per capita (positive) that we would also expect in theory.*

be used because they are available only in index form, and the calculated data on wage levels are doubtful. Thus, there is still no general empirical confirmation of the connection between price levels and competition intensity; any such connection has only been partially established in applied research, such as in studies that investigate the effects attributable to the liberalization of the telecommunications industries (OECD, 1997).

3.2 Competition Intensity and Inflation Rate

In the next step, the impact of competition intensity on inflation rates is estimated using the equation

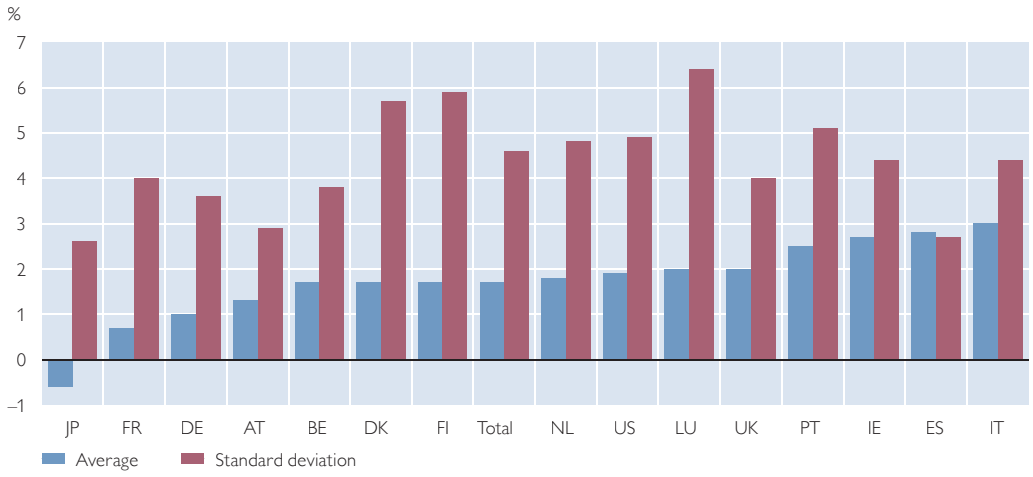
$$\Delta log\ P_{jt} = \alpha \Delta log\, \hat{c}_{jt} + \beta log\ \hat{Comp}_j + \gamma \Delta log\ \hat{c}_{jt}\ log\ \hat{Comp}_j + \eta_j + \eta_c + \upsilon_{jt}$$

where ΔP_{jt} denotes the price change and $\Delta\ \hat{c}_{jt}$ the cost change. $\Delta log\ \hat{c}_{jt}\ log\ \hat{Comp}_j$ is an interaction term which, if significant, would indicate that the pass-through of costs to prices interacts with competition intensity (e.g. along the lines of "if competition intensity decreases, fewer costs are passed through to prices"). In this respect, inflation does not mean consumer price inflation, but instead derives from the price index series for the gross manufacturing output of each industry captured by the EU KLEMS dataset.[7] Chart 5 depicts the inflation rates for each country, which average 1.7%. This rate is certainly plausible for the period from 1991 to 2005, during which the phenomenon known as "Great Moderation" was observed. A comparison of inflation rates with the markups in chart 1 shows a positive correlation (e.g. for Spain, Ireland and Italy). Japan is the exception, since its deflation was caused primarily by macroeconomic factors that stemmed from its year-long efforts to eliminate problematic financial assets from the balance sheet.

In addition to the variables outlined above, this study applies the following set of control variables, which are used routinely in empirical research on inflation (e.g. Neiss, 2001): *previous year's*

Chart 5

Average Sector Inflation Rates and Standard Deviation



Source: EU KLEMS database, OeNB.

[7] *We use the GO_P variable in the EU KLEMS dataset, a price index series where 1995 = 100.*

inflation as a measure of inflation persistence, *M3 growth,* the *output gap* as a measure of the business cycle, the degree of *openness* of a country's national economy, *per capita GDP* as a measure of institutional development, and *market size*. As these variables are only available at the country level, correlations of the error term might occur at this level; these are adjusted for by applying robust standard clustered errors. The above regression of inflation on competition intensity is estimated four times for annual and average inflation rates, once with and once without dummy variables in each case. The results are summarized in table 1.[8]

There is a significantly negative correlation between competition intensity and inflation in both models that use annual inflation rates and in the model that uses average rates and dummy variables (the specification preferred in this study since dummy variables also simplify the containment of data measurement errors). In the specification without dummy variables, the control variables *previous year's inflation, output gap, per capita GDP* and *M3 growth* have the theoretically expected signs and are statistically significant. The impact of the *openness* and *market size* variables is most likely already included in competition intensity (quality test of markups as competition indicators). In the regression using dummy variables, the only significant control variable is *previous year's inflation*. In this case, more than 80% of costs are passed through to prices. The interaction term is generally not significant.

The estimates are tested for robustness by correcting for extremes and checking for possible endogeneity in the competition variable (competition impacts inflation, but, as noted previously, inflation may also have an influence on competition). Neither of the two corrections produces a change in the statistically significant correlation. In addition, estimating the equation using average inflation rates across the entire period from 1980 to 2005 reveals no significant relationship between competition and inflation during that time, which leads to the conclusion that the impact of competition on inflation is rather temporary.

The results for the observation period from 1991 to 2005 are significant in both econometric and economic terms. A twofold increase in competition intensity (i.e. cutting markups by half) would lead to a decline in inflation ranging between 0.14 and 0.17 percentage points, while perfect competition (markups equal to 0) would cause inflation to drop by 0.20 to 0.33 percentage points, depending on the model used.

3.3 Competition Intensity and Price Variance

To determine the impact of competition intensity on price variance, a Hodrick-Prescott filter is first applied to the price and cost series taken from the EU KLEMS database to adjust for cyclical effects. Using the noncyclical components,

$$log\ sd(P_j) = \alpha log\ \hat{sd}(c_{jt}) + \beta log\ \hat{Comp}_j + \\ + \eta_j + \eta_c + v_{jt}$$

is estimated, where $sd(P_j)$ represents the standard deviation of prices and $\hat{sd}(c_{jt})$ the standard deviation of costs. Rising levels of competition intensity significantly reduce the standard devia-

[8] *In each case, the full effect of the competition variable is captured, i.e. the coefficient of the variable plus the relevant part of the interaction variable.*

Table 1

Estimates of the Correlation between Competition and Inflation – Results

	Price level 1	Price level 2	Annual inflation 1	Annual inflation 2	Average inflation 1	Average inflation 2	Price variance 1	Price variance 2
Competition intensity (Comp)	**0.0343**	**0.024**	**–0.00599***	**–0.01007*****	**–0.00529**	**–0.0091*****	**–0.00775****	**–0.02102*****
	(–0.0475)	(–0.0622)	(–0.00306)	(–0.00331)	(–0.00446)	(–0.00336)	(–0.00494)	(–0.00709)
Constant	–0.658***		0.0155***		0.00876*		0.00007	
	(–0.162)		(–0.00351)		(–0.00439)		(–0.00662)	
Observations	344	344	5.031	5.031	389	389	389	389
Dummy variables		yes		yes		yes		yes
Control variables	yes		yes	yes	yes		yes	
R^2	0.139	0.609	0.710	0.725	0.712	0.826	0.780	0.883

Source: Authors' calculations.

*Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in brackets.*

Additional explanatory variables: Cost inflation/standard deviation of costs; interaction term of cost inflation/standard deviation of costs with competition.
Dummy variables: Countries and sectors; years in regressions with annual change.
Control variables: Previous year's inflation, degree of openness, output gap, per capita GDP, market size, M3.

tion of prices – a new finding that has not yet been reported in the empirical literature. The results are summarized in table 1.

4 Conclusions

This study aims to contribute to the empirical discussion of the correlation between competition intensity and inflation, price level and price variance – a topic that has recently received renewed interest, particularly following the inflation peak in 2008.

The calculation of markups *per se* reveals major differences in competition intensity. Irrespective of its connection to prices and inflation, competition intensity is an influential factor in productivity growth and thus in economic growth. Empirical studies have identified significant interactions between competition and productivity. Within and across countries, major differences appear at the sectoral level. These are entirely plausible since we know, for instance, that the mobile telecommunications sector in Austria is much more competitive than the same sector in France.

The econometric conjunction of competition intensity and inflation indicates a significantly negative correlation for the period from 1991 to 2005, while this correlation breaks down for longer periods. Intuitively, it seems probable that a temporary inflationary impact is attributable to intensified competition, which means that it is certainly possible to correct rising inflation by employing competition policy measures. However, if the underlying cause of an uptrend in inflation is permanent, measures aimed at intensifying competition will have little effect.

Baumgartner's analyses (2008a, 2008b) have shown that price increases among selected Austrian product groups during the period between 2007 and 2008 cannot be attributed exclusively to the development of international commodity prices. Therefore, increased competition in the sectors concerned (and in other sectors as well) could be a contributing factor in moderating inflation. Böheim (2008a), for example, who is in favor of institutional reforms in competition policy, offers numerous options of how to intensify competition. The cornerstones of his suggestions include a reversal of the burden of evidence in antitrust proceedings; merging

the Federal Competition Authority and the Federal Cartel Attorney to establish a single, comprehensive competition authority; repositioning the competition commission as an autonomous expert body modeled on the German Monopolies Commission; transferring the right of first-instance decisions in antitrust cases to the Federal Competition Authority; and implementation of a forward-looking competition policy framework based on transparent, quantitative competition monitoring.

Janger (2010; in this issue) suggests a number of options for intensifying consumer-side competitive pressure, e.g. by employing awareness-raising measures to boost price comparison activity in sectors with low price comparison and switching rates, or by extending Internet price comparison to service sectors.

Finally, according to Böheim (2008b), a short-term curb on inflation can be achieved by promoting competition in the markets for network-bound energy and over-the-counter medications.

The new insight this paper provides is that intensified competition has a stabilizing effect on inflation and that a reduction in markups has a significantly negative impact on price variance.

In the dataset analyzed for this study, the correlation between price levels and competition intensity is not significant. Achieving a robust estimate would require significantly better data material.

References

Aghion, P. and R. Griffith. 2005. Competition and Growth: Reconciling Theory and Evidence. Zeuthen Lectures. Cambridge: MIT Press.

Barro, R. and R. Gordon. 1983. A Positive Theory of Monetary Policy in a Natural Rate Model. In: Journal of Political Economy 91(4). 589–610.

Baumgartner, J. 2008a. Statistische Zerlegung produktspezifischer Inflationsraten in Österreich und in der Eurozone. WIFO-Monographien 7.

Baumgartner, J. 2008b. Die Preistransmission entlang der Wertschöpfungskette in Österreich für ausgewählte Produktgruppen. WIFO-Monographien 7.

Böheim, M. 2008a. Reformoptionen zur Wettbewerbspolitik in Österreich. In: WIFO-Monatsberichte 6. 449–459.

Böheim, M. 2008b. Zur Rolle der Wettbewerbspolitik in der Inflationsbekämpfung. Ein Überblick über kurzfristige realisierbare Maßnahmen zur Intensivierung des Wettbewerbs. In: WIFO-Monatsberichte 9. 693–706.

Cavelaars, P. 2003. Does Competition Enhancement Have Permanent Inflation Effects? In: Kyklos 56(1). 69–94.

Chirinko, R. S. and S. M. Fazzari. 2000. Market Power und Inflation. In: The Review of Economics und Statistics 82(3). 509–518.

Christopoulou, R. and P. Vermeulen. 2008. Markups in the Euro Area und the US over the Period 1981–2004: A Comparison of 50 Sectors. Working Paper 856. European Commission.

Gwin, C. R. and B. A. Taylor. 2004. The Role of Search Costs in Determining the Relationship between Inflation and Profit Margins. In: Journal of Money, Credit and Banking 36(1). February. 139–149.

Hall, R. E. and D. W. Jorgenson. 1967. Tax Policy and Investment Behavior. In: American Economic Review 57(3). 391–414.

Hall, R. E. 1988. The Relation between Price and Marginal Cost in U.S. Industry. In: The Journal of Political Economy 96(5). 921–947.

Inklaar, R. and M. P. Timmer. 2008. GGDC Productivity Level Database: International Comparisons of Output, Inputs und Productivity at the Industry Level. Research Memorandum GD-104. Groningen: University of Groningen. September.

Janger, J. 2008. Supply-Side Triggers for Inflation in Austria. In: Monetary Policy & the Economy Q2/08. Vienna: OeNB. 34–69.

Janger, J. 2010. Determinants of Price Comparison and Supplier Switching Rates in Selected Sectors. In: Monetary Policy & the Economy Q1/10. Vienna: OeNB.

Janger, J. and P. Schmidt-Dengler. 2010. Competition and Inflation. Mimeo. Vienna: OeNB.

Koszerek, D., K. Havik, K. Mc Morrow, W. Röger and F. Schönborn. 2007. An Overview of the EU KLEMS Growth und Productivity Accounts. Annex 7. Markup Analysis. European Economy Economic Papers 290. October.

Kydland, F. and E. Prescott. 1977. Rules Rather than Discretion: The Inconsistency of Optimal Plans. In: Journal of Political Economy 85(3). 473–492.

Neiss, K. S. 2001. The Markup and Inflation: Evidence in OECD Countries. In: The Canadian Journal of Economics 34(2). 570–587.

Nicoletti, G. and S. Scarpetta. 2003. Regulation, Productivity and Growth: OECD Evidence. In: Economic Policy 18(36). 9–72.

OECD. 1997. The OECD Report on Regulatory Reform, Synthesis. Paris.

Oliveira Martins, J., S. Scarpetta and D. Pilat. 1996. Mark-Up Pricing, Market Structure and the Business Cycle. OECD Economic Studies 27(II). 71–105.

O'Mahony, M., C. Castaldi, B. Los, E. Bartelsman, Y. Maimaiti and F. Peng. 2008. EUKLEMS – Linked Data: Sources und Methods. Mimeo. University of Birmingham.

Przybyla, M. and M. Roma. 2005. Does Product Market Competition Reduce Inflation? Evidence from EU Countries and Sectors. ECB Working Paper Series 453. March.

Röger, W. 1995. Can Imperfect Competition Explain the Difference Between Primal and Dual Productivity Measures? Estimates for US Manufacturing. In: Journal of Political Economy 103(2). 316–330. April.

Solow, R. M. 1957. Technical Change and the Aggregate Production Function. The Review of Economics and Statistics 39(3). 312–320.

Timmer, M., T. v. Moergastel, E. Stuivenwold, G. Ypma, M. O'Mahony and M. Kangasniemi. 2007. EU KLEMS Growth and Productivity Accounts. Version 1.0, Part I Methodology. EU KLEMS Consortium.

Annex

Table 2

Definition of Economic Sectors

Sector code	Industry
15–16	Manufacture of food products, beverages and tobacco products
17–19	Manufacture of textiles, textile products and wearing apparel, leather and footwear
20	Manufacture of wood and wood products (except furniture)
21–22	Manufacture of pulp, paper and paper products; publishing, printing and reproduction of recorded media
23	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products
25	Manufacture of rubber and plastics products
26	Manufacture and processing of glass, manufacture of other non-metallic mineral products
27–28	Manufacture of basic metals and fabricated metal products
29	Manufacutre of machinery and equipment n.e.c.
30–33	Manufacture of office machinery, computers and other information processing equipment, and of electrical, precision and optical equipment
34–35	Manufacture of transport equipment
36–37	Manufacture of furniture, jewellery, musical instruments, sports goods, games and toys; miscellaneous manufacturing; recycling
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles
52	Retail trade, except of motor vehicles and of automotive fuel; repair of personal and household goods
60–63	Transport (land, water and air transport; activities of travel agencies)
64	Post and telecommunications
70	Real estate activities
71–74	Renting of machinery and equipment; computer and related activities; research and development; other business activities
A–B	Agriculture, hunting and forestry; fishing
C	Mining and quarrying
D	Manufacturing
E	Electricity, gas and water supply
F	Construction
G	Wholesale and retail trade
H	Hotels and restaurants
I	Transport, storage and communication
J	Financial intermediation
K	Real estate, renting and business activities
L	Public administration and defense, compulsory social security
M	Education
N	Health and social work
O	Other community, social and personal service activities
PRI	Total economy excluding public services (excluding L–O)
PRI_SE	Services excluding public services
Total	Total economy

Source: Statistics Austria.