RĪGAS EKONOMIKAS AUGSTSKOLA
STOCKHOLM SCHOOL OF ECONOMICS IN RIGA

SSE Riga Student Research Papers
2008:11(107)

CAUSALITY BETWEEN PRICE AND WAGE INFLATION IN THE LATVIAN ECONOMY

Authors: Andris Puriņš
Artūrs Kaņepājs

ISSN 1691-4643
ISBN 978-9984-842-00-4

November 2008
Riga

Causality between Price and Wage Inflation in the Latvian Economy

Andris Puriņš

and

Artūrs Kaņepājs

Supervisor: Anna Zasova

May 2008
Riga

Abstract

This paper investigates the relationship between price inflation and wage inflation in the Latvian economy. Several specifications of Granger causality tests are applied in two approaches. The first approach investigates relationship between price inflation and productivity-adjusted wage inflation. The second approach investigates relationship between inflation of components of price index and productivity-adjusted wage inflation. The main findings are as follows. Firstly, changes in productivity-adjusted wages lead to changes in the price index. Secondly, labour cost-intensive good prices, in contrast to labour cost-intensive service prices, do not respond to changes in productivity-adjusted wages. In conclusion, implications for policy are drawn based on these findings and suggestions for further research are offered.

Acknowledgements

We would like to thank the people that have helped us to write this paper.

First and foremost, we are grateful to our supervisor Anna Zasova for the valuable and frequent comments during the process of writing this paper.

We highly appreciate the useful suggestions and materials that Eugene Babaitsev provided us with for the analysis of our data.

We would like to thank our fellow students Olga Babina and Andrii Shekhirev, and Janis Pastars and Oskars Cimermanis for the constructive criticism during the review of the empirical findings and final presentations respectively.

We also thank the helpful Eurostat staff for their assistance in preparing our dataset.

Finally, we would like to thank everyone who expressed their interest in the topic and thus motivated us to research it.

Table of Acronyms

ADF	Augmented Dickey-Fuller test for unit root
BIC	Bayesian Information Criterion for determining lag length
CPI	Consumer Price Index
ECT	Error Correction Term
EU	European Union
GDP	Gross Domestic Product
HICP	Harmonised Index of Consumer Prices
ULC	Unit Labour Costs

TABLE OF CONTENTS

1. Introduction

The relationship between price and wage inflation forms the focus of this paper. The booming economies of the Baltic States and particularly Latvia have in recent years registered record high rates of economic growth and experienced increasing inflation, which reached 14.1 per cent per annum in December 2007 (Latvijas Statistika, 2006). Inflation is widely expected to continue rising until the middle of 2008.

Theoretically, wage inflation is regarded as one of the main factors that can cause price inflation. The expectations augmented Phillips curve, which is the theoretical cornerstone of our study, shows that wage growth leads to price inflation. However, workers, given the tight labour market conditions, have a strong position in wage bargaining, and it is clear that they demand pay increases that are at least equivalent to expected inflation, which, in turn, is quite close to past rates of inflation (Benkovskis and Paula, 2007). Therefore, we look at the interrelationship between prices and wages with the aim of uncovering the direction of causality. To this end, we run Granger causality tests, which determine whether or not one time series contains information that can be used to predict the development of another time series. Quantification of these relationships would help to spot problems ahead and modify policy decisions accordingly.

In Latvia, some components of the consumer price index have risen particularly sharply, and the relationship with prices may differ among them. It is also clear that it is hard to predict the part of inflation that is not related domestic economic variables. For instance, fuel prices, which are an important cause of inflation, cannot be predicted with an acceptable degree of accuracy. Because of these reasons we also look at this problem on a disaggregated basis. Hence, our main research question is, **'What is the nature of the causality between price inflation and wage growth?'** Our secondary research question is, **'Are disaggregated data more informative about inflationary developments than the main macroeconomic variables?'**

In our paper we thus aim to estimate the nature of the links between the abovementioned variables. As a result, since inflation is a painful problem, we would like to give our contribution to investigating and forming the economic rationale behind the policy decisions affecting wages and prices in both the public and private sector. In late 2007, the then government announced that fiscal austerity, including but not limited to reduced administrative wage growth, would be one of the main tools to curb inflation. It had earlier put in place an anti-inflation plan. In a U-turn move, the current government has said that, in order to avoid a hard landing, the Latvian economy needs a fiscal expansion and that no additional measures will be taken to decrease inflation (DPA, 2008).

The rest of our paper is structured as follows. Section 2 gives an overview of the literature on inflation and its effects, and linkages between prices and wages. Section 3 develops a theoretical framework for our study. Next, we introduce our dataset and analyse several key macroeconomic variables that are central to our research. Section 5 outlines the methodology of our study. The following two sections develop two models that link prices and wages. The first model is a based on the work of Zanetti (2005) and builds a model that links prices and wages. The second model relates to a paper by Brauer (1997) and is concerned with disaggregated data, which leads to a more unconventional model. In Section 8 we discuss the results. Section 9 concludes and gives suggestions for further research.

2. Literature Review

In this section we present review literature we have found most relevant for our research. First, it is important to understand the role of inflation in the decisions of economic agents and how these decisions aggregate to determine the course of the whole economy. Second, we summarise the key findings of the studies that have investigated the link between prices and wages. Third, we look at the articles that deal with the economy of Latvia.

2.1. Costs of Inflation

Some inflation is generally seen as acceptable or inevitable, and this is why even the European Central Bank, whose main function is to ensure price stability by all means, 'aims at inflation rates of below, but close to, 2% over the medium term' (Monetary Policy, undated). Also the Bank of England's inflation target is 2% (Monetary Policy Framework, undated). However, estimates of the cost of inflation abound. For instance, by using innovative computational methods, Burdick (1997) reports that reducing the annual rate of inflation from 2.5% to 0% would lead to a rise in the annual real GDP growth by 0.36%. In turn, the Bank of Latvia has opted for the exchange rate strategy for the implementation of its monetary policy, pegging the Latvian lat to the euro. Previously, the lat was pegged to the SDR, which is a basket of currencies (Bank of Latvia, 2007). This limits the ability of the central bank to use other monetary policy instruments, such as interest rates, to achieve internal stability and manage inflation.

It is often assumed that moderate inflation *per se* is not harmful on the condition that it can be correctly forecasted and taken into account by all relevant economic agents. A problem arises when inflation becomes unpredictable, as this can seriously dampen economic activity because individuals, enterprises and the government face uncertainty over the outcome of their decisions. There are several channels through which inflation uncertainty feeds into real economy. Elder (2000) summarises the negative effects of inflation uncertainty. First and foremost, it reduces the efficiency of prices, which should signal whether or not a particular economic activity should be undertaken. As a result, economic agents either abstain from undertaking that activity or risk misallocating their resources. Further, inflation uncertainty blurs the difference between nominal and real shocks, resulting in similar consequences for the economy. Hence, when inflation cannot be reined in, it becomes increasingly hard to predict its exact magnitude and the aforementioned effects kick in. For instance, the author reports that an increase in inflation uncertainty of one standard deviation reduces the output growth by 2% after two months.

2.2. Links between Wages and Prices

There has been a lot of research to investigate links between wages and prices, but empirical evidence is still mixed.

Based on a sample period from 1952 to 1999, Mehra (2000) finds that 'higher wage growth does lead to higher future inflation, as predicted by the cost-push view.' He also reasons that it is more useful to look at the relationship between wages and consumer prices, rather than at the GDP deflator, because the former is the most widely used measure of inflation. An investigation of sub-samples reveals that wage growth does not explain inflationary developments in times of low inflation.

Hess and Schweitzer (2000) argue that lately attention has turned from unemployment levels to wage growth as an indicator of imminent inflation. But, based on US data, they find little evidence to support the assumption that increased wages cause inflation, even though, from a theoretical point of view, if unemployment drops below a certain level, or the natural rate of unemployment, this should cause friction in the labour market. This would then result in higher wages, which would, in turn, cause inflation to rise. However, this is not what happened in the US in the 1990s. Therefore, economists have turned their attention to wage and compensation growth as a more appropriate labour market indicator of forthcoming inflation. The authors find little support for the view that higher wages cause higher prices. On the contrary, they find more evidence that higher prices lead to wage growth. Likewise, Cassion and Joyce (2003) show that a number of labour market indicators can be used for inflation forecasting, and they find that wage growth Granger-causes inflation.

Zanetti (2005) constructs a quarterly time series for nominal hourly wages and unit labour costs for the Swiss economy from 1975 onwards and looks at the link between wages and inflation in order to identify causality links between the two variables. Thus, he is interested in investigating the information content of the wage dynamics for inflation forecasting. The author finds that causality works in both directions; however, while prices systematically influence wages, the influence of wages on prices via cost-push inflation depends on the choice of the sample period. The link is strong in times of relatively high inflation, but its explanatory power is rather limited when inflation is low. It also takes time before the companies that have increased wages are able to make adjustments to the prices of their final products, and this may not be possible due to competition or this will have take place less often because there are costs associated with changing prices very frequently. At least, a lag between the two events can be expected. One must note that the author looks at causality in an econometric sense, thus we can talk more about information content and have to be cautious about causality *per se*.

Brauer (1997) notes that the compensation growth in the service industry can help forecast price inflation for specific groups of services. He argues that by focusing on labour compensation developments in private sector services, one can forecast inflation more precisely. This assumption is based on the premise that the CPI can be split into three broad groups, which are heterogeneous with respect to the strength of the link between prices and wages. The same idea is echoed by Aaronson (2001), who investigates how changes in minimum wages affect prices in the fast food industry in the US and Canada.

For ease of reference, this subsection of the literature review is summarised in Table 28 in Appendix G.

2.3. Literature on Latvia

Several papers that discuss the variables we look upon have been published quite recently, but to our knowledge none focuses on the main questions of this paper.

According to Vanags and Hansen (2007), inflation in Latvia is a sign of more profound macroeconomic imbalances, as well as a serious problem in itself. They argue that the tightness of the labour market is one of the main reasons why inflation has picked up.

Benkovskis and Paula (2007) contribute to the inflation debate by examining the effect of inflation expectations, which have arguably become one of the driving forces behind rising price levels in Latvia. They use a model based on Vector Autoregression, but do not analyse the actual mechanism of forming inflation expectations. They find support for the hypothesis that inflation expectations have a statistically significant effect on inflation, and the response to an increase in inflation expectations occurs after 3 to 5 months. The authors come to the conclusion that expected inflation is roughly equal to the actual rate of inflation.

Zepa et al. (2006) identify a multitude of factors that influence wages and salaries and give a comprehensive overview of the labour market in Latvia. They find that the most significant factor that influences a person’s earnings is their education. Such variables as company size, its financial results, location and industry. However, these variables change rather slowly and can be assumed to remain constant in the short to medium term. The authors also investigate the mechanism of wage determination and find that to a large degree it is determined by inflation. When determining pay for employees with low and medium qualifications, most employers consider the official rate of inflation. When determining pay for highly qualified employees, employers consider both the minimum wage and the current rate of inflation. One must note that the minimum wage is dependent on the general economic conditions in the country and, among other things, inflation. In reality, the minimum wage is determined through political wrangling in which the government, trade unions and employers are involved. The authors report that wages also depend on the level of pay in other companies, which is again indirectly linked to inflation. One must note that this paper was published in 2006, but part of research was carried out as early as in 2005, which means that the link between price inflation and wage inflation may have become even stronger in the meantime.

All in all, the literature is ambiguous about the causal relationship between wages and prices, and the strength of this link varies across countries and time. However, there is strong preliminary evidence that in Latvia wage inflation contributes to price inflation (Vanags and Hansen, 2007). Several authors (Brauer, 1997; Zepa et al., 2006) have also found that it is worthwhile to look at different industries separately to investigate the effect.

3. Theoretical Framework

The expectations augmented Phillips curve forms the theoretical framework for our study. In its original form, the Phillips curve implies a trade-off between low unemployment and low inflation. For instance, a fiscal expansion, intended to boost output and employment, would also increase inflation. The validity of the Phillips curve came under scrutiny in the late sixties, as the UK and other countries moved away from the original Phillips curve relationship (Proctor, 1992).

However, the augmented Phillips curve recognises that inflation can remain high because of inflation expectations and has a better empirical record. Hence, prices are formed by adding a mark-up to wages, wages depend on expected inflation, and expected inflation is a function of past rates of inflation.

(3.1) $\Delta p_t = \alpha_0 + \alpha_1 \Delta (w_t - q_t) + \alpha_2 D_t + \alpha_3 S_t$

(3.2) $\Delta (w_t - q) = \beta_0 + \beta_1 E(\Delta p_t) + \beta_2 D_t + \beta_3 S_t$

(3.3) $E(\Delta p_t) = \sum_m^n \lambda_m \Delta p_{t-m}$

Where p_t is the price level;

w_t is the wage level;

q_t is labour productivity;

$E(\Delta p_t)$ is the expected change in price level;

D_t is the demand pressure variable;

S_t is the supply pressure variable.

Source: Mehra (1991)

Note: all variables are expressed as natural logarithms

Hence, adjusted for supply and demand shocks, prices and wages are closely related, and the model suggests that both variables influence each other.

In the following paragraphs, we elaborate on the dynamics of the equations above. The basic proposition of the mark-up pricing theory is that firms set prices by adding a mark-up to the cost of a product or service. Such a pricing mechanism ensures that increased costs are passed from producers and retailers to consumers. This means that if the costs of producing a product go up, the final price of that product will also increase. The marginal cost pricing theory implies that the price of a good will be equal to its marginal cost. Although it is appealing from a theoretical point of view, nowadays many products and services are branded and have a low elasticity of demand. This means that prices are higher than marginal costs. However, the reasoning that increased (marginal) costs are passed from producers and retailers to consumers is still valid. In the model above, this explains why wage inflation causes price inflation and sums up the basic properties of cost-push inflation.

Another aspect of our model is that workers try to negotiate their nominal wages upwards to make sure that their real earnings increase or at least remain constant. The expected rate of inflation is an important factor in wage bargaining because wage earners will compare their wage rises to the costs inflicted by inflation. Most members of the general public may be uninformed about economic theory, but they estimate that the next year's inflation rate will be at least equal to past rates of inflation. Hence, wage earners will demand pay rises to cover for inflation, and employers, depending on the conditions in the labour market, will consider these demands. If the rate of unemployment is low, it is likely that they will give in to those demands. In the model above, this explains why price inflation causes wage inflation.

To test these relationships from a practical perspective, we will rely on Granger causality tests. Granger causality testing is a statistical technique that, in its standard form, establishes whether one time series contains information that can be used to forecast another time series, i.e. it shows whether or not incremental predictability is present. This technique has received criticism because causality can be tested in an econometric sense, and one can argue that the results obtained by such regressions may be deceiving and tell us little about true causality. However, it has remained as one of the most widely used techniques. Its basic premise is that 'a feedback mechanism may be considered as the sum of two causal mechanisms and that these causalities can be studied by decomposing cross or partial cross spectra suggests methods whereby such mechanisms can be investigated' (Granger, 1969).

This implies that Yt causes Xt if the prediction power of Xt using all available information other than Yt is improved by its inclusion. Further, it has been extensively argued in the review of literature that wages and prices cause each other -- by this we mean a feedback mechanism in which Xt can be used to predict Yt and vice versa. Of course, a third option of independence is also possible, which means that neither of the two or more time series contains information that can be used to improve the reliability of other's prediction.

Considering the above assumptions and definitions, we must exercise a fair degree of caution in declaring that one time series can be used to predict another time series, let alone conclude that one event actually causes another event. Yet, coupled with a sound theoretical framework, this technique ensures that we arrive at a qualified opinion about the relationship between two key variables, prices and wages.

4. Data

4.1. Data Sources

We use secondary data for our study. There are two principal sources of detailed economic data on Latvia: the Central Statistical Bureau of Latvia (CSB) and the Statistical Office of the European Communities (Eurostat). Although these sources present the information we need somewhat differently, in both cases the underlying data are gathered by the Central Statistical Bureau of Latvia. In addition, some of the data come from the Bank of Latvia.

Our sample contains quarterly data from 1996 until 2007. Some of the variables (e.g. components of price indices) have not been calculated for the last quarter of 2007, which decreases the number of observations. Another aspect is that we do not use these variables in levels, but as percentage changes. As a result, our sample consists of 51 observations, which is a relatively small number; in some specifications, it is further decreased by the unavailability of data on some of the control variables, due to data filtering to make adjustments for seasonality, and due to differencing of variables. However, in all cases the number of observations is larger than 30, which is a small but sufficient sample size to enable us to make statistical inferences about the sample period.

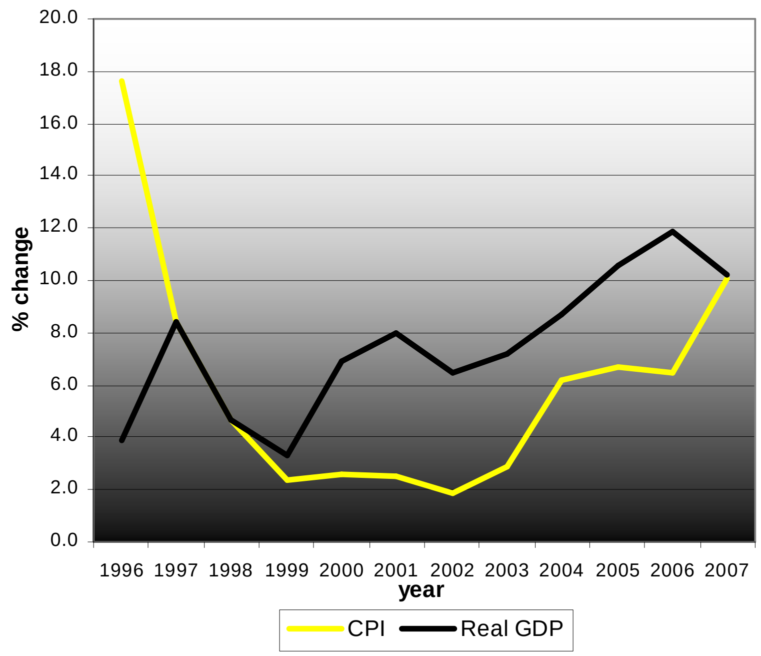
4.2. Historical Developments

At this point, we cannot analyse all the variables we use in our study because many of them, e.g. unit labour costs, will be introduced as results of our own calculations. However, we consider necessary to introduce two key variables, prices and output.

Latvian consumer price inflation skyrocketed in the early nineties after abandonment of price controls and subsidies. Hyperinflation persisted for several years, but was gradually brought down by a successful currency reform, which saw a switch to an interim currency, the Latvian rouble, in 1992, before the re-introduction of the lat in 1993. The state of the Latvian economy in the early nineties was poor, and output declined for several years in succession; the result was that the GDP per capita of Latvia almost halved.

In our study, we analyse price inflation and wage development after 1995 because this year marked the end of the most important economic reforms. Ensuing stabilisation of key economic variables, such as output growth and inflation, also renders the data suitable for econometric analysis. The annual changes of CPI and real GDP are shown in Figure 1.

Figure 1: Annual CPI Inflation and Real GDP growth in Latvia 1996-2007



Source: Latvijas Statistika (2006)

After 1995, inflation continued to decline, falling to 17.6% in 1996. This was mainly due to the prudence of the Bank of Latvia and non-expansionary fiscal policy exercised by the governments of this period. 1997 was the first year that saw a single-digit rate of inflation of 8.5%. Output has been growing relatively steadily since 1995. In 1997, the real GDP growth rate was 8.4%. In the following years, the Latvian economy again hit a rough patch because of the 1998 Russian economic crisis, which damaged Latvian exports to Russia and other countries in the Commonwealth of Independent States. However, inflation continued to decline and dropped to 2.4% in 1999 and remained below 3% until 2004.

In 2004, the inflation rate jumped to 6.2%. This was partly a consequence of Latvia joining the European Union on May 1, 2004. The accession to the EU implied a number of key changes for the country’s economy. First, more enterprises and farmers would gain access to funding from EU structural funds, which stimulated an economic expansion. Second, some tax rate streamlining took place. Third, the EU labour market was partially opened up to workers from the new member states, resulting in workforce migration to the United Kingdom and Ireland. All of this, coupled with increased inflation expectations, caused inflation to go up. Easily available mortgages and rising energy prices also had an effect on inflation.

In 2005 and 2006, the rate of inflation remained relatively stable at 6.7% and 6.5% respectively. However, 2007 saw inflation creep back into double-digits for the first time in a decade. The government came up with an anti-inflation plan, but this move was later seen as belated and insufficient to tackle the inflation problem in the short-run even by the people who developed it (Petrane, 2007).

In 1998 and 1999, economic growth slowed down due the Russian economic crisis. However, the economy bounced back quickly, and over that last few years Latvia has recorded the highest rate of growth in the EU.

5. Methodology

In order to answer our research question, we will analyze the effects of labour cost and price measures, as well as their lags. We will initially look at simple correlations and graphics, and afterwards extend the analysis with Granger causality tests in different specifications, which in turn require stationarity analyses. We will extensively use ‘Intercooled Stata 9.1 for Windows’ statistical package, from now on referred to as ‘Stata’, for the statistical analysis of the data. We will also use Microsoft Excel for minor tasks (e.g. formatting and seasonal adjustments).

5.1. Preparing Data

After obtaining the crude data on price or labour cost measures, we will firstly perform a seasonal adjustment as shown in (5.1) below:

$$(5.1)\begin{cases} adjX_t = \tfrac{1}{8}(X_{t+2} + 2X_{t+1} + 2X_t + 2X_{t-1} + X_{t-2}) \mid 3 \le t \le n-2 \\ adjX_t = \tfrac{1}{5}(X_{t+2} + 2X_{t+1} + 2X_t) \mid t = 1 \\ adjX_t = \tfrac{1}{7}(X_{t+2} + 2X_{t+1} + 2X_t + 2X_{t-1}) \mid t = 2 \\ adjX_t = \tfrac{1}{7}(2X_{t+1} + 2X_t + 2X_{t-1} + X_{t-2}) \mid t = n-1 \\ adjX_t = \tfrac{1}{5}(2X_t + 2X_{t-1} + X_{t-2}) \mid t = n \end{cases}$$

Where $adjX_t$ is the seasonally adjusted value of variable X at time t;
X is the variable to be adjusted, i.e. either price or labour cost variable;
n is the number of observations.

We consider such adjustment appropriate for quarterly data as it is designed to incorporate seasonal effects of all four quarters in equal proportions. The method of calculation of 1^{st} and 2^{nd}, as well as the last two values is likely to lead to some upward and downward bias respectively (as both prices and labour costs generally grow over time), but, considering our limited sample size, we consider it better than excluding them.

As the last step before starting quantitative analysis and for the sake of interpretation, we must also take natural logarithms of both price and labour cost variables.

5.2. Tests for Stationarity

As the first step in our analysis we will plot the variables of interest over time as well as look at simple correlations of variables and their lags. This may give some insight regarding relationship of variables before we run Granger causality tests, which are described in the next subsection. However, an essential issue is that, prior to considering Granger causality, stationarity analysis of labour cost and price series must be performed.

The stationarity properties of price indices and wages are different across countries and over time. In some cases, these variables are found to be integrated of order one, but other researchers have come to the conclusion that they are integrated of order two with the general rule being that transitional economies are characterised by less stable macroeconomic variables (Zanetti, 2005). To test for the presence of a unit root, we rely the most widely used technique, the Augmented Dickey-Fuller (ADF) test, which allows for autocorrelation of residuals. The general form of the ADF test is formulated as follows:

$$(5.2) \quad \Delta Y_t = \alpha + \beta_t t + \delta Y_{t-1} + \sum_{i=1}^{n} \beta_i \Delta Y_{t-i} + \varepsilon_t$$

Where Y is the variable in question;
t is the time or trend variable.

We will include trend term when testing levels of variables, but exclude it and keep the constant term only when testing the first or further differences as well as error correction terms.[1]

Generally, a time series is integrated if the value of δ in (5.2) is found to be significantly less than zero. We will start by performing ADF tests for variable in question Y in the above mentioned form. If the null hypothesis that $\delta = 0$ cannot be rejected, we will redefine Y as ΔY and perform the same ADF tests, otherwise concluding that the time series is integrated of order 0. Should the hypothesis that $\delta = 0$ not be rejected for the ADF of redefined Y, we will perform test for differences of differences, thereby concluding that the time series is integrated of level 1 and so on.

We will perform the abovementioned tests for both prices and labour costs and then use the level of differences from their lowest common integration level in further analysis. We will generate residuals, or error correction terms (ECT). The ECT values are obtained from a simple regression of the two variables. For example, if $Y = \Delta \ln(P)$ and $X1 = \Delta \ln(L)$, where P denotes prices and L denotes labour costs, then the error correction terms $ec_{Y,t}$ are equal to the residuals ε_t from the following regression:

$$(5.3) \quad \Delta \ln P_t = \beta_1 + \beta_2 \Delta \ln L_t + \varepsilon_t$$

[1] From the theoretical viewpoint, constant term should be excluded when testing error correction terms as they as shown in this subsection, are actually residuals from simple regressions. However, in such case Stata did not report MacKinnon p-values of the tests, which are reported for all other tests and also shown in the appendices. For the sake of consistency in reporting we thus keep the constant in the specification. We note that the test results (Z values) with constant term were very similar to those reported and would not have affected the conclusions.

We then run ADF tests, as in Equation (5.2), for the residuals. If H_0: $\delta = 0$ is rejected, this proves that labour cost and price measures are cointegrated.

Then, we move on to Granger causality tests. The analysis of the coefficients in those equations will reveal which variables at which time periods can be useful to predict prices or wages respectively, and what other inferences can be made about the relationship between prices and wages.

5.3. Granger Causality Tests

After the stationarity analysis described in the previous section, we will generally run Granger causality tests in the following form:

$$(5.4)\quad Y_t = \alpha + \sum_{i=1}^{n_Y} \beta_{Y,i} Y_{t-i} + \beta_{ec} ec_{Y,t-1} + \sum_{i=1}^{n1} \beta_{1,i} X1_{t-i} + \ldots + \sum_{i=1}^{nk} \beta_{k,i} Xk_{t-i} + \varepsilon_t$$

Where Y_t is the value of the dependent variable at period t;

$X1_{t-i,}\, X2_{t-i}, \ldots, Xk_{t-i}$ are lags of the independent variable;

$ec_{Y,t-1}$ is the error correction term (ECT) at period t-1 from the cointegration regression;

ε_t is the residual at period t.

In the equation above, the independent variable Y will be a variable characterising either prices or labour costs. If Y is a variable characterising prices, X1 will be variable characterising labour costs and vice versa. X2 to Xk are other variables that we expect to have an effect on Y, and they are discussed in the following section.

In both Approach I and Approach II, we will initially include only price and labour cost variables in the test, i.e. only Y and X1. In literature, this test is referred to as the Direct Granger Procedure (Test) in a Bivariate Setting or the Unaugmented Granger Causality Test. Afterwards, we repeat the procedure with the control variables, i.e. X2 … Xk added. In literature, this test is referred to as the Direct Granger Procedure (Test) in a Multivariate Setting or the Augmented Granger Causality Test.

In Equation (5.4), the ECT, or $ec_{Y,t-1}$, is not included in the standard form of Granger tests, but we include it in order to mitigate the effect of short-term deviations that inevitably occur in response to various shocks.

After considering different options, for the basis specification we will use theoretically and empirically appealing number of 4 for the lagged difference terms $n_Y, n_{X1}, n_{X2}, \ldots, n_{Xk}$ to be included in the Granger causality model in Equation (5.4). This is also in line with Zanetti (2005) who uses 4 lags for his exogenous variable in the tests without ‘control’ variables and 4 lags for all variables in the tests with ‘control’ variables.

We do, however, also want to test the sensitivity of the results to different lag lengths. For this purpose, we will report results for two other lag lengths. Firstly, we will consider a 2 year period, i.e. 8 lags, which is very likely to include all the lags that have some effect, but may, for example, lead to less significant coefficients because of too long a time horizon.

Secondly, we will use the Bayesian Information Criterion (BIC), which is also called the Schwarz Information Criterion. The general form of the BIC is calculated as follows:

$$BIC = \ln\left(\frac{RSS}{n}\right) + m\ln(n) \quad (5.5)$$

Where *RSS* is the sum of squared residuals of the Autoregression function in question;
m is the number of parameters to be estimated in the Autoregression function
n is the number of observations.
Source: Gujarati, 1995, p.632

The lower the value of the BIC, the less unexplained variation remains in the dependent variable. Therefore, we will report results of the specification with the smallest value of the BIC.

6. Approach I

This approach aims to discover a general relationship between wage and price inflation from 1996 until 2007, based on quarterly data. In the following paragraphs, the most important results are mentioned, but the full results of our tests can be found in appendices.

As far as the labour costs are concerned, we rely on the quarterly data from the national accounts. We use the widely accepted definition of labour compensation as the total remuneration, in cash or by payments in kind, paid by employers to their employees in return for work performed by the latter during a given accounting period. Thus, compensation of employees consists of wages, salaries and social contributions. However, increases in wages that stem from productivity gains do not exert inflationary pressures, and the data have to be adjusted accordingly. Therefore, we have chosen the Unit Labour Costs (ULC) as the most appropriate measure of wage inflation. According to the definition provided by the Organisation for Economic Co-operation and Development, the ULC 'measure the average cost of labour per unit of output and are calculated as the ratio of total labour costs to real output.' Therefore, we calculate the ULC by dividing nominal labour compensation by real gross value added; this approach reflects the costs pressure that producers have to deal with. We obtain quarterly data for the ULC from 1996 I to 2007 III.

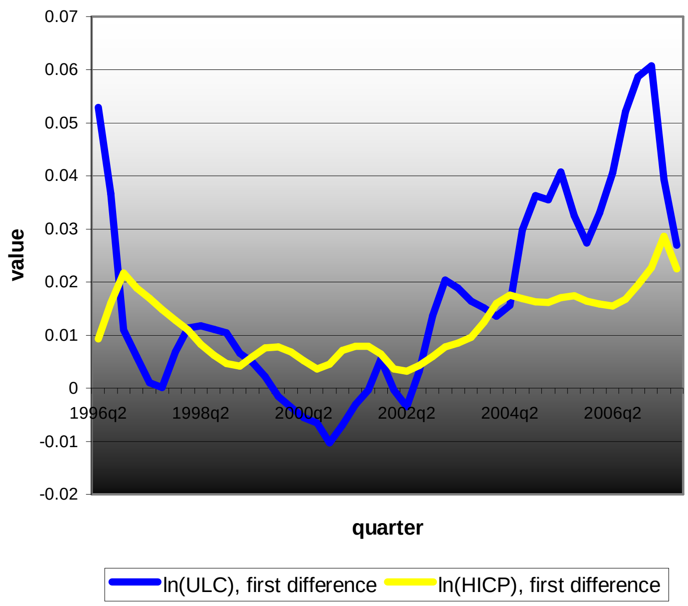
Among other things, this approach to calculating labour costs ensures that we do not have to deal specifically with illegal employment, which is still rife in the Latvian economy and could potentially be a problematic issue. These incomes have been allocated in the national accounts.

The price level, as measured by the Harmonised Index of Consumer Prices (HICP), is assumed to be the main indicator reflecting inflationary developments in Latvia. This variable measures monetary expenditure on goods and services for final consumption and can be compared across the member states of the European Union. We use monthly data for 1996 to 2007 and calculate quarterly inflation as the geometric average from the corresponding monthly values. Similarly for the ULC, we also obtain quarterly data for 1996 I to 2007 III here. The reason why we have chosen this index of consumer prices rather than, for instance, the GDP deflator is that inflation targets are expressed in terms of the former. One must note that the HICP, like many other fixed basket indices, tends to overestimate inflation because it neglects the substitution effect, which inevitably kicks in as prices begin to change. However, it is beyond the scope of this work to dwell on this drawback of the HICP.

As discussed in the methodology section, prior to analysis we perform seasonal adjustment for both the ULC and the HICP, and then take natural logarithms of the obtained values.

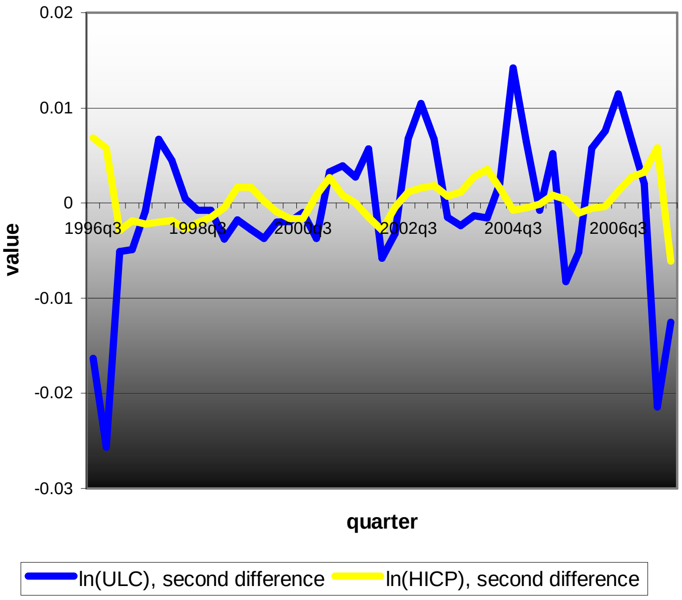
As a starting point, we plot changes in the two variables against time. Preliminary graphical analysis of Figure 2 and Figure 3 does not strongly suggest that either time series contains considerable structural breaks.

Figure 2: First Differences of ln(HICP) and ln(ULC)



Source: Calculated by Authors based on Eurostat (2008)

Figure 3: Second Differences (Acceleration) of ln(HICP) and ln(ULC)



Source: Calculated by Authors based on Eurostat (2008) Data

Nevertheless, we must not exclude the possibility of existence of such breaks. For instance, we must treat the period around 1998 with caution because the Russian financial crisis of 1998 hit the Latvian economy and its exports to the Commonwealth of Independent States, which had to be redirected to EU countries. This resulted in an increase in unemployment, as troubled companies laid off workers. Further, imports from Russia became cheaper due to the devaluation of the Russian rouble. In either case, our variables of interest, wages and prices, could have been affected. Also, 2004 is another year that may be difficult to analyse because of the inflation expectations that arose temporarily before Latvia's accession to the EU (Benkovskis and Paula, 2007).

Before proceeding with our analysis, we run correlations between the changes in the ULC and the HICP (i.e. quarterly inflation). The full results are reported in Table 1 and Table 2 in Appendix A.

The correlation coefficient between the changes in the ULC and inflation is 0.66, which indicates that the two time series clearly are interdependent.[2] The highest correlation between current inflation and lagged ULC values is with ULC at time t-3 reaching 0.85. In the other direction, the correlation remains highest for the current values and the second highest is between the current ULC and the HICP at time t-1, namely 0.61. Another

[2] Hereforth in the body text the correlation coefficients and p-values of statistical tests are rounded to 2 decimals, the results with 4 decimals are given in the appendices.

interesting difference is that the correlation between current inflation and lagged ULC starts decreasing noticeably already with the 4^{th} lag of ULC, while in the other direction a significant decrease of correlation can be observed only starting with the 6^{th} lag.

While the significance of these results can be disputed, they suggest at least two things: firstly, we should expect that changes in the ULC precede changes in the HICP rather than the other way around. Secondly, we should expect prices to feed into the ULC more gradually than the other way around. Whatever the conclusion turns out to be after our Granger causality tests, we note that the interpretation regarding true causality may not be unequivocal. As Zanetti (2005) notes, for example, even if it appears that wages gradually feed into inflation, it might just be that workers correctly anticipate a rise in inflation.

We now continue the analysis with our Granger causality tests. To determine the level of cointegration, we initially run the ADF tests as in Equation (5.2). As noted in the methodology section, when testing levels of variables, we include a trend term, whereas we exclude it when testing the differences of these variables. Due to the small sample, we consider a p-value of less than 0.10 sufficient to conclude that the variable in question is stationary. The results of the tests are reported in Table 3 in Appendix A.

As expected, the variables in levels can be considered non-stationary, with p-values of tests at 0.83 and 0.24 for the HICP and the ULC respectively. Next, we look at both variables in their first differences. The hypothesis that the ULC contains a unit root in its first difference can be rejected (p-value is 0.06), thus we conclude that this variable is integrated of order one. The HICP is more troublesome in this respect because its first difference appears to be non-stationary (p-value 0.23). However, we do not consider this result conclusive as stationarity tests are generally highly sensitive to the time period under inspection.[3] It appears that differences of both the ULC and the HICP could exhibit a nonlinear trend (Figure 3), and thus squared trend should be included in ADF test (incidentally, in his classical paper MacKinnon (1996) also observes this for data on inflation he uses). The statistical package we use does not allow adjusting for this, however.

[3] As we have previously indicated, there may be even structural changes within the sample period. Thus, we tested the robustness of this result (p-value of 0.23) by excluding some of the observations from the sample. Indeed, after excluding the last observations, the significance of the results improved. After excluding the 5 last observations, p-value decreased to 0.07 and became even lower also for smaller numbers of observations. For consistency, we performed the same also for levels of the ULC, which had a test p-value of 0.24 in levels. This does not yield promising results (the p-value rose to 0.41 when last 5 observations are excluded).

Due to the small size of the sample we do treat this as an encouraging result but continue the analysis without excluding any observations, i.e. with the full dataset.

If we further differenced the HICP, this would lead to interpretation problems because we would only be able to relate acceleration in the rate of change in one variable to that in another. One must also take into account that by over-differencing the variables we might lose valuable information about their long-run developments. For the above reasons, we continue the analysis without rejecting the hypothesis that both times series could be integrated of order one.

We then proceed with the analysis of cointegration. If the two time series are cointegrated, a stationary error correction term must be included in the model. This is done to mitigate the effect of short-terms deviations that inevitably occur in response to various shocks. Hence, we regress the logarithm of the HICP on the logarithm of the ULC and vice versa:

(6.1) $\ln(HICP_t)=\alpha_1+\alpha_2\ln(ULC_t)+\varepsilon_t$

(6.2) $\ln(ULCt)=\beta_1+\beta_2\ln(HICP_t)+\varepsilon_t$

Next, we run the ADF tests for the residuals of the above regressions, reported in Table 4 in Appendix A. It is sufficient to run either of the above regressions.

We exclude the trend term, but keep the constant term compared to the standard specification of the test given in Equation (5.2). The tests confirm that the error correction term is stationary and thus we conclude that the two time series are cointegrated and move on to Granger causality tests.

Initially, we use do not introduce any other variables. Firstly, we run Direct Granger Tests in a Bivariate Setting tests in the following form:

$$(6.3)\ \Delta\ln(HICP_t)=\alpha+\sum_{i=1}^{n_P}\beta_{i,P}\Delta\ln(HICP_{t-i})+\beta_{ec}ec_{P,t-1}+\sum_{i=1}^{n1}\beta_{1,i}\Delta\ln(ULC_{t-i})+\varepsilon_t$$

$$(6.4)\ \Delta\ln(ULC_t)=\alpha+\sum_{i=1}^{n_L}\beta_{L,i}\Delta\ln(ULC_{t-i})+\beta_{ec}ec_{L,t-1}+\sum_{i=1}^{n1}\beta_{1,i}\Delta\ln(HICP_{t-i})+\varepsilon_t$$

Where $n_{\Delta\ln(HICP)}$, $ec_{\Delta\ln(HICP),t}$, $\beta_{\Delta\ln(HICP),t}$ and $n_{\Delta\ln(ULC)}$, $ec_{\Delta\ln(ULC),t}$, $\beta_{\Delta\ln(ULC),t}$ from now on denoted as n_P, ec_P, β_P and n_L, ec_L, β_L respectively for simplicity.

As already discussed in the methodology section, we will consider results of tests with four lags (i.e. in the above equations, $n_P=n_L=n1=4$), with 8 lags, and the optimal lag length according to the BIC. We report the results of the relevant F-tests and t-tests in Table 5 in Appendix B. Due to small sample, as with ADF tests we consider test p-value of less than 0.10 sufficient to conclude that the null hypothesis of coefficient(s) being equal to naught can be rejected.

As it could be anticipated from simple correlations, F-test results of the Direct Granger Tests in a Bivariate Setting indicate that changes in quarterly values of the ULC lead to changes in the HICP, but not the other way around. For the Price-on-ULC specification, p-value of F-tests remains under 1% with 3, 4 and 8 lags. The strength of the reverse relationship is considerably weaker and is not statistically significant even at 10% for any of the considered lag lengths, although the p-values between 0.2 and 0.4 suggest that, for instance, a longer time series might yield potentially statistically significant results. The autocorrelation of residuals is not a problem (see Table 6 in Appendix B).

Somewhat unexpected are the p-values of t-tests for error correction term (ECT) coefficients that are also reported in Table 5 in Appendix B. Exactly opposite to what was obtained above, coefficient on ECT is very insignificant, even with a changing sign, for Price-on-ULC specifications, but significant for ULC-on-Price specifications (p-value of 0.03 with 4 lags, and close to, but under 10% with 3 and 8 lags).

The results suggest that in the long run a general change in the HICP will lead to a general rise in the ULC. This can have very interesting implications and we expand on this in the Analysis and Discussion section.

As for now, we proceed with the Direct Granger Tests in a Multivariate Setting in order to account for the effects of other variables. In line with the previously developed theoretical framework, these tests take the following form:

$$\begin{aligned}\Delta \ln(HICP_t) = \alpha + \sum_{i=1}^{n_P} \beta_{P,i} \Delta \ln(HICP_{t-i}) + \beta_{ec} ec_{P,t-1} + \sum_{i=1}^{n1} \beta_{1,i} \Delta \ln(ULC_{t-i}) + \\ + \sum_{i=1}^{n2} \beta_{2,i} OG_{t-i} + \sum_{i=1}^{n3} \beta_{3,i} \Delta \ln(M1_{t-i}) + \sum_{i=1}^{n4} \beta_{4,i} \Delta \ln(RP_{t-i}) + \varepsilon_t\end{aligned} \tag{6.5}$$

$$\begin{aligned}\Delta \ln(ULC_t) = \alpha + \sum_{i=1}^{n_L} \beta_{L,i} \Delta \ln(ULC_{t-i}) + \beta_{ec} ec_{L,t-1} + \sum_{i=1}^{n1} \beta_{1,i} \Delta \ln(HICP_{t-i}) + \\ + \sum_{i=1}^{n2} \beta_{2,i} OG_{t-i} + \sum_{i=1}^{n3} \beta_{3,i} \Delta \ln(M1_{t-i}) + \sum_{i=1}^{n4} \beta_{4,i} \Delta \ln(RP_{t-i}) + \varepsilon_t\end{aligned} \tag{6.6}$$

The control variables that we choose are similar to those used by Zanetti (2005) in his analysis of the Swiss economy, which we consider relevant as Latvia is also a small, open economy. *OG*, or output gap, is the actual output divided by its long-run trend, which in turn is obtained from the simple regression of output over time from 1995I to 2007III. Output gap is expected to characterise the demand pressure, which is present in the expectations augmented Phillips curve formula; because the level of output gap is related to inflation, we do not difference this variable. Also, because it is already expressed in relative terms we do not take the logarithm of it. Further, *M1* is money supply and is intended to capture the effect of monetary conditions, and it has historically been used to predict inflation. *RP* is the ratio of the import price index over the whole of the HICP and thus serves to characterise the supply pressure that is present in the mark-up pricing theory, as well as exchange rate fluctuations that are important in a small and open economy. One should note that the Latvian lat is pegged to the euro, but fluctuates vis-à-vis other currencies such as the Russian rouble and the US dollar.

The lag length for the variables of interest is, following the above discussion, set to 4 and also determined by using the BIC, with the difference that we do not perform tests with 8 lags[4]. The results are presented in Table 8 and Table 9 in Appendix B.

In both cases, the BIC leads to use of only one lag, which is not very surprising. Regarding the F-tests and t-tests which were present in Direct Granger Procedure Tests in a Bivariate Setting, there are no significant new ones, and the results here generally support the previous findings. P-value of F-test for coefficients of ULC lags in Price-on-ULC specifications is 0.10 with 4 lags and below 0.01 with 1 lag. The p-value of t-test for coefficient on ECT in ULC in Price-on-ULC specification is very large, 0.46 with 4 lags, but just 0.05 with 1 lag (with the coefficient being negative in both cases).

[4] This is because the statistical package STATA does not allow to perform such testing as the exogenous variables (in our case residuals) may not be collinear with the dependent variables, or their lags (ULC, prices and the control variables).

7. Approach II

Like other researchers, we have found somewhat mixed results of the relationship between wages and prices. Therefore, it would be helpful to look at this model from a more unconventional point of view. Brauer (1997) argues that additional insights can be obtained by breaking down a price index into several components that are likely to react differently to changing labour costs. The basis for the division of a price index is the relative proportion of labour costs of the total cost of production. Another option would be to look at the price index decomposed into tradable and non-tradable goods and services, but this would be very challenging given the data available. Arguably, the composition of a US price index is different from that used in the EU and Latvia, but we have addressed this problem by following the guidelines set by Brauer rather than the letter of his work (e.g. medical services are more regulated in Latvia than in the US).

It is important to recognise that it is close to impossible to correctly forecast future inflation because it depends on such factors as energy prices, which are very volatile and dependent on, for instance, political events in the Middle East. Hence, we divide the HICP into three broad groups: labour sensitive goods, labour sensitive services and other expenditure items. Each group is formed from a bunch of smaller components (see Table 10 in Appendix C).

We then form the three new indices in the following manner:

$$(7.1)\ SP_t = \sum_{i=1}^{n} (spw_{i,t} \times sp_{i,t})$$

$$(7.2)\ GP_t = \sum_{i=1}^{n} (gpw_{i,t} \times gp_{i,t})$$

$$(7.3)\ OP_t = \sum_{i=1}^{n} (opw_{i,t} \times op_{i,t})$$

In the equations (7.1), (7.2) and (7.3) the left-side variables SP_t, GP_t and OP_t denote Labour cost-sensitive services price index (further referred to as Service Prices), Labour cost-sensitive goods price index (Goods Prices), and Other expenditure categories price index (Other Prices) respectively at time t;

$sp_{i,t}$, $gp_{i,t}$ and $op_{i,t}$ are the respective components of these services at time t;

$spw_{i,t}$, $gpw_{i,t}$ and $opw_{i,t}$ are the respective weights in the particular price index;

n denotes the component of the indices (see Table 10 in Appendix C for the list of components).

Price indices can be broken down for 1996I-2007IV on a quarterly basis, but their weights are available on an annual basis for 1996-2007. Therefore, we use the same weight in all quarters within a particular year. For the sake of simplicity, we adjust all indices so that they take a value of 100 in the initial period of the sample.

Having entertained the option of using another labour cost measure instead of the ULC, we have decided against this step for two reasons. First, it would make sense to disaggregate the ULC the way we have done it with the HICP; however, this is not possible because earnings data are not reported in categories that would correspond to the composition of the price index in question. An arbitrary decomposition would do more harm than good. Second, the continued use of the ULC means that we can compare the results of Approach 1 to those of Approach 2 and can trace back any causal relationship to the general price index.

After generating the new indices, we perform seasonal adjustment for them, in line with the algorithm described in the methodology section, and take natural logarithms before going on.

We do not perform graphical analysis of the relationship as in the previous section, and start by looking at the correlation coefficients. The results are reported in six tables, Table 11 to Table 16 in Appendix D. The results indicate that there is quite a strong relationship (the highest correlation coefficients over 0.7) between Service Prices and ULC lags, as well as Other Prices and ULC lags. The relationship is much weaker (the highest correlation coefficient slightly over 0.3) between Goods Prices and ULC lags. The relationship in the other direction is, as could be expected, much weaker in all three cases. When looking at the distribution of coefficients over time, it appears that the ULC affects Service Prices sooner than Goods Prices and Other Prices (strongest relationships at 2nd, 4th and 5th lags respectively), as, on a microeconomic level, it could be expected due to inventory effects.

Overall, the correlation coefficients strongly suggest that we should expect results similar to that of Brauer (1997), namely, changes in the ULC lead to changes in Service prices, but not changes in Goods prices.

We then continue with Augmented Dickey-Fuller tests, and the results are reported in Table 17 in Appendix E. For Service Prices and Other Prices, the results show that the variables are non-stationary in levels and become stationary in differences (due to the small sample size, we consider test a p-value of less than 0.10 sufficient for concluding that a time series is stationary), and the p-values of all tests in first differences are under 0.10. Goods prices appear to be stationary already in levels, but for the sake of analysis we carry on only with differences of all variables (tests for the ULC were performed in the previous section).

Next, we perform ADF tests for residuals from regressions of the ULC and each of the three price indices similar as in Equation(5.2), a total of six tests. As in the previous section, we do not include a trend term. The results are reported in Table 18 in Appendix E. All residuals are stationary at p-levels below 0.10.

We then continue with the Granger causality testing, firstly with the Direct Granger Procedure in a Bivariate Setting as in Equation(6.3) and Equation(6.4), with the only difference being that the HICP is substituted with one of the three price indices. As in the previous section, we report results for Granger causality tests with 4 lags, 8 lags and the optimal number of lags according to the BIC. The results are reported in Table 19, Table 20 and Table 21Table 21: Direct Granger Procedure in a Bivariate Setting Test Results. ULC and Other Expenditure Category Price Index in Appendix F.

In line with the correlation results, we do not find significant F-test evidence that any of the three price indices, solely taken, Granger-causes changes in the ULC. The coefficient on ECT is the only one that has p-value near the 10% threshold, namely 0.07 with 4 lags and 0.12 with 2 lags in the direction form Service Prices to the ULC. On the other hand, also in line with the correlation coefficients, significant results show that the ULC Granger-causes Service prices (except with 8 lags, p-values below 5% for specifications with 4 and 2 lags) and Other prices (p-values below 1% for specifications with 2, 4 and 8 lags), but not Goods prices.

The results for Service Prices and Goods Prices correspond to those of Brauer (1997) and provide empirical support in Latvia for his argument that it is harder to adjust prices for goods according to changes in labour costs because these, contrary to services, are subject to international trade.

We extend the abovementioned analysis of Brauer by performing the Direct Granger Procedure in a Multivariate Setting, as in the previous section, also with 4 lags and lag length according to the BIC, but not with 8 lags. The results of the six regression specifications as in Equation(6.5) and Equation(6.6), with the relevant price index instead of the HICP, are reported in six tables, from Table 22 - Table 27 in Appendix F. The main finding of the Direct Granger Procedure in a Bivariate Setting – that ULC leads to increase in Service prices, but does not lead to increase in Goods prices – remains the same. For Service prices-on-ULC specifications, the p-values with 1 and 4 lags are now both below 1%. The coefficient on ECT in the opposite direction is only significant with 4 lags, but then with a p-value of 0.03.

These results have two interesting implications. First, the level of output gap is a good predictor of Service prices (in a specification with four lags, the F-test p-value is Output Gap is 0.04), not as good a predictor of Goods prices (p-value of 0.12). In contrast, the output gap does not have a statistically significant effect on Other prices (p-value of 0.36). The first two results give additional evidence of different effects of friction in the labour market for goods and services prices. The third one could be explained by the fact that this index includes services with administratively regulated prices, which means that, for instance, the effect of labour shortages is much less pronounced and is in line with our expectations. These results should, however, be treated with particular caution, as we use a very basic measure for output gap.

The second implication is the highly significant evidence (p-value of 0.01 for a specification with 4 lags) that changes in Goods prices lead to changes in the ULC, but there is no corresponding effect for either Service prices or Other prices. Also, the p-value for the ECT coefficient from the opposite direction regression (i.e. Goods Prices-on-ULC) is 0.08. A possible explanation would be that prices of such goods are more important than prices of services or other prices when employees ask for a pay rise, but we have no theoretical strong grounds for asserting this. Also, it is suspicious that these effects only appear when the control variables are introduced. Therefore, this phenomenon would require a closer inspection, which we consider beyond the scope of our work.

8. Analysis and Discussion

8.1. Main Results

In our work, we have looked at the development of several key macroeconomic variables, and our principal aim was to determine the causality between wage and price inflation. The primary reason for choosing to research this particular area was to contribute to the policy debate on the underlying causes of inflation in Latvia.

It must be noted that one contribution of our work comes from investigating the effects of changes in productivity-adjusted wages on the consumer price inflation. In this way, we ensure that we remove some of the bias that has featured so prominently in public debate that has linked changes in nominal wages to rising inflation.

We have identified other interesting results in the two previous sections, but in this section we consider the main findings with respect to the focus of this paper, the relationship between price and wage inflation. Three such findings have remained quite robust for different Granger causality test specifications, i.e. for different lag lengths and with or without control variables.

Firstly, the results of Approach I show that from a statistical point of view, the consumer price index contains little or no information for forecasting of productivity-adjusted wages. In other words, although from historical data it is hard to predict exactly when and how past rates of inflation will lead to increased wage demands, our analysis suggests that it might eventually do so. Supposedly, this is a consequence of the fact that the dynamics of determining labour compensation has changed several times during the period under review. In the late 1990s, Latvia had relatively big reserves of workforce and a low inflation base, which meant that employers were in a more favourable position in wage negotiations, but workers did not seek to offset the relatively small increases in the consumer price index through regular demands for pay revision. In contrast to this, the situation changed dramatically after Latvia joined the EU, and inflation rose due to increased inflation expectations and increases in regulated prices. Another reason of the insignificance of specific lags may be that part of the consumer price inflation that Latvian wage earners experience does not originate in this country. Latvia is a small and open economy, which relies heavily on trade. This amplifies the exposure of Latvia to external shocks.[5]

[5] This is not, however, supported in our work as the variable which is included in Augmented Granger Tests to account for such effects – relative prices – does not have significant coefficients. However, the interpretation of this variable may be disputed, yet this would require separate discussion.

Secondly, changes in the unit labour costs lead to an increase in prices, and the effect is easily observable. The fact that, after adjusting for productivity, wage inflation precedes price inflation is itself troubling and shows that the roots of many of Latvia's economic problems are to be found in the labour market. First, as more and more people emigrated to United Kingdom, Ireland and, to a lesser extent, other EU countries, the bargaining power of the remaining workers increased enormously and they achieved remuneration increases that were disproportional to gains in productivity. Second, labour productivity itself is one of the factors that have not been properly addressed by policymakers. For instance, Ministry of Economics has recently been criticised as not paying enough attention to decreasing the administrative burden on employment. (Petrane, 2008).

However, how far can prices be increased? In such a case, if there is wage pressure, some companies keep the prices stable at the expense of margins; some companies may raise the prices temporarily to avoid losses, and then improve efficiency to decrease prices again or keep them stable for a longer period; and some companies must increase the prices permanently and are eventually forced out of their market. The recent high domestic inflation when compared to main trading partners' inflation, combined with the lat being pegged to the euro, could be one of the reasons of the loss of competitiveness and thus inevitable need to adjust prices after wage increases for many companies. The high recent current account deficit gives more evidence that imports may have pushed and are pushing some of the local companies out of their markets.

The third main finding comes from Approach II and is that changes in labour costs precede changes in prices of labour cost intensive service prices, but not labour cost-intensive good prices. This adds additional insight to what is said in the previous paragraph and suggests that companies which might have suffered most from the rises in wages could be those that produce labour-intensive tradable goods. Although it is nature's law that "the best survive" and rise in labour costs may be a good motivator for companies to increase their efficiency, the bankruptcy costs (which include, for instance, lost jobs, depreciation of capital) may turn out to be unnecessary high.

8.2. Policy Implications

Based on our work and the previous sub-section in particular, we are now able to compile a set of implications for policymaking. These results should not be seen as exhaustive or all-encompassing, as they are derived from approaches that, although look at key macroeconomic data, mainly link the information content present in price and productivity-adjusted wage inflation.

1. The exact moment at which price inflation will start triggering wage inflation may be hard to observe, but findings are that price inflation does eventually lead to permanent increases in wages. Therefore, to avoid formation of price/wage spiral, keeping inflation low should remain a principal objective of the policymakers in all times.
2. Evidence suggests that, due to wage pressures, important proportion of companies may be operating close to or with loss, and producers of labour cost-intensive goods may require the most urgent attention. If avoiding bankruptcy costs is an aim, policymakers should take this into account when considering support to measures that increase productivity. (For example, training programmes for employees organized by State Employment Agency could be adjusted accordingly.)
3. Relationship between prices and wages is characterised by a certain degree of inertia; therefore, many policy decisions (e.g. anti-inflation plans) will take time to feed into the economy and affect the related variables.
4. Changes in the unit labour costs can be well used as a predictor for the development of harmonised consumer price index and labour cost-intensive service prices, but not for labour cost-intensive goods prices.

9. Conclusions and Suggestions for Further Research

In this paper, we have looked at the relationship between price inflation and wage inflation since this has become one of the most heated points in the debate on the sustainability of Latvia's economic growth. The structure of our work was focused on answering our research questions. Our primary research question was, **'What is the nature of the causality between price inflation and wage growth?'** Our secondary research question was, **'Are disaggregated data more informative about inflationary developments than the main macroeconomic variables?'**

The Granger causality tests that we have run suggest that changes in productivity-adjusted wages lead to consumer price inflation, although the respective error correction terms are often insignificant. The overall effect is statistically significant even in the presence of several broad macroeconomic variables and a different numbers of lagged values. Although the reverse link is also a rational proposition from a theoretical point of view, we find little evidence of past inflation causing changes in the real unit labour costs. We have mentioned several events (e.g. Latvia's accession to the EU) that could be regarded as structural breaks, which might have disrupted the relationship; however, due to the shortness of our time series we have not been able to investigate the dynamics of our variables in sub-samples.

With regards to our secondary research question, we broke down the CPI into three broad categories, which, as we hypothesised, would respond differently to wage inflation. This approach is based on the work of Brauer (1997), with a few modifications by the authors to reflect the different composition of the consumption basket used for calculating price inflation in Latvia. Labour cost-intensive services prices are the most sensitive component of the HICP with respect to changes in the ULC, which stems from the immobility of these services and the high labour to total cost ratio. As we expected, labour cost-intensive goods prices are not sensitive to changes in the ULC, and this result contributes to the discussion of results and implications. Thus, we conclude that disaggregated data is indeed more informative than the main macroeconomic variables.

In writing this paper, we have encountered several problems and therefore recommend corresponding improvements, some which could only be feasible using larger samples. To sum up, we also regard that the following areas that are related to our study would benefit from further research:

1. More extensive analysis of sensitivity of results with respect to the lag length of Granger causality tests;
2. The stability of the relationship between wages and prices across smaller sub-samples;
3. The dynamics of wage bargaining and determination on a microeconomic level and its effect on the average wage in the whole country;
4. Controlling for changes in the national minimum wage, which is also used a benchmark for determining pay for part of the workers in the public sector;
5. Analysis of the ULC in accordance with the breakdown of the HICP;
6. Effects of inflation which is adjusted for substitution effects.

We conclude by acknowledging that ‘an apple a day keeps the doctor away’. Soon economy of Latvia will undergo either hard or soft, but certainly - a landing. Firstly, we hope that our paper will, in the short term, contribute to policymaking that makes the landing less painful. Secondly, in the longer term we would be glad to see that this paper is useful for further research, which in turn will bring us closer to the aim of excluding the hard landing from the list of the likely development scenarios for the Latvian economy.

Works Cited

Aaronson, D. (2001, February). Price Pass-through and the Minimum Wage, *Review of Economics and Statistics*, 83-1.

Bank of Latvia (2007). *I. The Current Monetary Policy: the Lats is Pegged to the Euro.* Retrieved March 28, 2008, from the Bank of Latvia Web Site: http://www.bank.lv/eng/main/all/monpolicy/ls-euro/cmp1/

Benkovskis, K., and Paula, D. (2007). *Inflācijas gaidas Latvijā: patērētāju apsekojuma rezultāti.* Retrieved October 30, 2007, from the Bank of Latvia Web site: http://www.bank.lv/lat/main/all/pubrun/petijumi/infl_gaidas/

Brauer, A. D. (1997, September). Do Rising Labor Costs Trigger Higher Inflation? *Current Issues, Federal Reserve Bank of New York,* 3-11.

Burdick, C. A. (1997). *A Transitional Analysis of the Welfare Cost of Inflation.* Retrieved March 28, 2008, from the IDEAS Web site: http://ideas.repec.org/p/fip/fedawp/97-15.html

Cassino, V. and Joyce M. (2003). Forecasting Inflation using Labour Market Indicators. Retrieved May 12, 2008 from the Social Sceinces Research Network Web site: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=530663

DPA, Latvian central bank criticises the Commission report (February, 2008). Retrieved March 28, 2008, from the Earth Times Web site: http://www.earthtimes.org/articles/show/185580,latvian-central-bank-criticises-the-commission-report.html

Elder, J. (2000, November). *Another Perspective on the Effects of Inflation Uncertainty*. Retrieved January 4, 2008, from the Social Sciences Research Network Web site: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=262182

Eurostat – Data Navigation Tree. European Commission. Retrieved January 9, 2008, from the Eurostat Web site: http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/na/namq&language=en&product=EU_MASTER_national_accounts&root=EU_MASTER_national_accounts&scrollto=0

Granger, C. W. J. (August, 1969). Investigating causal relations by Econometric Models and Cross-Spectral Methods. *Econometrica. The Econometric Society*, vol.37, 424-438.

Gujarati, D. N. (1995). *Basic Econometrics*. Singapore: McGraw-Hill International Editions.

Hess, D. G., and Schweitzer E. M. (April, 2000). *Does Wage Inflation Cause Price Inflation?* Retrieved October 30, 2007, from the IDEAS Web site: http://ideas.repec.org/a/fip/fedcpd/y2000iaprp1-14n1.html

Latvijas Statistika. 2006. Central Statistical Bureau. Last retrieved March 27, 2008, from Central Statistical Bureau Web site: http://www.csb.gov.lv/csp/content/?lng=en&cat=355

MacKinnon, J. G. (Nov-Dec, 1996) Numerical Distribution Functions for Unit Root and Cointegration Tests). *Journal of Applied Econometrics*, Vol. 11, No. 6, pp. 601-618.

Mehra, Y. P. (September, 1991). Wage Growth and the Inflation Process: An Empirical Note. *The American Economic Review*, 931-937.

Mehra, Y.P. (2000), Wage-Price Dynamics: Are They Consistent with Cost Push?, *Economic Quarterly,* Federal Reserve Bank of Richmond, Vol. 86, 27-43.

Mehra, Y. P. (August, 1993). The Stability of the M2 Demand Function: Evidence from an Error-Correction Model. *Journal of Money, Credit and Banking*, 25-3.

Monetary Policy Framework. Bank of England (n.d.). Retrieved January 5, 2008, from the Bank of England Web site: http://www.bankofengland.co.uk/monetarypolicy/framework.htm

Monetary Policy. European Central Bank (n.d.). Retrieved January 5, 2008, from European Central Bank Web site http://www.ecb.int/mopo/html/index.en.html

Petrane, L. (2008, February 28). *LDDK neapmierināta ar Ekonomikas ministrijas uzsākto akciju.* Retrieved March 27, 2008, from Dienas Bizness Web site: http://www.db.lv/Default2.aspx?ArticleID=e7971a6c-60a8-4159-8da8-b9261faf748a

Petrane, L. (2007, October 8). *Ekonomikas ministrija: pretinflācijas plāna realizācijas temps ir nepietiekams.* Retrieved March 28, 2008, from Dienas Bizness Web site: http://www.db.lv/Default2.aspx?ArticleID=491c480c-4176-4b2e-b61e-1e734e6feaf6

Proctor, N. (1992). *Macroeconomics*. Chester: Checkmate Publications.

Stock, J. H. and Watson, M. W. (2004). *Introduction to Econometrics*. Shanghai University of Finance & Economics Press.

Vanags, A., and Hansen, M. (June 2007). *Inflation in Latvia: causes, prospects, and consequences.* Retrieved October 31, 2007, from the BICEPS Web site: http://www.biceps.org/en/OccasionalPapers

Zanetti, A. (2007). Do Wages Lead Inflation? Swiss Evidence. *Swiss Journal of Economics and Statistics*, 143-1.

Zepa, B., Hazans, M., and Žabko, O. (2006). *Darba algas un to ietekmējošie faktori*. Retrieved October 28, 2007, from the Welfare Ministry Web site: http://sf.lm.gov.lv/esf/?main_page_id=5&page_type=d_cat&second_page_id=31&doc_id=25

Appendix A. Approach I: Correlations and ADF Test Results

Table 1: Correlation Coefficients between Δln(HICP) and lagged Δln(ULC)

$\Delta\ln(ULC_{t-i})$:	i=0	i=1	i=2	i=3	i=4	i=5	i=6	i=7	i=8
$\Delta\ln(HICP_t)$	0.6629	0.7588	0.8162	0.8486	0.8253	0.7566	0.6663	0.5838	0.4907

Source: Calculated by Authors

Table 2: Correlation Coefficients between Δln(ULC) and lagged Δln(HICP)

$\Delta\ln(HICP_{t-i})$:	i=0	i=1	i=2	i=3	i=4	i=5	i=6	i=7	i=8
$\Delta\ln(ULC_t)$	0.6629	0.6115	0.6044	0.5867	0.5889	0.5874	0.5587	0.4931	0.3970

Source: Calculated by Authors

Table 3: Results Summary of ADF Tests for ln(HICP) and ln(ULC)

Variable	Z(t)	Mac-Kinnon p-values
ln(HICP)	-1.488	0.8331
ln(ULC)	-2.679	0.2449
Δln(HICP)	-2.137	0.2300
Δln(ULC)	-2.796	0.0588

Source: Calculated by Authors

Table 4: Result Summary of ADF Tests for Error Correction Terms

Variable	Z(t)	Engle-Granger p-value
Residuals: ln(HICP) on ln(ULC)	-3.783	>1%, <5%

Source: Calculated by Authors

Appendix B. Approach I: Granger Causality Test Results

Table 5: Direct Granger Procedure in a Bivariate Setting Test Results. ULC and HICP.

Prices on ULC [Equation (6.3)]				ULC on Prices [Equation (6.4)]			
Lag Length	p-value of F-test for ULC terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT	Lag Length	p-value of F-test for Price terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT
4	0.0013	.0045148	0.573	4	0.2100	-.0482392	0.028
8	0.0025	-.0015972	0.950	8	0.4004	-.1285463	0.087
3 (BIC)	0.0001	.0049278	0.479	3 (BIC)	0.2926	-.0326479	0.099

Source: Calculated by Authors

Table 6: Lagrange-Multiplier Test p-values

Prices on ULC [Equation (6.3)]		ULC on Prices [Equation (6.4)]	
Lag length	p-value (Chi-squared)	Lag length	p-value (Chi-squared)
3 (BIC)	0.57931	3 (BIC)	0.50271

Note: H0: no autocorrelation at lag order. Autocorrelation at optimal lag order reported, higher lag orders and different lag lengths yielded similar results with few exceptions.
Source: Calculated by Authors

Table 7: Critical Values for the Engle-Granger ADF Statistic

10%	5%	1%
-3.12	-3.41	-3.96

Source: Adapted by Authors from Stock and Watson (2003, p.557)

Table 8: Direct Granger Procedure in a Multivariate Setting Test Results. HICP on ULC [Equation (6.5)]

Lag Length	p-value of F-tests for ULC terms	p-value of F-tests for M1 terms	p-value of F-tests for Relative Prices terms	p-value of F-tests for Output Gap terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT
4	0.0965	0.6589	0.7358	0.6989	-.0292464	0.296
1 (BIC)	0.0025	0.7975	0.6637	0.6355	.0076486	0.602

Source: Calculated by Authors

Table 9: Direct Granger Procedure in a Multivariate Setting Test Results. ULC on HICP [Equation (6.6)]

Lag Length	p-value of F-test for Price terms	p-value of F-test for M1 terms	p-value of F-test for Relative Prices terms	p-value of F-test for Output Gap terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT
4	0.8669	0.0939	0.1810	0.8273	-.0407857	0.463
1 (BIC)	0.3737	0.1259	0.7320	0.2644	-.0750859	0.048

Source: Calculated by Authors

Appendix C. Approach II: Disaggregation of CPI

Table 10: CPI Expenditure Categories and Average Weights

Labour cost-sensitive services	**100.0%**
Cleaning, repair and hire of clothing	0.6%
Services for the maintenance and repair of the dwelling	1.1%
Out-patient services	5.3%
Hospital services	1.0%
Operation of personal transport equipment	20.0%
Postal services	0.3%
Recreation and culture	26.6%
Education	5.3%
Catering services	19.4%
Accommodation services	2.8%
Miscellaneous goods and services	17.7%
Labour cost-sensitive goods	**100.0%**
Clothing materials	0.7%
Garments	29.7%
Other articles of clothing and clothing accessories	1.9%
Footwear including repair	18.0%
Furnishings, household equipment and routine maintenance of the house	30.6%
Materials for the maintenance and repair of the dwelling	5.7%
Purchase of vehicles	13.3%
Other expenditure categories	**100.0%**
Food	48.6%
Non-alcoholic beverages	3.2%
Alcoholic beverages	6.0%
Tobacco	3.1%
Actual rentals for housing	2.5%
Water supply and miscellaneous services relating to the dwelling	5.0%
Electricity, gas and other fuels	15.9%
Medical products, appliances and equipment	4.3%
Telephone and telefax equipment	0.3%
Telephone and telefax services	6.4%
Transport services	4.6%

Source: Calculated by Authors based on Eurostat (2008) data. Notes: Average weights are the arithmetic averages of all weights in the sample period, 1996-2007. These averages were not used in calculations and are shown here for informative purposes only.

Appendix D. Approach II: Correlations

Table 11 Correlation Coefficients between Δln(SP) and lagged Δln(ULC)

Δln(ULC_{t-i}):	i=0	i=1	i=2	i=3	i=4	i=5	i=6	i=7	i=8
Δln(SP_t)	0.6297	0.7282	0.7722	0.7431	0.6662	0.5496	0.4231	0.3085	0.2212

Source: Calculated by Authors

Table 12 Correlation Coefficients between Δln(ULC) and lagged Δln(SP)

Δln(SP_{t-i}):	i=0	i=1	I=2	i=3	i=4	i=5	i=6	i=7	i=8
Δln(ULC_t)	0.6297	0.5588	0.5247	0.5101	0.5338	0.5750	0.5939	0.5815	0.5346

Source: Calculated by Authors

Table 13 Correlation Coefficients between Δln(GP) and lagged Δln(ULC)

Δln(ULC_{t-i}):	i=0	i=1	i=2	i=3	i=4	i=5	i=6	i=7	i=8
Δln(GP_t)	0.1021	0.1904	0.2681	0.3098	0.3195	0.2874	0.2450	0.2153	0.1946

Source: Calculated by Authors

Table 14 Correlation Coefficients between Δln(ULC) and lagged Δln(GP)

Δln(GP_{t-i}):	i=0	i=1	i=2	i=3	i=4	i=5	i=6	i=7	i=8
Δln(ULC_t)	0.1021	0.0320	-0.0092	-0.0257	-0.0338	-0.0362	-0.0346	-0.0385	-0.0716

Source: Calculated by Authors

Table 15 Correlation Coefficients between Δln(OP) and lagged Δln(ULC)

Δln(ULC_{t-i}):	i=0	i=1	i=2	i=3	i=4	i=5	i=6	i=7	i=8
Δln(OP_t)	0.5263	0.6070	0.6619	0.7053	0.7248	0.7257	0.6887	0.6332	0.5598

Source: Calculated by Authors

Table 16 Correlation Coefficients between Δln(ULC) and lagged Δln(OP)

Δln(OP_{t-i}):	i=0	i=1	i=2	i=3	i=4	i=5	i=6	i=7	i=8
Δln(ULC_t)	0.5263	0.4889	0.4766	0.4162	0.3750	0.3372	0.2984	0.2452	0.1671

Source: Calculated by Authors

Appendix E. Approach II: ADF Test Results

Table 17: Results Summary of ADF Tests for Prices and ULC

Variable	Z(t)	Mac-Kinnon p-values
ln(ULC)	-2.679	0.2449
ln(SP)	-2.179	0.5016
ln(GP)	-6.594	0.0000
ln(OP)	-2.489	0.3334
First difference of ln(ULC)	-2.796	0.0588
First difference of ln(SP)	-2.674	0.0786
First difference of ln(GP)	-3.751	0.0034
First difference of ln(OP)	-3.191	0.0205

Source: Calculated by Authors

Table 18: Result Summary of ADF Tests for Error Correction Terms

Variable	Z(t)	Engle-Granger p-values
Residuals: ln(SP) on ln(ULC)	-3.356	>5%, <10%
Residuals: ln(GP) on ln(ULC)	-5.517	<1%
Residuals: ln(OP) on ln(ULC)	-3.783	>1%, <5%

Source: Calculated by Authors

Appendix F. Approach II: Granger Causality Test Results

Table 19: Direct Granger Procedure in a Bivariate Setting Test Results. ULC and Labour Cost-Sensitive Service Price Index

Prices on ULC				ULC on Prices			
Lag Length	p-value of F-test for ULC terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT	Lag Length	p-value of F-test for Price terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT
4	0.0207	.0082564	0.430	4	0.3502	-.0384861	0.074
8	0.2935	.0102774	0.646	8	0.2821	-.0805539	0.117
2 (BIC)	0.0025	.0093329	0.320	2 (BIC)	0.3008	-.0172124	0.379

Source: Calculated by Authors

Table 20: Direct Granger Procedure in a Bivariate Setting Test Results. ULC and Labour Cost-Sensitive Good Price Index

Prices on ULC				ULC on Prices			
Lag Length	p-value of F-test for ULC terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT	Lag Length	p-value of F-test for Price terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT
4	0.8905	-.0245198	0.111	4	0.8118	-.0040122	0.808
8	0.6450	-.0133615	0.672	8	0.1848	-.0261226	0.372
3 (BIC)	0.4794	-.0170994	0.237	3 (BIC)	0.7388	-.0002325	0.987

Source: Calculated by Authors

Table 21: Direct Granger Procedure in a Bivariate Setting Test Results. ULC and Other Expenditure Category Price Index

Prices on ULC				ULC on Prices			
Lag Length	p-value of F-test for ULC terms	Coefficient of Error Correction Term (ECT)	p-value of Ft-test for ECT	Lag Length	p-value of F-test for Price terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT
4	0.0023	-.0094144	0.261	4	0.4231	-.0274835	0.163
8	0.0083	-.0212554	0.180	8	0.1700	-.0405607	0.275
2 (BIC)	0.0008	-.0105941	0.139	2 (BIC)	0.5826	-.0140974	0.447

Source: Calculated by Authors

Table 22: Direct Granger Procedure in a Multivariate Setting Test Results. Labour Cost-Sensitive Service Price Index on ULC

Lag Length	p-value of F-test for ULC terms	p-value of F-test for M1 terms	p-value of F-test for Relative Prices terms	p-value of F-test for Output Gap terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT
4	0.0070	0.0679	0.1236	0.0472	-.1188185	0.028
1 (BIC)	0.0014	0.7342	0.6569	0.0293	-.014406	0.411

Source: Calculated by Authors

Table 23: Direct Granger Procedure in a Multivariate Setting Test Results. ULC on Labour Cost-Sensitive Service Price Index

Lag Length	p-value of F-test for Price terms	p-value of F-test for M1 terms	p-value of F-test for Relative Prices terms	p-value of F-test for Output Gap terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT
4	0.2852	0.0887	0.0255	0.6689	-.0108038	0.887
1 (BIC)	0.4253	0.5425	0.2363	0.2752	-.0818626	0.032

Source: Calculated by Authors

Table 24: Direct Granger Procedure in a Multivariate Setting Test Results. Labour Cost-Sensitive Good Price Index on ULC

Lag Length	p-value of F-test for ULC terms	p-value of F-test for M1 terms	p-value of F-test for Relative Prices terms	p-value of F-test for Output Gap terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT
4	0.9336	0.5880	0.1906	0.1137	-.1428073	0.083
4 (BIC)	-””-	-””-	-””-	-””-	-””-	-””-

Source: Calculated by Authors

Table 25: Direct Granger Procedure in a Multivariate Setting Test Results. ULC on Labour Cost-Sensitive Good Price Index

Lag Length	p-value of F-test for Price terms	p-value of F-test for M1 terms	p-value of F-test for Relative Prices terms	p-value of F-test for Output Gap terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT
4	0.0146	0.2304	0.0081	0.1598	.0041469	0.933
4 (BIC)	-””-	-””-	-””-	-””-	-””-	-””-

Source: Calculated by Authors

Table 26: Direct Granger Procedure in a Multivariate Setting Test Results. Other Expenditure Category Price Index on ULC

Lag Length	p-value of F-test for ULC terms	p-value of F-test for M1 terms	p-value of F-test for Relative Prices terms	p-value of F-test for Output Gap terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT
4	0.0434	0.4243	0.4143	0.2694	-.0186966	0.747
1 (BIC)	0.0131	0.7354	0.9988	0.3842	-.01745	0.270

Source: Calculated by Authors

Table 27: Direct Granger Procedure in a Multivariate Setting Test Results. ULC on Other Expenditure Category Price Index

Lag Length	p-value of F-test for Price terms	p-value of F-test for M1 terms	p-value of F-test for Relative Prices terms	p-value of F-test for Output Gap terms	Coefficient of Error Correction Term (ECT)	p-value of t-test for ECT
4	0.4718	0.1020	0.0236	0.7676	.00563	0.926
1 (BIC)	0.3191	0.8029	0.0993	0.4931	-.0426583	0.196

Source: Calculated by Authors

Appendix G. Literature Summary

Table 28: Literature Summary on Price/ Wage Relationship

Author(s) (Year)	Country	Title	Main Findings
Mehra (2000)	USA	Wage-Price Dynamics: Are They Consistent with Cost Push?	Wage growth Granger-causes inflation; the same hypothesis does not hold in times of low inflation
Hess and Schweitzer (2000)	USA	Does Wage Inflation Cause Price Inflation?	Price inflation Granger-causes wage inflation; little support for the reverse hypothesis
Cassino and Joyce (2003)	Great Britain	Forecasting Inflation using Labour Market Indicators	Labour market indicators Granger-cause inflation; the reverse hypothesis is not tested
Zanetti (2005)	Switzerland	Do Wages Lead Inflation? Swiss Evidence	Price growth causes wage growth and vice versa
Brauer (1997)	USA	Do Rising Labor Costs Trigger Higher Inflation?	Wage growth in particular sectors Granger-causes inflation

Source: Compiled by Authors