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The Switch to Near-Rational Wage-Price Setting Behaviour: The Case of United Kingdom

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Abstract: The overall consensus of empirical evidence on the wage and price relationship reveals that causal relationships are difficult to identify. Moreover, elements other than wages, prices and productivity have significant impact in determining the wage-price setting equilibrium. Application of partial correlation and VECM analysis in the wage-price causal relationship in UK over the period 2000:Q1–2014:Q4 implies that there is strong evidence of structural change in the relationship. The VECM analysis implies statistically robust long-run cointegration relationship and negates short-run causality in any direction. Remarkably, there has not been a switch from near-rational to fully rational behavior, but the opposite. Additionally, the estimated values of cointegration coefficients provide strong evidence in favor of hypothesis that the assumption of near-rational behavior in the wage-price relationship in UK is valid. Specifically, the wage setters have under-adjusted for inflation as probably in their view the costs of such behavior were low. Furthermore, it seems that wage and price setters have unconditionally accepted the rigor of monetary policy authorities and did not pursue a policy which raises inflation rate above the target rate of monetary authorities. Ultimately, this near-rational behavior can be accredited to the high degree of labor market flexibility in UK.

Keywords: Inflation; Rational Expectation; Causality; Co-integration; Structural Change

1 Introduction

Generally, one has to agree with the argument of Knotek & Zaman (2014) that connection between wages, prices and economic activity is more akin to a tangled web than a straight line. Specifically, in the United States (US), they have found that wages and prices have tended to move together, even though the causal relationships are difficult to identify. Regardless, of this argument as well as of many caveats faced in empirical work this paper will attempt to examine the price-wage causal relationship in the United Kingdom (UK) and try to untangle the issue by employing Vector Error Correction Model (VECM). In addition to this, it will evaluate whether the labor market characteristics play any significant role in the adjustment dynamics of the wage-price relationship. The specific dilemma examined in this paper is why in the case of an increase in the rate of inflation, following the events of global recession in the year 2008, the wage setters in UK have not responded with demands for higher wages so as to restore their real wages. In fact, the answers to this dilemma are complex too and therefore should be investigated taking into account multiple aspects.

In the first place, different sample lengths, number of explanatory variables, measures of time series data, different models etc. will produce different inferences on the respective issue, (Hess & Schweitzer, 2000). Moreover, the adjustment process may also depend on the reaction of monetary policy authorities and their willingness to accommodate certain expansionary fiscal policies, (Mehra,

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2000). Additionally, one may also list other relevant dimensions to the complex nature of the wage-prices setting process such as market competition, export shares, collective wage agreements, employment protection legislation as well as the reaction of temporary unemployment, (Bertola, Dabusinskas, Hoeberichts, Izquierdo, Kwapil, Montornès & Radowski, 2010). As a matter of fact, it is a well known fact in the literature that the levels of nominal and real rigidities are not universal across the countries, (Turner, Richardson & Rauffet, 1993; HM Treasury Report, 2003; OECD, 2004).

In particular, over time the economy is subjected to structural changes (Marcellino & Mizon, 2000), however, the failure to take into account those changes (i.e. structural changes or regime shifts), which are often observed in the economic and financial time series data, has led many authors to view it as the main cause of forecast failures, (Pesaran, Pettenuzzo & Timmermann, 2004). Furthermore, in a study of a large set of macroeconomic time series, Stock & Watson (1996) have reported that majority of the series displayed evidence of instability. In their view, such structural breaks pose a formidable challenge to economic forecasting and have led many authors to view it as the main source of forecast failure. In particular, even though modeling and forecasting of wages, prices and unemployment with Vector Autoregressive (VAR) models performs well in some cases, it is evident that Vector Error Correction Model (VECM) provides a better description of the data within sample and moreover the equilibrium terms are significant at conventional significance levels, (Clements & Hendry, 1996). Considering that structural changes are pervasive in economic time series relationships it can be quite perilous to ignore them. Certainly, under those circumstances, inferences about economic relationships can go astray, forecasts can be inaccurate, and policy recommendations can be misleading or worse, (Hansen, 2001).

In order to provide an effective answer to the puzzle of the wage-price setting dynamics in UK in the post-2008 period it is necessary to assess the validity of arguments supported by Akerlof, Perry & Dickens (2000) and Kromphardt & Logeay (2007). Specifically, Akerlof *et al*. 2001 have argued that in setting wages and prices, the lay public does not use the same model of the economy as economists. Given the complexity of their decisions and, for the most part, their lack of training as economists, it would, indeed, be surprising if they did. It is thus highly unlikely that the welter of interdependent, intuitively based decisions of a real economy will produce a coefficient of inflationary expectations on wage and price inflation that is always exactly one. In fact they have offered a theory for such a departure as price and wage setters under-adjust for inflation when it is not very salient and when the cost of such behavior is low. Correspondingly, in their view, this theory factually yields a lowest sustainable rate of unemployment and an accompanying rate of inflation, (see Akerlof *et al*. 2000). In addition to this, one may also ponder the Kromphardt & Logeay (2007) argument that the wage and price setters have finally accepted the rigor of the monetary policy authorities, meaning that they would neither try nor do they have the market power to do so due to ever increasing level of globalization and international competition, to pursue a policy which raises the inflation rate significantly above the target inflation rate of the Central Bank, or alternatively as Akerlof *et al*. 2001 have suggested, above the rate of inflation that minimizes the sustainable rate of unemployment.

The rest of the paper is organized as follows: section 2 presents a brief literature review on the determinants of prices, wages, productivity, and on the impact of labor markets institutions on the wage-price dynamics; section 3 describes the mathematical and econometric modeling issues; section

4 describes the variables and examines the stationary properties of data; section 5 provides analysis of the rate of growth and of partial correlation coefficients; section 6 presents results of VECM analysis and of relevant diagnostic tests; finally, section 7 concludes by summing up the main findings.

2 The Wage-Price-Productivity Relationship and the Role of Labor Market Institutions

Regardless of the frequently approved proposition that wages and prices move strongly together, one has to agree with Hess & Schweitzer (2000) argument that there is a sharp division among economists on whether wages cause prices or vice-versa. In explaining such a causal relation, economists often use the “Granger-causality” by testing if the lagged values of one series (say wages) have a significant in-sample explanatory power for another variable (say prices). Indeed, in some cases both variables may Granger-cause one another, in which case researcher can only conclude that both economic series are determined simultaneously. If that is the case, the researcher may be unable to infer that one series has independent causal effect on the other. Frequently, the issue becomes more complex if variables in question are cointegrated, which is the case when levels of the series move together over the long-run, even though the individual series are best modeled in growth terms. In that case, the researcher must be careful to include the error correction terms in Granger-causality tests so as to allow the series to catch up with one another. The significance of the ECM terms in Granger-causality tests simply reflects the fact that the series in question are driven to return to a long-run equilibrium relationship that it is non-causal, (Hess & Schweitzer, 2000). Although there is an abundant stock of papers on the issue of wage, price and productivity relationship this section will only present a brief review of selected number of papers.

Determinants of wages - For instance, Rich & Rismiller (2001) have provided an empirical investigation into the determinants and stability of the aggregate wage inflation process in US over the period 1967-2000. By using compensation per hour as the measure of wages, they have specified a Phillips curve model that links wage growth to its past values as well as to the unemployment rate, price inflation, labor productivity growth and an additional set of labor market variables. Their results do not reject the hypothesis that real wages and labor productivity move proportionally in the long-run. Moreover, endogenous structural break tests have provided little evidence of model instability. Correspondingly, Blanchard & Katz (1999) have argued that wage setting depends on the behavior of unions, stringency of the hiring and firing regulations as well as the dynamics of productivity. In addition to this, they favor the hypothesis of a much stronger positive effects of productivity, capital intensity, and profitability on establishment wage differentials, conditional on worker characteristics, in France than in the US.

Likewise, Claussen & Staehr (2001) have highlighted the role of productivity on wages. In their view, lower unit labor costs might stem from higher productivity (possibly because of new technology) but could also be the result of wage restraint unrelated to New Economy (NE) developments. Correspondingly, Chen & Chihying (2007) have developed a method to uncover the causal order in stationary multivariate time series with a vector autoregressive presentation. They have applied the time series causal model (TSCM) to a wage-price dynamic and have consequently obtained the result that price-inflation rate is one of causes that drive wage-inflation rate while the wage-inflation rate has had only a very weak indirect influence on the price-inflation rate. Importantly, Akerlof *et al*. 2000 have argued that because there may be subjective or objective costs associated with fully rational behavior, or because implementing fully rational behavior may require overcoming some perception threshold or behavioral inertia, it is plausible to assume that the costs of non-rational behavior may be too small to induce rational behavior from all economic agents. However, if inflation increases further, the costs of being less than perfectly rational about it will also rise, and people will switch their behavior to take inflation into full account. Thus, although increasing inflation modestly above zero will permit lower unemployment, there is a rate of inflation above which the sustainable unemployment rate rises as more and more people adopt fully rational behavior. Accordingly, if there is a higher rate of inflation, than the wage-price setters' equilibrium will switch from near-rational to fully rational behavior.

Determinants of prices - Similarly, the literature on the determinants of prices is rich.For example Gordon (1979) has argued that the level of prices in the context of the price-wage spiral depends on excess labor demand, deviation of productivity from its trend value, changes in personal and social security tax rates, as well as the changes in unemployment. Specifically, Emery & Chang (1996) have found that inclusion of unit labor costs in forecasts of consumer price inflation provides no significant improvement in forecasting errors. Moreover, there is an argument suggesting that wage increases which cause higher prices, as described by the cost push view, depend on the reaction of monetary policy authorities, (Mehra, 2000). In addition to this, Bertola *et al*. 2010, in the context of cost-push view, have argued that wage induced changes in prices depend on the level of market competition, export shares, collective wage agreements, employment protection legislation, and reaction of temporary unemployment. On the other hand, Nourzad (2010) has analyzed the effect of different measures of prices and wages in predicting causal relationship between prices and wages. Additionally, Knotek & Zaman (2014) have investigated the connections between wages, prices and economic activity and their findings imply that causal relationships between wages and prices are difficult to identify and that the ability of wages to help predict future inflation is limited.

Determinants of productivity - Generally, in contrast to wages and prices, it can be argued that productivity enters the price-wage relationship as an exogenous variable as its value is determined outside the model. In the first place, it is well known fact from the Solow (1959) model that output depends on the level of technology, capital and labor. In addition to these factors one may also add human capital and land as additional factors of production, which subsequently also have significant impact on productivity. Furthermore, there are a number of studies that have comprehensively examined productivity and its dynamics over time. For instance, Smolny (2000) has provided an empirical review on the sources of productivity growth by employing German sectoral data, with particular emphasis on allowing for inter-industry spillovers and scale economies at the aggregate level, as well as for scale economies associated with human capital at the sectoral level. Additionally, he argues that business cycle affects observed productivity changes in the short-run and in the long run. In contrast, Stiroh (2001) has analyzed productivity growth by examining the key distinctions between the neoclassical and new growth theories. In his analysis of neoclassical view, the exogenous technical progress drives the long-run productivity growth as capital suffers from diminishing returns. In contrary, the new growth models yield long-run growth endogenously, either by avoiding diminishing returns to capital or by explaining technical progress internally. On the other side, Doraszelski & Jaumandreu (2013) have examined the relation between R&D and productivity, and their study provides account of endogenous productivity growth.

The role of labor market institutions on the wage-price relationship - Equally important to the dynamics of the wage-price relationship are the dynamics in the area of labor market institutions. There are many studies that have examined the relationship between wages and prices and the corresponding role of labor market institutions. In the first place, Turner *et al*. 1993 have analyzed the impact of real and nominal rigidities. In their view, those rigidities appear to be much higher in US and Germany than Japan. Furthermore, they have found particularly marked differences in real rigidities in wage determination across the G3 countries, with wages being most sensitive to unemployment in Japan and least sensitive in US. In contrast, Marcellino & Mizon (2000) have examined the relationship between wages, prices, productivity, inflation, and unemployment in Italy, Poland, and the UK between the 1960's and the early 1990's using a cointegrated vector autoregression subject to regime shifts, specifically the occurrence of structural changes in economy. They have argued that many economies in Europe have experienced significant changes in economic structure and economic policies. Some economies have undergone substantial liberalization of their labor, financial, and foreign exchange markets, an example being the UK. Other economies of Eastern and Central Europe, for example Poland, have moved from being centrally planned towards free market economies.

In particular, the HM Treasury (2003) study has reported that a flexible and efficient labor market imply higher employment, thus a fairer (for example, in terms of reducing social exclusion), more competitive and more productive economy. It also implies an economy that is better able to adapt to the changing economic environment. In addition to this, labor market flexibility is a central element in determining the overall performance of UK economy. In contrast, Prasad (2004) has examined the relationship between labor market institutions and overall labor market performance, using micro data from the German Socio-Economic Panel to document that the wage structure in West Germany was remarkably stable over the period 1984–97. The results strongly suggest that the stability of German wage structure is rather more attributable to the constraints imposed by institutional factors than to the market forces. Furthermore, he has argued that although these "solidaristic" policies and the unbearable stability of the German wage structure may have served Germany well in previous decades, they have had a deleterious effect on labor market performance during 1984–97, a period during which the economy has been buffeted by a number of adverse shocks. Likewise, Bertola *et al*. 2010 have suggested that the presence of collective wage agreements at industry or national level makes a price increase more likely. The data also seem to suggest that price increases are more likely in countries with more stringent employment protection legislation.

3 Methodology

The ***mathematical relationship*** of wages, prices and productivity can be expressed in various functional forms. *First*, wages can be expressed as function of prices and productivity,

$$W = P \cdot MPL \quad \text{or} \quad W = f(P, MPL) \qquad (3.1)$$

where, W - wages, P - prices, and MPL – marginal productivity of labor. *Second*, prices can be expressed as function of wages and productivity,

$$P = W / MPL \quad \text{or} \quad P = f(W, MPL) \qquad (3.2)$$

Third, real wages can be expressed as function of productivity,

$$W / P = MPL \quad \text{or} \quad W / P = f(MPL) \qquad (3.3)$$

In addition to this, one may transform these equations using natural logarithms, thus obtaining the following forms: first, LNW = LNP + LNMPL, i.e. wage equation indicates that wages are positively related to prices as well as to marginal productivity of labor; second, LNP = LNW – LNMPL, i.e. price equation indicates that prices are positively related to wages and negatively related to productivity; and third, LN(W/P) = LNMPL, i.e. real wages are positively related to productivity. Moreover, wages and prices will be treated as endogenous variables due to the fact that when they enter the model their values are determined from within the model or the system of equations, (see Emery & Chang, 1996; Hess & Schweitzer, 2000). Other variables may also be considered and included in the model. Nevertheless, increasing the number of variables and equations does not necessarily lead to a better model as by doing so it becomes harder to capture the dynamic and inter-temporal relations between relevant variables due to loss of power. In fact, in some forecast comparisons the univariate time series models were found to outperform large scale econometric models. Specifically, Lütkhepohl & Krätzig (2004) suggest that a possible reason for the failure of larger models is their insufficient representation of the dynamic interactions in a system of variables.

Applied econometric models – Initial analysis will begin with inspection of stationary properties of the time series data. After that the analysis will proceed with examination of the rate of growth and of partial correlation coefficients of respective time series data in order to examine the dynamics of each series, strength of linear relationships between variables, as well to possibly derive some useful information on the pattern, dynamics and potential structural changes in the relationship. Finally, the analysis will conclude with VECM model as it certainly provides a more comprehensive framework for obtaining economically and statistically robust results. The respective model selection criteria for determining the number of lagged differences, as well the tests for the rank of cointegration will be carefully performed prior to estimating the VECM model. Additionally, section 6 will provide a detailed explanation of diagnostic tests which will facilitate in assessing the economical and statistical robustness of the VECM models. However, only the relevant results will be presented and discussed very concisely.

4 Data

The focus now shifts on explanation of data that will represent respective variables as well as conduct the analysis of their stationary properties. Specifically, this study will use quarterly data covering period 2000:Q1-2014:Q4. First, wage (WUK) variable represents labor cost index (LCI), i.e. nominal value, seasonally adjusted and adjusted data by working days for business economy. Second, price (PUK) variable is represented by the Harmonized Index of Consumer Prices (HICP). Third, productivity (QUK) variable is represented by the real labor productivity per person. Henceforth, wage, price and productivity variables are denoted as WUK, PUK and QUK, respectively. The source of data for all three variables is EUROSTAT. Detailed description of all variables is provided in Table 9 in appendix. Accordingly, in Figure 3 in appendix the plots of log-levels and first difference of log-levels have been presented. The visual (informal) analysis of the plots of levels clearly indicate that time series data may not be stationary, i.e. data may be integrated of order 1 or I(1), and that deterministic trend may be present in the levels of the respective data. In contrast, the first differences of log-levels of data clearly indicate stationarity, i.e. time series data are integrated of order zero or I(0). Also, the visual inspection of data and plots indicates potential break-dates in the time series data, i.e. trend-shifts, specifically 2009:Q1 for WUK, 2008:Q2 for PUK, and 2008:Q1 for QUK.

Table 1 Augmented Dickey-Fuller (ADF) test

Variable	**μ_0**		**$\mu_0 + \mu_1$**		**μ_0 + sd**		**$\mu_0 + \mu_1$ + sd**	
LD	***1***	***0***	***1***	***0***	***1***	***0***	***1***	***0***
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
LWUK	***-4.29	**-2.89	-0.91	-1.28	**-4.27	*-2.84	-0.80	-1.13
DLWUK	***-5.85	***-10.2	***-7.66	***-12.3	***-5.61	***-9.82	***-7.49	***-11.9
LPUK	1.61	1.17	-2.34	-2.03	0.85	1.75	-2.14	-2.22
DLPUK	***-4.07	***-8.70	***-4.21	***-9.16	***-4.20	***-4.84	***-4.34	***-4.99
LD	***4***	***3***	***4***	***3***	***4***	***3***	***4***	***3***
LQUK	*-2.83	***-3.56	-1.63	-1.38	*-2.77	***-3.43	-1.58	-1.46
LD	***3***	***2***	***3***	***2***	***3***	***2***	***3***	***2***
DLQUK	***-3.98	***-11.7	***-4.71	***-13.2	***-3.82	***-8.83	***-4.54	***-10.1

***Note 1*:** **μ_0** – constant; **μ_1** – trend; and **sd** – seasonal dummies. Critical values for columns (2), (3), (6) and (7): *** significant at - 1% = -3.43; ** - 5% = -2.86; * - 10% = -2.57; and for columns (4), (5), (8) and (9): *** - 1% = -3.96; ** - 5% = -3.41; * - 10% = -3.13.

Besides, there are several formal unit root tests available such as Augmented Dickey-Fuller (ADF), Schmidt-Phillips, Phillips-Perron test for processes with level shift or Kwiatkowski, Phillips, Schmidt and Shin (KPSS) tests. However, this study will employ ADF and Schmidt-Phillips test procedures. Comprehensive theoretical account of all these tests is provided in Lütkepohl & Krätzig (2004), however for the purpose of maintaining space restrictions the results of tests will be presented and evaluated very concisely. In addition to this, a decision on the autoregressive (AR) order has to be made or, equivalently, on the number of lagged differences (LD) of respective series used in the relevant tests. This choice may rely on the model selection criteria (AIC – Akaike Information Criterion; FPE - Final Prediction Error; HQC – Hannan-Quinn Criterion; and SC – Schwarz Criterion), or a sequential testing procedure may be used to eliminate insignificant coefficients sequentially starting from some high-order model, (see Lütkhepohl and Krätzig, 2004). The suggested numbers of LD have been estimated using respective model selection criteria and have been presented in Table 10 in appendix.

Table 2. Schmidt-Phillips unit root test

Variable	Z(tau) statistic			
LD	***3***	***2***	***1***	***0***
(1)	(2)	(3)	(4)	(5)
LWUK	-1.14	-1.08	-1.05	-1.22
DLWUK	***-12.29	***-11.42	***-10.76	***-10.99
LPUK	-1.13	-1.15	-1.05	-1.12
DLPUK	***-7.68	***-7.42	***-6.59	***-6.85
LD	***4***	***3***	***2***	***1***
LQUK	***-8.44	***-7.48	***-7.20	***-6.03
DLQUK	***-24.62	***-21.99	***-20.65	***-19.38

***Note 1*:** Critical values: *** - significant at 1% = -3.56; ** - 5% = -3.02; * - 10% = -2.75.

The ADF test procedure has been performed for log-levels and first differences of log-levels using 1) constant, 2) constant and trend, 3) constant and seasonal dummies, and 4) constant, trend and seasonal dummies. The results of ADF tests have been presented in Table 1. Correspondingly, the results of Schmidt-Phillips tests have been presented in Table 2. In the same way as plots, the overall evidence derived from formal tests suggests that log-levels of all three time series data need to be differenced once in order to render them into stationary time series. Specifically, the test value of -1.61 for LPUK in column (2) of Table 1 indicates that H_0 on the presence of unit root cannot be rejected at any reasonable level of significance (l.s.), whereas the test value of -4.07 for DLPUK in column (2) of Table 1 indicates that H_0 can be rejected at 1 percent l.s. Remarkably, the H_0 can also be rejected for the levels of wages and productivity series when trend is not fitted in the testing procedures, however when trend variable is fitted one may not reject the H_0 in the respective levels of the series.

Likewise, the Schmidt-Phillips test indicates more or less the same results as the ADF tests. Specifically, the test value of -1.14 for LWUK in column (2) of Table 2 indicates that H_0 cannot be rejected at any reasonable l.s., whereas the test value of -12.29 for DLWUK in column (2) of Table 2 indicates that H_0 can be rejected at 1 percent l.s. In contrast to the ADF procedure though, on the basis of values of test statistics from Schmidt-Phillips procedure it can be argued that both log-level and first differences of log-levels of productivity series appear to be stationary, whereas now in variance with ADF test, irrespective of the number of lags used in the testing procedure, the levels of wage series are not stationary. For clarification, the Schmidt-Phillips test in contrast to ADF tests uses Z(tau) statistic, (see Lütkhepohl & Krätzig, 2004). Finally, on the basis of comprehensive evidence provided by the formal unit root tests, it can be clearly argued that unlike log-levels only the first differences of time series data are stationary beyond any reasonable doubt.

a) wages *vs.* prices b) wages *vs.* productivity c) prices *vs.* productivity

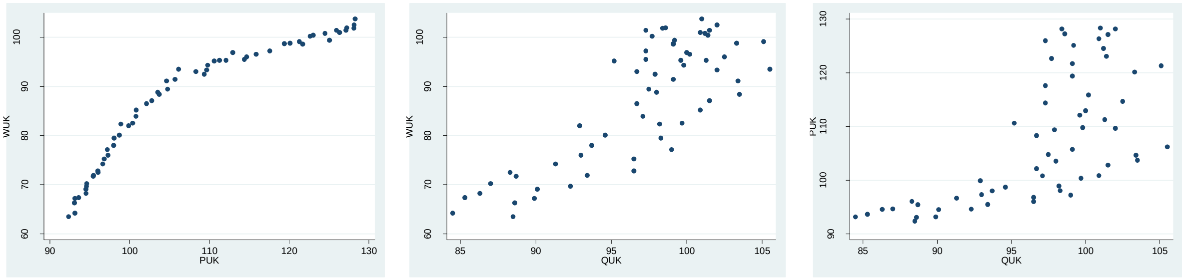


Figure 1. Cross-plots of time series data

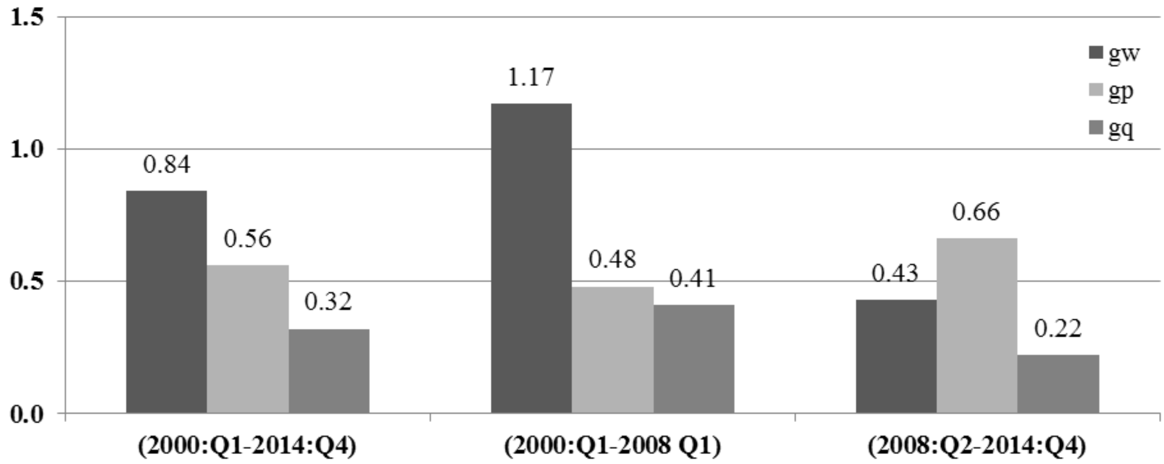


Figure 2. Quarterly rate of growth in percent

5 Analysis of The Rate of Growth and Partial Correlation.

The Figure 1 shows the respective cross-plots of wages, prices and productivity series. The panel (a) indicates that wages and prices have a very strong positive relationship, however there is an apparent structural break in the relationship starting from 2008:Q2, i.e. the potential break-date - T_B is 2008:Q2 (additional analysis on selection of this specific break-date will follow in subsequent section). Furthermore, on the basis of cross-plot evidence, the relationship between wages and productivity (panel b) as well as that between prices and productivity (panel c) appear to be less stable and visually there is greater variance in distribution after the T_B. The visual inspection reveals unclear pattern of relationship between these two sets of variables after the T_B. In fact, the structural change has been possibly caused by the global economic recession that began in year 2008. Specifically, in statistical terms, the trend-shift can be unambiguously explained by the fact that prior to T_B the quarterly rate of rate of growth of wages has been higher than the rate of growth of prices, whilst the opposite is true for the post T_B period. This hypothesis is corroborated by the evidence presented in Figure 2 which shows that quarterly rate of growth of wages (g_w) has decreased from 1.17% prior to T_B to 0.43% after. Conversely, for prices (g_p) it has increased from 0.48% prior to T_B to 0.66% after. Moreover, the quarterly rate of growth of productivity (g_q) has declined from 0.41% prior to T_B to 0.22% after. With this structural change in mind, one has to reiterate Stock & Watson (1996) and Pesaran *et al*. 2004 arguments that non-inclusion of structural brakes has led many authors to view it as the main source of forecast failures. Thus, ignoring such a structural brake or regime shift in the economy, as it is clearly indicated by the data, may cause a serious failure in the model.

Table 3. Coefficients of partial correlation

Period	**2000:Q1-2014:Q4**			**2000:Q1-2008:Q1**			**2008:Q2-2014:Q4**		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variable	WUK	PUK	QUK	WUK	PUK	QUK	WUK	PUK	QUK
WUK	-	**0.92 (0.00)	**0.76 (0.00)	-	**0.97 (0.00)	**0.54 (0.00)	-	**0.98 (0.00)	0.09 (0.65)
PUK	**0.92 (0.00)	-	**-0.52 (0.00)	**0.97 (0.00)	-	*-0.33 (0.06)	**0.98 (0.00)	-	-0.04 (0.84)
QUK	**0.76 (0.00)	**-0.52 (0.00)	-	**0.54 (0.00)	*-0.33 (0.06)	-	0.09 (0.65)	-0.04 (0.84)	-

Note 1: ** - significant at 5 %; * - 10 %. Numbers in brackets show *p* values.

Correspondingly, the partial correlation coefficients $r_{WP,Q}$ and $r_{WQ,P}$ in Table 3 indicate that there is statistically significant strong positive correlation (see *p values*) between wages and prices ($r_{WP,Q} = 0.92, p = 0.00$) as well as wages and productivity ($r_{WQ,P} = 0.76, p = 0.00$) over the entire period, though there is negative and statistically significant correlation between prices and productivity ($r_{PQ,W} = -0.52, p = 0.00$). The mathematical signs and statistical significance are in compliance with prior theoretical expectations. Even though the coefficient of partial correlation of wages and prices ($t < T_B$: $r_{WP,Q} = 0.97, p = 0.00$; *and* $t \geq T_B$: $r_{WP,Q}= 0.98, p = 0.00$) has remained unaffected and is also highly statistically significant in the post T_B period, the coefficients of partial correlation between wages and productivity ($t < T_B$: $r_{WQ,P} = 0.54, p = 0.00$; *and* $t \geq T_B$: $r_{WQ,P} = 0.09, p = 0.65$) as well as between prices and productivity ($t < T_B$: $r_{PQ,W} = -0.33, p = 0.06$; *and* $t \geq T_B$: $r_{PQ,W} = -0.04, p = 0.84$) indicate that there is a weaker linear dependence between respective time series data in the post T_B period compared to the pre T_B period. The mathematical signs are correct however there is no statistically significant impact. Although this is a simple statistical method, nonetheless it still provides useful information in confirming that there is an obvious change in the patterns and the dynamics of the wage-price-productivity relationship in the post 2008 period.

Table 4. Tests for the rank of cointegration

Test	LD	Intercept ($\mu_0 \neq 0$ $\mu_1 = 0$)		Intercept + trend ($\mu_0 \neq 0$ $\mu_1 \neq 0$)		Orthogonal trend
		rk (Π) = 0	rk (Π) = 1	rk (Π) = 0	rk (Π) = 1	rk (Π) = 0
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Johansen	3	***50.85 (0.00)	***14.00 (0.00)	***31.18 (0.00)	7.03 (0.35)	***23.41 (0.00)
	2	***56.65 (0.00)	***14.60 (0.00)	***32.47 (0.00)	5.68 (0.51)	***23.80 (0.00)
Saikkonnen & Lütkhepohl	3	***24.77 (0.00)	*4.09 (0.05)	***20.17 (0.00)	3.91 (0.22)	**12.06 (0.02)
	2	***26.90 (0.00)	*4.05 (0.05)	**19.17 (0.01)	2.20 (0.49)	**10.46 (0.04)
Saikkonnen & Lütkhepohl tsh08q2	3	***24.77 (0.00)	*4.09 (0.05)	***20.17 (0.00)	3.91 (0.22)	**12.06 (0.02)
	2	***26.90 (0.00)	*4.05 (0.05)	**19.17 (0.01)	2.20 (0.49)	**10.46 (0.04)
Saikkonnen & Lütkhepohl tsh09q1	3	***24.77 (0.00)	*4.09 (0.05)	***20.17 (0.01)	3.91 (0.22)	**12.06 (0.02)
	2	***26.90 (0.00)	*4.05 (0.05)	**19.17 (0.01)	2.20 (0.49)	**10.46 (0.04)

Note 1: *** - significant at 1 %; ** - 5 %; * - 10 %. Numbers in brackets show *p* values.

6 VECM Estimation

In case that two or more variables have a common stochastic trend, it may possible that there are linear combinations of them that are I(0). If that is the case then variables are cointegrated. Although sometimes the VAR model may be suitable in accommodating variables with stochastic trends, it is not the most suitable type of model if interest centers on cointegration relations, as they do not appear explicitly in those models, (Lütkhepohl & Krätzig, 2004). For this reason, the VECM model is a more convenient setup for analyzing variables with common stochastic trend. Simultaneously, it may also be a more suitable model setup for analyzing the causal relationship between wages and prices in UK.

Determination of cointegration rank - rk (Π) – Prior to conducting any VECM regression analysis, one has to perform cointegration tests in order to determine the rank of cointegration. Specifically, *Johansen Trace Test* and *Saikkonen and Lütkhepohl* test have been carefully utilized in examining cointegration properties of LWUK and LPUK, (see Lütkepohl & Krätzig, 2004). Tests have been performed using quarterly seasonal dummy variables as well. Furthermore, as suggested by the information criteria, tests have been performed with three and two LD. In addition to this, the case with a) intercept, b) intercept plus trend, and c) orthogonal trend (the trend that is confined to some individual variables but is absent from the cointegration relations) have been performed for both types of cointegration test. Simultaneously, tests have been conducted by examining applicability of both 2008:Q2 and 2009:Q1 as potential break-dates.

Comprehensive results of cointegration tests have been presented in Table 4. Next only a concise description of the tests will be provided. First, when the Johansen Trace Test with three and two LD is applied in the case with only intercept included in the testing procedure, the null hypothesis H_0 that rk (Π) = 0 and alternative hypothesis H_1 that rk (Π) = 1, are both rejected in favor of another hypothesis, let say, H_2 that rk (Π) > 1, with relevant high test statistics and low *p* values confirming this, (see column 3 and 4). Conversely, when three and two LD are used in the case when intercept plus trend, and orthogonal trend are fitted in the test procedure then one may reject at 1 percent l.s. the H_0 that rk(Π) = 0 in favor of H_1 that rk (Π) = 1.

Similarly, the evidence from Saikkonen and Lütkhepohl test strongly suggests that rk (Π) = 1. Specifically, when three and two LD are included in the testing procedure one may in all three cases comfortably reject the H_0 that rk (Π) = 0 in favor of H_1 that rk (Π) = 1. For example, the value of the test statistic of 20.17 and *p* value of 0.00 in column 5 are significant at 1 percent l.s., thus on the basis of these values one may clearly reject the H_0 that rk (Π) = 0 in favor of H_1 that rk (Π) = 1. Additionally, the Saikkonen and Lütkhepohl procedure enables tests with trend-shift dummy variable included in the testing procedure. Accordingly, the tests have been carried out for two potential break-dates, respectively 2008:Q2 and 2009:Q1. Evidently, the test statistics do not differ from the case when trend-shift variables are not included in the tests. In summary, on the basis of overall results produced by cointegration tests, it can be clearly argued that there is sufficient evidence to proceed subsequent analysis with one cointegration relation included in the VECM model, i.e. rk (Π) = 1.

Number of lagged differences – prior to running the VECM regression it is necessary to determine the number of LD by utilizing the relevant information criteria. The test results on suggested number of LD have been presented in Table 5. On the basis of obtained evidence it can be argued that suggested number of LD for all the models is the same, irrespective of fitting an unrestricted or restricted trend term to cointegration relation, as well as in the cases when each break-date 2008:Q2 and 2009:Q1 are included in the VECM model. Generally, whereas AIC overestimates the number of LD it is the SC that provides the most consistent estimates. In all cases AIC, FPE, HQC and SC suggest using two LD. Also when the values of the test statistics in Table 4 are compared it is evident that in all cases the value of the test with two LD is always higher than the value of test statistics with three LD. In these model specifications LWUK and LPUK have been set as endogenous variables, whereas LQUK has been set as an exogenous variable, given the fact that the values of wages and prices are determined within the system whereas the value of productivity is determined outside the system. Furthermore, quarterly seasonal dummies (S1, S2, and S3) and trend (t) have been fitted in the model. Intercept term is not included in any of the models, as in the first place it is explicitly absent in the mathematical model.

Table 5. Determination of the optimal number of lagged differences

Model	**AIC**	**FPE**	**HQC**	**SC**
(1)	(2)	(3)	(4)	(5)
$VECM^{08Q2}_{U}$	2	2	2	2
$VECM^{08Q2}_{R}$	2	2	2	2
$VECM^{09Q1}_{U}$	2	2	2	2
$VECM^{09Q1}_{R}$	2	2	2	2

***Note 1*:** For instance, the VECM models are denoted as $VECM^{08Q2}_{R}$: **08** = year, **Q2** = quarter and **U** or **R** = trend (μ_1) is **U**n/**R**estricted to cointegration relationship.

***Interpretation of estimated coefficients of cointegration matrix* -** It has to be emphasized that the first coefficient in the cointegrating relation β_1 has been normalized to 1 by JMulTi, i.e. $\beta_1 = 1$. With this normalization, one may also verify whether the estimated cointegrating relation β_2 is close to what one would expect on the basis of prior considerations by using the asymptotic distribution of the second coefficient. The *loading coefficients α* are also to some extent arbitrary because they are determined by normalization of cointegrating vectors, though their *t* ratios can be interpreted in the usual way as being "conditional on the estimated cointegration coefficients". Thus, they can be used to assess if the cointegration relations resulting from this normalization enter a specific equation significantly. The estimators of the parameters associated with LD of the variables (short-run parameters) may be interpreted in the usual way. Their *t* ratios are asymptotically normal under our assumptions. The same is not necessarily true for the parameters associated with deterministic terms as their *t* ratios are provided just for completeness (Lütkhepohl & Krätzig, 2004; Lütkhepohl & Krätzig, 2005).

Table 6. VECM estimated coefficients

Model	**$VECM^{08Q2}_{U}$**		**$VECM^{08Q2}_{R}$**		**$VECM^{09Q1}_{U}$**		**$VECM^{09Q1}_{R}$**	
(1)	(2)		(3)		(4)		(5)	
α_{11}	**-0.04 [-5.73]		**-0.01 [-8.45]		-		**0.01 [7.96]	
α_{21}	**0.04 [3.98]		**0.03 [3.00]		**0.02 [2.99]		**0.00 [5.42]	
β_{11}	1.00 (0.00)		1.00 (0.00)		1.00 (0.00)		1.00 (0.00)	
β_{12}	**-1.053 [-42.22]		**-1.28 [-19.95]		**-1.85 [-11.41]		**-0.52 [-7.50]	
Rest. trend (res μ_1)	n/a		-0.01 [-1.09]		n/a		-0.01 [-0.56]	
(1)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5c)
	DLW_t	**DLP_t**	**DLW_t**	**DLP_t**	**DLW_t**	**DLP_t**	**DLW_t**	**DLP_t**
$DLWUK_{t-1}$	**-0.62 [-5.58]	-	**-0.62 [-5.51]	-	**-0.47 [-4.15]	-	**-0.46 [-4.10]	-
$DLPUK_{t-1}$	-	-	-	-	-	-	-	**0.35 [2.80]
$DLWUK_{t-2}$	*-0.29 [-2.56]	-	**-0.28 [-2.47]	-	-	-	-	-
$DLPUK_{t-2}$	-	-	-	-	-	-	- 0	-
$LQUK_t$	-	**0.01 [4.58]	-	**0.01 [3.36]	**0.00 [8.07]	**0.02 [3.19]	-	-
trend-shift	**0.00 [-4.47]	*0.00 [2.41]	**0.00 [-6.39]	**0.00 [3.44]	**0.00 [-4.07]	**0.00 [2.66]	**0.00 [-3.86]	-
S_1	*-0.01 [-2.15]	**-0.00 [-3.56]	*-0.01 [-2.13]	**-0.00 [-3.39]	-	**0.01 [-3.74]	-	**-0.01 [-4.14]
S_2	-	**0.00 [3.64]	-	**0.01 [3.50]	-	**0.01 [3.62]	-	**0.01 [3.63]

S_3	-	**-0.00 [-2.69]	-	**-0.00 [-2.61]	-	**-0.00 [-2.84]	-	**-0.01 [-3.60]
trend (μ_1)	*0.00 [2.10]	*0.00 [-2.20]	n/a		-	-	n/a	

***Note 1*: ** - significant at 1 %; * - at 5 %. Numbers in brackets show *t* ratios.**

Athough the sample includes data from 2000:Q1 to 2014:Q4, i.e. 60 observations, only 57 observations from 2000:Q4 to 2014:Q4 have been used in the VECM models, as two LD have been fitted in the models and additionally one observation has been lost due to first difference transformation. Full results of the estimated VECM models have been presented in Table 6, respectively $VECM^{08Q2}_{U}$ in column 2, $VECM^{08Q2}_{R}$ in column 3, $VECM^{09Q1}_{U}$ in column 4, and $VECM^{09Q1}_{R}$ in column 5. Specifically, all VECM resgressions have been performed using the Two Stage (S2S) procedure, i.e. Johansen procedure in the first stage and Feasible Generalized Least Squares (FGLS) procedure in the second stage. Additionally, it is worth emphasizing that System Sequential Elimination of Regressors (SER) procedure utilizing SC has been employed in order to eliminate those regressors that lead to the largest reduction of the respective information criteria. Consequently, all the coefficients with *t* ratios lower than two have been eliminated or restricted to zero in the second stage of estimation, (see Lütkhepohl & Krätzig, 2004; Lütkhepohl & Krätzig, 2005).

For example, on the basis of estimated loading coefficients of $\mathbf{VECM^{08Q2}_{R}}$ model in column 3 it can be argued that cointegration relation resulting from normalization of cointegration vector enters significantly in both equations. The loading coefficient α_1 = -0.01 for the wage equation has a *t* statistic of -8.45, and the other coefficient α_2 = 0.03 for the price equation has a *t* statistic of -3.00, and both are significant at 1 percent l.s. In fact, the cointegration relation enters significantly in all but the first equation of $\mathbf{VECM^{09Q1}_{U}}$ where the loading coefficient has been restricted to zero by the SER procedure due to its low value. Again by selecting $LWUK_t$ as the first variable in the model, it means that the coefficient of this variable in cointegration relation has been normalized to 1 in the maximum likelihood estimation procedure. The high value of *t* statistic of the second coefficient, β_2, in all the estimated models clearly indicates that there is sufficient evidence in favor of a strong cointegration relationship between $LWUK_t$ and $LPUK_t$. Consequently, the respective models from Table 6 can be simply expressed as,

$\mathbf{VECM^{08Q2}_{U}}$: $LWUK_t = 1.053\ LPUK_t + ec_t^{FGLS}$ (6.1)

[-42.22]

$\mathbf{VECM^{08Q2}_{R}}$: $LWUK_t = 1.28\ LPUK_t + ec_t^{FGLS}$ (6.2)

[-19.95]

$\mathbf{VECM^{09Q1}_{U}}$: $LWUK_t = 1.85\ LPUK_t + ec_t^{FGLS}$ (6.3)

[-11.41]

$\mathbf{VECM^{09Q1}_{R}}$: $LWUK_t = 0.52\ LPUK_t + ec_t^{FGLS}$ (6.4)

[-7.50]

where the numbers in brackets show *t* ratios. Taking into account that logs of variables have been used, the relation in formula (6.2) expresses the elasticity of wages on prices, hence the coefficient of 1.28 is the estimated wage elasticity. Accordingly, if the log of prices increases by 1 percent it is expected that the log of wages would increase by 1.28 percent. In other words, a 1 percent increase in the log of prices would induce a 1.28 percent increase in the log of wages. Importantly, this coefficient is statistically significant at 1 percent l.s. The corresponding price elasticity is calculated as $1 / \beta_2 = 1 / 1.28 = 0.78$ whereas the equation can be expressed as,

$$\textbf{VECM}^{\mathbf{08Q2}}_{\mathbf{R}}: \qquad LPUK_t = 0.78\ LWUK_t + ec_t^{FGLS} \qquad (6.2)$$

When the coefficients associated with lagged variables for $\mathbf{VECM^{08Q2}_R}$ are analyzed, it results that only the coefficients which estimate the impact of $DLWUK_{t-1}$ and $DLWUK_{t-2}$ on DLWUK, are statistically significant at 1 percent, respectively 5 percent l.s. In contrast, all other coefficients have been restricted to zero as their their *t* ratios had low values, thus during the SER procedure have been eliminated in the second stage of VECM estimation when FGLS procedure was employed. Furthermore, the estimated productivity coefficient of $LQUK_t$ indicates a statistically significant though very small impact of productivity on prices with coefficient value of 0.01 having a *t* statistic of 3.36. From coefficients of deterministic terms, those of seasonal dummies for LWUK are statistically significant just for the first quarter. At the same time, all coefficients of seasonal dummies for LPUK are significant at 1 percent l.s. The tshq08q2 dummy used in $VECM^{08Q2}_U$ and $VECM^{08Q2}_R$ is statistically significant in both equations. Conversely, the tshq09q1 dummy used in $VECM^{09Q1}_U$ is significant in both equations, whereas in $VECM^{09Q1}_R$ is significant only in the first equation. All other coefficients of respective models can be interpreted in similar way.

Diagnostic tests **-** Details of graphical tests have been presented in Figure 4 in appendix, respectively the formal diagnostic tests in Table 7 ($VECM^{08Q2}_U$ in column 2, $VECM^{08Q2}_R$ in column 3, $VECM^{09Q1}_U$ in column 4, and $VECM^{09Q1}_U$ in column 4). In summary, the visual inspection of the plots of residuals, standardized residuals, residual autocorrelation and cross-correlation raises no serious concerns on the statistical adequacy of $VECM^{08Q2}_R$. In particular, the standardized squared residuals indicate some high values in the residuals of all equations in each model, respectively the high values of residuals can be observed *first*, in 2005:Q1 and 2008:Q2 for u_1, and then again the value of 2009:Q1 and 2011:Q1 for u_2. In a more distinctive way the formal diagnostic tests clearly suggest that model that satisfies best the diagnostic criteria is $VECM^{08Q2}_R$. Specifically, the VECM model statistics which tests whether any information is lost when restrictions are imposed by the SER procedure, it clearly indicates that less information is lost if restrictions are imposed on the $VECM^{08Q2}_U$ and $VECM^{08Q2}_R$, than on $VECM^{09Q1}_U$ and $VECM^{09Q1}_R$ models. In particular, the LM statistic and *p* values of VECM model statistics strongly favor models which use 2008:Q2 as the break-date over the models which use 2009:Q1.

Table 7. VECM models diagnostic tests

Model	**VECM$^{08Q2}_{U}$**	**VECM$^{08Q2}_{R}$**	**VECM$^{09Q1}_{U}$**	**VECM$^{09Q1}_{R}$**
(1)	(2)	(3)	(4)	(5)
VECM Model statistics	10.57 (0.31)	10.79 (0.29)	19.78 (0.10)	***30.35 (0.00)
LM-Type Test for autocorrelation with 5 lags	21.49 (0.37)	23.31 (0.27)	24.88 (0.21)	27.37 (0.13)
TESTS FOR NONNORMALITY				
Doornik & Hansen	**10.45 (0.03)	3.90 (0.42)	***21.36 (0.00)	**10.01 (0.04)
Skewness	0.78 (0.68)	0.58 (0.75)	***10.91 (0.00)	*5.58 (0.06)
Kurtosis	***9.67 (0.01)	3.32 (0.19)	***10.44 (0.01)	4.43 (0.11)
Lütkepohl	*8.99 (0.06)	3.30 (0.51)	***21.12 (0.00)	**9.96 (0.04)
Skewness	0.82 (0.66)	0.61 (0.74)	***10.51 (0.01)	*5.40 (0.07)
Kurtosis	**8.17 (0.02)	2.69 (0.26)	***10.61 (0.01)	4.56 (0.10)
Jarque-Berra				
u_1	0.33 (0.85)	0.10 (0.95)	2.44 (0.30)	2.53 (0.28)
u_2	***13.03 (0.00)	*5.05 (0.08)	***19.45 (0.00)	**7.39 (0.02)
ARCH-LM TEST with 16 lags				
u_1	19.26 (0.26)	16.18 (0.44)	11.18 (0.80)	10.65 (0.83)
u_2	9.10 (0.91)	10.20 (0.86)	6.35 (0.98)	8.46 (0.93)
MULTIVARIATE ARCH-LM TEST with 5 lags				
VARCH LM test statistic	41.88 (0.61)	40.01 (0.68)	49.72 (0.29)	56.06 (0.12)

Note 1: *** - significant at 1 %; ** - 5 %; * - 10 %. Numbers in brackets show *p* values.

Additionally, the Breusch-Godfrey test with 5 lags suggests no potential problems with residual autocorrelation when tshq08q2 is used as a break-date, with values of LM statistics of 21.49 and *p* value of 0.37 for VECM$^{08Q2}_{U}$, respectively 23.31 and 0.27 for VECM$^{08Q2}_{R}$, clearly higher than critical levels. Moreover, all the tests on non-normality (Doornik & Hansen; Lütkepohl; and Jarque-Bera), clearly favor VECM$^{08Q2}_{R}$ over all other models. In fact, VECM$^{08Q2}_{R}$ is the only model in which the zero hypotheses on normal distribution of residuals, H_0, may not be rejected at conventional levels of significance. Conversely, in all other models one may reject the H_0 in favor of H_1 that residuals of respective models have non-normal distribution. Finally, the ARCH-LM tests with 16 lags and Multivariate ARCH-LM tests with 5 lags raise no concerns regarding potential statistical issues in these models. Respective LM test statistics are low and their *p* values are sufficiently higher than the critical level of 0.10, with exception of $VECM^{09Q1}_{R}$ in the case of Multivariate ARCH-LM test with p value being very close to 0.10 (see Lütkhepohl & Krätzig, 2004 for detailed discussion of diagnostic tests).

Evaluation of theoretical assumptions - Subsequently, the values of estimated cointegration coefficients β_2 of each model are going to be compared with the values that one would expect on the basis of prior theoretical considerations. In a simple theoretical model, the rational expectations approach assumes that people use all relevant information in forming expectations of economic variables. For example changes in the price level as a result of increase in money stock, leave output and employment unchanged. Money and wages will rise, but since the real wage is unchanged, neither the quantity of labor supply nor that demand will change, (see Muth, 1961; Sargent & Wallace, 1976). Nonetheless, there is a difference between how expectations are formed and how are used. According to Akerlof *et al*. 2001 it is highly unlikely that the welter of interdependent, intuitively based decisions of a real economy will generate a coefficient of inflationary expectations on wage and price inflation that is always exactly one. Thus, provided that assumption of rational expectations holds true, then it is expected that the wage elasticity is going to have the value of one, H_0, or else, if the value of wage (price) elasticity is higher (lower) than one then assumption of near-rational wage-price setting behavior is valid, H_1.

Table 8. Testing the hypothesis on validity of rational vs. near-rational behavior

Model	$VECM^{08Q2}_{U}$	$VECM^{08Q2}_{R}$	$VECM^{09Q1}_{U}$	$VECM^{09Q1}_{R}$
(1)	(2)	(3)	(4)	(5)
estimated β_2	-1.053	-1.28	-1.85	-0.52
Std. of β_2	0.025	0.064	0.162	0.070
t statistic	**-2.12	***-4.38	**-5.25	**6.86

Note 1: Level of significance: *** - significant at 1 %; ** - 5 %; * - 10 %. The corresponding values of *price elasticity* are: 0.95, 0.78, 0.54 and 1.92.

Specifically, one can use the asymptotic distribution of cointegration coefficients, β_2, of each model to test the hypotheses, H_0, that the values of estimated elasticity coefficients from equations (6.1), (6.2), (6.3) and (6.4) are -1, as theoretically expected, or H_1, that they are statistically different from -1. The results of this test have been presented in Table 8. For instance, the *t* statistic of the $VECM^{08Q2}_{R}$ is calculated using formula t = (estimated β_2 + 1) / (se), specifically t = (-1.28+1) / 0.025 = -4.38. The results of the first three *t* tests clearly suggest that one may reject H_0 in favor of H_1 that the value of wage (price) elasticity coefficients is higher (lower) than one. Consequently, on the basis of comprehensive arguments presented in this paper it can be argued that the rational behavior in the wage-price relationship in UK does not hold true. On the contrary, these results indicate that there is a stronger case in favor of near-rational wage-price setting behavior. Importantly, additional argument in favor of using tsh08q2 as a break-date is that the values of β_2 from $VECM^{08Q2}_{R}$ and $VECM^{08Q2}_{R}$ are closer to the theoretically expected value, as well are more trustworthy on the basis of diagnostic criteria. Next the final section will recap the main findings of this paper and suggest potential causes for the shift in the pattern of the wage-price relationship.

7 Conclusion

The purpose of this paper has been to analyze the pattern of relationship between wages and prices in UK during the period of time 2000:Q1-2014:Q4. The data clearly suggest that quarterly rate of growth of price inflation (increased) has overtaken that of wage inflation (decreased) in the post 2008:Q2 period. Certainly, the partial correlation coefficients only strengthen the hypothesis of a change in the pattern of relationship between variables by indicating that even though the linear association between wages and prices has remained strong after 2008:Q2, there is no statistically significant linear dependence between wages and productivity, as well as prices and productivity in the post break-date period, although it existed prior to that date. Likewise, the evidence from VECM models strongly suggests that the trend-shift is a significant variable in all the estimated models. However, the statistical evidence suggests that 2008:Q2 is a stronger and more reliable candidate for break-date than 2009:Q1. Moreover, the estimated wage (price) elasticity coefficients provide a stronger case for near-rational, rather than for fully rational wage-price setting behavior.

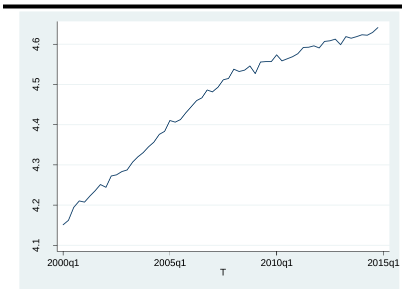
Nonetheless, the key dilemma that this paper has attempted to investigate and explain is why the increase in the rate of inflation in UK in the post 2008 period has been accompanied by a decrease in the rate of growth of wage inflation? Certainly, it is reasonable to argue that wage-setters in UK have not reacted with demand for higher real wages in the post 2008 period for two possible reasons: *first* reasoning can rely on *Akerlof et al*. 2000 proposition that the rate of growth of inflation has still been modest, hence the wage and price setters have under-adjusted for that modest increase in the rate of growth of inflation as it has not been very salient and additionally the cost of engaging in such a behavior has been low; and *second* reasoning can rely on Kromphardt & Logeay (2007) explanation and argue that the wage and price setters in UK have unconditionally accepted the strict rigor of monetary policy authorities and have not tried, although hardly any country today has the market power to do so due to an ever increasing level of globalization and competition, to pursue a policy which raises inflation rate significantly above the target inflation rate of monetary policy authorities.

It is also important to realize that there is another element that has had a significant impact on the path of wage and price setting dynamics. Specifically, that is the labor market flexibility. As evidence implies, it is very likely that flexible wage structure in UK, or not a rigid one as, for instance, Prasad, 2004 has found to be the case with Germany, is attributable to the flexible and efficient labor market which, as HM Treasury (2003) study has discovered, is considered as a precondition for higher employment, as well as fairer, more competitive and more productive economy. Additionally, one may accentuate additional arguments from the report that labor market flexibility may also entail an economy that is better able to adapt to the changing economic environment, and ultimately the labor market flexibility is considered as a central element in determining the overall performance of UK economy. As a matter of fact, one would find it very hard to reject this hypothesis for any country too.

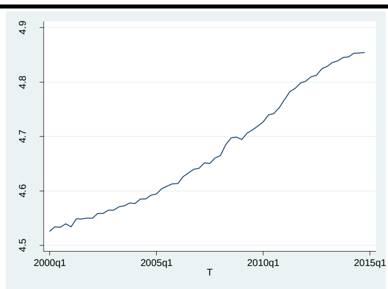
8 Appendix

Table 9. Description of variables

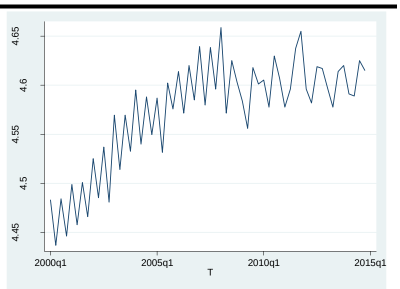
Variable	Description	Variable	Description
(1)	(2)	(3)	(4)
WUK_t	wages	c *or* μ_0	constant or intercept
$LWUK_t$	log of WUK	t *or* μ_1	trend term
$DLWUK_t$	first difference of LWUK	s_0	first quarter
PUK_t	Prices	s_1	second quarter
$LPUK_t$	log of PUK	s_2	third quarter
$DLPUK_t$	first difference of LPUK	s_3,	fourth quarter
QUK_t	productivity	tsh08q2	trend-shift dummy T_B =2008:Q2
$LQUK_t$	log of QUK	tsh09q1	trend-shift dummy T_B =2009:Q1
$DLQUK_t$	first difference of LQUK	u_{1t} & u_{2t}	residuals of equations 1 and 2



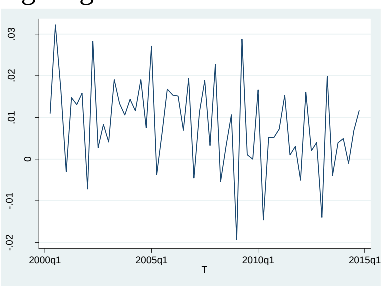
log-wages



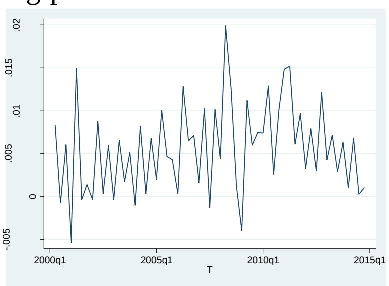
log-prices



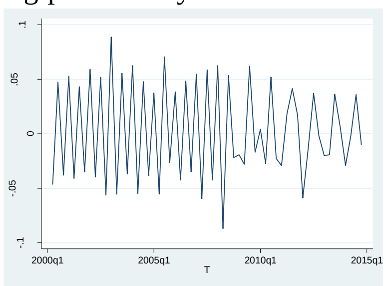
log-productivity



first diff. of log-w



first diff. of log-p

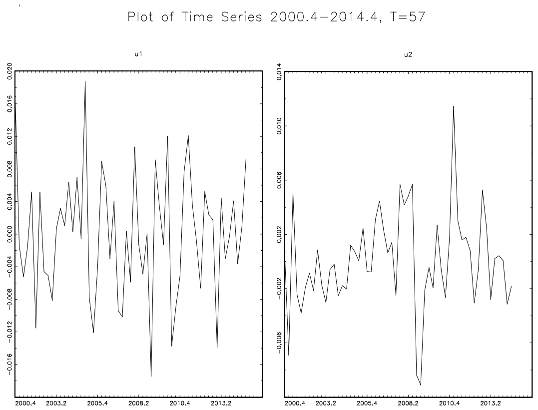


first diff. of log-q.

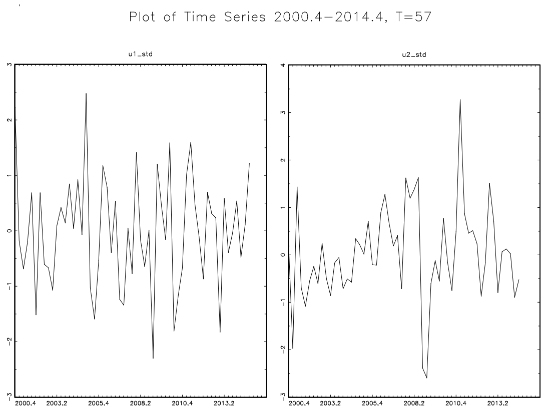
Figure 3. Plots of wage, price and productivity series

Table 10. Tests for number of lagged differences

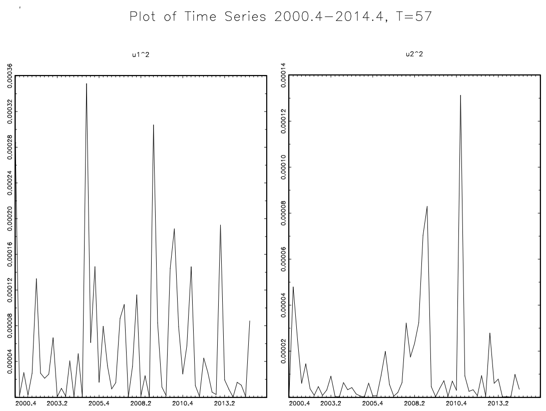
Variable	**μ_0**				**$\mu_0 + \mu_1$**				**μ_0 + sd**				**$\mu_0 + \mu_1$ + sd**			
(1)	(2)				(3)				(4)				(5)			
	AIC	FPE	HQ	CS	AIC	FPE	HQ	CS	AIC	FPE	HQ	CS	AIC	FPE	HQ	CS
LWUK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LPUK	6	6	6	6	6	6	6	6	6	6	1	1	6	6	1	1
LQUK	4	4	4	3	4	4	4	3	3	3	3	3	3	3	3	3
DLWUK	7	7	0	0	0	0	0	0	6	6	2	0	3	3	0	0
DLPUK	5	5	5	5	5	5	5	5	2	2	0	0	1	1	0	0
DLQUK	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2	2

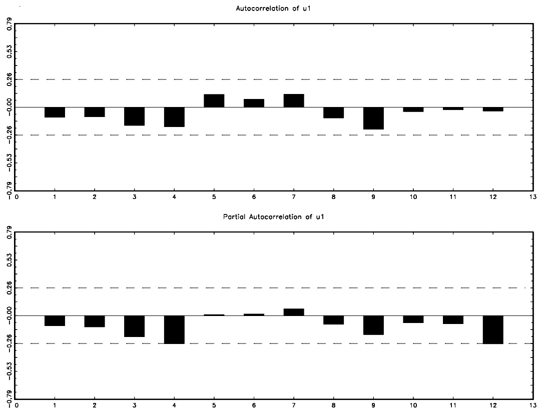


a) residuals

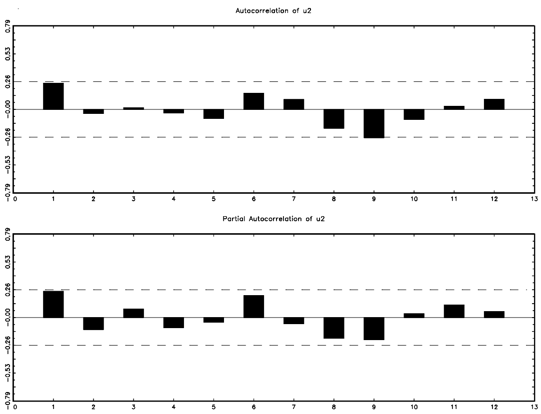


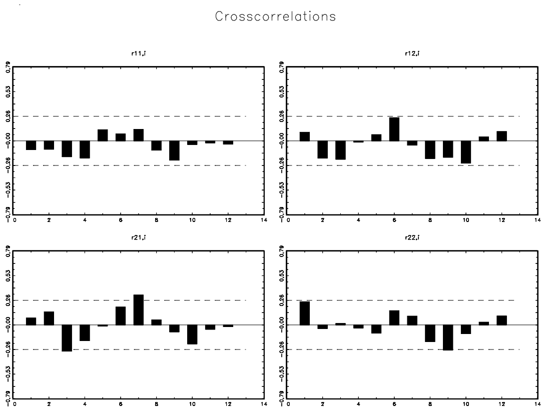
b) standardized residuals u_{1t} and u_{2t}





c) standardized squared residuals u_{1t} and u_{2t} d) residual autocorrelation of u_{1t}





e) residual autocorrelation of u_{2t} e) cross-correlations of residuals u_{1t} and u_{2t}

Figure 4. Plots of residuals of $\mathbf{VECM^{08Q2}_R}$

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