European Research Studies
Volume VII, Issue (3-4), 2004

The Causal Relationship Between Domestic Private Consumption and Wholesale Prices: The Case of European Union

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Abstract

The purpose of this paper is to investigate and measure the proportion of changes in wholesale prices transferred to private consumption prices in European Union economy. The data used in the investigation are monthly, covering the period from 1996:9 to 2001:7 and refer to consumer price indexes and wholesale price indexes of all products. Cointegration method is used in order to investigate the cost transfer from wholesale prices to consumer prices, or in other words to test the existence or not of a long-term equilibrium relationship between the two prices.

Key words

Private Consumption, Wholesale Price Index, Granger causality, Cointegration, Error Correction Models, European Union
JEL classification: E31, C12

1. Introduction

The consequences of economic policy that was applied in European Union the last years for agricultural sector could be ascertained by the comparable analysis of its cost production. These consequences can be formulated as follows:

The agricultural sector is completed gradually in every country's economic system since less and less outputs of production remain to it, while its internal inputs are increasing continually. On the other hand, the non-agricultural sector seems unwilling to use agricultural inputs in its production, substituting these inputs with other non-agricultural.

While wages and daily wages consist a constant percentage of the value of prime inputs in tertiary and agricultural sector, in secondary sector present downward trend.

It seems then that capital wage consisted serious factor in the modulation of added value in secondary sector from the prime of European Union. From the cost side, wages and daily wages affect the cost of prime inputs of tertiary sector. For agricultural sector the elimination of farm workers leaded to little percentage participation of wages and daily wages to total cost of prime inputs.

The agricultural production was combined with lower total, average and marginal cost rates than its marked growth rates. The automation of agricultural sector, the constant and little outlay for wages and daily wages and the lighter indirect taxation advocate to this ascertainment.

The factors in the process of product price determination can be categorized into two groups. Domestic factors belong to the first group such as the pressure of demand on labor supply and the other factors of production. When demand is high in relation to existing supply, there will be upward pressure on wages and income margins of the other factors of production. However, higher wages and income margins mean higher costs of production that lead to higher product prices. This problem that was examined in American agriculture by Tweeten and Griffin (1976) by postulating a neoclassical world, found that inflation could affect the relationship between product price and cost-price. Consequently, the higher product prices affect wages and to their final course the circular effect of wages-prices is added (Kennedy 1996).

External factors belong to the second group. The main external factor is the influence of import prices on export prices. Any rise in import prices will find its way into final product prices both directly and through its effect on production costs. However, in case that imports are competitive in relation to domestic production, the effects may not be so drastic, since demand will switch to domestic products (Kennedy 1996).

These two factors groups emphasized the side of the cost of production in the process of product price determination. However, the product price follows a chain of cost increments before it reaches the market. We could say that the first increment is the margin between producer's price and wholesaler's price and the second increment is the margin from wholesaler's price to consumer's price.

There is a large number of empirical studies that have employed with the relationship between wholesale price index and consumer price indexes (Robertson and Orden's 1990, Han, Jansen and Penson 1990, Moss 1992, Denbaly and Torgeson 1993, Loizou, Mattas and Pagoulatos 1997, Katsouli et al 2002).

The purpose of this paper is to investigate this second difference between wholesale price index and consumer price indexes. In other words this paper examines if there is a long-run equilibrium relationship between wholesale price index and consumer prices indexes. The second section of this paper employs with the Dickey – Fuller tests and investigates the data stationarity that we used. The bivariate cointegration analysis with Engle – Granger approach between wholesale price index and consumer price indexes is presented in the third section. Section 4 of this paper reports the statistical estimations of error correction models, while Section 5 deploys the Granger causality tests. Finally, Section 6 presents the conclusions of this study.

2. Stationarity tests

The data used in this investigation are monthly, covering the period from 1996:9 to 2001:7 and are taken from databases of Eurostat and Main Economic Indicators employing 1996 as base year. The examined variables for the empirical test appear in Table 1. The determinants of wholesale price index refer to finished goods of primary sector production for households, to finished goods of industrial sector production for households, to exported products of primary and industrial sector production and final products of foreign origin.

Table 1 – Variable Description

CPI0	= general consumer price index
CPI1	= consumer price index, food and non-alcoholic drinks
CPI2	= consumer price index, alcoholic drinks and tobacco
CPI3	= consumer price index, clothing and footwear
CPI4	= consumer price index, housing, water, electricity, gas and other fuels
CPI5	= consumer price index, furniture and home equipment
CPI6	= consumer price index, health
CPI7	= consumer price index, means of transportation
CPI8	= consumer price index, communication
CPI9	= consumer price index, recreation and culture
CPI10	= consumer price index, education
CPI11	= consumer price index, hotels, cafeterias and restaurants
CPI12	= consumer price index, other goods and services
WPI	= wholesale price index, overall final demand of finished goods

Examining the stationarity of the mentioned variables we have used the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests (1979, 1981). The results of these tests appear in Table 2.

The minimum values of the Akaike (1973) and Schwarz (1978) statistics indicated that the 'best' ADF equations were those including an intercept and trend and the corresponding numbers of lagged terms with the indication 'Lag'. As far as the autocorrelation disturbance term test is concerned, the Lagrange Multiplier LM(12) test has been used.

Table 2 - DF /ADF for a unit root test

Vari-able	In levels			1st differences		
	Lag	Test statistic **(DF/ADF)***	**LM (12)****	Lag	Test statistic **(DF/ADF)**	**LM(12)**
CPI0	0	-0.81572	56.1451[.000]	3	-5.9816	2.4630[.098]
CPI1	1	-1.8967	27.1884[.007]	1	-4.7761	1.6070[.128]
CPI2	0	-0.4093	23.0941[.000]	3	-6.0027	1.2807[.238]
CPI3	3	-1.4858	52.0467[.000]	3	-14.114	1.8877[.106]
CPI4	0	-0.78907	56.4974[.000]	0	-8.0743	2.7189[.430]
CPI5	0	-1.7551	52.7942[.000]	3	-6.8902	2.7303[.091]
CPI6	0	-2.6745	54.9497[.000]	2	-5.8049	1.4325[.095]
CPI7	0	-1.7250	56.4785[.000]	3	-3.9472	1.5340[.100]
CPI8	0	-3.3754	57.3139[.000]	0	-7.5609	1.5768[.565]
CPI9	2	-3.3575	37.7711[.000]	2	-7.3286	3.4206[.048]
CPI10	2	-2.5269	43.6549[.000]	0	-6.8913	3.5835[.047]
CPI11	0	-1.2577	56.2038[.000]	0	-6.3156	1.9654[.245]
CPI12	0	-0.75451	56.1665[.000]	0	-6.6562	2.5283[.772]
WPI	0	-2.3814	45.7614[.000]	3	-8.5976	2.3682[.431]

** Critical value : -3.4919*

*** The numbers in parentheses show the levels of significance*

The results of Table 2 suggest that the null hypothesis of a unit root in the time series cannot be rejected in variable levels and in their first differences at a 5% level of significance. Therefore, no time series appear to be stationary in variable levels. When the time series are transformed into first differences they become stationary and consequently the related variables can be characterized integrated order 1, so they are I(1). Moreover, for all variables the LM(12) test first differences show that there is no serial correlation in the disturbance terms.

3. Cointegration test

The hypothesis that we must examine in this section is that changes in wholesale prices are all transformed into consumption prices so that wholesale price index and consumer price indexes are drifting together. This common drifting of variables makes linear relationships between these variables that exist over long periods of time. Therefore, we should examine the long run relationships equilibrium of these variables. Consequently, if these linear relationships do hold over long periods of time wholesale prices and consumer prices are cointegrated, but if these linear relationships do not hold over long periods of time wholesale prices and consumer prices are not cointegrated.

Then we examine with the Engle – Granger (1987) approach if the wholesale price index is cointegrated with each one of the consumer price indexes individually (since all are integrated order 1). The Engle-Granger cointegration approach is preferable in case of two variables. The steps we employed are the following:

Initially, because the two variables are I(1), we estimated with OLS method the long-run equilibrium equation,

$$CPI_{it} = \alpha_0 + \alpha_1 WPI_t + u_t \qquad (1) \qquad \text{όπου it} = 1, 2, \ldots\ldots 12$$

Table 3 - Cointegrating regressions

Variables	CONST	WPI	R^2
CPI0	77.8027	0.24686	0.671
CPI1	81.9735	0.19496	0.774
CPI2	-71.6303	1.85462	0.634
CPI3	95.9591	0.04908	0.597
CPI4	65.7572	0.37598	0.680
CPI5	88.5203	0.13089	0.657
CPI6	70.9400	0.34926	0.508
CPI7	63.2522	0.39413	0.679
CPI8	14.4946	0.46682	0.650
CPI9	91.5107	0.10207	0.474
CPI10	49.1596	0.56992	0.636
CPI11	63.5819	0.40782	0.604
CPI12	72.8377	0.29685	0.697

Table 3 presents the results of the estimates of the cointegrating vectors. From these estimates, we obtained the corresponding equilibrium errors u_t.

We test if the equilibrium errors are stationary, so that the examined variables will be cointegrated.

To test this stationarity we applied the DF/ADF unit root methodology to the estimated equilibrium errors. However, the DF/ADF equations did not include a constant term, because by construction the OLS residuals u_t are centred around zero. Table 4 presents the results of the stationarity equilibrium errors. The DF/ADF statistics show that all residuals are stationary in their levels. In other words, the equilibrium errors are integrated of zero order so they are I(0). Therefore, the variables of wholesale price index and consumer price indexes are cointegrated. It should be mentioned that critical values reported in Table 2 are not suitable for this case. Mackinnon (1991) presented critical values for these tests stated in Table 4.

Table 4 - Unit root test for equilibrium errors

Variable	Lag	DF/ADF*	LM(12)**
U1	1	-8.0622	21.7208[.041]
U2	2	-6.4536	23.5124[.024]
U3	1	-6.0295	5.85999[.038]
U4	1	-12.4241	50.6570[.000]
U5	0	-8.4540	24.2460[.019]
U6	0	-6.7359	29.6803[.003]
U7	1	-8.1589	31.9101[.001]
U8	2	-8.0511	21.7979[.040]
U9	2	-8.2955	22.3587[.034]
U10	1	-9.3895	32.6840[.001]
U11	1	-7.9436	25.8122[.011]
U12	0	-8.2704	30.8064[.002]
U13	2	-8.8697	26.4192[.009]

**Critical Values: -4.30 (1%), -3.74 (5%), -3.45(10%).*

*** The numbers in parentheses show the levels of significance*

4. Error correction models

According to the Granger (1986) representation theorem, if the two variables are cointegrated then there is a long-run relationship between them. Of course in the short-run these variables may be in disequilibrium. This short-run disequilibrium relationship between these two variables can always be described by an error correction model (ECM). In this case this error correction model which connects the short-run and the long-run behavior of the two variables is given by:

$\Delta CPIit = lagged(\Delta CPIit , \Delta WPIt) + \lambda\ ut\text{-}1 + Vt$ (2)

where Δ is reported to all variables first differences

u_{t-1} are the estimated residuals from the cointegrated regression (long-run relation-ship) and represents the deviation from equilibrium in time period t.

$-1<\lambda<0$ is the short-run parameter which represents the response of dependent variable in each period that starts from equilibrium state.

V_t is the white noise disturbance term.

Because all the variables included in above equation are stationary in first differences we could use the OLS methodology in estimating this equation. Table 5 presents the results of both estimation of short-term and long-term parameters but also the estimation of disequilibrium error coefficient.

Table 5 - Estimation of short-term and long-term trends

Variables	Short-term trend	**Error coefficients**	Long-term trend
CPI0	0.011208	**-0.087625**	0.117569
CPI1	**0.000465**	-0.003769	**0.486231**
CPI2	0.135610	-0.028312	0.650372
CPI3	0.138670	-0.534271	0.178333
CPI4	0.002923	-0.059503	0.283481
CPI5	0.034735	-0.479431	0.041782
CPI6	0.026762	-0.201622	0.199632
CPI7	0.011789	-0.078170	0.016455
CPI8	0.013095	**-0.091841**	0.026404
CPI9	0.013527	-0.434672	0.039916
CPI10	0.036170	-0.287813	0.010884
CPI11	0.024987	-0.085331	0.043838
CPI12	0.012792	-0.076690	0.212609

From Table 5 we can refer that the estimations of coefficients are statistical significant with the expected signs. This means that the monthly variations of wholesale price index affect significantly the consumer price indexes. The deviation in consumer price indexes from its long-term level is corrected per month for CPI1 and for CPI3 by –0.003.

5. Granger causality tests

The model that was estimated in the previous section, was used in order to examine the Granger causal relationships between the two variables under

examination. As a testing criterion the F statistic was used. With the F statistic the hypothesis of statistic significance of explanatory variables was tested. The results relating to the Granger causal relationships between the variables: consumer price indexes (CPI_{it}) and wholesale price index (WPI_t) appear in Table 6.

Table 6 – Granger Causality Tests

Dependent Variable	Hypothesis tested	**F_1***	**F_2***
WPI	CPI0 there is a unidirectional relationship (WP0 $\Rightarrow$ CPI1)	0.023	15.99
	CPI1 there is a bilateral relationship (WPI $\Leftrightarrow$ CPI1)	7.460	4.482
	CPI2 there is a bilateral relationship (WPI $\Leftrightarrow$ CPI2)	4.449	8.068
	CPI3 there is a unidirectional relationship (WPI $\Rightarrow$ CPI3)	0.303	5.585
	CPI4 there is a unidirectional relationship (WPI $\Rightarrow$ CPI4)	2.044	21.33
	CPI5 there is a unidirectional relationship (WPI $\Rightarrow$ CPI5)	0.605	4.557
	CPI6 there is a bilateral relationship (WPI $\Leftrightarrow$ CPI6)	4.104	9.869
	CPI7 there is a unidirectional relationship (WPI $\Rightarrow$ CPI7)	0.328	25.75
	CPI8 there is a unidirectional relationship (WPI $\Rightarrow$ CPI8)	0.739	16.63
	CPI9 there is a bilateral relationship (WPI $\Leftrightarrow$ CPI9)	5.847	11.96
	CPI10 there is a unidirectional relationship (WPI $\Rightarrow$ CPI10)	1.322	11.03
	CPI11 there is a unidirectional relationship (WPI $\Rightarrow$ CPI11)	2.774	14.14
	CPI12 there is a unidirectional relationship (WPI $\Rightarrow$ CPI12)	0.207	21.11

** Critical value: 3.18*

From the results of Table 6 for the variation of wholesale price index we refer that:

There is a unidirectional causal relationship between wholesale price index and general consumer price index with direction from wholesale price index to general consumer price index.

There is a bilateral causal relationship between wholesale price index and consumer price index of food.

There is a bilateral causal relationship between wholesale price index and consumer price index of alcoholic drinks and tobacco.

There is a unidirectional causal relationship between wholesale price index and consumer price index of clothing and footwear with direction from wholesale price index to consumer price index of clothing and footwear.

There is a unidirectional causal relationship between wholesale price index and consumer price index of housing, water, electricity, gas and other fuels with direction from wholesale price index to consumer price index of housing, water, electricity, gas and other fuels.

There is a unidirectional causal relationship between wholesale price index and consumer price index of furniture and home equipment with direction from wholesale price index to consumer price index of furniture and home equipment.

There is a bilateral causal relationship between wholesale price index and consumer price index of health.

There is a unidirectional causal relationship between wholesale price index and consumer price index for means of transportation with direction from wholesale price index to consumer price index for means of transportation.

There is a unidirectional causal relationship between wholesale price index and consumer price index for communication with direction from wholesale price index to consumer price index for communication.

There is a bilateral causal relationship between wholesale price index and consumer price index for recreation and culture.

There is a unidirectional causal relationship between wholesale price index and consumer price index for education with direction from wholesale price index to consumer price index for education.

There is a unidirectional causal relationship between wholesale price index and consumer price index for hotels, cafeterias and restaurants with direction from wholesale price index to consumer price index for hotels, cafeterias and restaurants.

There is a unidirectional causal relationship between wholesale price index and consumer price index for other goods and services with direction from wholesale price index to consumer price index for other goods and services.

6. Conclusions

The purpose of this paper is to investigate the role of wholesale price index in determining consumer price indexes in the economy of European Union and to measure their influence in a monthly period. By cointegration analysis that we used, we concluded that there is a cost transfer from wholesale price index to consumer price indexes according to the the long-run equilibrium relationship that exists between these variables.

In relation to the part of deviation of the actual variables from its long-run equilibrium level that is corrected each month, the indexes of clothing and footwear, furniture and home equipment, recreation and culture, education and health indicated the largest monthly adjustment and finally the indexes of alcoholic drinks and tobacco and food indicated the smallest monthly adjustment.

Finally, with Granger causality we referred that there is a bilateral causal relationship between wholesale price index and consumer price indexes for food, alcoholic drinks and tobacco, health and recreation and culture, while there is a unidirectional causal relationship between all the other remained indexes with the same direction from wholesale price index to consumer price indexes.

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