Price transmission analysis between Finnish and selected European broiler markets

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Tiivistelmä

The import of poultry meat in Finland has been growing since 2000, mostly in broiler. Because of the avian flu scare, there has been a ban on importing poultry from Asia for the past two years, so Finland imported broiler mostly from European 25 countries, such as Denmark, Germany and France. The market share of broiler from foreign countries is growing, so is the competition on the price. Allowing for price signals to be transmitted spatially in different markets and market integration is the key premises in economics.

One of the main goals of the EU's common agricultural policy is to get spatially integrated agricultural commodity markets within and between all member states. In an integrated market, price information should be efficiently transmitted between the member states. EU commission claims that also domestic policies and regulations applied in the member countries, should support (or at least not to distort) the goal of achieving the informational efficient single European market. Particularly in Finland, with small and remote domestic market, the issue of market efficiency and transmission of market information have significant implications for the first is actions taken in accordance of the antitrust legislation on regulating the domestic food industry structures. The second is permission for domestic agricultural subsidy programs that supplement the CAP. The main purpose of the paper is to estimate the price transmission relationship between the Finnish broiler market and selected its major exporting partners using the wholesale prices, i.e. the prices in front of the slaughterhouses in each countries. The result implies that the price level of Finnish broiler market is rather stable in comparison to the most of other EU countries, and the domestic demand and supply mostly decide the wholesale price in Finland. Finnish broiler price is not cointegrated with the price of the selected countries, indicating that there is no significant long-run relationship between them. The findings show, however, the unidirectional causality between Finnish broiler price and the prices in the other EU countries in the short run. That is, the broiler price shock of Finland appears to be driven partly by the prices of imported countries, but the reverse is not true.

Asiasanat: boiler, price transmission, cointegrated, unidirectional, causality, shock.

Johdanto

Finland is self-sufficient in poultry market. However, the import of poultry meat in Finland has been growing since 2000, mostly in broiler (See Figure 1). For example, in 2006, Finland imported some 8.1 million kilograms of poultry meat, and over 50% of the import is broiler. It was less than 10% of Finnish domestic production. Because of the avian flu scare, there has been a ban on importing poultry from Asia for the past two years, so Finland imported broiler mostly from European 25 countries[1], such as Denmark, Germany and France. The market share of broiler from foreign countries is growing, so is the competition on the price. Allowing for price signals to be transmitted spatially in different markets and market integration is the key premises in economics.

One of the main goals of the EU's common agricultural policy is to get spatially integrated agricultural commodity markets within and between all member states. In an integrated market, price information should be efficiently transmitted between the member states. EU commission claims that also domestic policies and regulations applied in the member countries, should support (or at least not to distort) the goal of achieving the informational efficient single European market. Particularly in Finland, with small and remote domestic market, the issue of market efficiency and transmission of market information have significant implications for two important domestic policy measures. The first is actions taken in accordance of the antitrust legislation on regulating the domestic food industry structures. The second is permission for domestic agricultural subsidy programs that supplement the CAP.

A wide economic literature has studied the relationship between prices, either spatial or vertical. Concerning the former, a wide recent critical review is in Fackler and Goodwin (2001). The premises of full price transmission and market integration correspond to those of the standard competition model: in a frictionless undistorted world, the Law of One Price (LOP) is supposed to regulate spatial price relations, while pricing along production chains will depend exclusively on production costs, with all firms producing on the highest isoquant compatible with their isocost lines.

Thus, the aim of this study is to examine whether either are short and long-run relationships between Finnish broiler price at gate of slaughterhouses and other selected EU countries, which are France, Germany, Holland and Denmark using cointegration and causality analyses. The contributions of the present study are twofold: Firstly, the paper provides additional evidence on the integration and cointegration experience of Finland in food market given that the available empirical literature on this study is very limited until recent years (Liu et al. 2006). Secondly, the findings can point out the direction of future research in price transmission in Finnish broiler market.

Aineisto

Data are weekly broiler prices per 100 kg in Finland, France, Germany, Denmark and Holland, covering the period from 1995 to 2004. All the price series are obtained from the Information Centre of the Ministry of Agriculture and Forestry (TIKE). The prices used in the study are the prices that are paid to the producer for one slaughtered kilogram of meat at the gate of the slaughterhouse. They don't include transportation costs to slaughterhouse. The prices are the

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[1] Austria, Ireland, Belgium, Italy, Cyprus, Lithuania, Czech Republic, Luxembourg, Germany, Latvia, Denmark, Malta, Estonia, Netherlands, Spain, Poland, Finland, Portugal, France, Sweden, United Kingdom, Slovenia, Greece, Slovakia, and Hungry

average prices of the EUROP -quality classes, which have been weighted with the slaughterweights. The observations of the countries vary from 382 to 435, listed in Table 1. Graphs of the five time series presented from Figure 1 to Figure 5, show that all of the series except for Finnish broiler price had experienced moderate increases in volatility in the past. The trend in Finnish price over this period is relatively flat, in spite of four spikes (see Figure 1). Standard Deviation statistics further supports that Finnish broiler price is the least volatile series among all. The summary of the data statistics including the skewness, kurtosis, and Jarque Bera statistics, reported in Table 1, indicates that none of the price series are normally distributed. The correlation coefficient between Finnish and France, Germany, Denmark, and Holland are 0.54, 0.21, -0.08, 0.14 respectively for the period under consideration (not shown in the table), indicating very diversified tendency to move together in response to new market information. However, correlation alone does not necessarily imply causation in any meaningful sense of that word. The econometric graveyard is full of magnificent correlations, which are simply spurious or meaningless.
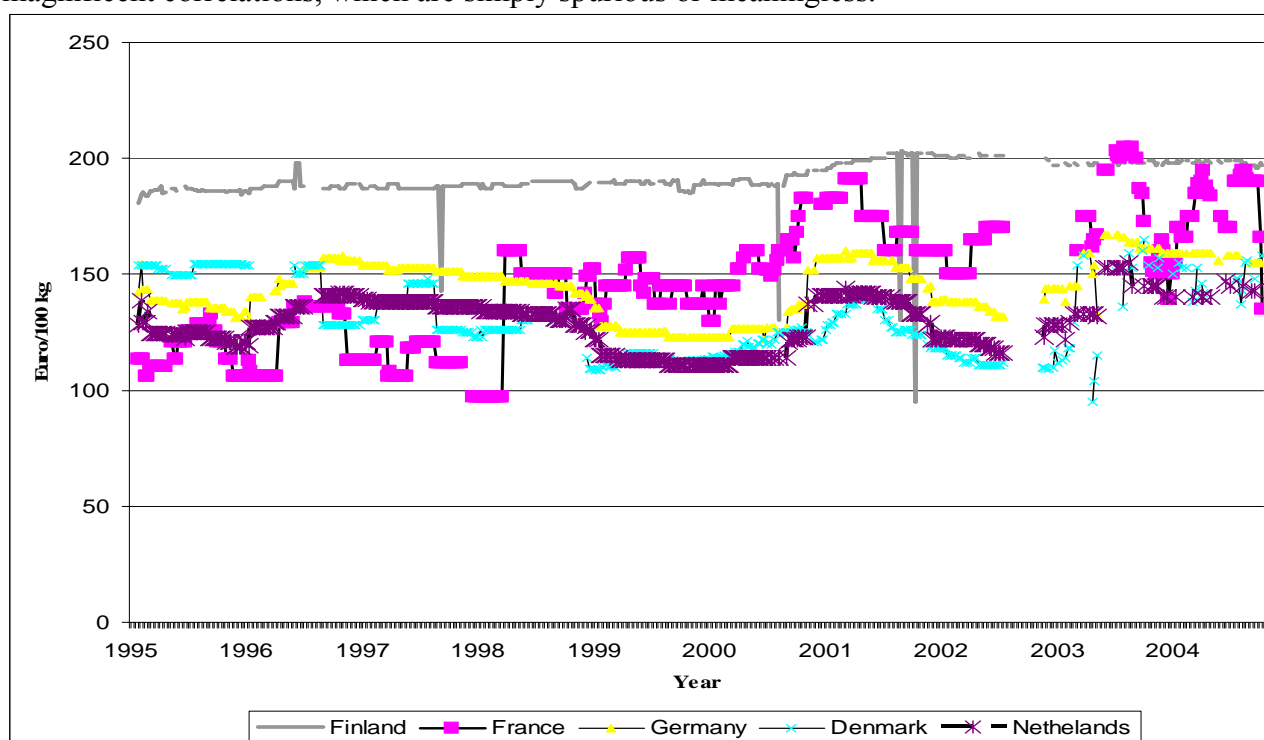

Figure1 Broiler prices in Finland and other selected EU countries.

Table 1. Summary of statistics of the broiler price in Finland, France, Germany, Denmark and Holland.

	Finland	France	Germany	Denmark	Holland
Mean	191.41	144.71	144.02	129.92	128.76
Median	189.55	144.83	146.00	126.00	130.00
Maximum	203.00	205.00	167.00	165.00	155.00
Minimum	95.00	97.00	122.00	95.00	110.72
Std. Dev.	8.58	26.68	12.11	15.40	10.73
Skewness	-5.17	0.11	-0.29	0.41	-0.13

Kurtosis	51.63	2.17	1.93	1.89	2.02
Jarque Bera	44792	12.97	25.99	30.18	17.23
Observations	435	425	426	382	405

Menetelmät, Tulokset ja tulosten tarkastelu

Testing for unit roots, cointegration and causality

Unit root test

Testing for cointegration can be performed in a bivariated or multivariate framework. However, given the present study focuses on the relationship between Finland and other European countries, the discussion is strictly restricted below to the bivarate frame work. Let $\ln p_t^{Fin}$

$\ln p_t^{France}$, $\ln p_t^{Germany}$, $\ln p_t^{Denmark}$ and $\ln p_t^{Holland}$ represent broiler prices of Finland, France, Germany, Denmark and Holland respectively with t = 1, 2, 3,…., T, where T is the sample size. The econometric methodology firstly examines the stationarity properties of the univariate time series. Test for stationarity for price series, denoted by and the order of integration of the individual price series. The series is integrated of order d denoted I(d) if it attains stationarity after differencing d times. If the series is I(1) it is deemed to have a unit root. Stationarity of the price processes is tested using a group of unit roots which include the Augmented Dickey-Fuller (ADF) test (1976), Phillips-Perron test (PP) (1988), and a test developed by Kwiatkowski-Phillips-Schmidt-Shin (KPSS) (1992). While the ADF, PP tests state the null hypothesis of non-stationarity or the presence of a unit root, the KPSS test defines stationarity as the null. The Monte Carlo simulations by Schwert (1989) showed that the ADF tests have low power and are sensitive to the choice of lag-length. The unit root tests are known to have low power problems in small samples, particularly, if the series include structural breaks (Kwiatkowski et al.1992; Leybourne & Newbold 2000).

The KPSS tests, on the other hand, have good power properties. PP test is an alternative (nonparametric) method of controlling for serial correlation when testing for a unit root. Since no single unit root test is without some statistical shortcomings, in terms of size and power properties, a group of unit root tests are applied to statistically determine the order of integration of the time-series used in cointegration analyses. The unit root test statistics are reported in Table 2. It is clear from ADF, KPSS and PP test statistics that a unit root is unlikely for the variables of Finland and France i.e. they are stationary in levels or integrated of order zero, $I(0)$, on the contrary, variables of Germany, Denmark and Holland uniformly tends to have a unit root i.e. they are non-stationary in levels or integrated of order zero $I(1)$.

Table 2. Unit Root Tests

	ADF (intercept included)	ADF (intercept and trend included)	KPSS (intercept and trend included)	Phillips-Perron (intercept included)
Finland	-15.59***	-18.17***	0.21	-17.27***
France	-2.73*	-3.51**	0.12	-2.78*
Germany	-1.7	-1.58	0.29***	-1.96
Denmark	-2.03	-0.53	-0.45***	-2.08
Holland	-2.11	-2.13	0.25***	-2.05

The hypothesis testing of cointegration have two conditions: $I(1)$ of the individual series, and $I(0)$ of a linear combination (Engle and Granger, 1987). In the other words, conintegration refers only to the second part of the hypothesis i.e. the test is performed conditional on the fact that each individual series is $I(1)$. The result from Table 2 show that the Finland and France variables are I(0) and Germany, Denmark and Holland are I(1). This suggests that it would be infeasible to consider a cointegration analysis between Finland and the other EU counterparts, which implies the broiler price of Finland and other EU countries are not linked to a common long-run equilibrium. It indicates that price development on the Finnish broiler market is affected by factors in domestic market rather than the factors from outside.

Causality test

Even though the previous section concludes no cointegration between broiler price of Finland and the ones of the other four EU countries, conventional Granger causality approach applies. The conventional Granger causality test (Granger, 1969 and 1988) is based on the hypothesis that variable X and Y are stationary or I(0) time series. Variable X granger causes Y if the prediction of Y is improved by including past values of X than by not including them if other relevant information, including past values of Y, are also considered. It therefore follows that tests for causality are essentially tests of the prediction ability of time/series models. In details, we perform Granger causality test on a bivariate, k^{th} order vector autoregressive (VAR(k)) representation in which $\ln p_t^{Fin}$ depends upon lags of itself and lags of $\ln p_t^{France}$, or lags of $\Delta \ln p_t^{Germany}$, $\Delta \ln p_t^{Denmark}$ and $\Delta \ln p_t^{Holland}$ [2] (See equations 1-2).

$$\ln p_t^{Fin} = \alpha_0 + \sum_{j=1}^{k} \beta_{1j} \ln p_{t-j}^{Fin} + \sum_{j=1}^{k} \lambda_{1j} \ln p_{t-k}^{France} + \mu_{1t}$$

$$\ln p_t^{Fin} = \alpha_1 + \sum_{j=1}^{k} \beta_{2j} \ln p_{t-j}^{Fin} + \sum_{j=1}^{k} \lambda_{2j} \Delta \ln p_{t-k}^{Germany} + \mu_{2t}$$

$$\ln p_t^{Fin} = \alpha_2 + \sum_{j=1}^{k} \beta_{3j} \ln p_{t-j}^{Fin} + \sum_{j=1}^{k} \lambda_{3j} \Delta \ln p_{t-k}^{Denmark} + \mu_{3t}$$
$$(1)$$

$$\ln p_t^{Fin} = \alpha_3 + \sum_{j=1}^{k} \beta_{4j} \ln p_{t-j}^{Fin} + \sum_{j=1}^{k} \lambda_{4j} \Delta \ln p_{t-k}^{Holland} + \mu_{4t}$$

$$\ln p_t^{France} = a_0 + \sum_{j=1}^{k} b_{1j} \ln p_{t-j}^{France} + \sum_{j=1}^{k} c_{1j} \ln p_{t-k}^{Finland} + \mu_{1t}$$

$$\ln p_t^{Germany} = a_1 + \sum_{j=1}^{k} b_{2j} \ln p_{t-j}^{Germany} + \sum_{j=1}^{k} c_{2j} \Delta \ln p_{t-k}^{Finland} + \mu_{2t}$$

$$(2)$$

$$\ln p_t^{Denmark} = a_2 + \sum_{j=1}^{k} b_{3j} \ln p_{t-j}^{Denmark} + \sum_{j=1}^{k} c_{3j} \Delta \ln p_{t-k}^{Finland} + \mu_{3t}$$

$$\ln p_t^{Holland} = a_3 + \sum_{j=1}^{k} b_{4j} \ln p_{t-j}^{Holland} + \sum_{j=1}^{k} c_{4j} \Delta \ln p_{t-k}^{Finland} + \mu_{4t}$$

Here, Δ denotes the first differenced operator e.g. $\Delta \ln p_t^{Germany} = \ln p_t^{Germany} - \ln p_{t-1}^{Germany}$, and $\mu_{.j}$ denote the random disturbances in each equation, assumed to have zero mean, constant variance and are uncorrelated.

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[2] Since $\ln p_t^{Fin}$ and $\ln p_t^{France}$ are $I(0)$ series; $\ln p_t^{Germany}$, $\ln p_t^{Denmark}$ and $\ln p_t^{Holland}$ are $I(1)$

The Wald test is employed to investigate Granger causality. The null hypothesis of each test is that there is no Granger causation. As listed in Table 3, the F statistics for Granger causation with k lags of VAR are chosen by Akaike(1974) Information Criterion (AIC). The model with the smallest AIC value is selected when it minizises the residual sum of squares.

Table 3. Granger causality Wald tests for the null hypotheses of no Granger causation

Direction of causality[a]	F statistics	Lags number	Result[b]
Broiler price of Finland and France			
$\ln p_t^{Fin} \rightarrow \ln p_t^{France}$	0.99	3	Do not reject
$\ln p_t^{France} \rightarrow \ln p_t^{Fin}$	8.09	3	Reject
Broiler price of Finland and Germany			
$\ln p_t^{Fin} \rightarrow \Delta \ln p_t^{Germany}$	1.000	7	Do not reject
$\Delta \ln p_t^{Germany} \rightarrow \ln p_t^{Fin}$	1.715	7	Reject[c]
Broiler price of Finland and Denmark			
$\ln p_t^{Fin} \rightarrow \Delta \ln p_t^{Denmark}$	0.39	7	Do not reject
$\Delta \ln p_t^{Denmark} \rightarrow \ln p_t^{Fin}$	5.37	7	Reject
Broiler price of Finland and Nethelands			
$\ln p_t^{Fin} \rightarrow \Delta \ln p_t^{Holland}$	0.86	7	Do not reject
$\Delta \ln p_t^{Holland} \rightarrow \ln p_t^{Fin}$	2.24	7	Reject

[a]The arrow, →, indicates the direction of Granger causality.
[b]GC denotes that there is Granger causality, and no GC denotes there is no Granger causality at 5% significant level
[c]10% significant level

Clearly, the test statistics show that there is no evidence of bi-directional Granger causality between Finnish broiler price and the prices of other selected European countries. In contrast, the Granger causality between Finnish broiler price and other EU countries is one directional. In details, the null hypothesis that broiler price of Finland is non Granger causal for France, Denmark and Holland is not rejected mostly at 5% significant level, and for Germany is not rejected at 10% significant level; the reverse causality from selected other European countries to Finland is rejected at 5% level of significance.

One-way causation between broiler price of Finland and of other selected EU countries suggests that "past and present" history of broiler prices in other EU countries are useful information to improve prediction of Finnish broiler price. However, the role of Finland in price signaling in broiler market is very trivial. .

Johtopäätös

This study examines the broiler price relationship between Finland and selected European countries, including Germany, Denmark, Holland, France using the methodology of Granger casality and vector auto regression (VAR). This study covers an important area of applied work in international trade between Finland and other major broiler producing countries in EU, which has relatively few studies until recently. The findings show that the broiler price in Finland is stationary, i.e. $I(0)$ while the broiler prices of selected other EU countries are inconclusive, i.e. either $I(0)$ or $I(1)$ depending on the specific unit root test procedures. These findings do suggest that there is no long-run relationship between Finnish broiler price and selected EU countries. It implies that in the long term trend of volatile broiler price in other European major exporting countries such as Germany,

Denmark, France have very limited impact on relatively stable Finnish broiler market. However, based on the Granger-sausation tests via a bivariate VAR approach, the study finds that there is a one-way directional causality between Finnish broiler price and selected EU countries. That is, the price of Finnish broiler is Granger caused by shocks coming from other EU countries, but not the other way around. Remote from EU continental countries, broiler price in Finland is likely to be the result from domestic demand and supply rather than from outside of country. High self sufficiency and strict quality control rules for the importing poultry products may explain partly the result. However, as Finnish import of poultry products from outside Finland goes up, especially with strong euro, cheap poultry goods directly and indirectly[3] importing from Brazil and Tailand may change the situation in the future. To be integrated into global market, the broiler price of Finland will become increasingly volatile in the future

Kirjallisuus

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[3] For example, Finland have imported increasingly big amount of poultry good from Holland, which have been originated from Brazil during recent years.