DYNAMIC INVESTIGATION OF THE PURCHASE PRICE AND QUANTITY OF MAIZE AND PIG

A KUKORICA ÉS A SERTÉS FELVÁSÁRLÁSI ÁRÁNAK ÉS MENNYISÉGÉNEK IDŐBELI VIZSGÁLATA

POÓR Judit*, HEGEDŰSNÉ BARANYAI Nóra

Pannon University Georgikon Faculty of Agriculture, Department of Economic Methodology
Telephone: +36/20-457-57-78, Fax number: +36/88-545-143, E-mail address: pj@georgikon.hu

ABSTRACT

The aim of our examination was to show the cyclic character in the case of agricultural prices. Beside the investigation of prices the analysis of the purchased quantity is of importance too. We examined the way the prices and quantity exercise mutual influence and the connection between the maize purchase price and the pig purchase price. We compared the Hungarian purchase prices with some international ones, and analyzed the tendencies, the influence of open economies and the approach of the prices.

Keywords: Cyclicism, Purchase Price and Quantity, Maize, Pig, Open Economy

ÖSSZEFOGLALÓ

Vizsgálatunk célja, hogy a főbb mezőgazdasági termékek áraiban rejlő ciklikusságot kimutassa. Az árak vizsgálata mellett a felvásárolt mennyiség elemzése is fontos. Kimutattuk az árak és mennyiségek kölcsönösen egymásra hatását. A késleltetett regresszió analízis segítségével taglaltuk a kukorica és a sertés felvásárlási ára közötti kapcsolatot. Hazánk felvásárlási árait összehasonlítottuk néhány országéval, vizsgálva a tendenciákat, a nyitott gazdaságok hatását és az árak közeledését.

Kulcsszavak: Ciklikusság, Felvásárlási ár és mennyiség, Kukorica, Sertés, Nyitott gazdaság

POÓR Judit, HEGEDŰSNÉ BARANYAI Nóra

DETAILED ABSTRACT IN HUNGARIAN

A rendszerváltás után több mint egy évtizeddel és az Európai Uniós csatlakozást követően nagy jelentőséggel bírnak az elmúlt időszakot vizsgáló kutatások és a jövőt megcélzó előrejelzések. A magyar gazdaság élelmiszer termelése és azon belül is az árak alakulása nagyon fontos makrogazdasági kérdés.

A felvásárlási- és piaci ár havi alakulását 1994. és 2005. között vizsgáltuk. Az elemzéseinknél a determinisztikus idősor-elemzési módszert alkalmaztuk, melynek lényege, hogy az idősor összetevőit (a trendet, a szezonalítást, a ciklust és a véletlent) elkülöníti egymástól, így lehetőség nyílik kizárólagosan a ciklushatás kimutatására. A ciklus pedig nem más, mint az idősor hosszabb távú hullámzása, mely konjunkturális és dekonjunkturális szakaszokból áll. Alakulásának vizsgálatából a jövőre nézve tehetünk megállapításokat (4).

A mezőgazdasági termelői árakra rendkívül sok tényező hat, így például a kereslet, a kínálat, a piac, a kormányzati hatások stb. Az élelmiszertermékek iránti kereslet rendszerint árrugalmatlan, azaz a kínálatban bekövetkező változások általában nagy árváltozásokkal járnak együtt. A mezőgazdasági termékek kínálata az időjárás, és egyéb okok miatt előre nem látható változékonyságot mutat. A kereslet rugalmatlansága magyarázatul szolgálhat az agrártermékek árában tapasztalható fluktuációra (9).

Az általunk vizsgált három gabonaféle (búza, kukorica, árpa) felvásárlási árának ciklikus hullámzása hasonló képet mutat, amit az első ábra szemléltet. A konjunkturális és dekonjunkturális szakaszok kétévente váltották egymást. Az átlaghoz képesti kilengések az idő előrehaladtával csökkenő tendenciát mutattak. Az időjárás, mint véletlen tényező döntő szerepet játszik a termelt mennyiség, és ennek következtében az árak alakulásában. Az ugyanazon éghajlati viszonyokat kedvelő búza, árpa és kukorica minősége és mennyisége is azonos módon változik. Elemzéseink során rávilágítottunk azoknak a befolyásoló tényezőknek a szerepére, amelyek döntő hatással voltak az általunk vizsgált termékek árainak alakulására.

Az árak vizsgálata mellett kiemelt jelentőséggel bír a felvásárolt mennyiségek elemzése is. Vizsgálatokat végeztünk arra vonatkozóan, hogy az árak és a mennyiségek időbeli változása milyen módon hat egymásra. A vágósertés felvásárlási mennyiségének és átlagárának ciklikus alakulását vizsgálva például megállapítható, hogy a mennyiség és az ár csúcs- és mélypontjai ellentétesen alakulnak, melyet a második ábra mutat. Vizsgálataink során késleltetett regresszió analízist végeztünk, melynek alapján megállapítható, hogy az árváltozás három hónappal megelőzi a mennyiség változást (R = 0,35).

Dolgozatunkban az általunk vizsgált mezőgazdasági termékek közül a kukoricára és a sertésre vonatkozó eredményeinket közöljük, melyet az indokol, hogy e két termék felvásárlási árának kölcsönös egymásra hatása szembetűnő. Vizsgálataink rámutattak arra a tényre, hogy a kukorica árában bekövetkező változásra a sertés ára 11 hónappal később reagál (R = 0,6). A természetes piaci reakciókat erőteljesen befolyásolhatja továbbá a behozatal, az állami beavatkozások valamint a hazai fogyasztás alakulása.

Elemzésünket nemzetközi kitekintéssel gazdagítottuk, melynek során ábrákkal és számításokkal is bizonyítottuk, hogy az egymás felé nyitott gazdaságokban a piac egységessé válása révén a termékek árai közelednek egymáshoz. A közeledést jól jellemzi a termelői árak alapján számított szóródási mutatószámok időbeli csökkenése, melynek révén az átlagár immár tükrözi az egyes termékek egységes ellenértékét.

Elemzéseink adatbázisául egyrészt a Központi Statisztikai Hivatal által közzétett havi felvásárlási árak és mennyiségek szolgáltak, másrészt az EUROSTAT AgrIS adatai (1).

INTRODUCTION

Not only the economic but also the social importance of Hungarian agriculture is significant. More than a decade after the political transformation and thereupon accession to the European Union research examining the past period and predictions aimed at the future are of importance.

Food production in the Hungarian economy and within that, the tendency of the prices is an important macroeconomic question. For this reason we examined the price changes of the main agricultural products of Hungary.

MATERIAL AND METHODS

We examined the monthly tendencies of purchase and market prices between 1994 and 2005 (monthly average of 1993 = 100%). In our analyses we applied deterministic methods of time series analysis. The aim of our examination was to show the cyclic character in the case of agricultural prices. On the course of analysis we put an emphasis on the role of influential elements, which affected the tendency of prices of the products examined. Beside the investigation of prices the analysis of the purchased quantity is of importance, too. We examined the way the prices and quantity exercise mutual influence on each other.

In the following study we show the cyclic characteristics of the tendency of the purchased quantity and the price

of cereals, with special regard to maize as well as pig sales. Interference of the purchase price of maize and pig is visible.

We added international outlook to our examination, in the course of which we proved by figures and calculations that the prices of products go together in economies open to each other in the framework of the single market of the EU. The value of dispersion indicators calculated on the basis of purchase prices decrease with time, which characterizes the convergence of prices. The average price already reflects the homogeneity in the value of the certain products.

The source of data is the publication of the Hungarian Central Statistical Office (HCSO): Monthly Bulletin of Statistics and data of the EUROSTAT AgrIS (1, 7).

RESULTS AND DISCUSSION

Cyclicism of the Purchase Price and Purchased Quantity of Maize

We examined the tendency of monthly purchase average price and quantity of maize from January 1994 to September 2005. The purchase average price of maize increased by 0.12 forint per kilogram monthly. Cyclicism is characteristic of the purchase average price of maize. Three cycles could be observed in the period under survey. Analyzing the cyclicism of the purchased quantity and average price it can be laid down that the cycles of the purchased quantity showed much more hectic behavior

than the price.

In 1995 a guaranteed price was introduced, export support was given for the maize trade, which boosted the tendency of the price. A rainy autumn, delayed harvest, the increase of the price of natural gas, and high drying costs are characteristic of the maize production of 1996. The purchase prices increased because of the lack of feed maize and of domestic demand expansion. The period of growing purchase average prices lasted till October 1996, then recession followed.

In 1997 a problem was caused by the fact that the stored maize of 1996 still remained unsold till the sowing in 1997. Thus a surplus resulted together with the produced maize of 1997, which led to price decrease. In December 1998 a mild decrease of the purchase prices and the market prices followed. In 1998 the autumn was very wet; therefore the autumnal works were completed only in the spring of 1999 (6). By this means the sowing of maize was delayed, only the early maize was sowed, with usually lower yields. This forecasted a lower production volume, which lead to the increase of the price. In 2000 the sowing of maize delayed again because of the weather, which caused the same problem as in 1999, in consequence of which the average price of maize kept increasing in 2000 (6).

The cycle reached a newer peak in February 2001, by more than thirty percent positive divergence. The influence of the increased amounts of produce became visible in increasing prices in 2001. Damage caused by
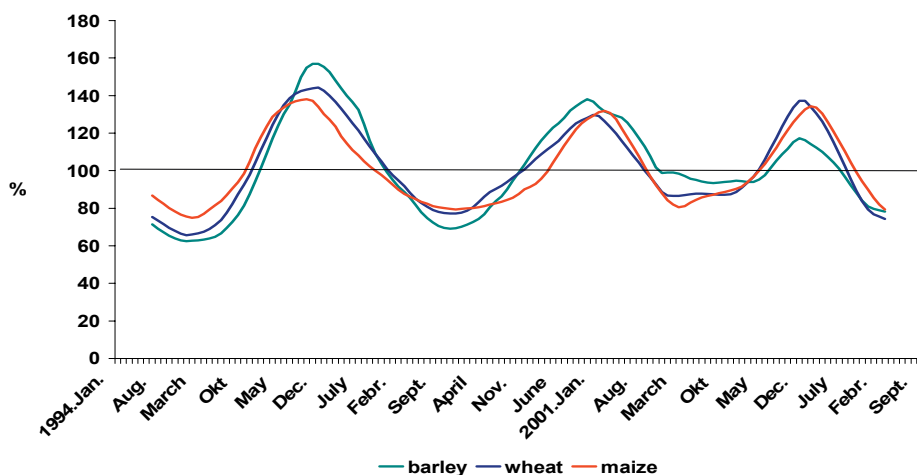

Figure 1: **Cyclicism of the Monthly Average Purchase Price of Cereals, 1994-2005**
(Source: Authors' Calculation on the Basis of the Data of the Monthly Bulletin of Statistics)
1. ábra: **A gabonafélék havi felvásárlási átlagárának ciklikussága, 1994-2005**
(Forrás: Szerzők saját számítása a Statisztikai Havi Közlemények alapján)

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the weather and the pest Diabrotica Virgifera Virgifera influenced favorably the production. Recession was characteristic of the cycle of the purchase average price till March 2000, from this period a newer boom began till the second month of 2004 (6). In 2003 the sowing area decreased, the forecasts threatened of poor harvest, in consequence of this the price increased from spring. The record production of 2004 resulted in decreasing prices (6).

The market average price of maize was formed in a similar manner as the purchase average price. The peaks and troughs of the cycles concurred in the first nine years of the period under survey.

According to the prediction of the European Union the average price of maize will decrease to a certain degree in the short run in the EU-25. Owing to the development of the livestock farming of Middle-Eastern and Southeast Asian countries demand of the maize will increase in the future.

The cyclical behavior of the purchase price of the three cereals examined shows a similar picture as Figure 1 represents. The rising and declining periods, which show the deviations from the trend in terms of percentage, changed every two year. Moreover it can be determined that the deviations from the average were on the decline.

The weather as a casual factor plays a key role in the tendency of the produced quantity, and in consequence, the price. The quality and the quantity of the wheat, the barley and the maize crops preferring the same climatic conditions change in the same way.

Cyclicism of the Purchase Price and Purchased Quantity of Pig for Slaughter

We analyzed the tendency of purchase price and purchased quantity of pig for slaughter between 1994 and 2005, as Figure 2 shows. The average purchase price of pig for slaughter increased on an average by 1,08 Ft/kg/month. Three complete cycles can be observed in the average purchase price and quantity time series in the period under survey.

At the beginning of the research a boom can be seen till June 1995, because of the low supply of pigs slaughtered. In the second half of 1995 neither the domestic market nor the foreign countries were ready to pay the high purchase price, therefore prices decreased. At the beginning of 1996 a new price decline was observed because of the market surpluses. The decrease of the export subvention caused the decrease of the purchase price of pigs for slaughter, which tendency kept till June 1996. From the end of 1996 the demand increased as well as the purchase price, more than the powerful increase in maize prices. As a result of the significant import from December 1997

the price of pigs for slaughter began to decrease, this declining period kept till May 1999 (6). At this time the Ministry of Agriculture and Rural Development fixed the guaranteed purchase price in a decree. In this year the sow cutting increased.

This situation resulted in the increase of the cycle of the purchase and the market price in 2000, since excessive demand was formed in the market. The increase in price kept till July 2001, to which another factor contributed, namely the foot and mouth disease, which further decreased the pig supplies. At the beginning of 2002 the support of the export ended, which reduced the pig-farming disposition. In 2003 a price board was established to develop the Hungarian price system to follow the purchase prices of the European Union. In the same year 80-100 thousands pigs had to be deducted in the market, that the relative balance was re-established and the prices did not decrease drastically (6). In 2004 the growers demonstrated to achieve that above the support by the EU the Hungarian government pay national support for them.

In 2004 farmers who purchased the feed directly after the harvest got 50 percentage of credit and interest support on 50% of the acquisition. In 2005 the number of pigs sank under 4 million, and this number decreased continuously. However, the growth of international trade is expected in the coming years (6).

On the basis of former researches we can conclude that cyclicism is experienced through the analysis of the average market price of pig for slaughter. In the case of pig for slaughter the conclusion is that the change of the average market price follows the change of the average purchase price.

Examining the tendency of the cyclicism of the purchased quantity and purchase price of pig for slaughter we can observe that the periods of upswings and declines of the quantity and the price were formed in the opposite direction, as Figure 2 shows. We applied delayed regression analyses in the course of our researches, on the basis of which it can be proved that the price change precedes the quantity change with three months (R = 0.35). Since the change of independent variable (purchase price of maize) resulted in earlier years influenced dependent variable (purchase price of pig for slaughter), delayed regression analyses is justified (5).

Mutual influence of the purchase price of maize and pig is visible. The decrease of the price of maize urges the pig-farmers to increase the number of pigs in the hope of high profit in the longer term. The demand for maize rises resulting in the increase in prices, which hinders the pig-farming disposition. The import, the state interventions, and the tendency of domestic consumption may also

influence the natural market reactions.

To sum it up: in the period under survey the purchase price and quantity of most agricultural produces show cyclicism. Not only the demand and the supply, but also the weather influences the tendency of the cycle in great extent. The tendency of the weather can not be accurately forecast. However, the supply quantity depends on this factor and the supply influences the demand, therefore, we can not tell with great certainty how the tendency of the cycle is going to be formed.

International Outlook

Economic experts agree that the prices of products automatically conform in open economies that are working toward a single market. According to certain theories only one single price is possible in the end, which is called the uniform price principle. In fact, it is not sure that the perfect single market can be realized since we can not talk about perfectly segmented markets, either real markets are situated between these two concepts (10). But as we notice in the above mentioned tendency, it is notable in the case of main agricultural products. The decrease in time of dispersion indicators calculated on the basis of the purchase prices characterizes the approaching of prices well, so that the average price already reflects the homogenous counter value of the certain products.

The world market prices of agricultural products showed continuously decreasing tendency past century (2). According to Grilli and Yang the real prices of food products (cereals, meat, dairy product, sugar) decreased on an average by 0,5 percentage/year between 1900 and 1986 (3). Similarly to the world market prices the prices of agricultural products decreased in European Union from 1990, too. The producer prices and the purchase prices of the member countries considerably differ from each other, still in the case of products regulated priced.

The difference between the producer prices of countries is owing to the difference of production costs, natural endowments, efficiency, taxes, wages, and land tax. Since the European Union is not uniform considering these factors, therefore we can not talk about uniform producer price and purchase price (8).

Data of the EUROSTAT AgrIS give the database of our examination. From the countries of the European Union, the examined prices of the products were available from 1990 to 2003 in the case of Austria, the United Kingdom and France, from 1991 to 2003 in the case of Germany, from 1995 in the case of Slovakia and from 1998 in the case of Hungary. We prepared the dispersion examination between 1998 and 2003 in order to get a favorable of data comparison.

Tendency of International Purchase Price of Maize

In the AgrIS database data relating to the United Kingdom do not exist. In the case of Austria, France and Germany the purchase price decreased from about 18 Euro/100 kg to about 12 Euro/100 kg. The purchase prices of the countries recently accessed by the European Union did
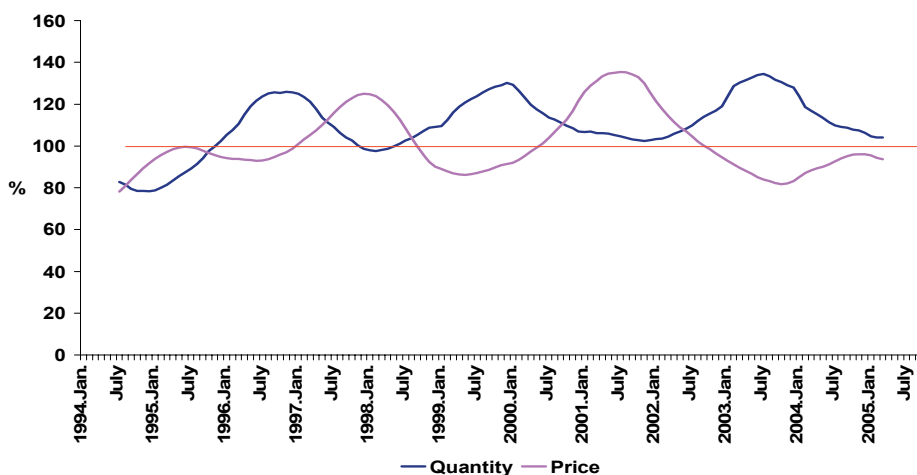

Figure 2: **Cyclicism of the Monthly Average Purchase Price and Purchase Quantity of Pig for Slaughter, 1994-2005** (Source: Authors' Calculation on the Basis of the Data of the Monthly Bulletin of Statistics)
2. ábra: **A vágósertés havi felvásárlási átlagárának és mennyiségének ciklikussága, 1994-2005**
(Forrás: Szerzők saját számítása a Statisztikai Havi Közlemények alapján)

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not reach the purchase price of the three above-mentioned countries in the period under survey, but followed their tendencies, as Figure 3 shows.

While the prices of the old member countries of the European Union conformed to each other, the price tendency of the in the new member countries were influenced by the surging of the mean remarkably (see Table 1).

Due to the drop in the price of the Hungarian maize in 2001 the coefficient of variation fell in 2000, then rose again in 2001. In the period under survey the last two years have experienced a homogenization.

Tendency of International Purchase Price of Pig Meat

From 1995 we can experience a similar tendency in the examined countries, reflected by the settled dispersion indicator as well. We can talk about a more hectic price tendency compared to cereals.

Table 1: **Tendency of the Average Purchase Price and the Coefficient of Variation of the Examined Countries in the Case of Maize** (Source: Authors' calculation on the Basis of the Data by AgrIS)
1. táblázat: A vizsgált országok felvásárlási árának átlaga és relatív szórása a kukorica esetében (Forrás: Szerzők saját számítása AgrIs adatok alapján)

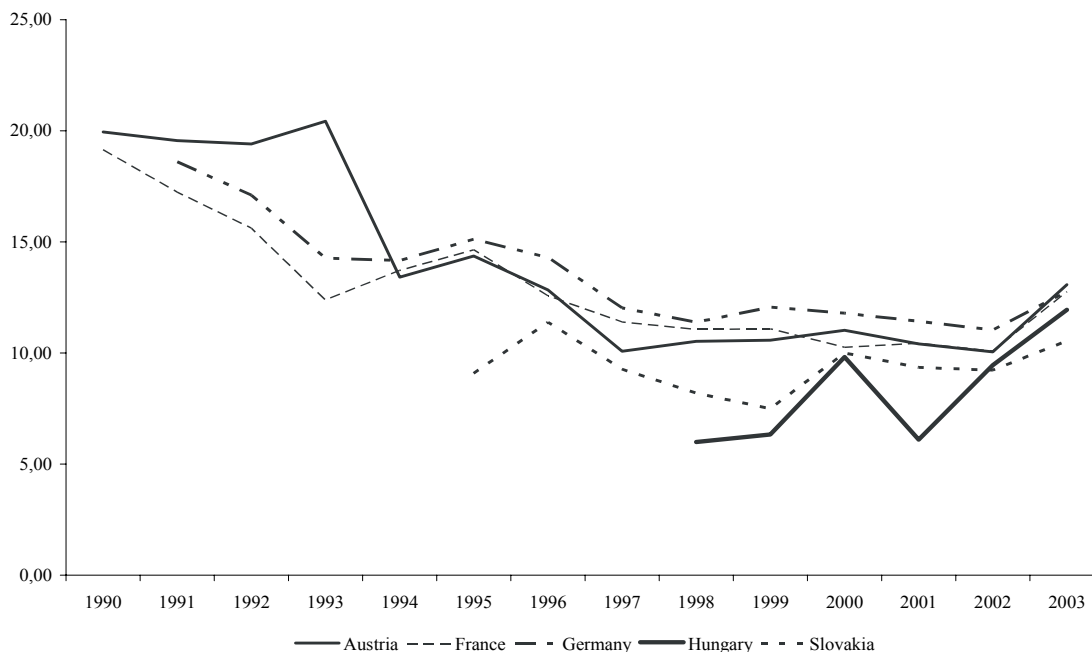| Year	Mean	Coefficient of Variation	Year	Mean	Coefficient of Variation
	Euro/100kg	%		Euro/100kg	%
1998	9.43	24.3	2001	9.55	21.6
1999	9.51	25.9	2002	9.97	7.0
2000	10.58	7.7	2003	12.22	8.4

Figure 3: **Tendency of the Purchase Price of Maize, Euro/100 kg**
(Source: Authors' Diagram on the Basis of the Data by AgrIS)
3. ábra: **A kukorica felvásárlási árának alakulása, Euró/100 kg**
(Forrás: AgrIs adatok alapján)

Change of demand of the market affected the unstable price tendency influenced, on one hand, by fashion, on the other hand, by the different swine diseases (foot and mouth disease, Bovine Spongiform Encephalopathy (BSE)).

CONCLUSION

The weather as a casual factor has a key role in the change of the produced quantity, and in consequence, the price. Beside the weather the demand on equilibration of the demand and the supply market significantly influences the cyclicism.

The price and the quantity of pigs for slaughter are stated by several factors as a combined effect. The interaction of the demand and the supply market, the export and import, the support, the domestic consumption, and the forage price can be considered as most important factors. The cost of forage considerably influences the price of pig for slaughter, which is proved by delayed regression analyses of the price of maize and pig for slaughter.

The purchase prices of examined products show similar tendency in the countries of the European Union in the period under survey. It is mainly due to the fact that these products are regulated in the European Union. From the point of view of Hungary it means that the prices of the member countries significantly influence the domestic purchase prices. These results seem to become even stronger in the future. Unfortunately monthly data are not available for international comparison.

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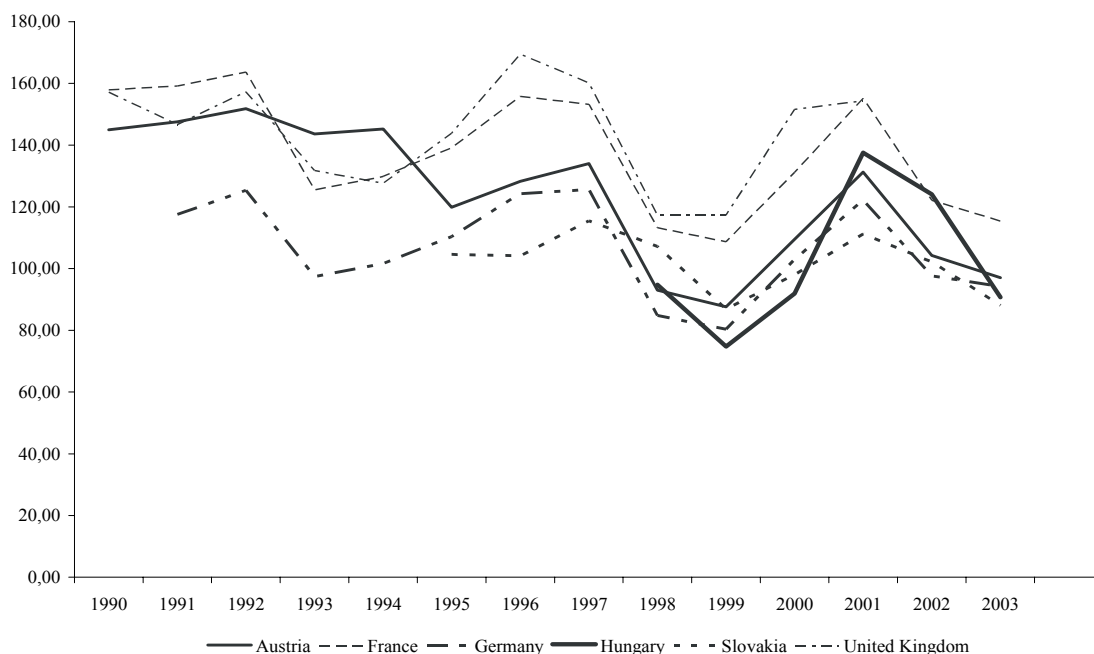
***Figure 4*: Tendency of the Purchase Price of Pig Meat, Euro/100 kg**
(Source: Authors' Diagram on the Basis of the Data byAgrIS)
4. ábra: **A sertés felvásárlási árának alakulása, Euró/100 kg**
(Forrás: Szerzők saját számítása AgrIs adatok alapján)

Table 2: **Tendency of the Average Purchase Price and the Coefficient of Variation of the Examined Countries in the case of Pig Meat** (Source: Authors' Calculation on the Basis of the Data by AgrIS)
2. táblázat: A vizsgált országok felvásárlási árának átlaga és relatív szórása a sertés hús esetében (Forrás: Szerzők saját számítása AgrIs adatok alapján)

Year	Mean	Coefficient of Variation	Year	Mean	Coefficient of Variation
	Euro/100kg	%		Euro/100kg	%
1998	101.74	12.6	2001	135.33	12.9
1999	92.61	18.0	2002	110.07	11.1
2000	114.21	19.9	2003	97.11	11.1

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