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COMPONENTS OF THE REAL EXCHANGE RATE IN HUNGARY

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Abstract

This paper provides a statistical analysis of the components of real exchange rate in Hungary for the period 1991-1996. The real exchange rate is decomposed into a tradable and a nontradable rate.

The following main conclusions are valid:

1. The Balassa-Samuelson effect, which presumes a real appreciation when productivity in the tradable sector grows faster than in the nontradable sector, is markedly substantiated by the data for Hungary.

2. The homogeneity assumption of the traded sector is not justified by the data. The traded sector defined by the usual statistical terms does not indicate PPP to hold.

3. The relative (common currency) price of the traded sector shows fluctuations driven by changes in the nominal exchange rate.

4. Fluctuations in the relative (common currency) price of the traded sector are larger than fluctuations of relative prices of nontradables in terms of tradables. In other words prices of the traded and non-traded sectors behave similarly to nominal exchange rate shocks: they have similar inertia.

5. A summary conclusion comprising findings of 1-4: for Hungarian data the definition of statistical categories of trading and non-trading sectors are useful in separating industries according to their rate of technological change, but it is much less helpful in separating good substitutes from poor substitutes for internationally traded goods.

In section 1 we describe the way we decomposed the real exchange rate. In section 2 we try to explain the determinants of the components, in section 3 we try to arrive to a quantification of the rate of change of the equilibrium real exchange rate in Hungary.

Data and simplifying assumptions

The real exchange rate to be decomposed is based on value added data. Throughout the paper when referring to prices we always mean value added prices.

The data sources were the national income statistics of the Central Statistical Office for Hungary, and the OECD Annual National Accounts, OECD Quarterly National Accounts for the trading partners.

The definition of the sectors was the following. Manufacturing industry was considered to be the tradable sector and services the nontradable sector. This classification is the most common in analyses of this kind.[1] Government services, agriculture, mining and energy were excluded from the analysis in the first round. The reason for the exclusion of government services and the energy sector is that in the period of 1991-1996 prices in these sectors were mostly regulated and therefore contain elements of arbitrariness. As to agriculture we are too uncertain in the assessment of developments during the period, therefore its effect on the real exchange rate will be discussed separately.

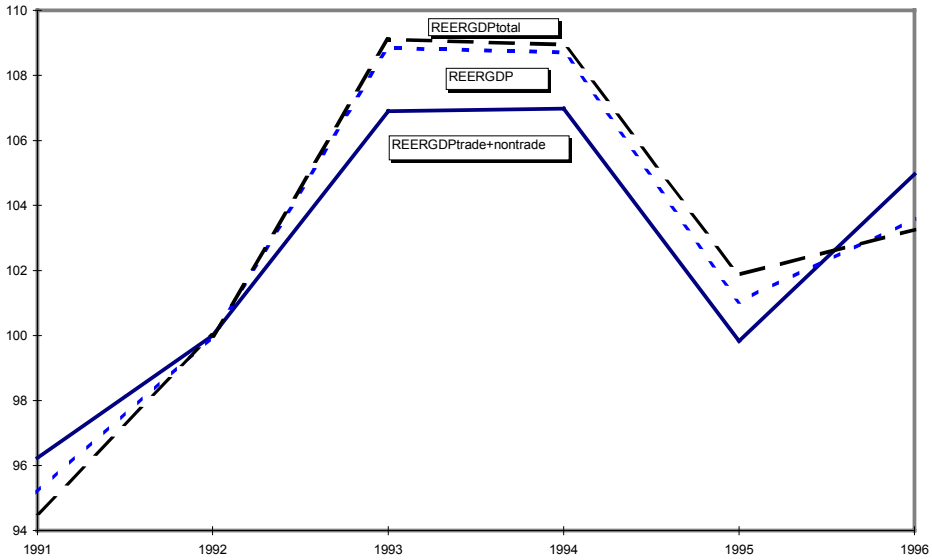
The weighting system that was used to calculate a representative market price of trading partner countries covers 76 percent of total trade. This is somewhat less than the coverage of the weighting system used in regular effective exchange rate calculations in the National Bank of Hungary .

For comparison on Figure 1 three measures of real exchange rates are given. $REER_{GDPtotal}$ is the index calculated by full coverage of both sectors and partner countries. $REER_{GDP}$ is the index based on partial coverage of partners but full coverage of sectors. $REER_{trade+nontrade}$ is calculated by partially covering trading partners and sectors. As it can be seen the partial coverage does not essentially alter the results.

[1] See for example Isard–Symansky (1996), Micossi–Milesi-Ferretti (1994), De Gregorio–Giovanni–Krueger (1993).

Figure 1

Various REER indices (1992=100)



Decomposition

Writing the aggregate price level as an average of the prices of tradables and non-tradables the definition of the real exchange may be formulated in the following way:

$$REER=P/(eP_f)=(P^{T\alpha}P^{N(1-\alpha)})/(eP_f^{T\beta}P_f^{N(1-\beta)}) \quad (1)$$

where

$REER$ – real effective exchange rate,

P – aggregate price level,

e – nominal effective exchange rate of the foreign currency

P^T ,P_f^T – price of tradables home and abroad,

P^N ,P_f^N – price of nontradables home and abroad,

α,β – share of tradables home and abroad.

After rearranging:

$$REER=[P^T/(eP_f^T)]\ [((P^N/P^T)/(P_f^N/P_f^T))^{(1-\alpha)}][(P_f^N/P_f^T)^{(\beta-\alpha)}] \quad (2)$$

According to the formulation of (2) the real exchange rate consists of 3 components:

1. *Tradable component:*Relative price of tradables in common currency $[P^T/(eP_f^T)]$.

2. *Nontradable component:* Relative price of nontradables to tradables *home vs foreign* $[((P^N/P^T)/(P_f^N/P_f^T))^{(1-\alpha)}]$.

3. A component due to differences in weights $[(P_f^N/P_f^T)^{(\beta-\alpha)}]$.

The components for the Hungarian case are the following:

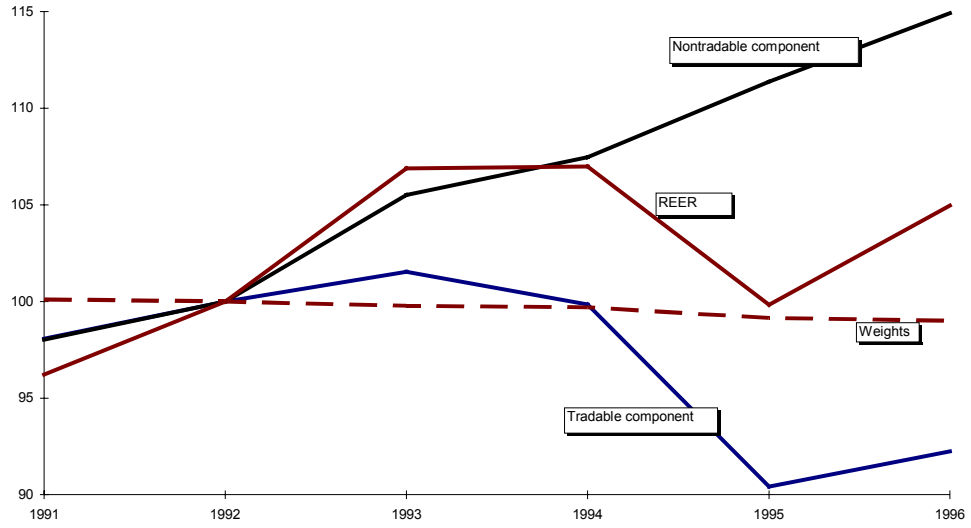
Table 1

Growth indices of components of the real exchange rate, 1992=100

	tradable component (1)	nontradable component (2)	weights (3)	REER
1991	98.1	98.0	100.1	95.2
1992	100.0	100.0	100.0	100.0
1993	101.5	105.5	99.8	108.8
1994	99.8	107.5	99.7	108.7
1995	90.4	111.4	99.1	101.0
1996	92.2	114.9	99.0	103.6
average growth rate %	-1.2	3.2	-0.2	1.7

Figure 2

Components of the real exchange rate



The nontradable component shows a remarkably steady growth during the period, at an average rate of 3.2 percent. The tradable component does not show any trend and fluctuates strongly. Knowing the historical development of the nominal exchange rate we can say that the relative price of tradables follows the shocks of the nominal exchange rate. The period is too short for trying to extract any information from the data about the PPP level of relative prices or about a possible adjustment to a PPP level.

Determinants of relative price components

Nontradables

Productivity rates

If wage and profit rates equalize across sectors, relative prices will be determined by productivity rates. If relative productivity of tradables at home increases faster than abroad relative nontradable price will increase.

Figure 3

Relative nontradable prices at home and abroad

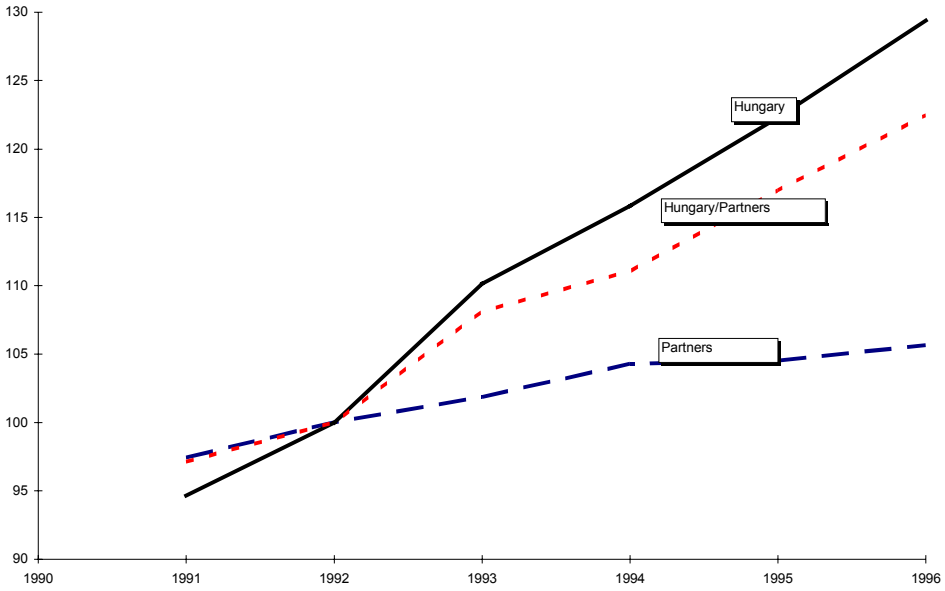


Figure 4

Relative productivity in the nontradable sector at home and abroad

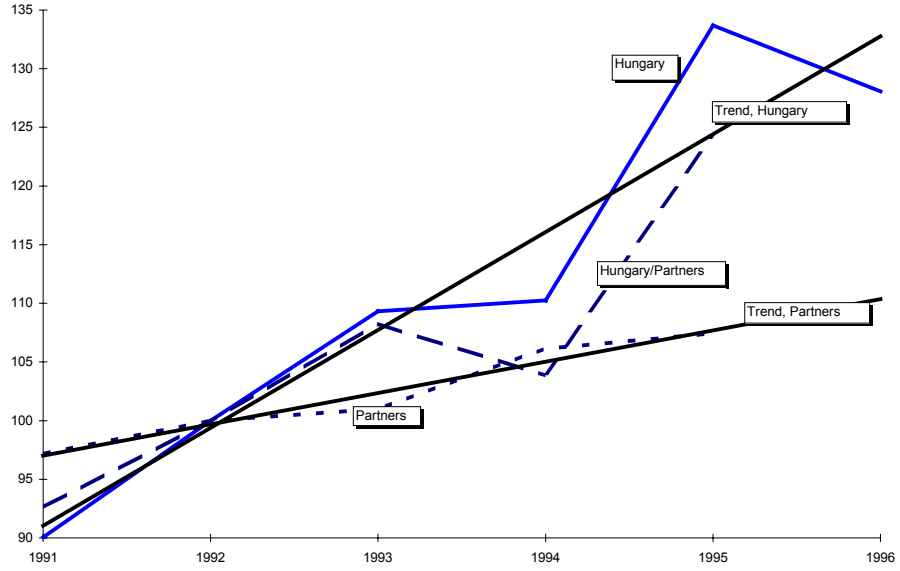


Table 2

Productivity and relative price indices, 1992=100

	Tradable/nontradable productivity			Nontradable/tradable prices		
	Hungary	Partners	Hungary/ Partners	Hungary	Partners	Hungary/ Partners
1991	90.1	97.2	92.7	94.7	97.4	97.1
1992	100.0	100.0	100.0	100.0	100.0	100.0
1993	109.3	101.0	108.2	110.1	101.9	108.1
1994	110.3	106.1	103.9	115.8	104.3	111.1
1995	133.7	107.5	124.4	122.3	104.5	117.0
1996	128.1	108.8	117.7	129.4	105.7	122.5
average growth rate %	7.3	2.5	4.6	6.5	1.6	4.7

As it can be seen relative prices and relative productivities changed very similarly. The average rate of change of relative productivity at home exceeded the rate abroad by 4.6%, while P_N/P_T price ratio increase by 4.7 % annually in comparison with partner countries. This means that the appreciation of nontradables in Hungary can be fully explained by changes in relative productivity in the last 6 years.

Year by year there are some differences. In 1994 there is a setback in the trend of relative productivity, which is however corrected in 1995. We know that in 1995 there was a structural change between the demands for tradables and nontradables. In 1994 the growth rate of tradables was only 2.4% higher than that of nontradables, in 1995 however the relative difference became 11.4%, mainly because of the 3% drop in nontradable value added. This development seems to confirm the theory that productivity responds to demand faster than prices. If this is true we may say that a price-based real exchange rate reflects long-run developments better than a productivity-based indicator.

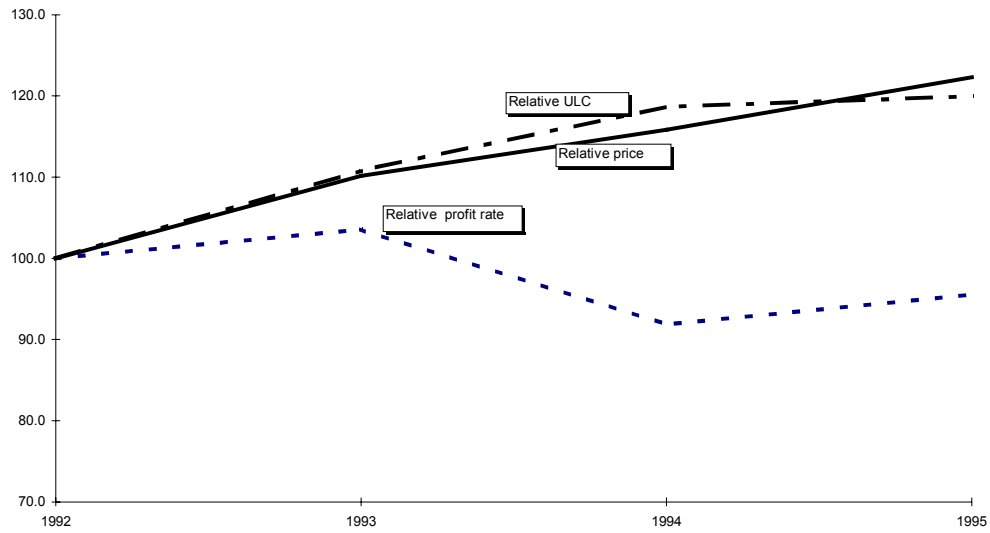
Factor renumerations

The appreciation effect can be seen by looking at factor costs as well. As shown on Figure 5 relative wage costs have increased along prices while profit rates remained approximately unchanged.[2] Considering the unreliable measurement of profits, the 10 percent fluctuation in the relative profit rate is well below measurement error.

The graph again confirms the statement that the increasing wedge between prices is due to changes in costs and not to profits.

Figure 5

Relative prices, relative unit labor costs and relative profit rates



Relative price of tradables

The steadyness of relative nontradable prices together with the volatility of relative tradable prices offers an interesting conclusion.

It seems that after a nominal exchange rate shock price adjustment towards PPP in the tradable sector is very slow, not discernible in the 6-year period. If this finding would be stated for the general price level, it would probably not a surprise to any analyst. What is surprising that this lack of fast adjustment seems to be true for the sector defined statistically as tradable, implicitly assuming that it is a class of good substitutes for international goods. Data indicate that this is not the case.

A devaluation in the nominal exchange rate may increase the home currency price of exports (statistics on export prices confirms this behavior) and consequently profits and the value added price of exports, but in the short run it seems to have no significant effect on the value added price of manufactures as a whole. In this respect the rest of manufactures (total minus exports) seems to behave as “nontradable”, just as the rest of the economy.

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[2] Data constraints forced the graph to cover only the period 1991-1995.

The pass-through behavior behavior of firms that could lead to this result would have to be analyzed in detail to explain it. There is one conclusion that seems to hold on the basis of looking purely on the graphs: The assumption of a homogenous tradable manufacturing sector is to simplistic in understanding relative price developments across industries.

Determinants and forecasting of the real exchange rate

Relative prices of other sectors

The definition used for tradable and nontradable sectors did not cover the whole economy. Although historically for the observed 1991-1996 period we did not see much difference between the aggregate and the partial real exchange rate, any conclusion on the aggregate indicator, especially regarding its forecast has to take into account the previously omitted sectors.

The omitted sectors were the following:

1. Agriculture, hunting and forestry,
2. Fishing,
3. Mining,
4. Electricity, gas, heating and water supply,
5. Public services and social security
6. Education
7. Health and social services

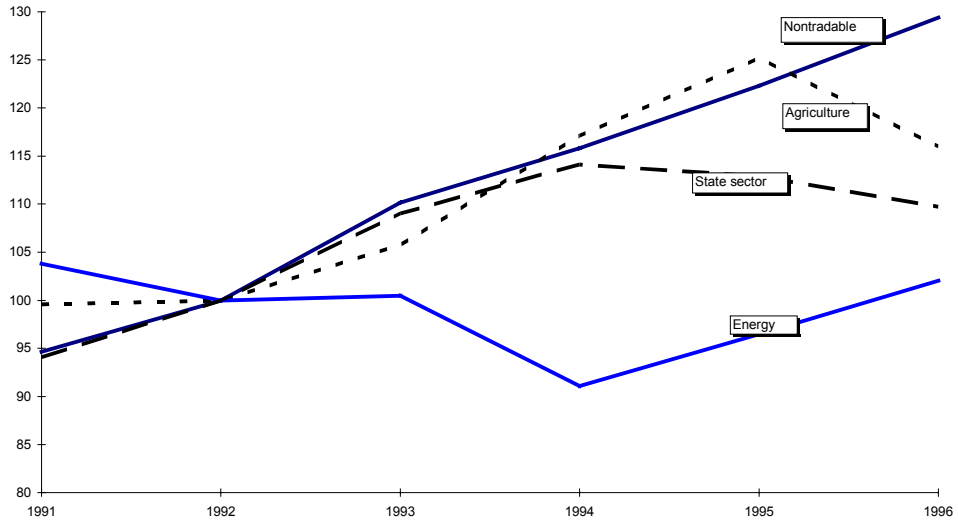
The above industries were aggregated into 3 sectors:

1. *Agriculture*, consisting of Agriculture, Hunting and Forestry, Fishing.
2. *Energy*, consisting of Mining, Electricity-gas-heating, and Water Supply.
3. Government, consisting of Public Services and Social Security, Education Health and Social Services

Relative prices of these sectors to tradables are given in the following graph:

Figure 6

Relative value added prices of various sectors to tradable prices 1992=100



Let us discuss to which extent we may consider the relative price developments observed in 1991-1996 as manifestations of long-run trends.

As government services are similar to non-government services in nature it is straightforward to assume that in the long run their prices behave similarly. This is justifiable even though in 1995-1996 relative prices of the government sector decreased. We know that this development is not due to a faster growth of productivity (which, owing to the principles of statistical measurement, would not be reflected in statistics even if it had happened), but to the wage policy of the government that reduced wages drastically in the public sector.

There is no reason to assume that productivity and value added price of the energy sector differ very much from that of the tradable sector. This assumption is justified by the data in 1991-1996. In the short run data fluctuate significantly because prices of energy are regulated and price setting reflects policy decisions on timing of price changes.

Relative agricultural prices grew together with prices of nontradables through most of the period, but fell sharply in 1996. (According to preliminary estimates they increased again in 1997). We do not feel informed enough to make any firm assessment on whether the observed increase reflects long-run productivity trends or a short-run adjustment from a formerly low level of relative agricultural prices. We can rely only on some speculative arguments.

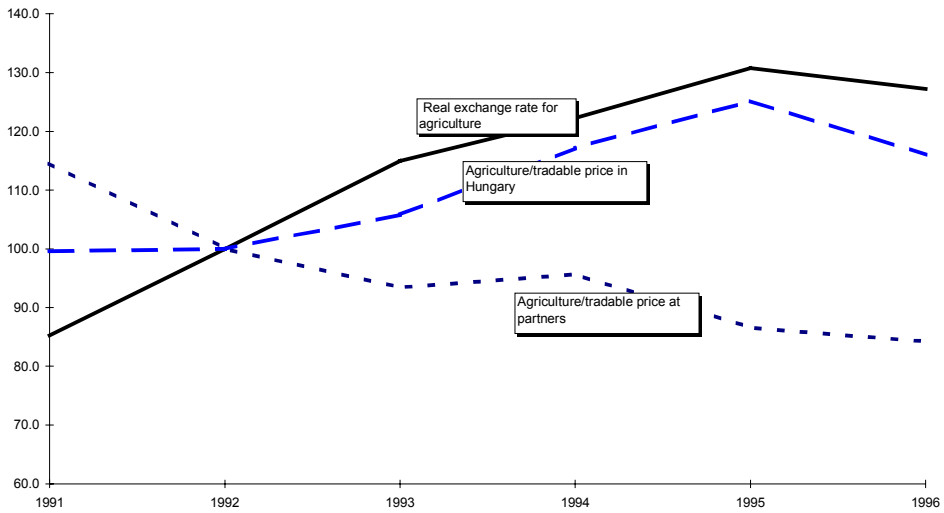
If agricultural goods would be homogeneously tradable, the question would not arise, the law of one price would determine agricultural prices. According to empirical studies the traded portion of goods in agriculture is about the same as in manufacturing.[3] However, as data for the manufacturing sector confirm, this share is

[3] See for example De Gregorio, Giovanni és Wolf (1994).

not enough for the law of one price to hold for the sector as a whole. A wedge between the growth indexes of relative prices in Hungary versus the European trading partners is very marked in the period 1991-1996.

Figure 7

Relative value added prices in agriculture 1992=100



The considerable difference in growth rates is probably partly a result of the price reform during the transition period. We do not know about the reasons of the decrease in the relative value added price of agriculture in our trading partner countries. It might easily reflect only a change in the system of subsidies. Because of these structural effects on both sides any extrapolation of relative price trends of 1991-1996 could be misleading. In an attempt of forecasting we have to use extraneous assumptions.

Predictions about the real exchange rate

Let us assume that the relative price of tradables would not change and the relative price of nontradables follows the trend of the observed 6 years, i.e. it increases by 4.6% annually. As we have seen previously this latter reflects an annual relative productivity increase of 4.6 percent.

In the table below sectoral composition of GDP and consumption is given. The former comes from the National Income Statistics, the latter from the input-output table of the CSO for 1993.

Table 3

Sectoral composition of GDP and consumption

	GDP	Final consumption
Manufacturing	21	12
Energy	7	4
Agriculture	8	22
Services	47	34
State sector	15	2
Import	0	26
Overall	100	100

Using the weights of the table the assumptions imply the following annual change in the value added real exchange rate for the "truncated" (manufactures + services) economy:

$1{,}046^{47/(47+21)} = 1.031$

If we use additional assumptions about the change in relative productivity for the other sectors we may arrive at predictions of the real exchange rate for the whole economy.

Trying to use assumptions that are consistent with common sense let us assume that

1. the government sector behaves as the services sector
2. energy sector behaves as manufacturing,
3. agriculture is part of the tradable sector and its real exchange rate does not change.

Then according to equation (2) the GDP deflator based real exchange rate change will be

$1.046^{0{,}47+0.15} = 1.029$, i.e. *2.9%* appreciation annually,

the personal consumption index based real exchange rate change will be

$1.046^{(0.34+0.02)} = 1.016$, i.e. *1.6%* appreciation annually.

The role of agriculture in the index is critical and as told before we do not have much information to base our assumptions on. Therefore we calculated some variants that differ in the assumption about agriculture.

There are two groups of variants. In the first group we assume that agriculture is nontradable.

Table 4

Annual real appreciation rates using various assumptions on agriculture

(agriculture as nontradable)

	Real appreciation (%)	
Appreciation of the REER of agriculture (%)	Based on GDP deflator	Based on CPI
0.0	2.9	1.6
5.0	3.3	2.7
8.3	**3.6**	**3.4**
15.0	4.1	4.8

The figures in bold characters show the variant that assumes agricultural prices to grow at the same rate as in 1991-1996.

An alternative approach might assume that agriculture is tradable. In this case a slow rate of growth in agricultural productivity, together with the implicit assumption that the composition of the traded sector is constant and relative prices of tradables are constant, means that the rate of real appreciation is slower to accommodate the competitiveness of agriculture.

Table 5

Annual real appreciation rates using various assumptions on agriculture

(agriculture as tradable)

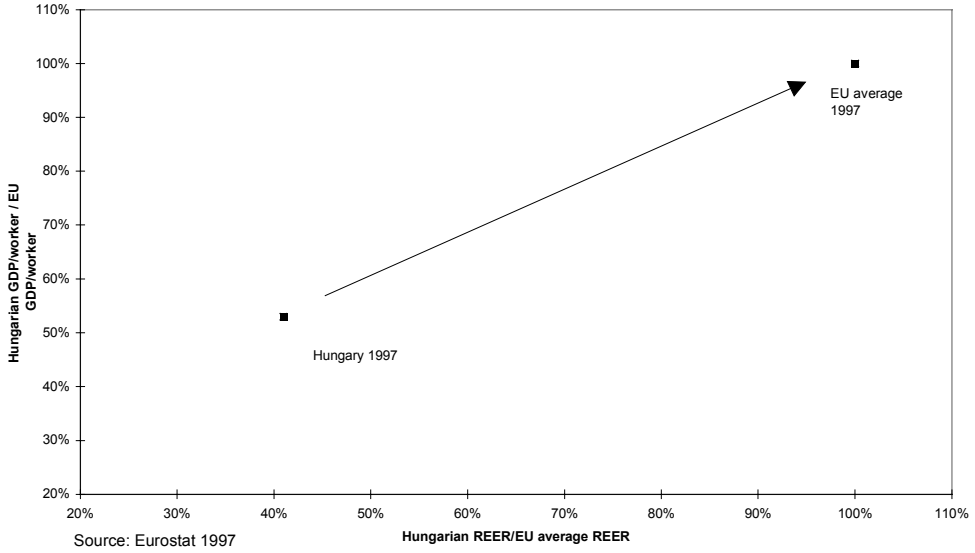
	Real appreciation (%)	
Appreciation of the REER of agriculture (%)	Based on GDP deflator	Based on CPI
0.0	2.9	1.6
5.0	2.2	1.4
8.3	**1.9**	**1.2**
15.0	1.1	1.0

As we see, there is a rather wide range of appreciation rates that are consistent with the assumed relative productivity growth of services to manufactures.

In order to narrow down the range let us use an alternative approach to determine the long-run real appreciation rate. In this approach we utilize an additional information, the real exchange rate in the highly developed countries. If Hungarian GDP/worker is approaching the rate of these countries, it has to approach their real exchange rate as well. The following figure shows these data for Hungary and the EU average.

Figure 8

Productivity and real exchange rates



Source: Eurostat 1997

Today the GDP/worker productivity (based on PPP) in Hungary is 37 percent of the level in the EU, while the real exchange rate measured by a consumption basket is 52 percent according to EUROSTAT.

This means that a catch-up in terms of GDP/worker implies a 170 percent increase in GDP/worker and a 92 percent increase in the real exchange rate, giving a 0,66 appreciation elasticity coefficient as a response to the change in productivity.

For the period 1991-1996 GDP/worker increased by 5 % annually. According to the catch-up criterion this is consistent with a *3.3 % growth* of the real exchange rate.

If this growth rate is maintained for 20 years Hungary will catch up with the *present* level of the EU by the year 2017 both in terms of GDP/worker and in the real exchange rate.

Our forecast is based on trends of technology and consequently it is meant only as a long-run forecast. Naturally we are not attempting to forecast real exchange rate effects of temporary shocks in the nominal exchange rate. As our forecast is meant to capture long-run effects only, it does not give much information whether the present value of the real exchange rate is on this long-run path or not. Though the dispersion of the possible rates of changes that might characterize the 10-20 year trend are not estimated and quantified econometrically in this exercise, it is very probable that they easily allow a 5-10 percent error in the assessment whether the present level of the real exchange rate is on this long run path or not. This means that our discussion is not suitable to draw a rigorous conclusion about the present "equilibrium" real exchange rate.

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