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Catching up: the role of demand and supply side effects on the real exchange rates of accession countries.

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Abstract

The main aim of the paper is to examine the exchange rate behavior of a group of four transitional, EU accession countries, with a view to making policy recommendations regarding their accession to full European Monetary Union. We employ the dynamic panel ols estimator to investigate relative importance of demand and supply influences on the exchange rates of these countries. Our analysis show that although supply-side effects are likely to be important for the accession countries, it seems highly likely that demand side influences will also be important determinants of inflation differentials and, as we shall argue in this paper, such demand side effects are likely to have a deleterious effect on inflation and competitiveness. An additional focus of the paper is on examining the role that administrative prices and the productivity of the distribution sector play in real exchange rate dynamics in these countries. Based on a unique database we show that administrative prices have been a powerful force behind price and real exchange developments in these countries. The distribution sector has an independent effect on the internal price ration over-and-above that generated by BS effect.

JEL-Codes: F3, F36.

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Introduction

In October 2002 the European Commission indicated that it saw no further barriers to a group of CEEC countries becoming full members of the EU. Such membership, in turn, requires a commitment to European monetary union (EMU). Current EU arrangements imply that the move to monetary union for the accession countries should be a two-stage process, with countries participating in ERM2 for (at least) two years before joining the euro. Therefore once the accession countries have gained entry to the EU one of the key issues, perhaps the key issue, facing these countries is at what point, and at what exchange rate, they should enter ERM2. Should they, for example, wait until they have satisfied a number of convergence criteria with respect to key economic indicators, such as inflation or in terms of real growth, or should they enter ERM2 contemporaneously with their membership of the EU? Some commentators (see for example Gros (2001)) have argued that real convergence should not be an obstacle to a rapid movement to ERM2 and indeed full monetary union for the accession countries. The argument is that since convergence is likely to be a supply-side phenomenon it is unlikely to affect the accession countries competitiveness (this is discussed in more detail below). In contrast, others (see, for example, MacDonald (2001) have issued a cautionary note that economic convergence should be addressed prior to participation in EMU. The latter argument is based on the degree of catch-up faced by the accession countries, which is very different to the experience of previous accession countries.

The issue of catch-up arises because CEEC candidate countries GDP per capita is only around 8638 USD compared to the current EU average of approximate 22303 USD and they would therefore have to grow by about 60% to reach the EU level. Of course, catching up with the EU average, is the rasion d’etre for the accession countries participation in EU. However, the catch-up process will necessarily have implications for the participating country’s inflation which, in turn, could have important implications for competitiveness, especially if the country aims for a rigid lock of its exchange rate. Such inflationary consequences will, of course, also have implications for the ability of the country to meet the Maastricht criterion for inflation (set at not more than 1.5 percentage points the average rate of inflation of three member-states with the lowest inflation).

However, proponents of a relatively fast entry to EMU stress that the inflationary pressures generated by the catch-up process are likely to be benign because they are viewed as emanating from the supply side in the form of the Balassa-Samuelson effect. Although such supply-side effects are likely to be important for the accession countries, it seems highly likely that demand side influences will also be important determinants of inflation differentials and, as we shall argue in this paper, such demand side effects are likely to have a deleterious effect on inflation and competitivness.

The main purpose of the present paper is to econometrically examine the relative importance of demand and supply side effects on the internal price ratios, and CPI-based real exchange rates, of a group of 4 accession countries.[1] One of the key novelties in our work is that we build new measures of demand and supply side effects. For example, previous studies have proxied the Balassa-Samuelson effect using the ratio of output to employment in industry (see, for example, Halpern and Wyplosz (1997,2001), Egert (2002)) and demand side influences have been captured using GDP per capita and the acceleration of inflation (Halpern and Wyplosz (2001)). Here we also use the ratio of output to employment as our chosen measure of productivity but we build this measure from output and employment in the traded sector. We also use new demand side factors, namely private and government consumption. Additionally, we attempt to measure the influence of the distribution sector on the internal price ratio and on the CPI-based real exchange rates. For example, MacDonald and Ricci (2001) have demonstrated that total factor productivity from the distribution sector can have a statistically significant effect on the real exchange rate, which behaves much like a Balassa-Samuelson effect, but coexists with the B-S effect and is not a proxy for the latter. Since a considerable proportion of the current FDI's into the accession countries is aimed at their distribution sector we believe that analysing this effect separately is an important element in understanding the behaviour of these countries exchange rates.

The outline of the remainder of this paper is as follows. In the next section we present a motivational overview of the influence of demand and supply side effects on real exchange rates and also overview the extent empirical literature on the Balassa-

[1] Our choice of countries reflects the availability of data, rather than any form of self-selection bias.

Samuelson effect. In Section 3 the data set used for our econometric tests is presented, along with our econometric tests. Section 4 presents our empirical results. The last section concludes.

2 Catch-up and Demand and Supply Influences on Real Exchange Rates.

A useful way of thinking about the sources of systematic movements of the real exchange rate is to consider the following decomposition of the real exchange rate. As usual, we define the logarithm of the (CPI-based) real exchange rate as:

$$q_t \equiv s_t - p_t + p_t^{*}. \tag{1}$$

where q represents the real exchange rate, s is the nominal exchange rate, p is the overall price measure - the CPI - an asterisk denotes a foreign variable and lower case letters denote natural logarithms. Decomposing these overall prices into traded and non-traded components as:

$$p_t = \alpha_t p_t^{T} + (1-\alpha_t) p_t^{NT}, \tag{2}$$

$$p_t^{*} = \alpha_t^{*} p_t^{T*} + (1-\alpha_t^{*}) p_t^{NT*}, \tag{2'}$$

where p_t^T denotes the price of traded goods, p_t^{NT} denotes the price of non-traded goods and the α's denote the share of traded goods in the economy. A similar relationship to (1) may be defined for the price of traded goods as:

$$q_t^{T} \equiv s_t - p_t^{T} + p_t^{T*}, \tag{3}$$

By substituting (2) in (3) our desired decomposition of the real exchange rate may be obtained as:

$$q_t = q_t^{T} + q_t^{T,NT},$$

where $q_t^{NT,T} = (\alpha_t - 1)(p_t^{NT} - p_t^{T}) + (\alpha_t - 1)(p_t^{NT*} - p_t^{T*})$, is the so-called internal price ratio, the relative price of non-traded to traded goods in the home relative to the foreign country. What are the factors driving these two components of the real exchange rate? Consider, first, the internal price ratio, $q_t^{T,NT}$.

In the traditional BS approach to understanding systematic movements in the real exchange rate (see, for example, De Gregorio, Giovannini and Wolf (1994)) productivity shocks in the traded sector are the key force driving the internal price ratio and, ultimately, the CPI-based real exchange rate. The key assumptions in BS is that the LOOP holds and therefore q_t^T is zero, or constant, production technology is Cobb-Douglas, with constant returns to scale, and there is some mechanism equalizing wages between the traded and non-traded sectors. With these assumptions it is then straightforward to demonstrate that a positive shock to total factor productivity in the traded sector raises the average wage in the economy, the relative price of non-traded to traded goods rises and the CPI-based real exchange rate appreciates. Hence the Balassa-Samuelson prediction is that there should be a positive (negative) relationship between total factor productivity in the traded (non-traded) sector and the CPI-based real exchange rate, and the coefficient should be equal to the share of expenditure on non-traded goods.

A second supply side influence on the internal price ratio involves relative factor endowments. In the traditional Hecksher-Ohlin two factor, two good, relative factor endowments model, nontraded (traded) goods are asssumed to be relatively labour-intensive (capital-intensive) in production. High per capita income countries are assumed to have a comparative advantage in producing commodities and so the relative price of non-traded goods will be higher in countries with relatively high per capita income.

The influence of demand, both public and private sector, on the internal price ratio has been highlighted by Dornbusch (1988), Neary (1988) and Bergstrand (1991). As a country catches up, and income rises, demand side factors can affect the internal price ratio if preferences are non-homothetic. Usually preferences are thought to be biased in favour of the non-traded good because services are viewed as superior goods. In this case, of course, the demand side influences would reinforce the supply side effects and although this may be thought of as an equilibrium relationship there may be policy issues in the short to medium run for an accession country wishing to avoid excessive inflationary consequences. Of course the policy implications of demand side effects are likely to be more pronounced if preferences are skewed in favour of traded goods.

Starting with Bergstrand (1991) a number of studies have sought to capture both the demand and supply side influences on the real exchange rate using GDP per capita. For example, Bergstrand (1991) has demonstrated that over 80 of the cross sectional variation of real exchange rates can be explained by per capita GDP and a constant, and that a 1 per cent increase in per capita GDP produces a 0.5 per cent increase in the real exchange rate (or the inflation differential). Sloek and Van Broek (2000) have demonstrated that a similar relationship also holds for the current group of accession countries.

As we have seen, an essential component of the Balassa-Samuelson hypothesis is that the LOOP holds continuously and that q_t^T is constant or zero. However, the broad thrust of the empirical evidence for developed countries is that the LOOP does not in fact hold. This is evident from studies which focus explicitly on testing the LOOP (see, for example, Isard (1977) and) and also studies which examine the decomposition of the CPI-based real exchange rate. For example, Engel (1993) and Rogers and Jenkins (1995) have shown that for developed countries the variability of q_t^T always dominates the variability of $q_t^{T,NT}$. There are a number of interpretations of this finding such as the importance of sticky prices (see, for example, Mussa (1986)), the pricing to market behaviour of firms (see Betts and Devereux ()) the importance of transaction costs in imparting non-linear adjustment to q_t^T (see Obstfeld and Taylor (1997)), or the imperfect substitutability of traded goods across countries (see MacDonald and Ricci (2002)). Although all of the foregoing arguments seem plausible, the issue of imperfect substitutability seems especially so given that casual empiricism suggests that goods entering international trade are imperfectly substitutable: a 3 series BMW, produced in Germany, for example, is not a prefect substitute for a Ford Mondeo produced in the UK, for example. Indeed, for white goods, such as refrigirators, which appear to be very similar across brands and countries, it is well know that even within Europe such items are highly differentiated to appeal to different tastes in different countries (see the Economist).

Of course, even if $q_t^{NT,T}$ is the dominant component in explaining real exchange rate variability, this does not necessarily mean that Balassa-Samuelson (BS) effects are unimportant. A number of studies have examined the impact of productivity in the traded and non-traded sectors on the real exchange rate. For example, using the OECD sectoral data base to construct measures of TFP, Chinn and Johnston (1999) demonstrate for the US dollar bilateral exchange rates of a set of developed countries, that the BS terms is correctly signed and statistically significant with a point estimate close to MacDonald and Ricci (2002) confirm this result for a similar panel of countries, although they show that once the productivity terms enter unconstrained, the coefficients are not equal and opposite as predicted by the Balassa-Samuelson proposition. Furthermore, when the wage enters as a conditioning variable, in addition to the BS term, the coefficient on TFP in the traded sector becomes statistically negative and the rather than zero as predicted. MacDonald and Ricci (2001) also show that the distribution sector behaves much like a BS effect on the real exchange rate and so should not be included in the non-traded sector as has been assumed in other studies.

MacDonald and Ricci (2002) present an alternative theory of how productivity effects impact on the real exchange rate and this helps to explain the seemingly perverse effect productivity has once the real exchange rate has been conditioned on relative wages. The starting point of this new approach is a model based on the so-called new trade theory of Helpman and Krugman (). This has at its core, product differentiation and a love of variety: in contrast to the standard neoclassical trade theory underpinning the Balassa-Samuelson effect, the imperfect substitutability of traded goods is a sine qua non in this approach. MacDonald and Ricci demonstrate, inter alia, that the coefficient on the productivity of tradables should be smaller in the presence of imperfectly substitutable traded goods and a home bias in favor of home goods. This differs from BS where the coefficient on productivity in nontradables relative to the coefficient on productivity in the tradable sector should be equal and opposite. Additionally, when the wage enters the exchange rate relationship as a conditioning variable the regression coefficient on productivity in the tradable sector can become significantly negative (because of the imperfect substitutabilty of traded goods).

Anumber of studies have quantified the Balassa-Samuelson effect, and also demand side effects, for the current group of accession countries. The first study to estimate the effects of productivity for transitional economies is that of Halpern and Wyplosz (1995) who use a reduced form approach to capture the effects of productivity and other measures of economic effectiveness on the real exchange rates of a panel of 80 countries (the countries in the panel fall into the following panel groupings: OECD, Africa, Southeast Asia, Latin America and transition economies). Halpern and Wyplosz are able to distinguish between these different groupings using fixed and random effects estimators. The productivity measure is average productivity (i.e. they do not distinguish between productivity in the tradable and nontradable sectors) and this is captured by GDP per worker. Their measure of aggregate average productivity produces a large and significant coefficient which is shown to be sensitive to the inclusion of regional and country dummies - it declines quite dramatically as such dummies are added in. Conversely the coefficient on investment in human capital (proxied using secondary school enrolment) rises as the regional and country dummies are introduced. They also find that a 10% decline in the size of agriculture relative to industry increases the dollar wage by between 1 and 2 per cent. A 10 per cent increase in the size of the government raises wages by 3 to 6 per cent. This effect is interpreted as measuring the effect of public services and infrastructure on aggregate productivity.

Halpern and Wyplosz (2001) focus more directly on the BS effect, using a panel data set, for 9 transition countries over the period 1991-1999. Their measure of productivity in the tradable sector is taken to be the ratio of industry output to employment, while the measure of productivity in the non-tradable sector is taken to be the ratio of output to employment in the service sector. Their panel regressions involve regressing the relative price of the service sector to the industry price onto the two productivity measures and the two demand side proxies, namely PPP-adjusted GDP per capita and the change in the rate of inflation. The productivity terms enter with the correct signs and are both statistically significant. The coefficient on productivity in the industry sector is 0.24 and that for the coefficient on productivity in the service sector is –0.18. GDP per capita also entered with a small, although positive, coefficient put; the inflation effect did not have a clear-cut effect on the internal price ratio. Halpern and Wyplosz demonstrate that their results are robust to a number of different estimation methods and that the Balassa-Samuleson effect is strongest in a regime of floating exchange rates.

Egert (2002) examine the BS effect for the Czech Republic, Hungary, Poland, Slovakia and Slovenia for the period 1991 quarter 1 to 2001, quarter 2. The productivity measure used is the ratio of the index of industrial production to employment in that sector. As in Halpern and Wyplosz, the industrial sector proxies the traded sector while the service sector represents the non-traded sector. The relative price of non-traded goods is determined as changes in the price of services relative to the producer price index of

final industrial goods. The econometric results are generated using the Johansen cointegration method, on a country-by-country basis, and using panel cointegration tests for the group of countries. Significant and correctly signed productivity affects are reported for this group of countries with respect to both the internal price ratio and also the CPI-based real exchange rate. In sum, significant and correctly signed effects of productivity effects on the internal price ratio and on the real exchange rate are reported.
In this section we have discussed the potential effects demand and supply side effects can have on the real exchange. We now explore the relationship between between these variables for a group of accession countries. Having done so we then, in a concluding section, draw out the policy implications of our findings.

3 Data description and estimation methods.

The countries considered in this study are Estonia, Hungary, the Slovak Republic and Slovenia. Austria serves as the foreign, or numeraire, country.[2] The choice of Austria as numeraire reflects the fact that it is geographically very close to Hungary, Slovenia and the Slovak Republic (it has a common border with these countries), has close trading links with these countries and is structurally very similar to the German economy, which is their main trading partner. The data frequency is quarterly and the time series dimension differs across countries and variables. However, we have constructed a balanced panel from the individual countries for the period 1995 quarter 1 to 2001 quarter 1. All of the data, apart from the interest rates, are in constant prices and are transformed into a base index with 1Q1995=100. All time series, apart from the real interest rates and net foreign assets, have been seasonally adjusted using an X-11 filter, and all data apart from the interest rates have been transformed by taking natural logarithms. Data on NFA and interest rates are taken from the IMF's International Financial Statistics CD-Rom, while data on Austrian interest rates are sourced from the OeNB. All other data have been obtained from the respective National Banks or Statistical Offices.

[2] Austria borders with Hungary, Slovenia and Slovak Republic and is one of the main trade partners for these countries. Besides, Austrian economy is very much liked to German one, which is the most important trade partner for almost all accession countries.

Two key dependent variables are used in our study. The first is the internal price ratio, Lrp100nta, the price index of nontradables relative to the price index of tradables. For this measure, tradables comprises the following categories: food and non-alcoholic beverages, alcoholic beverages and tobacco, clothing and footwear, transport and communication. Nontradables comprises the following categories: housing, household goods, health, recreation and entertainment, miscellaneous goods and services.[3] The second dependent variable is the index of the CPI-based effective real exchange rate (LRER). We have constructed this index so that an increase implies an appreciation of the real exchange rate.

The key independent variable used in our study is productivity in the tradable relative to the nontradable sector. We use labour productivity as a proxy for marginal total factor productivity and it is calculated by dividing value added, or GDP, by employment in the respective sector. The tradable sector includes the following: agriculture, hunting and forestry; fishing; mining and quarrying; manufacturing, transport and communication. The non-tradable sector includes the following: electricity, gas and water supply; construction; wholesale and retail trade; hotels and restaurants; financial intermediation; real estate, renting and business activities; public administration and defense; education, health and social work; other community; and social and personal activities.

Due to the lack of more disaggregated data for Hungary, tradables contained mining and quarrying, manufacturing and electricity, transport, storage and communications. Nontradables for Hungary comprised construction, trade, repair, hotels and restaurants, financial intermediation and real estate activities, public administration, education, health and social work, other community, social and personal service activities. For Slovakia, the tradable sector contains agriculture, mining and quarrying; manufacturing and transport, storage and communication, while the nontradables, in turn,

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[3] For Hungary tradables contain the category “goods total”, i.e. Food and alcoholic beverages, tobacco, Clothing and footwear, consumer durable goods, other goods incl. motor fuels and lubricants. Nontradables contains category “services total” , i.e. repairs and make clothing and footwear, rent, services for dwellings, household services, personal care and health services, transport services, communication, cultural, educational and entertainment services, gambling, membership, recreational services, other services.

consists of electricity, gas and water supply, trade, repair of motor vehicles and other services.

Our constrained productivity measure is labelled lratna and the unconstrained measures are lrata (productivity in tradables) and lrana (productivity in non-tradables). To evaluate the role of the distribution sector we use labor productivity in that sector (wholesale and retail sales). Data availability means that this variable can only be calculated for Estonia and Slovenia. In any estimation involving that sector, we exclude the distribution sector from nontradables.

The demand side variables included as explanatory variables are: consumption as a proportion of GDP; private consumption as a proportion of GDP; total consumption as a proportion of GDP; and finally GDP per capita. For Slovenia, quarterly data on consumption are only available from 1999. Therefore, to construct a quarterly series for the period before 1999, we have extrapolated the annual values. The final set of explanatory variables involve regulated prices.

As noted above, our empirical tests are conducted for a panel of four countries. Recent developments in the econometrics of panel data sets has sought to address the potential non-stationarity of the series entering the panel. In particular, McKoskey and Kao (1998), Pedroni (1997) and Phillips and Moon (1998) have proposed panel equivalents to the single equation fully modified estimator while McKoskey and Kao (1998) and Mark and Sul (1999) have proposed using a panel dynamic OLS (DOLS) estimator. Since Kao and Chiang (1999) have demonstrated that the panel DOLS procedure exhibits less bias than the panel OLS and panel fully modified estimators and Mark and Sul (1999) have emphasized the tractability of the estimator, we employ a panel DOLS estimator for all our regressions.

A version of the panel DOLS estimator which allows for limited heterogeneity in the form of fixed effects is:

$$y_{it} = \theta_{1i} + \theta_{2t} + \theta_3 x_{it} + \sum_{j=-p}^{+n} \theta_{4j} \Delta x_{it+j} + \omega_{it} \ ,$$

where y_{it} is a scalar, taken to be either LP100nta or LRER in our application, x_{it} is a vector of explanatory variables, discussed above, with dimension k, θ_{1i} is an individual fixed effect, θ_{2t} is a time effect, θ_3 represents a vector of coefficients, p is the maximum lag length, n is the maximum lead length and ω is a Gaussian vector error process. The leads and lags of the difference terms are included to ensure that the error term is orthogonalized. Our representation of the Panel DOLS estimator assumes that the dynamics are the same across individuals.

4 Empirical Results

i The base-line model and the Balassa-Samuelson Effect.

In this section we consider the effect of the BS term on the internal price ratio and on the CPI-based real exchange rate. For example, in the first column of Table 1 we report results from the panel DOLS regression of the internal price ratio (lrpnta) onto the constrained Balassa-Samuelson effect. The point estimate is correctly signed and strongly significant. The magnitude of the coefficient on the Balassa-Samuelson, although numerically below the magnitude of the expenditure share on non-traded goods is nonetheless insignificantly different from this expenditure share. The unconstrained coefficients, reported in column 2, are correctly signed, strongly significant and of a plausible magnitude. The unconstrained estimates show that the coefficient on tradable productivity is much larger than the coefficient on productivity in nontradables and indeed the hypothesis that they are equal and opposite is clearly rejected. This would seem to be evidence against a BS interpretation of the effect of productivity and favour the MacDonald and Ricci (2002) interpretation. Columns 3 and 4 show that the constrained and unconstrained BS terms have a similar effect on the CPI-based real exchange rate (LRER). It is noteworthy also that the magnitude of these coefficients is much higher, in absolute terms, than that in Halpern and Wyplosz (). This would seem to have implications for the competitiveness of these countries and also for implied inflation differentials in a monetary union.

In columns 5 and 6 we incorporate the constrained and unconstrained BS terms into a regression for the CPI-based real exchange rate containing both relative net foreign assets, as a proportion of GDP, and the real interest differential as explanatory variables. These variables are seen as key variables in explaining systematic movements of real exchange rates (see MacDonald (1999)) and we include them here to ensure that the effects of the BS with respect to the real exchange rate are spurious. In accordance with theory, the coefficient on both NFA and RIR is expected to be positive. Note that coefficients on the BS terms are similar, in terms of significance and sign, to the regressions where neither NFA nor the real interest differential are not included, although the magnitude of is different. Note also that the NFA and RIR terms are themselves correctly signed and statistically significant.

The last three columns contain the results from regressing the real exchange rate on various permutations of the two macro variables. The sign, magnitude and significance of the coefficients in these regressions is similar to the regressions which include the macro variables with the BS term, thereby confirming the robustness of our results. It is noteworthy that the coefficients on the NFA term is much smaller than that reported by Lane and Milessi-Ferreti who report a coefficient on NFA of 0.10 for a panel of developed countries and the coefficient on the real interest differential is much smaller than that reported in MacDonald and Nagayasu () for a group of OECD countries. The unconstrained estimates of the BS effect contrast with that reported in MacDonald and Ricci (2002) for a panel of G7 countries. They found that the coefficient on productivity in the tradable sector was smaller, in absolute terms, than the coefficient on nontradables. In the context of their model they rationalised this in terms of imperfectly substitutable traded goods and a home expenditure bias. We explain the opposite finding here in terms of an expenditure bias in favor of foreign goods.

ii Demand side variables the Balassa-Samuelson Effect.

The first three columns of Table 2 explore the effect of adding in the three demand variables – government consumption, private consumption and total consumption – in addition to the BS effect into the internal price equation. As can be seen, the coefficients on the demand variables are similar across the three equations, each being approximately –0.1. It is noteworthy that the coefficient on the B-S terms is unaffected by the introduction of the demand side variables and it would seem that the two variables coexist and have independent influences on the real exchange rate. Perhaps the most notable feature of the coefficient on the demand side variables is that they have negative signs. This means they are wrongly signed in terms of the conventional effect referred to in section 3. Of course as we have noted, the conventional (positive) sign presupposes that the law of one price holds. If it does not, and this is likely to be particularly so for the accession countries, then the negative sign is not entirely unexpected since traded goods are likely to be luxury goods for these countries rather than services, which is the conventional assumption. However, the negative sign clearly has important implications for these countries as they catch-up: some of the catch-up, by spilling over into the traded sector is likely to make that sector uncompetitive. Issue here of equilibrium vs. transitory effects.

However, when the demand side variables are introduced into the internal price equation with the BS term unconstrained, (columns 4,5 and 6) the coefficients on the demand side variables increase and become insignificant. The source of the insignificance of the demand side variables in the unconstrained regressions would seem to stem from the collinearity of the variables. For example, when the are introduced seems to be attributable to the correlation between x and x (the correlation table here).
Qualitatively, the results for the internal price ratio are confirmed in the regressions for the CPI-based real exchange rate. Here the coefficients on productivity, NFA and the real interest differential remain unchanged as demand side variables are added in, although the coefficients on the demand side variables are all insignificant.

iii. Balassa-Samuelson and the Wage Effect.

As we noted in section 3, the key channel through which the BS effect influences the overall CPI-based real exchange rate is through the wage. Following MacDonald and Ricci (2001) we include the wage into our regressions containing the BS effect. If the wage is indeed the channel through which the BS effect operates then its introduction should make the productivity term (s) insignificant. These results are presented in Table 3 for both the internal price ratio and the overall CPI-based real exchange rate (not sure about the former). The results for the overall real exchange rate are very interesting since, as predicted by the BS model, the coefficient on productivity becomes insignificantly distinguishable from zero. This finding contrasts sharply with the results in MacDonald and Ricci (2001) for the G7. As we have noted, these authors find that when the relative wage term is introduced into a regression of the real exchange rate on relative productivity the coefficient on productivity becomes significantly negative and this can only be rationalised by taking a non Balassa-Samuelson type framework. The result here seems to suggest that the BS interpretation of productivity is more relevant for the accession countries.

iv. The influence of Regulated Prices

Probably the most striking and the most interesting result of our estimations is that once the regulated price term is introduced into the model, the BS effect disappears.

v The Distribution Sector

Following MacDonald and Ricci (2001) we experimented with including a proxy for productivity in the distribution sector into our regressions. MacDonald and Ricci demonstrate that for the G7 countries the share of distribution sector in value added was an average of 15 per cent for the 10 OECD countries studied and 19 per cent of total employment. For the two countries for which we have access to the distribution data, namely Estonia and Slovenia, the employment share in 2000 was approximately 14 per cent for both countries, while the share of value added was 15 per cent and 12 per cent, respectively, for Estonia and Slovenia. Given that a large proportion of FDI into the accession countries consists of investment in the distribution sector, these numbers seem set to rise over time.

The results from incoporating the distribution sector for Slovenia and Estonia are reported in tables 5 and 6. For Slovenia, the new Balassa-Samuleson terms are correctly signed and significant and of the same order of magnitude as in the panel regresssions. The distribution effect has a significantly positive effect in the regression with a constrained BS term, but the effect is insignificant in the unconstrained BS regression, a finding we attribute to the collinearity amongst the series. For Estonia the BS terms are all statistically significant, although the coefficient on the productivity of the non traded sector becomes wrongly signed (suggesting that with the exclusion of dist we are capturing a greater traded element in the non traded sector). We note that the coefficient on distribution is correctly signed and significant in both the constrained and unconstrained cases. In the former, the coefficient on the BS term remains significant as does the coefficient on productivity of the tradable sector in the unconstrained regression (although coeff on nt prod is insignificant). In sum, the productivity in the distribution sector has an independent effect on the internal price ration over-and-above that generated from the BS effect.

Robustness Checks

We also implemented all of the above-noted tests using a variety of other estimators such as static OLS and DOLS with a correction for contemporaneous correlation. The application of these different estimators did not change the tenor of our results and they are therefore not reported here (but are available from the authors on request).

5 Concluding Comments

In this paper we have re-examined the effect of productivity differential and demand side effects on the CPI-based real exchange rates and internal price ratios of a group of accession countries. In contrast to other empirical studies of CEEC countries we use new, and we believe superior, measures of both productivity and demand side effects for these countries. Our tests were conducted for a panel of four countries, comprising Estonia, Hungary, the Slovak Republic and Slovenia. Amongst our main findings are: statistically significant effects of productivity in the traded and non-traded sectors on both real exchange rates and internal price ratios. A weakly negative influence of demand side effects on the two dependent variables. The magnitude of the coefficients on the productivity terms proved to be larger, in absolute terms, than those reported in other studies of the accession countries. We demonstrated that productivity in the distribution sector has a significantly positive effect on the internal price ratios of Estonia and Slovenia. We now consider the policy implications of our results for the membership of our group of countries in EMU.

Recently some economists (see, for example, Gros (2001)) have advocated a relatively rapid movement by the current group of accession countries to full monetary union with the EU. On this view, catch-up is not deemed to be an important issue with respect to an accession country's competitiveness because it is seen as a purely supply-side phenomenon and any inflation generated is regarded as benign in the context of a BS effect.

However, the discussion in this paper suggests that the catching-up process may not be as benign as is often thought. First, our estimates of the effect of productivity on the real exchange rate and internal price ratio suggest inflation differentials for our group of countries which are ….. These estimates would presumably have implications for competitiveness and also the ability of these countries to fulfill the Maastricht criteria. The competitiveness issue would make the ability of these countries to sustain a fixed parity in any form of ERM II very difficult and could have extremely serious consequences if they entered the ERM or full EMU too early. Our estimates of the demand side effects suggest that this could well exacerbate the uncompetitiveness aspects of the productivity differentials.

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Appendix Variable Definitions and Notation of variables

Country coding:

_ee Estonia

_hu Hungary

_si Slovenia

_sk Slovak Republic

_aa Austria

Variables:

a) Prices:

Lp100nta- log of relative prices of nontradables to tradables, seasonally adjusted

Lrpa- log of regulated prices, seasonally adjusted

b) Prodctivity variables:

Latna- log of relative productivity in tradable sector to nontradable sector, seasonally adjusted

Latnas- log of relative productivity in tradable sector to nontradable sector, seasonally adjusted, corrected by labor shars

Lata- log of productivity in tradable sector, seasonally adjusted

Lana- log of productivity in nontradable sector; seasonally adjusted

Lratnas, Lratna, Lrata, Lrana- the same but all relative to similar variables for Austria

Latnoda- log of relative productivity in tradable sector to nontradables sector, without the distribution sector, seasonally adjusted

Latoda- log of productivity in tradable sector, without the distribution sector, seasonally adjusted

Lanoda- log of productivity in nontradable sector, without the distribution sector, seasonally adjusted

Ladisa- log of productivity in distribution sector, seasonally adjusted

c) Demand variables:

Lgcgdpa- log of government consumption over gdp; seasonally adjusted

Lpcgdpa- log of private consumption over gdp; seasonally adjusted

Ltcgdpa- log of total consumption over gdp; seasonally adjusted

Lcapitaa- log of GDP per capita, seasonally adjusted

Lrgcgdpa, Lrpcgdpa, Lrtcgdpa, the same but all relative to similar variables for Austria

From the above you will see that:

L- log

p- prices

a- productivity

a (at the end of the name)- seasonally adjusted

capita- gdp per capita

t- tradable

n- nontradable

gc- government consumption

pc- private consumption

tp- total consumption

gdpa- gdp, seasonally adjusted

rir- relative real interest rates

r- relative variables

rp- regulated prices

od- without the distribution sector

s- corrected by labor shares

Construction of Variables:

Non-relative variables

Lp100nta=log(p100na)-log(p100ta)-relative prices

Latnas= snt*log(ata)-log(ana)- relative productivity adjusted for labor shares

Where= snt=(share of employment in nonrtadable sector/share of employment in tradables sector)

Latna= log(ata)-log(ana)- relative productivity

Lgcgdpa= log(gca/gdpa)- government consumption over GDP

Lpcgdpa= log(pca/gdpa)- private consumption over GDP

Ltcgdpa= log(pca/gdpa)- total consumption over GDP

Lcapitaa= gdp per capita

Lrpa= regulated prices

Relative variables are straightforward, for example:

Lrp100nta= Lp100nta_?-Lp100nta_aa

Lratna=Latna_?-Latna_aa

Lrgcgdpa=Lgcgdpa_?-Lgcgdpa_aa

where _? denotes a given country and _aa, denoted Austria

Table 1. Basic Model of Balassa-Samuelson and its Robustness. Estimation method: PDOLS

	Lrpnta	Lrpnta	LRER	LRER	LRER	LRER	LRER	LRER	LRER
NFA/GDP (rnfagdpa)					0.00006** (2.19)	0.00004 (1.18)	0.00008*** (2.77)	0.00004	
Real Interest Rates (rir)					0.005*** (3.87)	0.004** (2.039)	0.008*** (6.59)		0.007*** (5.53)
Balassa Samuelson (lratna)	0.41*** (5.79)		0.15*** (3.57)		0.42*** (4.63)				
Productivity in tradables (lrata)		0.51*** (7.45)		0.72*** (9.15)		0.49*** (3.26)			
Productivity in nontradables (lrana)		-0.23* (3.08)		-0.46*** (5.33)		-0.43*** (4.63)			
Testing restrictions on Balassa-Samuelson**									
-Chi-square									
-Probability									
Adj. R-squared	0.27	0.39	0.13	0.53	0.53	0.53	0.35	0.006	0.27
Number of Observations	100	100	100	100	100	100	100	100	100

Estimations are in levels, *, **, *** statistically significant at 10%, 5% and 1% level, absolute t-values in parenthesis.
**Wald Test on restrictions: HO:lata=-lana.

Table 2. Basic Model of Balassa-Samuelson and Demand Side and its Robustness. Estimation method: PDOLS

	Lrpnta	Lrpnta	Lrpnta	Lrpnta	Lrpnta	Lrpnta	LRER	LRER	LRER	LRER	LRER	LRER
NFA/GDP (rnfangdpa)							0,00006** (2,04)	0,00006** (0,071)	0,00006** (2,02)	0,00003 (0,82)	0,00004 (1,04)	0,00004 (1,01)
Real Interest Rates (rir)							0,005** (3,39)	0,005*** (3,67)	0,005*** (3,52)	0,003 (1,41)	0,004* (1,78)	0,004* (1,69)
Balassa Samuelson (lratna)	0,42*** (5,97)	0,43*** (6,01)	0,51*** (6,59)				0,43*** (4,49)	0,41*** (4,12)	0,42*** (4,27)			
Productivity in tradables (lrata)				0,52*** (7,18)	0,51*** (7,28)	0,51*** (7,26)				0,57*** (3,22)	0,51*** (3,1)	0,52*** (3,09)
Productivity in nontradables (lrana)				-0,21** (2,51)	-0,21** (2,45)	-0,21** (2,46)				-0,42*** (4,22)	-0,40*** (3,88)	0,41*** (4,02)
Government Consumption/GDP (lrgcgdpa)	-0,10** (2,27)			-0,003 (0,06)			0,004 (0,07)			0,06 (0,89)		
Private Consumption/GDP (lrpcgdpa)		-0,13** (2,03)			-0,03 (0,46)			-0,04 (0,6)			0,006 (0,07)	
Total consumption/GDP (lrtcgdpa)			-0,11* (1,73)			-0,01 (0,28)			-0,03 (0,42)			0,02 (0,29)
Wald test*												
-Chi-square												
-Probability												
Adj. R-squared	0,28	0,27	0,24	0,37	0,37	0,37	0,51	0,51	0,51	0,51	0,50	0,50
Number of Observations	100	100	100	100	100	100	100	100	100	100	100	100

Estimations are in levels, *, **, *** statistically significant at 10%, 5% and 1%level, absolute t-values in parenthesis.
*Wald Test on restrictions: HO:lata=lana=(demand variable)=0

Table 3. Introducing the wage effect. Estimation method: PDOLS.

	LRPNTA	LRPNTA	LRER	LRER	LRER	LRER
NFA/GDP (rnfangdpa)					0,00007*** (2,90)	0,00005* (1,67)
Real Interest Rates (rir)					0,003*** (3,40)	0,003* (1,82)
Balassa Samuelson (lratna)	0,33*** (3,47)		0,25*** (2,91)		0,12 (1,36)	
Productivity in tradables (lrata)		0,45*** (4,76)		0,35*** (4,01)		0,17 (1,26)
Productivity in nontradables (lrana)		-0,19** (2,06)		-0,15* (1,68)		-0,13 (1,43)
Real wage (lrwea)	0,08 (1,58)	0,05 (1,14)	0,31*** (6,48)	0,29*** (6,24)	0,28*** (6,21)	0,27*** (5,87)
Adj. R-squared	0,30	0,42	0,62	0,66	0,69	0,68
Number of Observations	100	100	100	100	100	100

Estimations are in levels, *, **, *** statistically significant at 10%, 5% and 1%level, absolute t-values in parenthesis.

Table 4. Basic Model of Balassa-Samuelson and Regulated Prices and its Robustness. Estimation method: PDOLS

	Lrpnta	Lrpnta	Lrpnta	LRER	LRER	LRER	LRER	LRER	LRER
NFA/GDP (rnfangdpa)				0,00001 (0,36)	-0,00002 (0,50)			-0,00002 (0,37)	
RIR				0,006*** (5,13)	0,004*** (2,53)			0,006** (1,87)	
Balassa Samuelson (lratna)		0,07 (1,05)		0,15 (1,36)		0,43*** (4,42)			
Productivity in tradables (lrata)			0,17*** (3,01)		0,26* (1,75)		0,55*** (5,61)		
Productivity in nontradables (lrana)			0,10 (1,88)		-0,14 (1,26)		-0,29** (2,87)		
Regulated prices (lrpa)	0,16*** (11,78)	0,14*** (8,26)	0,14*** (10,56)	0,10*** (3,57)	0,10*** (3,52)	0,07*** (2,97)	0,07*** (2,90)	0,14*** (6,65)	0,15*** (7,11)
Adj. R-squared	0,62	0,62	0,77	0,63	0,62	0,49	0,55	0,62	0,38
Number of Observations	100	100	100	100	100	100	100	100	100

Estimations are in levels, *, **, *** statistically significant at 10%, 5% and 1%level, absolute t-values in parenthesis.

Table 5.The Role of Distribution Sector in Estonia, 1994: 2001:1
(OLS with White Heteroskedasticity Consistent Coefficient Covariance).

	Lp100nta	Lp100nta	Lp100nta	Lp100nta	Lp100nta	Lp100nta
Balassa Samuelson (out of distribution) (latnoda)	0,349*** (5,30)				0,171*** (2,69)	
Productivity in tradables (out of distribution) (latoda)		0,371*** (6,62)		0,245*** (3,79)		0,173** (2,51)
Productivity in nontradables (out of distribution) (lanoda)			0,70*** (4,60)	0,368* (1,83)		0,09 (0,50)
Productivity in the DIS sector (ladisa)					0,545*** (8,35)	0,401** (2,38)
Testing restrictions on Balassa-Samuelson						
-Chi-square						64,77
-Probability						0,000
Adj. R-squared	0,26	0,55	0,49	0,61	0,72	0,75
Number of Observations	29	29	29	29	29	29

Estimations are in levels, *, **, *** statistically significant at 10%, 5% and 1%level, absolute t-values in parenthesis. Wald Test on restrictions: HO:lata=latoda=lanoda=ladisa=0

Table 6.Distribution sector in Slovenia, 1994:1 2001:1
(OLS with White Heteroskedasticity Consistent Coefficient Covariance).

.	Lp100nta	Lp100nta	Lp100nta	Lp100nta	Lp100nta	Lp100nta
Balassa Samuelson (out of distribution) (latnoda)	0,15*** (11,12)				0,179*** (8,35)	
Productivity in tradables (out of distribution) (latoda)		0,275*** (5,73)		0,204*** (5,74)		0,177*** (3,57)
Productivity in nontradables (out of distribution) (lanoda)			-0,167*** (-5,07)	-0,12*** (-6,22)		-0,181** (-2,72)
Productivity in the DIS sector (ladisa)					0,056* (1,83)	0,59 (0,733)
Dummy97						
Testing restrictions on Balassa-Samuelson						
-Chi-square						115,30
-Probability						0,0000
Adj. R-squared	0,78	0,52	0,53	0,80	0,80	0,80
Number of Observations	29	29	29	29	29	29

Estimations are in levels, *, **,*** statistically significant at 10%, 5% and 1%level, absolute t-values in parenthesis. Wald Test on restrictions: HO:lata=latoda=lanoda=ladisa=0