April 2003
IMF Country Report No. 03/114

Competitiveness in the Baltics in the Run-Up to EU Accession

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International Monetary Fund
Washington, D.C.

INTERNATIONAL MONETARY FUND

Competitiveness in the Baltics in the Run-Up to EU Accession

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Approved by Rick Haas

April 3, 2003

Contents Page

Executive Summary

Large current account deficits in Estonia and Latvia, and the continued real appreciation of the exchange rate in Lithuania, have prompted concerns about the competitiveness of the Baltic economies and called into question the sustainability of their current fixed exchange rate arrangements. Recent external performance, however, appears to be explained more by temporary or cyclical developments than by a deterioration in the underlying competitive position of the Baltic economies.

Real effective exchange rates have in fact been quite stable over the last four years compared to the strong real appreciations experienced in the earlier stages of the transition process, appreciating by an average of 2 percent a year since 1999. Estonia's effective exchange rate has been particularly stable, reflecting the kroon's peg to the euro in combination with a high proportion of trade with euro area countries. Latvia's real effective exchange rate is also close to its level of early 1999, although in the intervening period it has been sensitive to swings in the dollar-euro exchange through the peg to the SDR. In Lithuania, the exchange rate was pegged to an appreciating dollar until February 2002, and has been pegged to an appreciating euro since then. Very low inflation, however, has helped to limit the extent of real effective appreciation, which is more or less in line with the average of other central and eastern European accession candidates. Indicators based on measures of relative prices or costs that are more representative of the traded goods sector, such as producer prices or manufacturing unit labor costs, have been even more stable. A more direct assessment of competitiveness based on export performance is complicated by the importance of electronics sub-contracting in Estonia and oil processing in Lithuania, which are significant in terms of trade flows but much less so in terms of value-added. In general, however, exports have performed well despite the global slowdown, and the Baltics have been successful in maintaining and, in some cases, increasing their share of EU markets.

Several factors appear to have driven movements in equilibrium real exchange rates in the Baltics since the start of the transition process. In the earlier years of transition, price liberalization, increased demand for services and other non-tradables, and shifts in domestic production and exports toward higher valued-added products, contributed to real appreciation through higher measured inflation. The strength of the real appreciation during these years appears to also reflect the correction of an initial undervaluation of exchange rates. While these factors have to varying degrees dissipated, strong productivity growth, together with increased capital inflows in response to improved growth prospects, have continued to contribute to real appreciation. There is inevitably much uncertainty over estimates of equilibrium exchange rates. But an assessment based on a broad range of indicators and analysis of the factors behind exchange rate movements suggests no clear evidence of exchange rate misalignment that would call into question the underlying competitiveness of the Baltic economies or the sustainability of their exchange rate regimes.

The extent of any further appreciation of real exchange rates in the Baltics has important implications for their goal of participating in ERM II and adopting the euro at an early stage.

Productivity growth in the Baltics has been impressive in recent years and will likely continue to outstrip that in the euro area over the coming years. As a result, equilibrium real exchange rates will tend to continue to appreciate against the euro in the period leading up to and beyond EU accession. If, as they intend, the Baltics maintain or adopt fixed exchange rate arrangements with a peg to the euro, this will be reflected in inflation rates that are higher than in the euro area. The heavy weight of the tradable sector in the Baltics relative to the euro area, however, will limit significantly the extent to which productivity convergence translates into higher consumer price inflation. As such, productivity convergence alone is unlikely to preclude the ability of the Baltics to meet the Maastricht inflation criterion.

On balance, the strategy of maintaining fixed exchange rates within ERM II and then adopting the euro at the earliest possible date appears to be viable. But the strategy is not without risks. The continued consistency and credibility of macroeconomic and structural policies will be essential to ensure the maintenance of competitiveness and a smooth entry into EMU. Fiscal policy has the key role to play in this regard, by ensuring that domestic demand does not add to inflationary pressures and lead to a deterioration in external balances. Public sector pay restraint, for example, will be particularly important in moderating wage demands. Moreover, fiscal policy will also be the first line of defense in the event that there are temporary surges in capital inflows in anticipation of entry into ERM II or adoption of the euro. In such circumstances, a more contractionary fiscal position may be necessary to counteract the inflationary impact of such inflows.

I. INTRODUCTION

1. **Concerns about the competitiveness of the Baltic economies have re-emerged, as current account deficits have widened in Estonia and Latvia, and the real exchange rate has continued to appreciate in Lithuania.** Annual current account deficits in Estonia and Latvia are currently running at about 12½ and 7¾ percent of GDP, respectively (Figure 1).[1] Current account deficits of this magnitude are clearly unsustainable over the medium-to-longer term. While foreign direct investment (FDI) inflows remain substantial, net external indebtedness has increased.[2] In Estonia, this has been accompanied by persistently strong growth in wages over the last couple of years, in excess of productivity growth. Other indicators, however, including strong enterprise profitability, tend to mitigate concerns about competitiveness. In Lithuania, the current account deficit is under 5 percent of GDP, and net external debt has fallen. But the litas has continued to appreciate following its repegging from the US dollar to the euro in February 2002, raising concerns about the future competitiveness of Lithuania's exports to countries outside the euro area.[3] Inflation, however, is very low, which has helped to offset (but not fully eliminate) the appreciation in the nominal effective exchange rate. Wages also remain subdued, with real wages declining in 2001 and growing only moderately since then.

2. **The correct policy response, if any, to these developments depends on their causes,** specifically whether they reflect: short-run cyclical or other temporary factors that can be expected to reverse over the medium term; or a more fundamental underlying deterioration in the competitiveness of the Baltic economies that would call into question the sustainability of their current fixed exchange rate arrangements. At least part of the recent deterioration in the external position in Estonia and Latvia, for example, reflects a divergence

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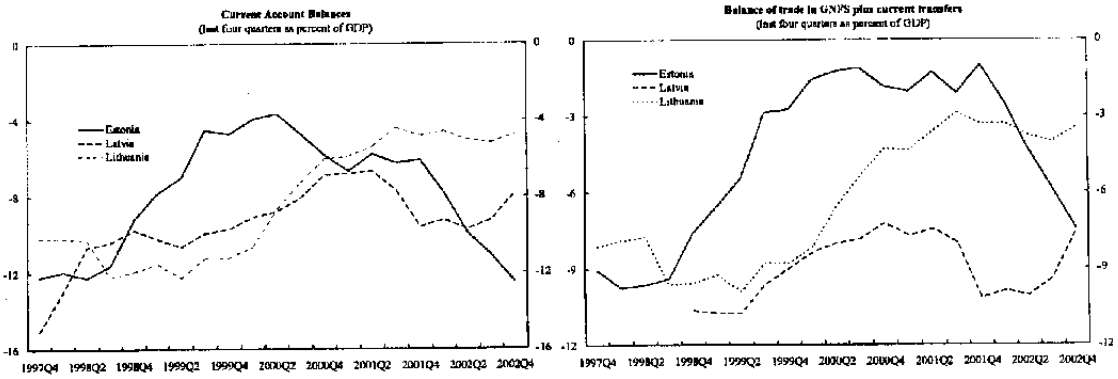
[1] The recent deterioration in Estonia's current account position is largely the result of a decline in the balance of trade in goods and non-factor services rather than an increase in factor income outflows. The latter are substantial, and reflect the profits of foreign companies operating in Estonia, which are recorded as income outflows on the current account (see SM/02/186, Box 2). The reinvested share of these profits has typically been high and is recorded as FDI inflows on the capital account.

[2] Mueller and others (2002) estimate that current account deficits in the Baltics of about 6–7 percent of GDP would be consistent with broadly stable levels of external debt. External indebtedness in the Baltics is, however, relatively low by international standards. Moderate increases in external debt ratios over the medium term need not necessarily precipitate a sudden and damaging reversal of capital flows, therefore, especially if foreign borrowing is used to finance productive investment that enhances the countries' long-term growth prospects.

[3] The euro has appreciated by about 25 percent against the dollar since the repegging.

in their cyclical position relative to the EU. This has been exacerbated by low interest rates in the euro area, which have contributed to the relatively easy monetary conditions currently prevailing in the Baltics. Imports into Latvia and Estonia have also been boosted by a number of one-off large investment projects associated, for example, with recent railway privatization and long-term restructuring of the energy sector. The relative cyclical position has not, as yet, had the same impact in Lithuania, where the exceptional performance of exports in 2002 led to a narrowing of the current account position despite the strong growth of domestic demand. This paper, however, focuses on the second set of issues and attempts to assess the underlying competitive position of the Baltic economies.

Figure 1. External Balances



Source: IMF staff estimates.

3. **These issues are also of particular relevance given the proximity of EU accession.** The Baltic states are among the ten countries that have been invited to join the European Union in May 2004.[4] EU accession and the accompanying commitment to work towards eventual adoption of the euro will have a number of implications for the exchange rate arrangements of the Baltic countries (see Box 1). Upon accession, although not necessarily immediately, they will be expected to participate in ERM II.

4. **The concept of international competitiveness, as applied to national economies, is popular but hard to define.** An appropriate level of competitiveness in the short run is typically associated with the value of the real exchange rate, which, in conjunction with other

[4] The other countries are: the Czech Republic, Hungary, Poland, the Slovak Republic, Slovenia, Cyprus, and Malta. See European Commission (2002) - http://europa.eu.int/comm/enlargement/report2002/strategy_en.pdf

Box 1: Exchange Rate Aspects of EU Enlargement

The EU has identified three distinct stages for the full monetary integration of candidate countries: the pre-accession stage; the accession stage, covering the period from accession to the EU until the adoption of the euro; and finally the adoption of the euro. Each stage has different implications for the choice of exchange rate policy.

- Prior to accession, there are no formal restrictions on the choice of exchange rate regime, although exchange rate policies, like other economic policies, are expected to contribute to macroeconomic stability and promote real and nominal convergence.

- Upon accession, new member states will be expected to treat their exchange rate policy as a matter of common interest, to participate in the coordination of economic policies, and to work towards fulfilling the Maastricht convergence criteria as a prelude to adoption of the euro. In the interim, they will be expected to join ERM II, although not necessarily immediately.

- Finally, participation in the euro area will be decided as soon as a new member state complies with the conditions for the adoption of the single currency (i.e., the fulfillment of the Maastricht convergence criteria, including participation in ERM II for a minimum of two years), and subject to agreement on the rate of conversion.

ERM II involves stable but adjustable central rates to the euro for participating currencies, with fluctuation bands of plus or minus 15 percent around the central rate. All three Baltic states have indicated their intention to join ERM II as soon as possible after entry into the EU. The EU has indicated that the currency board arrangements of Estonia and Lithuania, with their pegs to the euro, could be compatible with participation in ERM II.[1] The situation for Latvia, with its conventional fixed exchange regime with a peg against the SDR, is different, however, because the EU has determined that pegs against anchors other than the euro are incompatible with ERM II. Latvia will therefore be required to either repeg to the euro or adopt a managed float within ERM II bands about a mutually agreed central rate. In all three cases, any decision regarding participation in ERM II would also be subject to a satisfactory assessment of the appropriateness and sustainability of the arrangements, and mutual agreement on a central parity.

The Maastricht criteria also state that: average inflation should be no higher than 1.5 percentage points above the average of the three EMU member states with the lowest inflation rates (which would currently set an inflation limit of about 2.9 percent); the general government fiscal deficit should be no more than 3 percent of GDP; gross general government debt should be no more than 60 percent of GDP; and long-term nominal interest rates on public debt should be no higher than 2 percentage points about the average of the three EMU members states with the lowest inflation rates (which would currently set an interest rate limit of about 6 percent).

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[1] The EU has declared that "although currency board arrangements cannot be regarded as an acceptable substitute for participation in ERM II, they may in some circumstances constitute an appropriate unilateral commitment within ERM II. Such a commitment would not impose any additional obligation on the ECB, beyond those deriving from the ERM II resolution and the Central Bank Agreement." See Report by the (ECOFIN) Council to the European Council in Nice:
http://europa.eu.int/comm/economy_finance/publications/european_economy/2001/c2001_01_en.pdf

domestic policies, ensures both internal and external balance. The terms 'competitiveness problem' and 'inappropriate real exchange rate' are thus often used interchangeably. Over the long run, however, when real exchange rates are expected to have converged on their equilibrium value, competitiveness is more generally defined in terms of an economy's ability to support increases in living standards.[5] This in turn is largely a function of, and synonymous with, trend productivity growth. The focus on international *competition* is thought by some to be irrelevant or misleading since what matters most for achieving higher incomes are the domestic forces that propel productivity growth. Krugman (1994), for example, highlights the dangers of blaming *international competitiveness* for economic difficulties that are primarily domestic in origin. International comparisons of competitive benchmarks or indicators, however, can yield useful information about national economic performance without necessarily implying competition between nations in the popular ("win-lose") sense of the word. And there is no shortage of available indicators of competitiveness—ranging from the relative price or cost indicators regularly published by the IMF, OECD, and national statistical agencies, to absolute measures of competitiveness prepared by the World Economic Forum and Lausanne Institute for Management Development (see Box 2).

5. This paper is organized as follows. Section II reviews a typical range of competitiveness indicators, in some cases comparing performance against other accession candidates in central and eastern Europe. Section III briefly assesses recent productivity performance and the extent of convergence with the EU. Section IV analyses the factors that have affected equilibrium exchange rates in the Baltics, focusing on the role of productivity, and presents some quantitative estimates of underlying exchange rates. The policy implications of these issues are considered in Section V, with particular emphasis on the Baltics countries' goal of EMU membership.

II. Assessing Competitiveness

6. This chapter assesses developments in the Baltic countries' external competitiveness by reviewing a range of standard indicators. These include price- and cost-based measures of the real effective exchange rate, recent wage developments, and more direct measures of export performance. As each of these indicators is an imperfect measure of competitiveness, caution must be exercised in interpreting developments in any single measure.

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[5] Competitiveness in this sense has been variously defined as: "the degree to which a country can, under free trade and fair market conditions, produce goods and services which meet the test of international markets, while simultaneously maintaining and expanding the real incomes of its people over the long term" (OECD); "the ability of an economy to provide its people with high and rising standards of living and high rates of employment on a sustainable basis" (European Commission) ; and "a country's ability to maintain high rates of growth and employment in the medium term" (World Economic Forum).

Box 2: Survey-based Indicators of Competitiveness

Survey-based indicators of absolute competitiveness take into account a broad range of factors thought to be related to national economic performance, including value-added produced, the cost of living, the degree of economic openness, the cost of capital, intellectual property, labor costs, labor force characteristics, and human capital measures. The competitiveness of countries and that of firms are regarded as interdependent concepts, with countries ranked according to how their environments sustain firms' competitiveness. Although there have been few formal studies of the relevance of such composite survey-based indicators, they have a high profile among national policy makers, politicians, and business analysts. The two most widely quoted studies are prepared by the World Economic Forum (WEF) and the Lausanne-based Institute for Management Development. Estonia is the only Baltic country that appears in both lists, and has a rank that compares very favorably with the central and eastern European accession candidates, as well as some existing EU member states. Latvia and Lithuania are ranked 45th and 40th respectively according to the WEF report.

Global Competitiveness Lists
(2002 rankings)

	WEF	IMD
Finland	2nd	2nd
Germany	14th	15th
Ireland	20th	10th
Slovenia	27th	38th
Hungary	28th	28th
Estonia	**30th**	**21st**
Czech Republic	34th	29th
Portugal	36th	33rd
Greece	38th	36th
Lithuania	**40th**	...
Slovak Republic	42nd	37th
Latvia	**45th**	...
Poland	46th	45th

Source: World Economic Forum and Institute for Management Development

A. Real Effective Exchange Rate Indicators

7. **Real effective exchange rates (REERs) are the most frequently used indicators of external competitiveness**, and can be calculated with reference to a variety of alternative price and cost indices. This section reports REERs based on three such indices—Consumer Prices (CPI), Producer Prices (PPI), and Unit Labor Costs (ULC), the main advantages and disadvantages of which are summarized in Box 3.[6] Movements in these indices require careful interpretation, as they may reflect equilibrium phenomena rather than changes in competitiveness. Some appreciation of CPI-based REERs, for example, would be consistent with the convergence of living standards and productivity in the Baltics on advanced economy levels, while PPI- and ULC-based measures, which are more representative of the traded goods sector, could be expected to remain more stable. This has generally been the

[6] Export price-based measures were considered but found to be a poor indicator of competitiveness in the Baltics for a number of reasons. The Baltics are, for example, likely to be price takers in most of the markets within which they compete. Export prices are also highly distorted by transfer pricing activity in Estonia and by swings in oil prices in Lithuania.

Box 3: Real Exchange Rate Indicators of Competitiveness

The **CPI-based** measure is widely available, facilitating comparisons with other countries. It is also a broad-based indicator, including both goods and services. The main drawbacks are that such indices include a large number of non-traded goods and services, and exclude intermediate goods, which are an important component of traded goods; and the representative basket will vary across countries. In transition countries, the CPI can also be significantly affected by price liberalization and adjustments of administered prices.

The **PPI-based** measure retains the disadvantage that the basket varies across countries. However, the items in each basket are typically more representative of traded goods, including traded intermediate goods. But the PPI-based measure may not be a good measure of competitiveness as companies can price to market by squeezing profits in the short run.[1]

The **ULC-based** measure is often thought to be the most appropriate for use as a competitiveness measure because labor costs are an important component of production costs. But the measure misses some important aspects of actual production costs; a fall in unit labor costs that results from the substitution of capital for labor, for example, need not necessarily signal an improvement in underlying competitiveness. The measurement of productivity that underlies the ULC-based measure is difficult in practice, especially when used as a basis for cross-country comparisons, and typically highly sensitive to variations in the economic cycle.

The usefulness of REER measures is generally assessed according to their ability to explain actual trade flows. Marsh and Tokarick (1994), for example, find that for a range of advanced countries, trade flows are most closely correlated with ULC-based REER measures.

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[1] Corporate profitability is also difficult to compare across countries. In a recent survey, however, Citron and Walton (2002) ranked 23 countries by the profitability of their private non-financial corporate sectors in 2000/01. Estonia ranked fifth and Latvia eighteenth. The study did not include Lithuania.

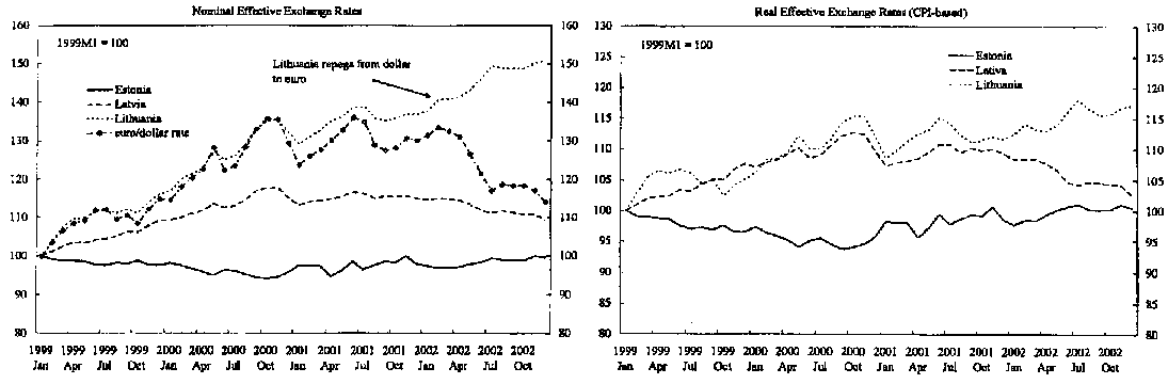
case in the Baltics, except where specific factors unrelated to competitiveness, such as the impact of oil prices on producer prices in Lithuania, have been at play.

8. **The CPI-based REERs of the Baltic countries have been relatively over the last four years** (Figure 2).[7] The REER for Estonia has moved within a very narrow band throughout this period, reflecting the close conformity between Estonia's peg to the euro and the structure of its trade flows: almost half of Estonia's exports over this period were directed

[7] This contrasts with the strong appreciation of real effective exchange rates in early phases of transition. According to analysis conducted in an earlier paper (SM/99/282), this reflected: (i) the substantial initial undervaluation of the currencies, especially in Estonia; (ii) price liberalization; and (iii) high productivity growth in the traded goods sector compared to the non-traded goods sector. These issues are re-visited in more detail in the analysis of long run equilibrium exchange rates in section IV.

towards the euro area (and Denmark, whose currency is linked to the euro through the ERM II).[8] The depreciation of the euro against the dollar through the end of 2000, and its more recent appreciation, thus had only a modest impact on Estonia's REER. Latvia and Lithuania's trade with the euro area (and Denmark) is lower, but still significant, accounting for over one-third of all exports (Figure 3).[9] The appreciation of the dollar against the euro therefore led into an appreciation of Lithuania's effective exchange rate through its link to the dollar, with the appreciation only partly offset in real effective terms by Lithuania's low inflation rates. The recent appreciation of the euro against the dollar has had a similar effect following the repegging of the litas from the dollar to the euro in February 2002. As a result, Lithuania's REER has risen by about 16 percent since early 1999. In the case of Latvia, the REER peaked in late 2000, as the dollar reached a new peak against the euro, but has since

Figure 2. Effective Exchange Rates
(against major trading partners, 2000 trade weights)

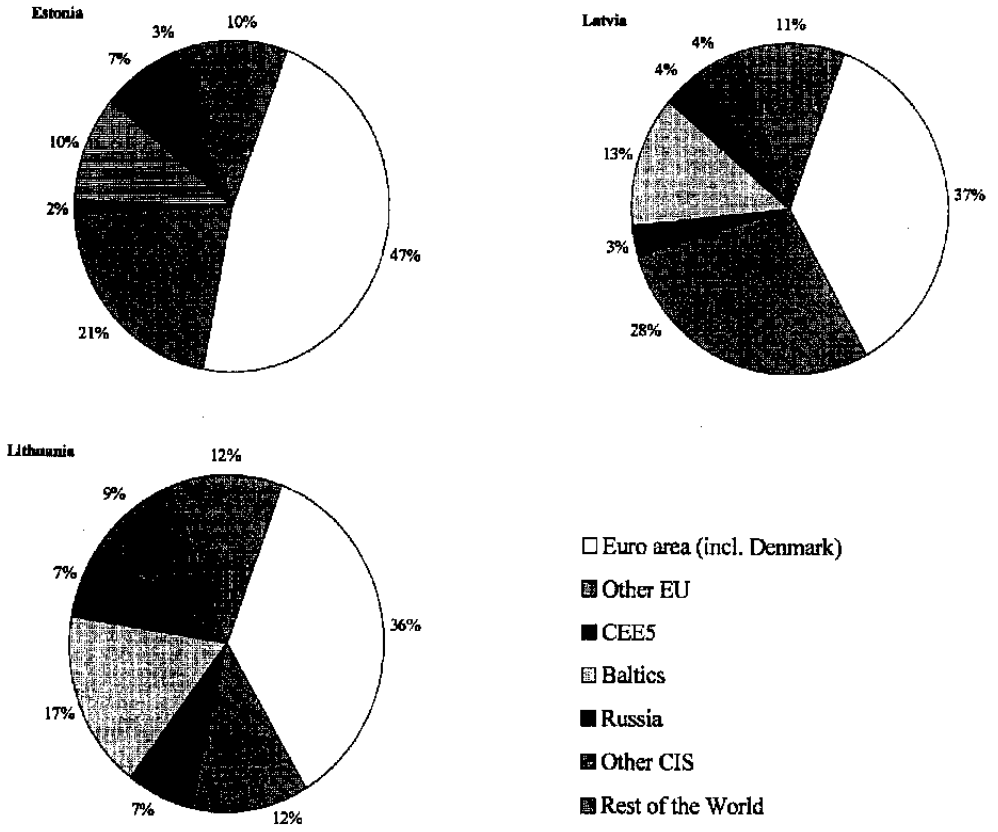


Source: IMF staff estimates.

[8] The Danish krone has fluctuated within narrow ERM II bands of ± 2¼ percent against the euro since the beginning of 1999.

[9] This represents a significant reorientation in the direction of trade from east to west since the Russia crisis, especially in Lithuania. In 1995, for example, Russia was by far the largest trading partner for Lithuania, accounting for 43 percent of exports compared to only 23 percent for the euro area countries (and Denmark).

Figure 3. Trade Shares
(export weights, 2000)



Source: Direction of Trade Statistics.

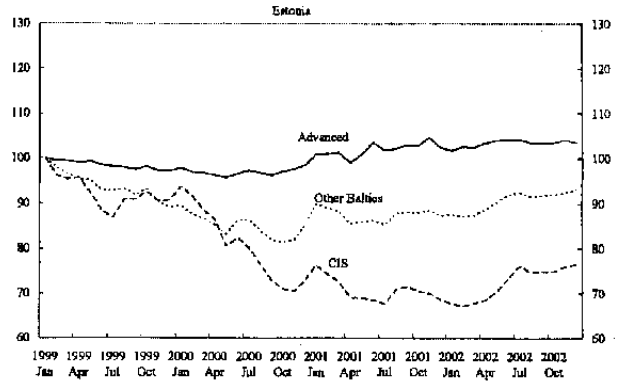
depreciated in response to both a fall in inflation in Latvia and, more recently, the depreciation of the dollar against the SDR and the euro.[10]

9. **Baltic REERs have tended to be strongest against advanced economy trading partners and, in the case of Lithuania, also against its Baltic neighbors.** Exchange rates against CIS-trading partners, by contrast, have generally depreciated since 1999 (Figure 4). While the overall appreciation of Lithuania's REER has exceeded that of its Baltic neighbors, it has been broadly comparable to that in other (transition) EU accession candidates

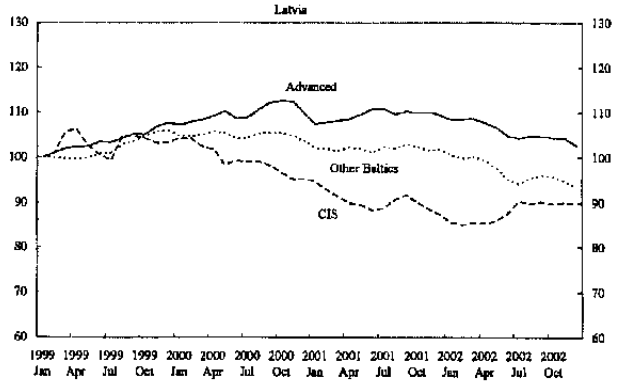
[10] The current SDR weights are: U.S. dollar 45 percent; euro 29 percent; Japanese yen 15 percent; Pound sterling 11 percent.

(Figure 5). In general, inflation rates have been lower in the Baltics, which has helped to offset the nominal appreciation that has taken place. Despite the reorientation of trade since the Russia crisis, the Baltics also continue to have a larger share of trade with Russia and other CIS countries than the other accession candidates.

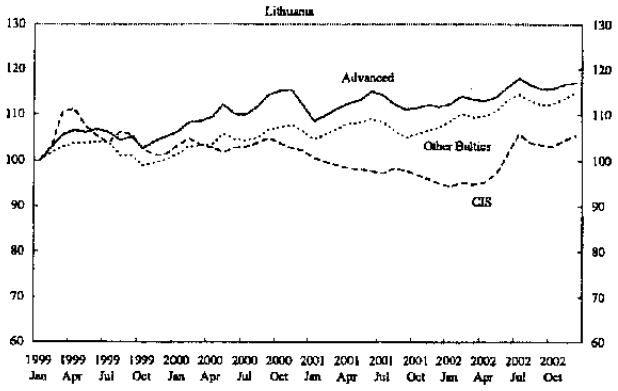
Figure 4. Real Effective Exchange Rates by Region



Source: IMF staff estimates.

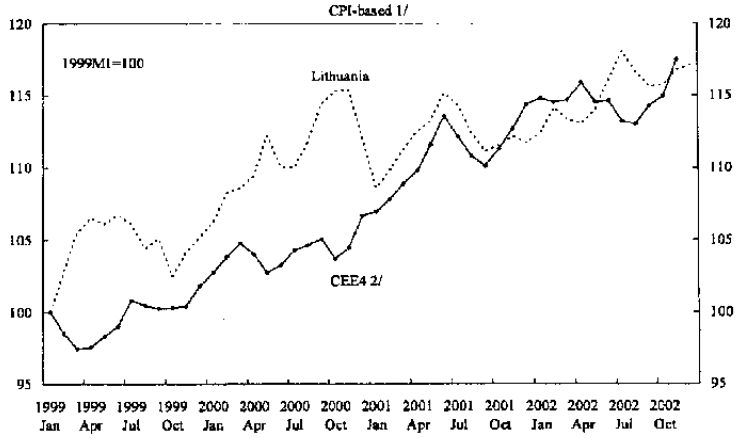


Source: IMF staff estimates.



Source: IMF staff estimates.

Figure 5. EU Accession Countries: Real Effective Exchange Rates



1/ Using 2000 trade weights for Lithuania, and 1995 trade weights for CEE4 countries
2/ CEE4 is unweighted average of Czech Republic, Hungary, Poland, and Slovak Republic

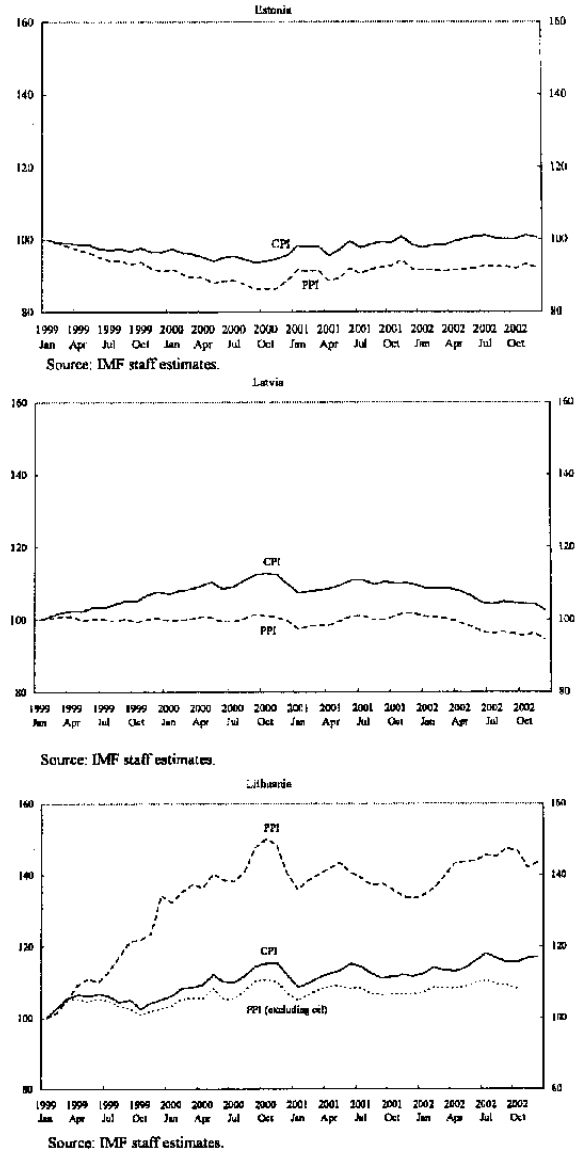
Source: IMF staff estimates.

10. **Producer price (PPI)-based measures of the real exchange rate have depreciated modestly in Estonia and Latvia since the beginning of 1999**, in line with the lower share of non-traded goods in the PPI than in the CPI (Figure 6). In Lithuania, however, the PPI-based REER has appreciated by over 40 percent since the beginning of 1999. This reflects the importance of the oil-processing trade in Lithuania, as a result of which the PPI is heavily biased towards oil products and sensitive to changes in international oil prices.[11] To the extent that the price of exported processed oil products also moves in step with changes in international oil prices, the sharp appreciation of the PPI-based REER should not, therefore, be interpreted as a decline in competitiveness. The PPI-based exchange rate excluding oil prices by contrast has appreciated by under 10 percent since the beginning of 1999—less than the corresponding appreciation in the CPI-based measure.

11. **Unit Labor Cost (ULC)-based real effective exchange rates have moved more or less in line with the equivalent CPI-based measures in Estonia and Latvia, but by significantly less than the CPI-based measure in Lithuania** (Figure 7). The growth of

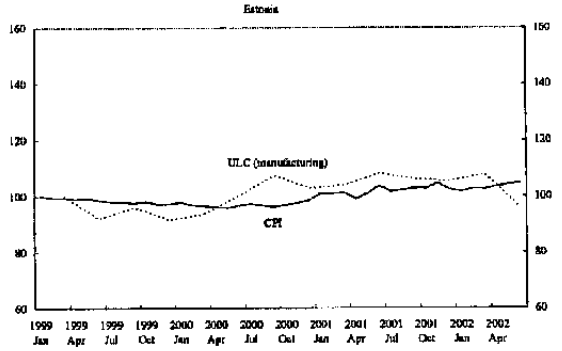
[11] Oil-related products account for about one fifth of Lithuanian imports and exports, and a similar share of the producer price basket, which has therefore been highly sensitive to recent large swings in international oil prices. However, the oil sector accounts for only about 2 percent of value-added in Lithuanian GDP.

Figure 6. Real Effective Exchange Rates (CPI- and PPI-based)
(against major trading partners, 2000 trade weights)

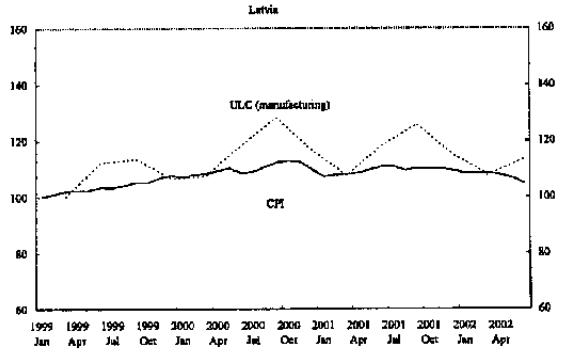


manufacturing wages has been particularly strong in Estonia in recent years (although lower-than-average wage growth in other sectors of the economy) but has generally been matched by equally strong growth of productivity. Both wage and productivity growth have been more moderate in Latvia. In Lithuania, the strong recovery following the post-Russia crisis recession coincided with an acceleration in the process of labor shedding, leading to exceptionally high increases in measured productivity. Manufacturing wages have risen only modestly since 2000, and the resulting fall in unit labor costs has fully offset the continued appreciation of Lithuania's nominal exchange rate.

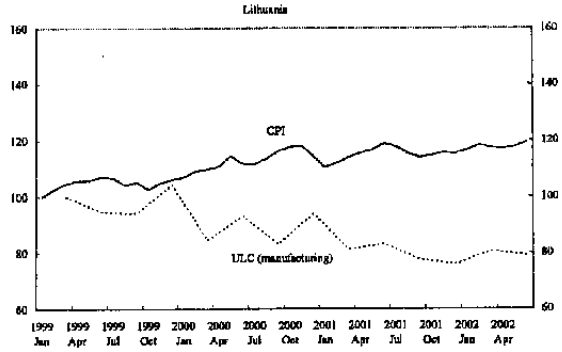
Figure 7. Unit Labor Cost-based Real Effective Exchange Rates
(against major trading partners excluding CIS countries, 1999Q1=100)



Source: IMF staff estimates.



Source: IMF staff estimates.



Source: IMF staff estimates.

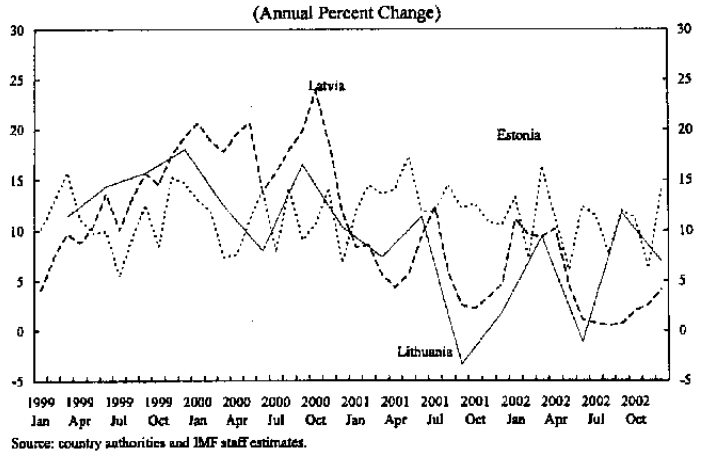
12. **More recent data covering the whole economy suggest that wage growth in Estonia may have become excessive.** Wages (measured in euros) increased at an average annual rate of 10¾ percent in 2002, well in excess of whole economy productivity growth.[12]

[12] The measurement of wages in the Baltics is complicated by the significant role of the informal sector. There is evidence that the recent strength of wage growth in Estonia, for

(continued...)

Recent wage increases (also measured in euros) in Latvia were more moderate, at 4.5 percent, although this was partly a reflection of the depreciation of the lat against the euro (wages measured in domestic currency increased by 8.5 percent). Wage growth in Lithuania also rebounded somewhat in 2002 to 6½ percent (Figure 8).

Figure 8. Wage Developments
(average gross monthly wages, whole economy, measured in euros)



Source: country authorities and IMF staff estimates.

13. **Wage growth in the Baltics has been similar to that in the other central and eastern European accession countries in recent years,** although over the last eighteen months wage growth has been somewhat faster than average in Estonia and to a lesser extent Latvia (Figure 9). The level of labor costs, however, remains well below the accession average and considerably below the EU average.[13] In 2000, hourly labor costs in industry were 2.91, 2.65, and 2.28 euros in Estonia, Lithuania, and Latvia, compared to an average of 3.70 euros in the Czech Republic, Hungary, Poland, and the Slovak Republic, and 22.70 euros in the EU. Labor costs tend to be somewhat higher in the service sector, although

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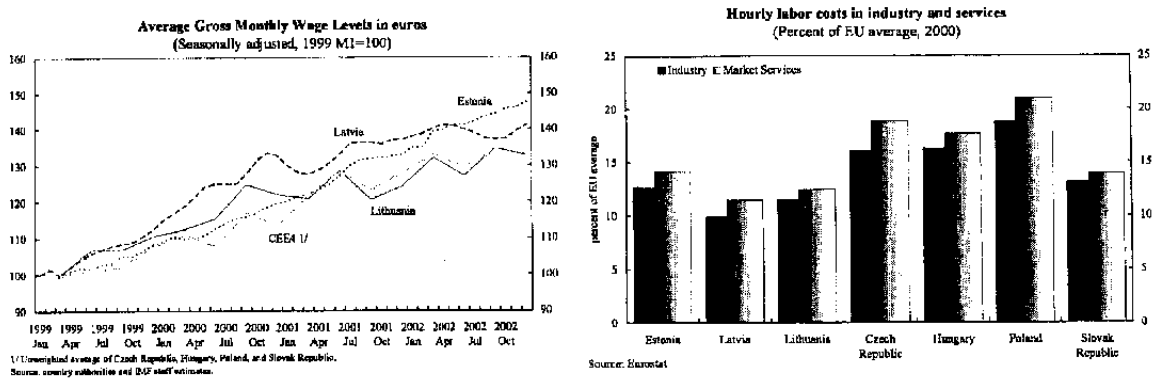
example, is partly a reflection of changes to the social insurance system, which have encouraged increased formal declaration of wages. Based on national accounts data, which also reflects cash-in-hand ("envelope") wages, nominal wage growth since 2000 has been about 3 percentage points below measured wage growth in the formal sector. There is some anecdotal evidence that the recent acceleration in wage growth in Latvia and Lithuania may reflect a similar phenomenon.

[13] Labor costs refer to the cost to employers of employing workers, and includes gross wages and salaries, other compensation including bonus payments and payments in kind, employers' social security contributions, and other costs including training and recruitment costs. Labor costs are estimated to account for about two-thirds of production costs for goods and services.

a similar pattern emerges with respect to hourly costs compared to other accession countries and the EU (Figure 9). The main exception is in financial services, where hourly wage costs in Estonia of 6.66 euros are marginally above the average of 6.40 euros in the other central and eastern European accession countries (excluding Slovenia).

Figure 9. Wage Developments in EU Accession Countries



B. Export Performance

14. **A more direct measure of competitiveness is given by export performance.** Export growth has recently accelerated in all three Baltics, driven primarily by a recovery in exports to non-CIS countries (Figure 10). Prior to that, exports to the EU were relatively weak, but this weakness was partly offset by renewed growth of export to CIS countries, supported by a depreciating real effective exchange rate against these countries and the growth of demand in the CIS.[14] The relative weakness of Baltic exports to the EU from 2000–01 was largely a reflection of the weakness in EU demand. Abstracting from this, however, the Baltics have been relatively successful in maintaining—and, in some cases, increasing—their share of the EU market (Tables 1 and 2).[15] Estonia and Lithuania have performed exceptionally well in this regard. Latvia's market share has risen more moderately, but excluding the wood sector—which suffered from a difficult market environment—Latvia has also performed well. The pattern of overall export performance is partly explained by the commodity composition of trade:

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[14] Lithuanian exports were additionally supported by a sharp increase in re-exports of used cars to Russia.

[15] Market shares can be computed by using either EU import data or individual countries' export data. The former calculation is distorted since the EU import data for Estonia and Latvia includes a large share of Russian oil exports transported through these countries (about 25 percent of EU imports from Estonia and 40 percent from Latvia in 1997).

- In Estonia, the sharp increase in market penetration in 2000 is largely a reflection of the assembly sub-contracting operations of Scandinavian telecommunications companies. This accounts for the bulk of the 125 percent rise in Estonia's exports in machinery and electrical products to EU in 2000, resulting in an increase in total exports to EU by 38.5 percent. It also led to a similar increase in imports, and the resulting share in total value added in the economy of this sector is thus relatively low. The collapse in the global telecommunications sector in mid-2001 has by the same token resulted in a fall in Estonia's market share. If machinery and electrical products are excluded, both the increase of Estonia's market share over recent years, and last year's reduction in share, have been more moderate.

- The more moderate increase in Latvia's EU market share is partly explained by the concentration of exports on wood and wood products (which account for about 50 percent of goods exports). There has been a general decline in EU demand for wood, with global wood exports to EU declining by 4.1 percent between 1997 and 2001. Wood prices have also been quite sluggish, declining by 0.9 percent between 1997 and 2001.[16]

- Lithuania's export base is more diversified than those of Estonia and Latvia, with oil, textiles, machinery and equipment all contributing significantly to export growth. Much of the large increase in Lithuania's market share in 2001, however, relates to the oil sector, and in particular the resolution of supply difficulties at the country's main oil refinery.[17] As with the electronics processing sector in Estonia, this also led to an increase in imports with only a minor impact on national value-added.

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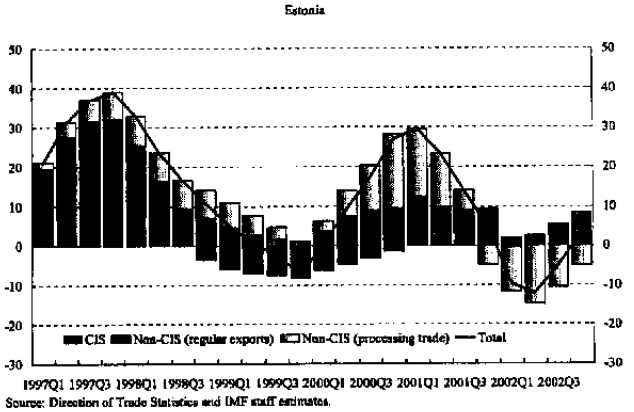
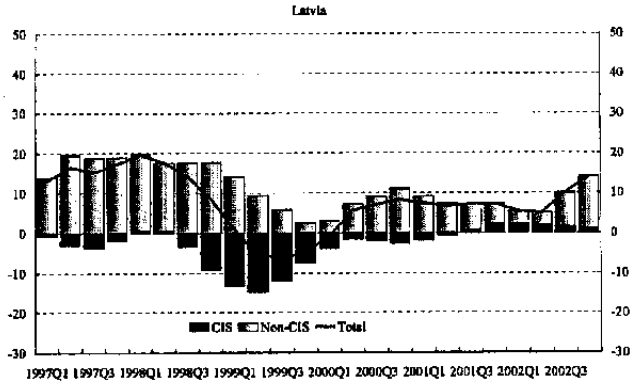
[16] See also Box 4 in SM/01/366.

[17] In addition, the state-owned oil refinery signed a one-off distribution contract with British Petroleum in 2001, as result of which exports to the UK are inflated in that year—exports to the UK more than doubled in 2001. Exports were re-directed to Switzerland last year, which thus superseded the UK as Lithuania's largest export partner in 2002.

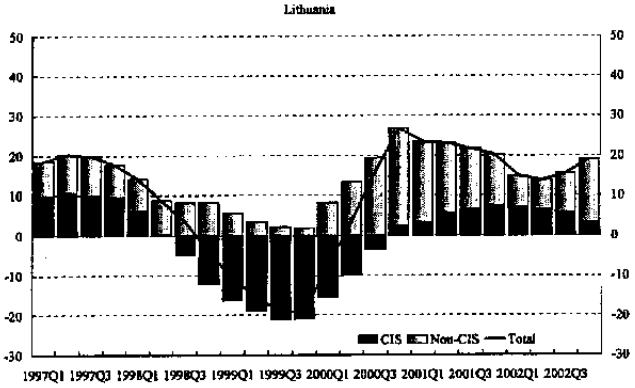
Figure 10. Export Growth
(contributions to merchandise export growth over preceding four quarters)



Source: Direction of Trade Statistics and IMF staff estimates.



Source: Direction of Trade Statistics and IMF staff estimates



Source: Direction of Trade Statistics and IMF staff estimates

Table 1. Market Shares of Baltic Exports to EU
(indexes, 1997 = 100)

	1997	1998	1999	2000	2001
Total exports					
Estonia	100.0	120.3	124.8	166.2	157.6
Latvia	100.0	120.2	124.0	133.5	140.1
Lithuania	100.0	107.6	112.5	131.1	162.8
Total excl. mach. & electr.					
Estonia	100.0	112.2	118.5	127.8	126.2
Latvia	100.0	121.7	127.5	139.2	144.8
Lithuania	100.0	106.0	112.2	138.2	170.1
Total excl. wood					
Estonia	100.0	120.9	123.3	178.4	169.3
Latvia	100.0	123.8	123.8	140.2	159.8
Lithuania	100.0	110.3	114.4	135.5	170.6
Total excl. mach. & electr. & oil					
Estonia	100.0	112.5	120.1	133.3	129.6
Latvia	100.0	119.5	126.2	141.9	145.1
Lithuania	100.0	106.8	113.2	130.0	138.8

Source: Comtrade database.

Table 2. Main Exports to EU from the Baltics

	Estonia		Latvia		Lithuania		World	
	Share 1/	Growth 2/	Share 1/	Growth 2/	Share 1/	Growth 2/	Share 1/	Growth 2/
Total	100.0	15.4	100.0	11.0	100.0	15.0	100.0	1.8
Oil and mineral products	2.2	-5.6	1.3	13.6	8.8	104.2	6.0	7.1
Chemical products	2.3	14.4	1.5	15.3	11.3	2.3	9.0	5.1
Wood and articles of wood	17.3	5.0	52.0	7.7	8.4	1.7	1.2	-4.1
Textiles and textile articles	13.8	6.5	18.2	8.7	33.0	10.5	5.5	-6.3
Base metals and articles of base metal	8.4	10.9	8.7	48.6	3.8	1.1	7.3	-0.4
Machinery and electrical equipment	34.7	37.0	3.3	4.3	10.1	9.0	27.3	3.6
Transport equipment	1.9	25.7	0.8	6.9	4.2	33.5	13.7	4.7
Misc manufactured articles	7.9	20.0	7.2	16.8	6.2	39.1	2.3	2.2

Source: Comtrade database.
1/ Share in the country's total exports to EU. 1997-2001 average.
2/ 1997-2001 annual average.

III. Productivity Developments in the Baltics

15. **Productivity is the main determinant of national living standards over the long run**—or at least the determinant over which policy makers in most countries have indirect leverage.[18] It refers to how well an economy uses the resources it has available by relating the quantity (and ideally quality) of inputs to outputs. It is generally accepted that productivity growth rates are strongly influenced by a country's position relative to the global production frontier, that is the potential for "catch-up" or "convergence". That said, there is also ample evidence that there is much more to relative productivity performance than simply lags in the diffusion of a common set of technologies, including the establishment of macroeconomic stability and the timeliness and intensity of structural reform efforts.[19] This section considers the recent productivity performance of the Baltics.

A. Labor Productivity

16. **Among the most simple and widely cited measure of a country's productivity performance is income or output per capita**, typically measured by GDP.[20] This measure also has the most direct bearing on average standards of living. Income per capita is 41 percent of levels in the euro area in Estonia, and about one-third in Latvia and Lithuania (Figure 11). Income levels are also still significantly below levels in other EU accession candidates. Although productivity is better defined as output per unit of productive inputs, such as GDP per worker, the productivity gap between the Baltics and the euro area remains about the same size as that for per capita incomes.[21] Differences between GDP per capita and labor productivity reflect cross-country variations in unemployment rates and labor force participation.

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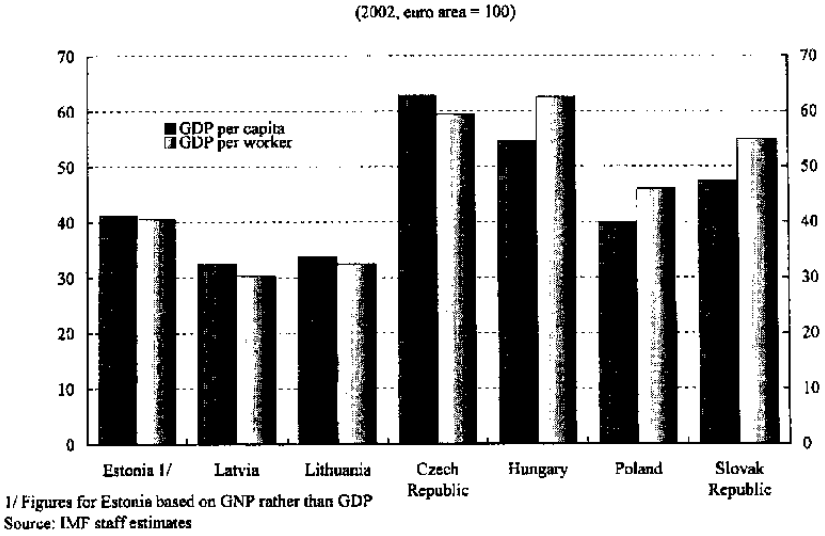
[18] For smaller more open economies, changes in the terms of trade also have a significant impact on living standards. For the Baltic economies, however, the terms of trade are essentially determined externally.

[19] For a review of recent evidence on convergence and growth, see Temple (1999). Relative growth performance in transition economies is discussed in Fischer and Sahay (2000).

[20] GDP in Estonia is inflated by profits made by foreign companies. The gap between GDP and GNP is relatively large (over 5 percent) and has been increasing in recent years. For cross-country comparisons, therefore, GNP rather than GDP is used for Estonia.

[21] Further refinements, such as GDP per hour worked, are possible. There is, however, considerable uncertainty regarding cross country comparisons of annual average hours worked. For the purpose of comparing productivity levels across countries, therefore, GDP per worker is used. Comparisons of income and productivity levels are also influenced by the exchange rate used to convert to common currencies. The above comparisons use the IMF measure of PPP exchange rates.

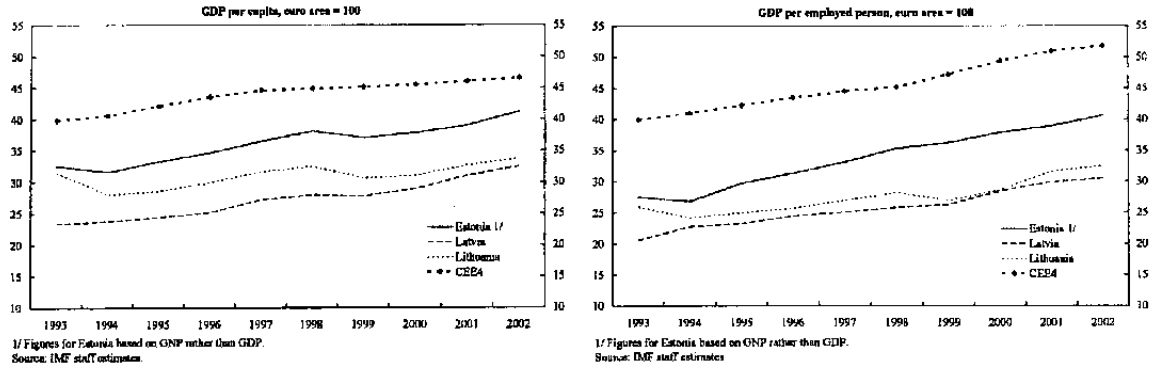
Figure 11. Income and Productivity Levels



1/ Figures for Estonia based on GNP rather than GDP
Source: IMF staff estimates

17. **Although the gap between income and productivity levels in the Baltics and the euro area remains very large, convergence is taking place.** And the convergence of productivity levels has been more rapid than convergence of income levels, as output growth has been maintained despite a decline of employment and participation rates towards average levels in the euro area (Figure 12). Convergence has generally been a little more rapid in the Baltics than in most other central and eastern European accession countries, possibly reflecting their lower starting levels. Labor productivity growth has, on average over the last five years, been close to 3¾ percentage points above productivity growth in the euro area, and about ¾ percentage points above average labor productivity growth in the Czech and Slovak Republics, Hungary and Poland.

Figure 12. Income and Productivity Convergence



1/ Figures for Estonia based on GNP rather than GDP.
Source: IMF staff estimates.

B. Total Factor Productivity

18. **Measures of labor productivity, however, are influenced by the extent of capital deepening** (increases in the quantity of physical capital per unit of labor input). While measures of labor productivity take into account the impact of changes in employment on output, they do not take into account the impact of changes in the capital stock. Total factor productivity (TFP) attempts to capture the efficiency with which both labor and capital inputs are used and therefore represents a theoretically more appealing measure of productivity. TFP is difficult to measure, however, especially in transition economies, where estimates of the effective capital stock and level of labor input at the start of the transition process are subject to considerable uncertainty.[22]

19. **Approximate estimates of the capital stock, however, suggest that capital accumulation contributed about 1¾–2 percentage points to annual GDP growth in all three Baltic countries from 1995–2001.** While this is significant, the estimates suggest that the rapid growth in output in the Baltics over this period primarily reflects TFP growth rather than capital deepening or increases in employment. Increases in TFP are estimated to have contributed 4¼ percent to annual GDP growth in Estonia, 3¾ percent in Latvia, and 3 percent in Lithuania. These estimates are somewhat larger than similar estimates for other accession candidates, and significantly larger than estimates for the euro area (Figure 13). The relative growth of total factor productivity may, however, be overstated as a result of the process of labor shedding, which only now appears to be coming to an end in the Baltics, as well as substantial improvements in the quality of capital and labor inputs during the transition period.[23]

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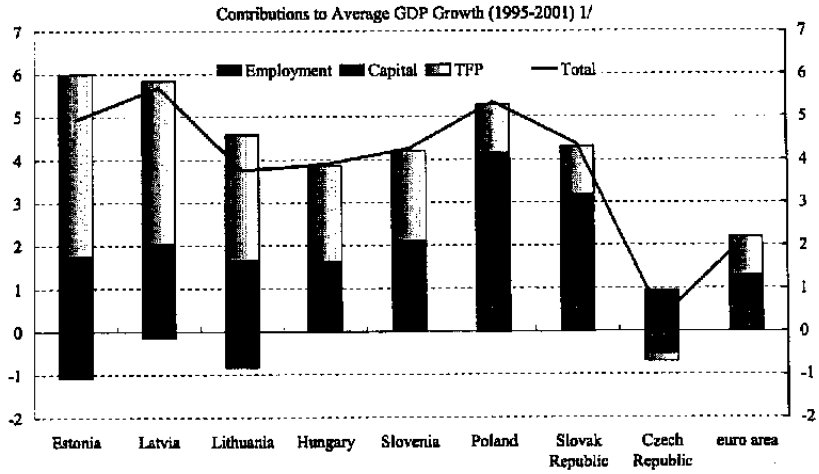
[22] For a more detailed discussion of some of the issues involved in estimating TFP in Estonia, and a description of the methodology used to calculate the estimates of TFP reported here, see SM/02/186, appendix I, and Doyle, Jiang, and Kuijs (2002).

[23] The fall in officially measured employment in the Baltics throughout much of the transition period partly reflects hidden unemployment and poorly allocated labor under the previous economic system. Hence, using employment levels—rather than some broader measure of the effective input of human capital—will tend to understate the real contribution of labor to growth, and overstate that of the residual TFP. Coricelli and Jazbec (2001) find that labor shedding accounts for a significant proportion of productivity growth in the Baltics relative to other central and eastern European accession countries.

Figure 13. Total Factor Productivity Growth



1/ Baltics: 1995-2001; Hungary, Poland, Slovak Republic, Slovenia: 1995-2000; Czech Republic: 1995-1999; euro area: 1996-2000
Source: IMF staff estimates; Doyle et al (2001); and Denis et al (2002).

IV. Equilibrium Real Exchange Rates

20. **Whether or not recent movements in real exchange rates are a cause for concern depends on whether they reflect underlying changes in equilibrium exchange rates.** This chapter therefore considers a range of factors that typically affect equilibrium exchange rates in transition economies, and provides some quantitative assessments of the importance of these factors in the Baltics. The first section focuses on whether the productivity improvements discussed in chapter III can explain the observed appreciation in real exchange rates in the Baltics. Some illustrative econometric estimates of equilibrium exchange rates in the Baltics are then presented. Alternative statistical methods to identify trend movements in real exchange rates are also considered and found to yield similar results, which are then compared against actual trade flows.

A. Productivity and Equilibrium Real Exchange Rates

21. **Perhaps the most simple methodology for defining equilibrium exchange rates is the purchasing power parity approach** (PPP), which states that the percentage change in the nominal exchange rate between two currencies will equal changes in the price levels of the corresponding countries—or, equivalently, that the real exchange rate between two countries remains a constant. The PPP approach is typically not a good explanation of exchange rate movements in the short-to-medium term, and is not therefore a good benchmark against which to assess competitiveness. But it can be of some use in analyzing longer-term trends. Currently, the exchange rates in all three Baltic countries are about 50 percent below the levels that would be necessary to ensure purchasing power parity with

the euro area (i.e., price levels are about 50 percent below price levels in the euro area) (Table 3).

Table 3:Exchange Rates Relative to Purchasing Power Parity (in 2001)

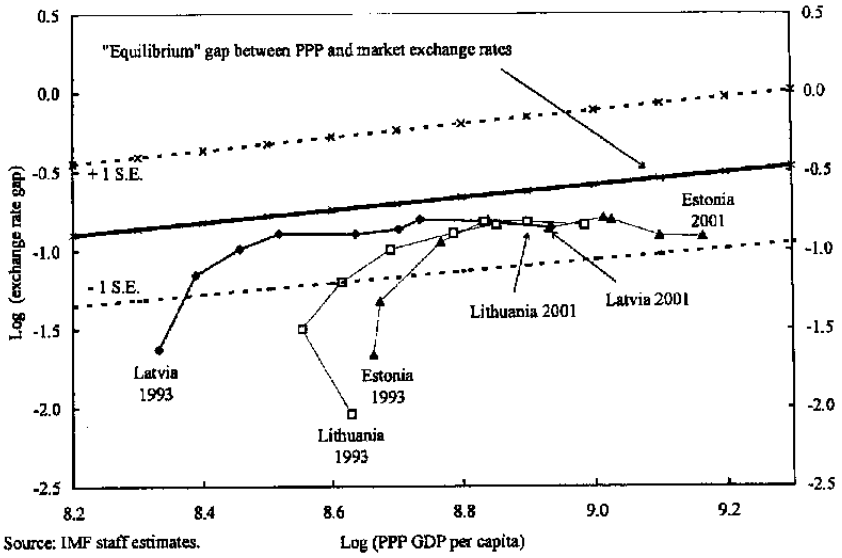
	Market Exchange Rate (euro/local currency)	PPP Exchange rate (euro/local currency)	Percent Undervaluation (-) relative to PPP
Estonia	0.06	0.13	-51
Latvia	1.78	3.44	-48
Lithuania	0.28	0.53	-47

Source: IMF staff estimates.

22. **The PPP approach can be further refined by taking account of differences in economic development.** Empirically, it has been observed that there is a systematic tendency for prices to be lower in low income countries than in high income countries. The gap between a country's market exchange rate and its PPP rate should therefore begin to close as real incomes converge on advanced country levels. De Broek and Sløk (2001) find evidence from a large cross-section of non-transition countries that catching up by one percent in real incomes will be associated with a 0.4 percent real appreciation.[24] This relationship, and the position of the Baltic countries relative to it, is shown in Figure 14. It indicates that, at the start of the transition process, the Baltic currencies quickly converged towards exchange rate gaps that were similar to those in market economies at comparable stages of development. They remain below the central line, indicating a continued degree of undervaluation relative to productivity-or income-adjusted PPP rates (29 percent in the case of Estonia, 16 percent in Latvia, and 15 percent in Lithuania, relative to the euro). However, the confidence intervals are very large, indicating, for example, that the Estonian kroon might by undervalued by as much as 56 percent or overvalued by 14 percent.

[24] See also IMF (2000), Box 4.4, pp 168–169, for a summary.

Figure 14. Exchange Rates and Income Levels



Source: IMF staff estimates.

23. **This empirical phenomenon is also known "the Balassa-Samuelson effect"** (see Box 4). As part of the process of real income convergence, productivity in the tradable goods sector tends to rise relative to productivity in the non-tradable sector. Given competitive pressures within the labor market, workers with similar skills will receive similar wages in the two sectors.[25] Faster productivity growth in the tradable sector will therefore drive up the relative cost of production in the non-tradable sector, and hence the relative price of non-tradables will rise. Assuming the relative price of tradable goods across countries remains constant, the increase in the price of non-tradables will lead to an appreciation of the real exchange rate. The theory suggests that this is a medium-to-long-run phenomenon, which could be perturbed in the short run by cyclical or monetary developments.

[25] Halpern and Wyplosz (2001) find that relative wages across sectors have been quite stable in the Baltics and other accession countries.

Box 4. The Balassa-Samuelson Effect

There is an expectation that, for most accession countries, there will be a trend appreciation of their exchange rates relative to the euro as part of the process of transition and the associated catch-up in productivity levels. Among the reasons for this is the Balassa-Samuelson effect, which in essence suggests that relatively faster productivity growth in the traded sectors of the accession countries will result in a higher inflation rate in these countries (if the exchange rate is held constant).

Under certain assumptions, it can be shown that for an accession country (A), inflation in the non-traded goods relative to the traded goods sector (π_{NT} and π_T, respectively) is determined by productivity growth in the traded relative to the non-traded goods sector (P_T and P_{NT}, respectively). The mechanism through which this occurs is straightforward. A rise in productivity in the traded goods sector will tend to drive up wages in this sector, but since the increase in wages is matched by higher productivity it will not give rise to higher traded goods prices. Labor is assumed to be mobile across sectors such that higher wages in the traded goods sector will drive up wages in the non-traded goods sector until wages are equalized. In the absence of a corresponding increase in productivity, however, the price of non-traded goods must also rise, such that:

$$\pi_{NT}^{A} - \pi_{T}^{A} = P_{T}^{A} - P_{NT}^{A} \quad (1)$$

By construction, CPI inflation in country A (π^A) is defined as a weighted average of inflation in the traded and non-traded goods sectors, where the weight of traded goods in the CPI basked is given by α:

$$\pi^{A} = \alpha\pi_{T}^{A} + (1-\alpha)\pi_{NT}^{A} \quad (2)$$

From (1) it follows that CPI inflation will be determined by the increase in traded goods prices and the difference in productivity growth between the two sectors:

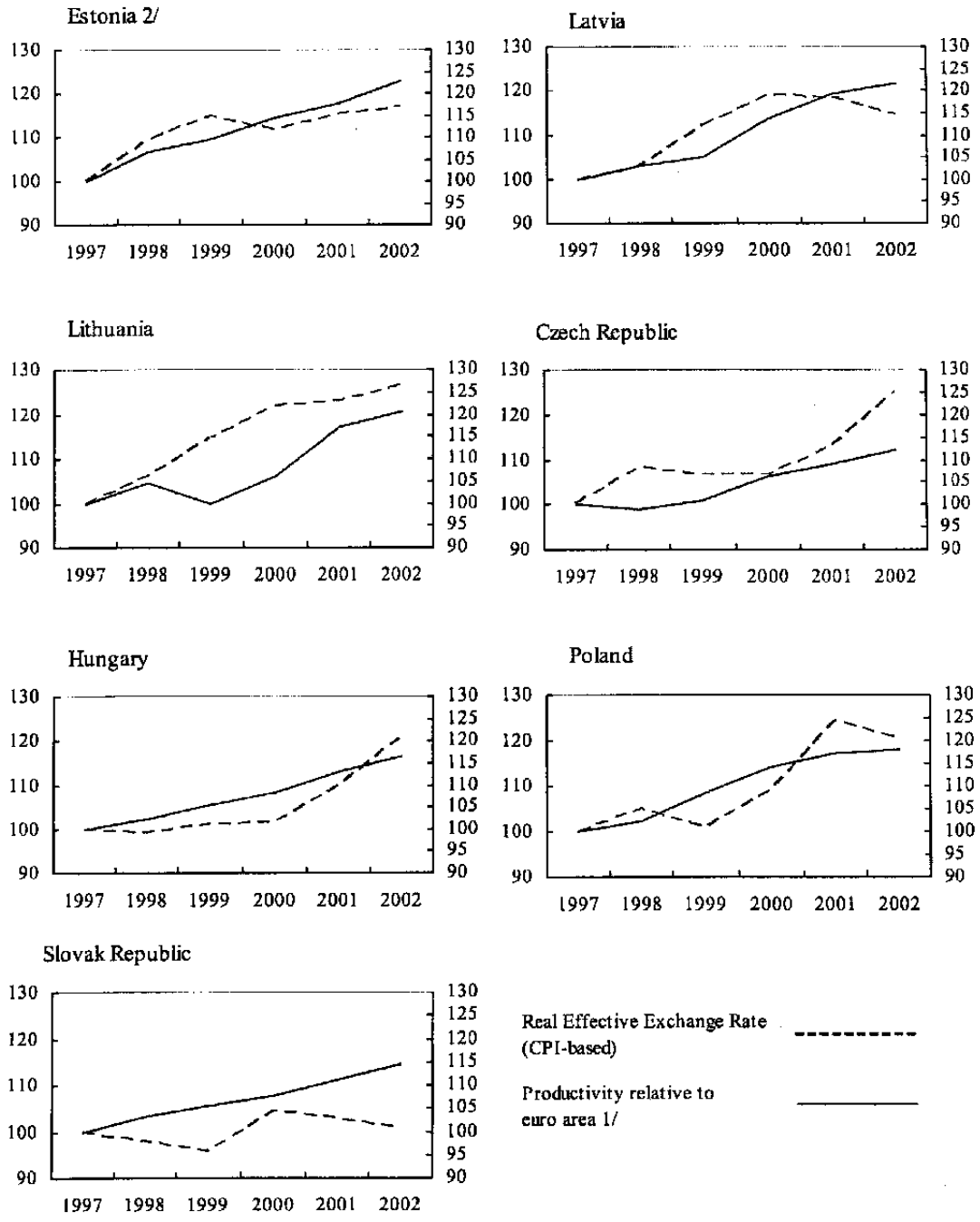
$$\pi^{A} = \pi_{T}^{A} + (1-\alpha)(P_{T}^{A} - P_{NT}^{A}) \quad (3)$$

A similar relationship can be derived for inflation in the euro area (E). Under certain simplifying assumptions—namely that productivity growth in the non-traded goods sectors and the shares of traded goods in consumption are equal across countries, and that the law of one price holds such that the price of traded goods are equal across countries (when expressed in a common currency)—it can be shown that:

$$\pi^{A} - \pi^{E} = (1-\alpha)(P_{T}^{A} - P_{T}^{E}) + \varepsilon \quad (4)$$

Thus the difference between CPI inflation in an accession country and the euro area is determined by relative productivity performance in the traded sector, adjusted for changes in the exchange rate (ε). It follows that, other things being equal, the Balassa-Samuelson effect will tend to be smaller in small open economies such as the Baltics, where the share of tradable goods in consumption is typically high.

Figure 15. Labor Productivity and Real Effective Exchange Rates (1997–2002)



Source: IMF staff estimates

1/ Productivity measured by GDP per worker, measured at purchasing power parity. Figures for 2002 are preliminary estimates or staff projections.

2/ Figures for Estonia are based on GNP rather than GDP.

24. **The Balassa-Samuelson effect is thought to be especially relevant for transition economies**, where liberalization and movements in relative prices led to restructuring and reallocation of resources to more productive, often exporting, sectors.[26] Productivity growth has indeed been quite closely aligned with the appreciation of real effective exchange rates in the Baltics in recent years (Figure 15). This contrasts with some other accession candidates: in the Czech Republic, exchange rate appreciation has for the most part exceeded the rate of productivity growth, while the opposite is true for the Slovak Republic. There have, however, been some sizeable variations between the pace of productivity growth and real effective appreciation in individual years, especially in Latvia and Lithuania when productivity growth failed to keep pace with the sharp appreciation of the exchange rate immediately following the Russia crisis. Over the past two years, however, productivity growth has generally kept pace with the appreciation in Lithuania's exchange rate, and exceeded the appreciation of Latvia's exchange rate.

25. **Estimates of the Balassa-Samuelson effect in the Baltics are shown in Table 4.** They are calculated on the basis of the relationships identified in Box 4 and on the basis of a range of alternative measures of productivity differentials relative to the euro area. The estimates assume that the share of non-tradables in consumption is approximately one-third in the Baltics and two-thirds in the euro area.[27] The resulting differences in pass-through from productivity growth to overall inflation has a significant effect in limiting the impact of relatively higher productivity growth in the Baltics on inflation differentials. Measures based on aggregate labor productivity convergence suggest that the Balassa-Samuelson effect could explain an annual inflation differential relative to the euro area of about 0.5–0.7 percentage points during 1997–2001.[28] Abstracting from the effect of capital deepening and changes in labor inputs, the Balassa-Samuelson effect measured on the basis of the relative growth of TFP is somewhat lower, at about 0.3–0.5 percentage points. Measures of relative productivity in the tradable and non-tradable sector (measured by manufacturing and services, respectively) give even smaller results in Estonia and Latvia, where some of the catch up process that has taken place reflects increased productivity in the non-tradable as well as

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[26] The evidence for other countries is mixed. For a survey of Asian economies see Ito, Isard, and Symansky (1997). ECB (1999) find some evidence that the Balassa-Samuelson effect can explain inflation differentials across the euro area.

[27] Recent estimates from the national central banks suggest that the share was 28 percent in Estonia and 30 percent in Lithuania in 2002. This is similar to the weights in other central and eastern European accession countries, quoted in Kovács et al (2002), but significantly lower than the average share in the euro area. The share of services in the consumer price in index in Germany, for example, is 63 percent (Federal Statistical Office).

[28] The average inflation differentials relative to the euro area over the corresponding period were 2.9 percent in Estonia, 1.6 percent in Latvia, and 0.3 percent in Lithuania.

tradable sectors. Productivity in the financial services sector, for example, has risen rapidly in recent years.[29]

Table 4: Alternative Estimates of the Balassa-Samuelson Effect on Inflation Differentials (1997-2001)

	Estonia	Latvia	Lithuania	euro area	Germany
Annual productivity growth, measured by:					
GDP per worker 1/	7.1	7.4	7.0	2.8	...
TFP 2/	3.3	3.3	2.5	0.9	...
Manufacturing 3/	7.3	6.0	7.2	...	1.7
Services 3/	5.3	4.5	3.9	...	0.9
Resulting inflation differential relative to euro area / Germany					
GDP per worker	0.6	0.7	0.5		
TFP	0.5	0.5	0.3		
Manufacturing / services	0.2	0.0	0.6		

Source: IMF staff estimates

1/ Measured at purchasing power parity. GNP for Estonia.

2/ TFP estimates consistent with Figure 13.

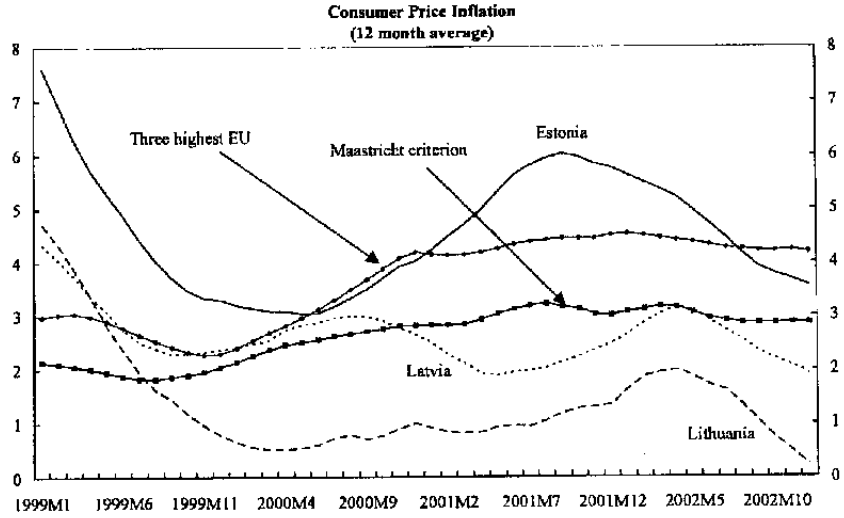
3/ Sectoral valued-added per worker in constant prices.

26. **The ability of the Baltics to meet the Maastricht inflation criterion for participation in EMU will partly depend on the scale of the Balassa-Samuelson effect.** The estimates in Table 4, however, suggest that even a continuation of the recent impressive productivity performance in the Baltics need not necessarily push inflation above the Maastricht limit.[30] In Estonia, inflation rates have recently fallen to levels that are close to the this limit (Figure 16). In Latvia and Lithuania, by contrast, inflation has been close to or below the Maastricht reference value for inflation for the last 1–2 years. This partly reflects the nominal appreciation of the lats and the litas against the euro over much of this period—a phenomenon that would of course not be repeated under ERM II, assuming Lithuania maintains and Latvia adopts a peg to the euro.

[29] Productivity has improved as a result of substantial foreign investment in the sector. In Estonia, other business services, including for example the operation of international call centers, have also increased in importance. These activities could more properly be classified within the tradable sector.

[30] The Maastricht criterion states average inflation should be no higher than 1.5 percentage points above the three EMU member states with the lowest inflation rates. The estimates in Table 4 suggest that higher productivity growth in the Baltics may lead to an inflation differential of up to 0.7 percentage points relative to the euro area. Inflation in the euro area has, in turn, generally been about 0.7–0.8 percentage points above the average of the 3 EMU member states with the lowest inflation rates.

Figure 16. Inflation Convergence



Source: country authorities and Eurostat.

27. **Several other studies have attempted to quantify the extent to which inflation differentials between EU accession candidates and EU member states can be attributed to the Balassa-Samuelson effect.**[31] Estimates of the magnitude of the Balassa-Samuelson effect differ significantly depending on estimation methods, countries, time periods, and the definition of tradable and non-tradable sectors. Studies that are based on relative price levels in accession countries compared to the EU tend to yield the highest estimates because they capture channels other than the Balassa-Samuelson effect that can give rise to a real appreciation during times of economic catch up. Pelkmans and others (2000), for example, estimate that the equilibrium inflation differential between accession candidates and euro area from 1997–1999 was between 3½–4 percent. Most studies, however, are based on some measure of productivity growth differentials to capture the Balassa-Samuelson effect. Halpern and Wyplosz (2001), for example, estimate that the annual rate of real exchange rate appreciation due to the Balassa-Samuelson effect was about 3 percent on average for a sample of eight accession candidates (including the Baltics) from 1991–1998. More recent studies attempt to further refine the analysis by quantifying other factors that can affect

[31] For a survey of recent studies see Deutsche Bundesbank (2001) and European Commission (2002). There are few studies that consider the Baltics explicitly, although Ross (2001) estimates that a 1 percent rise in the income level in Estonia leads to a 0.7 percent increase in the price level. This implies that per capita income growth, which has been about 3.2 percentage points higher than in the euro area from 1999–2002, more or less fully explains the average inflation differential of 2.1 percentage points over this period.

inflation differentials. Earlier studies that fail to control for these effects will therefore tend to overstate the "pure" Balassa-Samuelson effect. These factors are discussed in turn below:

- ***Initial undervaluation at the start of transition.*** It is possible that the appreciation of real exchange rates partly reflects a correction of an initial undervaluation of exchange rates. While it is not possible to test this directly given the data constraints, a number of studies have tested this indirectly by using out-of-sample estimates based on non-transition economies and using US dollar wages as a proxy for the real exchange rate.[32] They conclude that exchange rates were undervalued at the beginning of the transition process as a result of sudden excess demand for previously unavailable foreign goods and assets, capital flight associated with a burst of domestic inflation, and a tendency of authorities to set initial exchange rates at undervalued levels. More recent studies conclude that this catch-up phase from initial undervaluation tended to be mostly over about five years after the beginning of transition.[33]

- ***Increases in price of tradables.*** Since the start of transition, there has been an increase in PPI-based real exchange rates in the Baltics which, if the PPI indices are a reasonable proxy of tradable prices, suggests that an increase in the relative price of tradables has contributed to the overall appreciation in real exchange rates. This may reflect the fact that tradable goods also have a non-tradable component, such that productivity driven catch-up of non-tradable prices also leads to higher traded good prices.[34] Or it may be related to the changes in the composition of tradables as

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[32] These studies typically estimate equilibrium US dollar wage levels (as a proxy for the real exchange rate) based on a range of economic fundamentals such as indicators of productivity and human capital levels. See for example: Halpern and Wyplosz (1996): Krajnyák and Zettelmeyer (1998); and, for a specific reference to the Baltics, Richards and Tersman (1996). The results are consistent with the evidence presented in Figure 14, which is also based on out-of-sample estimates of non-transition economies, and which also suggests a significant degree of undervaluation at the start of transition.

[33] See Begg, Halpern and Wyplosz (1999), Coricelli and Jazbec (2001), and Kim and Korhonen (2002). This also seems to be consistent with typical estimates of the speed of convergence on PPP, which suggest that half of a deviation from PPP disappears in about 3–5 years—see, for example, Rogoff (1996).

[34] MacDonald and Ricci (2001) suggest that this may also explain their observation that increases in the productivity and competitiveness of the distribution sector—which is typically regarded as part of the non-tradable sector but represents an important input into the production of tradable goods—lead to an appreciation of the real exchange rate. The distribution sector accounts for about 15 percent of both value-added and employment in Estonia and Latvia, and about 15 percent of value-added and 19 percent of employment in

(continued...)

domestic production and exports shift toward higher valued-added products.[35] Since 1999, however, PPI-based real exchange rates have been more stable or falling suggesting that this process may have ended.

- ***Changes in the structure of demand.*** As real incomes rise, the demand for services tends to increase. This in itself will push up the relative price of non-tradables. Increases in government expenditure, which also tend to be concentrated on services and other non-tradables, would have the same effect.[36]

- ***The role of administered prices.*** The share of administered prices in Baltic consumer price indices remains significant, at about 20 percent (Table 5). Administered prices are typically concentrated on the services or non-tradable sector. Consequently, the share of market-based services in the CPI, which provides the pass-through from productivity growth to overall inflation, is reduced. In addition, price liberalization has contributed directly to an increase in the price of non-tradables.[37] Recent data suggest that increases in administered prices continue to exceed increases in other prices. Staff estimate that since 1997, administered price increases account for about 1.1 percentage points of the annual average CPI inflation of 5.6 percent in Estonia, and 2.8 percentage points of annual average CPI inflation of 1.7 percent in Lithuania (Figure 17). The extent to which such factors will affect future price formation is difficult to quantify. The liberalization of administered prices, or their adjustment to cost recovery levels, is in theory meant to be completed as a precondition for EU accession, but may be more gradual in practice. Residential energy prices, for example, which are the most important component of administered prices, remain

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Lithuania. The sector has also attracted a significant share of inward investment, accounting, for example, for about 13 percent of the stock of FDI in Estonia. MacDonald and Wójcik (2002) find that productivity increases in the distribution sector led to an appreciation in the real exchange rate in Estonia over and above that generated by the Balassa-Samuelson effect.

[35] Égert et al (2002) argue that a trend increase in the price of tradables explains at least part of the appreciation of real exchange rates in transition economies, including the Baltics, from 1995–2000. Ito, Isard, and Symansky (1997) find similar evidence of this phenomenon in Asia. This raises a methodological issue of whether consumer price indices adjust sufficiently for quality changes and the introduction of new goods.

[36] Coricelli and Jazbec (2001) find that these demand effects have been particularly important in the Baltics.

[37] MacDonald and Wójcik (2002) find that in a sample of accession candidates from 1995–2001, including Estonia, the adjustment of administered prices had an independent and possibly much stronger effect on real exchange rates than the Balassa-Samuelson effect.

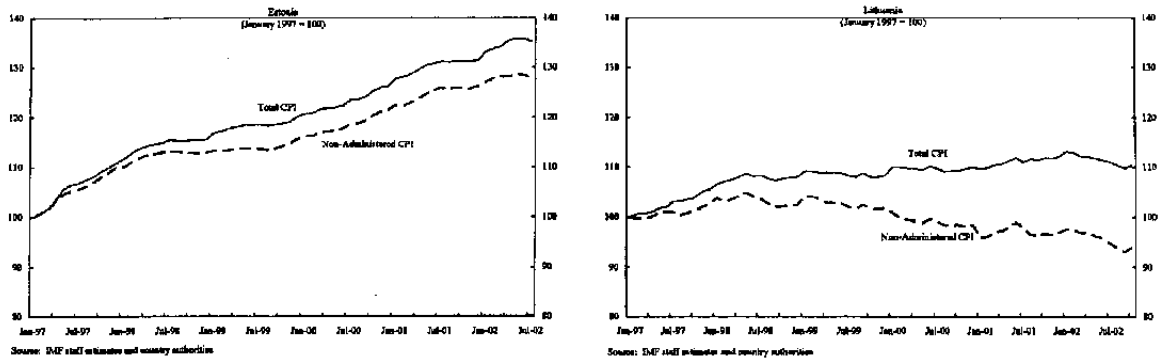
about 20 percent below cost recovery levels.[38] The need for adjustment may, however, be tempered by increased efficiency resulting from the restructuring of energy sectors, which remains largely incomplete in the Baltics. The adjustment of agricultural prices following integration into the EU Common Agricultural Policy may also place upward pressure on food prices. The extent to which such factors affect competitiveness, however, will depend on whether the resulting increase in consumer prices leads to higher wage claims, and indirectly to higher tradable prices.

Table 5. Share of Administered Prices in CPI

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Estonia	25.0	21.1	21.1	21.1	19.9	19.9	19.9	17.6	17.2
Latvia	16.6	16.6	17.8	19.6	20.4	22.0	22.3	22.0	20.7
Lithuania	na	na	na	15.5	15.5	14.6	16.1	18.5	18.7

Sources: country authorities and EBRD

Figure 17. Administered Prices and CPI



- ***Increased investment inflows***. Increased capital inflows can lead to an appreciation of the real exchange rate.[39] The establishment of macroeconomic stability in the Baltics and resulting reduction in risk premia, together with the increased investment opportunities following capital account liberalization and privatization, have contributed to significant capital inflows.[40] Whether this represents an equilibrium

[38] See EBRD (2001).

[39] Fischer (2002) argues that part of the observed productivity differential that is often fully attributed to the Balassa-Samuelson effect is in fact a reflection of increased investment demand.

[40] Capital account liberalization was largely completed at an early stage in the Baltics. The only remaining restrictions relate mainly to real estate and certain sectoral restrictions on FDI.

phenomenon is difficult to assess, and depends on whether the growth performance of the economy is enough to service the resulting external liabilities without the need for an adjustment in the real exchange rate.

B. Econometric Estimates of Equilibrium Real Exchange Rates

28. **The following section reports the results of an estimation of equilibrium real exchange rates in the Baltics.** The estimation is based on a theoretical framework that incorporates the Balassa-Samuelson hypothesis and the balance of payments approach to the determination of the equilibrium exchange rate.[41] It follows an illustrative model developed by Alberola and others (1999) based on the decomposition of the exchange rate into two different relative prices—the price of domestic tradable goods relative to foreign tradable goods; and the relative prices of non-tradable goods relative tradable goods within each country.[42] The first price captures the competitiveness of the economy and determines the evolution of a country's net foreign asset position. It is associated with the external equilibrium of an economy, characterized by the achievement of a desired stock of net foreign assets. The second price incorporates the concept of productivity differentials and the allocation of resources within an economy. It can therefore be associated with internal equilibrium in an economy. Real exchange rates are then determined by the following relationship:

$$REER = \beta_1 nfa + \beta_2 prod$$

where *nfa* represents net foreign assets and *prod* represents relative productivity differentials as proxied by the ratio of consumer prices to producer prices.[43] Estimation of the equilibrium exchange rate is then based on an unobserved component decomposition in a cointegration

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[41] For a discussion of the latter see, for example, Mussa (1984).

[42] Hansen and Roeger (2000) follow a similar approach with respect to current EU member states, as do Broner and others (1997) with respect to Latin America.

[43] As discussed above, the CPI and PPI indices are, in some circumstances, likely to be weak proxies for relative productivity differentials in the tradable and non-tradable sectors. The PPI indices in some countries (including Lithuania, and some of the Baltics' trading partners such as Russia), for example, are very sensitive to swings in oil prices. Moreover, movements in the relative price of non-tradables are likely to reflect a number of factors in addition to productivity differentials, including increases in administered prices, and increased demand for non-tradables as a result of rising real incomes or increased government expenditure. Net foreign assets are, in common with many other studies, estimated as the cumulative sum of current account positions, and may therefore be distorted by errors and omissions in the current account data, and by valuation changes.

framework. The presence of a cointegration relationship is interpreted as evidence of a time-varying equilibrium exchange rate. The estimation results are summarized below but discussed in detail, along with the derivation of the model, in Appendix I.[44]

29. **For each of the Baltics, there is evidence of a relationship between real effective exchange rates, the proxy for relative productivity performance, and net foreign assets** (Table 6). The impact of changes in relative productivity on the exchange rate is, as expected, close to one for all three countries. The net foreign asset position, however, enters the long-run relationship with a negative sign for all three countries. The results must be interpreted with considerable caution, however, given: the limitations in the underlying data; the short time period available for estimation; and the possibility that real exchange rates were significantly undervalued in the early 1990s (as discussed earlier) and that this is not captured by our estimates.[45]

Table 6. Estimation Results

Cointegration vectors:	
Estonia	*REER = 1.00 (prod) - 0.18 (nfa)*
Latvia	*REER = 0.99 (prod) -0.15 (nfa)*
Lithuania	*REER = 1.02 (prod) - 0.18 (nfa)*

30. **The negative relationship between real exchange rates and net foreign asset positions requires careful interpretation**, as it is at odds with the positive relationship normally associated with the balance of payments approach to determination of the equilibrium exchange rate. Countries with large external liabilities eventually need to run large trade surpluses to service them, and achieving these trade surpluses ultimately requires a more depreciated level of the real exchange rate. It may, however, take many years for

[44] For an earlier example of the application of this approach to Lithuania, see Alonso-Gamo et al (2002). This section and appendix I essentially extends their analysis to all three Baltic countries.

[45] It is well known that the power of cointegration tests is dependent on the length of time series available for estimation. Moreover, Shiller and Perron (1985) and Pierce and Snell (1995) demonstrate that it is the time span, and not the frequency of available data, that determines the power of the tests. The time span available for estimation in the case of the Baltics is limited to just over eight years(1994–2002Q1).

exchange rates to converge on this long-run equilibrium level.[46] In the interim, however, increased capital inflows, rising real exchange rates, and a deterioration in the trade balance, may be a natural response to the increased growth potential of the Baltic countries, resulting for example from the establishment of macroeconomic stability, productivity-enhancing structural reforms, or the opportunities afforded by EU accession.[47]

31. **The results suggest that equilibrium real exchanges rates have appreciated significantly in all three Baltic countries since 1994, although the rate of appreciation has, to varying degrees, slowed since the beginning of 1999** (Figure 18). The difference between the estimated equilibrium and actual exchange rates is also illustrated in Figure 18 together with the 95 percent confidence intervals to give an indication of the degree of accuracy of the results. At the beginning of 2002, the real exchange rates in Estonia and Lithuania appear to be only modestly undervalued, by anywhere from 4½ to 8½ percent and 2½ to 8¼ percent, respectively. The accuracy of the results in Latvia, however, is very low and it is not possible to say with any confidence whether the real exchange rate was under- or overvalued throughout the period under observation. Alternative statistical methods that identify underlying trend movements (using the Hodrick-Prescott filter) produce similar results (Figure 19). They also suggest similar degree of undervaluation relative to trend of about 5 percent in all three Baltics in 2002. The recent strength of the euro, however, may have removed some this undervaluation in Estonia and Lithuania.

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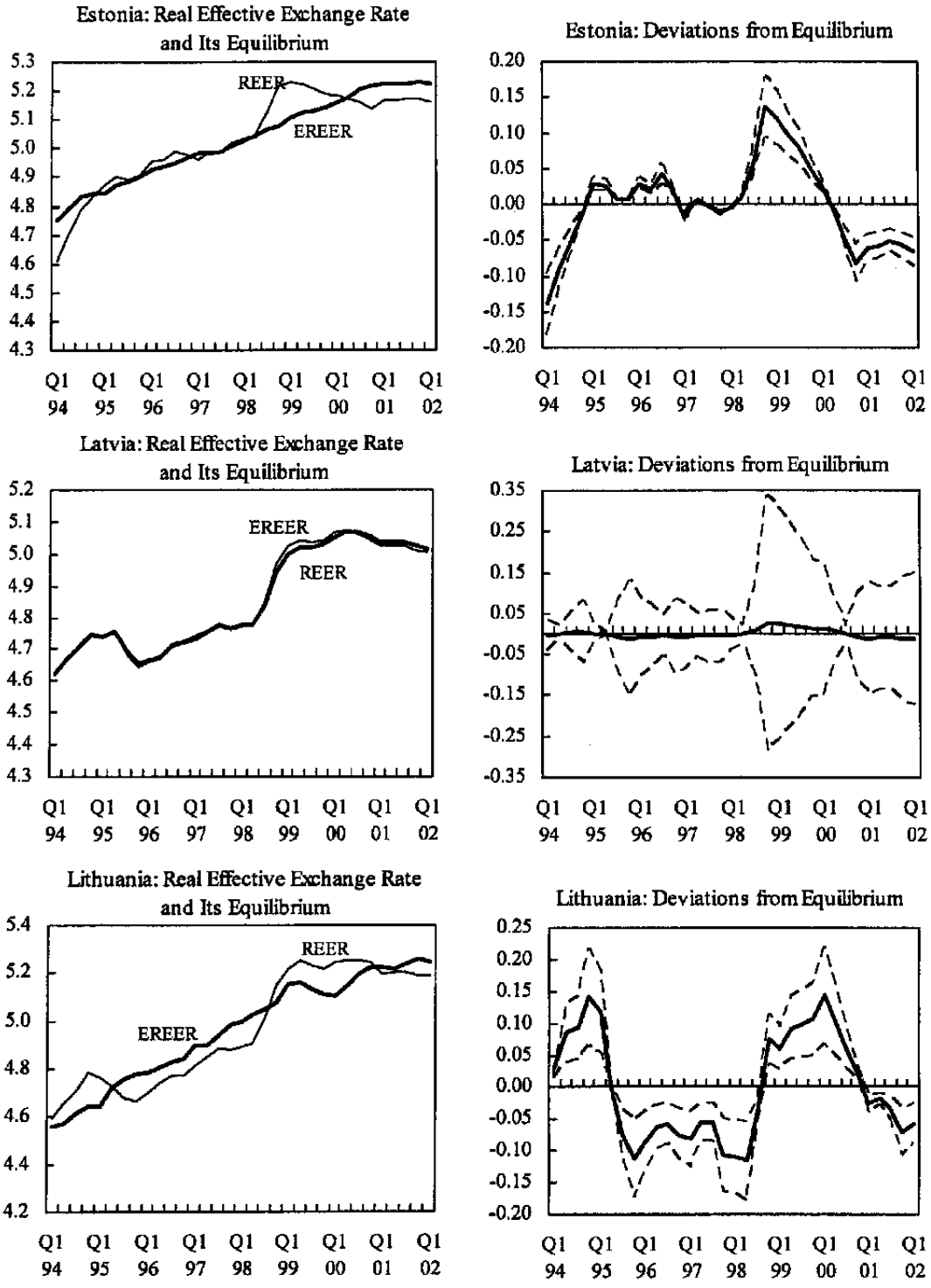
[46] Studies that do find a positive relationship between real exchange rates and net foreign asset positions tend to be based on much longer time series than our estimates (typically 20–30 years)—see, for example, Faruqee (1995), Gagnon (1996), Clark and McDonald (1998), Alberola and others (1999), and Broner and others (1997).

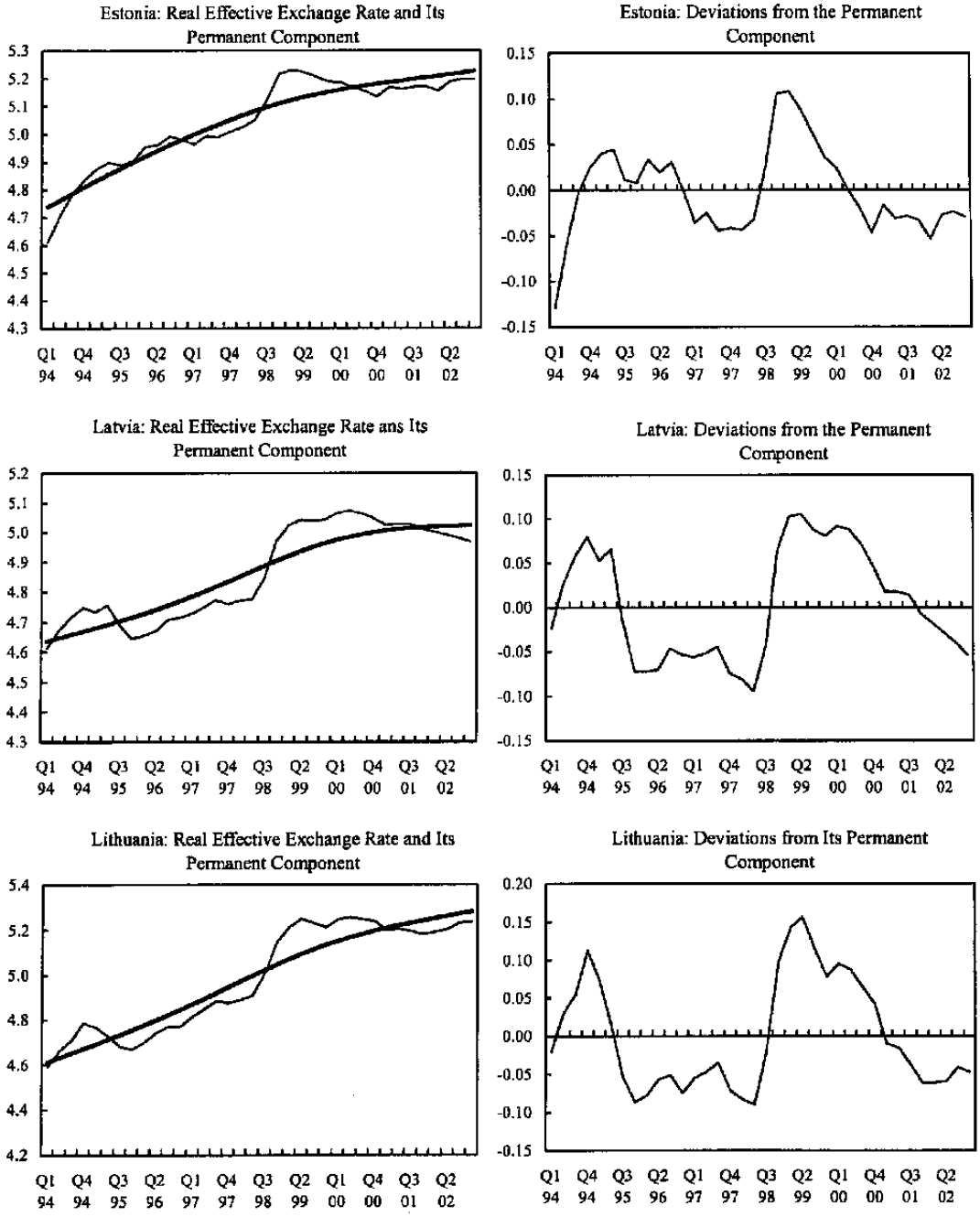
[47] In these circumstances, as Baltic assets become more attractive, there will be a reduction in the desired long run stock of net foreign assets. The real exchange rate will need to appreciate temporarily in order to reduce the trade balance and thereby the current stock of net foreign assets towards its lower desired long-run level. Changes in risk premia may have also affected the relationship between the exchange rate and net foreign assets. A reduction in risk premia in the Baltics, for example, would tend to reduce the size of the trade surplus that would ultimately be required to service external liabilities.

Figure 18. Baltics: Real Effective Exchange Rate (REER) and Its Equilibrium (EREER), 1994Q1–2002Q1



Source: IMF staff estimates.

Figure 19. Baltics: Real Effective Exchange Rate and Its Permanent Component, 1994Q1-2002Q4

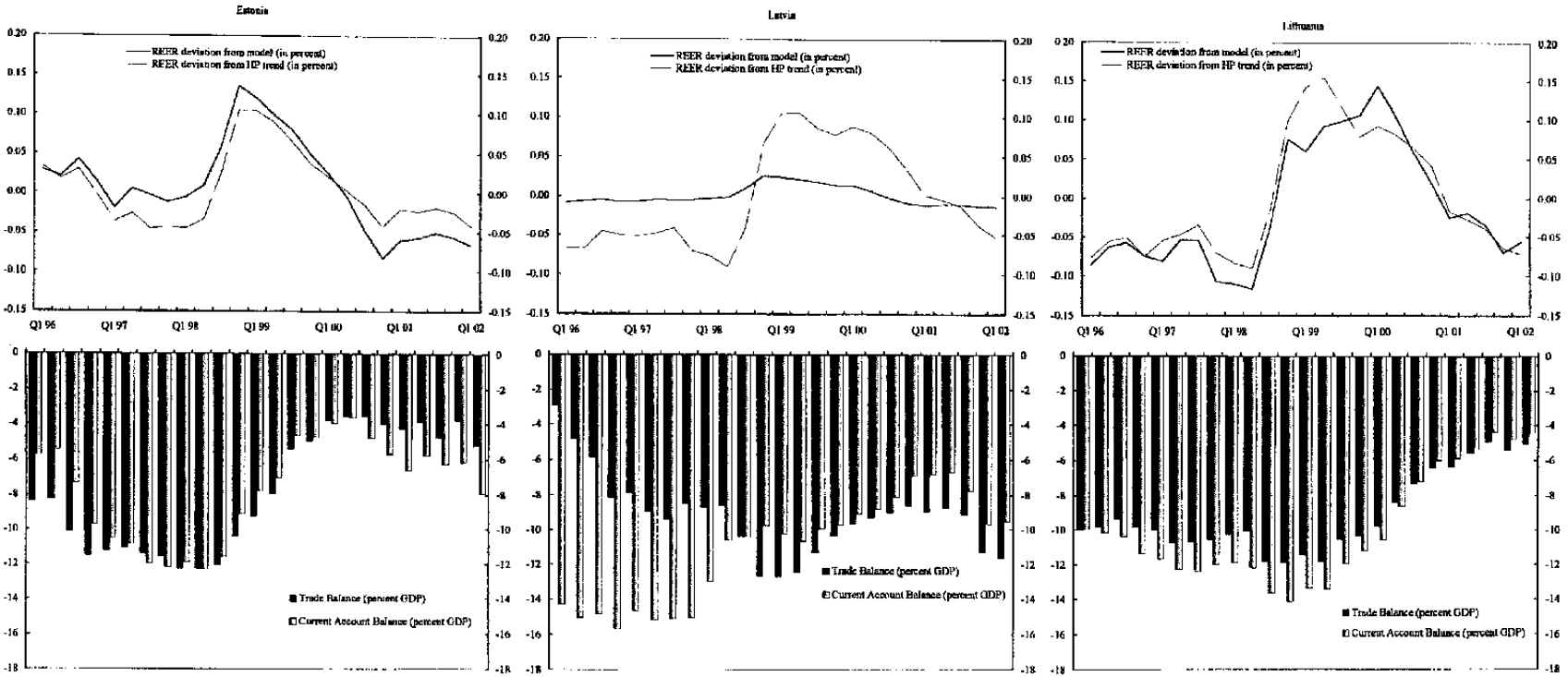


Note: The permanent component of the real effective exchange rate (REER) was estimated by applying the Hodrick-Prescott (HP) filter to quarterly REER series for the period 1994Q1-2002Q4 and projections for the period 2003Q1-2003Q4, using ARIMA(1,1,0) models. Projections are used to avoid end-period distortions induced by the HP filter when only historical data are considered (Kaiser and Maravall (1999)).
Source: IMF staff estimates.

32. **There appears to be no close relationship between external balances in the Baltics and movements in their underlying exchange rate positions**, suggesting that trade flows have been determined primarily by income or supply factors rather than by movements in relative prices. The relationship between the deviations in exchange rates from their underlying or trend levels and external balances (both the current account deficit and the balance of trade in goods and services) is shown in Figure 20. The improvement in the external positions of Estonia between mid-1998 and 2000 took place during a period in which the kroon was rising relative to its underlying or trend value. The recent deterioration in the external positions in Estonia and Latvia took place while their exchange rates were been falling relative to their trend values. Over the corresponding period, Lithuania's external position improved gradually despite a sizeable swing in the litas relative to its trend. This evidence has been confirmed more formally by a recent study by the Baltic central banks.[48] They find that net trade flows are not closely correlated with CPI- and PPI-based measures of the real exchange rate, or with measures of misalignment relative to an underlying trend or equilibrium. There are a number of possible reasons for this. Imports have been primarily determined by available income (which is, in turn, closely related to the volume of exports) while exports have to some extent been rationed by supply constraints or quality considerations rather than by relative prices. Recent increases in exports to the EU, for example, partly reflect investments that have been directed towards expanding export capacity and increasing product quality to meet required EU standards, rather than improvements in price competitiveness.

[48] For: Estonia, see Randveer and Rell (2002); Latvia see Bitans (2002); Lithuania see (Vetlov).

Figure 20. Real Effective Exchange Rate Deviations and External Balances



Source: IMF staff estimates

V. Conclusions and Policy Implications

33. **Real effective exchange rates in the Baltics have been quite stable over the last four years compared to the strong real appreciations experienced in the earlier years of the transition process.** REER indicators based on measures of relative prices or costs that are more representative of the traded goods sector have been even more stable. A more direct assessment of competitiveness based on export performance is complicated by the importance of electronics sub-contracting in Estonia and oil processing in Lithuania, which are important in terms of trade flows but much less so in terms of value-added. Aside from this, exports have generally performed quite well despite the global slowdown.

34. **Strong productivity growth, together with increased capital inflows in response to improved growth prospects, have continued to contribute to the real appreciation of equilibrium exchange rates.** Other factors that contributed to the strong real appreciations in the early years of the transition process have, to varying degrees, dissipated. While there is inevitably much uncertainty over estimates of equilibrium exchange rates, an assessment based on a broad range of indicators and analysis of the factors behind exchange rate movements, suggests no clear evidence of exchange rate misalignment that would call into question the underlying competitiveness of the Baltic economies or the sustainability of their exchange rate regimes.

35. **The extent of any further appreciation of real exchange rates, however, has important implications for the Baltics' goal of participating in ERM II and adopting the euro at an early stage.** Productivity growth in the Baltics has been impressive in recent years and will likely continue to outstrip that in the euro area over the coming years. As a result, equilibrium real exchange rates will tend to continue to appreciate against the euro in the period leading up to and beyond EU accession. Estonia and Lithuania intend to maintain their euro-based currency board arrangements within ERM II, while Latvia intends to adopt a conventional fixed exchange rate peg to the euro within the ERM II fluctuation bands. In all three cases, therefore, real appreciation will tend to result in inflation rates that are higher than in the euro area. The heavy weight of the tradable sector in the Baltics relative to the euro area, however, will limit significantly the extent to which productivity convergence translates into higher consumer price inflation. As such, productivity convergence alone is unlikely to preclude the ability of the Baltics to meet the Maastricht inflation criterion.

36. **While the strategy of maintaining fixed exchange rates within ERM II and then adopting the euro at the earliest possible date appears to be viable, it is not without risks.** The continued consistency and credibility of macroeconomic and structural policies will be essential to ensure the maintenance of competitiveness and a smooth entry into EMU. Fiscal policy has the key role to play in this regard, by ensuring that domestic demand does not add to inflationary pressures and lead to a deterioration in external balances. Public sector pay restraint, for example, will be particularly important in moderating wage demands. Moreover, fiscal policy will also be the first line of defense in the event that there are temporary surges in capital inflows in anticipation of entry into ERM II or adoption of the

euro. In such circumstances, a more contractionary fiscal position may be necessary to counteract the inflationary impact of such inflows.

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ESTIMATING EQUILIBRIUM REAL EXCHANGE RATES IN THE BALTICS IN A COINTEGRATION FRAMEWORK

This appendix considers the behavior of real effective exchange rates in the Baltics over the period 1994–2002. The analysis is based on a theoretical framework that encompasses two principal determinants of movements in equilibrium real exchange rates: (i) the concept of internal equilibrium, based on the Balassa-Samuelson or productivity hypothesis (discussed in section IV in the main text); and (ii) the concept of external balance, based on the asset market view of exchange rate determination. Long-run relationships between real exchange rates and these determinants are estimated empirically using cointegration techniques. An unobserved components analysis is then applied to identify the underlying time-varying equilibrium real exchange rates.

The concept of long-run or equilibrium exchange rates (EREER) has been widely addressed in the economic literature. One standard and traditionally used approach is the purchasing power parity (PPP) hypothesis. This implies a constant equilibrium exchange rate, as it posits that there is an underlying tendency for movements in the nominal exchange rate to offset inflation differentials with country's trading partners, such that deviations from the EREER will be transitory. However, persistent exchange rate deviations from PPP equilibrium can be produced by several factors, including technical progress, or more specifically, productivity differentials, which, according to the Balassa-Samuelson hypothesis, can lead to changes in the relative prices of tradable to non-tradable goods in an economy.

The Balassa-Samuelson hypothesis assumes that tradable goods produced in different countries are perfect substitutes, and that the nominal exchange rate adjusts to changes in tradable prices such that tradable prices across countries are equal when measured in a common currency. A lack of perfect substitution between traded goods, however, may also lead to deviations from PPP. Theories in this area have focused on the trade balance as the main determinant of the exchange rate, with capital flows being treated as exogenous shocks. With financial liberalization and the increasing volume of international trade in financial assets, modern exchange rate models emphasize financial-asset markets and the role of the exchange rate as one of many prices in the worldwide market of financial assets. Following these theories, the trade flows have still a useful role in asset-approach models, since trade flows have implications for financial-asset flows. In fact, the exchange rate must be consistent with a balance of payment position where any current account is compensated by a sustainable flow of international capital. A country running a current account deficit or surplus will accumulate or de-cumulate assets, and such imbalances would be due to the relevant propensities to save and invest in the respective countries, and it is assumed that such factors are not influenced by exchange market developments. In the long run, however, when agents' assets are at their desired level, the current account should be balanced.[1]

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[1] See Mussa (1984)

As a results, two main lines of research on the determination of equilibrium real exchange rates have developed, which emphasize the sectoral (tradable versus non-tradable) balance of the economy and the underlying net foreign asset position of the country, respectively. A model that encompasses both approach is developed in the next section and forms the basis for the subsequent empirical analysis.

A. The Theoretical Framework and the Empirical Model

The theoretical model used follows that developed by Alberola and others (1999) and is based on the decomposition of the exchange rate into two different relative prices: the price of domestic relative to foreign tradable goods; and the relative prices of non-tradable goods relative to tradable goods within each country. The first component captures the competitiveness of the economy and determines the evolution of the net foreign assets position, and is therefore associated with the external equilibrium of the economy. The second component incorporates the concept of productivity differentials identified in the Balassa-Samuelson hypothesis, and since these prices determine the allocation of resources within the economy, it is associated with the internal equilibrium of the economy. The long-run solution of the model represents an equilibrium value for the real exchange rate consistent with both the internal and the external equilibria of the economy.

Assuming that there are two countries in the world, each producing a tradable good (T) and a non-tradable good (N), the REER (q) in logarithm terms can be defined as

$$q = s + p - p^* \tag{1}$$

where p and p^* are the domestic and the foreign consumer price indices (CPI), respectively, and s is the nominal exchange rate. For each country, the CPI, which is formed by prices of domestic and foreign tradable goods and non-tradable goods, can be expressed as follows

$$p = (1-\alpha_T-\alpha_N)p_T + \alpha_N p_N + \alpha_T(p_T^* - s) \tag{2}$$

$$p^* = (1-\alpha_T^*-\alpha_N^*)p_T^* + \alpha_N^* p_N^* + \alpha_T^*(p_T - s) \tag{3}$$

where the αs determine the share of each good in the consumer price index. Substituting these expressions into (1), we obtain

$$q = (1-\alpha_T-\alpha_T^*)(p_T + s - p_T^*) + \alpha_N[(p_N - p_T) - (p_N^* - p_T^*)] \tag{4}$$

where, for simplicity, the weights of non-tradable goods for the two countries are assumed to be the same, and the lack of perfect substitution between tradable goods between different countries is also considered. From (4) it is clear that the exchange rate is determined by two different components: the evolution of relative prices of domestic to foreign tradable goods,

which reflects the external dimension of the economy

$$q_x = (p_T + s - p_T^*) \tag{5}$$

and the behavior of non-tradable goods relative to tradable goods across countries, which relates the internal dimension of the economy

$$q_I = [(p_N - p_T) - (p_N^* - p_T^*)] \tag{6}$$

Thus, the equilibrium exchange rate ($\bar{q}$) implies both external and internal equilibrium.

The external equilibrium. The external balance clears the tradable goods market, and is characterized by the achievement of a desired stock of net foreign assets. The evolution of the current account balance, which determines adjustments to the equilibrium, leads to an accumulation of net foreign assets. The current account balance (ca) is defined as the trade balance (x) *plus* the net income received or paid by residents (r^*) on foreign asset holdings (nfa) expressed in real terms:

$$ca = x + r^* nfa \tag{7}$$

The trade balance depends on the evolution of the external real exchange rate,[2] namely

$$x = -\gamma q_x \tag{8}$$

and, following Mussa (1984), the current account adjusts to the difference between the current and the desired level of net foreign assets, so that a current account surplus would reflect a net foreign asset position below the desired level

$$ca = \eta(\bar{nfa} - nfa) \tag{9}$$

In the long run, $\bar{nfa} = nfa$, and the equilibrium external exchange rate can be defined as follows, where the bars over the variables denote long-run equilibrium values:

$$\bar{q_x} = (r^* / \gamma)\bar{nfa} \tag{10}$$

The internal equilibrium. The evolution of the internal real exchange rate is determined by the different behavior of sectoral relative prices between countries, which in turn are related

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[21] An appreciation of the external exchange rate (q_x>0) will worsens the competitiveness of the domestic products and consequently the trade balance, when the Marshall-Lerner condition holds.

to the evolution of sector productivity. Starting from the productivity hypothesis, it can be shown that

$$\bar{p}_N - \bar{p}_T = \mu + (y_T - y_N) \tag{11}$$

where the y's are the average sectoral productivities. Neglecting constant terms, it follows that the equilibrium internal exchange rate can be expressed as follows

$$\bar{q}_I = \alpha_N[(\bar{p}_N - \bar{p}_T) - (\bar{p}_N^* - \bar{p}_T^*)] = \alpha_N[(y_T - y_N) - (y_T^* - y_N^*)] = \alpha_N \bar{n} \tag{12}$$

Putting together the external and internal equilibria concepts produces the equation for the equilibrium REER:

$$\bar{q} = (1 - \alpha_T - \alpha_T^*) r^* nfa / v + \alpha_N[\alpha_N r^* nfa + ((k - k^*) + (z - z^*))/2] \tag{13}$$

where: v is the speed of adjustment of net foreign assets to changes in relative prices; (k-k^*) is the difference between measures of relative sector productivity at home and abroad (where $k = y_T - y_N$ and $k^* = y_T^* - y_N^*$); and (z-z^*) captures demand shocks.

The empirical model. The theoretical model has identified two main determinants of the real exchange rate (q) in the long-run: the stock of net foreign assets (*nfa*); and the relative sectoral prices between countries (n) and could be rewritten in the following form by factoring *nfa*

$$\bar{q} = r^*[(1 - \alpha_T - \alpha_T^*)/v + \alpha_N^2)] nfa + \alpha_N[(k - k^*) + (z - z^*)]/2 \tag{14}$$

In this form the equilibrium real effective exchange rate is a function of **three variables,** *nfa*, the difference between measures of relative sector productivity at home and abroad, and demand shocks. Abstracting from demand shocks and using price differentials in lieu of the relative sector productivity differential at home and abroad, we obtain our empirical model:

$$q_t = \beta_0 + \beta_1 nfa_t + \beta_2 n_t + u_t \tag{15}$$

Since our main objective is to compute the equilibrium exchange rate as a function of its fundamentals, we have first to establish the existence of a long-run relationship among the variables, and second we have to compute the equilibrium levels of the determinants *nfa* and n. In order to determine the existence of a long-run relationship among variables (i.e. to test for cointegration), we use the Johansen procedure for cointegration. To establish the equilibrium level of the REER, we assume that q_t fluctuates around its long-term value, but it is not permanently at that value. Moreover, in order to derive the equilibrium exchange rate, we also allow for the possibility of nfa_t and n_t deviating from their long-run values.

From an empirical point of view, the three variables in the system are decomposed into transitory $[\hat{q}_t, \hat{nfa}_t, \hat{n}_t]$ and permanent components $[\bar{q}_t, \bar{nfa}_t, \bar{n}_t]$, with the latter capturing the equilibrium of the system:

$$\bar{q}_t = \beta_0 + \beta_1 \bar{nfa}_t + \beta_2 \bar{n}_t \tag{16}$$

Bearing in mind that a unique decomposition between permanent and transitory components does not exist, we consider the decomposition suggested by Gonzalo and Granger (1995), based on the assumption that shocks to the transitory component (i.e., our estimate of the misalignment) do not affect the permanent component (i.e., our estimate of the equilibrium).[3] They derive a decomposition where the transitory component does not Granger-cause the permanent component in the long run and where the permanent component is a linear combination of contemporaneous observed variables. In other words, the first restriction implies that a change in the transitory component today will not affect the long-run values of the variables. The second restriction makes the permanent component observable and assumes that the contemporaneous observations contain all the necessary information to extract the permanent component. The decomposition is done using the identification implicit in the cointegration of the series. In particular, if cointegration exists amongst a number of variables, then the vector will have a common, or factor, decomposition. Gonzalo and Granger demonstrate that the common factor can be estimated if it is assumed to be a linear combination of the series under analysis and if it is further assumed that the residuals from this model do not have a permanent effect on the original series. The former assumption makes the common factor observable, while the second permits identification.

Analytically, consider a 3×1 vector $x_t = [q_t, nfa_t, n_t]'$, which under the null hypothesis of one cointegration vector admits the following representation:

$$\Delta x_t = A_1 \Delta x_{t-1} + \ldots + A_{p-1} \Delta x_{t-p} + \Pi x_{t-p} + e_t, \tag{17}$$

where e_t is a vector white noise process with zero mean and variance Σ and Π is a 3×3 matrix, whose rank will determine the number of cointegration vectors. If cointegration exists, Π is not full rank ($r<3$, with $r=1$ in our case) and can be written as the product of two rectangular matrices, $\Pi = \alpha\beta'$, where β is the matrix whose columns are the linearly independent cointegrating vectors and α is the factor-loading matrix, indicating the speed with which the system responds to last period's deviation from the equilibrium level of the exchange rate. Next, one can always define the orthogonal complements $\alpha_\perp$ and $\beta_\perp$ as the eigenvectors associated with the unit eigenvalues of the matrices $\left(I - \alpha(\alpha'\alpha)^{-1}\alpha'\right)$ and

[3] For a discussion of the decomposition of time series into permanent and transitory components see Maravall (1993) and Quah (1992).

$\left(I - \beta(\beta'\beta)^{-1}\beta'\right)$, respectively. The matrix $\alpha_\perp$ is formed by the vectors defining the space of the common stochastic trends, and therefore should be informative about the key "driving" variable(s) in each of the systems, while $\beta_\perp$ gives the loadings associated with, i.e., the series which are driven by the common trends. Notice that $\alpha'_\perp \alpha = 0$ and $\beta'_\perp \beta = 0$. If the vector x is of reduced rank, r, Gonzalo and Granger have demonstrated that the elements of x can be explained in terms of a smaller number of (3-r) of I(1) variables called common factors, f_t, plus some I(0) components, the transitory elements, $\hat{x}_t$:

$$x_t = A_1 f_t + \hat{x}_t \tag{18}$$

The identification of the common factors may be achieved in the following way. If it is assumed that the common factors are linear combinations of the variables x_t:

$$f_t = B_1 x_t \tag{19}$$

and if $A_1 f_t$ and $\hat{x}_t$ form a permanent-transitory decomposition of x_t, then from the representation in (1), the only linear combination of x_t such that $\hat{x}_t$ has no long-run impact on x_t is:

$$f_t = \alpha_\perp x_t \tag{20}$$

This identification of the common factors allows to obtain the following permanent-transitory decomposition of x_t

$$x_t = \beta_\perp(\alpha'_\perp \beta_\perp)^{-1}\alpha_\perp x_t + \alpha(\beta'\alpha)^{-1}\beta' x_t \tag{21}$$

where the permanent and the transitory components are captured by the terms $\beta_\perp(\alpha'_\perp \beta_\perp)^{-1}\alpha_\perp x_t$ and $\alpha(\beta'\alpha)^{-1}\beta' x_t$, respectively. Gonzalo and Granger show that the transitory components defined in this way will not have any effect on the long-run values of the variables captured by the permanent components. The identification of the permanent component with the equilibrium implies that

$$\bar{x}_t = \beta_\perp(\alpha'_\perp \beta_\perp)^{-1}\alpha_\perp x_t \tag{22}$$

and

$$\hat{x}_t = \alpha(\beta'\alpha)^{-1}\beta' x_t \tag{23}$$

from where the estimation of the equilibrium exchange rate and its deviation directly follow.

B. Econometric Methodology

To understand the link between the concept of equilibrium and those of integration and cointegration, we start from the PPP hypothesis, which implies a constant value for the equilibrium exchange rate. In practice, this does not mean that the real exchange rate is expected to be always at its equilibrium level, but that on average it is. Econometrically speaking, the PPP hypothesis implies a stationary process, or a process integrated of order zero I(0), for the real exchange rate. If the latter is integrated of order one I(1) (i.e. it contains a unit root), it will not revert to its mean (i.e. no constant equilibrium can be defined) and the PPP hypothesis can be rejected. However, if the equilibrium is thought as a time-varying one, the real exchange rate will fluctuate around this time-varying equilibrium that will be characterized by the long-run cointegration relationship (i.e. its coefficients), if the variables are cointegrated, which means that a stationary combination among these variables exists. Thus the presence of a cointegration relationship implies the existence of a time-varying equilibrium exchange rate.

To infer the stationary characteristics of the series under analysis, we use panel integration and cointegration techniques, since standard unit root and cointegration methods are known to have low power if applied to short length time series. Given the short period of available data for these countries (1994–2002), an alternative to increase the power of the tests is to add the cross-sectional dimension to the analysis. In the literature, Im, Pesaran, and Shin (1997) and Pedroni (1998), among others, developed unit roots and cointegration statistics that, under quite general conditions, have more power than standard time series tests. In addition, the tests by Im, Pesaran, and Shin (IPS) and Pedroni allow for heterogeneity in the dynamics of each of the cross section unit in the panel. This implies that under the hypothesis of unit root in either the series of interest or the residuals of the cointegration regression, the dynamics of each cross section unit may differ. Under the alternative hypothesis of no unit root, the there are no homogeneity restrictions. This flexibility makes the use of these tests particularly suitable to our framework, where the coefficients of the long-run equilibrium and the short-run dynamics are likely to differ across countries.

Im, Pesaran, and Shin's statistic (*t-IPS*) tests the null hypothesis of a unit root in a panel. The test is based on the average of the standard *ADFt* statistics obtained from individual tests. Under the null hypothesis of a unit root, the panel unit root test is distributed as a standard normal. For analyzing the cointegration properties, we follow Pedroni, who proposes several panel cointegration tests. Two are used in this exercise, the *Group PP* (*GPP)* and the *Group t* (*Gt*). The former is computed on the basis of the individual Phillips-Perron statistics applied on the residuals of each cointegration regression, while the *Gt* is calculated on the basis of the individual *ADFt* statistics applied on the same residuals. In both cases, the panel cointegration tests are asymptotically normal.

C. The Data

The real effective exchange rates analyzed in this section are the Estonia kroon, the Latvian lat, and the Lithuanian litas. The time period under consideration is 1994Q1–2002Q1 and the data are quarterly.[4] The analysis has been conducted using the following variables:

- **Real Exchange Rate (q_t):** the multilateral CPI-based real effective exchange rate of the currency of the domestic economy relative to its trading partner countries is used. The variable is expressed in logarithms. The series used are the ones published by the Information Notice System (INS).

- **Net foreign Assets (nfa_t)** positions for each country are calculated by adding up the current account balances. The initial stock of net foreign assets is 1999Q3, as provided by the EDSS. The net foreign assets position is then normalized by the GDP in order to adjust for the size of the economy.

- **Relative Prices of Non-tradable to Tradable Goods (n_t)** are defined as the ratio of the domestic consumer price index (CPI) to the producer price index (PPI) relative to the corresponding weighted average of partner country ratios, using the same weights as the ones applied to q_t. The variable is expressed in logarithms.

D. Econometric Results

Testing for the Existence of Time-Varying Equilibrium Exchange Rates

Panel integration and cointegration techniques are used to infer the long-run property of the series and thereby test whether the PPP hypothesis holds and, if it does not, whether a time-varying equilibrium exchange rate exists for the three countries. For comprehensiveness, the results of time series unit root (*ADF*) and cointegration (Johansen (1988)) tests are also presented.

[4] Data are seasonally adjusted.

Table 1 shows the results of the unit root tests. Both the panel and the individual unit root tests indicate that the hypothesis that the variables are integrated of order one cannot be rejected, suggesting the presence of a unit roots in all three variables for all the three countries. Thus, there is evidence that the *PPP* hypothesis does not hold for any of the Baltic countries.

Table 1. Integration Tests 1/

	REER	nfa	n
Panel integration (*t-IPS*)	-0.18	2.76	-0.15
Time series integration (*ADF*)			
Estonia	1.76	-1.92	-1.81
Latvia	1.17	-1.42	-0.48
Lithuania	-2.5	2.45	-2.06

1/ Five percent critical values: for t-IPS is -1.69 and for ADF -2.95

The results of the cointegration analysis are presented in Table 2. Although the table shows some disparity in the results, with the panel cointegration test *Gt* strongly rejecting the null hypothesis of no cointegration, while the *GPP* test does not confirm the same result, considering the evidence of the time series cointegration tests, overall we can infer the presence of cointegration for the three countries.

Table 2. Cointegration Tests

	Panel Cointegration 1/	
	Pedroni's *GPP*	Pedroni's *Gt*
	10.31	-2.29*
	Time series cointegration	
	Trace	Lambda
Estonia	42.12*	38.39*
Latvia	29.14**	16.84
Lithuania	32.89*	16.83

1/ Critical value of panel tests at 5 percent is -1.69
Note: * and ** denote significant at 5 percent and 10 percent, respectively.

Table 3 displays the cointegration vectors for the three countries together with some diagnostic statistics on the residuals of the cointegration regression. The parameters associated with relative prices (n) are, as expected, systematically very close to one. By contrast with the empirical evidence for many other countries, however, the net foreign assets position enters in the long-run relationship with a negative sign for all the three countries. Given the similarities of these three countries, this behavior could be attributed to the fact that, for the period under consideration, the current account deficit was financed by increased demand of these countries' assets, since they started with a very small liability position at the beginning of the period and offered good potential opportunities for foreign investors ready to enter into attractive

Table 3. Cointegration Results

	REER	nfa	n
Cointegration vectors			
Estonia	1	0.18	-1.00
Latvia	1	0.15	-0.99
Lithuania	1	0.18	-1.02
Residual analysis			
Estonia			
Stationarity tests (c.v. 5.99)	28.92	27.4	19.88
Exclusion tests (c.v. 3.84)	19.79	13.99	27.25
Latvia			
Stationarity tests (c.v. 5.99)	188.2	207.5	211.90
Exclusion tests (c.v. 3.84)	56.7	66.5	90.60
Lithuania			
Stationarity tests (c.v. 5.99)	56.37	56.8	54.49
Exclusion tests (c.v. 3.84)	37.67	45.04	48.30

small open economies with high productivity growth, relative cheap labor costs, and a stable macroeconomic environment .

Equilibrium Exchange Rates

The estimation results for each of the Baltic countries are discussed in detail below and illustrated in Figures 21 and 18. Figure 21 displays the historic series of the real effective exchange rates and their determinants, while Figure 18 reports the estimated equilibrium real exchange rates. The left-hand panels of Figure 18 display the actual and the estimated equilibrium exchange rates, and the panels on the right-hand side present the deviations from the equilibrium along with the computed 95 percent standard errors bands. Positive values of misalignments indicate overvaluation of the real effective exchange rate with respect to its equilibrium. From Figure 18 it can be seen that in Estonia and Lithuania, REERs have fluctuated around their equilibrium rates within a range of about +/- 15 percent. Moreover the recent pattern has been similar, with both countries experiencing overvaluation following the 1998 Russia crisis, although the overvaluation was more prolonged in the case of Lithuania reflecting the sharp appreciation of the U.S. dollar and hence the litas against the euro from 1999–2000. By early 2002, however, both the kroon and the litas were modestly undervalued, by about 5–6 percent, with respect to their equilibrium levels. The accuracy of the results for Latvia, however, is very low (as can be seen from the wide confidence bands in Figure 18) and it is not possible to say with any confidence whether the lat was under- or overvalued throughout the period under observation.

The Estonian kroon

On the basis of the cointegration results (Table 2), there is evidence of one significant cointegration vector for the system regarding the Estonian kroon. As reported in Table 3, the cointegration relationship, normalized on the exchange rate, produces the following relationship:

$$q_t = -.018\beta_1 nfa_t + 1.0\beta_2 n_t .$$

The adjustment (or α loading matrix) associated to the cointegration vector is reported in Table 4. The significantly negative α coefficient in the exchange rate equation indicates that the exchange rate moves to close the gap of a disequilibrium by approximately 50 percent every five quarters, or that most of the adjustment to a shock to the real exchange rate will be offset after two and a half years. Moreover, the significantly positive α coefficient in the Balassa-Samuelson variable equation suggest that the Balassa-Samuelson variable moves to close the gap of a disequilibrium at approximately the same pace.

As the variable in the system are integrated of order one and there exists one cointegration relationship implied by the cointegration vector, one can infer that there must be two common trends. Tables 5 and 6, which report α and β orthogonal components, respectively, should read as follows. In Table 5, the row headings are the common trends, while the column headings show the contributions of the variables to the trends. Looking across rows,

the cell with the largest absolute value indicates that the shock to the variable in the row heading makes the largest contribution to the common trend. In Table 6, the column headings indicate the weights attached to the common trends, and the rows show how the weights are distributed amongst the variables. Focusing on a row, one can see which trend has the largest effect on a particular variable.

Table 4. Estonia. α Loading Matrix

	q	nfa	n
α	-0.12	-0.09	0.10
S.E.	(0.06)	(0.14)	(0.05)
half-life estimate	5.4		

Table 5. Estonia. α Orthogonal Components

	q	nfa	n
$\alpha\perp^1$	0.02	0.72	0.69
$\alpha\perp^2$	0.74	-0.45	0.49

Table 6. Estonia. β Orthogonal Components

	q	nfa	n
$\beta\perp^1$	-0.70	0.34	-0.63
$\beta\perp^2$	-0.16	-0.93	-0.33

Table 7. Estonia. Long-Run Impact Matrix

	Shock to q	Shock to nfa	Shock to n
q_t	0.34	-0.03	0.39
	(0.06)	(0.04)	(0.15)
nfa_t	2.04	2.40	4.72
	(1.66)	(1.25)	(3.9)
n_t	0.72	0.41	1.26
	(0.32)	(0.24)	(0.77)

Note: Standard errors in brackets.

The results in Table 5 indicate that the first common trend appears to correspond to unanticipated shocks to the net foreign assets position, while the second trend is driven by the real exchange rate. Table 6 indicates that the real exchange rate and the Balassa-Samuelson variable appear to be driven by the first common trend, and the net foreign assets position by the second trend.

Additional information on the driving variables in the systems may be obtained looking at the long-run impact matrix (Table 7), which measures the combined effect of the α and β orthogonal components and indicates if a shock to a particular variable has a permanent effect on the other variables in the system. Table 7 indicates that shocks to the Balassa-Samuelson variable has a significant cumulative impact on the real exchange rate, while the cumulative effect of a shock to the net foreign assets position does not seem to be significant.

The Latvian lats

There is evidence of one cointegration vector for the lat, which, once normalized for the exchange rate, produces the following relationship:

$$q_t = -.015\beta_1 nfa_t + 0.99\beta_2 n_t .$$

The estimated α coefficient in Table 8 indicates that the exchange rate adjusts to close the gap of a disequilibrium, but the speed of adjustment is slower than in Estonia, with adjustment completed within four and a half years. The Balassa-Samuelson variable, however, moves to close the gap of a disequilibrium much faster, in approximately 6 months.

Table 8. Latvia. α Loading Matrix

	q	nfa	n
α	-0.05	-0.05	0.42
S.E.	(0.04)	(0.07)	(0.02)
half-life estimate	13.5		

Table 9. Latvia. α Orthogonal Components

	q	nfa	n
$\alpha\perp^1$	-0.46	0.89	0.05
$\alpha\perp^2$	0.88	0.45	0.17

Table 10. Latvia. β Orthogonal Components

	q	nfa	n
$\beta\perp^1$	0.17	0.93	0.32
$\beta\perp^2$	0.69	-0.34	0.64

Table 11. Latvia. Long-Run Impact Matrix

	Shock to q	hock to nfa	Shock to n
q_t	0.12	-0.43	-0.04
	(0.05)	(0.08)	(0.08)
nfa_t	0.50	1.12	0.20
	(0.10)	(0.18)	(0.17)
n_t	0.19	-0.26	-0.01
	(0.03)	(0.06)	(0.06)

Note: Standard errors in brackets.

As shown in Table 9, there is evidence that the first common trend is mainly driven by the net foreign assets position, while the second one corresponds to unanticipated shocks to the exchange rate. Based on the results in Table 10, the net foreign assets position appears to be driven by the first common trend, while the exchange rate and the relative price differentials by the second trend.

Finally, from the estimated long-run impact matrix in Table 11, one can learn that shocks to the net foreign assets position has a significant cumulative effect on the real exchange rate, while the cumulative effect of a shock to the Balassa-Samuelson term does not appear to be significant.

The Lithuanian Litas

For the system regarding the real exchange rate for the Lithuanian litas, there is also evidence of a cointegration vector, which produces the following relationship, once normalized for the exchange rate:

$q_t = -.018\beta_1 nfa_t + 1.02\beta_2 n_t$.

Similar to the finding for the other two countries, the real exchange rate adjusts to close the gap of a disequilibrium (Table 12). The speed of adjustment is faster that in the other cases and suggests that the adjustment is completed within two years.

The results in Table 13 indicate that the both the first and second common trend appear to correspond to unanticipated shocks to the Balassa-Samuelson term. Table 14 shows that the variable that adjust most to the first trend is the net foreign assets position, while the real effective exchange rate and the Balassa-Samuelson term seem to be mostly affected by the second trend.

Table 12. Lithuania. α Loading Matrix

	q	nfa	n
α	-0.16	-0.03	0.06
S.E.	(0.05)	(0.07)	(0.06)
half-life estimate	4.0		

Table 13. Lithuania. α Orthogonal Components

	q	nfa	n
$\alpha\perp^1$	0.21	0.51	0.84
$\alpha\perp^2$	-0.38	0.42	-0.82

Table 14. Lithuania. β Orthogonal Components

	q	nfa	n
$\beta\perp^1$	-0.16	0.99	0.02
$\beta\perp^2$	0.72	-0.12	0.68

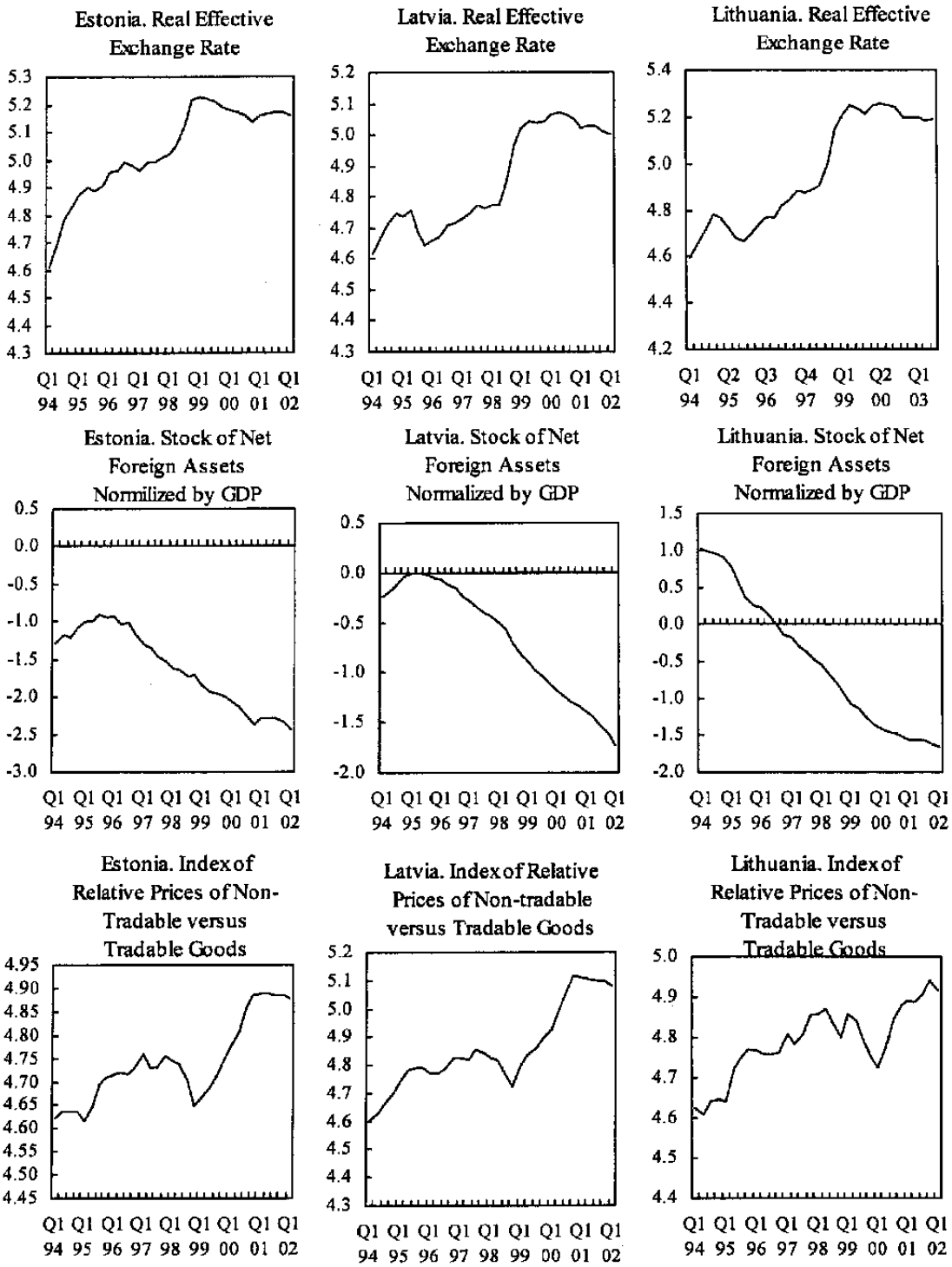
Table 15. Lithuania. Long-Run Impact Matrix

	Shock to q	Shock to nfa	Shock to n
q_t	0.33	0.17	0.81
	(0.24)	(0.19)	(0.38)
nfa_t	-0.41	1.39	-0.40
	(.56)	(.39)	(.89)
n_t	0.25	0.08	0.72
	(0.16)	(0.17)	(0.30)

Note: Standard errors in brackets.

The estimated long-run impact matrix for the Lithuanian litas is reported in Table 15. As for the Estonian-kroon system, shocks to the Balassa-Samuelson term has a significant cumulative effect on the real exchange rate, while the cumulative effect of a shock to the net foreign assets position seems not to be significant.

Figure 21. Baltics. Real Exchange Rate and Its Determinants
1994Q1–2002Q1



Source: Information Notice System and staff estimates.