March 2005
IMF Country Report No. 05/122

Republic of Lithuania: Selected Issues

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International Monetary Fund
Washington, D.C.

INTERNATIONAL MONETARY FUND

REPUBLIC OF LITHUANIA

Selected Issues

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Approved by the European Department

March 8, 2005

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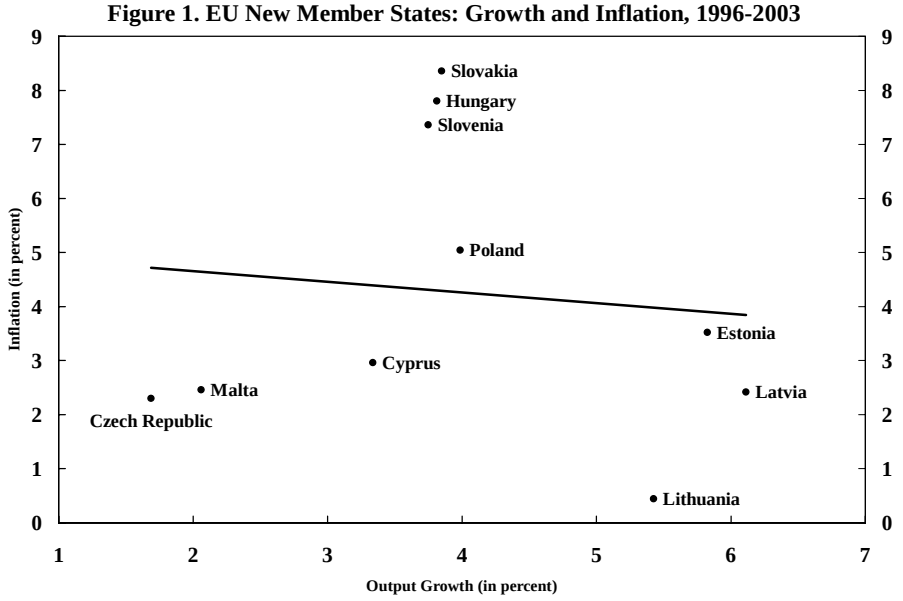
I. INFLATION RISKS IN A CURRENCY BOARD[1]

A. Introduction and Overview

1. **Of all the new member states of the European Union, Lithuania is distinguished by its recent history of very low inflation**. In spite of rapid GDP growth —indeed, one of the fastest in the same group— Lithuania's inflation rate has been very low since 1996. High growth and low inflation are common to all Baltic countries, but Lithuania has had by far the lowest inflation in the region (Figure 1).

Figure 1. EU New Member States: Growth and Inflation, 1996-2003



2. **After a short spell of deflation between late 2002 and early 2004, Lithuania has been experiencing a temporary resurgence of inflationary pressures**. Oil prices, administered prices, and indirect and excise taxes have driven the acceleration in the last few months against a backdrop of strengthening demand, partly fueled by fiscal stimulus. Wage increases, which remained subdued over the last few years, are accelerating on the back of a tighter labor market.

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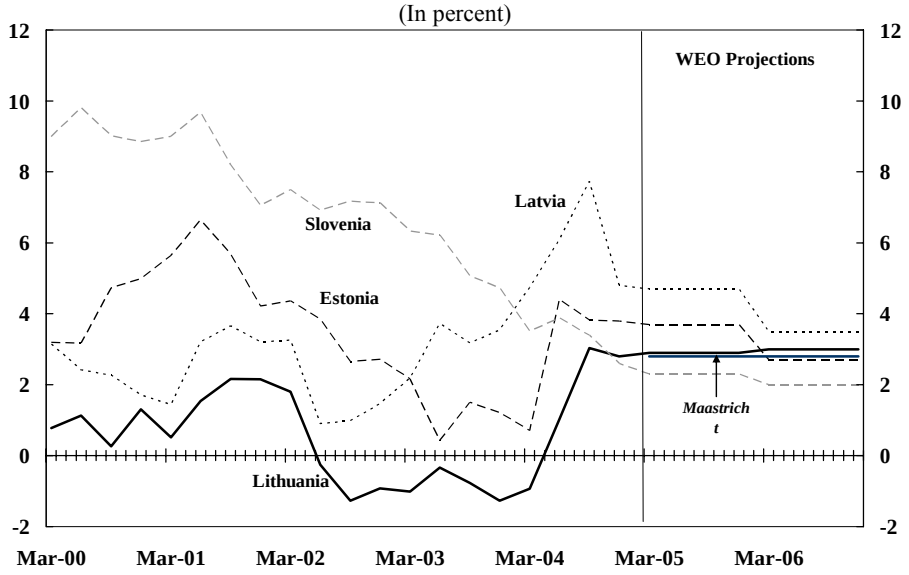
[1] Prepared by Leo Bonato. The paper has greatly benefited from discussions with Badi Baltagi, Zenon Kontolemis, Daniel Leigh, Lusine Lusinyan, and Ashoka Mody. The assistance of Katsiaryna Svirydzenka in the construction of the data set is gratefully acknoweledged.

Figure 2. EMU Candidates: Inflation Developments and the Maastricht Criterion
(In percent)



3. **There is a risk of temporarily breaching the inflation criterion under the Maastricht treaty.** Together with Estonia and Slovenia, Lithuania joined ERMII in June 2004, with a view to adopting the euro by January 2007. Latvia intends to follow a similar path, after repegging its currency to the euro in early 2005. For all these countries, a successful adoption of the euro will require meeting the Maastricht criteria in the next two years. Based on current inflation forecasts, the risk of breaching the inflation criterion, at least for the Baltic countries, is very high (Figure 2).

4. **This risk is heightened by the persistence of high oil prices**. Although oil prices are not the only reason for the current inflationary pressures, their recent increase and their persistence at high levels are likely to penalize the Baltic economies because of their high energy intensity.[2] Nonetheless, while the direct effect of oil price changes is certainly stronger in the Baltics, the overall impact depends crucially on how expectations of higher inflation become ingrained in the economy.

5. **Under these circumstances, currency boards may offer an advantage in terms of inflation performance.** While all new member states have chosen some form of exchange rate pegging, currency boards involve the strongest commitment to the peg, which improves the credibility of the monetary policy regime (Ghosh, Gulde, and Wolf, 2000). Indeed, currency boards in Lithuania and Estonia have been remarkably successful at maintaining monetary stability, thereby contributing to the outstanding economic performance of these

[2] The weight of "electricity, gas and other fuels" (category 045) in the Harmonized Index of Consumer Prices (HICP) is 9.4 percent in Lithuania, which is twice as high as the EU-25 average (4.7 percent). The corresponding values for Estonia and Latvia are, respectively, 8 percent and 8.5 percent.

countries in the last decade.[3] This "credibility bonus" may help these countries contain inflation risks even in the short term.

6. **This paper looks at short-term inflation dynamics in the new member states (NMS), focusing on the role of monetary policy regimes.** In Section B, we model the determinants of inflation in the NMS and assess how different theoretical frameworks best fit the data. In Section C, we investigate the macroeconomic performance of currency boards within the group of NMS, evaluate their role in reducing inflation, and identify some of their distinctive characteristics. Section D presents some conclusions.

B. Modeling Inflation in the New Member States

7. **Our initial approach is based on the traditional Phillips curve.** Within this framework, inflation depends on the state of the business cycle and some lagged values of inflation. Galí, Gertler, and López-Salido (2001) show that a simple such function with four lags of inflation and one lag of the output gap provides a good fit of the data for both the U.S. and the euro area in the postwar period. We estimate a similar equation for the panel of ten NMS over the period 1996Q1–2004Q3. Even though data are available even prior to 1996, it is only after that date that macroeconomic stability was fully achieved in all the NMS, as some of them, notably the Baltics, experienced hyperinflation in the early years of the transition.[4]

8. **The results do not provide a fully convincing account of inflation in the NMS.** Below we report the estimated equation [5]

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[3] Estonia introduced its currency board in June 1992, followed by Lithuania almost two years later, in April 1994.

[4] Panel unit root tests (Levin, Lin, Chu, 2002; and Im, Pesaran, and Shin, 2003) confirm that the null of stationarity cannot be rejected for inflation after 1996. For a description of the data used, see Appendix I.

[5] The equation is estimated with the Blundell-Bond (1998) one-step system generalized method of moments (GMM) estimator, using four lags of inflation and the output gap, and the change in oil price as instruments. While the unrestricted system GMM would use one instrument for each time period, variable, and lag distance, we restrict the number of instruments to one for each variable, and lag distance to avoid the bias arising when the number of instruments approaches the number of observations. This estimator is consistent in the presence of the lagged dependent variable, and Monte Carlo studies show it guarantees good results in a small macroeconomic panel (Judson and Owen, 1999). Robustness checks, not reported here, are performed with the two-step system GMM estimator with the Windmeijer (2005) correction for standard errors. By including oil price among the instruments, we intend to account for the impact of common macroeconomic shocks. The validity of this assumption is confirmed by the robustness of results, not reported here, obtained with two-way fixed-effect instrumental variables.

$$\pi_t = \underset{(0.27)}{1.21}\pi_{t-1} - \underset{(0.29)}{0.64}\pi_{t-2} + \underset{(0.17)}{0.49}\pi_{t-3} - \underset{(0.09)}{0.14}\pi_{t-4} + \underset{(0.03)}{0.06}\hat{y}_{t-1}$$

No. obs.=313; J=0.34; F=0.21; AR(2)=0.04; AR(3)=0.16; AR(4)=0.52; AR(5)=0.21[6].

The coefficient of the output gap is positive and mildly significant (p-value=0.07). Its size is similar to that obtained by Galí, Gertler, and López-Salido (2001) for the euro area. The statistics validate the overall specification of the instrument set, and the results are consistent with the theory.[7] The dynamic structure of inflation, however, appears very unstable, and the coefficient of inflation lagged once is implausibly large, possibly due to weak instruments, as shown by some remaining second-order autocorrelation in the residuals.

9. **The new Keynesian Phillips curve presents several attractive features**. One possible drawback of the traditional Phillips curve is its reliance on measures of the output gap, which are particularly uncertain in economies undergoing rapid structural change. The new Phillips curve (NPC) focuses instead on real marginal cost as the main driver of inflation. This variable is conceptually richer, as it encompasses both demand and cost-push components, and is typically measured by the labor income share, which is sensitive to productivity changes. Moreover, unlike the traditional Phillips curve, the NPC has clear microfoundations as it evolves from a model of staggered nominal price setting in monopolistically competitive markets. The NPC has been used successfully in empirical work on the U.S. (Galí and Gertler, 1999; and Sbordone, 2002) and the euro area (Galí, Gertler, and López-Salido, 2001). Although, in the original NPC, price setting depends only on expectations of future prices, Galí and Gertler (1999) derive a "hybrid" Phillips curve that allows for a subset of firms to use a backward-looking rule of thumb when setting prices. This extension is needed to account for the inflation persistence present in the data.

[6] Standars errors are in brackets. The reported statistics are the number of observations and p-values of a) Hansen J-test of overidentifying restrictions; b) F-test of the hypothesis that the sum of the coefficients of the lagged inflation terms does not significantly differ from one; and c) tests of second, third, fourth, and fifth order autocorrelation of the residuals.

[7] As results from the F-test show, the equation does not violate the condition that the coefficients of the lagged inflation terms add to one. This condition is consistent with the natural rate theory, which predicts no long-run trade-off between output and inflation, and ensures the desirable property of constant inflation in case output is at potential.

10. **As for the traditional Phillips curve, the results for the standard new Keynesian Phillips curve are not satisfactory.** Below we report our estimate of the hybrid NPC:

$$\underset{}{\pi_t} = \underset{(0.08)}{0.71\pi_{t+1}} + \underset{(0.10)}{0.31\pi_{t-1}} + \underset{(0.07)}{0.10\pi_{t-2}} + \underset{(0.02)}{0.02mc_t}.$$

No. obs.=301; *J*=0.45; *F*=0.07; AR(2)=0.07; AR(3)=0.88[8].

While the coefficient of forward-looking inflation expectations is large and significant, and in line with the results obtained for the euro area by Galí, Gertler, and López-Salido (2001), the impact of the real marginal cost is small and statistically insignificant.

11. **NMS are small open economies, and standard models developed for closed economies are likely to be inadequate.** Measured by the ratio of the sum of exports and imports to GDP, openness ranges from a minimum of 0.66 in Poland to a maximum of 1.81 in Malta on average over the sample period, which is substantially higher than in the U.S. or the euro area. The importance of this characteristic for inflation is clearly illustrated by Figure 3, which shows the behavior of inflation and its determinants in Lithuania during the 1998–99 Russian crisis. While the negative productivity shock drove up the real marginal cost in Lithuania, price of imports from Russia fell rapidly. The ensuing real appreciation reduced the price of tradables and that of imported intermediate goods, offsetting the impact of the productivity shock on inflation. If import prices were to be excluded from the picture, it would be impossible to understand the behavior of inflation in Lithuania over that period.

12. **The inclusion of import prices substantially improves the fit.** The NPC framework has been extended to the open economy case, but it still lacks a commonly accepted testable specification.[9] Short of a clear theoretical guidance, I include a measure of import prices. The

[8] The equation is estimated with the Blundell-Bond estimator described in footnote 5. Following a specification search, we now employ a more parsimonious dynamic structure, with only two lags of inflation. The real marginal cost is measured by the log deviation of the labor income share from its mean. π_{t+1} proxies for expectations of future inflation. Under rational expectations, the error in the forecast of π_{t+1} is uncorrelated with information dated *t* and earlier. Our instrument set includes four lags of inflation, two lags of the real marginal cost and the output gap, and oil price change. The *F*-statistic now refers to the null that the sum of the coefficients of both backward-looking and forward-looking inflation terms equals one.

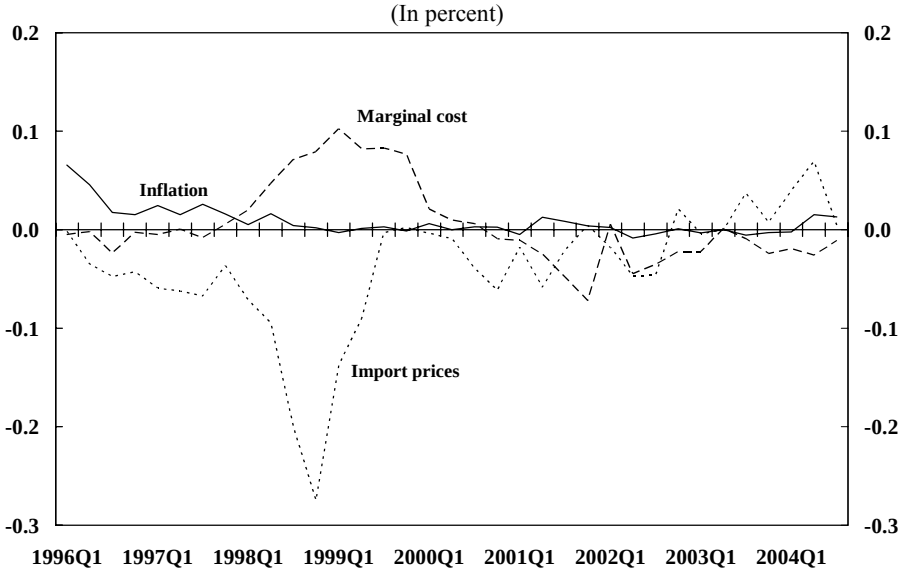
[9] Examples of empirical work based on different specifications of the open economy model are Kara and Nelson (2003), Genberg and Pauwels (2003), and Rumler (2004).

estimated equation is reported below:

$$\pi_t = \underset{(0.11)}{0.74}\pi_{t+1} + \underset{(0.13)}{0.31}\pi_{t-1} + \underset{(0.09)}{0.07}\pi_{t-2} + \underset{(0.02)}{0.06}mc_t + \underset{(0.03)}{0.12}ip_t .$$

No. obs.=287; *J*=0.42; *F*=0.04; AR(2)=0.07; AR(3)=0.50[10].

Figure 3. Lithuania: Inflation, Marginal Cost, and Import Prices
(In percent)



Not only is the coefficient of import prices of the right sign and reasonable size, and highly significant; it also improves the estimate of the real marginal cost coefficient; the latter becomes larger and fully significant, possibly indicating that the closed-economy specification suffers from an omitted-variable problem.[11]

[10] The estimator is the same used for the previous equation, with the addition of openness to the instrument set (see Appendix I).

[11] Unfortunately, the *F*-test shows that the results are not fully consistent with the natural rate theory, and some second order autocorrelation remains in the residuals, casting doubt on the strength of the instrument set. These awkward features disappear when the two-step efficient estimator is used, but the standard error for the coefficient of the real marginal costs also increases somewhat.

13. **Although price convergence is apparent in the data, there is no evidence of an independent effect on inflation.** The progressive integration of the NMS in the European economy has reduced price differences across all countries, with the notable exception of Slovenia (Table 1). However, convergence must have occurred mainly through the inflation process already described. In fact, convergence requires inflation to be higher in countries where there is more room for catching up, but we cannot find evidence of this in the data, as the coefficient of relative price levels turns out to be insignificant.

Table 1. Lithuania: Comparative Price Levels of Household Final Consumption (EU25=100)

	1995	2003
Cyprus	84.2	93.9
Czech Republic	41.2	55.2
Estonia	42.2	62.2
Hungary	44.0	58.0
Latvia	38.3	55.1
Lithuania	30.8	54.4
Malta	71.5 1/	72.8
Poland	46.5	53.3
Slovak Republic	39.8	49.8
Slovenia	77.1	77.1

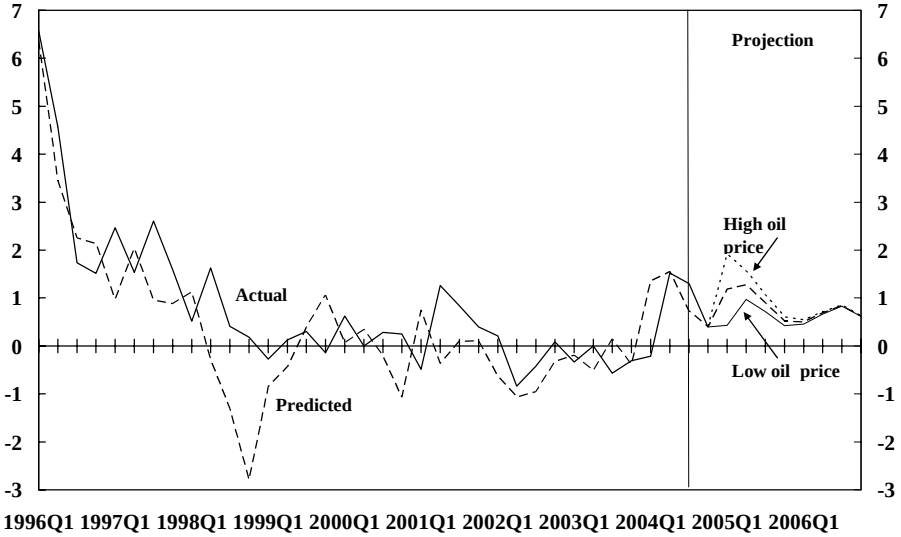
Source: Eurostat.
1/ 1999.

14. **Despite the importance of structural change in the NMS, no influence of relative price adjustment on inflation can be detected**. Most NMS are transition economies that have experienced the transformation from a centrally planned economy to a market economy. This transformation required a profound readjustment of relative prices, with implications for the distribution of price changes and its relation with inflation (Coorey, Mecagni, and Offerdal, 1996). In general, the variance of price changes will be higher the more intense the structural change. If downward rigidities of wages or prices are present, the adjustment will take place only through wage or price increases, i.e., the distribution will be skewed, and the average price level will be higher as a result. The Balassa-Samuelson effect, whereby lower productivity growth in the nontradable sector increases its relative prices, will also lead to a skewed price adjustment. One way to test for these effects is to estimate the inflation equation including terms for the moments of the distribution of price changes. Both variance and skewness of price changes turn out to be insignificant, possibly owing to the absence of significant price and wage rigidities and the strong productivity growth experienced by the NMS in the nontradable sector.[12]

15. **The open-economy new Keynesian Phillips curve provides a good characterization of inflation dynamics in Lithuania.** With the exception of the period coinciding with the Russian crisis, when the equation predicted a drop in inflation that did not occur, the fitted values from the equation in paragraph 12 follow actual inflation quite closely (Figure 4).

[12] This result is consistent with Arratibel, Rodríguez-Palenzuela, and Thimann (2002), who do not find evidence of Balassa-Samuelson effects in a sample of EU accession countries.

Figure 4. Lithuania: Inflation, Actual, and Predicted
(Quarterly change of HICP, in percent



16. **Significant short-term risks for Lithuania are related to oil price developments**. We can use this equation to project the path of inflation for three different scenarios: a) baseline, which corresponds to the current WEO baseline assumption of oil prices at US$46.50 in 2005 and US$43.75 in 2006; b) a "high-oil-price" scenario, where oil prices are 20 percent higher through the projection period; and c) a "low-oil-price" scenario, where oil prices are 20 percent lower.[13] In the baseline scenario, represented by the dashed line, inflation reaches 3.9 percent in 2005 and then decelerates to 2.7 percent in 2006. Differences in oil price developments would entail significant changes in the short-term inflation path. In the high-oil-price scenario, inflation would reach as high as 5.3 percent in 2005, whereas in the low-oil-price scenario inflation would drop to 2.6 percent in the same period. Low persistence, which characterizes the dynamics of the estimated equation, would rapidly bring the inflation paths in the three scenarios to convergence by the end of 2006.

C. Are Currency Boards Special?

17. **There is strong evidence of the good macroeconomic performance of currency boards**. In their influential paper, Ghosh, Gulder, and Wolf (2000) show that currency boards experienced lower inflation and higher growth, with the former reflecting lower money supply growth ("discipline effect") and faster money demand growth ("credibility effect"). In their sample of IMF member countries over the period 1975–96, they find that inflation was on average lower by 2.2 percent on an annual basis, 0.3 percent of which reflected the discipline effect and 1.9 percent the credibility effect.

[13] In all three scenarios, we assume a continuation of the current upward trend in the real marginal cost owing to a tightening of the labor market.

18. **Indeed, Estonia and Lithuania, the two examples of currency board regimes in our sample of NMS, have enjoyed a superior macroeconomic performance.** The unconditional statistics reported in Table 2 confirm that the two currency boards have had lower inflation and higher growth, on average, than the other NMS since 1996. Contrary to what Ghosh, Gulder, and Wolf (2000) found in their sample, though, the discipline effect is unlikely to have played an important role, as money grew faster in currency boards than elsewhere. The more rapid decline in velocity indicates that currency boards have probably benefited from a stronger increase in money demand.

Table 2. Lithuania: Macroeconomic Performance in NMS, 1996-2004
(Average quarterly growth rate, in percent)

	Currency Boards	Non Curr. Boards	*t* 1/
CPI	1.1	1.4	0.04
HICP	1.1	1.4	0.04
Core HICP	0.6	1.1	0.00
GDP deflator	1.3	1.4	0.36
GDP	1.4	1.0	0.04
Broad money	4.2	3.1	0.00
Br. mon. velocity	-1.4	-0.6	0.04

Sources: IMF IFS; Eurostat.

1/ *P*-value of the one-sided *t*- test of the difference of the mean.

19. **Currency boards experienced lower inflation than the other NMS owing entirely to stronger credibility.** Following Ghosh, Gulder, and Wolf (2000), we estimate an inflation equation including the growth rates of money and output, openness, and a dummy to capture the impact of currency boards. The results are reported below:

$$\pi_t = \underset{(0.17)}{0.61}\pi_{t-1} + \underset{(0.12)}{0.19}\pi_{t-2} + \underset{(0.02)}{0.06}m_t - \underset{(0.03)}{0.05}y_t + \underset{(0.0009)}{0.0007}open_t - \underset{(0.0004)}{0.002}cb_t .$$

No. obs.=306; *J*=0.87; AR(2)=0.03; AR(3)=0.43[14].

Although the coefficients for output and openness are insignificant and the statistics point to weakness in some of the instruments, the impact of currency boards emerges very clearly. Based on this estimate, the inflation advantage of currency boards, as measured by the unconditional coefficient, is 0.13 percent, or about ½ percentage point on an annual basis.[15] While money growth added almost 0.3 percent to annual inflation, the stronger credibility of currency boards helped them achieve lower inflation through a more robust growth of money demand, with an estimated credibility bonus of 0.8 percent per year.

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[14] The estimator used is the Blundell-Bond system GMM, as in previous equations, with the instrument set including four lags of inflation, money, and GDP growth; openness; the oil price; and the currency board dummy.

[15] The coefficient unconditional on money growth is $\beta^{uncond} = \beta^{cond} + \beta^{m}(\Delta m^{CB} - \Delta m^{NCB})$, where β^{cond} is the regression coefficient for currency boards, β^{m} is the regression coefficient for money growth, and Δm^{CB} and Δm^{NCB} are the average growth rates of money for currency boards and other regimes, respectively. Accordingly, the estimated unconditional coefficient is -0.0013 (*p*-value=0.01).

20. **Credibility may also affect inflation expectations, reducing their persistence**. In order to identify differences between currency boards and other monetary policy regimes, we reestimate our baseline equation (paragraph 12) for the latter group only. The results are reported below:

$$\underset{}{\pi_t} = \underset{(0.20)}{0.58\pi_{t+1}} + \underset{(0.13)}{0.26\pi_{t-1}} + \underset{(0.14)}{0.19\pi_{t-2}} + \underset{(0.03)}{0.05mc_t} + \underset{(0.08)}{0.19ip_t}.$$

No. obs.=219; *J*=0.91; *F*=0.78; AR(2)=0.09; AR(3)=0.12.

By comparing these results with those in paragraph 12, we draw the tentative conclusion that inflation expectations may be less persistent in currency boards (the coefficient of the forward-looking term is lower in noncurrency boards than for the whole sample, while the opposite is true for the sum of the backward-looking coefficients). Lower persistency is likely to be a consequence of stronger credibility and well-anchored long-term expectations. This result is consistent with the literature, which shows that a stable and credible monetary policy regime is associated with lower inflation persistence.[16]

D. Conclusions

21. **New member states are small open economies where excess demand and external factors play an essential role**. Standard closed-economy models cannot accurately describe inflation in the NMS, but a new Keynesian Phillips curve, augmented with import prices, provides a good fit of the data. Coefficient estimates are comparable with those for the euro area (Galí, Gertler, and López-Salido, 2001, and Galí, Gertler, and López-Salido, 2003). In particular, they show that, despite the rapid structural change characterizing the NMS, the impact of excess demand measures on inflation is clearly identifiable, as in other more developed countries. The coefficients also show the strong impact of import prices on inflation dynamics and a significant forward-looking component in expectations. No evidence was found of an independent impact of price convergence and of relative price changes, as the Balassa-Samuleson effect would have implied.

22. **The open economy new Keynesian Phillips curve provides a good description of inflation dynamics in Lithuania.** The good fit shows that this equation, estimated for the sample of NMS, represents well the main characteristics of inflation in Lithuania. The empirical model captures the decline in inflation from 1996 to 1999 as well as the recent acceleration. It overpredicts, however, the decline in inflation associated with the Russian crisis.

23. **Strong credibility explains the superior inflation performance of currency boards in the NMS**. Despite stronger money growth, inflation has been significantly lower

[16] Galí and Gertler (1999) show that the coefficient of lagged inflation drops in the post-Volker sample period in the US. Paloviita (2004) finds that the forward-looking term, which was more important in low-inflation countries in the euro area before EMU, has generally increased in recent years.

in currency boards, testifying the importance of a stable and credible monetary regime for anchoring expectations. Our estimates indicate that currency boards lowered inflation by ½ percentage point per year. Unlike Ghosh, Gulder, and Wolf (2000), we do not find that currency boards had a "discipline" effect on money growth. On the contrary, money growth turned out to be faster in the two currency boards than elsewhere, adding 0.3 percent to annual inflation. Faster growth in money demand—the "credibility" effect — more than offset the impact of stronger money growth, lowering annual inflation by 0.8 percent.

24. **Nonetheless, currency boards are vulnerable to short-term inflation risks**. When asymmetric shocks cause the business cycle to deviate from that of the anchor currency, inflation can accelerate if labor markets are not fully flexible and fiscal policy does not intervene to counter the shocks. Strong credibility may help, as expectations adjust more rapidly to the steady state when temporary shocks occur. Indeed, we find that inflation persistence may be lower in currency boards. If shocks are deemed persistent, however, a more rapid adjustment of expectations may imply higher inflation in the short term. Our projections show that oil price developments represent a significant short-term risk for inflation in Lithuania.

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DATA SOURCES AND DEFINITIONS

Inflation (π): quarterly change in the log of the Harmonized Index of Consumer Prices (HIPC) from the Eurostat database. This variable is available for all countries in the sample for the period 1996Q1–2004Q3.

Output gap ($\hat{y}$): in percent, obtained from the Hodrick-Prescott-filtered GDP. GDP at constant prices from the Eurostat database was not available for the whole sample period for Malta (1999Q1–2004Q3) and Poland (1996Q1–2003Q3).

Oil price: quarterly change in the log of petroleum price from the IMF Global Data Source database, expressed in domestic currency. Available for the whole sample.

Marginal cost (*mc*): log difference of marginal cost from its mean, with marginal cost being measured by the ratio of compensation of employees to GDP from the Eurostat database. For Cyprus, Hungary, Poland, and Slovenia quarterly series of compensation of employees were not available. When possible, quarterly series were obtained by interpolating the annual series with unit labor costs (Poland, Hungary: OECD database) deflated by CPI and with the log difference between the Eurostat labor cost index (Slovenia) deflated by CPI and productivity. The annual series was used for Cyprus. The data are not available for the whole sample period for Hungary (1996Q1–2003Q4), Malta (1999Q1–2004Q3), Poland (1996Q1–2002Q4), and Slovenia (1996Q1–2003Q4).

Import prices (*ip*): quarterly change in the log of the component-based import price from the IMF World Economic Outlook database, expressed in domestic currency by using the effective exchange rate from the IMF Information Notice System. Available for the whole sample.

Openness (*open*): log difference between the sum of exports and imports and GDP from the Eurostat database. The data are not available for the whole sample period for Malta (1999Q1–2004Q3), Poland (1996Q1–2002Q2), and Slovenia (1999Q1–2004Q3). The series were smoothed with a centered five-term moving average.

Comparative price levels: quarterly series for this variable were constructed by interpolating the annual index of comparative price levels (EU15=100) provided by Eurostat with the HICP inflation differential vis-à-vis the EU15. The series were smoothed with a backward-looking four-term moving average.

Variance of price changes: we calculated the weighted variance for the 94 four-digit HICP subindices. When this level of disaggregation was not available, we employed the 12 two-digit subindices. This introduced a break in the series for some countries (Czech Republic: 2000Q1; Hungary: 2001Q1; Lithuania: 2001Q1; Slovenia: 2000Q1). The series were smoothed with a centered five-term moving average. Available for the whole sample.

Skewness of price changes: using the same information as for the calculation of the variance, we computed the Theil skewness as

$$sk = \frac{\sum_{i=1}^{n} w_i (\pi_i - \bar{\pi})^3}{(\sum_{i=1}^{n} w_i (\pi_i - \bar{\pi})^{3/2}} \text{ where } \bar{\pi} = \sum_{i=1}^{n} w_i \pi_i .$$

Money (*m*): quarterly change in the log of broad money from the IMF International Financial Statistics database. The data are not available for the whole sample period for Malta (1996Q1–2003Q3) and Poland (1996Q1–2004Q2).

Output (*y*): quarterly change in the log of GDP at constant prices (see output gap).

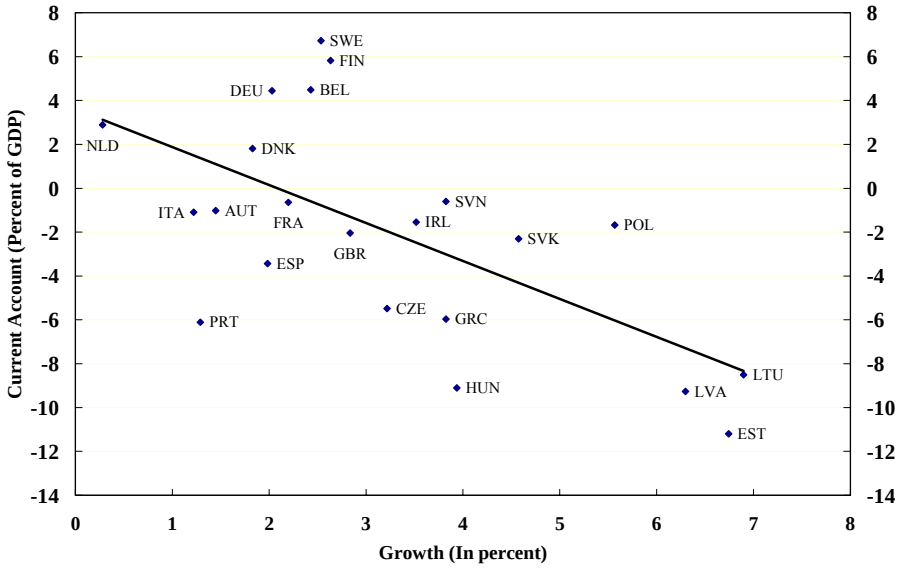
All the data were seasonally adjusted using XARIMA12.

II. CURRENT ACCOUNT SUSTAINABILITY [17]

A. Introduction

1. **Lithuania has experienced strong growth and growing current account deficits in recent years.** In 2004, real GDP grew by some 6.7 percent while the current account deficit reached an estimated 8.6 percent. Meanwhile, external debt has been above 40 percent of GDP since 1999 and reached 43 percent in 2004. As Figure 1 shows, this combination of strong growth and large current account deficits characterizes the experience of the new Member States of the European Union (EU). In contrast, the member states of the pre–2004 EU have had, on average, lower growth rates and current account positions near to balance or in surplus.

Figure 1. Current Account Versus Growth in the EU, 2004



2. **These developments raise the following important question: Is Lithuania's current account deficit sustainable?** For the purposes of this chapter, a current account deficit is defined as unsustainable when the present discounted value of the country's expenditure is greater than the present discounted value of future output, i.e., when the country's intertemporal budget constraint is violated. A related question regards the method of financing the current account deficit. To what extent is the deficit being financed by debt-creating flows and, over the medium term, is the external debt level a reason for concern?

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[17] Prepared by Daniel Leigh. The paper has greatly benefited from comments by Leo Bonato, Zenon Kontolemis, and Ashoka Mody, and contributions by Zuzana Brixiova.

3. **This chapter seeks answers to these questions based on three approaches.** First, an estimated model of regional income convergence based on Blanchard and Giavazzi (2002) is used to test how much of Lithuania's current account can be explained in terms of a long-term catch-up process with the EU. Second, the level of the current account deficit that would be expected on the grounds of sustainable consumption-smoothing behavior is estimated and compared to the actual level. Finally, the chapter uses a debt sustainability analysis to forecast the future path of external debt over the medium term and to investigate to what extent plausible economic shocks to Lithuania's economy could substantially increase external indebtedness.

4. **The analysis reveals that Lithuania's current account deficit is consistent with underlying fundamentals**. As Lithuania converges to EU living standards, its current account deficit is expected to decline. Meanwhile, while the debt-to-GDP ratio is expected to remain stable in the absence of shocks, this stability could be disturbed by shocks of plausible magnitudes. In particular, a further deterioration of the current account deficit could place the external debt-to-GDP ratio on an unstable increasing path.

5. **The rest of the chapter is organized as follows.** Section B describes what the current account deficit has been financing and to what extent it is being financed by debt- and non-debt-creating flows. Section C investigates the sustainability of the current account using (a) the model of regional catch-up, and (b) estimates of the consumption-smoothing current account position. Section D conducts the external debt projections under a number of economic shocks, and Section E concludes the chapter.

B. Recent Developments

6. **Lithuania's strong growth prospects are associated with both a decline in private saving and an increase in investment rates that have stimulated demand for imports of capital and intermediate goods.** Almost one-fifth of imports are capital goods (Table 1) and growth has been closely tied to the growth of imports (Figure 2). Buoyant imports in recent years have been tied closely to domestic expansion, and, as imports in 2004 soared, the trade balance deteriorated by almost 2 percent of GDP. With larger dividends and repatriated earnings on past FDI, the negative income balance also widened by 2 percent of GDP in 2004 (Table 2). Regarding the financing of the deficit, staff estimates that with foreign direct investment at about 3 percent of GDP in the medium term and EU financing around 2–3 percent of GDP, debt-creating flows to close the financing gap would make up 2–3 percent of GDP.

Table 1. Lithuania: Imports of Main Groups of Goods, in 2000 Prices

	2000	2001	2002	2003	2004
	(Share in Total)				
Total	100.0	100.0	100.0	100.0	100.0
Capital Goods	12.5	14.1	18.4	19.8	17.8
Intermediate Goods	61.9	58.7	55.3	55.4	58.7
Consumption Goods	18.7	19.1	17.3	17.6	17.6
Others	6.9	8.0	9.0	7.2	5.1
Of which: transport equipment	4.0	6.1	7.1	5.9	5.1

Figure 2. Lithuania: Output and Import Growth
(In percent)

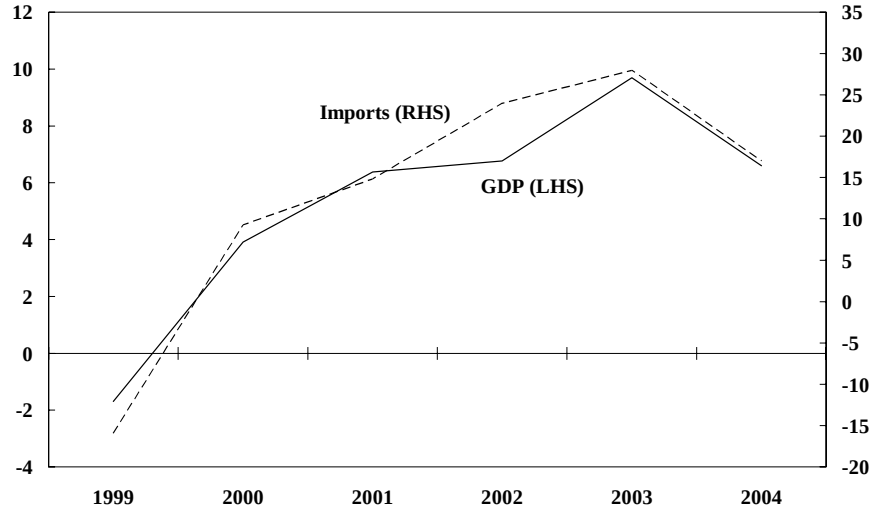
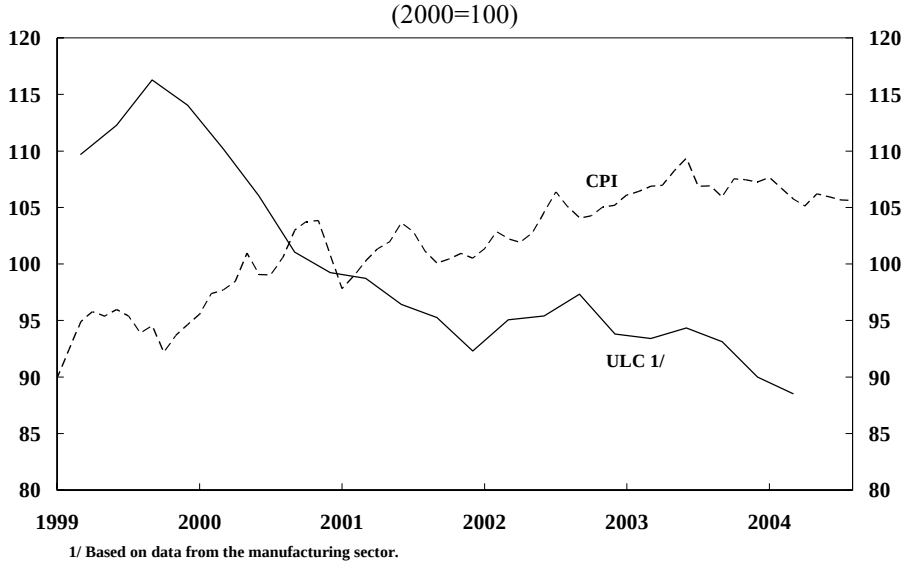


Table 2. Lithuania: Level and Composition of Current Account Deficit

	2002	2003	2004
Trade balance	-5.6	-5.9	-7.8
Trade balance, goods	-9.5	-9.3	-10.5
Trade balance, services	3.9	3.3	2.7
Net factor income	-1.2	-2.6	-4.3
Current transfers	1.7	1.6	3.5
Current account balance	**-5.2**	**-7.0**	**-8.6**

7. **The deficit does not appear to have been caused by a decline in competitiveness.** Although the real effective exchange rate based on the CPI measure has appreciated by about 5 percent since 2000, it has depreciated somewhat in terms of relative unit labor costs (Figure 3). Structural reforms and the technological and managerial restructuring of private companies have maintained high productivity growth. Lithuania has continued to diversify its exports away from dependence on the CIS, and export growth has been accompanied by increasing profit margins over the past five years.

Figure 3. Lithuania: Real Effective Exchange Rate
(2000=100)



1/ Based on data from the manufacturing sector.

C. Sustainability of Lithuania's Current Account

A Model of Regional Income Convergence

8. **In this section, I test how much of Lithuania's current account deficit is based on sustainable intertemporal optimization using a model of regional income convergence.** In this model, relatively poor countries converge ("catch up") toward the income levels of their richer neighbors. With access to international capital markets, lower-income countries can finance their catch-up growth partly via external borrowing. Other things equal, a relatively low income level should be associated with a larger current account deficit and higher growth. In this model, a current account deficit implies, in effect, that Lithuanians are borrowing from the rest of the world to consume and invest today in the expectation that their living standards will converge with their richer neighbors and that the resultant catch-up growth will allow them to repay the obligations incurred.

9. **The basic growth theory of income convergence therefore motivates the empirical specification, which entails regressing the current account deficit on the level of income per capita relative to the group average. The regression equation is:**

$$ca_{it} = \alpha_t + \beta_t\{y_{it} - y_t\} + \gamma X_{it} + \varepsilon_{it} \qquad (1)$$

This empirical specification is largely standard. The ratio of the current account surplus to GDP ratio in year t for country i, ca_{it}, depends on a (i) common time effect, α_t, (ii) on the level of (log) income per capita in year t for country i, y_{it}, relative to the average level of (log) income per capita in year t for the group of countries in the sample, y_t, and (iii) on other control variables included in the vector X_{it}. Two controls are used in addition to the time effects: the dependency ratio, constructed as the ratio of population to the labor force (other

things equal, a country with a higher dependency ratio is expected to save less), and the rate of growth of output from year *t*-1 to *t* (to capture cyclical effects of movements in output on the current account).[18]

10. **The only nonstandard aspect of the specification, based on Blanchard and Giavazzi (2002) is that the effect of the level of income per capita, β_t, is allowed to vary over time.** As emphasized by Blanchard and Giavazzi (2002), financial integration in Europe has increased substantially over the past 15 years, leading, in poorer countries, to even greater investment and a decrease in saving.[19] In addition, greater economic integration makes it easier for these relatively poor countries to borrow, and thus to run larger current account deficits. The main distinctions between the approach here and that of Blanchard and Giavazzi (2002) are that (i) I use all the 2004 EU accession countries in a sample that leads up to 2004, and (ii) the model is used to provide quantitative predictions for the current account. The period of estimation runs from 1975 to 2004. For the formerly centrally planned economies that joined the EU in 2004, the sample begins in 1995 to avoid the structural breaks associated with the shift to a market economy. Income per capita is constructed as PPP GDP per capita in 1985 dollars, using the data from Heston and Summers up to 1992, and extrapolated using real GDP growth rates thereafter.[20]

11. **A simple way to present the regression results is to plot the set of estimated β_t coefficients against time.** Figure 4 shows that the coefficient is nearly always positive and that there has been a steady increase in the coefficient from the late 1980s on. By the mid-1990s, the coefficient is both statistically and economically significant. For example, the estimated coefficient of 0.15 in 2004 implies that, other things equal, for a country that is 60 percent below the EU average (which is roughly the case of Lithuania), the current account-to-GDP ratio should be 9 percentage points lower than the EU average.

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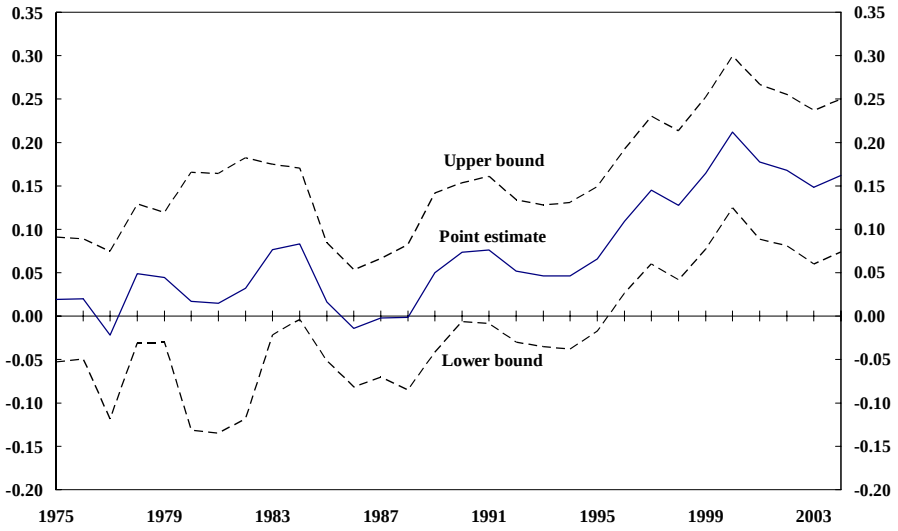
[18] For recent surveys and extensions of the literature of the determinants of current accounts, see, for example, Debelle and Faruqee (1996) or Chinn and Prasad (2000).

[19] Factors associated with the increase in external borrowing include the elimination of capital controls and other explicit barriers to financial flows, and the harmonization of financial market rules; the latter has reduced regulatory uncertainty faced by foreign lenders and improved the transparency of information on potential borrowers.

[20] Data for 2004 are based on the *World Economic Outlook,* IMF (2004), and on staff estimates. Luxembourg is excluded from the sample due to its highly idiosyncratic behavior, with reported current account surpluses that are consistently in the 10-15 percent range.

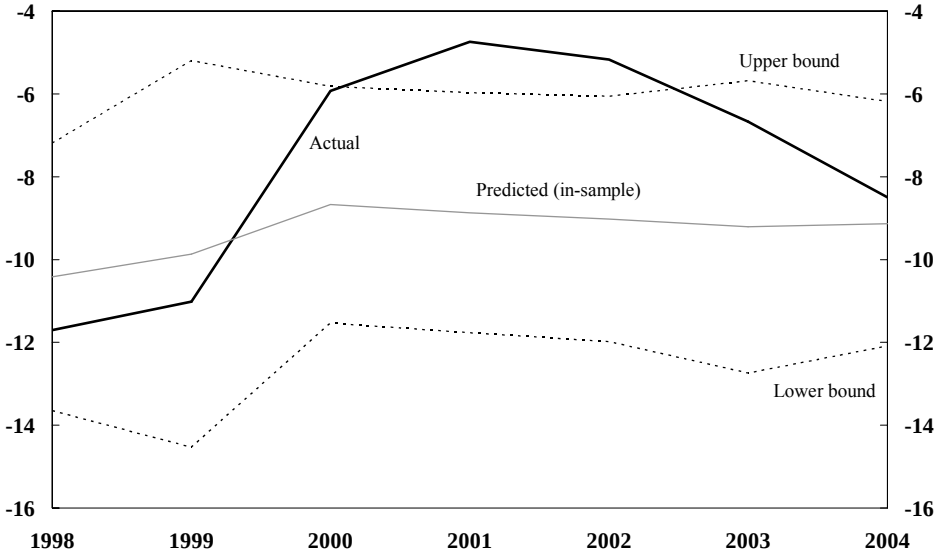
Figure 4. Effect of Relative per Capita Income on the Current Account, 1975-2004 1/



1/ The dashed lines show, respectively, the upper and lower bounds of the 95 percent confidence interval.

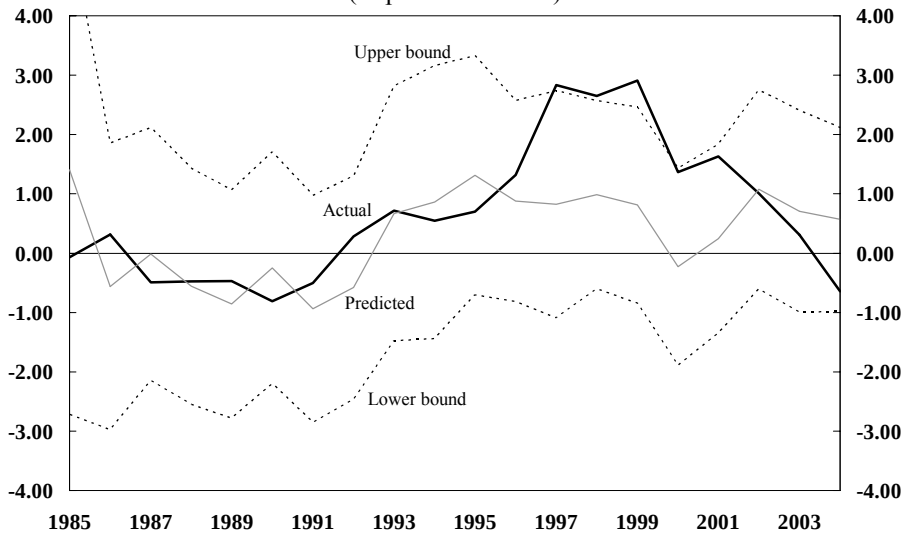
12. **Based on the estimates of the catch-up model, the level for predicted Lithuania's current account deficit in 2004 was 9.1 percent of GDP.** The actual current account deficit of 8.6 percent in 2004 is, therefore, well in the range that would be expected based on the model. Figure 5 shows the predictions of the current account, along with the 95 percent confidence bands and the actual level. Given that the model is based on the premise of intertemporal optimization subject to the intertemporal budget constraint, the results suggest that Lithuania's 2004 deficit is sustainable.

Figure 5. Lithuania: Current Account Prediction Based on Model 1/
(In percent of GDP)



The model estimates also suggest that, as Lithuania catches up to the average income level of the EU, it will operate a more balanced current account position. For example, the model predicted that a wealthier country, such as France, should have achieved a surplus of about 1 percent in 2004. As Figure 6 suggests, France's actual current account has been in surplus since 1995, and is close to the predicted level.

Figure 6. France: Current Account Prediction Based on Model
(In percent of GDP)



Consumption-Smoothing Current Account Estimates

13. **This section investigates how much of Lithuania's current account is based on sustainable intertemporal optimization by estimating the consumption-smoothing current account position.** In this model, agents respond to an increase in permanent income by consuming more than their current income, thus raising the current account deficit. Assuming quadratic utility on the part of the representative agent and a subjective discount factor equal to the inverse of the real interest rate, the current account surplus can be written as:

$$ca_t = z_t - E_t \tilde{z}_t = -\sum_{s=t+1}^{\infty} \left(\frac{1}{1+r}\right)^{s-t} E_t \Delta z_s \qquad (2)$$

Here, the consumption-smoothing current account surplus is denoted by ca_t and equals the difference between current income, z_t, and expected permanent income, $E_t \tilde{z}_t$, i.e., the present discounted value of all current and future expected income. The real interest rate is denoted by r,and E_t denotes the expectations operator.

14. **How does one estimate the consumption-smoothing current account?** The key is to obtain forecasts of future income, i.e., the future expected income terms, $E_t \Delta z_s$ in

equation (2). Current and lagged income growth serve as good predictors of future income growth, but consumers typically have more information than that available for predicting their future income. For example, current and lagged values of the current account may well contain information regarding future income. Indeed, equation (2) suggests that all relevant information available to consumers about future income is contained in the current account. This use of *all* information that is theoretically available to the consumer to predict the current account is what distinguishes this approach from the catch-up model. In the catch-up model described above, only the information available to the econometrician, i.e., the right-hand-side variables in equation (1), such as the current level of per capita income, are used to predict the current account.

15. **Given these considerations, the canonical strategy is to assume that consumers' forecasts of future income can be proxied by predictions made using a bivariate VAR in income growth and the current account**.[21] Income, z_t, is typically measured using "net income," defined as GDP net of investment and government spending. The bivariate VAR is estimated in Δz_t and ca_t (where Δz_t is income growth and ca_t is net income growth in year t). All variables except the interest rate, r, are expressed in levels as a percentage of GDP. The VAR can be written as:

$$\begin{bmatrix} \Delta z_t \\ ca_t \end{bmatrix} = \begin{bmatrix} \psi_{11} & \psi_{12} \\ \psi_{21} & \psi_{22} \end{bmatrix} \begin{bmatrix} \Delta z_{t-1} \\ ca_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \tag{3}$$

where ε_{1t} and ε_{2t} are errors with conditional means of zero.[22] The parameters ψ_{ij} correspond to the VAR coefficients. Once the VAR parameters have been estimated, forecast of future income changes are made using equation (3). For period $t+1$, expected income conditional on period t information is:

$$E_t \Delta z_{t+1} = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} \hat{\psi}_{11} & \hat{\psi}_{12} \\ \hat{\psi}_{21} & \hat{\psi}_{22} \end{bmatrix} \begin{bmatrix} \Delta z_t \\ ca_t \end{bmatrix} \tag{4}$$

where the $\hat{\psi}_{ij}$ terms represent the estimated VAR matrix coefficients. Based on Equation (2), the predicted current account surplus is:

$$\hat{ca}_t = -\sum_{s=t+1}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} E_t \Delta z_s \tag{5}$$

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[21] The methodology is due to Sheffrin and Woo (1990). For further details and applications to other countries, see also Obstfeld and Rogoff (1996).

[22] To avoid further complexity, and because I am using annual data, the first-order specification of the VAR is satisfactory.

which, by substituting Equation (4) into Equation (5), can be rewritten as:

$$\hat{ca}_t = -\begin{bmatrix}1 & 0\end{bmatrix}\left[(1+r)^{-1}\hat{\Psi}\right]\left[I-(1+r)^{-1}\hat{\Psi}\right]^{-1}\begin{bmatrix}\Delta z_t \\ ca_t\end{bmatrix} \tag{6}$$

where I is a (2x2) identity matrix and Ψ is the matrix $[\psi_{ij}]$. Equation (6) is the predicted current account that I compare with the actual data.

16. **Given the short time series available for Lithuania, I estimate the model using a panel VAR and data for Estonia, Latvia and Lithuania annual for 1995–2004.**[23] In constructing the optimal current account balance, I therefore use a modified version of equation (6), namely:

$$\hat{ca}_{it} = -\begin{bmatrix}1 & 0\end{bmatrix}\left[(1+r)^{-1}\hat{\Psi}\right]\left[I-(1+r)^{-1}\hat{\Psi}\right]^{-1}\begin{bmatrix}\Delta z_{it} \\ ca_{it}\end{bmatrix} \tag{7}$$

where the *i* and *t* subscripts reference the variables for country *i* in year *t*. To form the matrices on the right-hand side of equation (7), I assume a value for the real world interest rate of $r = 3$ percent. The results, however, are very robust to a range of plausible values for *r*. For example, using values from 1 percent to 6 percent made very little difference to the predicted paths of the current account. The panel VAR characterizing the Baltic data is displayed in Table 3. By inserting the estimated parameters $\hat{\psi}_{ij}$ into equation (7), one obtains the predicted values for the current account.

Table 3. Lithuania: Panel VAR Estimation Results 1/

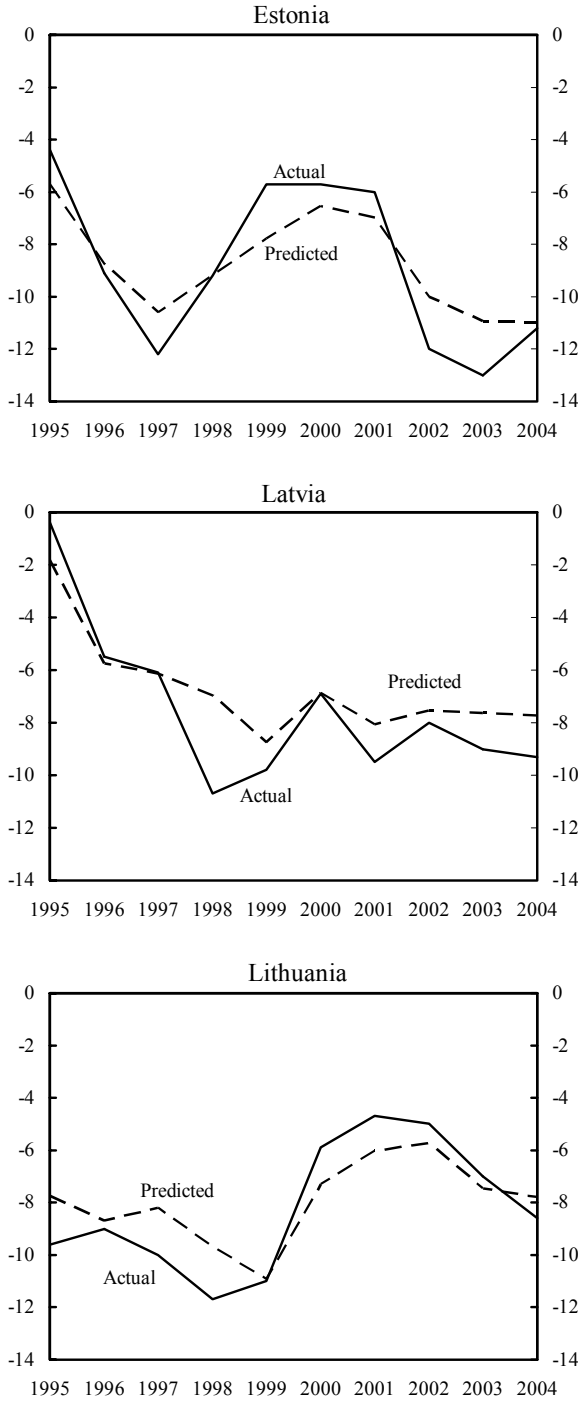
	Δz_{it}	ca_{it}
Δz_{it-1}	0.072	0.216
	(0.172)	(0.138)
ca_{it-1}	-0.312	0.431
	(0.144)	(0.114)
R^2	0.15	0.40

1/ Standard errors in parentheses. Regressions include a constant.

17. **Figure 7 graphs the actual and the predicted current account balances for the three Baltic economies.** What is interesting is that, despite the model's simplicity, the model captures well the changes in the current accounts in the Baltic economies. The results suggest

[23] The panel VAR method used follows the approach of Stavrev (2003), who uses data for the Baltic countries for the time sample ending in 2002. The assumption that matrix Ψ is the same for the three Baltic economies does not seem unduly restrictive given the three countries' similar characteristics.

Figure 7. The Baltic Countries: Actual and Predicted Current Accounts
(In percent of GDP)



that Lithuania's high future income prospects account well for its current account deficits. In 2004, Lithuania's predicted current account deficit based on the consumption-smoothing model was 7.8 percent, close to the actual level. Overall, the finding that Lithuania's current account is well described by the optimization-based model suggests that the current account is sustainalbe.

D. Current Account Financing and the External Debt Level

18. **While Section C assesses whether the level of Lithuania's current account is appropriate, it does not consider the composition of financing.** Indeed, the models that motivate the analysis implicitly assume that the alternative methods of financing are equivalent. For example, debt and FDI financing are assumed to be equivalent in terms of risk and liquidity. However, this assumption is unduly restrictive. If an adverse shock were to lower growth, foreign investors who have provided direct investment share the risk by receiving lower returns on their investment. On the other hand, the obligation to service debt liabilities and repay the principal remains even if there is an adverse shock.

19. **In the case of Lithuania, debt-creating liabilities are expected to account for about one-third of current account financing.** Staff forecasts that foreign direct investment will constitute about 3 percent of GDP in the medium term and EU financing around 2–3 percent of GDP, debt-creating flows to close the financing gap will thus make up some 2–3 percent of GDP, i.e., almost one-third of the predicted 8–9 percent over 2005–09. Lithuania's external debt in 2004 was 43 percent of GDP.

20. **It is important to determine how debt is likely to respond to a number of adverse shocks over the medium term.** Using a standard debt-accounting framework, I simulate the response of the external debt-to-GDP ratio to economic shocks of plausible magnitudes. For each shock, I forecast the path of the debt-to-GDP ratio over the 2005–09 period and compare it to the baseline prediction based on the assumption of no shocks. The dynamics of gross external debt (as a percentage of GDP) are governed by a standard debt accounting identity.[24] All variables are expressed in U.S. dollar terms and the dynamics follow the following process:

$$d_{t+1} - d_t = \frac{1}{1 + g_t + \rho_t + g_t \rho_t}(r_t - g_t - \rho_t(1 + g_t))d_t - tb_{t+1} \qquad (8)$$

[24] See Milesi-Ferretti and Razin (1996) for a derivation of the equation governing the dynamics of the debt-to-GDP ratio.

where d is the debt-to-GDP ratio, r is the effective nominal interest rate on foreign debt, g denotes the rate of real GDP growth, and tb is the noninterest current account balance in percent of GDP. The term ρ_t denotes the change in the domestic GDP deflator in U.S. dollar terms, i.e., $(1+\rho_t) = (1+\pi_t)(1+\varepsilon_t)$, where π_t is domestic GDP deflator inflation and ε_t is the rate of nominal appreciation.

21. **Before discussing the impact of a number of economic shocks, I briefly discuss the baseline scenario.** The baseline projection for the external debt-to-GDP ratio is based on staff predictions for the right-hand-side variables in equation (7). Given these predictions, the external debt level declines modestly over 2005–09 by about 1 percentage point. The main reason for this relative stability is that the upward pressure on the debt level due to the current account deficit is countered by the positive wedge between real growth and the real interest rate ($g_t - r_t$) in equation (7)).

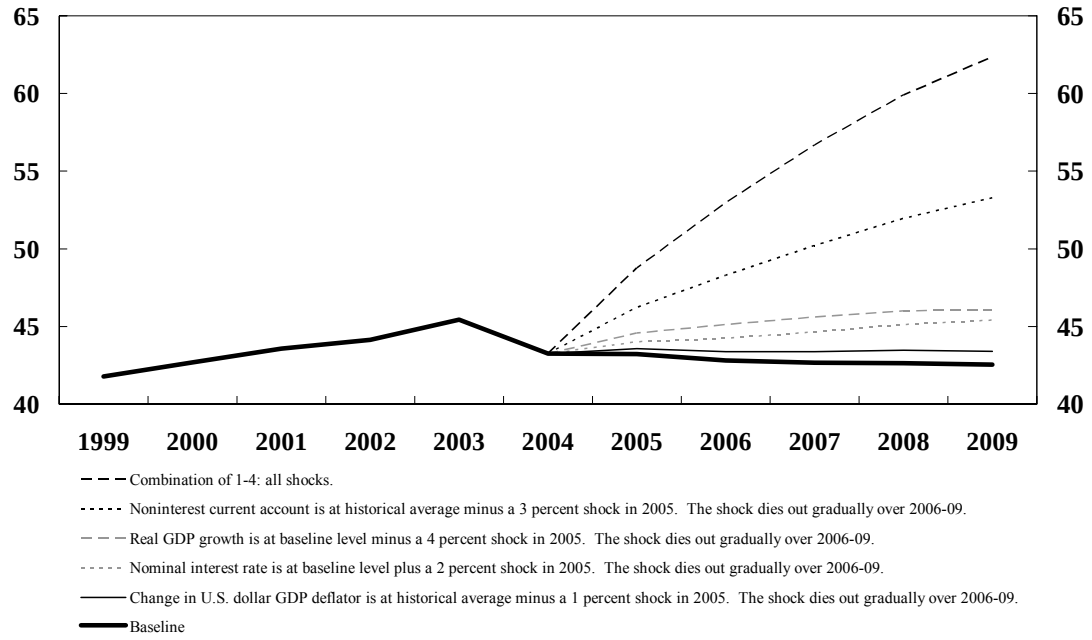
22. **Next, I consider five scenarios in which this stable baseline projection for external debt could be disturbed.** The five scenarios are as follows: (i) a 2 percent rise in foreign interest rates, (ii) a 4 percent decline in real domestic growth, (iii) a shock of -1 percent to the rate of inflation (measured in U.S. dollar terms), (iv) a deterioration in the noninterest rate current account deficit of 3 percent, and (v) the simultaneous occurrence of the four abovementioned shocks. These magnitudes for the shocks are plausible, given Lithuania's experience since the 1999 crisis. In each case, I allow the shock to have a persistent effect. Specifically, I assume that each shock receives an innovation in 2005 and gradually dies out at a rate of 10 percent per annum over subsequent years. Formally, each shock follow the following process:

$$\varepsilon_{it} = \varphi\varepsilon_{it-1} + \upsilon_{it} \qquad (9)$$

where ε_{it} is the shock for variable i in year t, υ_t is the innovation to the shock in year t, and the AR parameter of $\varphi = 0.9$ implies that the shock declines to 60 percent of its initial value in the fifth year. Assuming lower persistence by choosing a smaller AR parameter would imply a more favorable outcome.

23. **Figure 8 shows the results of the simulations.** I find that, individually, the first three scenarios (interest rate, growth, and deflation shocks) do not substantially increase debt above the baseline projection. However, a 3 percent shock to the noninterest current account deficit would set the debt-to-GDP ratio on an upward path to some 53 percent of GDP by 2009, well above the baseline projection for that year. In the worst case scenario, (v) which involves a combination of all four shocks occurring simultaneously, the external debt reaches 62 percent of GDP by 2009, substantially above the baseline. Overall, the findings suggest the need for policies aimed at enhancing non-debt-creating sources of finance such as FDI and reducing the rate of private and public borrowing.

Figure 8. Lithuania: External Debt Responses to Shocks
(In percent of GDP)



E. Conclusions

24. **This chapter has evaluated the sustainability of Lithuania's current account deficit and has reached two main conclusions.** First, a process of sustainable intertemporal optimization appears to largely explain the size of Lithuania's current account deficit. Second, the baseline prediction for the external debt-to-GDP ratio is that it will decline modestly over the 2005–09 period.

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