DO COUNTRIES CATCH COLD WHEN TRADING PARTNERS SNEEZE? EVIDENCE FROM SPILLOVERS IN THE BALTICS

Kingsley I. OBIORA, PhD*
International Monetary Fund, Washington, DC
kobiora@imf.org

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Abstract

How do countries respond to shocks from their major trading partners? This paper addresses the question in the context of the observed shifts in trade linkages between the Baltic countries and their major trading partners. Vector autoregression (VAR) models were used to examine the magnitude and sources of growth spillovers to the Baltics from key trading partners, as well as shocks from the real effective exchange rate (REER). Our results show there are significant cross-country spillovers to the Baltics, with spillovers from the EU outweighing those from Russia. Shocks to the REER generally depress growth in the Baltics, and this effect rises over time. We also find that financial and trade linkages are the dominant transmission channels of spillovers to the region, which explains the current realization of downside risks to the Baltics from the global slowdown. In general, therefore, these results suggest that the Baltics are susceptible to shocks from their key trading partners.

Keywords: spillovers, Baltics, vector autoregression, financial and trade linkages

1 Introduction

Given the historical and economic ties among the countries, Russia's 1998 economic crisis had significant consequences for the Baltic States.[1] The crisis, triggered by sharp

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[1] The current global crisis has had significant effects on the Baltic countries, as on many other areas of the world. However, work on this paper began well before the crisis fully materialized. The analyses only cover until end-2007, unless explicitly stated.

declines in oil and commodity prices and non-payment of taxes by major energy and manufacturing companies, affected the Baltic countries (Estonia, Latvia and Lithuania) through financial and trade linkages. Specifically, Baltic banks that had invested heavily in Russia's short-term treasury bills suffered significant losses following the country's debt default. Interest rates also rose sharply in Baltic interbank markets. In addition, there were significant declines in Baltic exports to Russia because of the sharp depreciation of the Russian ruble. As a result, all three Baltic countries recorded precipitous declines in GDP growth rates.

Since then, changes in trade linkages suggest some decoupling from the Russian economy towards the EU countries. The Baltic countries' trade with Russia has declined in the years since the crisis. Over the period 2000-07, exports of the Baltic countries to Russia have fallen, as a share of total exports, by nearly 8 percent while exports to the EU countries have grown by an average of about 10 percent. Similarly, Baltic imports from Russia have fallen by an average of 4¼ percent while imports from the EU have risen by over 6 percent since the crisis. Foreign direct investment (FDI) in the Baltics is also increasingly tilted toward Europe with a significant share originating from Sweden, Finland, and Denmark. These shifts in economic linkages raise important questions concerning how the Baltic countries will respond to shocks from its major trading partners.

Against the backdrop of these shifting trade patterns, this paper analyses economic spillovers to the Baltic countries. We examine the relative effects of both external shocks in key trading partners and internal shocks captured by the real effective exchange rate on the Baltic economies. We will be building on two main papers, namely, Kanda (2007) and Swiston and Bayoumi (2008). While the former dealt with spillovers in Ireland, the latter looked at spillovers across NAFTA. One of the key contributions of this paper, therefore, is to measure the magnitude and sources of spillovers for the Baltic countries, given that the author does not know of any such endeavors in current literature. Although the magnitude of the effect is still contentious, the literature on spillovers and international business cycles typically finds that countries with greater trade and financial linkages have more synchronized business cycles (see Imbs, 2004; Inklaar, Jong-a-pin and De Hann, 2005; Herrero and Ruiz, 2007; Koopman and Azevedo, 2007).

Some other studies have pointed to different types of spillovers from a given country to its trading partners. Coe et al. (2008) showed the impact of domestic and foreign investments in research and development (R&D) on total factor productivity and growth in trading partners. While trade linkages have been found to be important in influencing a country's growth, spillover effects may also be transmitted through financial linkages with growing foreign direct and portfolio investments. Finally, there may be indirect effects, with business and consumer confidence in major trading partner countries influencing confidence in another country (Arora and Vamvakidis, 2006).

The rest of this paper is structured as follows. Section 2 discusses the 1998 Russian economic crisis and its effects on the Baltics. In section 3, we present some stylized facts on trade and financial linkages of the Baltics with their major trading partners. Section 4 uses vector autoregression (VAR) models to assess the dynamics and severity of shocks in trading partners and their effects on competitiveness in the Baltic economies. Following

Bayoumi and Swiston (2007), we estimate the contribution of spillovers from trade, finance and commodity prices in section 5. Section 6 contains an evaluation of how our model's predictions fit actual responses of the Baltics to the global crisis while section 7 concludes the paper with some policy implications.

2 The 1998 Russian crisis

The consequences of cross-border spillovers on the Baltics were particularly visible during the Russian crisis. All three Baltic countries suffered precipitous declines in GDP growth during the crisis. Only Latvia did not fall into a recession during the period as both Estonia and Lithuania recorded negative growth rates from 1999:Q1 to 1999:Q3. The fall in growth seems to have been associated with reductions in the growth rates of investment and external demand. Investment fell more in Estonia and Latvia than in Lithuania. Lithuania's growth was mostly affected by the fall in total exports given its relatively high export exposure[2] to Russia. Remarkably, in all three Baltic countries, households appeared to smooth consumption, as consumption growth remained stable throughout the period.

The recovery of Russia's output began in early 1999 and provided an impetus for economic activity in the Baltics. This was initially driven by import substitution due to substantial real depreciation of the ruble, and had a further adverse effect on the Baltics. However, the recovery later became more broadly based as domestic demand, including investment and private consumption, began to grow buoyantly. The Baltic countries responded to this rebound after two to three quarters with GDP growth rates turning positive by 2000:Q1 in all the countries.

3 Trade and financial linkages

Direction of trade data indicates that Russia and the European Union are the main trading partners of the Baltic countries. In consequence, they are key determinants of economic activity in the region. However, spillovers from these trading partners would not only affect one Baltic country directly but may also have significant indirect effects on the other Baltic countries given high intra-regional trade. Although Russia remains an important trading partner, there has been considerable reorienting of Baltic exports toward the EU (Table 1).[3]

A comparison of export shares of the Baltic countries before and after the Russian crisis shows a significant decline in the share of exports to Russia and a simultaneous increase in exports to the EU. Within the EU, Baltic trade is mostly concentrated in a small number of countries, with Finland, Germany, Poland, Sweden, and the UK being the main trade partners. There has also been greater foreign direct investment from European countries, especially since EU accession.

[2] Export exposure is calculated as the share of total exports to a given country as a percentage of GDP.

[3] In Table 1, advanced EU consists of Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Spain, Sweden and the UK, while emerging EU comprises Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, and Portugal.

Table 1: The Baltic countries: direction of exports to major trading partners (in % of total)

	1994-99	2000-07
	Estonia	
Advanced EU	51.2	58.5
Emerging EU	13.8	14.4
Russia	15.4	8.2
	Latvia	
Advanced EU	39.4	51.0
Emerging EU	21.1	24.0
Russia	18.1	9.0
	Lithuania	
Advanced EU	37.2	41.2
Emerging EU	19.5	24.2
Russia	19.8	11.8

Source: IMF DTTS and author's calculations.

The dominance of foreign-owned banks in the Baltics has also reinforced linkages with the EU. Measured by share of banking sector assets a significant part of bank ownership is vested in foreign banks. On average, over 80 percent of banking sector assets in the Baltics belong to foreign-owned banks. Given these linkages, the Baltic countries may have well synchronized business cycles with their major trading partners. Kose et al. (2003) argues that the similarity in these cycles could reflect the influence of common world business cycles or common global shocks.

4 Econometric analysis

A combination of vector autoregression models was used to evaluate current growth spillovers in the Baltic countries. In particular, a four-variable vector autoregression model was estimated for each of the Baltic countries. Given the perceived effect of oil price growth in the Baltics vis-à-vis their economic linkages to Russia, these VAR models were extended to include the percentage change in oil prices. The analyses also decomposed the contributions of three potential channels of spillovers. All variables were seasonally adjusted and shown to be stationary using the Ng-Perron tests (Table A1).[4] Data for the analyses spanned 2000:Q1 to 2007:Q4.

[4] This testing procedure was adopted because of its superiority in size and power over the more commonly-used Dickey-Fuller and Phillips-Perron tests. Especially in small samples, the Dickey-Fuller and Phillips-Perron tests tend to over-reject the null hypothesis when it is true and under-reject when it is false (see Dejong et al., 1992; and Harris and Sollis, 2003 for details).

4.1 Vector autoregression models

Three vector autoregression models were estimated in order to evaluate the impact of spillovers to the Baltic countries. The VAR models were estimated with four lags for each variable.[5] Following Cholesky decomposition, the variables in the VAR were ordered as follows: EU real GDP growth[6], Russian real GDP growth, the Baltic country real GDP growth, and the unit labor cost (ULC) based real effective exchange rate (REER). In this regard, the ULC-based REER was preferred to the CPI-based REER because it is superior in reflecting a country's ability to sell its products in international markets and capturing domestic cost considerations associated with tradable goods. The inclusion of own GDP shocks in the analysis is meant to capture autonomous demand shocks. For sensitivity analysis, the ordering of the EU real GDP and Russian real GDP were reversed and the results were not significantly sensitive to this change.

Variance decomposition results reveal that partner country shocks explain a substantial amount of variations in Estonian and Lithuanian GDP growth but much less so in Latvia (Table A2) with the share of variation explained by Russian GDP being largest in Lithuania. This may be related to Lithuania's high export exposure to Russia, and the strategic influence of Russia on Lithuania's oil refinery. The share of variation attributable to Russia rises over time in all the Baltic countries.

Shocks to competitiveness captured by the REER explain a substantial share of output variation in Estonia and Latvia, particularly at longer horizons. However, over the same period, only about 7 percent of variation in Lithuanian GDP growth is attributable to REER. Given that much of Lithuania's foreign trade is oil-related, and oil is a tradable good, changes in Lithuania's REER are not likely to cause significant changes in net exports and therefore, unlikely to account for a significant share of variation to the country's GDP growth. In all three cases, however, the share of variation in GDP growth attributable to changes in REER takes some time to build up. This implies that shocks to the REER may have much stronger effects on growth in the Baltic countries over longer time horizons.

The impulse response functions suggest that shocks from the EU exert significant effects on the growth rate of Baltic countries particularly in the first year (Figure A1). Impulse responses were normalized to one percent shocks to simplify comparison across countries. In all cases, there is a fairly significant contemporaneous increase in GDP growth rate for the Baltic country. In contrast to EU shocks, the effects of shocks from Russian GDP are not large. In all the Baltic countries except Lithuania, shocks from Russian GDP leave their GDP growth rate unaffected on impact. Lithuania's GDP response to a one percent shock from Russia occurs contemporaneously with growth of about ½ percent.

[5] Test results for Latvia and Lithuania indicated an optimal lag of two. However, we used four lags for each equation to allow for comparability. In addition to being the logical choice for quarterly data, this is also consistent with the specifications in Stock and Watson (2005), Perez et al. (2007), and Swiston and Bayoumi (2008).

[6] The euro area real GDP we adopted consists of the combined real GDP of the fifteen member states of the EU prior to the accession of ten candidate countries in 2004. These are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

An appreciation of the REER generally depresses growth in all three Baltic countries. In the context of increases in the REER, signifying appreciation of the exchange rate, and therefore, a loss of international competitiveness, shocks to the REER have adverse effects on the Baltics, with the effects in Estonia and Latvia lasting much longer than in Lithuania. An increase in the REER contemporaneously depresses GDP growth in Estonia by about ¾ percent in the first quarter, deteriorates further to 1¼ percent and continues up to the fifth quarter. In Latvia, an innovation to the REER contemporaneously reduces growth by about ½ percent in the first quarter, and this effect lasts up to the fourth quarter. These results coincide with those from variance decomposition and strongly suggest that the effect of an appreciation of the REER could persist for over one year in these countries.

4.2 Extended vector autoregression models

The better to assess effects from Russia, we introduced oil price growth to the VAR. Changes in the price of oil may have opposite effects on the Baltics: increases in oil prices may have positive effects on these countries through stimulated growth in Russia but may also impose negative supply shocks on them. The inclusion of oil price growth in the VAR, therefore, attempts to isolate the effects of Russia from those of oil prices. Results from the variance decomposition and impulse response functions are presented in Table A3 and Figure A2.

In terms of relative importance of shocks, growth in oil prices explains a significant share of variation in GDP growth for the Baltic countries. The inclusion of oil price growth in the base VAR also led to significantly higher share of variation in Baltic GDP growth attributable to Russia. In the base VAR, Russia accounted for an average of 9.1 percent, 3¾ percent, and 17½ percent of fluctuations in GDP growth for Estonia, Latvia and Lithuania, respectively. With the inclusion of oil price growth, Russia's share of variation rises to 47 percent, 20 percent, and 18½ percent for the three countries in the same order.

In contrast with the variance decomposition results of the base VAR model, the following emerge from the extended VAR model. First, the average share of variation to Baltic GDP attributable to EU GDP falls. Second, shocks from Russian GDP account for a significantly higher proportion of variation to GDP in the Baltic countries. Third, the share of variation attributable to REER falls in Estonia and Latvia but rises in the case of Lithuania. Finally, variation associated with changes from domestic GDP generally falls. One possible explanation for this result is that the share of variation associated with shocks from GDP in the base VAR models may also have been capturing supply side effects, most of which have now been accounted for by the inclusion of oil price growth in the extended VAR models.

Introducing oil price growth has the following effects on the impulse response functions.[7] First, oil price shocks have negative effects in all three Baltic countries. Although the contemporaneous impact on Lithuania is the highest among the three countries, it makes

[7] For robustness, both VAR models were also estimated using data from 1996:Q1 to 2007:Q4. The results are not significantly different and strengthens the stance that the adopted sample (2000:Q1 to 2007:Q4) is best suited to shed light on current spillovers in the Baltics.

the fastest recovery following the shock as its GDP growth rate rises by about half a percentage point in the second quarter and further by almost one percent in the fifth quarter. Second, the standard errors of the impulse response functions generally become smaller, which suggests an improvement in the precision of the estimates. Third, the responses from EU GDP growth remain largely unchanged while shocks from the REER depress growth in all three Baltic countries. Finally, the effects of shocks from Russia become significant. In particular, shocks from Russia have a negative effect on Estonia and Latvia but a positive effect on Lithuania.

Russia's negative effect on Estonia and Latvia could be mainly related to the supply-side distortions that oil prices may introduce into the economies of oil-importing countries like Estonia and Latvia. In particular, an increase in the international price of oil is likely to lead to a faster pace of economic activity in Russia while conversely having an adverse effect on the oil-importing Baltic countries.

5 Measuring the channels of spillovers

The relative importance of potential channels of spillovers to the Baltics is examined in this section, following the procedure of Bayoumi and Swiston (2007). This consists of augmenting our original VAR model by introducing variables that proxy for these potential channels of spillovers as exogenous variables in a separate VAR. The difference between the response of GDP in the base and augmented VAR is interpreted as the size of the spillover attributable to that particular channel. For example, the difference between the response of a Baltic country to Russian growth in the base VAR and the augmented VAR with financial conditions equals the impact of financial spillovers between the two countries. This difference is interpreted as the share of spillovers from Russia that is transmitted through financial linkages. Thus, the contribution of a given channel to spillovers can be given as:

$$K_{i,j} = IR_i - IR_{i,j} \tag{1}$$

where $K_{i,j}$ is the contribution of a particular channel to spillovers, IR_i is the impulse responses from the base VAR while $IR_{i,j}$ is the responses from augmented VAR in which a given channel, j, is introduced as an exogenous variable, rather than as an additional equation in the VAR. Since the estimation of channels of spillovers are carried out using this separate methodology, the sum of the contributions is not constrained to reflect the estimates of total spillovers from the base VAR. Rather, our goal is to measure the relative importance and contribution of each potential source of spillovers.

The analysis considered three potential sources of spillovers, namely, trade, financial conditions, and commodity prices. Spillovers from trade were captured by the contribution of net exports to real GDP growth as it reflects the contemporaneous interaction of a given country with foreign demand, and is likely to be exogenous to domestic conditions. For financial channels, we used equity prices in EU countries. The non-energy component of the Goldman Sachs Commodity Index and the average petroleum spot price (APSP) of oil were used to capture commodity prices. These commodity prices were converted into real terms using the US GDP deflator because they are expressed in US dollars. To

allow for transmission lags, both their contemporaneous and lagged values were introduced into the VAR in quarterly percent changes.

In terms of spillovers from major trading partners, financial conditions and trade linkages are the most important channels of spillovers to Latvia and Lithuania (Table 2). Jointly, these channels account for the transmission of over 75 percent of spillovers to Latvia and Lithuania, with commodity prices contributing an average of 19 percent in Latvia and 25 percent in Lithuania. This result is quite plausible since the Baltic countries have contiguous borders with most of their major trading partners. In the case of financial channels, the result also conforms to a priori expectations, given that over 80 percent of banking sector assets in the Baltics belongs to foreign-owned banks. Klyuev (2008) argues that financial conditions matter more than trade with regard to spillovers from the U.S. to Canada while Osterholm and Zettelmeyer (2007) finds that financial conditions are more important than commodity prices in transmitting spillovers from the U.S. to Mexico.

Table 2: Contribution to overall spillovers in the Baltic countries (in %)

	Finance	**Trade**	**Comm-prices**
	Estonia		
EU-15	23.4	25.6	51.0
Russia	23.0	29.8	47.2
	Latvia		
EU-15	36.8	41.7	21.4
Russia	26.4	58.1	15.5
	Lithuania		
EU-15	31.9	39.7	28.4
Russia	37.5	41.3	21.2

Source: Author's calculations.

In Estonia, commodity prices account for the largest share of transmission of spillovers from major trading partners. On average, they account for nearly half of spillovers from the EU and Russia, with financial conditions and trade linkages contributing the remainder. The effect of commodity prices also seems to depend on the structure of trade in each country. As Bayoumi and Swiston (2007) argue, global commodity price shocks are likely to be dominated by oil prices. Therefore, their impact on GDP growth may be negative for net importers of commodities like Estonia.

However, financial linkages are clearly the most dominant transmission channel of spillovers from the Scandinavian region[8] (Table 3).[9] On average, financial conditions account for the transmission of about 45 percent of spillovers from the Scandinavian region to

[8] The Scandinavian region comprises Denmark, Norway, and Sweden.

[9] The impulse response functions of the Baltics from a one percent shock from the region were similar to those from the EU. The results are presented in Figure A4.

the Baltics. This result coincides with the percentage of the country's banking system that is foreign-owned. In Estonia, nearly 100 percent of banks are foreign-owned; indeed, 75 percent of banking sector assets belongs to only two Swedish banks. By contrast, 56 percent and 92 percent of banks are foreign-owned in Latvia and Lithuania, respectively.

Table 3: Contribution to overall spillovers in the Baltics from the Scandinavian region (in %)

	Finance	Trade	Comm-prices
Estonia	51.9	20.7	27.4
Latvia	40.1	31.6	28.3
Lithuania	42.6	29.4	28.0

Source: Author's calculations.

6 Model predictions and the global crisis

Since the outset of the global crisis, whose signs became clearly visible in early 2008, real GDP growth has plummeted in the Baltic countries. Over the period 2008-2009, average real GDP declined by 8¾ percent, 10½ percent, and 6¼ percent in Estonia, Latvia, and Lithuania, respectively. Over the same period, real GDP declined by 1½ percent, 2¼ percent, and 1¾ percent in the EU, Russia and the Scandinavian region, respectively. However, ex ante forecasts from our VAR estimates suggest that over the period 2008-2009, real GDP would decline by 8 percent, 12¼ percent and 8½ percent in Estonia, Latvia, and Lithuania, respectively. The difference between our model's predictions and actual developments over the past two years may be due to the relatively large standard errors of the VAR estimates, possibly reflecting the short sample size of the time series adopted for the study.

7 Conclusions and lessons for policy

This paper sought to examine growth spillovers to the Baltic countries in the context of shifting trade patterns. Supplementing a discussion of trade and financial linkages between the Baltic countries and their major trading partners, vector autoregression models were used to estimate the magnitude of spillovers from these partners and from shocks to the real effective exchange rate. We have also evaluated the relative importance of potential channels of spillovers by decomposing our estimated spillovers into commodity prices, financial conditions and trade linkages.

The following conclusions emanate from our results. There are significant cross-country spillovers to the Baltic countries from their major trading partners, namely, the EU countries and Russia. However, both versions of our VAR models suggest that spillovers from the EU to the Baltics may be greater than those from Russia, especially in the context of the changes in trade shares between the two major trade partners. Shocks from trading partners explain a significant share of variation in Estonian and Lithuanian GDP

growth but less so for Latvia. While financial conditions and trade linkages are the most important transmission channels of spillovers in Latvia and Lithuania, commodity price channels transmit the largest share of spillovers to Estonia. The paper also shows that the effects of shocks from the Scandinavian region resemble those of the EU but financial linkages are the dominant channels of transmission of shocks from the region. Adverse shocks to the REER generally depress growth in the Baltics, with its most significant effect on Estonia.

Several policy implications arise from these results. Against the backdrop of our finding that financial linkages and trade are important channels of spillovers to the Baltics, there are significant downside risks for growth in the Baltic countries following the global slowdown. In light of the significant effects of REER shocks on the Baltics, policy attention would be necessary to forestall a loss of competitiveness through rising wages or high inflation. And given that our results suggest that REER shocks rise over time, changes in Baltic competitiveness may continue to impinge on growth more lastingly than anticipated.

*Table A1: Results of Unit Root Tests using the Ng-Perron Procedure**

	Test statistics 1/	Critical values		
		1 percent level	5 percent level	10 percent level
Estonia Real GDP				
MZa	-20.07***	-13.80	-8.10	-5.70
MZt	-3.17***	-2.58	-1.98	-1.62
MSB	0.16***	0.17	0.23	0.28
MPT	1.23***	1.78	3.17	4.45
Latvia Real GDP				
MZa	-70.67***	-13.80	-8.10	-5.70
MZt	-5.91***	-2.58	-1.98	-1.62
MSB	0.08***	0.17	0.23	0.28
MPT	1.46***	1.78	3.17	4.45
Lithuania Real GDP				
MZa	-13.26***	-13.80	-8.10	-5.70
MZt	-2.56***	-2.58	-1.98	-1.62
MSB	0.19***	0.17	0.23	0.28
MPT	1.91***	1.78	3.17	4.45
EU-15 Real GDP				
MZa	-11.12***	-13.80	-8.10	-5.70
MZt	-2.35***	-2.58	-1.98	-1.62
MSB	0.21***	0.17	0.23	0.28
MPT	2.22***	1.78	3.17	4.45
Russia Real GDP				
MZa	-44.81***	-13.80	-8.10	-5.70
MZt	-4.73***	-2.58	-1.98	-1.62
MSB	0.11***	0.17	0.23	0.28
MPT	2.04***	1.78	3.17	4.45
Estonia REER				
MZa	-15.71***	-13.80	-8.10	-5.70
MZt	-2.72***	-2.58	-1.98	-1.62
MSB	0.17***	0.17	0.23	0.28
MPT	6.27***	1.78	3.17	4.45
Latvia REER				
MZa	-26.23***	-13.80	-8.10	-5.70
MZt	-3.55***	-2.58	-1.98	-1.62
MSB	0.14***	0.17	0.23	0.28
MPT	3.92*	1.78	3.17	4.45
Lithuania REER				
MZa	-31.62***	-13.80	-8.10	-5.70
MZt	-3.97***	-2.58	-1.98	-1.62
MSB	0.13***	0.17	0.23	0.28
MPT	2.90**	1.78	3.17	4.45

1/, **, and *** represent rejection of the unit root hypothesis at the 10 percent, 5 percent, and 1 percent levels, respectively.*

Note: MZa, MZt, MSB, and MPT are modified versions of the Philips-Perron (1988) Z-tests, which suffer from severe size distortions when the error term has a negative moving-average root. These "modified Z-tests" corrects for the shortcoming of the Z-tests.

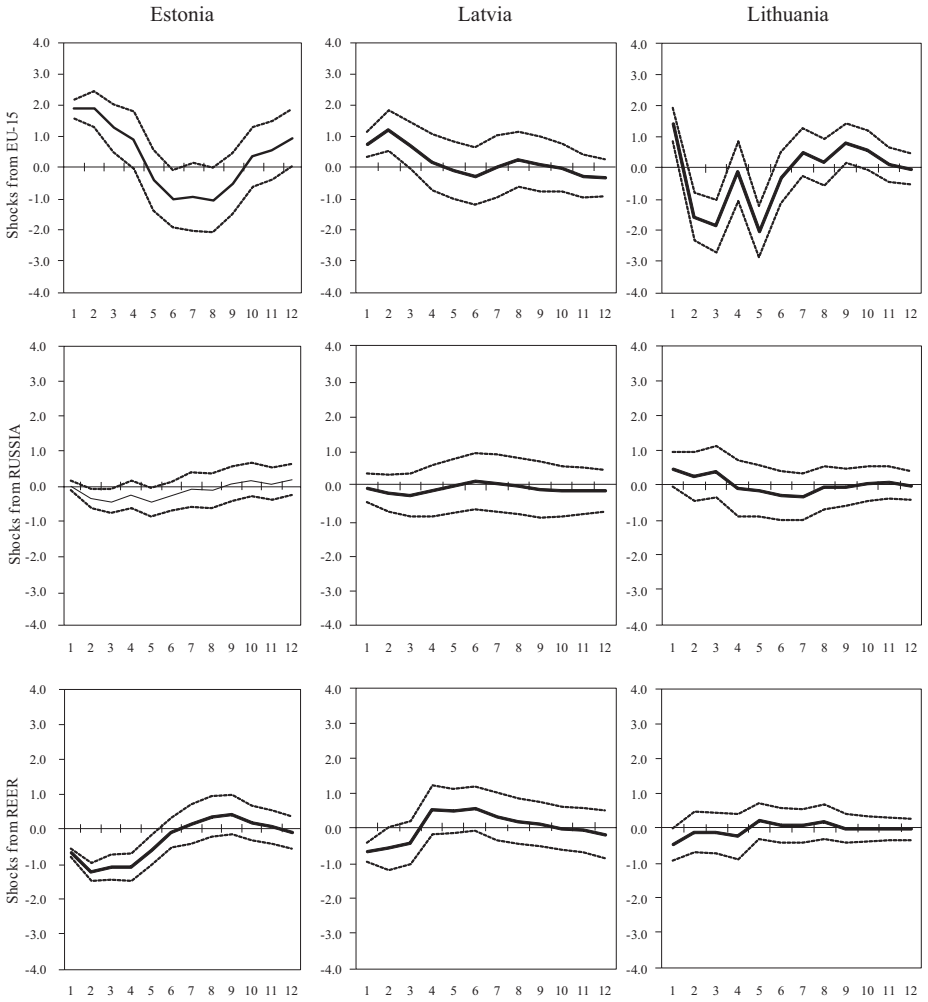
Source: Author's calculations.

Table A2: Variance decomposition for Baltic countries' real GDP (in %, base VAR models)

Horizon (Quarters)	EU-15 GDP	Russia GDP	Estonia GDP	REER (ULC-based)
1	40.1	0.0	41.9	18.0
2	34.0	4.7	29.7	31.7
3	28.7	8.3	28.4	34.6
4	24.4	7.5	30.7	37.4
5	23.1	10.7	28.6	37.6
6	24.5	11.8	27.6	36.1
7	25.8	11.6	27.5	35.1
8	26.0	11.0	30.0	33.1
9	25.8	10.7	30.3	33.2
10	25.7	11.1	30.1	33.1
11	26.1	11.1	29.9	32.9
12	26.9	11.2	30.1	31.8
Horizon (Quarters)	**EU-15 GDP**	**Russia GDP**	**Latvia GDP**	**REER (ULC-based)**
1	4.8	0.2	90.0	5.0
2	12.4	2.7	81.4	3.6
3	11.2	4.8	70.7	13.3
4	9.1	4.5	59.6	26.8
5	7.9	3.9	52.0	36.1
6	6.9	3.8	45.6	43.6
7	6.5	3.7	44.8	45.0
8	6.3	3.5	45.6	44.5
9	6.2	3.7	46.5	43.7
10	6.1	4.1	46.4	43.3
11	6.3	4.5	46.1	43.1
12	6.4	4.8	45.7	43.1
Horizon (Quarters)	**EU-15 GDP**	**Russia GDP**	**Lithuania GDP**	**REER (ULC-based)**
1	9.9	12.7	75.5	1.9
2	18.8	14.6	64.6	2.0
3	26.3	18.1	53.5	2.0
4	25.1	17.4	53.8	3.7
5	32.4	15.4	47.4	4.8
6	31.7	17.2	46.2	5.0
7	31.2	19.3	44.5	5.1
8	30.9	19.1	43.9	6.1
9	31.9	18.7	43.4	6.0
10	32.3	18.6	43.2	5.9
11	32.1	18.7	43.3	5.9
12	32.1	18.8	43.2	5.9

Source: Author's calculations.

Figure A1: Baltic countries: GDP growth responses to one percent shocks from major trading partners and real effective exchange rate 1/



1/ A shock to the real effective exchange rate corresponds to an appreciation.

Note: The vertical axis is measured in percent while the horizontal axis represents quarters of a 3-year time horizon.

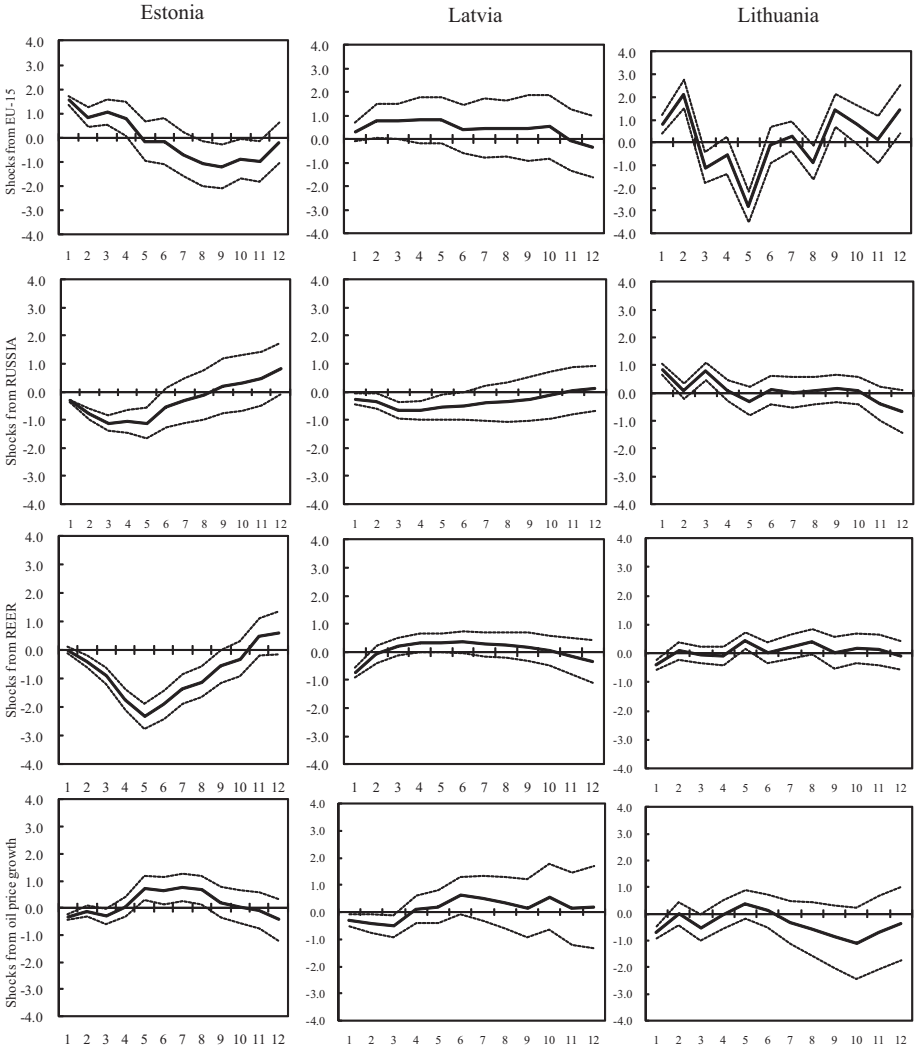
Source: Author's calculations.

Table A3: Variance decomposition for Baltic countries' real GDP (in %, extended VAR models)

Horizon (Quarters)	Oil price growth	EU-15 GDP	Russia GDP	Estonia GDP	REER (ULC-based)
1	25.4	41.3	17.2	13.8	2.3
2	13.2	24.4	53.9	6.9	1.7
3	10.2	15.0	66.3	3.6	4.8
4	6.6	11.0	66.6	3.1	12.7
5	13.9	6.8	56.9	3.5	19.0
6	17.3	5.6	50.0	4.5	22.6
7	22.8	5.4	44.8	4.3	22.6
8	26.2	6.0	41.0	4.3	22.5
9	26.0	7.1	40.3	4.2	22.3
10	25.6	7.7	40.5	4.2	22.0
11	24.8	8.3	41.0	4.3	21.7
12	24.5	7.6	42.1	4.1	21.7
Horizon (Quarters)	**Oil price growth**	**EU-15 GDP**	**Russia GDP**	**Latvia GDP**	**REER (ULC-based)**
1	20.5	0.8	2.9	66.1	9.5
2	17.3	4.8	6.5	63.5	8.0
3	13.9	6.5	17.3	51.7	10.6
4	11.6	7.8	24.1	42.5	14.0
5	11.1	9.0	26.4	36.7	16.8
6	17.0	7.7	25.1	31.2	19.0
7	19.3	7.1	23.6	29.8	20.2
8	19.3	6.8	22.7	29.7	21.5
9	18.9	7.0	22.6	29.5	22.1
10	19.9	7.4	22.3	28.8	21.6
11	21.9	7.1	21.5	28.0	21.5
12	23.7	6.7	19.9	26.7	22.9
Horizon (Quarters)	**Oil price growth**	**EU-15 GDP**	**Russia GDP**	**Lithuania GDP**	**REER (ULC-based)**
1	24.3	0.5	22.1	44.2	8.9
2	20.2	16.6	18.5	36.9	7.8
3	23.7	15.6	25.4	29.4	5.9
4	22.9	15.8	24.7	30.6	5.9
5	20.3	27.4	19.9	23.5	8.9
6	20.5	27.2	19.9	23.5	8.9
7	22.0	26.3	19.1	22.8	9.8
8	25.9	24.5	17.0	20.6	12.0
9	34.1	23.5	14.7	17.5	10.2
10	44.3	20.1	12.1	14.9	8.7
11	47.2	18.5	12.4	13.7	8.3
12	45.4	19.2	14.5	13.1	7.8

Source: Author's calculations.

Figure A2: Baltic countries: GDP growth responses to one percent shocks from major trading partners, oil price growth and REER 1/



1/ A shock to the real effective exchange rate corresponds to an appreciation.

Note: The vertical axis is measured in percent while the horizontal axis represents quarters of a 3-year time horizon.

Source: Author's calculations.

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