

Белорусский экономический
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Belarusian Economic Research
and Outreach Center

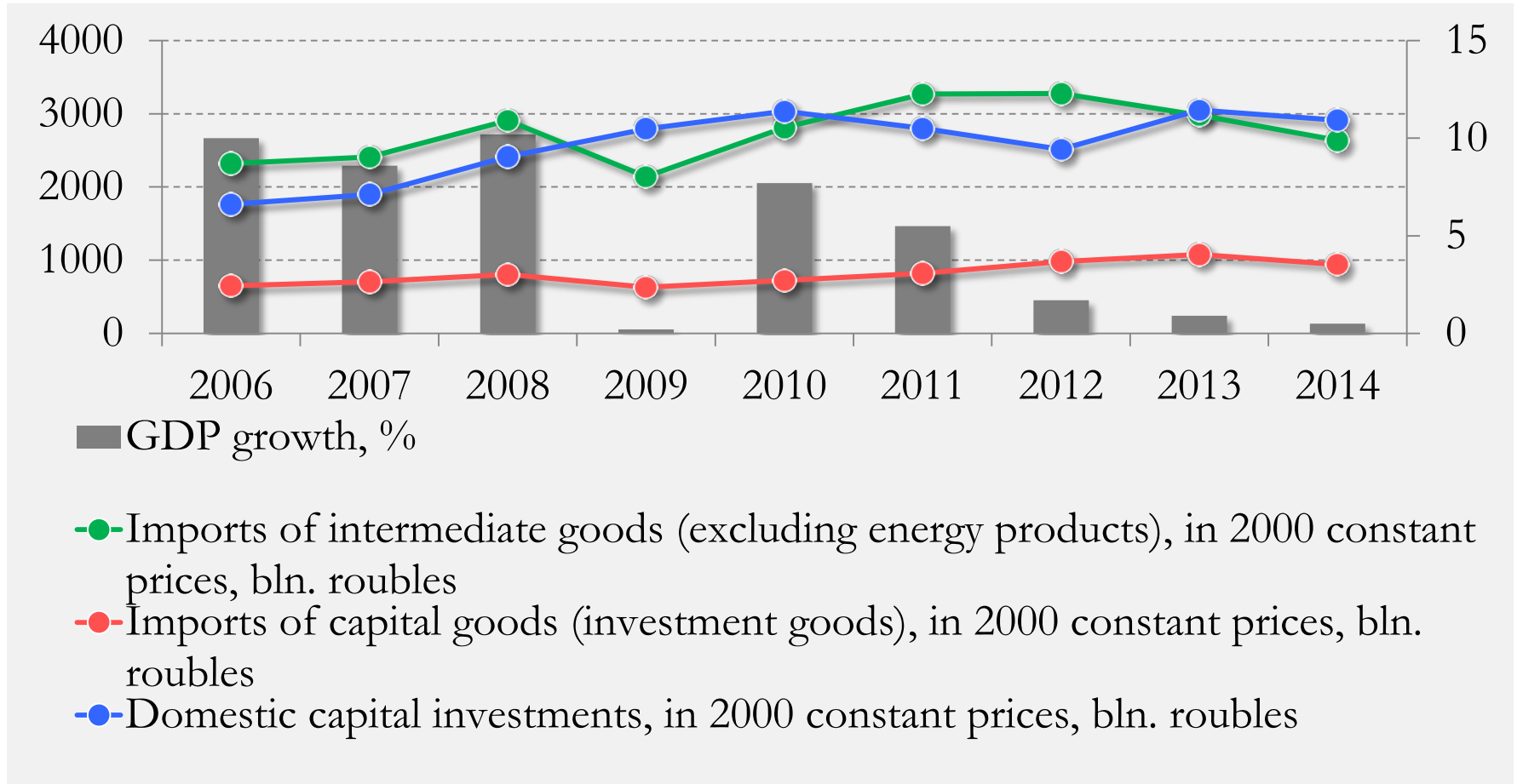


Exchange Rate, Imports of Intermediate and Capital Goods and GDP Growth in Belarus

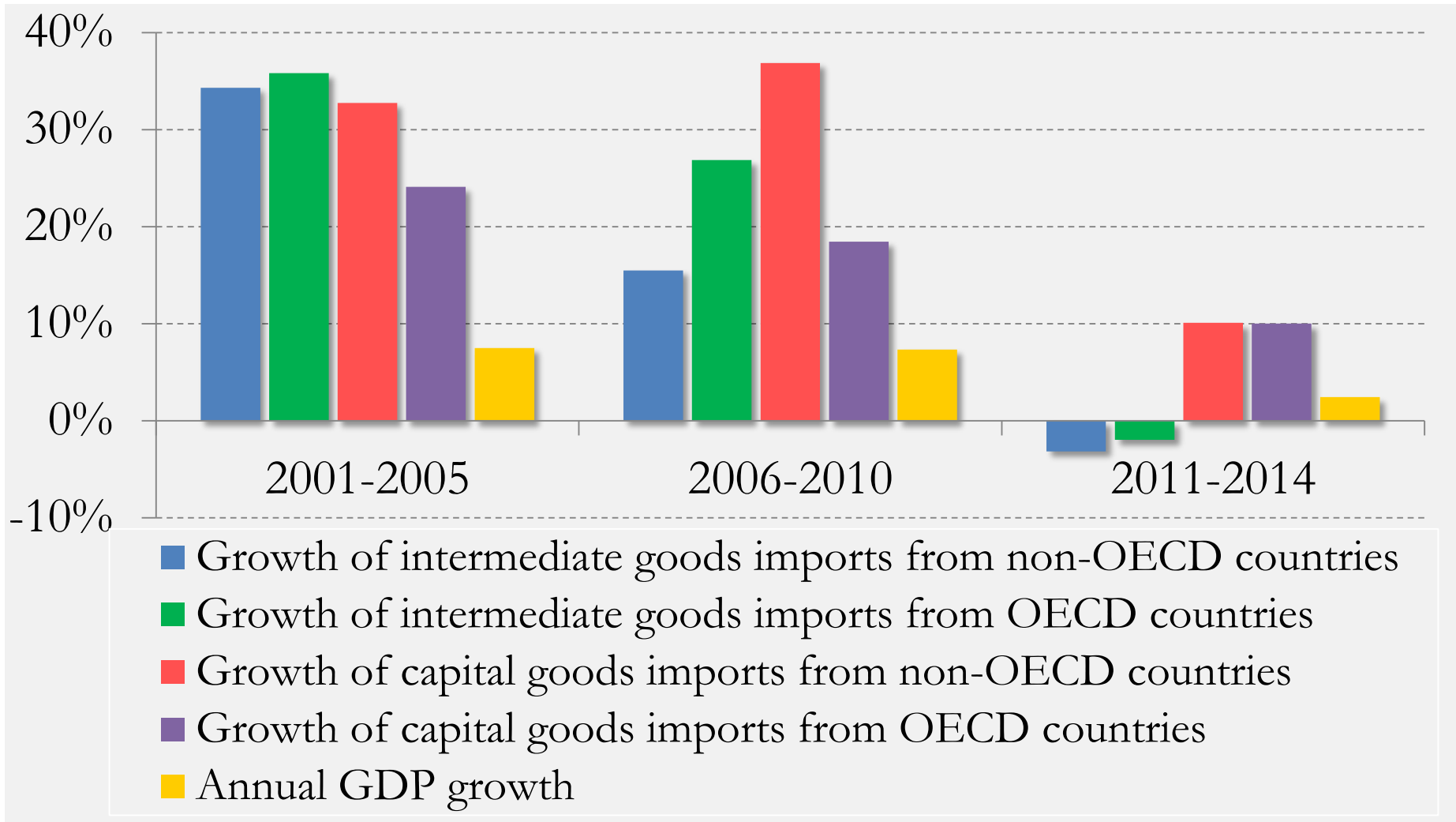
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Introduction (1)

1. Technological progress is one of the main factors that stimulate economic growth both in developing and developed countries



Introduction (2)



Introduction (3)

2. Depreciation increases the domestic currency price of imported goods and decreases the quantity of imports – **direct cost effect**
3. Depreciation motivates local companies to expand production for export increasing demand for intermediate and capital inputs – **derived demand effect**
4. Substantial reliance of Belarus's export sector on imported inputs jointly with these side effects decrease its competitiveness and, overly, economic growth in the country

Introduction (4)

The paper addresses the following **questions**:

- What happens to GDP growth over the short and long term due to changes in imports of intermediate and capital goods following changes in nominal and real exchange rate of Belarusian ruble?
- Are there any causal relationship between exchange rate, import of intermediate and capital goods and GDP growth in Belarus?
- What is the direction of the causality? (If any?)
- How much of the fluctuations in imports of intermediate and capital goods and GDP growth in Belarus are explained by changes to each of their explanatory variables over a two-year forecasting period?

Literature Review: Theory (1)

- **Neoclassical growth theory** helped to relate trade to growth via its effects on technology and productivity
- The **endogenous growth theory** explained long-term growth within the model

Literature Review: Theory (2)

Channels of trade 's influence on growth:

- The adoption of outward oriented trade policies – **Export-Led Growth (ELG) hypothesis**
- A greater availability of imports (intermediate and capital goods) – **Import-Led Growth (ILG) hypothesis**
- The role of learning-by-doing in countries with low levels of industrialization

Literature Review: Empirical Research (3)

Research methodologies used to examine the trade-growth relationships:

- Firm and industry-level research
- Cross-section country-level studies
- Time series and panel country-level studies

Data (1)

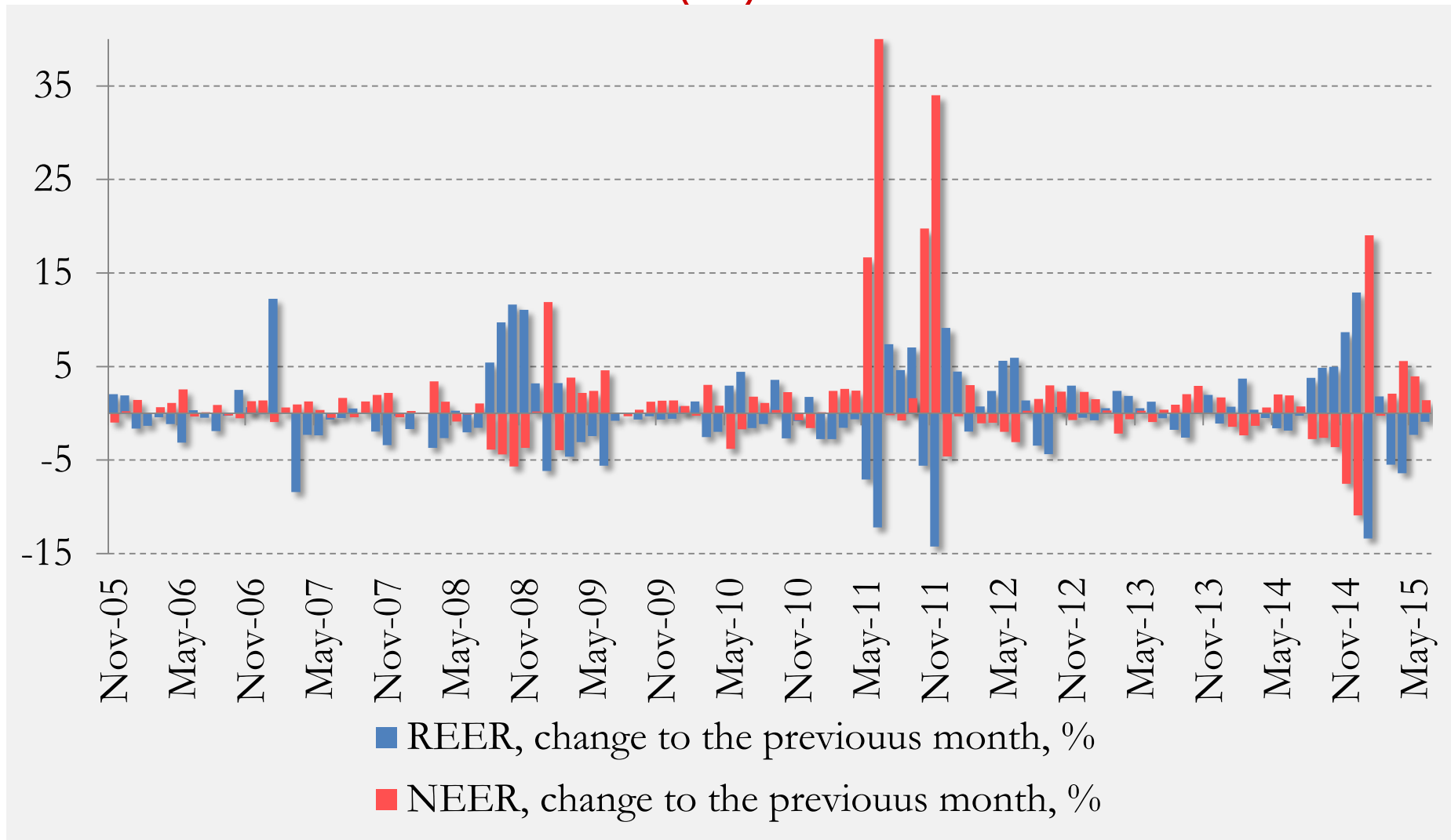
Period: 2005-2015, monthly

Variable	Description
Ln(GDP)	GDP, in constant prices, logarithm
Ln(Exports)	Exports, in constant prices, logarithm
Share of intermediate goods imports in GDP (IMPINTER_TO_GDP)	Share of intermediate goods imports in GDP (without imports of energy recourses)
Ln(Intermediate goods imports)	Imports of intermediate goods, in constant prices, logarithm
Ln(Labor)	Number of economically active population, logarithm
Share of capital goods imports in GDP (IMPCAP_TO_GDP)	Share of capital goods imports in GDP
Ln(Capital goods imports)	Imports of capital goods, in constant prices, logarithm
Share of domestic capital investments in GDP (DOMCAP_TO_GDP)	Share of domestic capital investments in GDP

Data (2)

Series	Mean	Min	Max	Std. dev.	Obs.	Data source
<i>LnGDP</i>	6.859	6.472	7.387	0.186	116	BELSTAT
<i>LnExports</i>	6.254	5.644	6.823	0.248	116	BELSTAT
<i>LnLabor</i>	8.435	8.407	8.460	0.016	116	BELSTAT
Share of intermediate goods imports in GDP (<i>IMPINTER_TO_GDP</i>)	0.238	0.118	0.467	0.052	116	BELSTAT
Share of capital goods imports in GDP (<i>IMPCAP_TO_GDP</i>)	0.069	0.035	0.165	0.019	116	BELSTAT
Share of domestic capital goods in GDP (<i>DOMCAP_TO_GDP</i>)	0.217	0.101	0.428	0.059	116	BELSTAT
<i>NEER</i>	0.014	-0.11	0.40	0.06	116	NBRB
<i>REER</i>	0.001	-0.14	0.13	0.04	116	NBRB

Data (3)



Data (4)

Appreciation Events

Period	ΔNEER	ΔREER
January 2007	-0,9%	+12,24%
August 2008	-3,9%	+5,43%
September 2008	-4,4%	+9,73%
October 2008	-5,7%	+11,61%
November 2008	-3,7%	+11,05%
July 2011	-0,2%	+7,37%
September 2011	+1,6%	+7,02%
December 2011	-4,6%	+9,14%
May 2012	-2,0%	5,62%
June 2012	-3,1%	+5,93%
November 2014	-7,5%	+8,68%
December 2014	-10,9%	+12,92%

Data (5)

Depreciation Events

Period	Δ NEER	Δ REER
March 2007	+1,0%	-8,43%
January 2008	+0,2%	-6,16%
June 2009	+4,6%	-5,61%
May 2011	+16,7%	-7,08%
June 2011	+40,1%	-12,11%
October 2011	+19,7%	-5,62%
November 2011	+34,0%	-14,25%
January 2015	+19,0%	-13,40%
March 2015	+2,1%	-5,50%
April 2015	+5,6%	-6,40%

Methodology (1)

The autoregressive distributed lag (**ARDL**) approach (**Pesaran et al. 2001**):

1. Unit root tests to ensure the stationarity of the data at level $I(0)$ or at their first differences $I(1)$ – **ADF, PP, KPSS unit root tests**
2. Determination of the optimal lag length of the ARDL model on the bases of minimum value of Schwarz Information Criteria:

$$\Delta Y_t = \lambda_0 + \sum_{i=1}^{\rho} \theta_i \Delta Y_{t-i} + \sum_{i=0}^{\rho} \lambda_i \Delta X_{1t-i} + \sum_{i=0}^{\rho} \gamma_i \Delta X_{2t-i} + \sigma_1 Y_{t-1} +$$

$$+ \sigma_2 X_{1t-1} + \sigma_3 X_{2t-1} + \sum_{j=1}^n \alpha_j D_{-EX_j} + v_t$$

where θ, λ, γ – short-run coefficients;

$\sigma_1, \sigma_2, \sigma_3$ – long-run coefficients;

α_j – coefficients for exchange rate dummies for appreciation/depreciation events

Methodology (2)

The exchange rate dummies are constructed using next formulas:

$$\ln(NEER)_t - \ln(NEER)_{t-1} \geq 0.05,$$

$$\ln(NEER)_t - \ln(NEER)_{t-1} \leq -0.05.$$

$$\ln(REER)_t - \ln(REER)_{t-1} \geq 0.05,$$

$$\ln(REER)_t - \ln(REER)_{t-1} \leq -0.05.$$

Methodology (3)

The autoregressive distributed lag (**ARDL**) approach (**Pesaran et al. 2001**):

3. **Bounds-testing procedure** to check the presence of cointegration among variables and to identify the long-run relationship(s) between a dependent and independent variables
4. Assessment of the short-run dynamics by estimating the **error-correction model (ECM)** associated with each of the long-run estimates

Methodology (4)

5. **Toda Yamamoto (TY) Granger causality approach** to study direction of causal relationship between considered variables
6. **Forecast error variance decomposition** to identify what proportion of the variation in economic growth, growth in imports of intermediate and capital goods can be explained due to changes in their underlying determinants

Results: ADF unit root test (1)

Series	Statistical level			Statistics (1st difference)		
	with intercept	with intercept and trend	none	with intercept	with intercept and trend	none
Ln(GDP)	-2.59*	-9.11***	1.36	-8.30***	-8.26***	-8.15***
Ln(Exports)	-2.11	-2.31	0.37	-12.04***	-11.98***	-12.07***
Ln(Labor)	-1.33	-1.69	0.02	-4.70***	-8.53***	-4.71***
Share of domestic capital investments in GDP	-5.25***	-5.32***	-0.07	-8.28***	-7.86***	-8.32***
Ln(Intermediate goods imports)	-2.64*	-2.49	0.16	-12.95***	-12.98***	-13.01***
Share of intermediate goods imports in GDP	-2.43	-2.53	-0.61	-12.14***	-12.12***	-12.19***
Ln(Capital goods imports)	-2.23	-2.30	0.13	-12.47***	-12.47***	-12.52***
Share of capital goods imports in GDP	-3.21**	-3.17*	-0.63	-13.56***	-13.52***	-13.62***

Results: PP unit root test (2)

Series	Statistical level			Statistics (1st difference)		
	with intercept	with intercept and trend	none	with intercept	with intercept and trend	none
Ln(GDP)	-5.62***	-9.14***	1.67	-62.23***	-58.36***	-36.86***
Ln(Exports)	-2.08	-2.31	0.39	-12.03***	-11.97***	-12.06***
Ln(Labor)	-1.28	-1.58	0.17	-8.55***	-9.12***	-8.57***
Share of domestic capital investments in GDP	-5.10***	-5.20***	-0.65	-28.11***	-52.88***	-28.33***
Ln(Intermediate goods imports)	-2.52	-2.38	0.25	-12.99***	-13.06***	-13.04***
Share of intermediate goods imports in GDP	-5.19***	-5.27***	-0.68	-35.26***	-48.36***	-34.56***
Ln(Capital goods imports)	-4.87***	-6.49***	0.17	-22.35***	-22.86***	-22.43***
Share of capital goods imports in GDP	-7.83***	-7.91***	-1.08	-59.90***	-72.71***	-60.41***

Results: Cointegration Analysis (3)

Series	Ln(GDP)	Ln(Intermediate goods imports)	Ln(Capital goods imports)
Bounds testing for cointegration			
Optimal lag length	(1, 5, 1, 1, 0, 1)	(10, 3, 0, 0, 0)	(4, 0, 0, 0)
F-statistics	4.410 ^{a ***}	5.483 ^{a **}	6.000 ^{a ***}
t-statistics	-4.450 ^{a ***}	-3.473 ^{a *}	-3.978 ^{a ***}
Diagnostic tests			
χ^2NORMAL	2.911 (0.233)	0.573 (0.751)	53.377 (0.000)
χ^2BPG	18.541 (0.293)	27.409 (0.100)	1.359 (0.182)
χ^2RESET	7.344 (0.196)	1.593 (0.247)	0.009 (0.992)
χ^2SERIAL	0.361 (0.718)	0.154 (0.877)	3.087 (0.543)

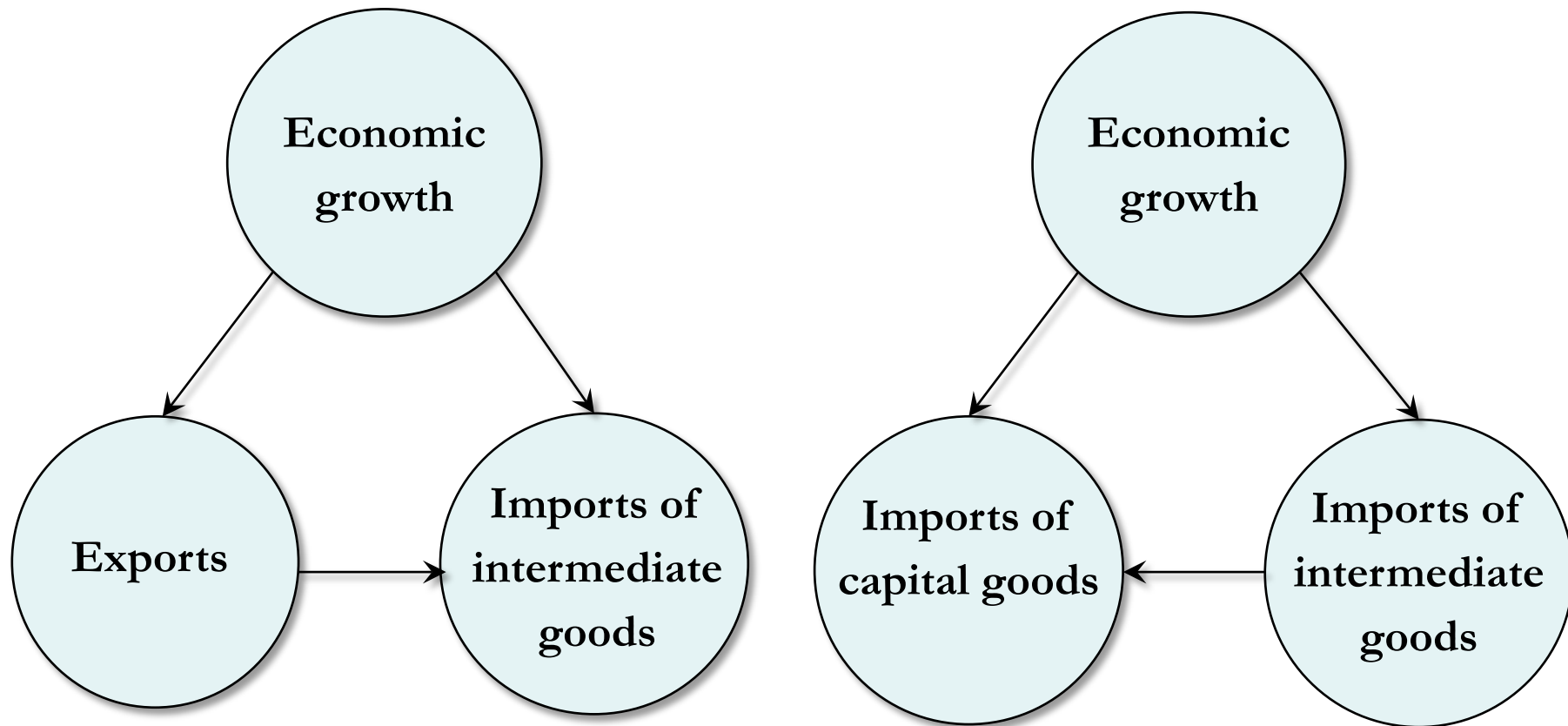
Results: Long-Run Estimates (4)

Series	Ln(GDP)	Ln(Intermediate goods imports)	Ln(Capital goods imports)
Ln(GDP)			1.497***
Ln(Exports)	0.663***	0.484***	
Share of intermediate goods imports in GDP	-2.719***		6.545***
Ln(Labor)	0.391***	0.224***	-0.901***
Share of capital goods imports in GDP	-2.033	2.457***	
Share of domestic capital investment in GDP	1.073**	0.773***	
D1REER_D2NEER	-0.093	-0.072**	
D4REER_D4NEER	-0.193**	-0.101**	
D2011			-0.357**

Results: Short-Run Estimates (5)

Series	Ln(GDP)	Ln(Intermediate goods imports)	Ln(Capital goods imports)
$\Delta \text{Ln(GDP)}$			0.553***
$\Delta \text{Ln(Exports)}$	0.163***	0.290***	
$\Delta(\text{Share of intermediate goods imports in GDP})$	-2.684***		2.420***
$\Delta \text{Ln(Labor)}$	5.052*	0.122***	-0.333***
$\Delta(\text{Share of capital goods imports in GDP})$	-0.572	1.227***	
$\Delta(\text{Share of domestic capital investments in GDP})$	-0.113	0.386***	
ECM_{t-1}	-0.281***	-0.499***	-0.369***
R^2	0.904	0.904	0.682
D.W.	2.263	2.021	2.016

Results: TY Causality Test (6)



Results: Variance Decomposition (7)

Horizon	<i>LnGDP</i>	<i>LnExports</i>	<i>LnL</i>	<i>IMPINTER _TO_GDP</i>	<i>IMPCAP _TO_GDP</i>	<i>DOMCAP _TO_GDP</i>
3	63.16	0.50	4.40	1.20	0.12	30.59
6	55.96	1.25	10.56	6.44	3.57	22.19
9	54.12	1.14	10.36	7.04	4.02	23.30
12	54.13	1.01	11.46	8.28	4.45	20.64
15	53.17	0.88	11.24	9.46	4.79	20.44
18	53.00	0.83	11.23	10.18	5.09	19.64
21	52.68	0.79	11.03	10.93	5.23	19.31
24	52.47	0.77	10.82	11.52	5.44	18.95

Results: Variance Decomposition (8)

Horizon	<i>IMPCAP</i> <i>_TO_GDP</i>	<i>LnExports</i>	<i>LnL</i>	<i>IMPINTER</i> <i>_TO_GDP</i>	<i>LnGDP</i>	<i>DOMCAP</i> <i>_TO_GDP</i>
3	44.84	0.74	0.09	8.47	39.09	6.74
6	43.77	2.38	2.08	10.14	34.22	7.38
9	40.26	9.15	3.25	9.79	30.83	6.69
12	35.94	15.94	4.26	9.29	28.16	6.38
15	31.96	22.98	4.48	8.37	26.59	5.59
18	29.19	27.89	4.52	7.84	25.42	5.11
21	27.24	31.57	4.53	7.44	24.50	4.68
24	25.75	34.52	4.46	7.19	23.70	4.35

Results: Variance Decomposition (9)

Horizon	<i>IMPINTER</i> <i>_TO_GDP</i>	<i>LnExports</i>	<i>LnL</i>	<i>LnGDP</i>	<i>IMPCAP</i> <i>_TO_GDP</i>	<i>DOMCAP</i> <i>_TO_GDP</i>
3	23.25	11.30	0.83	41.11	0.13	23.35
6	16.63	20.86	2.45	39.27	3.77	17.00
9	11.64	34.21	1.91	34.64	5.92	11.65
12	8.47	39.06	1.43	35.49	6.95	8.57
15	6.59	42.59	1.25	35.59	7.27	6.69
18	5.53	44.15	1.17	35.99	7.59	5.55
21	4.78	45.22	1.18	36.33	7.69	4.78
24	4.24	45.93	1.26	36.49	7.85	4.21

Conclusions

1. Imports of intermediate goods negatively influences economic growth in Belarus both in the short and long run
2. Depreciation of the Belarusian ruble has negative effect both on GDP growth and imports of intermediate goods
3. GDP growth Granger cause growth in imports of intermediate and capital goods and growth in exports
4. Changes in imports of intermediate and capital goods in Belarus are mostly driven by changes in exports especially in the long-run
5. Domestic capital investment is the main contributor to fluctuations in Belarus's GDP