



Bern
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The Resilience of the Indian Economy to Rising Oil Prices as a Validation Test for a Global Energy-Environment-Economy CGE Model

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Motivations... can we trust our model?

- In our modeling results, we noticed India is highly vulnerable to oil shocks.
 - At odds, with the observed resilience of the Indian economy to rising oil prices over 2003-2006
- Empirical validity of hybrid CGE models ? (econometric critique, McKittrick 1998, Barker 2004, Scrieciu 2007)
- Twofold objective:
 - Understand the discrepancy between our model's results and observations... and, if possible, correct this discrepancy;
 - Disentangle the mechanisms at play in India's response to rising oil prices.

Growth in Imaclim-R model

- Exogenous potential growth engine
 - Exogenous technical progress that increases labor productivity (as Solow's neoclassical model of economic growth)
 - Convergence assumption (Barro and Sala-i-Martin 1992):
 - Empirical calibration with two analysis on economic convergence: Maddison (1995) for past trends and Oliveira Martins (2005) for future trends.
 - For India, default assumptions for labor productivity growth lie between 5.7% and 5.3% per year over the 2003-2006 period.
- But gaps between potential growth and effective growth (endogenous to the model)
 - Interaction between growth engine and short-term constraints:
 - Available capital flows for investments
 - Not full utilization of production factors (labor and capital) due to the inadequacy between flexible relative prices (including wages) and inert capital vintages characteristics.

Growth in Imaclim-R model

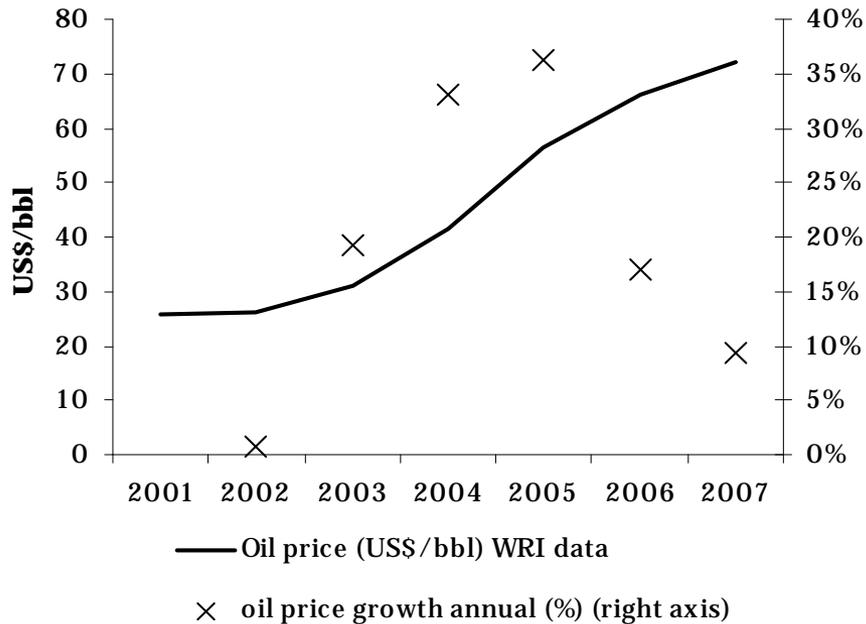
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Default parametrization

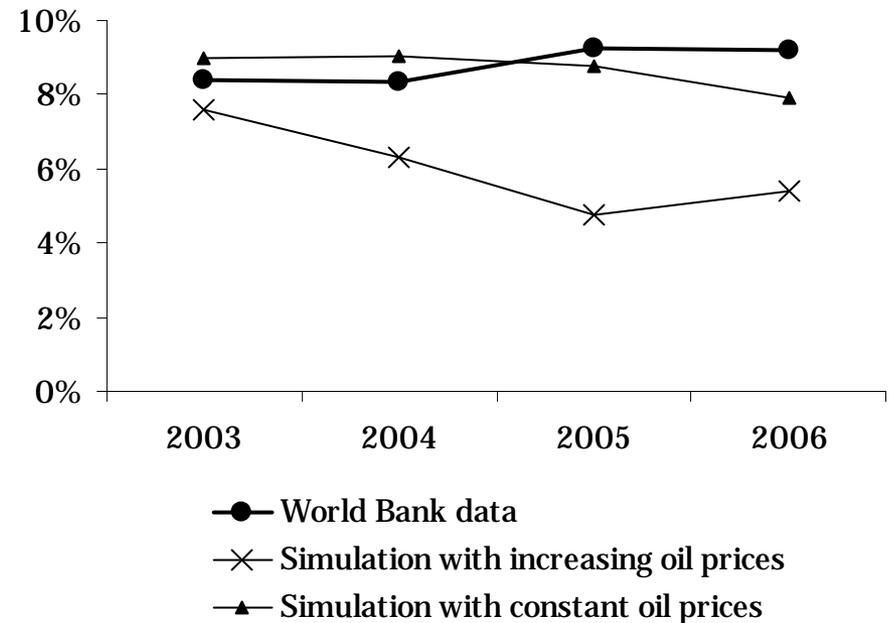
- GTAP 6 database (2001)
- Exogenous trends for demography and for labor productivity growth
- Gradual reduction of international capital imbalances on the long term
- Standard market-share equations depending on relative export prices for energy goods trade

The model does not reproduce observations

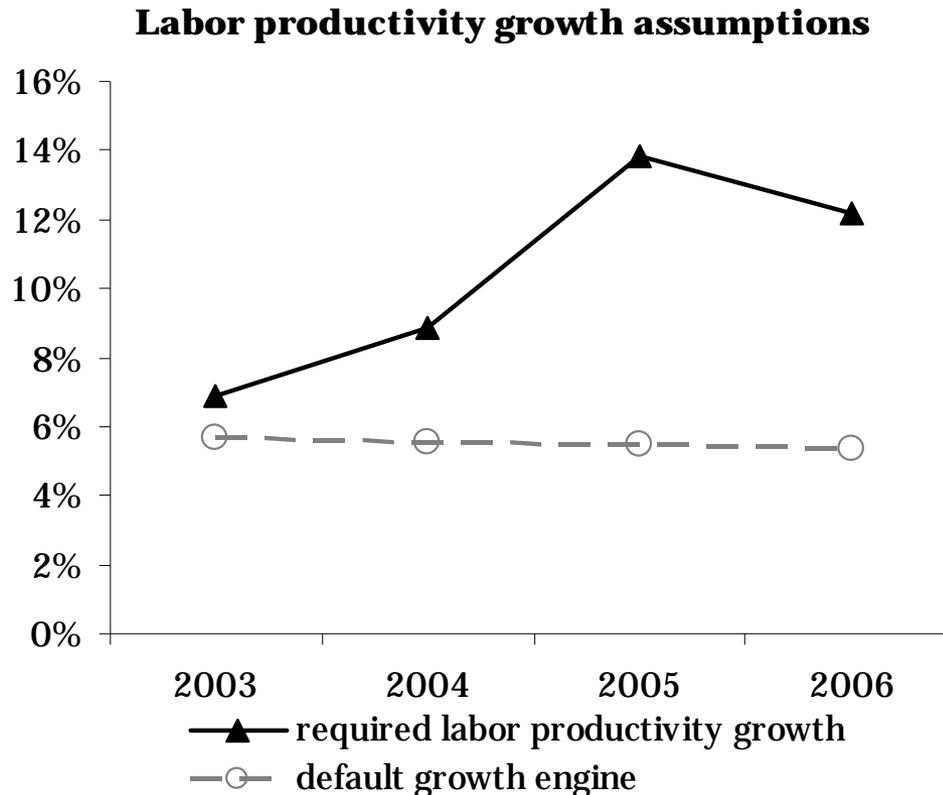
International oil price



GDP growth



Can labor productivity explain the difference?



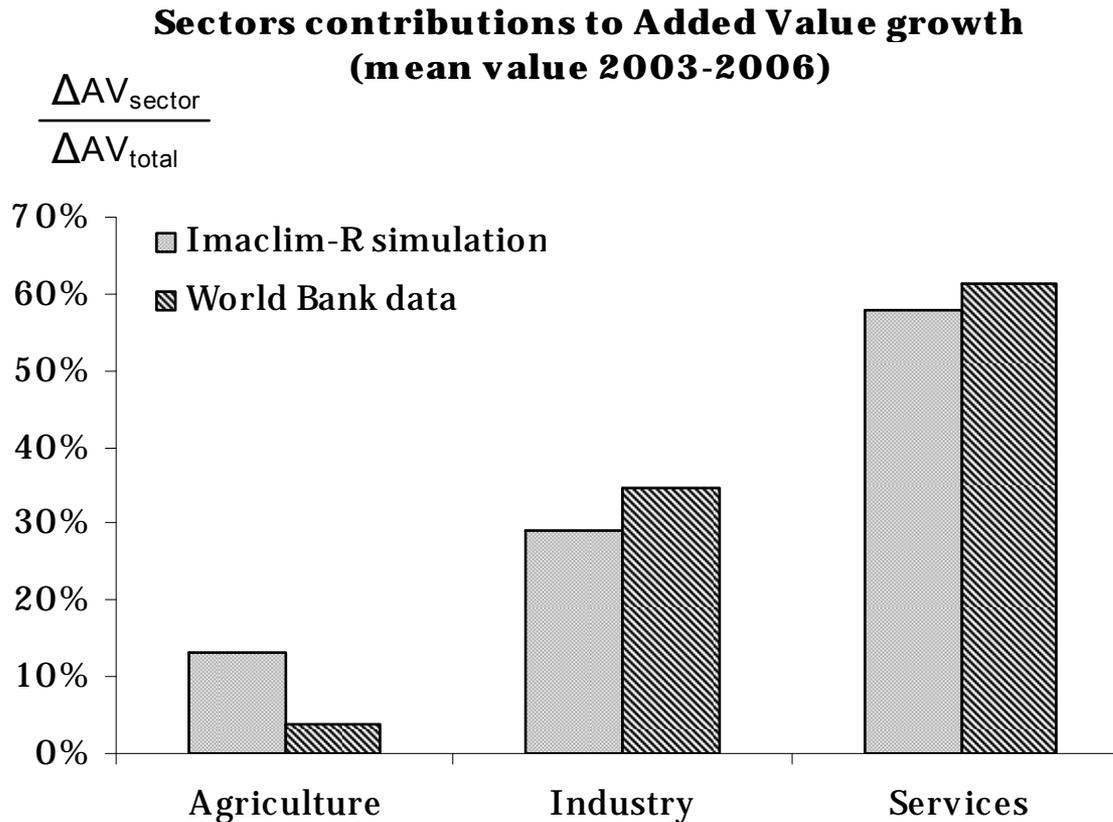
- To reproduce observed growth path, annual labor productivity gains of 14% are necessary. Realistic?
 - Peak at 8.7% for the “Asian dragons” (South Korea, 1983), 9% for France in the post-war period

In search for other mechanisms

- February 2006 IMF country report on India (Fernandez, 2006): four key mechanisms that explain the strong Indian growth despite rising oil prices:
 1. *Sectoral reallocation away from oil-intensive activities;*
 2. *Strong capital inflows and trade deficit;*
 3. *Incomplete pass-through of international petroleum prices;*
 4. *Rise of India as an exporter of refined products*

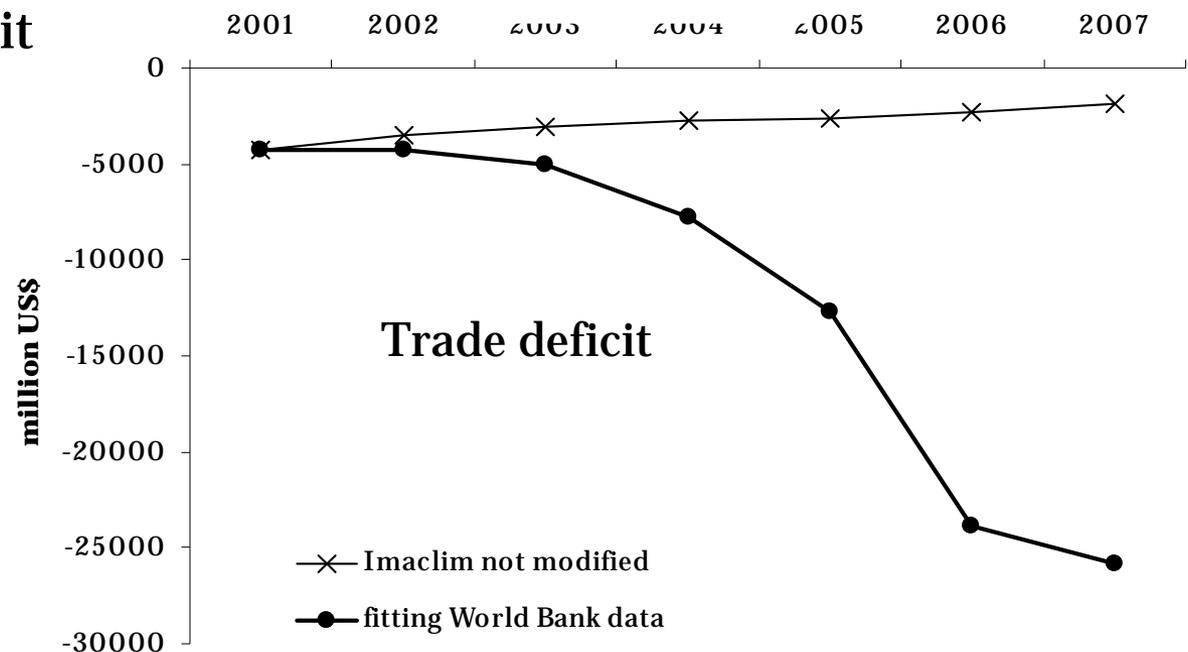
1. Sectoral reallocation

- Well reproduced by the default model



2. Strong capital inflows and trade deficit

- Default assumption: capital and trade imbalances are gradually reduced over time
 - Difficult to predict/model capital flows over the short-term
 - Inconsistent with observations
- Modified model: Capital inflows allow the observed increase in Indian trade deficit



3. Incomplete pass-through of international oil prices

- **Default assumption: no modification of tax and subvention structure**
 - Difficulty to predict (all the more to model) political response to exogenous shocks
 - Political response observed: 40% pass-through of international oil prices to domestic consumers via cuts in government-owned petroleum company margins
- **Modified model : equivalent tax reductions to represent the incomplete pass-through**

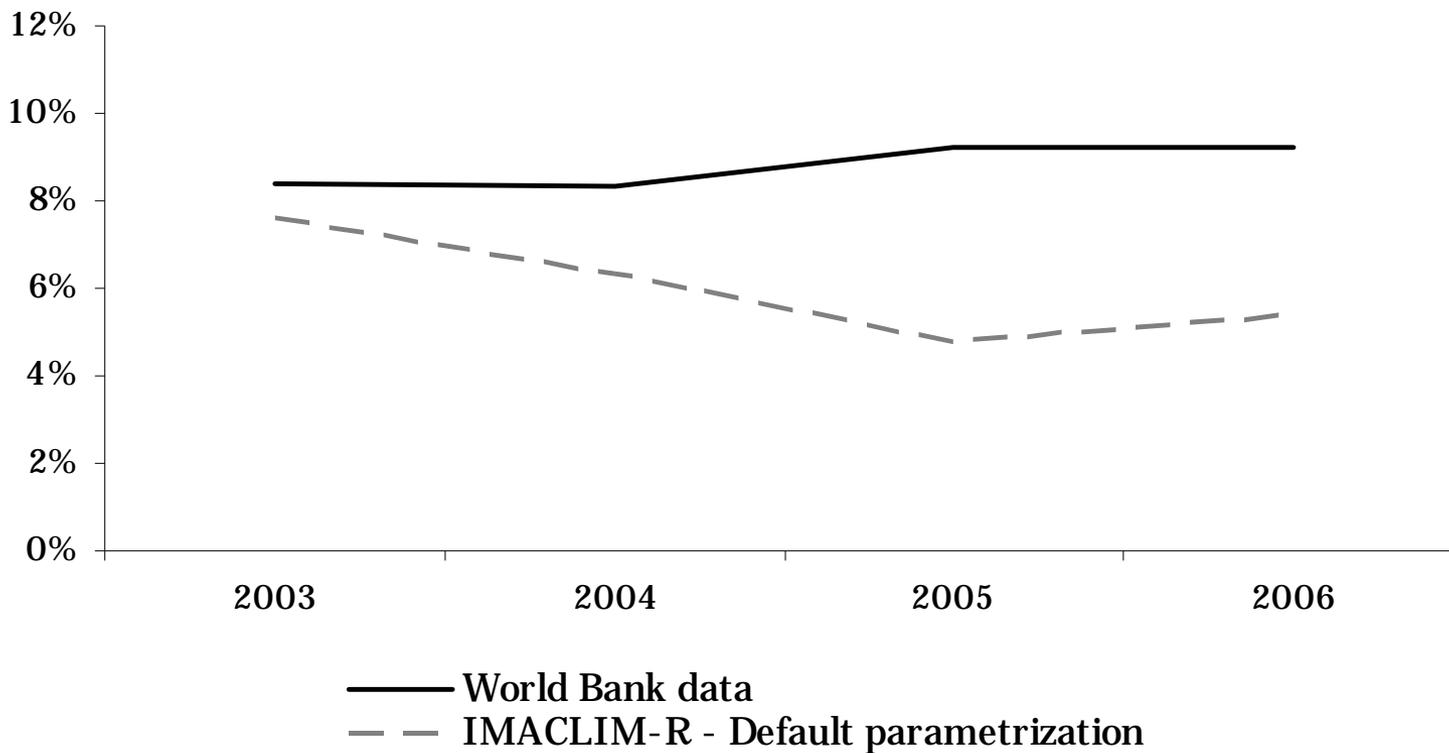
4. *Rise of India as an exporter of refined products*

- **Default assumption: Endogenous prices formation and export shares in the model doesn't reproduce the rise of India's exports of refined products.**
 - **Model: from US\$2.1 billion in 2003 to 3.1 in 2006**
 - **Observations: US\$6.1 billion in 2006.**

- **Modified model : volume of refined-products exports forced to follow data.**

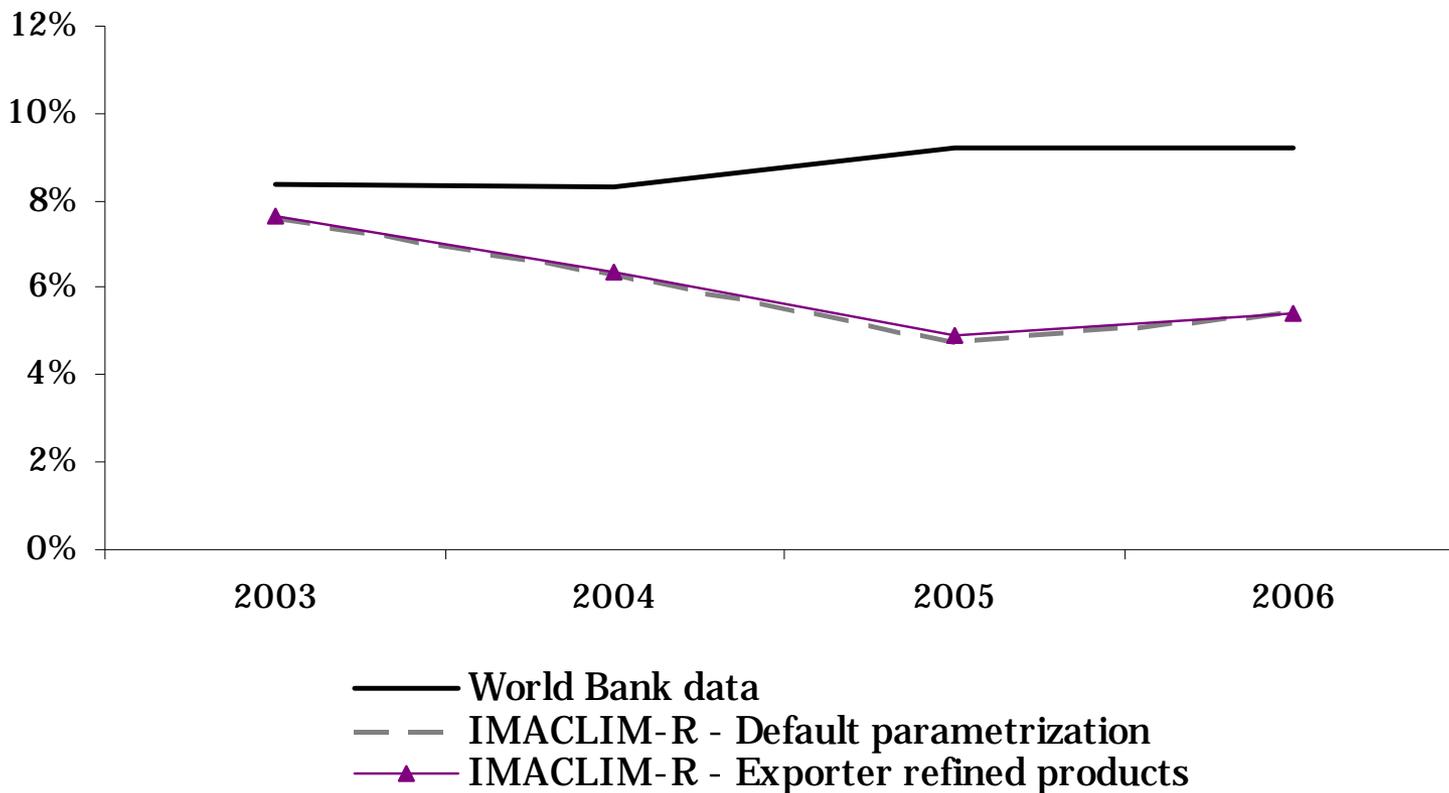
Modified model results

GDP growth



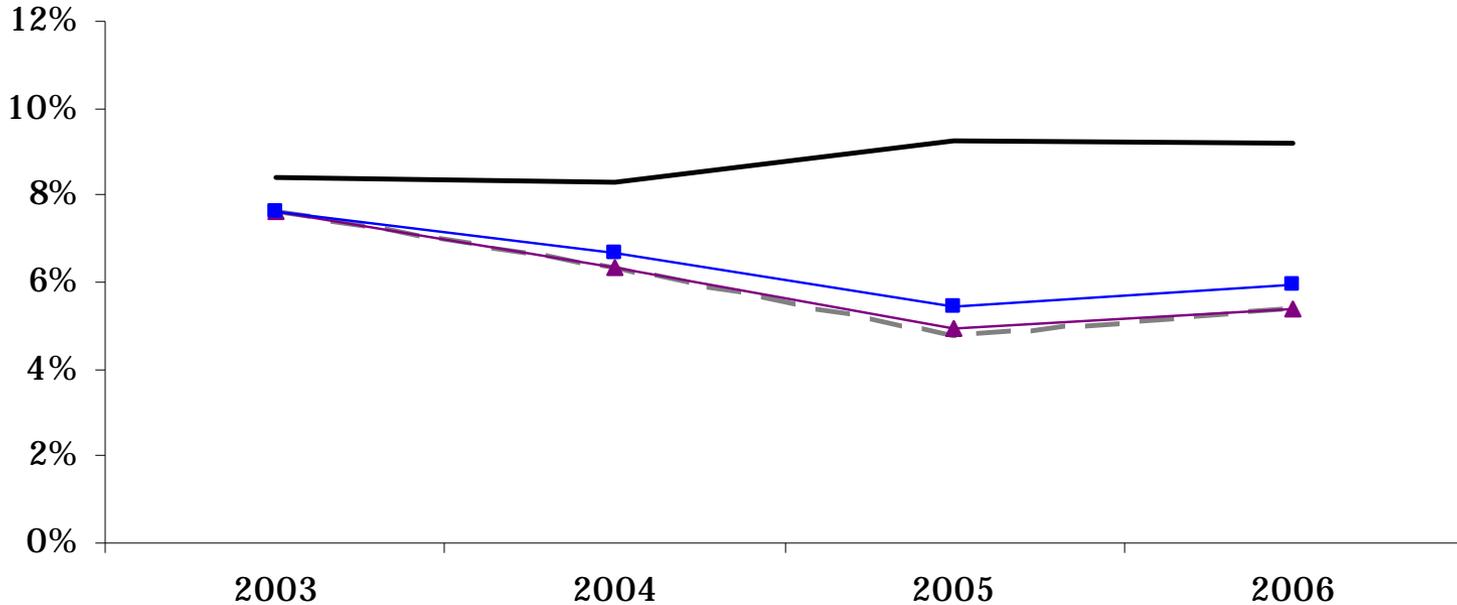
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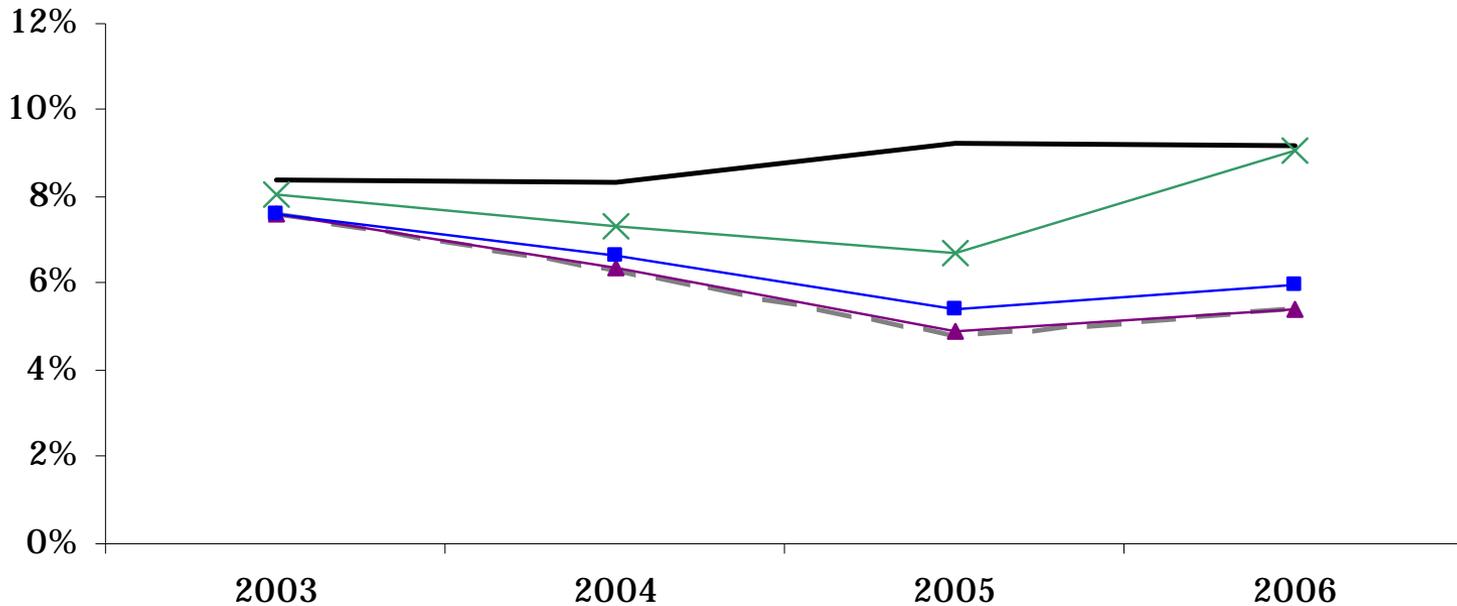
GDP growth



- World Bank data
- - IMACLIM-R - Default parametrization
- ▲ IMACLIM-R - Exporter refined products
- IMACLIM-R - Passthrough 40%

Modified model results

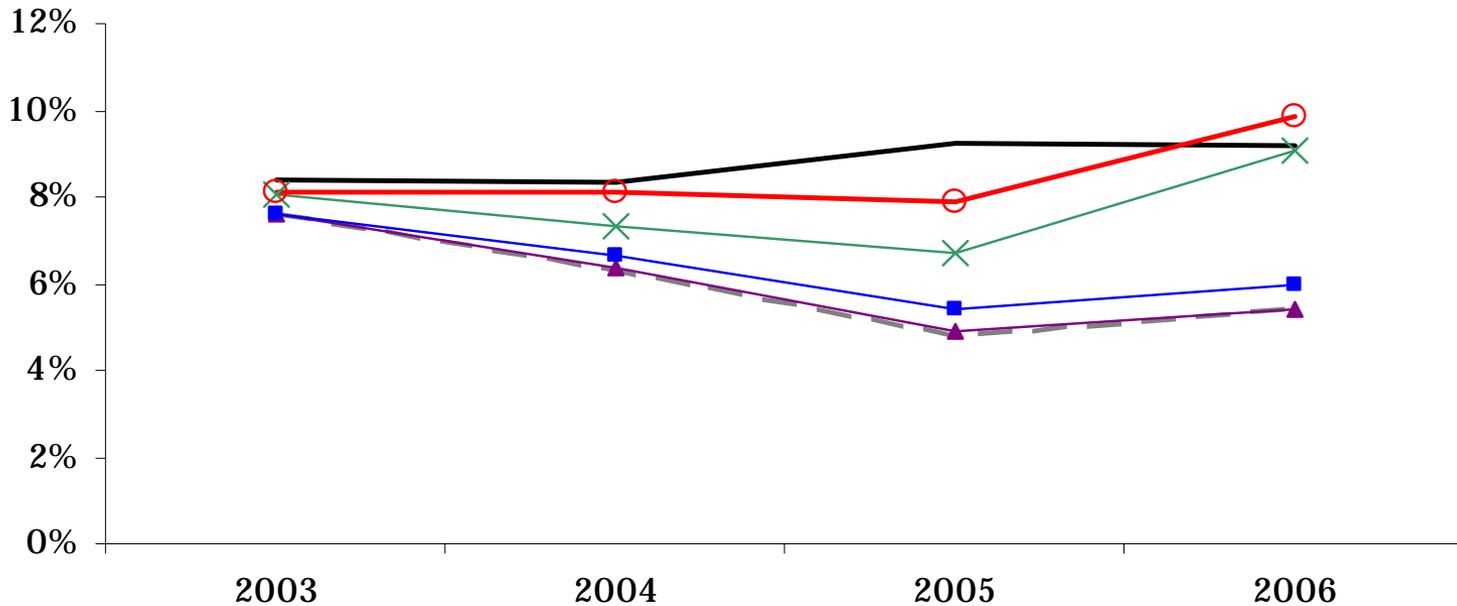
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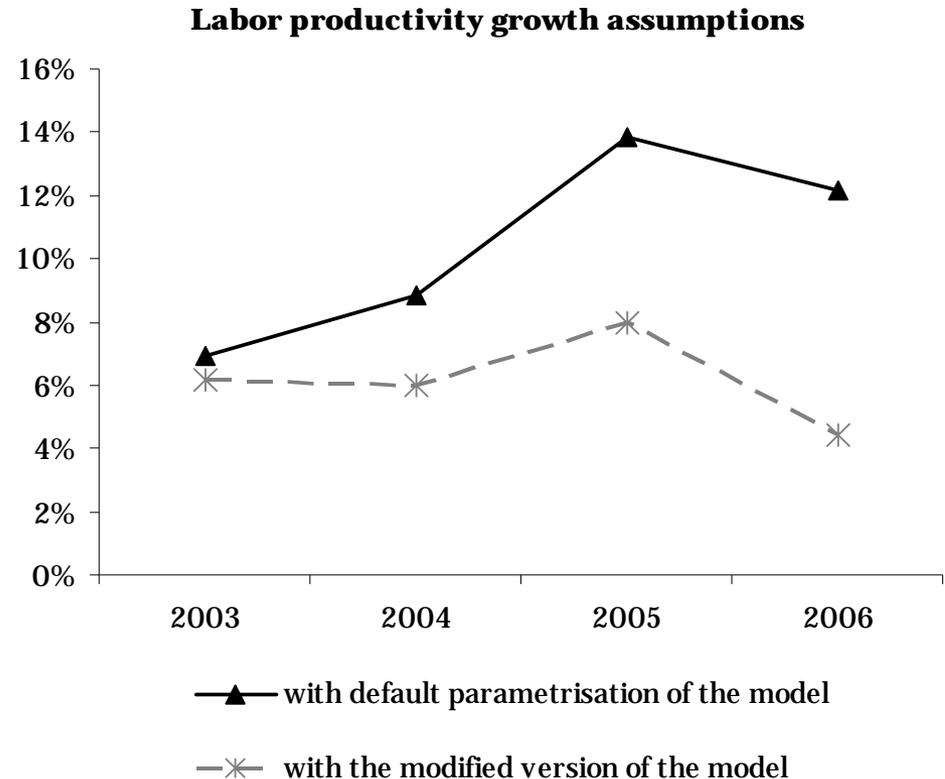
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- × IMACLIM-R - Trade Balance forced
- IMACLIM-R - All three mechanisms added

Explaining the remaining difference

- Required labor productivity growth assumptions



- Other economic mechanisms neglected or imperfectly reproduced:
 - Monetary policy (Blanchard and Gali 2007)
- Imperfection of data sources used to calibrate the model

Conclusions

- A first step toward validation of a long-term global E3 CGE model against macroeconomic data.
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- Policy implication: highlight and assess two mechanisms that can smooth adverse effect of oil shocks over the short-term (subsidy to consumption and capital inflow or trade balance deficit)

Conclusions

- A first step toward validation of a long-term global E3 CGE model against macroeconomic data.
 - Need for similar tests with other countries, other periods, other models...
- Policy implication: highlight and assess two mechanisms that can smooth adverse effect of oil shocks over the short-term (subsidy to consumption and capital inflow or trade balance deficit)
- Methodological implication: discrepancy arises from disregarded short-term mechanisms:
 - Acceptable when analyzing long-term issues or path-dependency?
 - Anyway, a major role in the transition dynamics and policy costs.

Thank you for your attention!

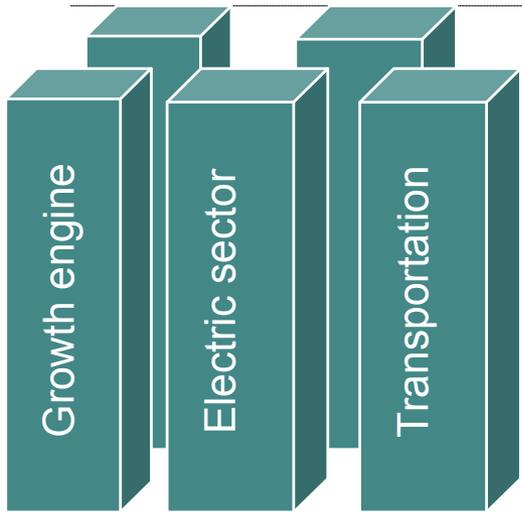
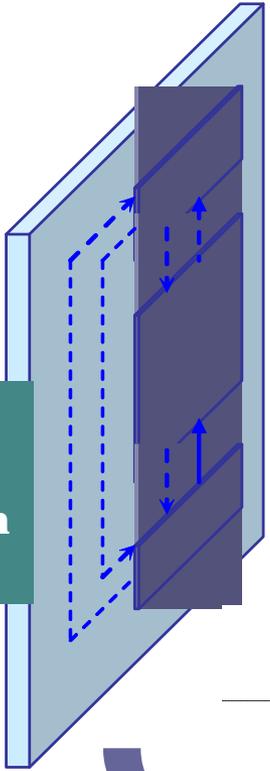
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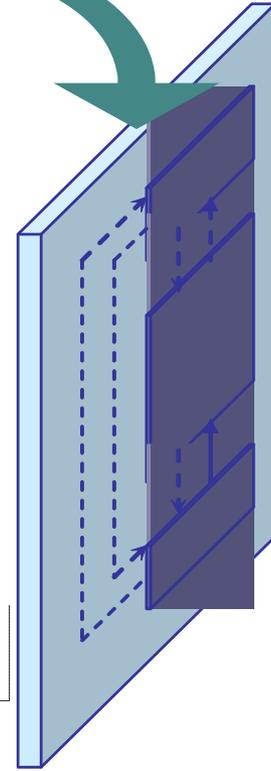
Static Equilibrium t

Updated parameters
(tech. coef., stocks, etc.)

Static equilibrium under short-term constraints



Bottom-up sub models (reduced forms)
Macroeconomic growth engine



Static Equilibrium $t+1$

Price-signals, rate of return
Physical flows

Evolution of constraints