Sustainability as Determinant of Potential Output in Open Economies

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- **Potential output** is an important unobserved variable for macroeconomic modelling, policy analysis and policy making (eg EU sanctions depend on structural budget deficit, hence on potential output)

- **Univariate methods:** atheoretical

- **Model based methods 1. Phillips-curve:** not satisfactory for open economies in general, and for developing countries in particular

- **Model based methods 2. Production-function, like EU methodology:** based on NAIRU/NAWRU (non-accelerating inflation/wage rate of unemployment) & trend productivity & actual capital stock: conceptual problems and major revisions

Motivation, cont.

- **Potential output methodology used by the European Union has major shortcomings (conceptual & practical)**
- **The methodology considers three inputs:**
  - **Capital**: the actual capital stock (typically measured as accumulated investments less amortisation) is used;
  - **Labour**: after identifying labour supply, a measure of 'equilibrium' unemployment rate, the so-called NAWRU (non-accelerating wage rate of unemployment), is used to estimate the sustainable level of employment. NAWRU is estimated with a statistical technique;
  - **Total factor productivity**: measured as a residual after taking into account the contributions of capital and labour to actual output; for calculating potential output, it is assumed that productivity changes along a smooth path and a statistical method is used to adjust actual data to this smoothness concept.

Large revisions to the European Commission estimates 1.

■ European Commission NAWRU estimates follow the actual trend of the unemployment rate, and were revised significantly for the past when the trend changed
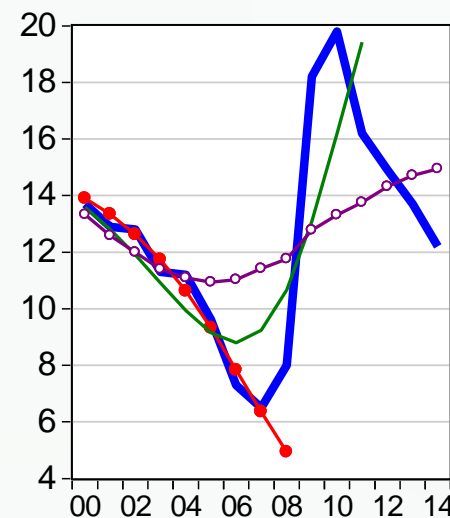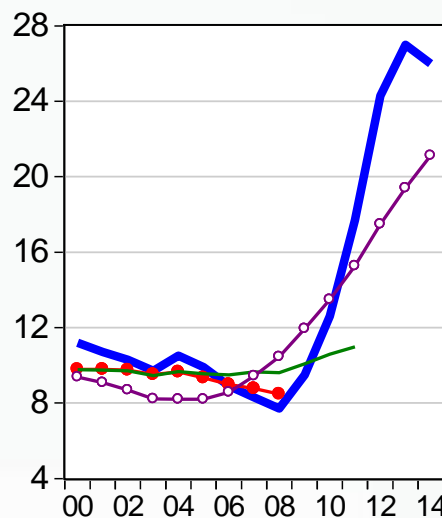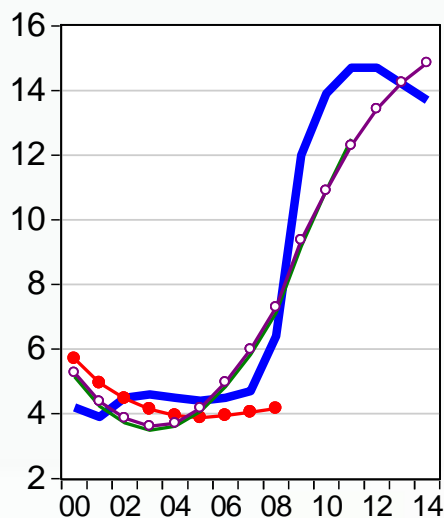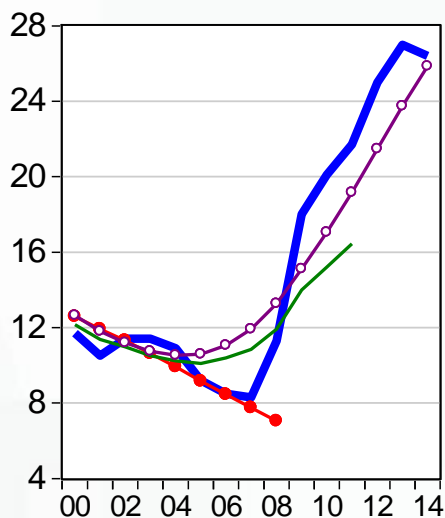
NAWRU estimates and forecasts by the European Commission at different dates and the actual unemployment rate, 1995-2014

Legend: Unemployment rate — NAWRU estimate in 2007 — NAWRU estimate in 2010 — NAWRU estimate in 2013

NAWRU = non-accelerating wage rate of unemployment
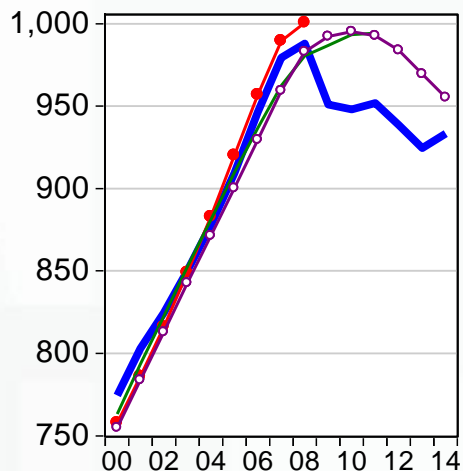
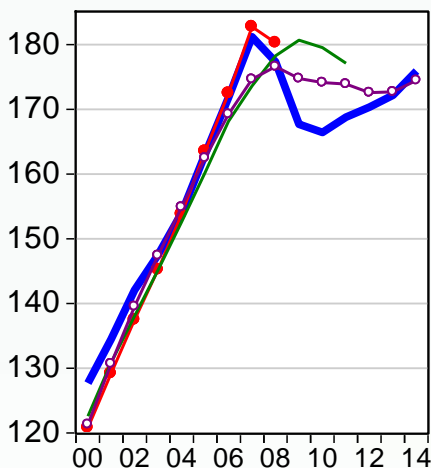Note: 2013-14 data are forecasts made in May 2013

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- In 2007, European Commission estimated that Ireland, Spain and Portugal had negative output gaps that year, and Latvia' output was close to potential. These estimates were revised significantly in later years.

Potential output estimates and forecasts by the European Commission at different dates and the actual output, 1995-2014
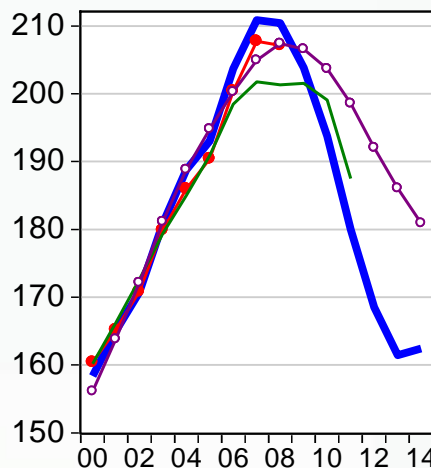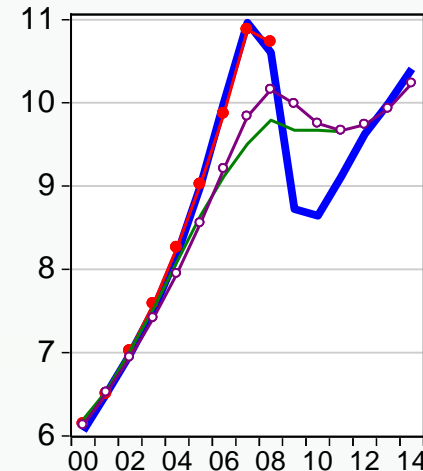

Spain · Ireland · Greece · Latvia

— GDP (constant prices) —•— Potential output estimate in 2007 —— Potential output estimate in 2010 —○— Potential output estimate in 2013

Note: 2013-14 data are forecasts made in May 2013

Motivation, cont.

- **We offer a new concept:** „sustainable output" and estimate to a wide selection of open economies using an unobserved component (UC) model

- **The main idea is that in open economies:**
  - the effects of excess demand is not symmetric across the tradable and non-tradable sectors, because foreign supply can fill the gap between demand and supply in the tradable sector, but not in the non-tradable sector
  - excess demand may manifest itself in the deterioration of the trade balance, parallel to, or even without, the increase of inflation

Outline

1. **Concepts and objectives**
2. **The model**
3. **Empirical results**
4. **Comparison of our results with European Commission estimates**
5. **Summary**

- **Potential output**

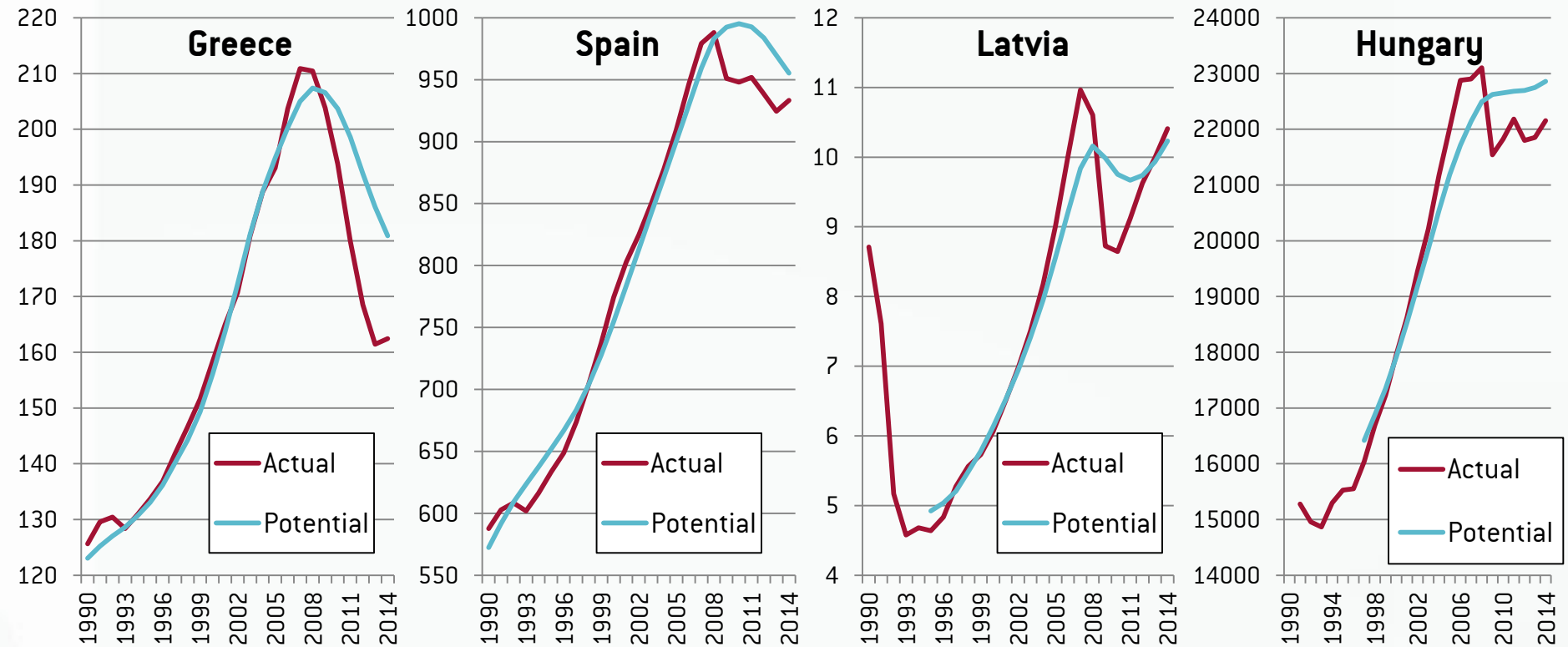 non-inflationary level of output: aggregate supply=demand

- **Atheoretical models**

  smooth supply $\Leftrightarrow$ fluctuating demand?

Problems:

- Is supply really smooth?
- New-Keynesian definition: output corresponding to flexible price level $\rightarrow$ more volatile than actual output

Potential output estimates by the European Commission in May 2013 (at constant prices)

Note: 2013-14 data are forecasts made in May 2013

EC estimates smooth a lot: e.g. is it realistic that Greek and Spanish potential outputs increased so much before the crisis and their more recent falls lag so much the collapse of actual output?

Concepts and objectives, cont.

Standard structural model:

excess demand $\Rightarrow$ employment tension $\Rightarrow$ inflation $\Rightarrow$ demand correction

Problems:

1. Only inflation is measurable directly (potential output/NAIRU are latent variables)

2. High share of tradable goods blurs the relationship between excess demand and employment/inflation. Price explosion may be postponed by exchange rate policy or a favorable market sentiment.

Our alternative approach

Observation: effect of excess demand is not symmetric across the tradable and non-tradable sectors

- *Non-tradable sector:* Phillips-curve

- *Tradable sector:* excess demand can be absorbed by increased foreign supply, ie a deteriorating trade (and later income) balance

Idea:

- Utilize the 2nd relationship as well

- Separation of the two sectors is not intended (and difficult) $\Rightarrow$ build a model that incorporates both effects

In this definition the output gap has two components:

- excess demand on the home goods market - "traditional" feature

- excess demand on the trade/current account balance - new feature

- **Which measure of external balance?**
  - Even when there is no excess demand, the current account balance should not be necessarily zero
  - In theory, there is balance corresponding to the equilibrium intertemporal allocation of resources → deviation from this balance
  - Problem: theory does not pin down an empirical method
  - Empirical estimates can be ad hoc
  - Use the deviation from an estimated equilibrium current balance. Options:
    - Lane and Milesi-Ferretti 2012 Journal of International Economics
    - Derive on the basis of equilibrium net International Investment Position
    - Hodrick-Prescott filter
   - Or simply the actual balance (i.e. deviation from zero)?

Lane and Milesi-Ferretti (2012) estimates of "equilibrium" current account balances

- Panel model for 65 advanced and emerging countries, not including oil exporters, poor and small countries
- Sample: 4-year non-overlapping averages (to smooth the business cycle) for 1969-2008
- Explanatory variables (next slide) are similar to the literature, including the IMF methodology
- Advantage of the 4-year averages: no need to incorporate the cyclical position of the economy
- E.g. the IMF uses annual data and considers the cyclically adjusted current account balance and the cyclically adjusted fiscal balance
- Note: our goal is to measure the cyclical position of the economy and therefore cannot use a model which uses cyclically adjusted variables
- We extended the sample period up to 2013 (by using the IMF's estimates)

- Explanatory variables (first 5 relative to trading partners):
  1. Fiscal balance
  2. GDP growth rate
  3. GDP per capita at PPP
  4. The old-age dependency ratio
  5. Population growth
  6. The aging rate
  7. Net oil export
  8. Lagged Net Foreign Assets (NFA) position
  9. Terms of trade
  10. Dummy for crisis
  11. Dummy for Asian crisis (to capture the specifics of the Asian crisis)
  12. Dummy for international financial centres

Spain - actual and estimated equilibrium current account balance (% GDP), 1969-2013
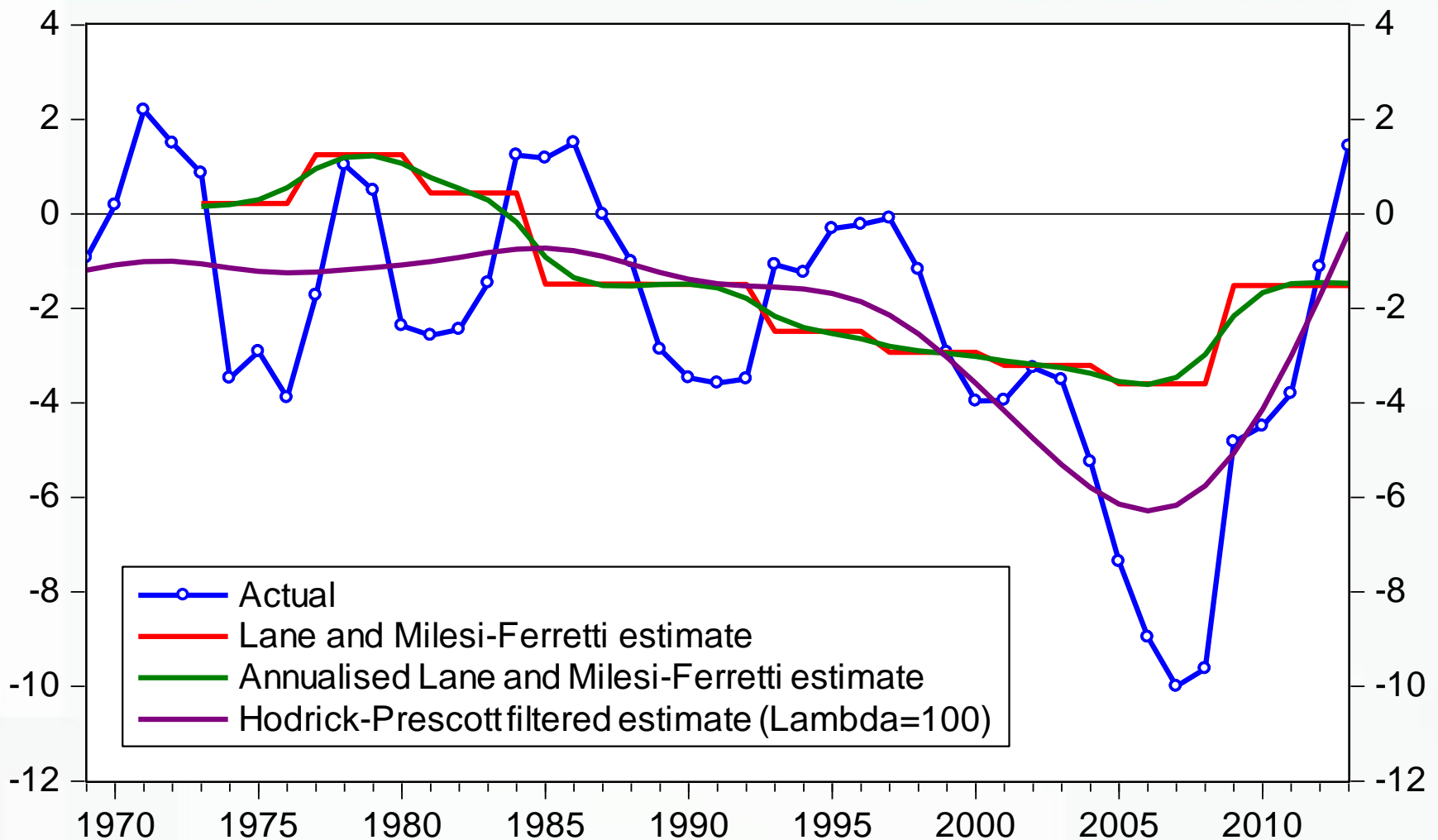
Note: the Lane and Milesi-Ferretti estimate is available up to 2008 for 4-year long periods; for 2009-2013 we have updated it on the basis of IMF estimates, which is a source of error

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Ireland - actual and estimated equilibrium current account balance (% GDP), 1969-2013
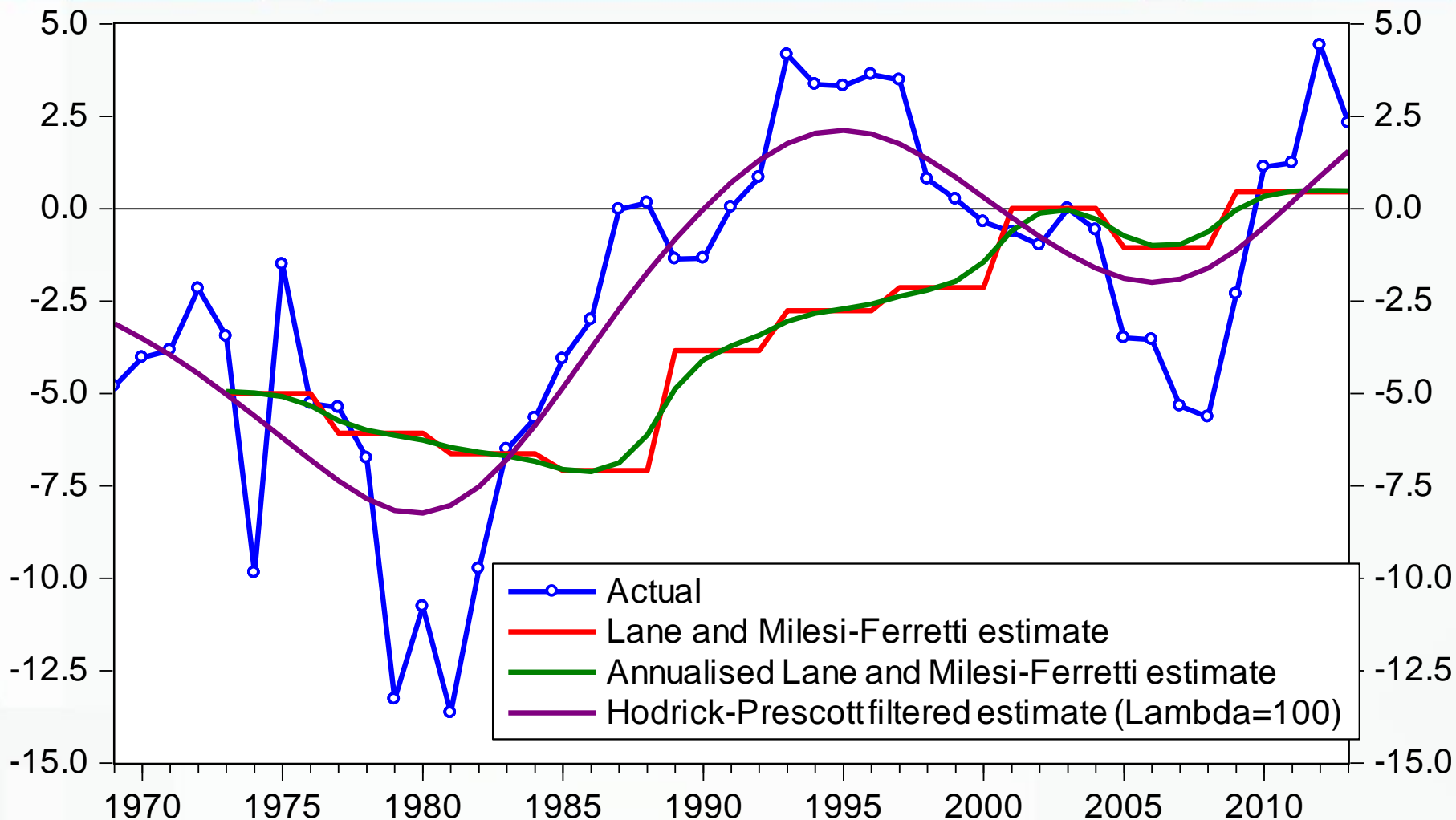
Legend:
- Actual
- Lane and Milesi-Ferretti estimate
- Annualised Lane and Milesi-Ferretti estimate
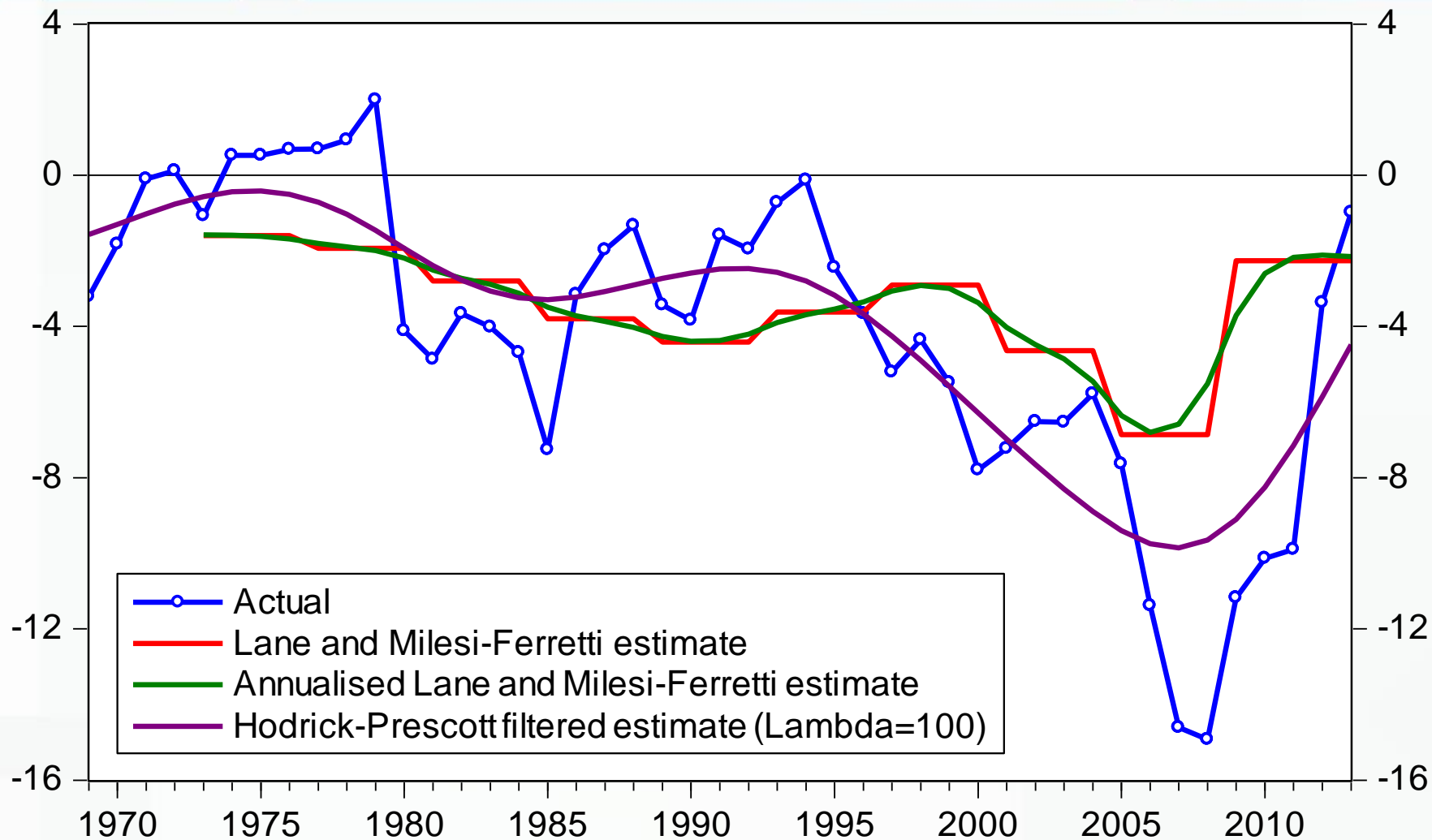- Hodrick-Prescott filtered estimate (Lambda=100)

Note: the Lane and Milesi-Ferretti estimate is available up to 2008 for 4-year long periods; for 2009-2013 we have updated it on the basis of IMF estimates, which is a source of error
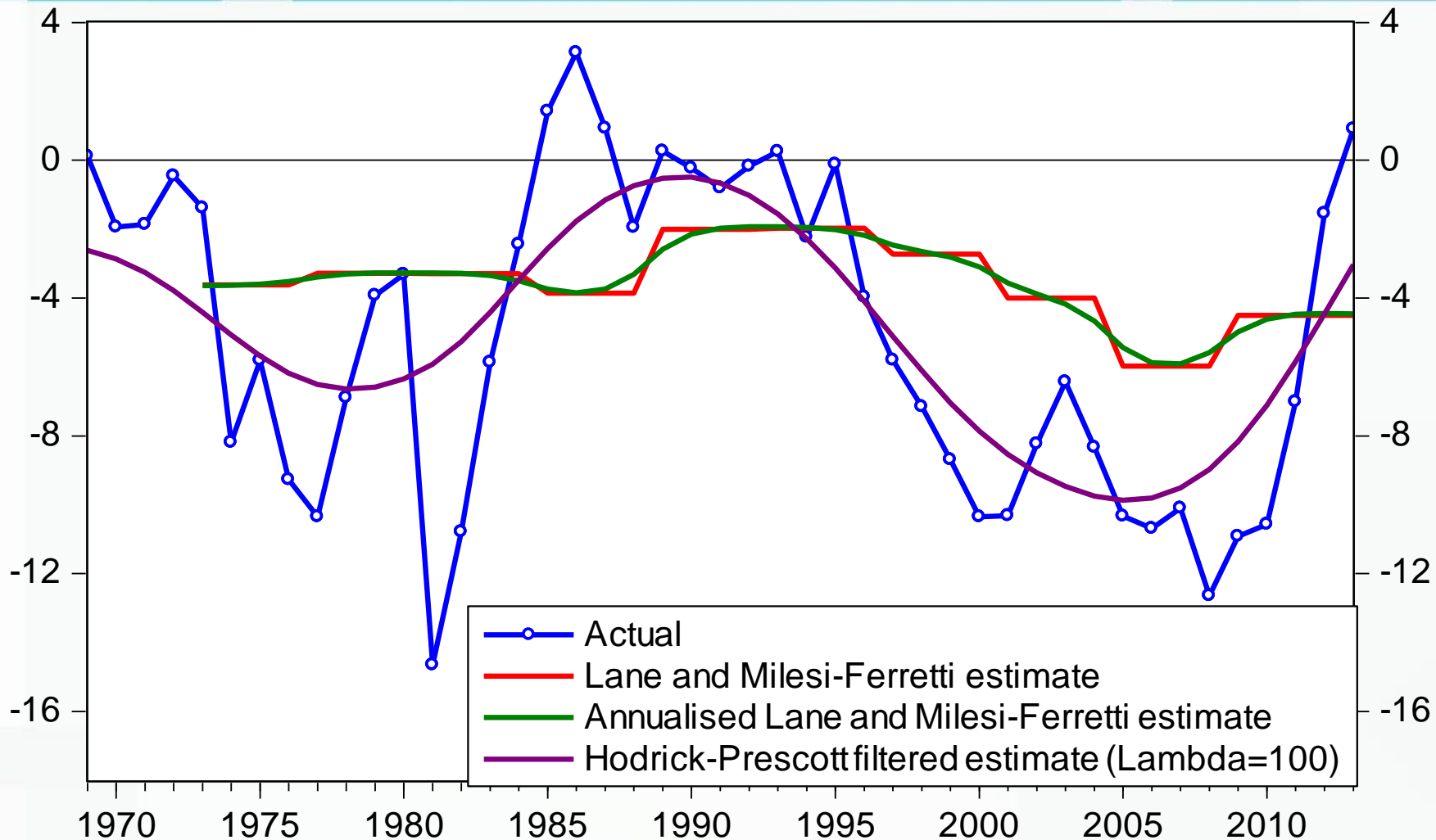
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Note: the Lane and Milesi-Ferretti estimate is available up to 2008 for 4-year long periods; for 2009-2013 we have updated it on the basis of IMF estimates, which is a source of error

Portugal - actual and estimated equilibrium current account balance (% GDP), 1969-2013

Note: the Lane and Milesi-Ferretti estimate is available up to 2008 for 4-year long periods; for 2009-2013 we have updated it on the basis of IMF estimates, which is a source of error

- **Open economy considerations:**
  - In the short-run, foreign output-gap matters for the trade balance
  - In the short-run, real exchange rate disequilibrium matters for both inflation and the trade balance

- **The economic model (observation equations of the state-space representation):**

$$\pi_t = \beta_0 + \beta(L)\pi_t + \beta_{gap}(y_t - \bar{y}_t) - \beta_{rer}(r_t - \bar{r}_t)$$

$$\tau_t - \bar{\tau}_t = \gamma_0 - \gamma_{gap}(y_t - \bar{y}_t) + \gamma_{wgap}(y_t^{(w)} - \bar{y}_t^{(w)}) - \gamma(L)(r_t - \bar{r}_t)$$

where

π_t inflation rate

τ_t current account balance/GDP; $\bar{\tau}_t$ is its intertemporal optimum

y_t log of GDP; $\bar{y}_t$ sustainable output

r_t log of real exchange rate; $\bar{r}_t$ equilibrium real exchange rate

$\rightarrow$ Note: verticality of the long-term Phillips-curve: $\beta(1)=1$ & $\beta_0=0$

Data

- Constant price GDP

- Consumer prices

- Current account (% GDP) – deviation from Lane and Milesi-Ferretti (2012) estimates for the equilibrium current account position

- CPI-based real effective exchange rate (against 67 trading partners)

- World demand: weighted average of constant price GDP of 67 countries

- Some practical questions:

  - What measure of foreign output-gap? (perhaps Phillips-curve, as trading partners are dominated by large and less open economies)

  - What measure of real exchange rate disequilibrium? (Currently: Hodrick-Prescott cycle with standard smoothing parameter)

Data – a potential handicap

- We use the actual inflation rate in Phillips-curve
- But many of our countries were converging in terms of GDP per capita: this implies a convergence in price levels (Balassa-Samuelson effect), which translates into a higher inflation – an equilibrium phenomenon

- Possible solution: relate equilibrium inflation to the difference in potential output growth relative to potential growth of trading partners (not yet done)

Estimation

- State-space representation
- Kalman−filter for inference on latent variables and parameters (ML/QML estimation)

Countries

- **Euro area periphery:** Greece, Ireland, Portugal, Spain

- **New EU members:** Hungary, Latvia

- **Industrial countries with floating exchange rate:** Australia, Canada

- **An emerging country:** Mexico

- In this presentation we report detailed results for the euro-area periphery

Estimated parameters

Estimated parameters

- Correct signs & statistical significance
  - → Most of the structural point estimates of β-s and γ-s are correctly signed and significant
- Magnitudes are interpretable in economic terms
  - → $\beta(\text{gap})$ in the Phillips-curve tends to be lower than published estimates for the US and EMU
  - → Verticality of the long-run Phillips-curve
  - → Real exchange rate tends to be more important for smaller countries
- In smaller countries, the trade balance is more important than the Phillips-curve in identifying the cycle
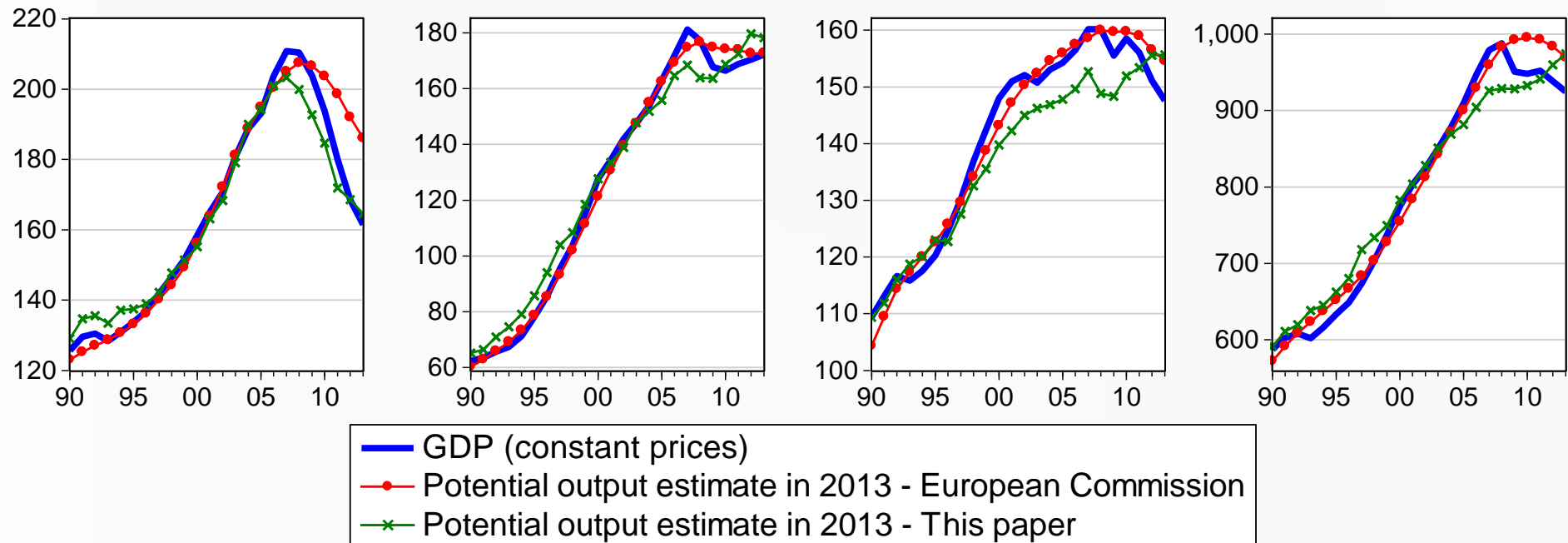- Cycles tend to be more volatile in smaller countries

Greece — **Ireland** — **Portugal** — **Spain**

Legend:
- **GDP (constant prices)**
- Potential output estimate in 2013 - European Commission
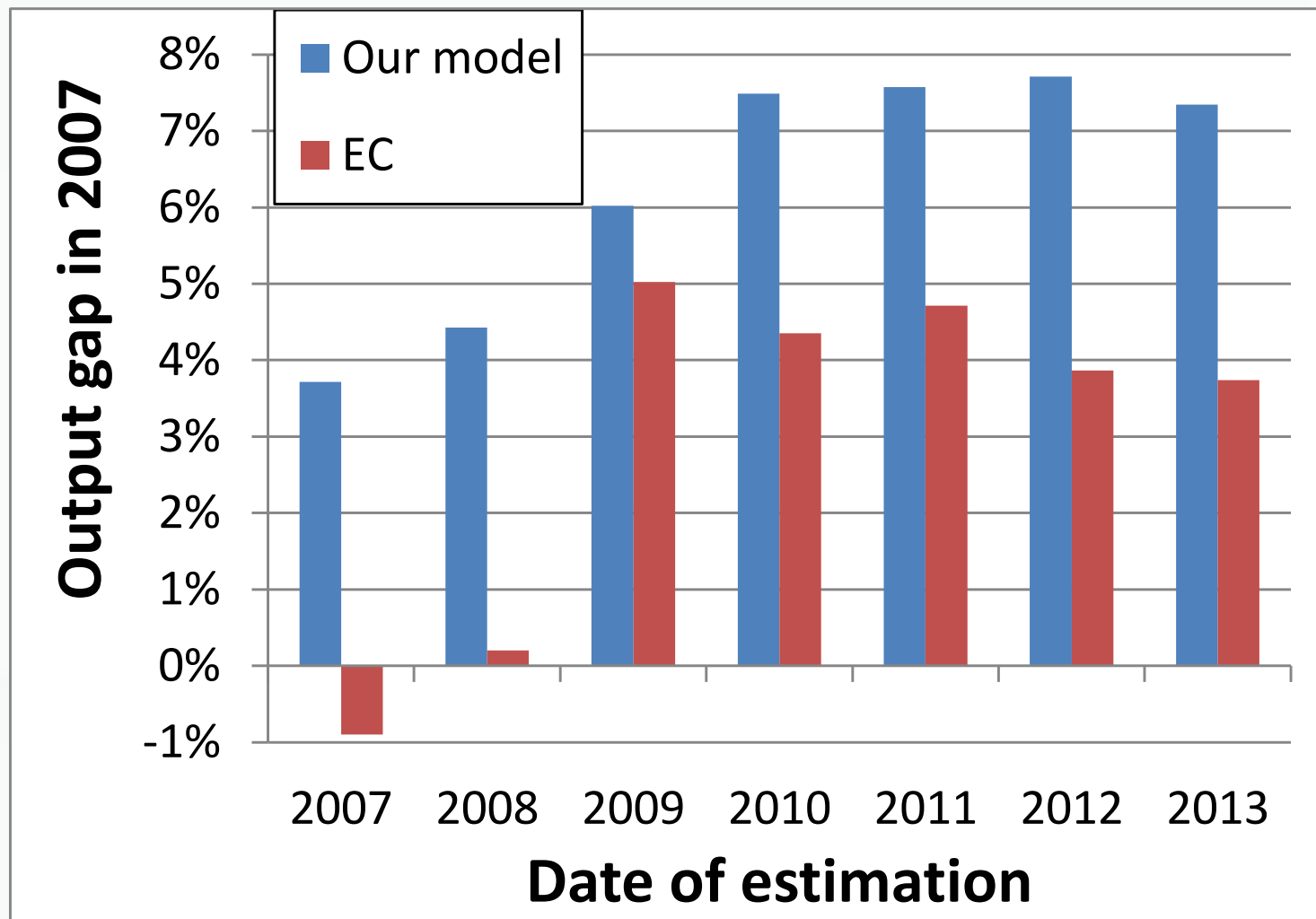- Potential output estimate in 2013 - This paper

- Before the crisis, potential output increased less according to our estimates than according to the European Commission

- Our estimates are less smooth than the Commission estimates
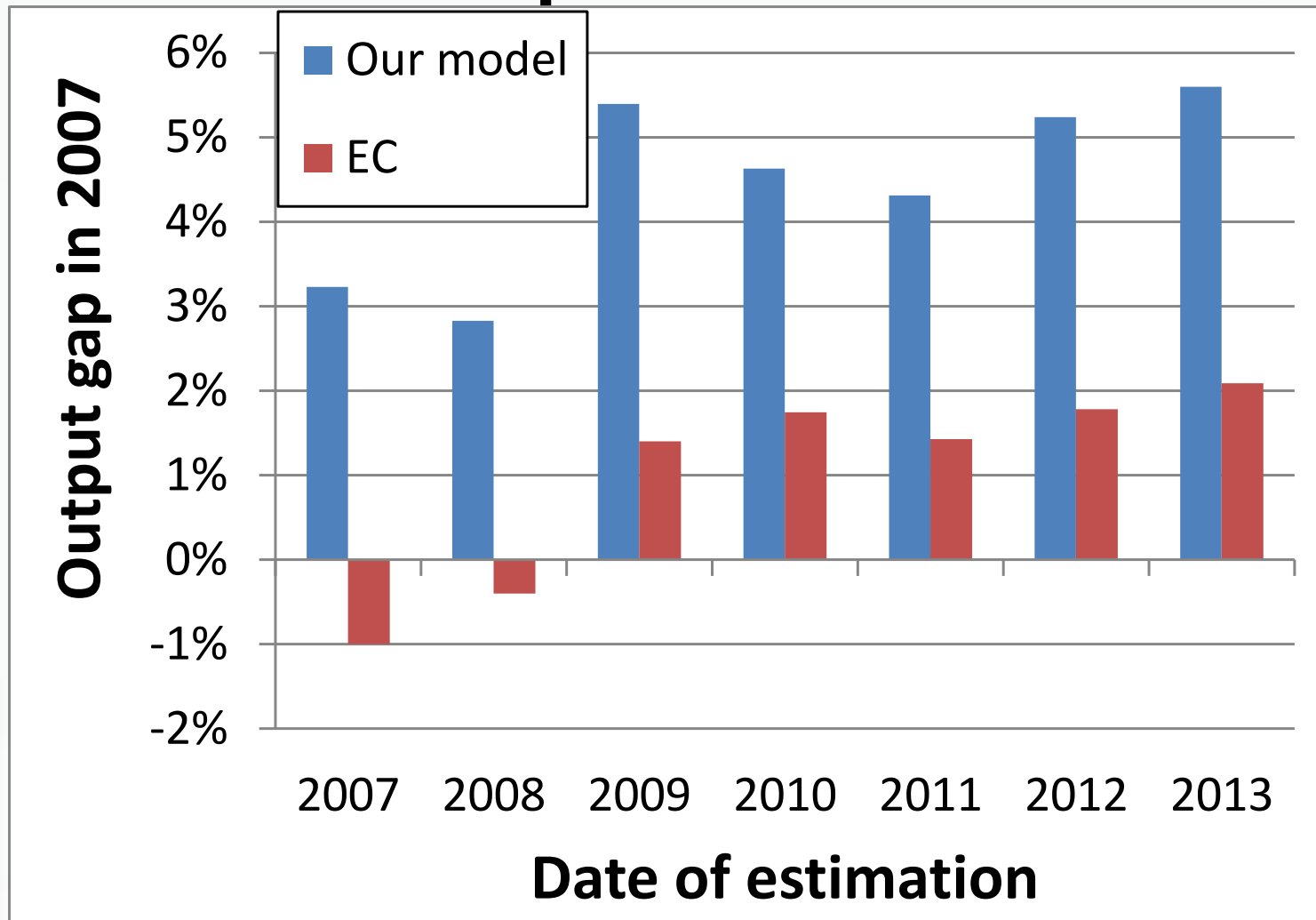
Ireland

Spain

Greece
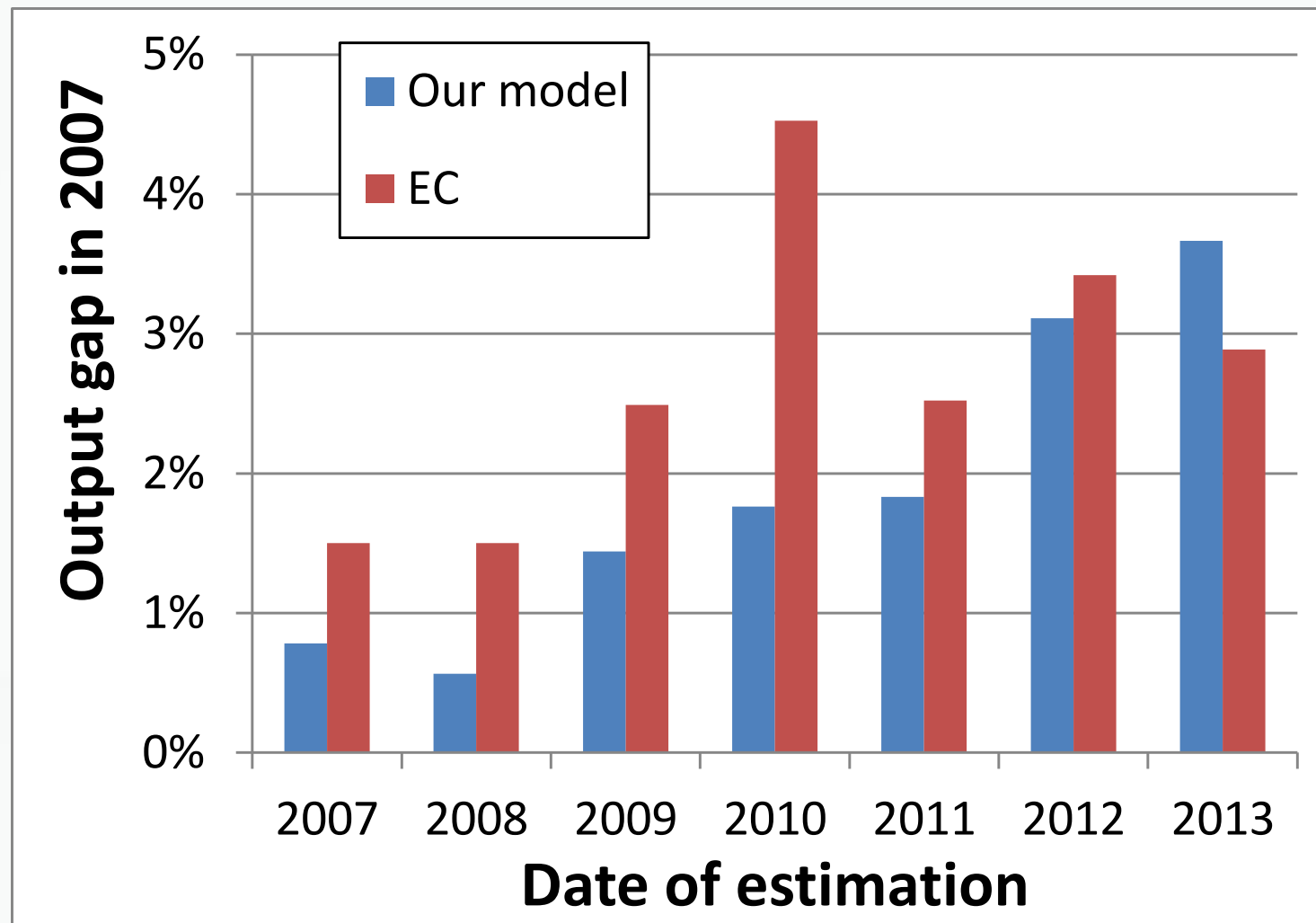
Portugal
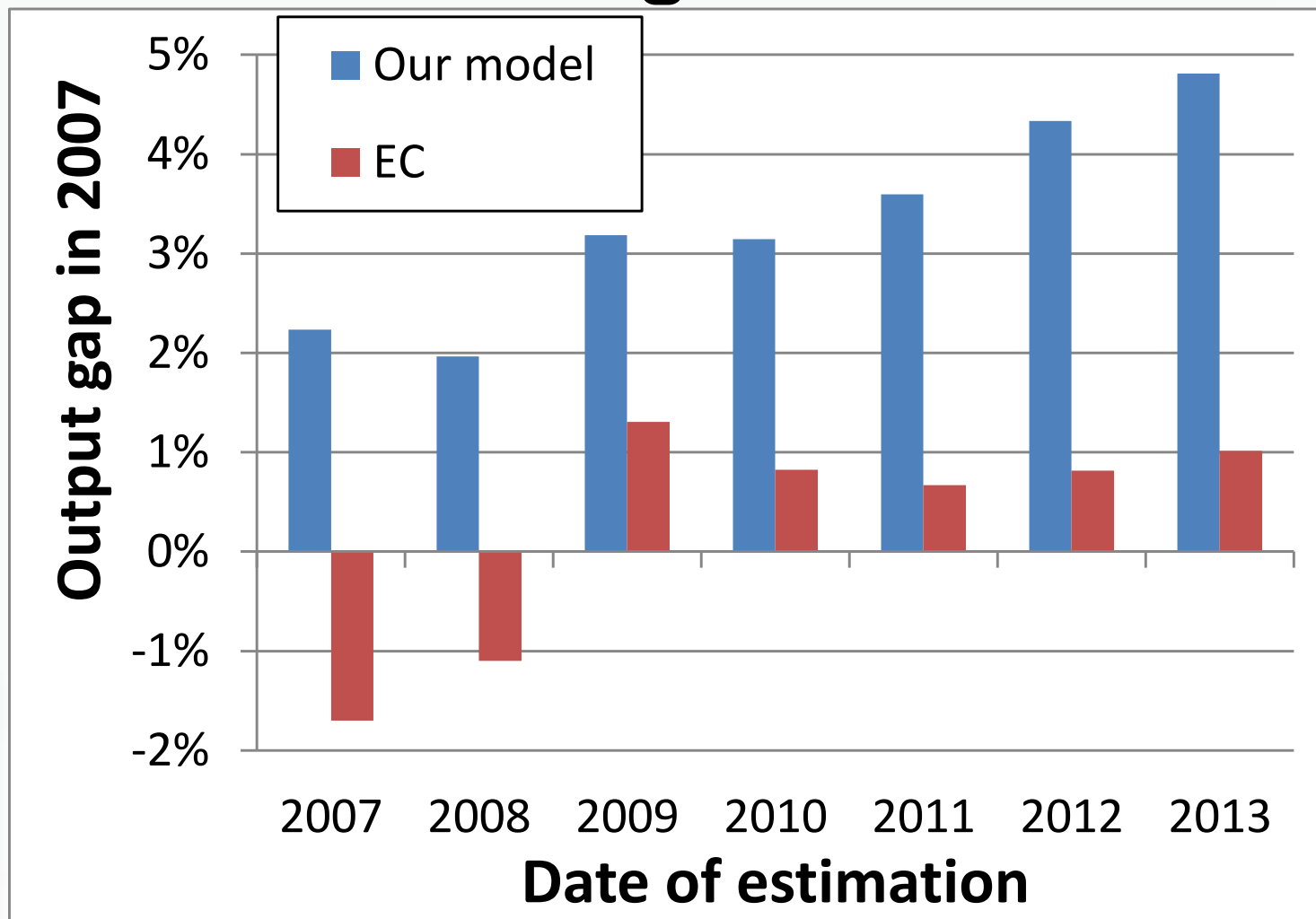
- **Potential output methodology used by the European Union has major shortcomings:**

  - Conceptual 1: the treatment of labour, capital, productivity

  - Conceptual 2: disregarding a major manifestation of excess demand, ie its impact on the external balance

  - Practical 1: NAWRU follows the trend of the unemployment rate and were revised significantly for the past when the trend changed

  - Practical 2: Output gap estimates were also revised significantly for the past

  - Implications for policy: EU's fiscal governance

- **Our alternative approach:**

  - Do not use the production function

  - Recognise that foreign supply can fill the gap between demand and supply in the tradable sector, but not in the non-tradable sector

  - A Phillips-curve cannot capture this phenomenon, so we use a structural model incorporating both a Phillips curve and a current account equation

- **Our approach is conceptually intuitive, but has practical problems:**

  - Which measure of equilibrium current account?

  - Which measure of inflation?

- **Our results so far are encouraging:**

  - Parameter estimates

  - Better identifying the sign of output gap in real time, though our results are also subject to revisions

Future work

- **Work is on-going:**
  - Extend the Lane and Milesi-Ferretti (2012) estimates for 2009-2013 so that the equilibrium current account estimates come from a single model
  - Possibly: Estimate the equilibrium net International Investment Position and derive equilibrium CA balance from it
  - Incorporate the Balassa-Samuelson effect
  - Find an estimate for the real exchange rate equilibrium (and thereby remove the use of the Hodrick-Prescott filter)
  - Study detailed results for other countries
  - Do truly real-time estimates: currently, for the 2007 vintage of our estimate we simply estimate the model up to 2007 on currently available data. A truly real time estimate should be based on data available in 2007: this is feasible, because the IMF World Economic Outlook databases are available for earlier years as well