



The post-2007 Developments in the Italian Economy and the Impact of Adverse Shocks: A Quantitative Analysis with the ITEM Model

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The issues of the presentation

- The Italian Treasury Econometric Model (ITEM) has been re-estimated in light of the new European System of Accounts (ESA 2010) and the need to enlarge the sample with the more recent data
- Preliminary to this, a counterfactual exercise had been conducted to appraise the performance of the old version of the model in reproducing the post-2007 developments in the Italian economy
- Indeed, to receive feedbacks for the re-estimation work, we investigated if and how the great recession has induced structural changes in the relationships among variables in the model's equations
- For the new version of ITEM, we draw special attention to changes in the model's properties. We document the dynamic responses of output and other variables to major exogenous shocks, including the fiscal ones

ITEM and the Great Recession: a Counterfactual Exercise (I)

- Strategy: use ITEM to simulate the path of GDP under the counterfactual scenario of setting the exogenous variables since 2007 at the values envisaged in the forecast scenarios of early 2007, just before the crisis erupted. Then, compare these results with the simulation outcome of the «factual» scenario, where exogenous variables are set at actual values
- Preview of the results: 1) large discrepancies between the GDP path simulated in the counterfactual scenario and that simulated in the «factual» scenario with the observed values of the exogenous variables
2) the path of GDP simulated in the «factual» scenario does not diverge significantly from the actual path of GDP
- Overall, the performance of ITEM in reproducing the post-2007 developments of the Italian economy has been satisfactory. Forecasts errors mostly reflect the assumptions on the path of exogenous variables

THE PATH OF THE EXOGENOUS VARIABLES DURING THE GREAT RECESSION

Difference in the rate of percentage change between the observed values of the exogenous variables and the corresponding forecasts as of 2007

		2007	2008	2009	2010	2011	2012	2013	2014
<u>External Enviroment</u>									
	World Trade	-0,6	-5,3	-16,5	4,0	-0,8	-4,8	-3,8	-0,4
	Manufacturing price	-0,1	1,5	-5,2	3,2	3,5	2,6	-3,9	-1,3
	Prices of Raw materials	0,8	-5,1	-1,0	2,8	0,8	1,0	1,7	-0,2
<u>Financial condition</u>									
	Exchange rate	-3,1	-8,9	2,7	3,5	-6,1	7,7	-3,2	0,0
	Bund 10 years*	0,0	-0,5	-1,3	-1,9	-2,1	-3,3	-3,2	-3,5
	Euribor 3 months*	0,4	0,4	-3,0	-3,4	-2,9	-3,7	-4,0	-4,0
	Spread Btp-Bund*	-0,1	0,3	0,7	0,9	2,4	3,6	2,4	1,3
	Financial Wealth - revaluation rate*	-0,8	-1,1	-0,2	0,2	0,1	-0,2	-0,2	-0,2
<u>Fiscal consolidation</u>									
	Fiscal Stance - Expenditure side	1,2	1,8	2,3	-2,2	-3,4	-3,2	-0,8	1,0
	Fiscal Stance - Tax revenue side	1,6	-3,3	-3,0	2,9	0,2	4,9	-0,3	0,3
<u>Structural TFP</u>		-0,8	-1,5	-1,7	-1,7	-1,7	-1,7	-1,5	-1,3
* Difference in the level									



THE PATH OF GDP DURING THE GREAT RECESSION: ACTUAL VALUES AND VALUES SIMULATED UNDER TWO SCENARIOS

Percentage deviation of GDP

	2007	2008	2009	2010	2011	2012	2013	2014
Difference between the observed values and the values simulated with the exogenous variables as of the forecast scenarios of 2007	0.1	-1.0	-7.8	-6.2	-6.8	-10.9	-14.8	-17.3
Difference between the values simulated with the exogenous variables as of the forecast scenarios of 2007 and the values simulated with the actual exogenous variables (Impact of revising the exogenous variables)	0.2	1.6	5.9	5.0	5.7	9.4	14.9	18.1
Difference between the observed values and those simulated with the actual exogenous variables	0.3	0.6	-1.9	-1.2	-1.1	-1.5	0.1	0.8



ITEM and the Great Recession: a Counterfactual Exercise (II)

- The exercise also allows us to assess the specific contribution of each exogenous variable to shape the Great recession scenario
- The post-2007 recession has been driven by different shocks. In ITEM these shocks pertain to the exogenous variables and their size amounts to the divergence between the values observed ex-post for each exogenous variable and those envisaged ex-ante in the forecasts before the crisis
- On the other hand, the model does not capture possible nonlinear effects due to amplification mechanisms induced by the simultaneity of the shocks



THE CONTRIBUTION OF EACH EXOGENOUS VARIABLE TO THE CHANGE OF GDP

Percentage deviation of GDP with respect to the simulation where *a//* the exogenous variables are set at the values forecasted in 2007

		2007	2008	2009	2010	2011	2012	2013	2014
<u>External Enviroment</u>									
	World Trade	-0.1	-1.3	-5.6	-4.1	-3.1	-3.2	-3.2	-2.3
	Manufacturing price	0.1	1.3	0.5	-0.3	0.5	1.1	0.9	0.0
	Commodity prices	0.0	-0.2	-0.1	-0.2	-0.3	-0.4	-0.4	-0.3
<u>Financial conditions</u>									
	Exchange rate	-0.1	-0.8	-0.7	-0.2	0.3	1.1	0.7	0.4
	Bund 10 years	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.5	-0.7
	Euribor 3 months	-0.1	-0.3	0.3	2.3	2.6	2.2	2.0	1.3
	Spread Btp-Bund	0.0	0.0	-0.2	-0.7	-1.1	-2.5	-4.4	-4.8
	Financial Wealth - revaluation rate	0.0	-0.2	-0.5	-0.7	-0.8	-0.7	-0.5	-0.4
<u>Fiscal consolidation</u>									
	Fiscal Stance - Expenditure side	0.2	0.4	1.0	0.5	-0.4	-1.5	-1.9	-1.7
	Fiscal Stance - Tax revenue side	-0.2	-0.2	0.5	0.8	0.7	0.3	-0.4	-0.8
<u>Structural TFP</u>		0.0	-0.3	-1.1	-2.3	-3.9	-5.5	-7.2	-8.8
Total		-0.2	-1.6	-5.9	-5.0	-5.7	-9.4	-14.9	-18.1



ITEM and the Great Recession: a Counterfactual Exercise (III)

- The exercise points to the following main results (see shaded areas in previous table)
- The sharp fall in world demand in 2008-09, the post-2010 shocks to financial conditions in coincidence with the sovereign crisis and the severe post-2010 fiscal contraction account for a large fraction of the GDP drop
- Another relevant driver of the GDP contraction is the fall in the trend component of TFP

A possible amplification of the effects of the shocks due to their impact on the trend of the economy (I)

- In the ITEM model, a distinction is drawn between actual TFP and structural TFP. The latter seeks to capture technical progress and innovation and is measured by the trend component of TFP obtained through the HP filter. The TFP gap reflects cyclical forces
- This trend component of TFP is exogenous. Thus, in our exercise, its drop contributes to shape the post-2007 recessive scenario. This fall has been largely unpredictable also for international institutions (e.g. EU, OECD) and has fuelled an intense debate
- We know how deep recessions can cause persistent effects on the growth trend of the economy through a reduction of its potential output (e.g. hysteresis; see Blanchard-Summers, 1986; Summers '14; Ball, '14)

A possible amplification of the effects of the shocks due to their impact on the trend of the economy (II)

- We allowed for the possibility that, during a particularly severe recession, the adverse shocks can have additional effects through their contribution to reduce the trend of the economy
- Starting from the counterfactual scenario, we conducted simulations where we varied one exogenous variable at a time, setting its values at the ex-post, actual levels. In doing so, we assumed that such variation induces also a change in the trend component of TFP, which is instead treated as exogenous in the standard simulation
- Under this assumption, while the contribution of the falling structural TFP to explain the drop in GDP is attenuated, the contribution of the other shocks to explain the great recession is conversely amplified

THE CONTRIBUTION OF THE SHOCKS TO ALL EXOGENOUS VARIABLE TO THE CHANGE OF GDP: STANDARD CASE (SEE PREVIOUS TABLE)

Percentage deviation of GDP with respect to the simulation where *all* the exogenous variables are set at the values forecasted in 2007

	2007	2008	2009	2010	2011	2012	2013	2014
All shocks but Structural TFP	-0.2	-1.3	-4.8	-2.7	-1.8	-3.9	-7.7	-9.3
Structural TFP	0.0	-0.3	-1.1	-2.3	-3.9	-5.5	-7.2	-8.8
Total	-0.2	-1.6	-5.9	-5.0	-5.7	-9.4	-14.9	-18.1

THE CONTRIBUTION OF THE SHOCKS TO ALL EXOGENOUS VARIABLE TO THE CHANGE OF GDP UNDER THE HYPOTHESIS OF ADDITIONAL EFFECTS EXERTED ON THE TREND OF THE ECONOMY

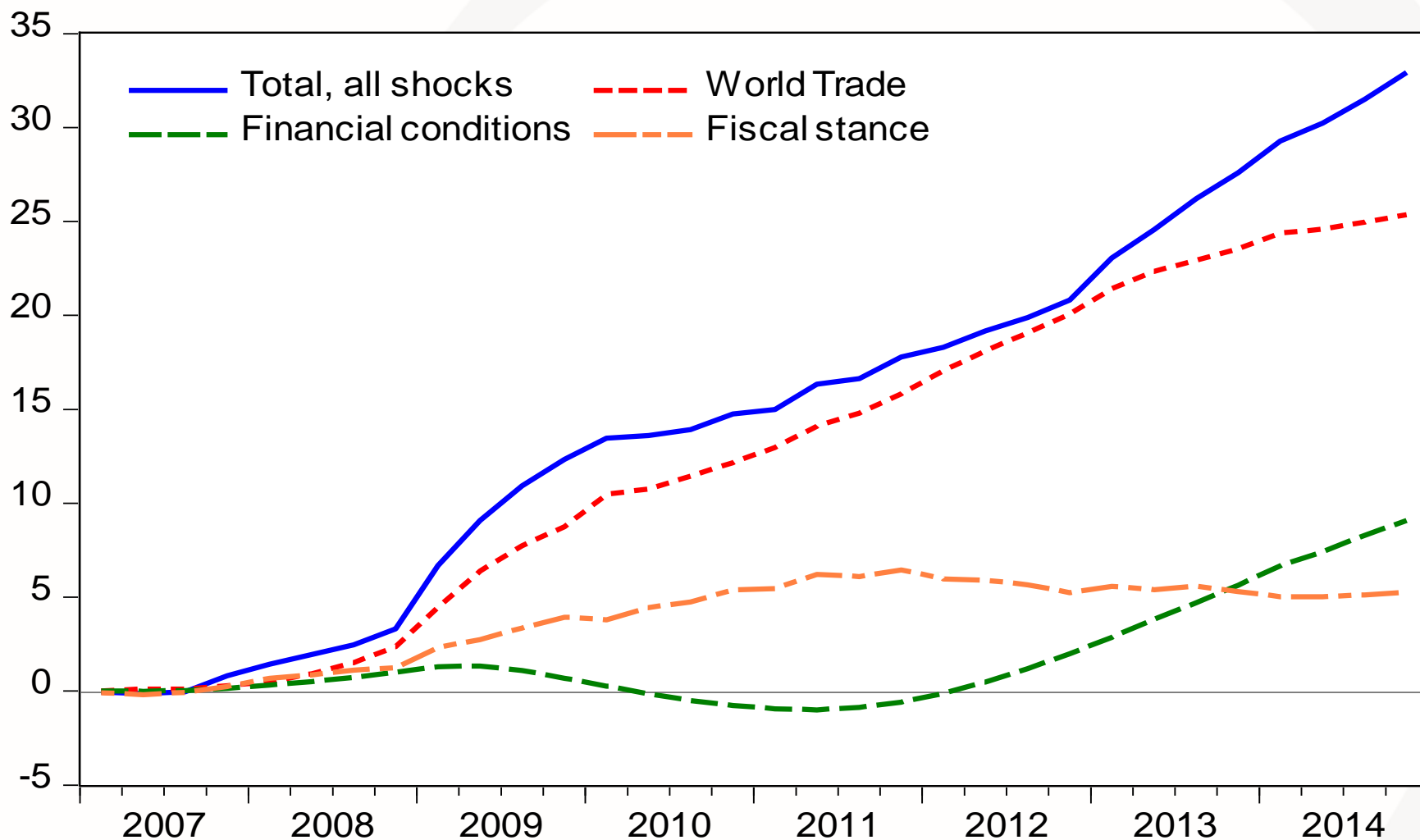
	2007	2008	2009	2010	2011	2012	2013	2014
All shocks but Structural TFP	-0.2	-1.6	-5.6	-4.1	-4.0	-6.6	-11.0	-13.1
Structural TFP	0.0	0.0	-0.3	-0.9	-1.7	-2.8	-3.9	-5.0
Total	-0.2	-1.6	-5.9	-5.0	-5.7	-9.4	-14.9	-18.1

The contribution of structural TFP to explain the drop in GDP is now scaled down while the contribution of all other shocks is amplified: in 2014 they explain 13.1 percentage points of the 18.1 points of GDP drop. Albeit reduced, the contribution from the fall of TFP is still large (5 pp in 2014). Arguably, it may also reflects factors not explicitly captured in the model, like a drop in confidence or expectations worsening

The Great Recession and the public debt-to-GDP dynamics

- The exercise also provides insights on the dynamics of the Italian public debt-to-GDP ratio and its determinants during the Great Recession
- At the end of 2014, the debt-to-GDP ratio simulated with the actual exogenous variables are about 33 percentage points above the level obtained in the counterfactual simulation using the pre-crisis forecasts for the exogenous variables
- We show that this dramatic worsening of the major indicator of public finance is primarily caused by the adverse cyclical conditions (e.g. the sharp fall in world trade, adverse financial conditions)
- By contrast, we show that the severe fiscal consolidation enacted since 2010 has contributed only to stabilize – rather than reduce – the debt-to-GDP ratio

Determinants of the public debt-to-GDP ratio during the Great recession



The update of the ITEM model

- The ITEM model has been re-estimated with the time series of national accounts constructed with the ESA 2010
- The estimation sample runs from 1996:Q1 (first period of availability for the ESA 2010 national accounts series) through 2013:Q4 (these data are deemed to be almost definitive)
- We introduced modifications in the behavioral equations in order to capture more precisely the relationships among aggregates
- To verify whether significant changes in the model's properties have taken place, we compare the dynamic impulse responses of major endogenous variables to an array of shocks, including those pertaining to public finance (on both the expenditure and the revenue side)

The re-estimation of the model

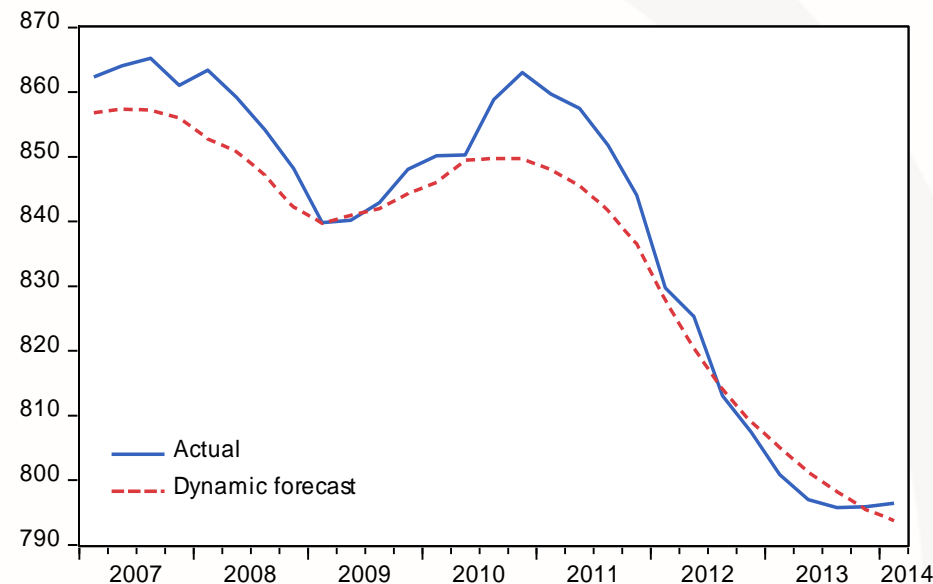
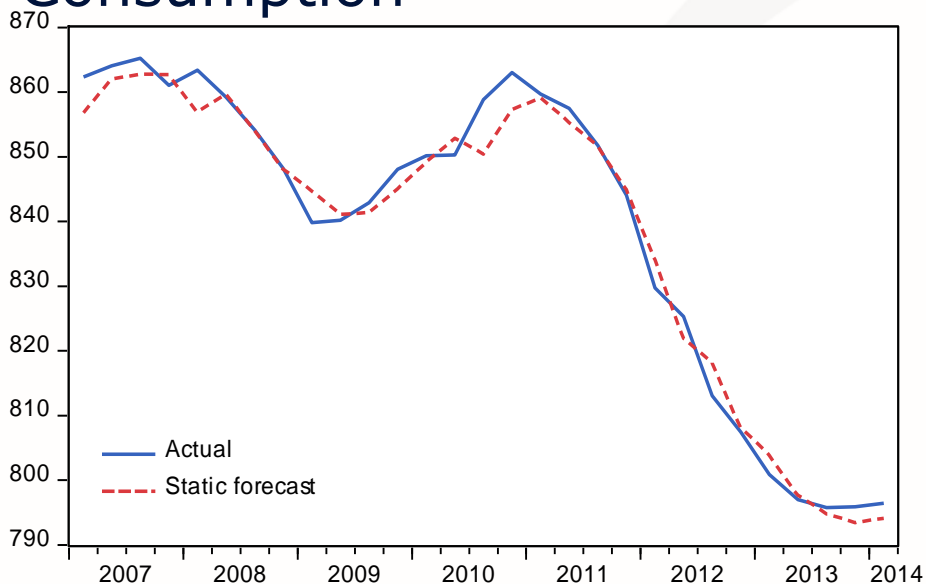
- ITEM features 41 stochastic equations, 221 identities plus a number of equations for projection
- The endogenous variables are 262, the exogenous variables are 131
- Typically, the specification of each equation features the error correction model (ECM) mechanism and allows for short-term and long-term relationships among variables
- The structure of the updated model has not been subject to major revisions (Cicinelli et al 2010)
- The model features a demand and a supply block
- The demand-side conditions are predominant in shaping the short-term dynamics while the supply-side conditions are predominant to shape the long-run developments

The re-estimation of the model

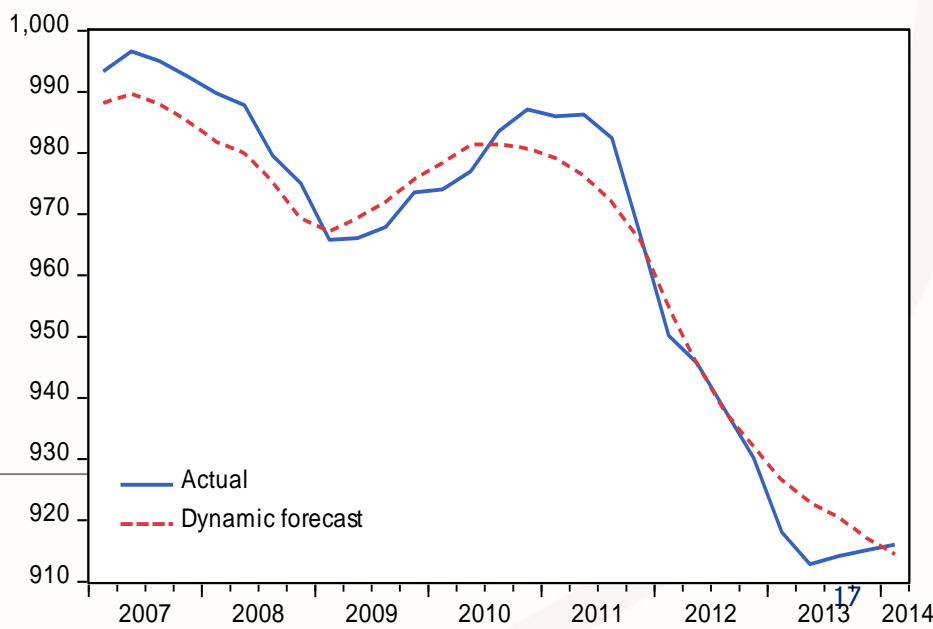
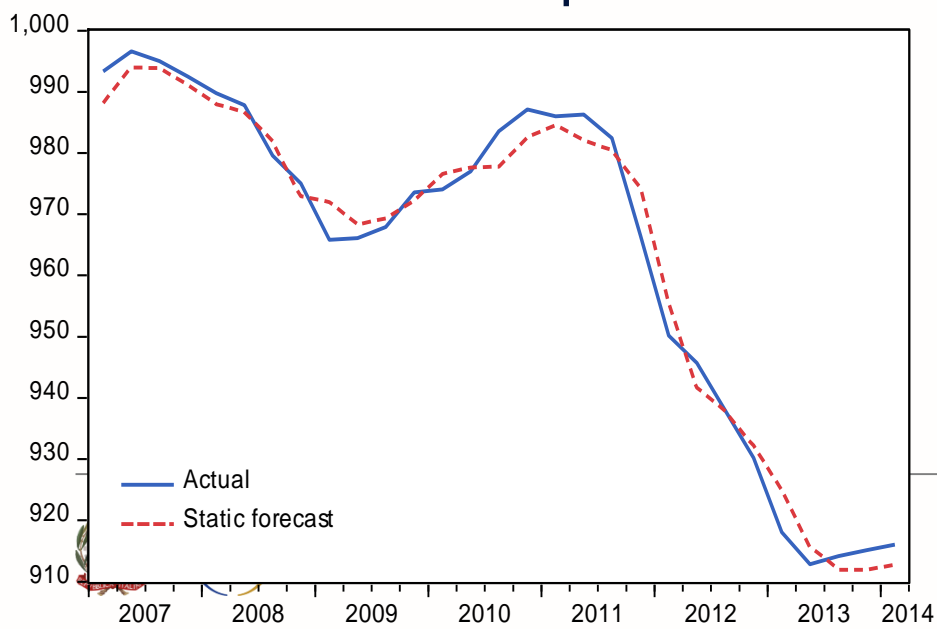
- Whilst the model ITEM exhibited a satisfactory performance in accounting for the developments associated to the great recession, the latter, however, has generated critical issues in some equations
- These critical issues have been detected in the previous version of the model also through a static and dynamic forecasting analysis at the single equation level over the period 2007:Q1 – 2014:Q1. This holds true no matter whether the old or the new time series are used
- In the re-estimation of the model, we had to revise the dynamic set-up of some equations and insert period-specific intercept terms for the post-2007 horizon through dummy variables. This aims at capturing possible breaks in the relations among variables (e.g. financial variables, price-wage block) and the pronounced volatility characterizing those years

Examples of good track with the previous model 1)

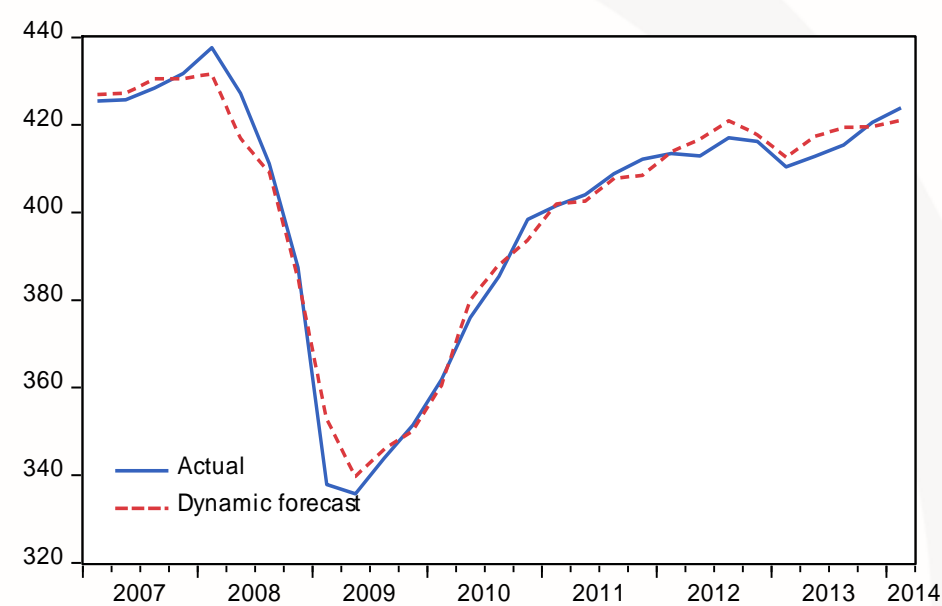
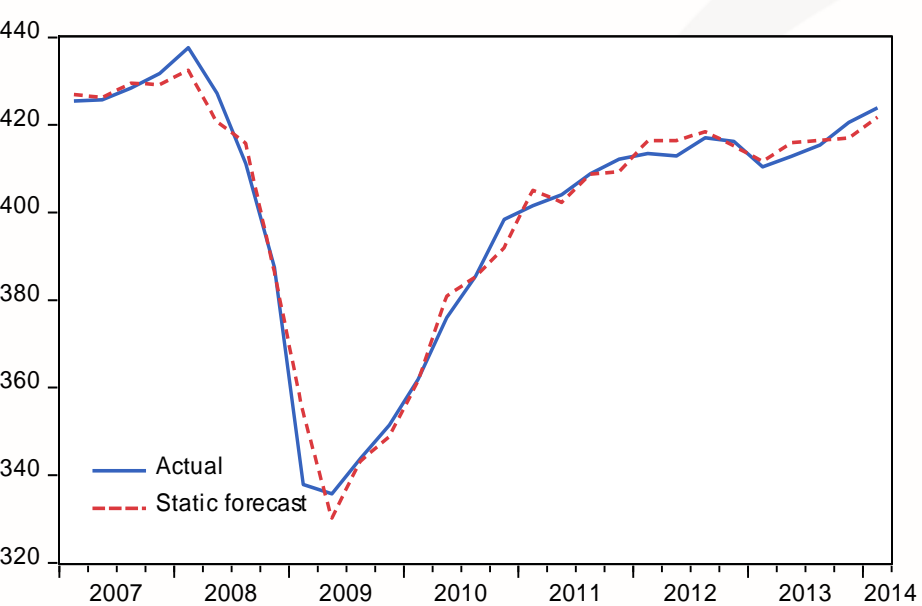
Consumption



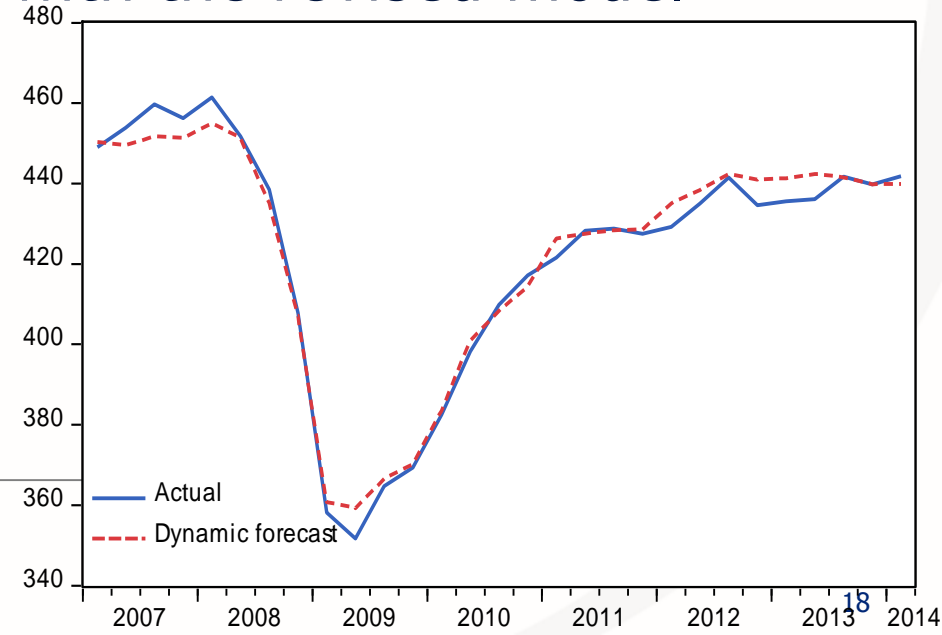
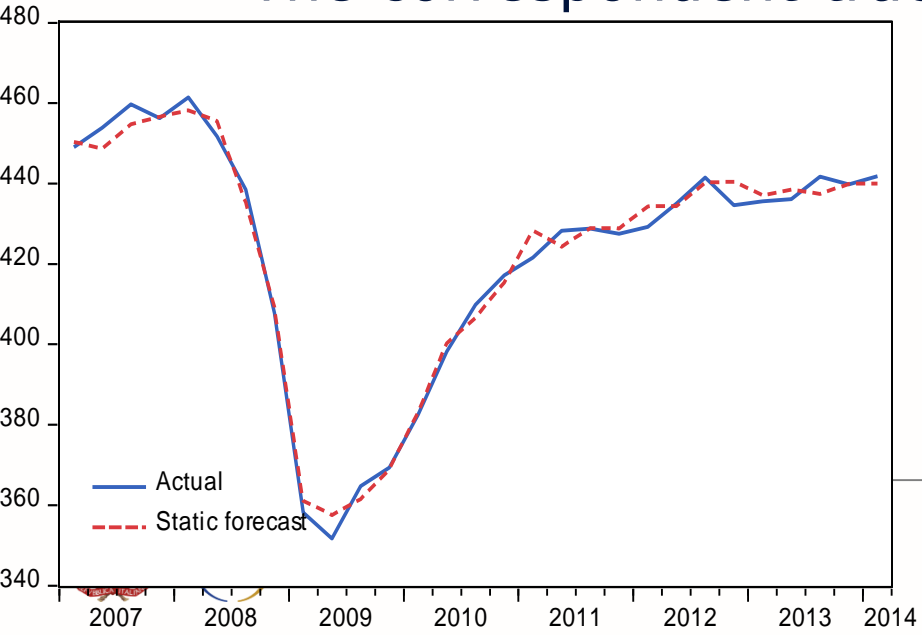
The correspondent track with the revised model



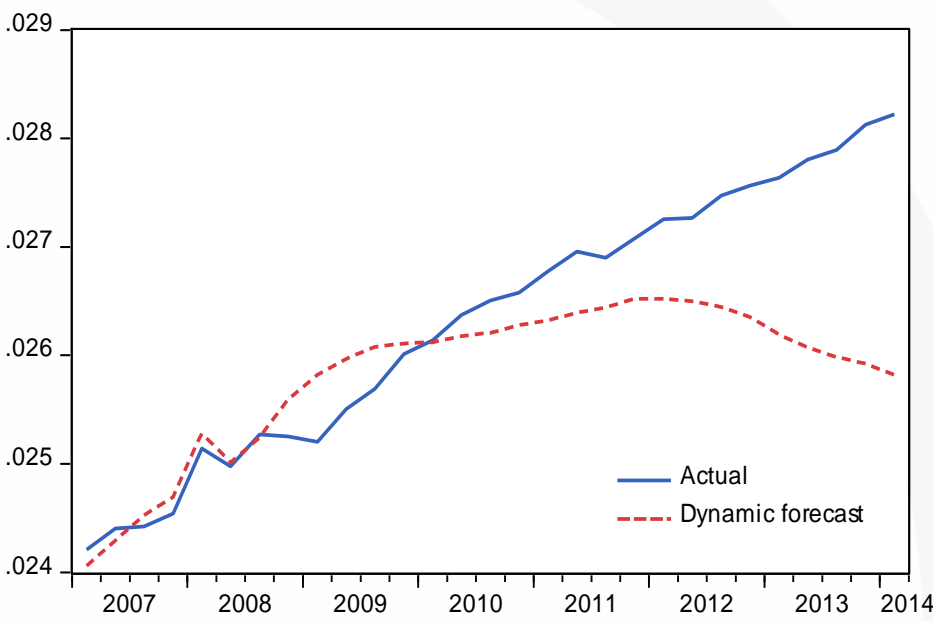
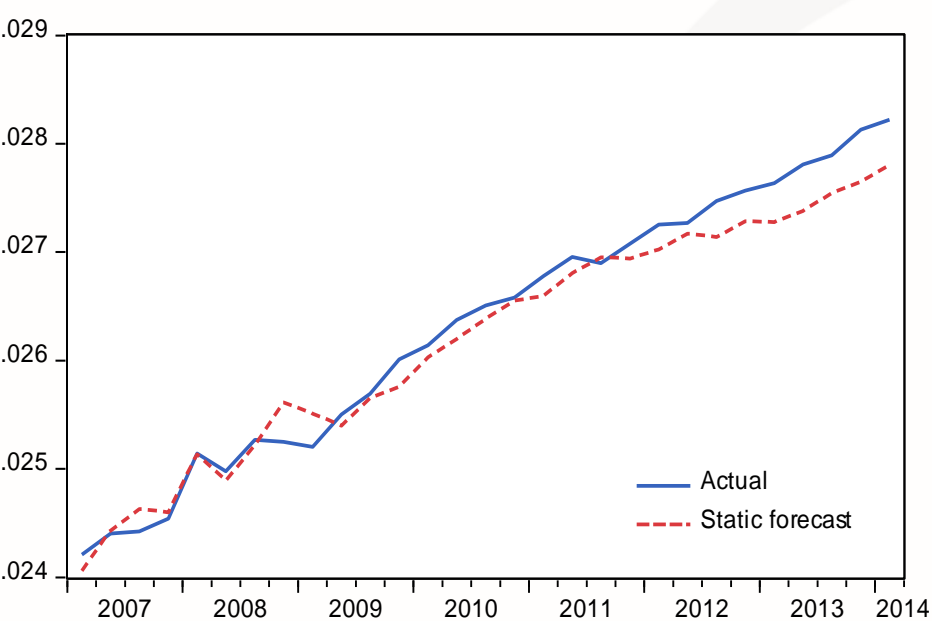
Examples of good track with the previous model 2) Export



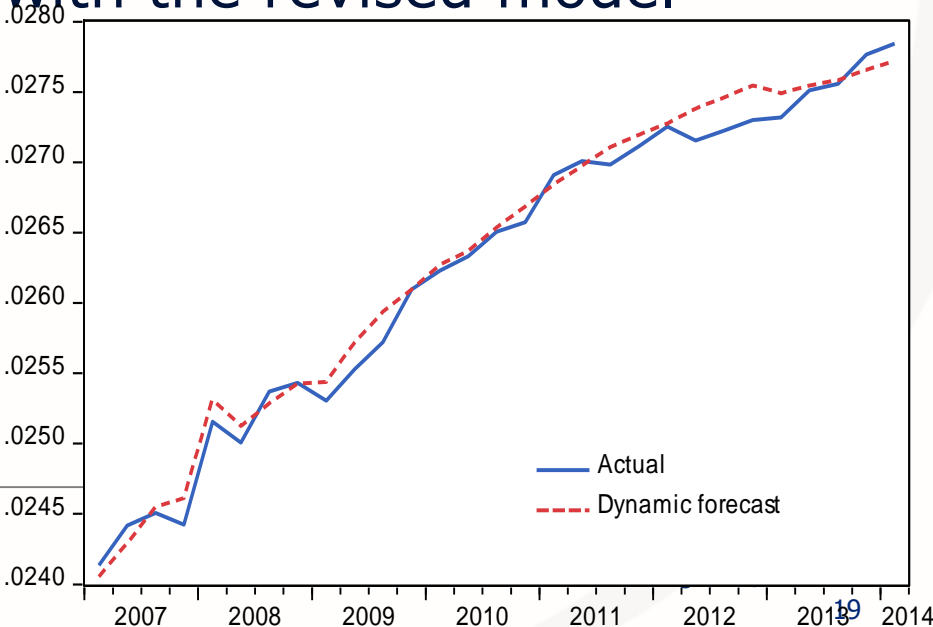
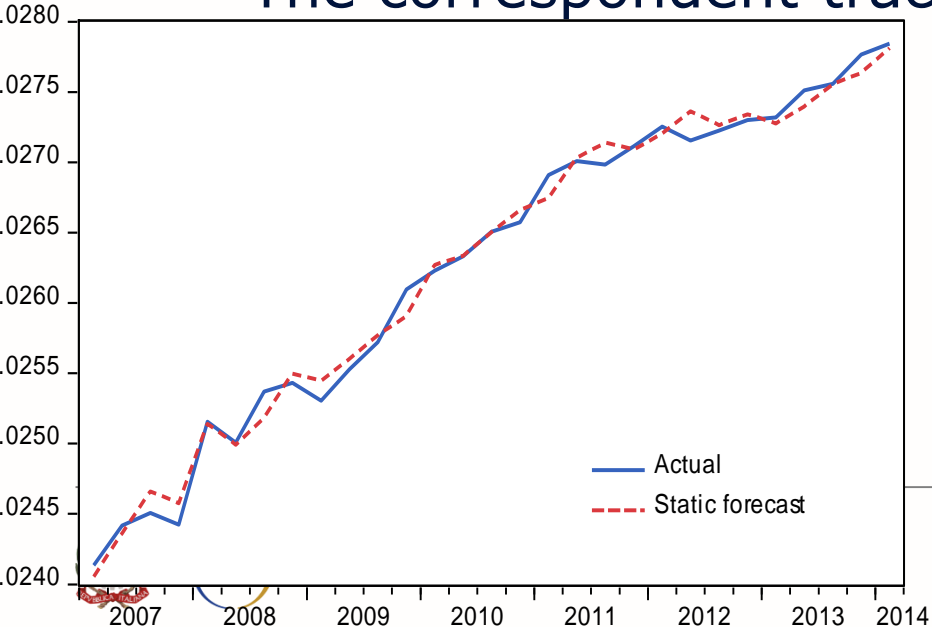
The correspondent track with the revised model



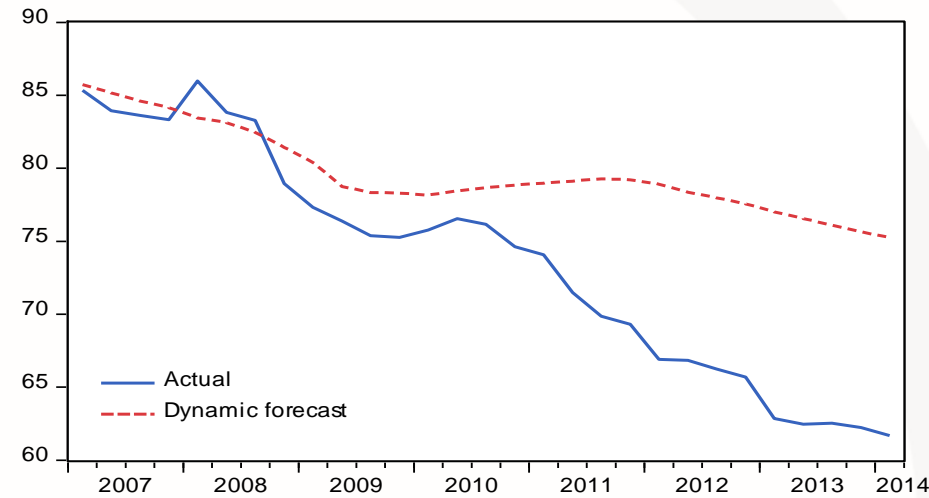
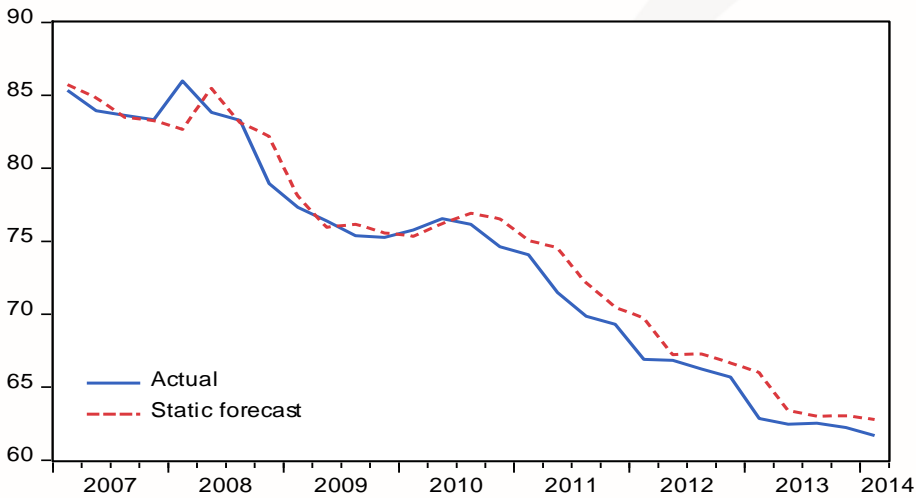
Examples of bad track with the previous model 1) Wages



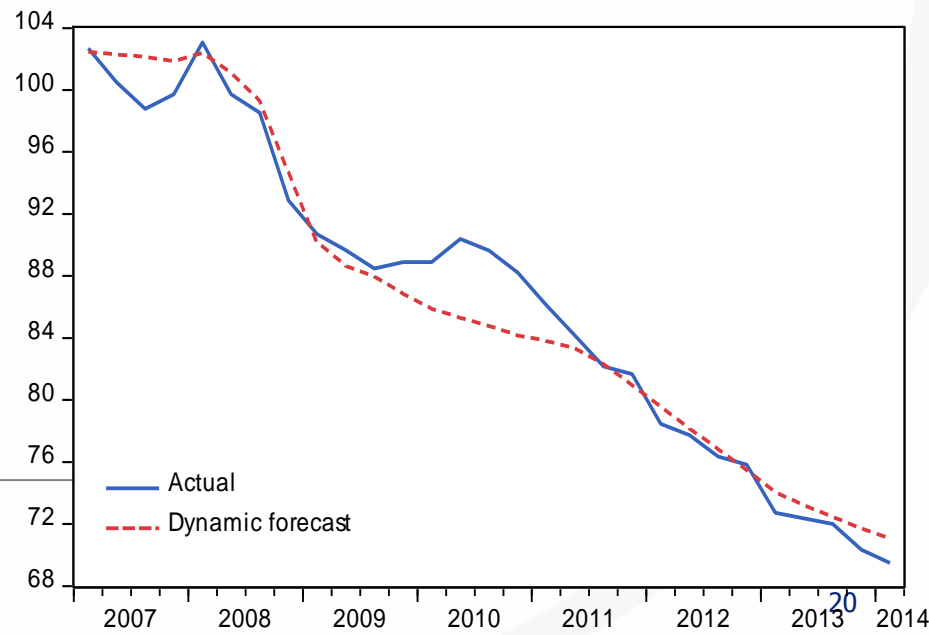
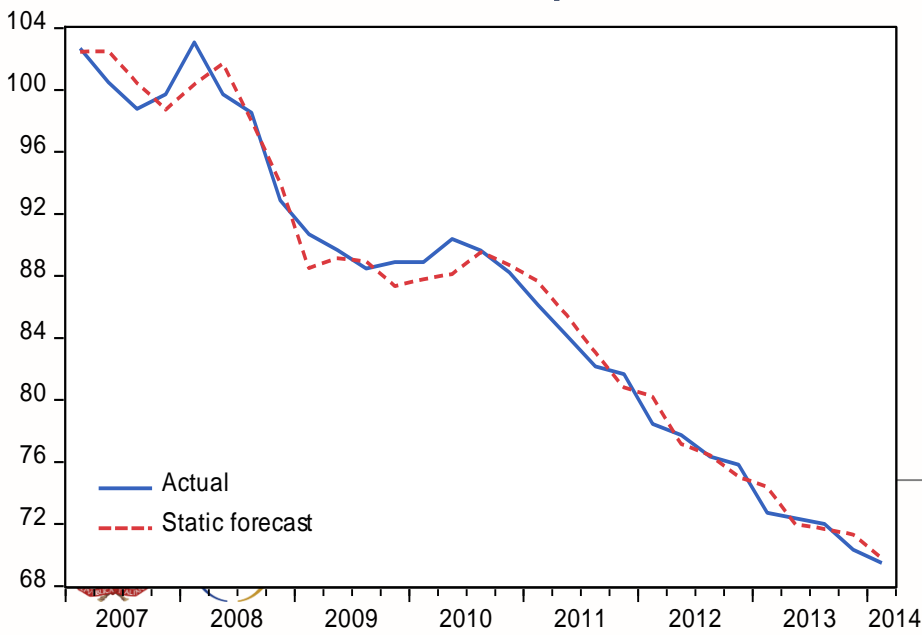
The correspondent track with the revised model



Examples of bad track with the previous model 2) investment in housing



The correspondent track with the revised model



The model's properties

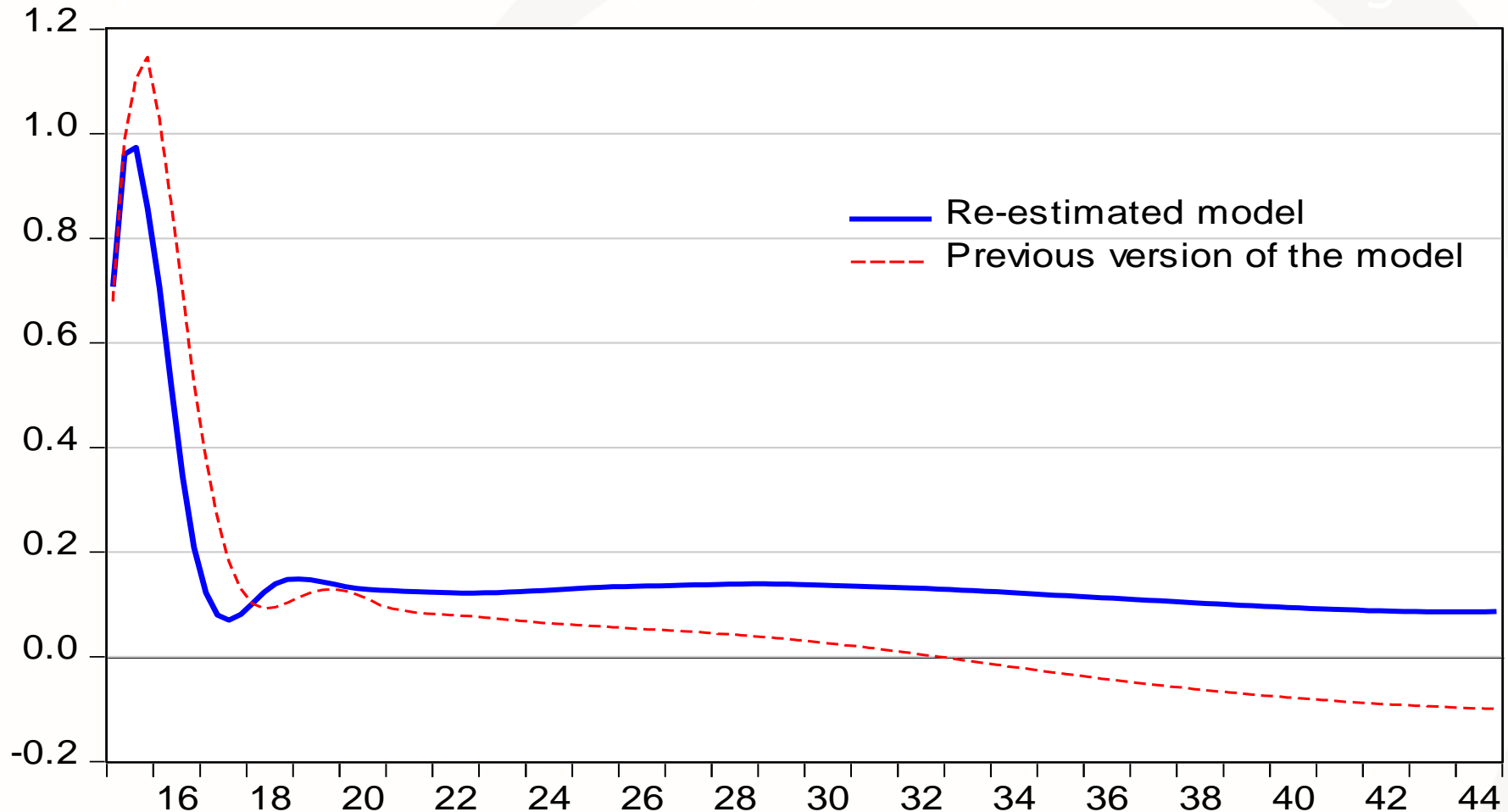
- The shocks to exogenous variables on the demand side – albeit permanent – yield effects on output only in the short run
- Conversely, the shocks to exogenous variables on the supply side yield permanent effects on output
- A number of shocks' transmission mechanisms in the model generate this type of dynamic responses to shocks
- To gauge the model's properties in a nutshell, let us examine the dynamic impulse response functions to a number of shocks
- In particular, we focus on

Two shocks on the demand side: 1) world trade; 2) Government purchases

Two shocks on the supply side: 3) Structural TFP; 4) Social security contribution rate

1) Shock to world trade (expansion)

Percentage deviation of GDP from baseline scenario

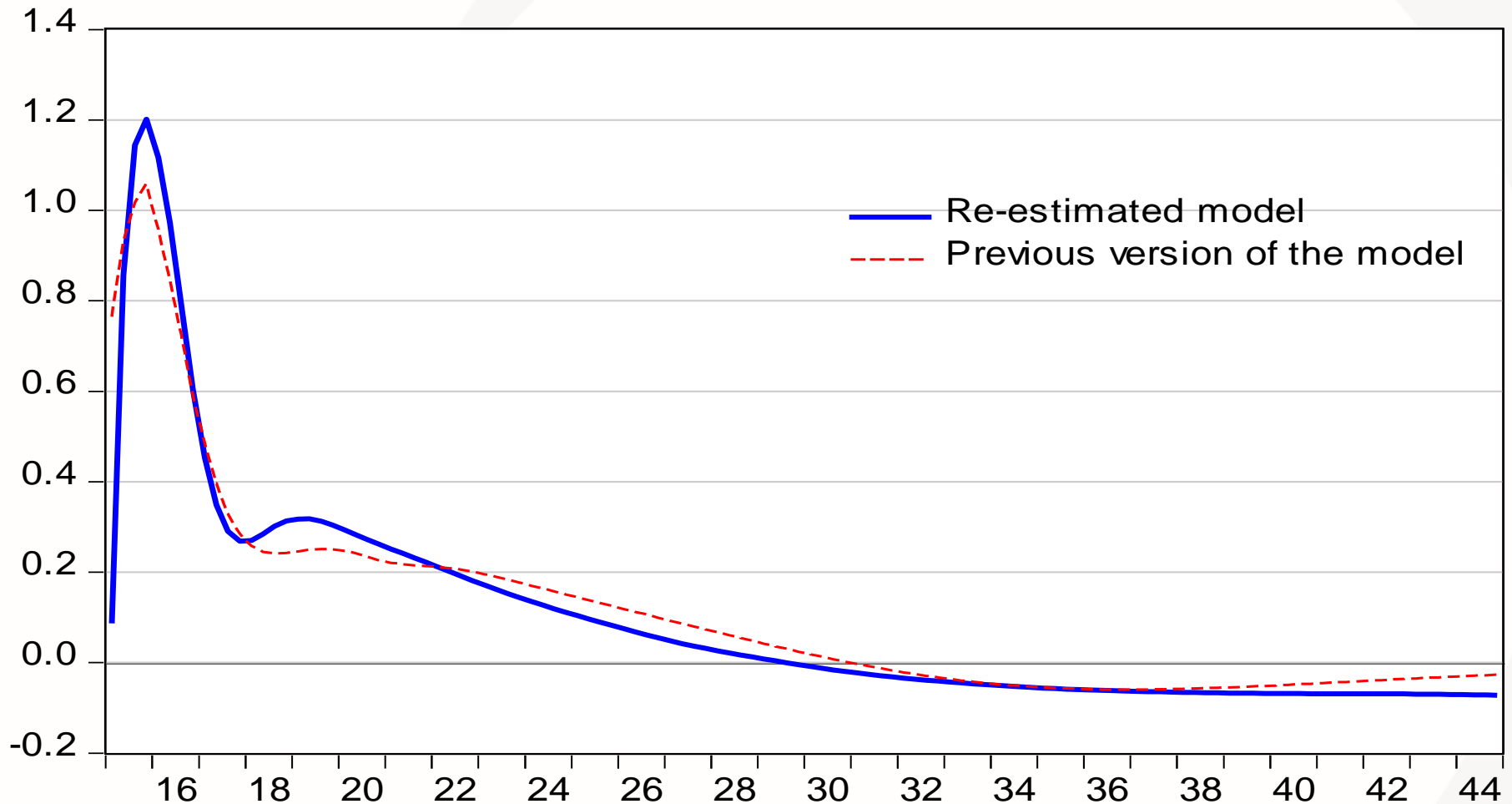


The trade-weighted indicator of world demand for Italian product has been revised. This contributes to explain the differences in the shape of the short run response



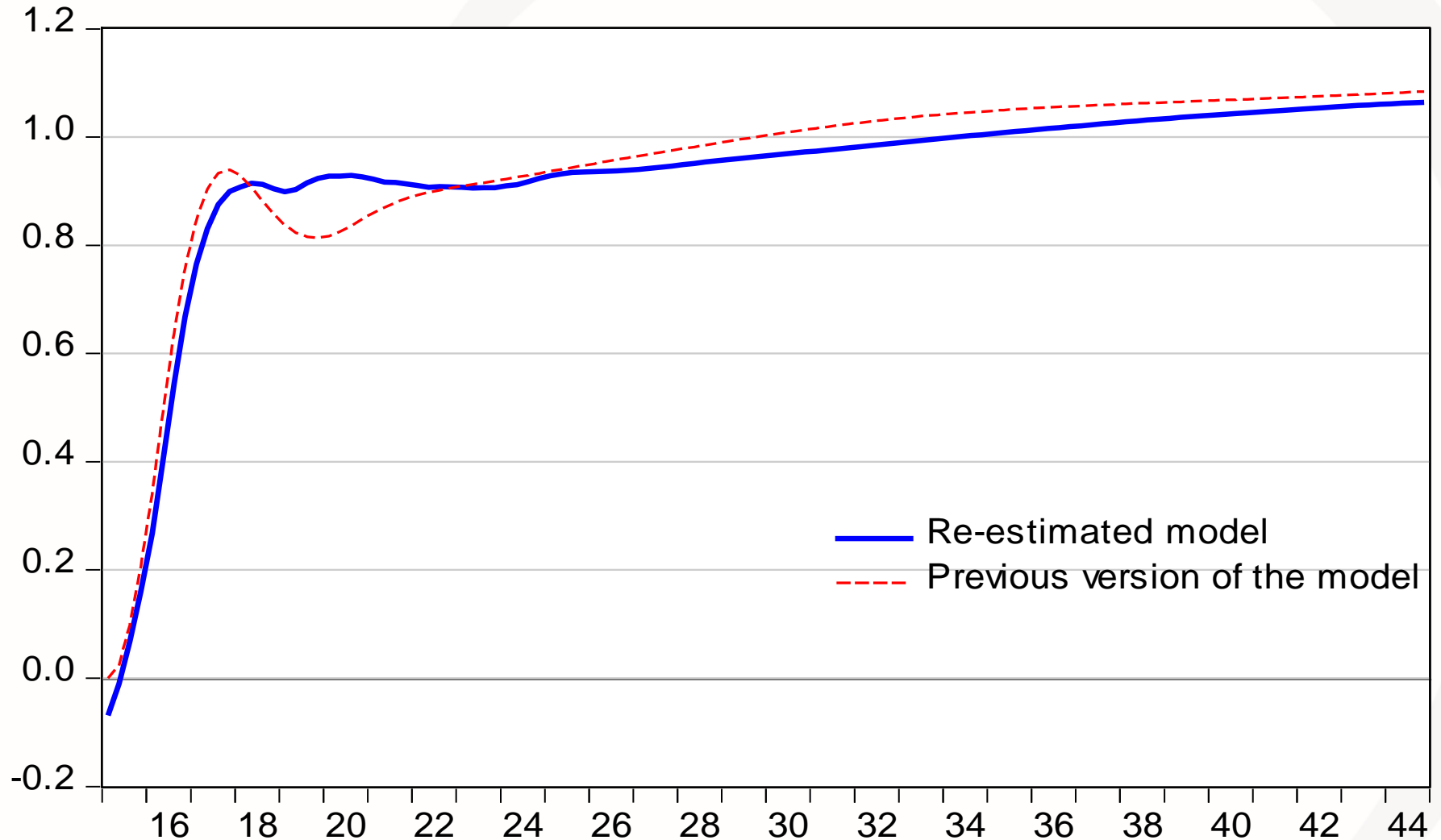
2) Shock to Government purchases (expansion)

Percentage deviation of GDP from baseline scenario

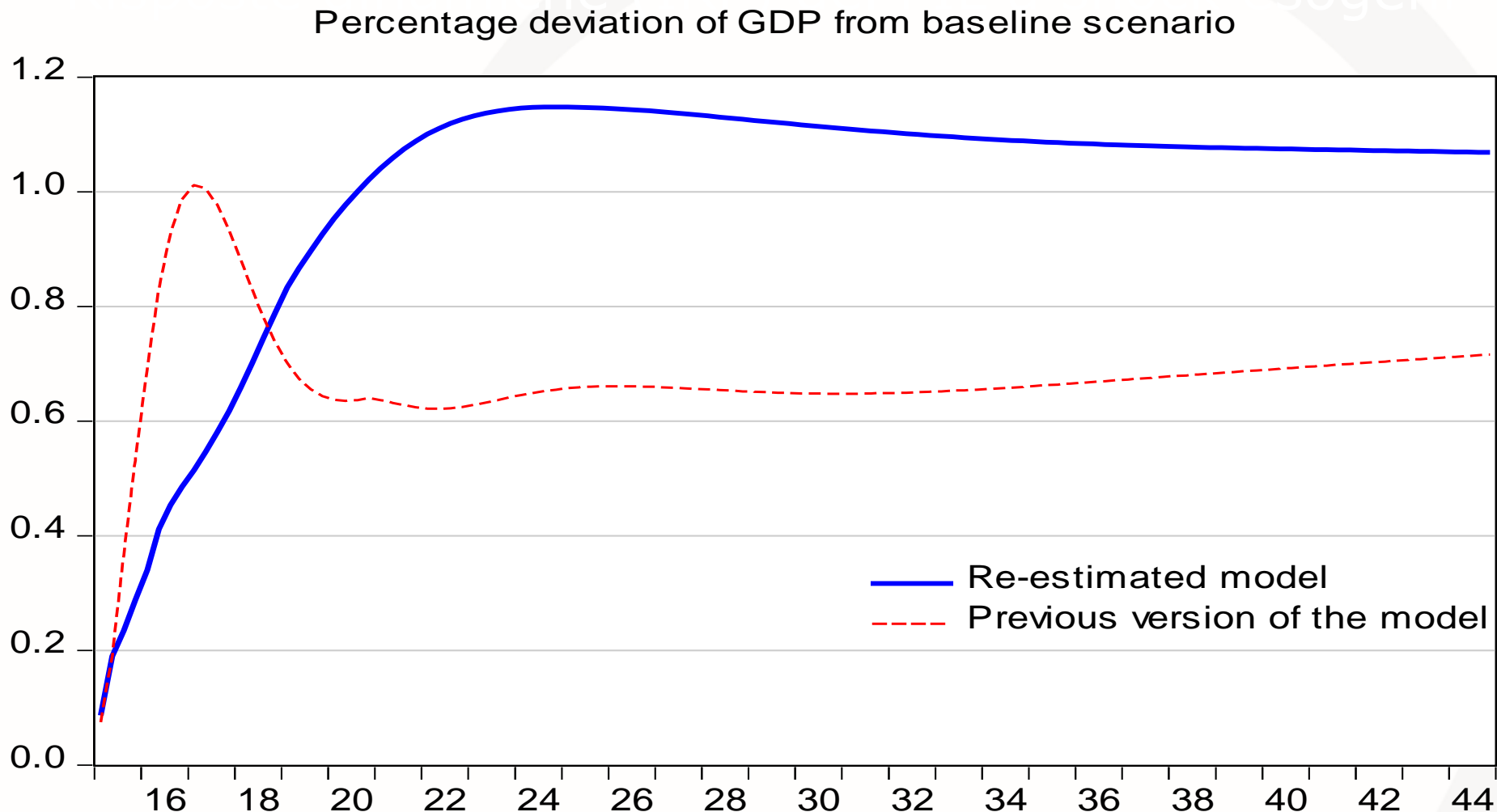


3) Shock to the structural component of TFP (expansion)

Percentage deviation of GDP from baseline scenario



4) Shock to the social security contribution rate for employers (reduction)



The different shape partly reflects changes in the long run response of wages to exogenous variations in the tax wedge



Focus: the fiscal multipliers

- We consider the dynamic response of GDP to fiscal expansions separately enacted through the expenditure and the revenue side
- We also compute aggregate multipliers, calculated as a weighted average of the multipliers resulting from each intervention
- In the new version of the model higher values of the fiscal multipliers are generally detected compared to the corresponding values of the multipliers from the previous version of the model
- The multipliers are obtained under the hypothesis of invariance of the real interest rate with respect to the baseline scenario

A) Fiscal Multipliers over a 5 yr horizon – New model estimated on data from ESA-2010 accounts						
Type of intervention	weights	1	2	3	4	5
VAT	0.28	0.2	0.7	0.9	0.9	0.9
Social security contributions	0.27	0.2	0.7	1.0	1.1	1.1
IRPEF (personal income tax)	0.33	0.2	0.6	0.7	0.7	0.7
IRES (corporate income tax)	0.06	0.2	0.3	0.3	0.3	0.2
IRAP (valeur ajoutée tax)	0.06	0.2	0.6	0.9	0.9	0.8
Revenues-weighted average of effects	1.00	0.2	0.6	0.8	0.8	0.8
Public investment	0.11	0.7	0.9	0.6	0.4	0.3
Investment subsidies	0.04	0.2	0.4	0.3	0.2	0.2
Government purchases	0.39	1.0	1.0	0.5	0.3	0.2
Public employment	0.47	1.1	1.0	0.7	0.5	0.4
Expenditure-weighted average of effects	1.00	1.0	1.0	0.6	0.4	0.3
Expenditure & Revenue (average)	1.00	0.6	0.8	0.7	0.6	0.5
B) Fiscal Multipliers over a 5 yr horizon – previous model estimated on data from ESA-1995 accounts						
Type of intervention	weights	1	2	3	4	5
VAT	0.28	0.2	0.5	0.7	0.7	0.6
Social security contributions	0.27	0.3	0.9	1.0	0.8	0.7
IRPEF (personal income tax)	0.33	0.3	0.6	0.6	0.6	0.5
IRES (corporate income tax)	0.06	0.2	0.4	0.4	0.3	0.2
IRAP (valeur ajoutée tax)	0.06	0.3	0.8	0.9	0.7	0.6
Revenues-weighted average of effects	1.00	0.2	0.6	0.7	0.7	0.6
Public investment	0.11	0.8	0.8	0.4	0.2	0.2
Investment subsidies	0.04	0.2	0.3	0.3	0.2	0.2
Government purchases	0.39	0.9	0.8	0.4	0.3	0.3
Public employment	0.47	0.9	0.7	0.6	0.5	0.6
Expenditure-weighted average of effects	1.00	0.9	0.7	0.5	0.4	0.4
Expenditure & Revenue (average)	1.00	0.5	0.7	0.6	0.5	0.5

The fiscal multipliers with the ITEM model

- A number of contributions in the literature convincingly show that the fiscal multipliers are state dependent and their values differ depending on the economy's conditions. During severe recessions the value of the multipliers are of larger size (e.g., Blanchard-Leigh '13; Auerbach-Gorodnichenko '12)
- In ITEM and in standard econometric models the fiscal multipliers and in general all the simulated effects of shocks do not vary conditionally on the cyclical conditions when the shock is imparted
- The estimated impact of the different shocks are therefore the same irrespective of whether the baseline scenario reflects a recessionary or an expansionary environment. Moreover, the macroeconomic effects are proportional to the size of the shock with no room for nonlinearities
- Against this backdrop, we nevertheless find that the fiscal multipliers with the new version of the model are more sizeable than those of the previous version



The fiscal multipliers: some further evidence

- We also compared the fiscal multipliers of the new version of ITEM with those obtained under alternative hypotheses:
 1. The estimation sample ends in 2007:Q4 and does not span the period of the great recession
 2. The invariance of the nominal (not real) interest rate with respect to the baseline scenario (this hypothesis resembles a scenario with the zero-lower bound binding)
- The results of these comparisons are in line with what was expected on a priori ground: multipliers are smaller under case (1.) and they are generally larger under case (2.)
- We also provide a comparison with the fiscal multipliers obtained with other models (e.g. Idea-BI-Eagle and Oxford Economics model)

