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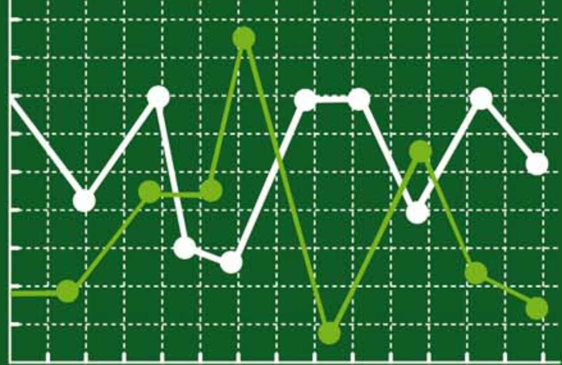

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The a/simmetrie annual macroeconometric model of the Italian economy: structure and properties

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Abstract –We develop a medium-sized annual macroeconometric model of the Italian economy. The theoretical framework is the usual AS/AD model, where the demand side is specified along Keynesian lines, and the supply side adopts a standard neoclassical technology, with Harrod neutral technological progress. The empirical specification consists of 140 equations, of which 29 stochastic, with 55 exogenous variables. The model structure presents some distinct features, among which the disaggregation of the foreign trade block in seven trade partner regions (thus representing the bilateral imports and exports flows in function of the regional GDP and of the bilateral real exchange rates), and the explicit modelling of the impact of labour market reforms on the wage setting mechanism (which explains the shift in the Phillips curve observed over the last two decades). The model is conceived for the analysis of the medium- to long-run developments of the Italian economy, and as such it adopts econometric methods that allow the researcher to quantify the structural long-run parameters. The equation are estimated over a large sample of annual data (1960-2013), using cointegration techniques that take into account the possible presence of structural breaks in the model parameters. The model overall tracking performance is good. We perform some standard policy experiments in order to show the model's response to usual shocks: an increase in public expenditure, an exchange rate devaluation, a slowdown in world demand, and an increase in oil prices. The shocks are evaluated by *ex post* simulation and their impact tracked over a five-year span. The dynamic multipliers appear to be consistent with the economic intuition.

JEL Codes: C51, C53, C54, E12, E62, F14, F41, F47

Keywords: Model construction and estimation; Simulation methods; Quantitative policy modeling; Keynesian model; Fiscal policy; Empirical studies of trade; Open economy macroeconomics; Macroeconomic issues of monetary unions; Forecasting and simulation.

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1 Introduction

Economic analysts need rigorous quantitative tools in order to forecast the future paths of some variables of interest and to evaluate alternative scenarios. In particular, banks, research centres, unions, associations, etc. rely on econometric models with specifications tailored for their peculiar requirements (e.g., banks will focus on the credit sector, government agencies will focus on the fiscal sector, unions on the labour market). Despite their specificities, at the core of these models lies usually a more or less standard macroeconometric module which, with different degrees of sophistication, works as the engine of the model, representing the performance of the economy. Italy has a long tradition of macroeconometric model building (Binotti and Ghiani, 2008; Welfe, 2013). Among the more recent macroeconometric models of the Italian economy are the quarterly models BIQM by the Bank of Italy (Busetti et al., 2005); the Italian block of the multicountry model by the European Central Bank (Angelini et al., 2006); the CSC model by Confindustria, the Italian employers' federation (Pappalardo et al., 2007); the ITEM model by the Italian Department of the Treasury (Cicinelli et al., 2010); and the annual models ModInail by Inail, the National Institute for Insurance against Accidents at Work (Tesei, 2009); MeMo-It by Istat, Italian National Statistical Institute (Bacchini et al., 2013); and the PROMETEIA model by the privately-run research centre Prometeia (Welfe 2013, Section 8.7.1).

Despite this fairly large body of literature, we feel that there could be room for further research. Just to quote a few issues: all the above models represent only aggregate trade flows, i.e., they do not take into account the possible difference in trade equation elasticities among different partner areas, and, as a consequence, they do not allow the researcher to evaluate the impact on the Italian economy of a slump or recovery of the world economy occurring at different paces in different areas; as far as the labour market is concerned, none of the previously cited models take into account the impact of labour market reforms on the wage setting process, which appears to have been a major determinant of a shift in the wage equation in Italy over the last two decades. At a more technical level, most of the previous models, even in the case in which they are explicitly designed for performing long-run scenario analyses, either do not take into account the possible presence of shifts in the structural long-run parameters, or do that in an *ad hoc* manner.

These drawbacks are especially relevant as far as the analysis of the current predicament of the Italian economy is concerned. There is now a growing consensus that the Eurozone has committed suicide by endorsing austerity policies. As a consequence, it is unlikely that in the next years a stimulus for a recovery of Italy will come from the Eurozone, and it becomes all the more important to correctly measure the contribution that external demand from third countries can give to the Italian growth. Since it is likely that trade flows will be more elastic with respect to the countries belonging to the same integrated area, by ignoring the disaggregation between intra- and extra-Eurozone trade, the existing models are likely to overestimate the impact on our economy of a recovery in the latter, because their estimated elasticities will be an average of the high intra-zone elasticity with the low extra-zone ones. This point deserves a careful empirical investigation.

The same applies to the importance of the so-called "structural reforms" (in other words, labour market flexibility). The role of labour market reforms is important for at least three reasons: first, because there is a growing body of literature that charges the imperfect design of labour market reforms with the sudden stop of Italian labour productivity since the mid-Nineties (Dew-Becker and Gordon, 2008; Travaglini, 2009; Daveri and Parisi, 2010); second, because the "upward wage rigidity" determined by labour market reforms (Pastore, 2010), is now suspected to be at the heart of the current stagnation of domestic demand; last, but not least, because the incumbent government is insisting on the crucial importance of further flexibility in the Italian labour market, a proposal that does not meet a consensus in the economic profession. It is therefore of some interest to integrate measures of labour market flexibility in a econometric model, in order to enable the researcher to get a quantitative assessment of the overall impact of labour market reforms.

Against this background, the Italian Association for the Study of Economic Asymmetries (a/simmetrie) has carried out the estimation of an annual macroeconometric model, aimed at coping with these issues.[1] The model builds on Bagnai *et al*. (2006). It is a medium-sized annual model, featuring 140 equations, of which 29 stochastic, with 55 exogenous variables, estimated on a sample ranging from 1960 to 2013. The trade block of the model is disaggregated by considering seven trade partner areas (Eurozone core, Eurozone periphery, United States, other European countries, BRICS, OPEC, and rest of the world). Fifteen exogenous variables are related to the international macroeconomic framework (real output and prices in each trade partner, and the EUR/USD exchange rate). The other exogenous variables are mostly related to the public sector, to the demographic evolution (dependency ratio, female participation ratio), and to the stock-flow reconciliation of public debt (Panizza, 2013).

The remainder of the paper is structured as follows. Section 2 sets out the model specification and motivates on theoretical and empirical grounds the modelling decisions taken in each block. The estimation methodology is discussed in Section 3. A description of data sources is given in Section 4, along with an analysis of the time series properties of the data. In Section 5 the main empirical findings obtained from the estimation step are discussed. Section 6 presents the results of some standard simulation experiments that allow the reader to better understand the model performance and properties. Section 6.5 concludes.

2 Model specification

2.1 The modelling strategy

In principle, a perfectly specified and realistic model of the world is already available: it is the world itself. The only drawback of this otherwise absolutely reliable 1:1 scale model of the reality is that it is unmanageable for research purposes. Since this is not a minor drawback, every academic or applied modelling exercise is the result of a

[1] The model has been developed in the framework of a research project on "Investigating the impact of European policy rules on the recovery of the Italian economy", jointly funded by a/simmetrie and the Nando Peretti Foundation.

compromise. In this introductory paragraph we briefly set out the main trade-offs that have been considered in defining the structure of our model.

The theoretical specification of the model is based on the standard AS/AD framework, a choice shared with most macroeconometric models (see Wallis, 2000). The main characteristic of this widely accepted framework is that price rigidities allow for the coexistence of a long-run neoclassical equilibrium with a short-run Keynesian behaviour. The supply side, i.e., technology and endowments of factors of production (capital accumulation and demography), determines the long-run properties, while in the short run the output is demand constrained. The specification of a theoretically consistent supply side is especially relevant in models aiming at the analysis of medium- to long-run scenarios, as it relates the potential output of an economy to the evolution of long-run determinants such as demography, the technological level, and the accumulation of physical capital. This point deserves some comment.

First, following a standard practice in macroeconometric modelling, we adopted a standard neoclassical technology as the "core" of the supply side specification. It should be kept in mind however that the neoclassical aggregate production function is subject to well-known criticisms, that originated the "two Cambridges debate" (see e.g. Garegnani, 2008; for a different perspective, Mas-Colell, 1989). In our opinion, these criticisms are still relevant. As a consequence, we have some doubt that the neoclassical production function may be interpreted as a sensible "technical constraint" (or even "technical relation") at the aggregate level. At the same time, owing to the development of the macroeconomic profession, the production function is still the most effective tool to present and interpret the relevant stylized facts about an economy's supply side. Our modelling choice was made in this spirit.

Second, unlike most macroeconometric modelling exercises, we did not attempt nor claim to "microfound" extensively the model's behavioural equations. The practice of "microfounding" models stands in the same relation to publishing in reputed journals as wearing a black suit to attending an opera premiere. However, one must recognize that in medium-sized macroeconometric models this practice always leads to at least two fatal inconsistencies. First, unless the model structure is so stylized as to be practically irrelevant, it becomes impossible (and in some cases meaningless) to trace the specification of every equation back in the solution of some consistent optimization exercise. In fact, in most presentations of microfounded macroeconometric models there is a solution of continuity between the introduction, where the authors usually display their knowledge of mathematical optimization techniques, and the presentation of the empirical results, where they are forced to adopt a number of *ad hoc* solutions, dictated by the nature of the data and by the size of the model itself (which generally makes impossible a truly "model based" optimization exercise). Second, at a more general level the practice of defining an econometric specification at the micro level, and to estimate the resulting equation with macro data, is absolutely meaningless, as stressed for instance by Kirman (1992). In particular, since the use of error correction models (ECM) has become overwhelmingly pervasive, the old criticism made by Lippi (1988) is especially relevant. Lippi shows that the dynamic shape of an aggregate ECM will necessarily differ, for statistical reasons, from the shape of every (supposedly underlying) "microfounded" dynamic equation. As a consequence, any attempt at "microfounding" a dynamic equation that is going to be estimated with aggregate data is perfectly meaningless, because the dynamic structure consistent with those data could result by a completely different dynamic behavioural equation at the individual (micro) level. More precisely, very simple micro-behaviours (e.g., static rules) can generate, after the aggregation, very complex macro-dynamics. It is therefore completely pointless to explain the macro-dynamics as "optimal rules" resulting from an optimization exercise carried out at the micro level. In other words, Lippi's paper, using relatively sophisticated but unquestionable statistical results, crumbles the agenda of the previous four decades of empirical research, where the main concern of the econometricians had been that of justify in terms of (possibly microeconomic) theory the lags they introduced in their aggregated empirical equations. While the vast majority of the academic profession is still unaware of this result, the macroeconometric modelling practice in most cases obeys to it, at least implicitly.[2] As a matter of fact, most macroeconometric models adopt the same compromise as we do in our model: optimization theory is invoked to define the long-run specification of the supply sector (potential output and factor demand equations), but no attempt whatsoever at microfoundation is made in other model blocks (such as the trade or the public sector block), especially as far as the dynamic shape of the relations (i.e., the order of lags of considered in the model) is concerned.

Third, our model does not adopt "model-consistent" (or "rational") expectations. There are several reasons for this modelling choice. In no particular order: 1) recent research (e.g., Weizsäcker, 2010) questions the empirical relevance of rational expectations, by showing that the individual behaviour generally does not conform to them; 2) in any case, the implementation of fully model-consistent expectations is impossible even in medium-sized models, and in the applied macroeconometric practice "rationality" is often bounded to subsections of the whole model (typically, the wage setting block, or exchange rate determination; see e.g. Beffy *et al*, 2003, Beeby *et al.*, 2004); 3) possibly as a consequence of the first two points, and despite the usual claim that "backward-looking" models failed at the beginning of the Seventies, the empirical performance of (small) models implementing full rationality hypothesis has always been very disappointing (see e.g. Bryant *et al.*, 1988, for a review of the first exercises, or Hendry and Mizon, 2014, for a review of the currently fashionable DSGE models), even in comparison to their counterparts. As is nowadays evident, the supposed "failure" of the Keynesian macroeconometric models in forecasting inflation at the beginning of the Seventies was determined by not taking properly into account supply side variables like food or energy prices, and by adopting misspecified Phillips curves

[2] The reluctance of the academic profession to reckon with Kirman and Lippi's arguments is understandable. By showing the logical impossibility to establish a relation between the behaviour of the observed macro relations with any "equilibrium" rule derived at the micro level, they confirm the "irrelevance of equilibrium economics" exposed by Kaldor (1972). As a matter of fact, however, the "equilibrium" approach has become dominant for both ideological and sociological reasons, the same set out by Keynes in the General Theory (chap. 3, par. 3). Equilibrium economics (Keynes called it "Ricardian") provides a technical explanation for "social injustice", and, being highly mathematized, it definitely satisfies the need for "intellectual prestige" of the researchers. Due to those two reasons (especially the second one), the failure of "equilibrium" theories such as the "negative multiplier" or "expansionary austerity", will not induce the profession to abandon them.

(Blinder, 1988), rather than by ignoring "rational expectations". The huge success of the latter in the theoretical literature is more related to their support to the Panglossian research agenda of the Eighties (Buiter, 1980), than to their practical or logical relevance. This explains why "rational" expectations had practically no impact outside the academic profession (i.e., in the applied forecasters world).

On a different, more constructive, note, one may wonder whether in a world where the macroeconomic landscape changes daily, "rational" expectations are so crucial in determining the behaviour of annual time series. In this framework it is equally reasonable to assume that expectations are anchored at the long-run trends of the economy, i.e., they are somehow backward-looking. In other words, one may wonder whether people learn more from experience, or from the likely unknown "true" model of the economy. As a matter of fact, backward-looking methods are adopted in a number of practical situations (consider for instance the huge literature originated by Makridakis *et al*., 1982). In any case, the error correction specification has been proved consistent with both backward- and forward-looking expectations (Domowitz and Hakkio, 1990). For this reason, a number of recent operational models, mostly relying on error correction representations, while admitting the importance of expectations, do not model them explicitly in a "model-consistent" way; among them the OECD Interlink model (Dalsgard *et al*., 2001), the Modtrim II model of the Belgian economy (Hertveldt and Lebrun, 2003), the EMMA model of the Estonian economy (Kattai, 2005), Dreger and Marcellino (2007) model of the Eurozone economy, and many more). It is particularly telling that most of these models are run and managed by national statistical offices, where forecast accuracy is at a premium over academic elegance. In any case, it should be kept in mind that the "microfounded" approach consisting in explaining the dynamic shape of aggregate relations in terms of individual expectation rules becomes logically flawed whenever the resulting specifications are estimated on aggregated data. For these reasons, the claim that by not taking into account (better: by not pretending to take into account) "model consistent" expectations, a model rules completely out the role of expectations, and is therefore "outmoded", does not seem to be firmly grounded on both economic theory and practice.

Finally, our model is a structural equation model (SEM). This contrasts the nowadays fashionable practice of estimating vector auto regressive (VAR) models. VAR were proposed at the beginning of the Eighties as a way to perform "atheoretical" macroeconomics. The idea that macroeconomic modelling could become a merely "technical", "aseptic" exercise, independent from the judgment and choices of the researcher, was obviously related to the Panglossian research agenda, and was miserably disproved by the subsequent developments. On the econometric side, it was soon realized that even the most harmless choice (such as the choice of listing the model variables in one or another way) had an impact on the model results (in particular, in the analysis of the impulse response functions; Hamilton, 1994, par 11.4). At the same time, the econometric performance of VAR models was poor, leading in most cases to absurd multipliers (Bryant *et al*., 1988). As a result, economic theory, thrown out the door, came back through the window, leading to the so-called "structural" VAR (SVAR) models (a development that took place along with the progress of cointegration theory). While SVAR models performance is generally good, their main drawback is that in order to be manageable they must be kept at very small dimension. This makes them unsuitable to practical macroeconometric modelling, where one must keep into account a number of fundamental accounting relationships (such as the national income identity) and definitions (such as the definition of the unemployment rate). For this reason, medium- to large-size models are generally specified as SEMs (Welfe, 2013).

Against this background, the remainder of this Section analyses the main features of the model's design. The full structure of the model is presented in Appendix 4, and full details on the estimated stochastic equations are given in Appendix 5. In the following discussion, the equation numbers refer to the model's representation presented in Appendix 5.

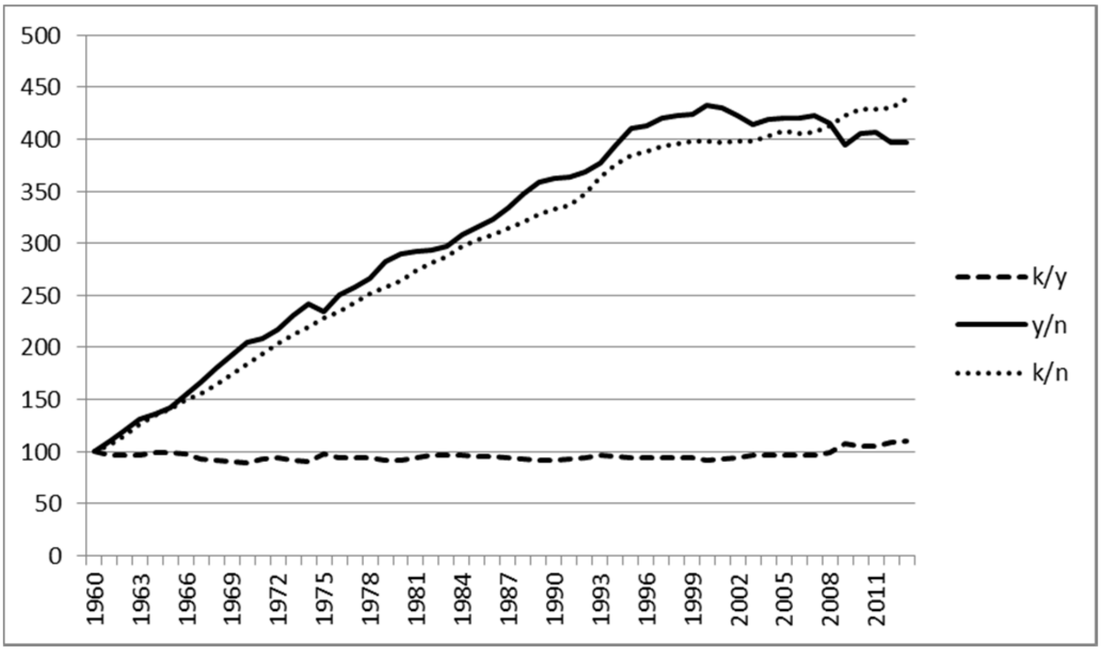

Figure 1 – Capital/output ratio (k/y), average labour productivity (y/n), and capital intensity (k/n), in the private sector. Indices, base 1960=100. Source: Model's database.

2.2 Supply

Figure 1 summarizes some relevant stylized facts of the Italian economy's supply side in the last five decades. The most apparent feature is the sudden stop of average labour productivity by the mid-Nineties. Another important feature is the stability of the capital/output ratio over the whole sample[3]. The latter suggests a Cobb-Douglas production function with constant returns to scale and labour-augmenting (Harrod-neutral) technical progress as an appropriate specification for the model technology.

We express the production function in labour-intensive form as follows:

[3] A possible exception is given by the post-2007 period when the capital/output ratio increases, mostly as a consequence of the substantial and sudden drop of the denominator, i.e., by the collapse of real GDP.

$$\frac{y}{n} = A\left(\frac{k}{n}\right)^{\alpha} e^{\lambda t(1-\alpha)}$$

where y, k and n are, respectively, private gross domestic product in real terms (GDPBV), capital stock (KBV) and employment in the private sector (ETB), A is the level of technology, $e^{\lambda t}$ is a labour-enhancing term, and α is the elasticity of output to capital (capital share). The specification adopted suggests two possible explanations for the productivity slowdown: a slowdown in capital intensity, possibly accompanied by a decrease in the rate of growth of labour-augmenting technical progress λ. Figure 1 shows that the capital/labour ratio actually flattened more or less in coincidence with the labour productivity slowdown. However, other analyses carried out at a disaggregated level, such as Daveri and Parisi (2010), attribute the Italian productivity slowdown to a decrease in TFP growth, rather than to a slowdown in capital deepening. The two explanations are not mutually exclusive.

In order to assess their relative role we estimated the production function in logarithmic terms (eq. [1.1]):

$$\ln\left(\frac{y}{n}\right) = \ln(A) + \alpha \ln\left(\frac{k}{n}\right) + \lambda(1-\alpha)t$$

by allowing for the possible existence of structural breaks of unknown date in its parameters.

The production function allows us to take into account supply side frictions, which are represented by the private sector output gap (GAPB, eq. [1.2]), defined as deviations of the actual private sector real GDP from its potential value as defined by the previous equation. The output gap feeds back into the consumer prices as well as the Taylor rule (see below).

Factor demand equations follow from the problem of cost minimisation by firms, subject to the above specified technological constraint. The conditional labour demand function is given by

$$n = \left(\frac{1-\alpha}{\alpha}\frac{P_K}{W}\right)^{\alpha} \frac{y}{A} e^{-(1-\alpha)\lambda t}$$

where P_K is the cost of capital[4] and W the wage rate. The labour demand equation was estimated conditional on the estimate of α obtained by estimating the production function and using a logarithmic specification as follows (eq. [1.5]):

$$\ln(n) - \hat{\alpha}\left(\frac{1-\hat{\alpha}}{\hat{\alpha}}\right) + \hat{\alpha}\ln\left(\frac{W}{P_K}\right) - \ln(y) = -\ln(A) - (1-\hat{\alpha})\lambda t$$

[4] In the estimated equation, P_K is replaced by the deflator of private gross fixed capital formation (P_{IB}), a proxy adopted by other studies such as Chiarini e Placidi (1991).

Total employment (ET, eq. [1.6]) is given by the sum of the estimated private and public sector employment (ETB, eq. [1.5], and ETG, respectively, the latter being an exogenous variable).

A further condition which should hold in a competitive market states that the marginal productivity of capital (*mpk*) is equal to the user cost of capital (*ucc*). Under a Cobb-Douglas technology with constant returns to scale and a user cost of capital measure given by the real interest rate (*r*) plus the scrap rate (ω)[5] and a risk premium (ς)[6], the marginal productivity condition is

$$mpk = \frac{\partial y}{\partial k} = \alpha \frac{y}{k} = ucc = r + \omega + \varsigma$$

The spread between the marginal productivity and the user cost of capital enters in the equation for the desired growth rate of capital (KGR, eq. [1.12]), following the approach proposed by Knight and Wymer (1978), and adopted for instance by Dramais (1986) and Fagan et al. (2001). The growth rate of capital in turn defines capital accumulation (KBV, eq. [1.11]).

Some identities complete the supply block: private and public value added (VABV, eq. [1.3], and VAGV, eq. [1.4], respectively), average productivity of labour and capital (APL, eq. [1.7], and APK, eq. [1.8], respectively), marginal productivity of capital (MPK, eq. [1.9]), unemployment rate (UNR, eq. [1.10]), and profits and other non-wage income (PROF, eq. [1.13]).

2.3 Demand

The demand block represents the various components of gross domestic product (GDP) from the expenditure side: private and public consumption, investment, and exports and imports of goods and services.

Private consumption in real terms (CPV, eq. [2.1]) depends on real disposable income of households (YDHR, eq. [5.11]). Moreover, the ratio of female participation to the labour force (FPR) is included in the long run relationship as it has been shown to be an important determinant of long-run aggregate saving (Graham, 1987).[7]

Gross fixed capital formation is divided in two components: private and public. While the latter is taken as exogenous, the former (IBV, eq. [2.2]) is derived from the desired stock of capital of the private sector, k_t, solving for investment through the formula of the perpetual inventory method

$$k_t = (1-\omega)k_{t-1} + i_t \quad \Rightarrow \quad i_t = k_t - k_{t-1}(1-\omega)$$

where i_t is the investment of the private sector, and ω is the scrap rate. Changes in inventories (ISKV, eq. [2.3]) are modelled with an equation linking them to the change of value added of the private sector (VABV, eq. [1.3]).

[5] In our model, ω is proxied by the implicit depreciation rate.
[6] As Fagan et al. (2001) we calibrate ς so that the marginal productivity condition holds on average.
[7] The modelling of government consumption (CG, in nominal terms, or GCV, in real terms) will be discussed below in the *Public sector* block.

Exports and imports of goods and services (XGSV, eq. [2.4], and MGSV, eq. [2.5], respectively) are both given as sum of the corresponding flows of goods (XGV and MGV), on the one hand, and services, on the other hand (XSV and MSV). The same applies for flows in nominal terms (XGS and MGS, eq. [2.6] and eq. [2.7], respectively). A detailed illustration of how these flows are obtained is given below in the *Trade* block.

Finally, nominal and real gross domestic product (GDP, eq. [2.8], and GDPV, eq. [2.9], respectively) are given by the aggregation of their various components.

2.4 Trade

Exports/imports of goods (expressed in US dollars) have been disaggregated in bilateral flows to/from seven blocks:

- Eurozone core countries ("Core"): Austria, Belgium, Finland, France, Germany, Luxembourg and Netherlands.
- Eurozone peripheral countries ("Periphery"): Greece, Ireland, Portugal and Spain.
- United States of America.
- Other European countries ("Non-euro"): Denmark, Sweden, Switzerland and United Kingdom.
- OPEC countries.
- BRIC countries: Brazil, Russia, India and China.
- Rest of the world.

The previous grouping is, of course, arbitrary. However, it was dictated by both geo-political and economic considerations: Europe is split into *Core*, *Periphery* and *Non-euro* countries as this subdivision (specially the Core/Periphery one) has been at the heart of the debate after the Eurozone crisis; the United States is usually considered as a single area in most multicountry models because of its size; shocks from oil prices can be better modelled by aggregating oil-exporting countries, which are included in the OPEC block; the most integrated and influential new industrialised countries are grouped in the BRIC block; trade coherence is achieved by creating a *Rest of the world* block.

Bilateral flows depend on two variables: real demand (foreign for exports, domestic for imports) and bilateral real exchange rate (competitiveness). The latter is the same either in the exports and in the imports bilateral functions and is given by relative prices in a common currency (i.e., the real exchange rate, RER*i*, eq. [3.3]) with respect to the partner. This measure is given by the ratio of domestic exports prices (P_X, converted in US dollars, i.e., PXGSUS*i*, eq. [3.2]) and the export prices of partner *i* ($P^{\$}_{X,i}$, PXGSUSD*i*):

$$RER_i = P_X \times (\overline{E} / \overline{E_b}) / P^{\$}_{X,i}$$

where E is the EUR/USD exchange rate, considered as exogenous.[8]

As previously said, each bilateral flows specification has a specific demand component: exports to partner *i* (XGUSDV*i*, eq. [3.4]) depend on the its demand, proxied by its GDP (in constant US dollars, GDPVUSD*i*), while imports from partner *i* (MGUSDV*i*, eq. [3.5]) are a function of Italian GDP (in constant US dollars, GDPVUSD, eq. [3.1]).

Aggregate exports and imports in constant US dollars (XGUSDV*i* and MGUSDV*i*) are used in order to obtain the respective flows in constant and current euros: series in real terms (XGV*i*, eq. [3.9], and MGV*i*, eq. [3.10], respectively) are obtained by dividing the constant US dollar series by the base year exchange rate; current values of the flows (XG*i*, eq. [3.6], and MG*i*, eq. [3.7], respectively) are obtained through normalized deflators. Aggregate exports and imports in constant euros are obtained by summing bilateral real flows (XGV, eq. [3.11], and MGV, eq. [3.12], respectively). The same applies to nominal exports and imports (XG, eq. [3.13], and MG, eq. [3.14], respectively). These flows enter in the definition of final GDP (in nominal, eq. [2.8], and real terms, eq. [2.9]) after having added the expenditure relative to exports/imports of services (respectively, eq. [2.4] and eq. [2.5] for constant term flows, and eq. [2.6] and eq. [2.7] for nominal terms flows).[9]

2.5 Wages and prices

In a competitive equilibrium, real wage must be equal to marginal labour productivity. Thus, consistently with our preferred technology, the following equilibrium condition should hold:

$$\frac{W}{P} = \frac{\partial y}{\partial n} = (1-\alpha)\frac{y}{n}$$

where W is the nominal wage rate (eq. [4.11]) and P the output price. Taking logarithms, we get:

$$\ln\left(\frac{W}{P}\right) = \ln(1-\alpha) + \ln\left(\frac{y}{n}\right)$$

The equilibrium condition states that in the long run the real wage rate and labour productivity are tied with unit elasticity. The short-run wage equation includes the unemployment rate (u) as a wage-pressure variable, inflation expectations ($\tilde{\pi}$), and it is specified in terms of consumption prices, in order to account for the internal price wedge (i.e., the difference between GDP and consumption prices).[10]

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[8] E_b is the exchange rate in the base year.

[9] The stylized model presented in Table 1 assumes that there are no exports/imports of services.

[10] This specification follows Fagan et al. (2001). See also Wallis (2004) for a discussion on the properties of the model by Fagan et al. (2001) and a comparison with other models.

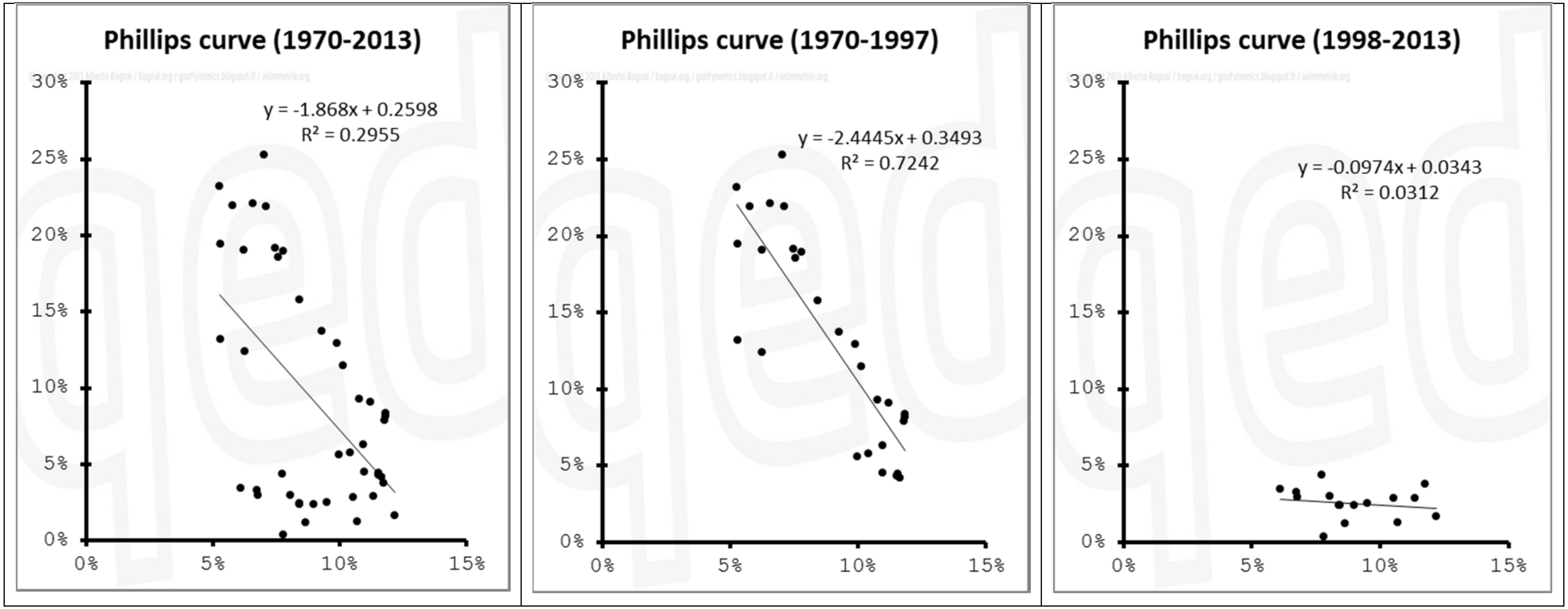

Figure 2 – The progressive flattening of the "standard" Phillips curve in the Italian economy. Wage growth on the vertical axis, unemployment rate on the horizontal axis.

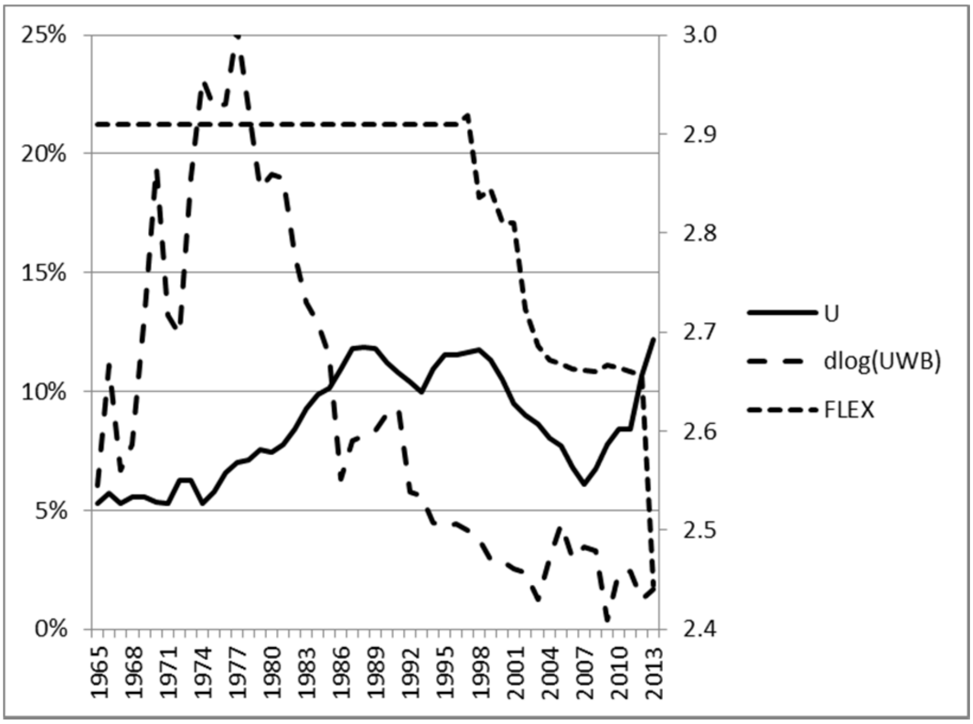

Figure 3 – Unemployment (U), wage growth (dlog(UWB)), and employment protection index (FLEX) in Italy.

Moreover, we added to the equation the OECD (2014) employment protection indicator as a measure of labour market flexibility, FLEX. In order to motivate this choice, it is useful to have a look at some stylized facts about the Italian economy. Figure 2 shows the behaviour of a "standard" Phillips curve, i.e., of a simple linear regression of wage inflation on unemployment, first over the 1970-2013 sample, then over the two subsamples going from 1970 to 1997, and from 1998 to 2013. Over the whole sample the fit of the equation is poor, with an R^2 equal to 0.29. However, if we consider only the 1970-1997 sample, even this very poor specification provides a remarkable fit, with an R^2 equal to 0.72. Needless to say, this implies that in the second subsample (1998-2013) the fit is even worse than in the whole sample: the curve actually flattens, with an R^2 equal to 0.03. A glance at Figure 3 may explain why this happens.

Over the long run, there is an apparent trade-off between unemployment and inflation. The deflation of the Eighties occurs at the expense of an increase in the unemployment rate. Since the mid-Nineties both unemployment *and* the inflation rate begin to fall. This occurs when the employment protection index starts its decline, as a consequence of the "Treu package" (the first major labour market reform in Italy, approved in 1997), and of the following reforms (the "Biagi law", the "Giovannini law"). There is some evidence that the introduction of more flexible contracts has somewhat weakened the workers' bargaining powers, which on the one side has had positive effects on employment (with possibly detrimental effects on average productivity, as stressed by Daveri and Parisi, 2010), but on the other side has accelerated an ongoing process of wage deflation. All in all, we find that these considerations suggest to include the employment protection indicator in the Phillips curve, where otherwise the coefficient of unemployment could be severely downward biased, because it would represent as a flattening of the curve what could have been a leftward shift of an equally sloped curve. Our preferred dynamics specification is therefore:

$$\Delta \ln\left(\frac{W}{P_{CP}}\right) = f\left(u, \tilde{\pi}, flex, \left[\ln\left(\frac{W}{P}\right) - \ln\left(1-\hat{\alpha}\right) - \ln\left(\frac{y}{n}\right) - \lambda t\right]_{t-1}\right)$$

Consumer prices (pre-tax, eq. [4.3]) follow closely the long-term path set by the pricing behaviour of firms, which consists on a mark-up on import prices (P_M) and unit labour costs (eq. [4.2]). The indirect tax rate (r_{tind}) is added to obtain post-tax consumer prices (eq. [4.4])

$$\log(P_{CP}) = \vartheta \log(P_M) + (1-\vartheta)\log(ULC) + \log(1+r_{tind})$$

where ULC = $W/(y/n)$ and P_M (PMGS, eq. [4.1]) is computed as a weighted geometric average of export prices of partners (i.e., import prices from the partners) expressed in euro, where weights are the import shares from partner i. The short-run equation includes the output gap as a demand-pressure variable.

A similar formulation is used for the deflators of exports of goods and services (PXGS, eq. [4.9]), and gross fixed capital formation (PIBNET, eq. [4.5], and PIB, eq. [4.6]). PIBNET is used in the specification of the deflator of public gross fixed capital formation (PIGNET, eq. [4.7]). The gross domestic product deflator is given as the ratio of nominal-to-real GDP (eq. [4.10]).

2.6 Incomes

The incomes determination block contains several identities which define total disposable income, thereby linking the supply side, wage, and public sector blocks to the demand side of the model. Aggregate wages (WAGE, eq. [5.2]) are given as the sum of wages in the private sector (WAGEB) and public sector (CGW). These two components, in turn, are obtained as the number of total workers times the unit wage rate in each sector (eq. [5.1] and eq. [6.2], respectively).[11] Total compensation of employees (WSSS, eq. [5.3]) is obtained by adding to WAGE the employers contributions to social security and pension funds (TRPBTH, eq. [5.4]), which is the sum of contributions to pension funds by private employers and the public sector (SSCB, eq. [6.11], and TRPGPH, respectively). Besides total wages, two further voices contribute to households' incomes: current transfers received by households (TRRH) and self-employment and property income (YOTH). The former (eq. [5.5]) is the sum of social security benefits (SSPG, eq. [6.1]), other current transfers (TRPG), both paid by the government, and a residual term (TRRHX) which covers other kind of transfers and statistical discrepancies. YOTH (eq. [5.6]) is the sum of general government interest

[11] Note that unitary wages (UWB and UWG) are expressed as indexes, in the same way as prices (all the indices are equal to 1 in the base year). To obtain the actual wage rate, each index is multiplied by the value of the base year wage rate in the appropriate sector (WRB_b and WRG_b, respectively).

payments (GGINTP, eq. [6.7]) and self-employment and property income other than that deriving from shares of public debt (YPEX) that depends on nominal GDP (eq. [5.7]).

Total nominal disposable income is finally given by the total amount of resources (YDH, eq. [5.10]) net of direct taxes on households (TYH, eq. [6.8]) and total transfers paid by households (TRPH, eq. [5.9]).

2.7 Public sector

This block represents the main items of government revenues and expenditures, as well as the government balances and the accumulation of public debt, at a level of aggregation consistent with the other blocks of the model.

Government consumption in nominal terms (CG, eq. [6.4]) consists of the sum of the expenditure on wages (CGW, eq. [6.2]) and non-wage items (CGNW, eq. [6.3]), the latter being the sum of intermediate consumption (CINT), consumption of fixed capital (CFKG) and other items included in the final consumption expenditure (YPEPGX). Public consumption in real terms (CGV, eq. [6.6]) is obtained by deflating CG by the deflator of public consumption (PCGV). Real public consumption enters the definition of real GDP (GDPV, eq. [2.9]), thereby linking the government accounts to aggregate demand.

General government interest payments (GGINTP, eq. [6.7]), are obtained as general government gross financial liabilities (GGFL, eq. [6.21]) times the average *ex post* interest rate on government liabilities (IRGOV, eq. [7.4]). GGINTP feeds back in the definition of households' disposable income (through eq. [5.6] and [5.8]), thus concurring to the level of aggregate demand via the level of private consumption expenditure.

Another crucial item of government expenditure, the security benefits paid by the government (SSPG, eq. [6.1]), is modelled by a stochastic equation, in terms of the level of economic activity, the demographic structure (the dependency ratio AGE), and the unemployment rate.

The government current expenditure, YPG (eq. [6.15]), is then obtained by summing government consumption, interest expenditure, security benefit, plus two exogenous items, namely subsidies (TSUB) and other current transfers paid (TRPG).

On the revenues side, the households' and firms' direct taxes (TYH and TYB, respectively) are represented by multiplying a proxy of their respective aggregate taxable incomes by the corresponding average *ex post* tax rate (eq. [6.8] and [6.9]). The revenue from indirect taxes (TIND, eq. [6.10]) is obtained in a similar manner by multiplying nominal expenditure by the average indirect tax rate (RTIND). A similar approach is adopted in modelling the social security contributions paid by the business sector, SSCB (eq. [6.11]).

The government current revenues, YRG (eq. [6.16]), are then defined as the sum of tax and social security contribution revenues, plus two minor exogenous items: the other current transfers received (TRRG), and property income received (YPERG).

By subtracting government current revenues from government current expenditure we obtain the current deficit of the government, CDG (eq. [6.17]). The net capital outlays, CAPOG (eq. [6.18]), are obtained in turn by subtracting the (exogenous) government capital revenues (KRG) from government capital expenditure (KPG, eq. [6.14]), the latter obtained as the sum of government investment (IGG) and other capital disbursement (KXG).[12] Finally, public sector borrowing requirements (PSBR, eq. [6.19]) is the sum of current deficit and net capital outlays of the government (CDG and CAPOG, respectively).

The total amount of outstanding public debt (GGFL, eq. [6.21]) is given as the sum of previous year debt, current year borrowing requirements (PSBR, eq. [6.19]) and a residual term (SF). The latter represents what Panizza (2013) calls the "unexplained part of public debt", mostly accounting for stock-flow discrepancies.

Despite providing a very aggregate representation of the public sector, the model allows the researcher to investigate a wide range of policy options, among which a variation in government intermediate consumption, in the government average wage rate, in government investments, in the average rate of social security contribution, in the households or corporate average tax rate, in the average indirect tax rate, and in government transfers to the households or to the firms sector. The impact of some policy instruments will be tested in Section 6 below.

2.8 Interest rates

The short term nominal interest rate (IRS, eq. [7.1]) follows a Taylor rule where fluctuations around output are expressed in terms of private sector output gap (GAPB, eq. [1.2]). The long term nominal interest rate (IRL, eq. [7.2]) is given as a function of IRS and the borrowing requirements of government as a ratio of GDP (PSBRQ, eq. [6.20]). Real long term interest rate (IRLR, eq. [7.3]) is obtained as the difference between IRL and the percentage variation of the GDP deflator. The effective interest rate on government liabilities (IRGOV, eq. [7.4]) is linked by a bridge equation to the average rate given by the arithmetic mean of the short- and long-term interest rates.

The model structure is synthesized in the following Table 1, where variables in lower case indicate the corresponding real value of the variable in upper case (e.g., y and Y are, respectively, GDP in constant and current values); a dot over a variable indicates its rate of variation; all variables are at time t except where explicitly stated (e.g., D is current debt, while D_{-1} is previous' period debt);and the exogenous variables are indicated with a bar above the name of the variable.

3 Methodology

The model equations were estimated within the cointegration framework and represented using the associated ECM. This approach allows us to represent both the

[12] There is a slight statistical discrepancy between total government gross fixed capital formation reported in national accounts (IG) and government accounts (IGG). This is accounted for by the bridge equation [6.5].

long-run equilibria and the associated short-run adjustments, thus ensuring a good compromise between theoretical consistency and statistical significance.

One issue to take into account when estimating cointegrating models is the possible presence of structural breaks in the long-run parameters. Just to give an example, in discussing the productivity slowdown shown in Figure 1, we have mentioned that it could be explained by both a slowdown of capital intensity growth *and* a decrease in the rate of growth of labour augmenting technical progress, λ. While the reasons for which structural breaks can occur will not be discussed in this methodological section, we will present here the solutions adopted in this study estimating a cointegrated model with structural breaks.[13] The main method adopted in this paper is due to Gregory and Hansen (1996a and 1996b; GH henceforth) and is based on the estimation of the following models

$$y_t = \alpha_1 + \alpha_2 D_t + \beta' x_t + \varepsilon_t \qquad \text{model } C$$

$$y_t = \alpha_1 + \alpha_2 D_t + \beta' x_t + \delta t + \varepsilon_t \qquad \text{model } C/T$$

$$y_t = \alpha_1 + \alpha_2 D_t + \beta_1' x_t + \beta_2' x_t D_t + \varepsilon_t \qquad \text{model } C/S$$

$$y_t = \alpha_1 + \alpha_2 D_t + \beta_1' x_t + \beta_2' x_t D_t + \delta_1 t + \delta_2 t D_t + \varepsilon_t \qquad \text{model } G$$

where D_t is a dummy variable defined as

$$\begin{array}{ll} 0 & \text{if } t \le [N \times \tau] \\ 1 & \text{if } t > [N \times \tau] \end{array}$$

where τ is a parameter that indicates the relative timing of change point (unknown *a priori*), N is the sample size and [ ] indicates the integer part. In the previous models β' and δ are, respectively, the slopes the trend coefficient in the "partial breaks" models C and C/T, while α_1, β_1' and δ_1 are, respectively, the intercept, slopes and trend coefficient in the first regime, and α_2, β_2' and δ_2 are corresponding values in the second regime.

As in the non-breaking case, the null hypothesis is no cointegration and it is tested by conducting an ADF tests on ε_t by using GH critical values.

GH models are general enough to accommodate for alternative specifications of cointegration with structural changes: C is a level shift model, C/T is a level shift with trend model, C/S is a regime shift model, and G is a regime and trend shift model. Moreover, the most appealing aspect of this methodology is that the break date is endogenously determined: the various models are estimated for all possible dates in a properly trimmed sample, i.e., $\tau \in (\kappa, 1-\kappa)$ where κ is usually 0.15,[14] and the cointegration test statistic ADF* is the corresponding smallest value (the largest negative value).

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[13] See, for instance, a recent review on structural breaks by Perron (2005).

[14] The value of 0.15 for κ is suggested by Gregory and Hansen (1996a) as it is small enough so that the statistics can be computed.

Table 1 – The model structure

Demand

$cp = f[\, YD / P_{CP}, FPR \,]$

$i = k - k_{-1}(1-\omega)$

$x = \sum_i x_i^{\$} / \bar{e}_b$

$m = \sum_i m_i^{\$} / \bar{e}_b$

$y = cp + \overline{cg} + i + \overline{ig} + ik + x - m$

$Y = cp \times P_{CP} + \overline{cg} \times P_{CG} + i \times P_{IB} + \overline{ig} \times P_{IG} + ik \times P_{IK} + x \times P_X - m \times P_M$

Supply

$y^* = f[\, A, k, n, \lambda, t \,]$

$mpk = \alpha \times y/n$

$\dot{k} = f[mpk - (r + \omega + \varsigma)]$

$\ln(n) = f[y, W/P_Y, \lambda, t]$

$n = nb + \overline{ng}$

$u = 100 \times (\, 1 - n/\overline{lf} \,)$

Trade

$x_i^{\$} = f[\, y_i^{\$}, RER_i \,]$

$m_i^{\$} = f[\, y, RER_i \,]$

$RER_i = P_X \times (\bar{E} / \bar{E}_b) \,/\, P_{X,i}^{\$}$

Wages and prices

$\frac{W}{P_{CP}} = f\left[\frac{y}{n}, flex, u\right]$

$ULC = W / (y/n)$

$P_{CP}/(1+\delta) = f[\, ULC, P_M, y - y^* \,]$

$P_{IB}/(1+\delta) = f[\, ULC, P_M \,]$

$P_X = f[\, ULC, P_M \,]$

$P_M = \prod \left(\bar{P}_{M,i}^{\$} \times \frac{\bar{e}_b}{e} \right)^{ms_i}$

$P_Y = Y / y$

Incomes and taxes

$WT = W \times nb + \overline{WG} \times \overline{ng}$

$YD = WT + SC + GGINTP + YA + YN - DT$

Public sector

$SSPG = f[\, y, P_Y, AGE, u \,]$

$DT = \tau \times Y$

$SC = \sigma \times WT$

$GGINTP = IRGOV \times D$

$GB = DT + IT + SC - G - GGINTP - SB$

$D = D_{-1} - GB$

Interest rates

$IRS = f[\, \dot{P}_{CP}, y - y^* \,]$

$IRL = f[\, IRS, GB/Y \,]$

$irl = IRL - \dot{P}_Y$

$IRGOV = f[\, IRL, IRS \,]$

Variables

A = Total factor productivity
AGE = Structural dependency rate
cg = Final consumption of the government
cp = Final consumption of households
δ = average indirect tax rate
D = Public debt
DT = Direct taxes
E = USD/EUR exchange rate
flex = OECD indicator of employment protection
FPR = Female participation ratio
gapb = Output gap of the private sector
GB = Government balance
i = Gross fixed capital formation, private sector
ig = Gross fixed capital formation, public sector
ik = Changes in inventories
IRGOV = Implicit nominal interest rate on government liabilities
IRL = Long term nominal interest rate
IRS = Short term nominal interest rate
IT = Indirect taxes
k = Stock of physical capital, private sector
λ = rate of growth of labour augmenting technical progress
lf = Labour force
m = Imports of goods and services
$m_i^\$$ = Imports of goods and services from partner *i* in US dollars
mpk = Marginal productivity of capital
n = Total employment
nb = Employment, private sector
ng = Employment, public sector
$P_{X,i}^\$$ = Deflator of goods and services of partner *i* in US dollars
P_Z = Deflator of variable *Z*
r = Long term real interest rate
RER_i = Real exchange rate with respect to partner *i*
σ = average social security contribution rate
SC = Employers contributions to pension funds
t = Time trend
τ = average direct tax rate
U = Unemployment rate
ucc = User cost of capital
ULC = Unit labour cost
W = Wage rate, private sector
WG = Wage rate, public sector
WT = Total wages
x = Exports of goods and services
$x_i^\$$ = Exports of goods and services from partner *i* in US dollars
y = Gross domestic product
$y_i^\$$ = Gross domestic product of partner *i* in US dollars
YA = Self-employment and property income
*y** = Potential output
YD = Disposable income of households
YN = Net transfers received by households

Parameters

α = Capital share
δ = Indirect tax rate
λ_L = Rate of labour augmenting technical progress
ω = Scrap rate
ς = Risk premium
ms_i = Import share from partner *i*

Notes

Lower cases indicate the corresponding real value of the variables in upper case; a dot over a variable indicates its rate of variation; the exogenous variables are indicated with a bar above the name of the variable.

An extension of the GH models to the two-break case has been proposed by Hatemi-J (2008; HJ henceforth). Considering only the *C/S* equation, the model becomes

$$y_t = \alpha_1 + \alpha_2 D_t + \alpha_3 D_t + \beta_1' x_t + \beta_2' x_t D_t + \beta_3' x_t D_t + \varepsilon_t \qquad \text{model } C/S$$

where the new parameters α_3 and β_3' are the intercept and slopes in the third regime, and D_{1t} and D_{2t} are dummy variables defined as

$$D_{1t} = \begin{cases} 0 & \text{if } t \le [\, N \times \tau_1 \,] \\ 1 & \text{if } t > [\, N \times \tau_1 \,] \end{cases}$$

and

$$D_{2t} = \begin{cases} 0 & \text{if } t \le [\, N \times \tau_2 \,] \\ 1 & \text{if } t > [\, N \times \tau_2 \,] \end{cases}$$

where τ_1 and τ_2 are the unknown relative timing of the structural change and are found by minimising the ADF* statistic over all possible breaks points in a trimmed subsample ([(0.15+τ_1)×N], [0.85×N]) and such that $\tau_1 \in (0.15, 0.70)$ and $\tau_2 \in (0.15 + \tau_1, 0.85)$.

If a cointegrating relationship emerges, with or without breaks, we will exploit the Granger representation theorem and will specify the short term dynamics by means of an error correction model (ECM) which takes the form

$$\Delta y_t = \mu + \theta' \Delta x_t + \gamma \varepsilon_{t-1} + u_t$$

where ε_{t-1} is the residual term of the cointegrating-residual. Our estimation strategy is as follows:

1. we test the null of no cointegration against the alternative of cointegration with no structural breaks by running a CRADF test on the residuals of the model without breaks;
2. if the null is rejected, we estimate the GH models (*C*, *C/T*, *C/S*, *G*) and, conditionally on the most likely date for a structural break, we test the null of no cointegration against the alternative of cointegration;
3. if no evidence emerges in favour of the null hypothesis, we estimate the HJ models and, conditionally on the most likely dates for the breaks, test the null of no cointegration against the alternative of cointegration.
4. When it is not possible to reject the null of no-cointegration with the three test statistics no further testing is needed and we conclude for lack of cointegration with or without breaks.

If the null of no cointegration is rejected against more than one alternative, we select the alternative corresponding to the most parsimonious model, or the one more consistent with economic theory. We then model the short-run relation as an ECM using the appropriate cointegrating residual. A flow chart of our specification strategy is provided by Figure 4.

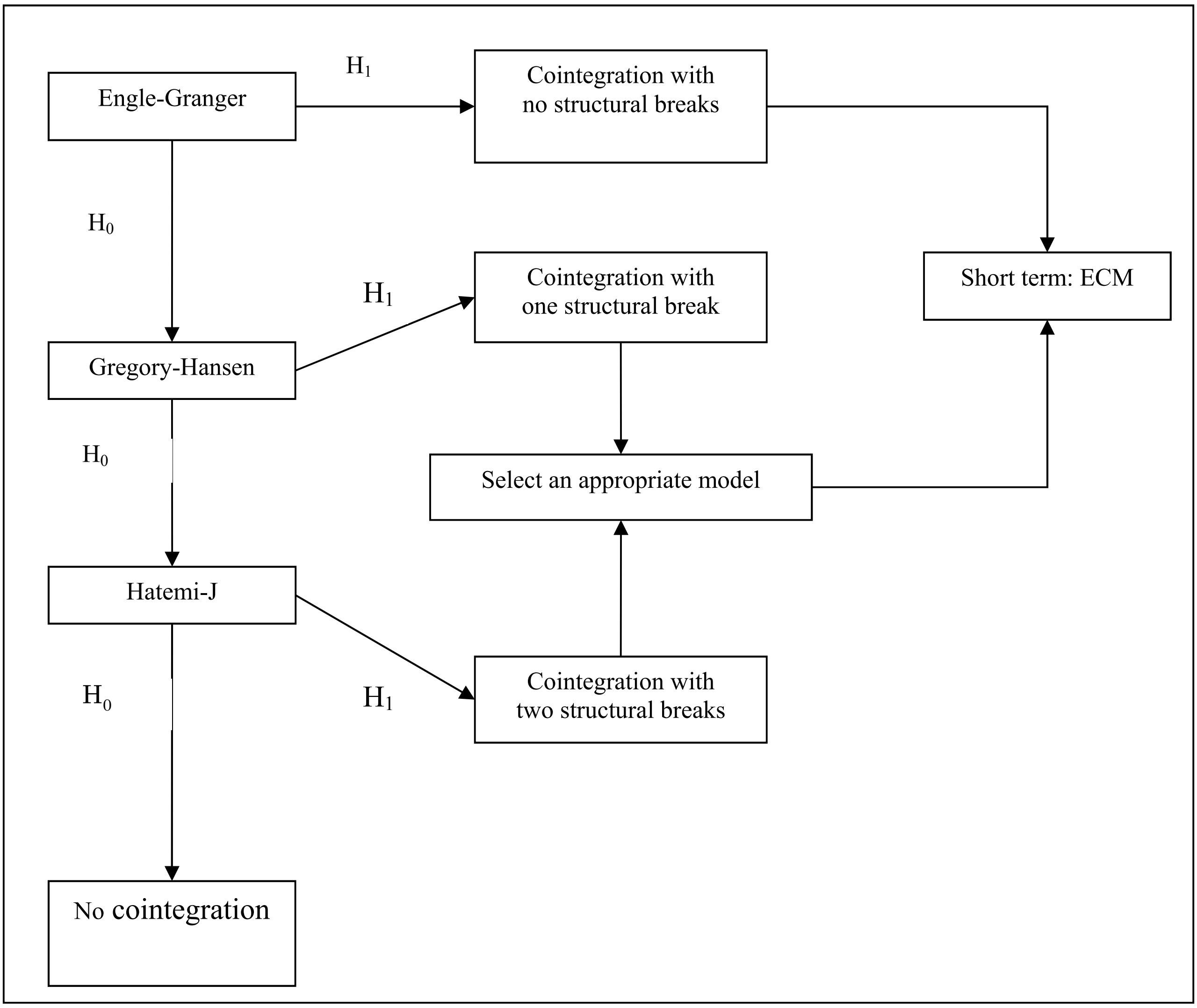

Figure 4 – Our preferred estimation strategy. Note: H_0 and H_1 stand for, respectively, non-rejection and rejection of the null hypothesis.

4 Data

4.1 Sources

The primary statistical source for the database of the model is *OECD.Stat*, compiled by the OECD statistical office and available on-line at http://stats.oecd.org/.

We supplemented non-available data in the *OECD.Stat* database by resorting to other sources. In particular, the most used alternative source is the *I.Stat* database which is the on-line database of the Italian Statistical Office (Istat) and is available at http://dati.istat.it/. The series drawn from *I.Stat* are *IGV*, *IG*, *KBV*, *VAGV*, *WORKERS*, *WSSS*, *WAGE*, *WSSG*, *WAGEG*, *YOTH*, *TRRH*, *YRH*, *TROPH*, *YDH*, *FPR*.

Data on bilateral trade in current US dollars by partner come from two sources. From 1988 to the last available observation we used the *International Trade by Commodity Statistics* (ICTS) database (Harmonised System 1988), available from *OECD.Stat*.[15] Before 1988 we reconstructed the series from *ICTS* by using the corresponding series available in the *CHELEM* database.[16] The nominal series have been converted in real terms by using Italy's aggregate exports deflator for bilateral exports and the partner's aggregate export deflators for bilateral imports. Aggregate exports data come from the *World Development Indicators* database.[17] Deflators have been obtained as the ratio of aggregate exports in current US dollars to aggregate exports in USD at 2005 prices. Bilateral relative prices were constructed as the ratio of Italy's aggregate exports deflator to the partner's aggregate exports deflators, all in US dollars.[18]

4.2 Time series properties

The characterisation of the data generating processes (DGP) of the series, in particular the integration order, were obtained by unit root testing. Detailed results are reported in Appendix 2. The unit root tests employed are standard ADF type tests and the strategy adopted to determine which deterministic components should be included in the ADF auxiliary regressions follows Elder and Kennedy (2001).

The unit root tests indicate that the vast majority of series are $I(1)$. There are some $I(0)$ series, e.g., *FPR* and ln(*MGUSDVF*), and $I(2)$ series, e.g., some deflators. We will not exclude the $I(0)$ and $I(2)$ series from the long run cointegrating relations which involve $I(1)$ variables given that: 1) the ADF tests for the $I(0)$ series are not significant when a 1% confidence interval is considered, implying that there is not a *very strong* evidence in favour of the stationarity of the series; 2) even if adding $I(2)$ series in an equation with non $I(2)$ variables makes it unbalanced, we privileged the theoretical implications of the estimated models, instead of the mere statistical properties. In both cases, an indirect evidence of cointegration will be simply the sign, strength and significance of the coefficient associated to the error-correcting term.

[15] http://stats.oecd.org/Index.aspx?DataSetCode=HS1988

[16] http://www.cepii.fr/anglaisgraph/bdd/chelem.htm

[17] http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=-world-development-indicators

[18] When data had to be reconstructed because the current versions of the databases consulted did not report oldest data, we used one of the following approaches: 1) we checked for possible changes in statistical definitions (i.e., classification methods) of the series and, if present, merged them; 2) we searched for a database with longer historical records; 3) we used series available from previous works. The former approach was mainly adopted in particular for some series from *I.Stat* as there was an update from Nace Rev. 1.1 to Nace Rev. 2 in October 2011.[18] An example of the method mentioned in 2) was already presented for bilateral trade data, which were extracted after 1988 from *ICTS* and before that date they come from *CHELEM*. The latter case was adopted basically for most of the series as it is not usual to have them starting from 1960.[18] In all of these cases, we retropolated the new series by using the percentage change of the previous versions of the database by using the formula $X_{t-1}^{N}=X_{t}^{N}\times X_{t}^{O}/X_{t-1}^{O}$ where X is a generic series and the subscripts N and O stand for "New" and "Old", respectively, and represent new and old series.

5 Estimation results

In this Section we discuss the main features of the estimated equations. A detailed presentation of the estimation results, based on the original EViews outputs, is provided in Appendix 5.

Before entering into the single equation details, we provide here some summary results.

First, the null of no cointegration is rejected for every equation. However, only in three out of 29 cases the null is rejected against the alternative of cointegration with *no* structural breaks. This happens for the imports from OPEC countries (MGUSDVF) and for the exports towards other European countries (XGUSDVE) and OPEC countries (XGUSDVF); see Appendix 3.

Second, the observed shifts in the long-run parameters are 23, of which about a half (ten) occur in the Nineties, and six of them between 1996 and 1999. In particular, the production function undergoes a structural break in the rate of labour augmenting technical progress in 1997. This confirms that the strive to join the EMU has induced significant structural changes in the Italian economy.

Third, the estimated equations generally track the data very well, with R^2 averaging 0.8 and ranging from 0.51 in the equation of XGUSDVG (exports towards the BRICS) to 0.99 in the equation of PIGNET (deflator of gross fixed capital formation). It should be noticed that these values are extremely high, because they refer to equations where the dependent variable is specified mostly in logarithmic differences. As a consequence, the full-model dynamic simulation tracks the behaviour of the dependent variables fairly well, as we shall see in detail in Section 6. We now turn to some specific comments.

5.1 Supply

The specification of the aggregate production function (eq. [1.1]) has proven tricky. Using the whole sample, no significant cointegration test statistic was found, either with or without breaks. Since the tests with structural breaks are carried out in a sample which is trimmed by 15%, as explained in Section 3, this implies that the possible structural changes must occur in the subsample 1968-2005. As a consequence, the post-2008 crisis period is excluded. In other words, a practical limitation of the statistical method adopted prevented us from taking into account any possible hysteresis effect determined by the massive shock that hit the Italian economy in 2008 (see for instance Gawronski, 2014). Being confronted with this practical difficulty, we first explored the presence of structural breaks in the 1967-2001 period (using the 1960-2008 sample). The tests statistics in this subsample shows evidence of cointegration. In particular, the GH tests signal a C/T model with a break in 1974, while the C/S model is chosen by HJ with the breaks dates in 1974 and 1995. Both of these specifications, however, were unsatisfactory from an economic point of view: the C/T model resulted in a capital share parameter of 1.18 while the C/S model gave a value equal or above one for the capital share in two out of three periods and a negative value in the last period. Given these results, we took the G model in the HJ specification and reestimated it after a third break in the trend was imposed in 2008. This modelling choice resulted in economically sound parameters: the capital share starts from a value of 0.47, increases to 0.54 in the first 1970s and reaches 0.66 in the late 1990s (i.e., it mirrors the observed behaviour of the labour share; Pastore, 2010); the technical progress coefficient is positive until 1997 (from 4% during the 1960s it slows down to 1%), it then becomes basically zero up to 2008, a feature which is consistent with the observed behaviour of average labour productivity; afterwards, it becomes negative (-0.6%), thereby signalling that the demand shock experienced by the Italian economy is somehow affecting its supply side.

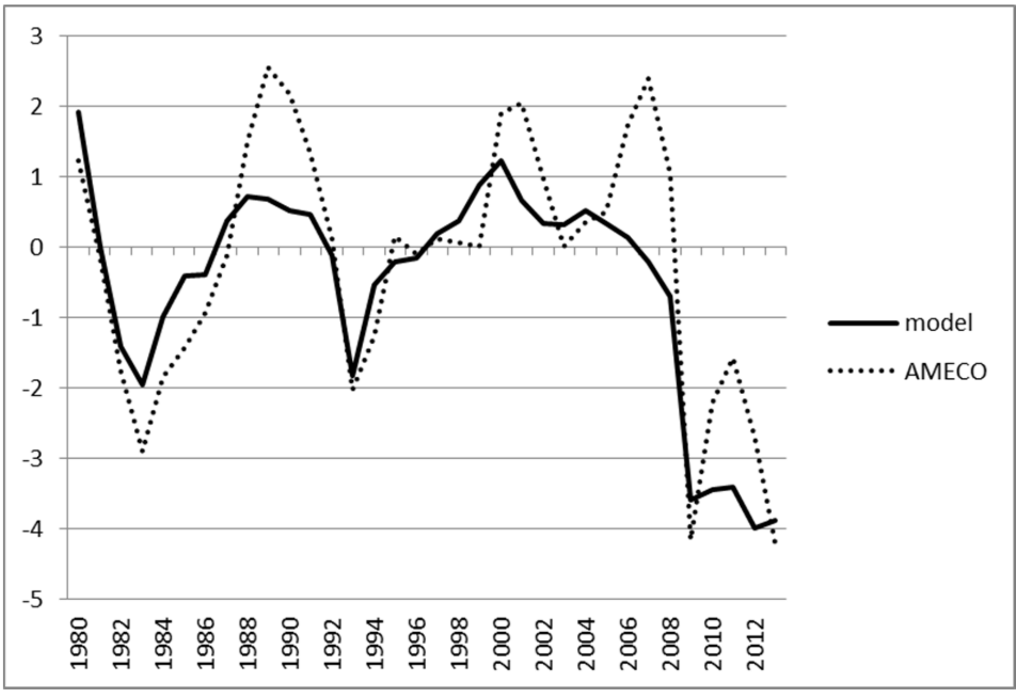

Figure 5 – The output gap generated by dynamic simulation of the full model, compared with the AMECO estimate.

The output gap is defined in terms of deviation of the actual output from its long-run value determined by the cointegrating equation. Figure 5 compares the output gap generated by the dynamics simulation of the full model with the estimate of the same variable provided by the AMECO online database (series AVGDGP). As is to be expected, the model simulation has slightly less variance (the standard deviation of the simulated output gap is 1.5, as compared to 1.8 for the AMECO estimate), but its behaviour is qualitatively very close to that of the AMECO estimate: the major turning points of the Italian economic cycle are tracked fairly well.

The capital share parameter α and the relative timing of structural breaks estimated in the production function equation (eq. [1.1]) are used in the conditional labour demand function (eq. [1.5]), in the marginal productivity condition in the capital growth rate equation (eq. [1.12]), and in the private sector wage equation (eq. [4.11]).

The labour demand equation was estimated by imposing the same structural breaks as those found in the production function. The elasticity to output was constrained to one (according to the theoretical specification), and the elasticity to relative factor costs, α, was given the value resulting from the estimation of the production function (i.e., -0.66 at the end of the sample). According to our modelling strategy, we did not impose any constraint on the specification of the short-run equation, where we obtained an elasticity to output equal to 0.28 and an elasticity to relative factor costs equal to -0.12. The resulting equation explains about 80% of the variance of private employment growth in Italy.

5.2 Demand

The main stochastic equation of this block is the consumption function (eq. [2.1]), because investment is determined in the supply block (through the desired rate of growth of the capital stock), and aggregate exports and imports result from the sum of the bilateral flows modelled in the trade block. The estimation results for the consumption function were conform to economic theory: the long-run elasticity to real income is equal to one and the coefficient of female participation ratio is positive. A level shift was found by the GH model in the mid-1990s. The short-run estimates display a relatively large impact elasticity to real income, near 0.72. This implies that about three fourths of an income shock translates to consumption in the first year, and the remaining deviation from the equilibrium gets corrected by 34% each year.

5.3 Wages and prices

The price equations are driven by import prices (PMGS) and by the unit labour costs (ULC), which in turn depend on the private sector wage rate.

In the long run, real wages depend on average labour productivity. The long-run elasticity is constrained to one, according to the theoretical specification set out above. The estimated steady-state wage equation features two breaks in the trend of labour augmenting technical progress, one in 1971 and the other one in 1997 (in correspondence with the beginning of the Italian labour market reform; see eq. [4.11] in Appendix 5). At the end of the sample (i.e., after the break occurring in 1997) the estimated steady-state equation, omitting the deterministic components, is:[19]

$$\ln\left(\frac{W}{P}\right) = \ln\left(\frac{y}{n}\right) - 1.02u + 0.07\,flex$$

Both the unemployment rate and the employment protection index enters the equation in natural units. As a consequence, their estimated coefficients are semi-elasticities. The corresponding elasticities can be obtained by multiplying the coefficients estimates for the values of the respective explanatory variable. Since the long-run coefficient on unemployment is approximatively equal to one (see footnote 19), this implies that the long-run elasticity of real wage to unemployment is

[19] It is worth noting that since the unemployment rate enters the ECM specification in levels, it features in the steady-state solution with a long-run coefficient equal to the ratio of the short-run coefficient to the feedback coefficient (the coefficient of the lagged residual in the ECM specification). The long-run coefficient of unemployment is therefore -0.42/0.41=-1.02.

approximatively equal to the value of the unemployment rate itself.[20] With the current value of the unemployment rate, around 0.13 (13%), a one point increase in the rate from 0.13 to 0.14 (equal to a 7.7% increase in the rate), would bring about a 0.13×0.077 = 0.01 = 1% *decrease* in the long-run level of real wages.

As for the employment protection index, since its average value is around 2.5, the corresponding elasticity is about 2.5×0.07 = 0.175, which implies that a 10% decrease in employment protection entails a 1.75% decrease in the long-run real wage *level*. From 1999 to since the beginning of the crisis in 2008 the employment protection index in Italy fell by about 30%, thus determining a *ceteris paribus* decrease in the long-run level of private real wages equal to about 5%. In other words, the effect of labour market reforms did more than offset the upward pressure on the long-run real wages determined by the contemporaneous fall by 4.5 points in the unemployment rate.

The short-run Phillips curve (i.e., the relation between the rate of growth of nominal wages and the unemployment rate) has a slope equal to -0.42. The estimated ECM has a good fit ($R^2 = 0.93$), with a strong error correcting behaviour.

Estimates of the consumption and private investment deflators (eq. [4.3] and [4.5], respectively) show, as expected, that ULC is a key driver for price dynamics: in both equations, the long-run and impact elasticities are quite consistent. Moreover, estimates show that external prices have a relatively moderate effect. A different picture comes from the export deflator estimates, where import prices exert a conspicuous effect on both the long- and the short-run. This pattern reflects the dependence of the output prices in the manufacturing sector from the prices of imported inputs.

5.4 Trade

The properties of the trade block depend on the long-run elasticities of the bilateral trade equations. An overview of these elasticities is provided by Table 2, while Table 3 reports the implied aggregate elasticities, obtained by taking the weighted averages of the bilateral elasticities (using the respective market shares as weights), and compares them with the estimates of the same elasticities reported by other studies. Since most studies consider Italy along with other countries, we show both the Italian estimates, and the cross-countries averages (in the right-hand panel of the Table).

Considering first the bilateral elasticities reported in Table 2, they are in general strongly significant (at the 1% level) and present the correct signs, with a very few exceptions.[21] Another distinct feature is that the estimated elasticities differ widely from one partner to the next (which implies that aggregate estimates, by implicitly imposing

[20] In the estimation we did not express the unemployment rate as a percentage. In other words, a 10% unemployment rate is measured as $u = 0.1$.

[21] Exports towards the BRIC are not elastic to relative prices before the structural change occurring in 1993 (see eq. [3.4.G] in Appendix 5). Imports from OPEC countries have very low elasticities (for obvious reasons), and the income elasticity is significant only at the 10% level and has the wrong sign (possibly reflecting a long-run shift to more energy efficient technologies). A more puzzling result is the negative elasticity to relative prices of imports from the other European countries. While this result needs a more careful analysis, it is not likely to affect the general properties of the model, because the corresponding market share is about 10% of Italy's total trade.

an equality constraint, would be biased). Both the income and relative price elasticities seem in general to be higher (in absolute value) in the bilateral relations with our closer partners: the European countries (Eurozone core, Eurozone periphery, other European), and possibly the United States. As far as the income elasticities are concerned, on the side the highest value is found in the United States equation, while on the imports side in the Eurozone periphery equation. As far as the relative price elasticities are concerned, both on the export and on the import side the highest value is found in relation with the Eurozone periphery. A significant exception to this pattern is the high relative price elasticities of the exports towards the BRICS, which takes a value of -1.20 after a structural break occurring in 1993, possibly related to the acceleration of China's opening after Deng Xiaoping "Southern tour" in 1992. Moreover, the Marshall-Lerner condition is satisfied in every bilateral trade relation, with the exception of the OPEC countries, where a devaluation implies a worsening of the trade balance. This is obviously related to the dependency of Italy on oil imports, as witnessed by the very low value of the relative price elasticity, which implies a small import substitution effect.

Table 2 – Long term elasticities of bilateral trade

	Export				**Import**		**ML**
	Regime 1		*Regime 2*				
	Income	Prices	Income	Prices	Income	Prices	
Eurozone core	1.85***	-0.58***	1.85***	**-1.27*****	2.12***	1.03***	2.30
Eurozone periphery	1.86***	-0.43***	**2.79*****	**-1.92*****	3.18***	1.98***	3.90
United States	3.69***	-1.03***	3.69***	-1.03***	1.40***	0.39***	1.42
Other European countries	1.86***	-1.52***	1.86***	-1.52***	1.83***	-0.46***	1.07
OPEC countries	0.27***	-0.68***	0.27***	**-0.68*****	-0.17*	0.16***	0.84
BRIC	1.37***		1.37***	**-1.20****	0.93*	0.74***	1.95
Rest of the world	1.55***	-0.47***	1.55***	**-0.47****	1.55***	1.19***	1.66

Note: Some exports equations underwent structural breaks and their values in the different regimes are reported below the *Regime 1* and *Regime 2* columns (in boldface the parameters that changed); under the *ML* column (Marshall-Lerner condition) the sum of price elasticities in absolute terms is reported; *, ** and *** represent, respectively, statistical significance at the 10%, 5% and 1%.

We now turn to a comparison of the aggregate elasticities implied by our bilateral estimates, with the results of other studies, in order to verify whether the values we have found are consistent with previous empirical results. This comparison is carried out in Table 3.

As for the elasticities to income, they seem quite in line with other estimates. This applies in particular for imports elasticities, which are in all cases above 1, except in Bahmani-Oskooee and Kara (2005) who obtain a unit elasticity. The cross-country comparison gives the same results as the lowest value is 1.25 in Perraton and Turner (1999).Export elasticities estimates are relatively more heterogeneous as they range from values below 1 (e.g., 0.39 in Bahmani-Oskooee and Kara, 2005) to values over 2 (e.g., 2.24 in Wu, 2008). A recent study by Algieri (2014) confirm that the income elasticity of Italian exports is well above 1 by using newer data and controlling for non-price competitiveness. A similar conclusion can be obtained at the international level by looking at the cross-country average elasticities which in just in one case (Perraton and Turner, 1999) is below 1.

As far as the relative price elasticities are considered, our estimates generally fall in the highest range of the previous estimates. On the export side, our aggregate relative price elasticities in regime 2 is equal to -1.1, the second highest estimates reported in the Table, after the value of -1.78 reported by DG-ECFIN (2010). It is worth noting, however, that the estimates by Wu (2008) and Algieri (2014) are not very far from our estimate, and that the cross-country averages such as in Caporale and Chui (1999) are even higher. [22] We performed a sensitivity analysis of our results by estimating again the model without taking into account the structural breaks. In this case, we would obtain an aggregate value of -0.89, relatively in line with other studies. It is therefore likely that the results obtained depend on having explicitly considered the possible presence of structural breaks. In fact, the progress of globalization, by widening the opportunities of trade and opening new markets, could result in an increased reactivity of the trade flows to relative prices. A similar increase has already been observed with respect to the elasticity to income,[23] and this point deserves future research.

Similar considerations applies to the price elasticities in the imports equations, where our aggregate estimate is equal to -0.81. While some of the previous estimates are very low (e.g., -0.01 and -0.23 respectively in Bahmani-Oskooee and Kara, 2005, and Perraton and Turner, 1999), higher values (-0.71/-0.74) have already been obtained by Caporale and Chui (1999). A tentative interpretation of the low elasticities found in other studies can be two-fold. On the one hand, the choice of the relative price plays a central role: for instance, Bahmani-Oskooee and Kara (2005) use the ratio of the index of unit value of imports to the index of wholesale prices. This should be avoided at any level of aggregation as “[t]here is no evidence of homogeneous product classes for which unit value indices may be reliably used” and “[s]ignificant unit value bias arises within strata defined at levels of detail well beyond that available in customs systems” (Silver, 2007). On the other hand, aggregation matters: the studies reported in Table 3 consider aggregate imports, thus any bias induced by aggregating countries and industries are reflected in the final estimate. With this respect, Chiarlone (2000) has analysed bilateral trade data for 10 industries disaggregated at the 5-digits disaggregation level of SITC Rev.3 in the period 1988-1996. His results show an average elasticity of -0.73, which is not very different from ours.

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[22] Specifically -1.17, obtained with the ARDL estimator.

[23] Crane *et al*. (2007): “With the exception of Canada, estimates of the income elasticity for the G-7 countries over the period 1981–2006 are as large as or larger than those for the period 1981–94. This could be interpreted as evidence that export elasticities with respect to income are increasing over time.” Bagnai (2010) finds an increase in the income elasticity of imports for Belgium, Canada, Denmark, The Netherlands, Sweden and the United Kingdom. Note that in our study even if the largest increase is that in the elasticity to price (from 1.49 to 1.91), the elasticity to income goes from 1.80 to 1.87.

Table 3 – Long-term elasticity estimates of exports and imports.

	Italy					Cross country average				
	Income		Prices		ML	Income		Prices		ML
	Import	*Export*	*Import*	*Export*		*Import*	*Export*	*Import*	*Export*	
Our estimates, average	1.65	1.84	-0.81	-0.89	1.70					
Our estimates, regime 1, average	1.65	1.80	-0.81	-0.68	1.49					
Our estimates, regime 2, average	1.65	1.87	-0.81	-1.10	1.91					
Bahmani-Oskooee and Kara (2005) [a]	1.03	0.39	-0.01	-0.33	0.34	1.35	1.39	-1.24	-1.01	2.65
Caporale and Chui (1999) [b]	1.69	2.21	-0.71	-0.93	1.64	1.52	1.87	-0.53	-0.49	1.20
Caporale and Chui (1999) [c]	1.72	2.02	-0.74	-0.47	1.21	1.54	1.76	-0.55	-1.17	1.72
Crane et al. (2007) [d]	1.63	1.64	-0.33	-0.57	0.90	1.71	1.59	-0.45	-0.71	1.06
Crane et al. (2007) [e]	2.48	1.74	-0.23	-0.74	0.97	2.08	1.72	-0.44	-0.67	1.49
Hooper et al. (2000) [f]	1.40	1.62	-0.40	-0.88	1.28	1.54	1.23	-0.42	-0.91	1.34
Perraton and Turner (1999) [g]	2.00	0.88	-0.23	-0.66	0.89	1.25	0.77	0.16	-0.19	0.50
Wu (2008) [h]	1.56	2.24	-0.31	-0.99	1.30	1.34	1.92	-0.50	-0.57	1.52
Algieri (2014) [i]		1.59		-0.83						
Algieri (2014) [j]		1.68		-0.93						
DG-ECFIN (2010) [k]		1.08		-1.78			1.07		-1.15	
Chiarlone (2000) [l]	2.71		-0.73							

Notes: In order to facilitate comparisons, our estimates of the elasticities of imports to prices are reported with a negative sign (our relative price measure is the same for exports and imports, thus its estimated—and expected—sign is originally positive); averages are unweighted arithmetic averages; "regime 1" spans from 1970 to the mid-1980s, while "regime 2" spans from the mid-1980s to 2013; [a] Quarterly data (1973-1998), 28 countries, ARDL estimator; [b] Annual data (1960-1992), 21 countries, DOLS estimator; [c] Annual data (1960-1992), 21 countries, ARDL estimator, [d] Quarterly data (1981-1994), 7 countries, Johansen ML estimator; [e] Quarterly data (1981-2006), 7 countries, Johansen ML estimator; [f] Quarterly data (1972/1976, imports/exports, Italy)-1994, 7 countries, Johansen ML estimator; [g] Annual data (1957-1995), 15 countries, SURE estimator; [h] Annual data (1960-1998), 35 countries, DOLS estimator.; [i] Quarterly data, (1978-2011), ML estimator, aggregate Italian exports, the relative prices measure is the ratio of competitors' export prices to domestic export price; [j] as [i], except that the relative prices measure is the CPI based REER; [k] Quarterly data (1980/2008, except France: 1980/2000), 5 countries (Austria, Germany, Spain, France, Italy), single ECM models; [l] Quarterly data (1988-1996), 10 industries disaggregated at the 5-digits SITC Rev.3, LSDV estimator.

Finally, in our aggregate estimates the Marshall-Lerner condition is fully satisfied in both regimes, going from 1.49 in the first regime to 1.91 in the second regime. The average value over the sub-samples being 1.70 is in line with Caporale and Chui (1999)[24]. The previously mentioned high value of the import elasticity and the increase in the second sub-sample of the export elasticity give an elasticity which is closer to 2. Even if this is not common in previous estimates of Italy's trade, a sum of price elasticities above 2 is not uncommon for other countries. For instance, the cross-country average of the ML condition in Bahmani-Oskooee and Kara (2005) is 2.65. It should be said, however, that this number comes from the aggregation of very different countries. Regardless, it is possible to gather from Bahmani-Oskooee and Kara's (2005) study the group composed by Greece, Spain and Ireland (countries which, along Italy and Portugal, are called the GIPSI countries)[25] have an average ML condition of 2.81.[26] Following the same line, the average value in Greece, Ireland and Spain in Wu (2008) is 2.27. [27]

5.5 Interest rates

Short- and long-run interest rates were estimated using the autoregressive distributed lag (ARDL) approach by Pesaran *et al*. (2001). Both equations present the expected signs. A one point increase in the output gap leads to a 1.10 points increase in the short-term interest rate. A one point increase in the PSBR leads to a 0.28 points increase in the long-term interest rate. The average cost of government debt, IRGOV, is modelled as a function of the average between the short- and long-term interest rates, and reacts with some sluggishness to an increase in these variables. As a consequence, a 100 basis points increase in the interest rates (determined for instance by an increase in the Italian interest rate spread) will determine an increase in IRGOV equal to 39 basis points in the first year, reaching 60 basis points after three years.

6 Simulations

The model properties were investigated using dynamic simulation methods in order to assess the tracking performance as well as the response to a set of standard shocks. The tracking performance was first evaluated over the 33 years subsample ranging from 1980 to 2013. Then, the model response was investigated by considering the following shocks:

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[24] DOLS estimates.

[25] No estimates are available for Portugal in Bahmani-Oskooee and Kara (2005).

[26] Greece, 1.84; Spain, 4.68; Ireland, 1.9.

[27] It is worth noting that in our specification the relative price term is specified as the ratio of exports to import prices (i.e., as bilateral terms of trade), rather than as a real exchange rate index. The latter would compare with the price of imported goods with the price of domestic good in the domestic (rather than the foreign) market, taking some domestic demand deflator, rather than the export deflator, as the numerator of the ratio. Since the empirical literature shows that firms practice different price policies in the domestic and foreign markets (by adopting "price to market" policies), the two specification are likely to bring about different values of the estimated elasticities. Some sensitivity analysis carried out by estimating alternative specifications of the relative prices term shows that adopting different measures of the relative prices does not imply a significant difference in the estimated elasticities.

1. a permanent increase in nominal government investment by 1% of baseline nominal GDP;
2. a permanent increase in government wage expenditure by 1% of baseline nominal GDP;
3. a permanent EUR/USD exchange rate devaluation by 20%;
4. a permanent reduction of world real GDP growth rate by 1%;
5. a permanent increase in oil prices by 50%.

Table 4 – Mean Absolute Percentage Errors (MAPE) and Root Mean Squared Percentage Error (RMSPE) of some model variables

Variable	MAPE	RMSPE	Variable	MAPE	RMSPE
APL	1.39	1.79	PSBRQ ‡	1.39	1.62
CPV	2.61	2.95	PXGS	1.18	1.55
ET	1.51	1.67	SSPG	4.94	6.00
ETB	1.73	1.91	TBQ ‡	0.94	1.13
GAPB ‡	0.86	1.05	TBQ_B ‡	0.45	0.55
GDPBV	1.91	2.52	TBQ_C ‡	0.09	0.11
GDPV	1.69	1.96	TBQ_D ‡	0.11	0.14
GGFL	6.79	7.66	TBQ_E ‡	0.21	0.24
GGFLQ ‡	6.92	8.18	TBQ_F ‡	0.17	0.24
GGINTP	13.86	15.78	TBQ_G ‡	0.14	0.19
GGINTPQ ‡	1.03	1.26	TBQ_H ‡	0.41	0.49
IBV	5.63	7.12	TYB	1.63	2.08
IRGOV ‡	0.71	0.87	TYH	2.10	2.51
IRL ‡	1.46	1.70	UNR ‡	1.37	0.15
IRS ‡	1.18	1.39	UWB	1.43	1.84
KGR ‡	0.00	0.00	UWBR	1.07	1.46
MGSV	2.95	3.63	XGSV	2.06	2.63
MGUSDVB	4.89	5.79	XGUSDVB	2.42	2.94
MGUSDVC	7.08	8.07	XGUSDVC	2.94	4.09
MGUSDVD	7.49	9.03	XGUSDVD	4.60	5.86
MGUSDVE	5.15	6.55	XGUSDVE	5.37	6.04
MGUSDVF	7.30	9.08	XGUSDVF	6.62	8.71
MGUSDVG	8.19	9.89	XGUSDVG	11.41	14.32
MGUSDVH	6.13	7.39	XGUSDVH	7.16	8.51
PCPNET	1.47	1.81	YDH	2.36	2.85
PIBNET	1.25	1.54	YDHR	2.48	2.86
PIGNET	1.78	2.24	YPEX	3.83	4.71

Note: ‡ indicates that variables are ratios or rates and Mean Absolute Errors (MAE) and Root Mean Squared Errors (RMSE) were computed.

The evolution of the main endogenous variables is tracked for four years after the shock. The impact year is labelled as year 0.[28] The results are expressed as percentage deviations from the baseline for flows, index, and stock variables (as GDP, prices, or employment, respectively), and as absolute deviations from the baseline for rates or GDP ratios (as the unemployment rate, or the PSBR-to-GDP ratio respectively), as well

[28] The counterfactual experiment is performed *ex post* and the exogenous variables are shocked in 2004.

as for the percentage growth rates (like for instance the real rate of growth, or the inflation rate).

6.1 Model's performance

Appendix 4 reports after each stochastic equation the graphs of simulated vs. actual values, as well as the patterns of some variables modelled through identities. Table 4 reports the standard goodness-of-fit summary statistics (Mean Absolute Percentage Error, and Root Mean Squared Percentage Error) for the main endogenous variables.[29] As is to be expected, given the high goodness-of-fit statistics and the strong error correcting behaviour of the stochastic equations, the dynamic simulation of the model tracks the actual values quite well.

Table 5 – An increase in nominal public investment equal to 1% of nominal baseline GDP.

	-1	0	1	2	3	4
Nominal GDP (billion EUR)						
Counterfactual	1345.48	1412.67	1474.00	1557.45	1623.45	1664.33
Baseline	1345.48	1400.92	1456.83	1535.93	1599.39	1638.60
Deviation	0.00	11.75	17.17	21.52	24.06	25.73
Nominal government investment (billion EUR)						
Counterfactual	32.93	47.58	48.45	50.36	52.12	51.61
Baseline	32.93	33.57	33.88	35.00	36.13	35.23
Deviation	0.00	14.01	14.57	15.36	15.99	16.39
Government investment deflator (index)						
Counterfactual	0.93	0.95	0.99	1.05	1.09	1.12
Baseline	0.93	0.95	0.99	1.05	1.09	1.12
Deviation	0.00	0.00	0.00	0.00	0.00	0.00
Real GDP (billion EUR at 2005 prices)						
Counterfactual	1413.22	1456.86	1471.42	1487.96	1501.08	1503.36
Baseline	1413.22	1440.78	1451.04	1465.64	1478.70	1481.06
Deviation	0.00	16.08	20.37	22.32	22.37	22.30
% Deviation	0.00%	1.12%	1.40%	1.52%	1.51%	1.51%
Keynesian multiplier	0	1.09	1.38	1.53	1.52	1.52

6.2 Increase in nominal government investment

This scenario investigates the impact on the Italian economy of an increase in (nominal) public investment (IGG) equal to 1% of baseline GDP. A "big push" to government investment, possibly ignoring the fiscal constraint defined by the Fiscal compact, is often invoked as a strategy to put the Italian recession to an end. Table 5 describes how the shock is defined, while some results are reported in Table 6.[30]

[29] $MAPE = \frac{1}{n}\sum|\hat{y} - y|/y$ and $RMSPE = \sqrt{\frac{1}{n}\sum((\hat{y} - y)/y)^2}$, where y is a generic variable and $\hat{y}$ is its simulated value.

[30] The detailed simulation tracking is available upon request.

Since the baseline nominal GDP is equal to about €1400 billion in the year of the shock (year 0), the increase in nominal government investment in equal to €14 billion, corresponding to about 40% of the baseline value. The real GDP response is equal to €16 billion (at 2005 prices). This corresponds to an increase of 1.12% with respect to the baseline value. Using the government investment deflator (that is almost unaffected by the shock), we can express in real terms the shock to government investment. The ratio of the increase in real GDP to the increase in real government investment, i.e., the Keynesian multiplier of investment, is equal to 16/(14/0.95) = 1.09 in the first year. The same reasoning allows us to track the model response in the four years after the shock. The multiplier rises to 1.53 in the second year, then it stabilises at 1.52, a completely reasonable estimate in the light of the more recent empirical literature (as admitted in the rather ludicrous palinode in Box 1.1 of IMF, 2012), even considering the studies that take explicitly into account the role of the informal economy (as in Acconcia *et al.*, 2011).

We can now turn to a more detailed analysis of the results. The boost to public investment has the expected effect on growth: the increase of real GDP by 1.12% with respect to its baseline value (sixth row of Table 6) corresponds to an increase by 1.14 points in real GDP growth (as can be easily verified with the figures reported in Table 5, and as reported in the lowermost panel of Table 6). The increase in growth is driven mostly by domestic expenditure: the rates of growth of private investment and consumption increase by 1.46 and 0.60 points respectively (lowermost panel of Table 6). This increase in both public and private investment has a positive impact on average labour productivity, and hence on real wages, that increase by 0.93% and 0.59% of the respective baseline values in the year of the shock (uppermost panel of Table 6). The increase in output brings about an increase in total employment equal to about 0.20% of the baseline value, say 41 000 more jobs in the first year, that rise to 90 000 after four years. This corresponds to a decrease in the unemployment rate by about 0.36 points in the medium run (reported in the first row of the middle panel of Table 6). While this reductions exerts a pressure on nominal wage rate, the increase in labour productivity dampens the unit labour costs, that actually decrease by about 0.65% with respect to their baseline value in the impact year, then reverting to the baseline rather quickly. As a consequence, the expansionary fiscal policy has no noticeable inflationary consequences. On the contrary, owing to the increased productivity the competitiveness improves slightly, causing a little increase in exports. However, the impact of the fiscal stimulus on the trade balance is negative, because imports react to the increase in income more than exports to the decrease in relative prices. The overall trade balance decreases by about 0.77 GDP points (middle panel of Table 6), and about a half of this worsening (0.34 GDP points) is caused by the balance with the Eurozone core countries.

The increase in the government deficit is partially offset by the expansionary effects of the stimulus. The public sector borrowing requirement increases only by 0.76 points (instead of 1 point) in the first year, and the public debt-to-GDP ratio does not increase (-0.07 GDP points) because of the increase in its denominator. The government and external balance follow a “twin deficits” path. Over time, however, as the growth effects flag, the public debt-to-GDP ratio increase, reaching 1.25 GDP points above the baseline in the fourth year after the shock.

Table 6 – An increase in nominal public investment equal to 1% of nominal baseline GDP.

year	0	1	2	3	4
Percentage deviations from the baseline					
private consumption (CPV)	0.59	1.13	1.34	1.30	1.28
public consumption (CGV)	0.00	0.00	0.00	0.00	0.00
private investment (IBV)	1.45	1.87	2.06	2.02	1.97
exports (XGSV)	0.11	0.13	0.08	0.00	-0.03
imports (MGSV)	3.05	2.99	2.79	2.47	2.35
real GDP (GDPV)	1.12	1.40	1.52	1.51	1.51
total employment (ET)	0.19	0.30	0.36	0.39	0.39
private employment (ETB)	0.21	0.34	0.41	0.43	0.44
potential output (GDPBV)	0.41	0.46	0.51	0.55	0.59
average labour productivity (APL)	0.93	1.10	1.16	1.12	1.11
unit labour costs (ULC)	-0.65	-0.50	-0.28	-0.06	0.05
real wage rate (UWBR)	0.59	1.05	1.40	1.57	1.62
wage rate (UWB)	0.41	0.88	1.26	1.50	1.62
consumption price index (PCP)	-0.17	-0.17	-0.14	-0.06	0.00
investment deflator (PIB)	-0.43	-0.33	-0.19	-0.04	0.03
export prices (PXGS)	-0.18	-0.15	-0.06	0.02	0.05
nominal disposable income (YDH)	0.64	1.03	1.20	1.24	1.32
real disposable income (YDHR)	0.82	1.20	1.34	1.31	1.32
Absolute deviations from the baseline					
unemployment rate (UNR)	-0.17	-0.28	-0.34	-0.36	-0.36
short-term interest rate (IRS)	-0.04	0.11	0.16	0.20	0.19
long-term interest rate (IRL)	-0.02	0.12	0.24	0.30	0.30
average interest rate on public debt (IRGOV)	-0.01	0.04	0.09	0.13	0.14
public debt-to-GDP ratio (GGFLQ)	-0.07	0.26	0.55	0.90	1.25
public deficit-to-GDP ratio (PSBRQ)	0.76	0.67	0.54	0.47	0.46
trade balance-to-GDP ratio (TBQ)	-0.77	-0.76	-0.71	-0.63	-0.59
t.b. with Eurozone core (TBQ_B)	-0.34	-0.32	-0.27	-0.23	-0.21
t.b. with Eurozone periphery (TBQ_C)	-0.06	-0.06	-0.07	-0.08	-0.08
t.b. with the USA (TBQ_D)	-0.02	-0.03	-0.03	-0.03	-0.03
t.b. with the other European countries (TBQ_E)	-0.07	-0.08	-0.08	-0.07	-0.07
t.b. with the OPEC countries (TBQ_F)	0.00	0.01	0.01	0.01	0.01
t.b. with the BRIC (TBQ_G)	-0.06	-0.03	-0.02	-0.02	-0.02
t.b. with the rest of the world (TBQ_H)	-0.22	-0.25	-0.25	-0.21	-0.20
Absolute deviations of percentage growth rates					
private consumption (CPV)	0.60	0.54	0.20	-0.03	-0.02
public consumption (CGV)	0.00	0.00	0.00	0.00	0.00
private investment (IBV)	1.46	0.42	0.18	-0.04	-0.05
exports (XGSV)	0.12	0.02	-0.06	-0.08	-0.04
imports (MGSV)	3.21	-0.06	-0.21	-0.32	-0.11
real GDP (GDPV)	1.14	0.29	0.12	-0.01	-0.01
total employment (ET)	0.19	0.12	0.06	0.02	0.00
private employment (ETB)	0.21	0.13	0.07	0.02	0.01
potential output (GDPBV)	0.42	0.05	0.06	0.03	0.04
average labour productivity (APL)	0.93	0.17	0.06	-0.03	-0.01
real wage rate (UWBR)	0.59	0.47	0.34	0.17	0.06
wage rate (UWB)	0.42	0.48	0.40	0.25	0.13
consumption price index (PCP)	-0.18	0.00	0.04	0.08	0.07
investment deflator (PIB)	-0.44	0.10	0.15	0.15	0.07
exports prices (PXGS)	-0.18	0.03	0.09	0.08	0.04
nominal disposable income (YDH)	0.66	0.39	0.18	0.04	0.08

Summing up the results, while a "big push" on public investment would have a remarkable impact on growth and a lasting effect on income and consumption, it would also undermine the sustainability of Italy's external accounts.

6.3 Increase in nominal government consumption (wage expenditure)

A further simulation analyses the impact of an increase in the wage component of government consumption (CGW), of the same size of the increase in nominal public investment analysed in the previous experiment, namely, 1% of baseline GDP. The simulation has been carried out by shocking the average wage rate of the government sector (UWG). The detailed results are reported in Table 7.

The 1 nominal GDP point increase in government wage corresponds to roughly a 5.5% increase in government consumption above its baseline value (second row of Table 7). The implied Keynesian multiplier of this expansionary measure is 1.23 in the first year, and stabilizes at 1.64 after three years. In other words, the impact of wage expenditure is more expansionary than the impact of investment. Real GDP growth increases by 1.35 points in the first year (as compared to 1.14 in the previous experiment; see the bottom panel of Table 7), mostly because the increase in government wages boosts consumption (whose rate of growth increases by 1.40 points, as compared to 0.60 in the previous experiment).

Since in this case the measure insists on the demand side of the economy, it has a non-negligible inflationary impact. The unit labour cost increases by 2.62% above its baseline, bringing the inflation rate 1.48 points and the growth of exports prices 0.73 points above their respective baselines. As a consequence, in the first year the real wage rate is almost constant (-0.08% with respect to the baseline), while real exports decrease by -0.44% with respect to the baseline. Since at the same time the rise in consumption fosters imports, the trade balance worsens by almost one GDP point (of which almost a half towards the Eurozone core). The adverse consequences on the external balance are therefore more pronounced and persistent in this case.

On the other hand, this policy measure has a larger impact on employment, which increases by more than 110 000 units at the end of the simulation horizon. Another consequence of the more inflationary environment is that, despite an increase in the deficit-to-GDP ratio, the public debt-to-GDP ratio actually decreases, because nominal GDP increases by almost three points in the first year, and by a cumulated six points over the simulation horizon. As a consequence, the public debt-to-GDP ratio decreases by almost four points in the fourth year after the shock.The increase in demand stimulates private investment and through this channel productivity. This in turn brings about a rise in the real wage rate, that by the end of the simulation horizon is 1.76% above its baseline. The effect on households' real disposable income and therefore on private consumption are larger than in case of a public investment increase. At the end of the simulation horizon they are both at about 2.60% above their respective baselines (twice as much as in the case of investment expansion). Despite the larger leakage through imports, the medium-run effect on aggregate demand and on employment is therefore larger in this case.

Table 7 – An increase in nominal government consumption by 1% of nominal baseline GDP

year	0	1	2	3	4
Percentage deviations from the baseline					
private consumption (CPV)	1.38	2.36	2.70	2.65	2.58
public consumption (CGV)	5.45	5.41	5.47	5.41	5.38
private investment (IBV)	2.37	3.26	3.44	3.20	2.95
exports (XGSV)	-0.44	-0.79	-1.00	-1.10	-1.10
imports (MGSV)	4.13	4.61	4.46	3.99	3.85
real GDP (GDPV)	1.32	1.72	1.83	1.77	1.75
total employment (ET)	0.36	0.56	0.61	0.56	0.48
private employment (ETB)	0.41	0.63	0.69	0.62	0.54
potential output (GDPBV)	0.70	0.79	0.84	0.85	0.89
average labour productivity (APL)	0.96	1.16	1.22	1.20	1.27
unit labour costs (ULC)	2.62	3.69	4.78	5.53	5.80
real wage rate (UWBR)	-0.08	0.74	1.40	1.72	1.76
wage rate (UWB)	1.36	3.19	4.81	5.86	6.31
consumption price index (PCP)	1.44	2.43	3.36	4.07	4.47
investment deflator (PIB)	1.70	2.41	3.13	3.62	3.80
export prices (PXGS)	0.72	1.05	1.27	1.37	1.32
nominal disposable income (YDH)	3.37	4.91	6.18	6.87	7.23
real disposable income (YDHR)	1.90	2.42	2.72	2.69	2.64
Absolute deviations from the baseline					
unemployment rate (UNR)	-0.33	-0.52	-0.57	-0.52	-0.44
short-term interest rate (IRS)	1.03	1.00	1.18	1.06	0.89
long-term interest rate (IRL)	0.44	0.68	0.83	0.79	0.64
average interest rate on public debt (IRGOV)	0.29	0.44	0.55	0.56	0.50
public debt-to-GDP ratio (GGFLQ)	-2.22	-3.13	-3.73	-3.88	-3.94
public deficit-to-GDP ratio (PSBRQ)	0.42	0.21	0.13	0.15	0.19
trade balance-to-GDP ratio (TBQ)	-0.96	-1.11	-1.09	-0.98	-0.92
t.b. with Eurozone core (TBQ_B)	-0.44	-0.47	-0.44	-0.38	-0.35
t.b. with Eurozone periphery (TBQ_C)	-0.09	-0.14	-0.18	-0.19	-0.19
t.b. with the USA (TBQ_D)	-0.04	-0.06	-0.07	-0.07	-0.06
t.b. with the other European countries (TBQ_E)	-0.09	-0.11	-0.11	-0.11	-0.10
t.b. with the OPEC countries (TBQ_F)	0.01	0.02	0.03	0.03	0.04
t.b. with the BRIC (TBQ_G)	-0.05	-0.03	-0.01	-0.01	-0.01
t.b. with the rest of the world (TBQ_H)	-0.26	-0.32	-0.31	-0.26	-0.26
Absolute deviations of percentage growth rates					
private consumption (CPV)	1.40	0.97	0.34	-0.05	-0.08
public consumption (CGV)	5.58	-0.04	0.06	-0.06	-0.03
private investment (IBV)	2.39	0.87	0.17	-0.22	-0.24
exports (XGSV)	-0.46	-0.37	-0.22	-0.10	0.00
imports (MGSV)	4.35	0.47	-0.15	-0.47	-0.13
real GDP (GDPV)	1.35	0.40	0.11	-0.07	-0.01
total employment (ET)	0.37	0.20	0.05	-0.05	-0.08
private employment (ETB)	0.42	0.22	0.05	-0.06	-0.08
potential output (GDPBV)	0.71	0.09	0.04	0.01	0.04
average labour productivity (APL)	0.96	0.20	0.06	-0.02	0.07
real wage rate (UWBR)	-0.08	0.82	0.66	0.32	0.04
wage rate (UWB)	1.40	1.87	1.66	1.06	0.44
consumption price index (PCP)	1.48	1.01	0.95	0.71	0.40
investment deflator (PIB)	1.74	0.73	0.73	0.49	0.18
exports prices (PXGS)	0.73	0.34	0.23	0.10	-0.04
nominal disposable income (YDH)	3.47	1.54	1.28	0.68	0.36

Table 8 – EUR/USD exchange rate devaluation by 20%.

year	0	1	2	3	4
Percentage deviations from the baseline					
private consumption (CPV)	-0.87	-2.06	-2.76	-2.69	-2.26
public consumption (CGV)	0.00	0.00	0.00	0.00	0.00
private investment (IBV)	0.36	-0.44	-0.90	-0.95	-0.78
exports (XGSV)	2.06	1.20	1.25	1.82	2.41
imports (MGSV)	-0.46	-1.58	-1.54	-0.97	-0.65
real GDP (GDPV)	0.03	-0.94	-1.34	-1.17	-0.75
total employment (ET)	0.39	0.42	0.39	0.44	0.56
private employment (ETB)	0.44	0.48	0.44	0.49	0.63
potential output (GDPBV)	0.26	-0.08	-0.13	-0.06	0.03
average labour productivity (APL)	-0.35	-1.35	-1.72	-1.60	-1.30
real wage rate (UWBR)	-0.92	-1.79	-2.34	-2.59	-2.59
wage rate (UWB)	1.05	1.84	2.33	2.53	2.48
consumption price index (PCP)	1.99	3.69	4.78	5.25	5.21
investment deflator (PIB)	4.70	5.16	5.52	5.52	5.28
export prices (PXGS)	6.91	8.51	8.50	8.04	7.53
nominal disposable income (YDH)	0.76	1.29	1.82	2.49	2.86
real disposable income (YDHR)	-1.20	-2.32	-2.83	-2.62	-2.23
Absolute deviations from the baseline					
unemployment rate (UNR)	-0.36	-0.39	-0.37	-0.41	-0.52
short-term interest rate (IRS)	0.55	0.95	0.74	0.49	0.11
long-term interest rate (IRL)	0.23	0.48	0.45	0.28	0.04
average interest rate on public debt (IRGOV)	0.15	0.34	0.36	0.28	0.13
public debt-to-GDP ratio (GGFLQ)	-1.28	-2.18	-2.69	-2.93	-2.87
public deficit-to-GDP ratio (PSBRQ)	-0.42	-0.49	-0.38	-0.11	0.08
trade balance-to-GDP ratio (TBQ)	-0.50	-0.08	-0.07	-0.19	-0.37
t.b. with Eurozone core (TBQ_B)	-0.48	-0.56	-0.71	-0.87	-0.94
t.b. with Eurozone periphery (TBQ_C)	-0.09	-0.36	-0.45	-0.40	-0.34
t.b. with the USA (TBQ_D)	0.22	0.34	0.34	0.27	0.22
t.b. with the other European countries (TBQ_E)	0.14	0.20	0.24	0.26	0.22
t.b. with the OPEC countries (TBQ_F)	-0.12	-0.17	-0.18	-0.16	-0.19
t.b. with the BRIC (TBQ_G)	-0.21	0.02	0.08	0.10	0.08
t.b. with the rest of the world (TBQ_H)	0.05	0.44	0.61	0.60	0.57
Absolute deviations of percentage growth rates					
private consumption (CPV)	-0.89	-1.21	-0.72	0.08	0.44
public consumption (CGV)	0.00	0.00	0.00	0.00	0.00
private investment (IBV)	0.37	-0.80	-0.47	-0.04	0.16
exports (XGSV)	2.15	-0.88	0.05	0.59	0.57
imports (MGSV)	-0.48	-1.16	0.03	0.60	0.32
real GDP (GDPV)	0.04	-0.98	-0.41	0.17	0.42
total employment (ET)	0.40	0.03	-0.03	0.04	0.12
private employment (ETB)	0.45	0.04	-0.03	0.05	0.14
potential output (GDPBV)	0.27	-0.35	-0.05	0.07	0.08
average labour productivity (APL)	-0.35	-0.99	-0.38	0.13	0.30
real wage rate (UWBR)	-0.92	-0.88	-0.57	-0.25	0.00
wage rate (UWB)	1.08	0.81	0.50	0.21	-0.05
consumption price index (PCP)	2.04	1.73	1.10	0.47	-0.04
investment deflator (PIB)	4.80	0.46	0.37	0.00	-0.24
exports prices (PXGS)	6.98	1.56	-0.02	-0.43	-0.48
nominal disposable income (YDH)	0.78	0.54	0.55	0.70	0.37

6.4 Exchange rate devaluation

Table 8 presents the results of the simulation of an EUR/USD exchange rate devaluation by 20%. It is frequently claimed that such a devaluation, would relieve our economy, by allowing us to recover some price competitiveness towards our non-Eurozone trade partners and thereby boosting Italian exports. The results of the simulation cast doubt on this conclusion. As a matter of fact, the middle panel of Table 8 shows that a devaluation of the euro would have the expected outcome with respect to the United States, to the non-Eurozone European countries, and to the rest of the world, but *not* with respect of the other trade partners, for different reasons. The trade balance towards the OPEC countries worsens because of the Italian dependency on imported fuels; the trade balance towards the BRICS presents a pronounced "J curve" effect, mostly because of the low values of the short-run price elasticities (equal to 0.4 for imports and zero for exports); the trade balance towards the other Eurozone countries are also persistently negative, because of two adverse effects: first, the rise in the price of the imported inputs has sizeable inflationary consequences, especially on the exports prices, whose growth rate increases by about 7 points above its baseline value (the inflation rate, measured by the change in the private consumption deflator, rises instead by only 2 points). This determines a real appreciation towards the Eurozone countries. Second, the initial increase in real GDP dampens the import substitution effect. As a consequence, the trade balance towards the Eurozone worsens by 0.57 GDP points in the impact year, reaching -1.28 GDP points at the end of the simulation horizon.

The rate of growth of aggregate exports would nevertheless rise on average by about 0.5 points (with an impact effect of 2.15 points; bottom panel of Table 8). This would exert a significant effect on employment, which would grow by about 0.5% with respect to the baseline (say, around 100 000 new jobs would be created). However, this measure would not stimulate investment, nor productivity, and the real wage rate would fall, as would real disposable income, and private consumption.

This simulation experiment is consistent with the results provided by Bagnai and Carlucci (2003), where the aggregate European economy is found not to respect the Marshall-Lerner condition. As explained in Bagnai and Mongeau Ospina (2014), this may depend on the fact that for most Eurozone peripheral countries a devaluation of the euro is a zero-sum game, because the income earned on the third countries markets is then spent in the Eurozone core. However, this results must be interpreted with some caution, because they do not take into account of the international repercussions of the euro devaluation. In other words, in the simulation design the other countries' incomes and prices are taken as exogenous. The indirect effects of the exchange rate devaluation could affect the results in several ways. For instance, the possible inflationary effect in the other Eurozone countries could dampen the real exchange rate appreciation of the Italian economy (thus reducing the adverse impact on the Italian trade balance with the Eurozone), while the strengthening of the dollar could reduce the US rate of growth (thus mitigating the improvement of the trade balance towards the US).

Table 9 – Reduction of world demand growth by 1 percentage point with respect to the baseline.

year	0	1	2	3	4
Percentage deviations from the baseline					
private consumption (CPV)	-0.22	-0.62	-1.05	-1.41	-1.69
public consumption (CGV)	0.00	0.00	0.00	0.00	0.00
private investment (IBV)	-0.58	-1.37	-2.29	-3.24	-4.23
exports (XGSV)	-1.60	-3.18	-4.62	-5.98	-7.23
imports (MGSV)	-1.16	-2.30	-3.36	-4.23	-4.91
real GDP (GDPV)	-0.43	-0.98	-1.56	-2.11	-2.58
total employment (ET)	-0.07	-0.19	-0.33	-0.47	-0.60
private employment (ETB)	-0.08	-0.22	-0.37	-0.53	-0.68
potential output (GDPBV)	-0.16	-0.35	-0.57	-0.81	-1.06
average labour productivity (APL)	-0.36	-0.79	-1.24	-1.64	-2.00
unit labour costs (ULC)	0.26	0.45	0.54	0.51	0.41
real wage rate (UWBR)	-0.23	-0.64	-1.19	-1.77	-2.33
wage rate (UWB)	-0.16	-0.51	-1.02	-1.63	-2.25
consumption price index (PCP)	0.07	0.13	0.17	0.15	0.09
investment deflator (PIB)	0.17	0.30	0.36	0.33	0.27
export prices (PXGS)	0.07	0.13	0.15	0.13	0.08
nominal disposable income (YDH)	-0.23	-0.59	-0.98	-1.34	-1.68
real disposable income (YDHR)	-0.30	-0.72	-1.14	-1.49	-1.77
Absolute deviations from the baseline					
unemployment rate (UNR)	0.07	0.18	0.31	0.45	0.56
short-term interest rate (IRS)	0.01	-0.04	-0.12	-0.22	-0.33
long-term interest rate (IRL)	0.00	-0.01	-0.04	-0.06	-0.08
average interest rate on public debt (IRGOV)	0.00	-0.01	-0.04	-0.07	-0.10
public debt-to-GDP ratio (GGFLQ)	0.40	1.04	1.95	3.07	4.49
public deficit-to-GDP ratio (PSBRQ)	0.06	0.17	0.37	0.60	0.87
trade balance-to-GDP ratio (TBQ)	-0.09	-0.21	-0.35	-0.53	-0.72
t.b. with Eurozone core (TBQ_B)	-0.07	-0.10	-0.15	-0.22	-0.29
t.b. with Eurozone periphery (TBQ_C)	-0.03	-0.07	-0.11	-0.14	-0.17
t.b. with the USA (TBQ_D)	-0.05	-0.11	-0.17	-0.20	-0.20
t.b. with the other European countries (TBQ_E)	-0.03	-0.05	-0.08	-0.11	-0.13
t.b. with the OPEC countries (TBQ_F)	0.00	-0.02	-0.04	-0.06	-0.09
t.b. with the BRIC (TBQ_G)	0.00	0.00	-0.01	-0.03	-0.05
t.b. with the rest of the world (TBQ_H)	0.09	0.16	0.21	0.22	0.21
Absolute deviations of percentage growth rates					
private consumption (CPV)	-0.22	-0.40	-0.44	-0.37	-0.29
public consumption (CGV)	0.00	0.00	0.00	0.00	0.00
private investment (IBV)	-0.59	-0.80	-0.93	-0.97	-0.99
exports (XGSV)	-1.68	-1.67	-1.58	-1.48	-1.30
imports (MGSV)	-1.23	-1.19	-1.13	-0.93	-0.71
real GDP (GDPV)	-0.44	-0.55	-0.59	-0.56	-0.48
total employment (ET)	-0.07	-0.12	-0.14	-0.14	-0.12
private employment (ETB)	-0.08	-0.14	-0.16	-0.16	-0.14
potential output (GDPBV)	-0.17	-0.19	-0.22	-0.24	-0.25
average labour productivity (APL)	-0.36	-0.43	-0.45	-0.41	-0.36
real wage rate (UWBR)	-0.23	-0.42	-0.55	-0.61	-0.58
wage rate (UWB)	-0.17	-0.37	-0.54	-0.65	-0.65
consumption price index (PCP)	0.07	0.06	0.04	-0.02	-0.06
investment deflator (PIB)	0.17	0.13	0.07	-0.02	-0.07
exports prices (PXGS)	0.07	0.06	0.02	-0.02	-0.04
nominal disposable income (YDH)	-0.24	-0.37	-0.42	-0.38	-0.36

Table 10 – Increase of oil prices by 50% of the baseline.

year	0	1	2	3	4
Percentage deviations from the baseline					
private consumption (CPV)	-0.38	-0.94	-1.31	-1.34	-1.27
public consumption (CGV)	0.00	0.00	0.00	0.00	0.00
private investment (IBV)	-0.37	-1.06	-1.50	-1.68	-1.82
exports (XGSV)	-0.81	-1.10	-0.95	-0.63	-0.26
imports (MGSV)	-1.00	-1.22	-1.12	-0.74	-0.46
real GDP (GDPV)	-0.35	-0.89	-1.15	-1.16	-1.09
total employment (ET)	0.03	-0.03	-0.09	-0.10	-0.08
private employment (ETB)	0.04	-0.04	-0.10	-0.12	-0.09
potential output (GDPBV)	-0.07	-0.26	-0.34	-0.37	-0.42
average labour productivity (APL)	-0.39	-0.86	-1.06	-1.06	-1.02
real wage rate (UWBR)	-0.42	-0.88	-1.26	-1.52	-1.65
wage rate (UWB)	0.12	0.09	-0.06	-0.29	-0.51
consumption price index (PCP)	0.54	0.98	1.21	1.25	1.16
investment deflator (PIB)	1.27	1.43	1.46	1.34	1.20
export prices (PXGS)	1.70	2.10	2.06	1.89	1.73
nominal disposable income (YDH)	0.02	-0.11	-0.16	-0.09	-0.15
real disposable income (YDHR)	-0.52	-1.08	-1.36	-1.33	-1.29
Absolute deviations from the baseline					
unemployment rate (UNR)	-0.03	0.03	0.09	0.10	0.07
short-term interest rate (IRS)	0.17	0.15	0.04	-0.05	-0.21
long-term interest rate (IRL)	0.07	0.09	0.05	0.00	-0.07
average interest rate on public debt (IRGOV)	0.05	0.06	0.04	0.01	-0.05
public debt-to-GDP ratio (GGFLQ)	-0.03	0.23	0.57	0.89	1.43
public deficit-to-GDP ratio (PSBRQ)	-0.06	0.01	0.14	0.28	0.38
trade balance-to-GDP ratio (TBQ)	-0.17	-0.20	-0.28	-0.32	-0.43
t.b. with Eurozone core (TBQ_B)	0.00	0.03	0.00	-0.06	-0.08
t.b. with Eurozone periphery (TBQ_C)	0.00	-0.06	-0.07	-0.05	-0.03
t.b. with the USA (TBQ_D)	0.00	0.00	0.01	0.01	0.01
t.b. with the other European countries (TBQ_E)	0.02	0.05	0.06	0.05	0.04
t.b. with the OPEC countries (TBQ_F)	-0.27	-0.41	-0.45	-0.40	-0.45
t.b. with the BRIC (TBQ_G)	0.02	0.03	0.01	-0.01	-0.02
t.b. with the rest of the world (TBQ_H)	0.06	0.15	0.17	0.13	0.09
Absolute deviations of percentage growth rates					
private consumption (CPV)	-0.38	-0.57	-0.38	-0.03	0.08
public consumption (CGV)	0.00	0.00	0.00	0.00	0.00
private investment (IBV)	-0.38	-0.69	-0.45	-0.18	-0.14
exports (XGSV)	-0.85	-0.30	0.16	0.34	0.36
imports (MGSV)	-1.05	-0.23	0.11	0.40	0.28
real GDP (GDPV)	-0.36	-0.55	-0.26	-0.01	0.07
total employment (ET)	0.03	-0.07	-0.06	-0.01	0.02
private employment (ETB)	0.04	-0.08	-0.07	-0.01	0.03
potential output (GDPBV)	-0.07	-0.19	-0.08	-0.03	-0.04
average labour productivity (APL)	-0.39	-0.47	-0.20	0.00	0.04
real wage rate (UWBR)	-0.42	-0.46	-0.39	-0.27	-0.13
wage rate (UWB)	0.12	-0.03	-0.17	-0.24	-0.23
consumption price index (PCP)	0.55	0.45	0.24	0.04	-0.09
investment deflator (PIB)	1.29	0.17	0.03	-0.12	-0.15
exports prices (PXGS)	1.72	0.40	-0.04	-0.17	-0.16
nominal disposable income (YDH)	0.02	-0.13	-0.06	0.07	-0.06

6.5 Reduction in world output growth

This scenario analyses the impact of a persistent reduction of world demand growth by 1 point below the baseline value. The experiment was implemented by considering a permanent reduction in the partner's real GDP growth rate by 1%.

As is to be expected, a decrease in world demand growth causes a fall in the rate of growth of Italian real exports. The impact effect, reported in the bottom panel of Table 9, is equal -1.68 points. This, in turn, determines a reduction of the real rate of growth by about 0.44 points, which reduces imports growth by 1.23 points. The impact effect on the aggregate trade balance is almost nil (-0.09 GDP points). Over time, however, although the rise in unemployment (progressively reaching 0.56 points above its baseline) exerts a downward pressure on the wage rate (bringing it -2.25% below its baseline at the end of the simulation horizon), the average labour productivity also falls. As a consequence, the unit labour cost rises, and the real wage rate, as well as the real disposable income, and private consumption, fall. The moderate real appreciation adds a further downward pressure on real exports.

Towards the end of the simulation horizon the pattern of the prices is reversed. While the real wage rate remains persistently lower, the exports deflator begins to decrease, thus reducing the negative effect on exports. However, at the end of the simulation the real growth rate is still -0.48 points below its baseline value.

6.6 Oil price shock

Table 10 reports the results of the simulation of a permanent increase in oil price by 50% of its baseline. This hypothesis was implemented by increasing the deflator of OPEC countries exports.

The trade balance towards the OPEC countries worsens by 0.27 GDP points and the increase in the price of imported inputs brings the inflation rate 0.55 points and exports prices growth 1.72 points above their respective baselines (bottom panel of Table 10). Starting in the second year, unemployment increases moderately. The result is stagflation: a decrease in employment coupled with an increase in prices. The supply-side shock affects in an adverse way average labour productivity, thus leading to a decrease in real wage rate and in real disposable income. Over time, the slowdown of economic activity compromises the government balance (because of the working of the automatic stabilizers) and the public debt to GDP ratio increases.

7 Conclusions

We presented the structure and properties of the a/simmetrie annual macroeconometric model of the Italian economy. The model structure was designed, and the estimation methods selected, in order to build a reliable tool for investigating the medium- to long-run trends in the Italian economy. Two features are relatively innovative: first, the disaggregation of the trade equations, in order to take into account the bilateral relations among Italy and seven trade partner areas; second, the inclusion of the OECD employment protection index as a proxy for the effect of "structural reforms" on the wage setting mechanism. The first allows us to track accurately the possible impact of heterogeneous growth recovery pattern in the different partner areas. The second accounts for an observed shift in the Phillips curve that could otherwise be erroneously identified as a progressive “flattening” of the unemployment-inflation trade-off (thereby leading to incorrect conditional forecasts and counterfactual experiments).

The estimation of the model is carried out using cointegration methods that take into account the possible presence of one or two structural breaks of unknown date in the long-run parameters. The estimation results are strongly significant and in line with the economic theory. The dynamic simulation results show that the model provides a rather accurate representation of the development of the Italian economy over the last three decades, with root mean square percentage errors of the simulation tracking mostly well below 5% in the 1980-2013 sample. We tested the properties of the model by examining its response to standard demand-side (government expenditure, world GDP) and supply-side (oil price) shocks. Results indicate that the dynamic multipliers seem to be consistent with economic theory. For instance, the Keynesian multiplier of the model is around 1.5, quite in line with the more recent estimates.

Although these results are encouraging, there is room for further research.

In our view, the most obvious shortcoming of the present specification is that it lacks stock-flow consistency, in the meaning of Tobin and Buiter (1974). The sectorial balances are only implicitly defined (the private sector balance can be obtained from the government and the external balance); there are no sectorial budget constraint (or balance sheets); no attempt is made to disaggregate the private sector balance into households and business sector, and the business sector further into non-financial and financial business sector. As a consequence, no representation of the private debt is given, as well as no representation of the net foreign assets/liabilities (possibly disaggregated by sector). While this is perfectly consistent with the biased representation of the crisis given by the media (as stressed by Constâncio, 2013), where the financial crisis is systematically related to the public debt sustainability, in the light of a more balanced view of what is going on in Europe the inability to track private sector external debt is a serious shortcoming that needs to be addressed (Bagnai, 2013).

The same would apply even if public debt sustainability was a major problem (as it is probably going to be), because the inclusion of a stock-flow consistent framework, and of the corresponding wealth effects in the behavioural function, is crucial for assessing the long-run effect of both fiscal and monetary policies.

This issue will be addressed in a next release of the model, and implies mostly a revision of the accounting framework, and the augmentation of some behavioural equation (typically, the consumption function) with the appropriate wealth effects. This can be done easily in an ECM framework by following the lines set out since Hendry and von Ungern-Sternberg (1981). Moreover, households’ property income needs to be related to the underlying stock of real and financial wealth, and the flow of interest on public debt needs to be disaggregated among different recipient categories.

On a different matter, the recent developments of the Eurozone crisis suggest the need to adopt a different disaggregation of the Italian trade flows, because on the one hand it is increasingly difficult to justify the inclusion of France in the “core Eurozone” group, and on the other hand political developments in Germany suggest the opportunity of investigate the consequences of an exit of this country from the single currency. Moreover, the external sector budget constraint needs to be specified, in such a way as to allow the model to track the evolution of Italian net foreign assets, possibly distinct by category of national lender/borrower. This is a crucial feature, because in any scenario related to the evolution of the Eurozone crisis the foreign exposure of national economic agents is an essential piece of information.

In our opinion, the present version of the model, despite its limitations, provides a convenient starting point for this research agenda.

8 References

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Appendix 1– Model variables

Table A.1 contains a list of the model variables. In the second column *X* indicates an exogenous variables and *N* indicates an endogenous variable. Variables are sorted by endogenous/exogenous and then alphabetically.

Table A.1 – Legend of the model variables

Acronym	Type	Variable
APK	N	Average productivity of capital
APL	N	Average productivity of labour
CAPOG	N	Net capital outlays of the government, current prices
CDG	N	Net currents outlays of the government, current prices
CG	N	Government final consumption expenditure, current prices
CGV	N	Government final consumption expenditure, constant prices
CGW	N	Government final wage consumption expenditure, current prices
CPV	N	Private final consumption expenditure, constant prices
ET	N	Total employment
ETB	N	Private sector employment
ETNIA	N	Total employment, national accounts basis
GAPB	N	Output gap of the economy, private sector
GDP	N	Gross domestic product, current prices
GDPBV	N	Private sector GDP, constant prices
GDPV	N	Gross domestic product, constant prices
GDPVUSD	N	Gross domestic product in USD, constant prices
GGFL	N	General government gross financial liabilities, current prices
GGFLQ	N	General government gross financial liabilities, percentage of GDP
GGINTP	N	General government interest payments, current prices
IBV	N	Private sector gross fixed capital formation, constant prices
IG	N	Public sector gross fixed capital formation, current prices
IRGOV	N	Effective interest rate of government gross financial liabilities
IRL	N	Long-term interest rate
IRLR	N	Long-term real interest rate
IRS	N	Short-term interest rate
ISK	N	Changes in inventories and acquisitions less disposals of valuables, current prices
ISKV	N	Changes in inventories and acquisitions less disposals of valuables, constant prices
KBV	N	Private sector capital stock, constant prices
KGR	N	Private sector capital stock growth rate
KPG	N	Government capital disbursements, current prices
MG	N	Import of goods in euros, current prices
MGi	N	Import of goods to country i in euros, current prices
MGS	N	Imports of goods and services, current prices
MGSV	N	Imports of goods and services, constant prices
MGUSDV	N	Imports of goods in USD, current prices

MGUSDVi	N	Imports of goods from partner i, constant prices
MGV	N	Import of goods in euros, constant prices
MGVi	N	Import of goods from partner i in euros, constant prices
MPK	N	Marginal productivity of capital
PCP	N	Private final consumption expenditure deflator
PCPNET	N	Private final consumption expenditure deflator, net of indirect taxes
PGDP	N	Gross domestic product deflator
PIB	N	Private sector gross fixed capital formation deflator
PIBNET	N	Private sector gross fixed capital formation deflator, net of indirect taxes
PIG	N	Government gross fixed capital formation deflator
PIGNET	N	Government gross fixed capital formation deflator, net of indirect taxes
PMGS	N	Imports of goods and services deflator
PROF	N	Profits and other non-wage income, current prices
PSBR	N	Public sector borrowing requirements, current prices
PSBRQ	N	Public sector borrowing requirements ratio, percentage of GDP
PXGS	N	Exports of goods and services deflator
PXGSUSD	N	Exports of goods and services in USD deflator
PXGSUSi	N	Exports of goods and services deflator, partner i exchange rate
REERi	N	Real effective exchange rate relative to partner i
SSCB	N	Private employers contributions to pension funds, current prices
SSPG	N	Social security benefits paid by government, current prices
SSRG	N	Social security contributions received by government, current prices
TB	N	Trade balance in euros, current prices
TB_i	N	Trade balance with respect to partner i, in euros, current prices
TBQ	N	Trade balance to GDP ratio
TIND	N	Indirect taxes, current prices
TRPBTH	N	Private employers contributions to social security and pension funds, current prices
TRPH	N	Total transfers paid by households, current prices
TRRH	N	Current transfers received by households, current prices
TRSSH	N	Social security contributions by households, current prices
TYB	N	Direct taxes on business, current prices
TYH	N	Direct taxes on households, current prices
ULC	N	Unit labour cost
UNR	N	Unemployment rate
UWB	N	Wage rate of the private sector normalised to the base year
UWBR	N	Real wage rate of the private sector normalised to the base year
VABV	N	Private sector value added, constant prices
VAGV	N	Public sector value added, constant prices
WAGE	N	Total wages, current prices
WAGEB	N	Wages of the private sector, current prices
WRB	N	Wage rate, private sector, current prices
WSB	N	Compensation of employees, private sector, current prices
WSSS	N	Compensation of employees, current prices
XG	N	Export of goods in euros, current prices
XGi	N	Export of goods to partner i in euros, current prices
XGS	N	Exports of goods and services, current prices

XGSV	N	Exports of goods and services, constant prices
XGUSDV	N	Exports of goods in USD, current prices
XGUSDVi	N	Exports of goods to partner i, constant prices
XGV	N	Export of goods in euros, constant prices
XGVi	N	Export of goods to partner i in euros, constant prices
YDH	N	Household disposable income, current prices
YDHR	N	Household disposable income in real terms
YOTH	N	Self-employment and property income received by households, current prices
YPEX	N	Self-employment and property income (other than government debt) received by households, current prices
YPG	N	Government current disbursements, current prices
YRG	N	Government current receipts, current prices
YRH	N	Current receipts of households, current prices
AGE	X	Age dependency ratio
ALFA	X	Technical parameter in the production function
CFKG	X	Government consumption of fixed capital, current prices
CGNW	X	Government final non-wage consumption expenditure, current prices
CINT	X	Government intermediate consumption, current prices
D*yy*	X	Dummy variable, equal to 1 in year *yy* and 0 elsewhere
ETG	X	Public sector employment
EXCHUi	X	Nominal exchange rate, partner i
FLEX	X	Labour flexibility index
FPR	X	Female participation ratio
GDPVUSDi	X	Gross domestic product of partner i in USD, constant prices
IFGT*yyyy*	X	Shift dummy variable, equal to 1 after year *yyyy* and zero elsewhere
IGG	X	Public sector gross fixed capital formation, constant prices
KRG	X	Government capital receipts, current prices
KXG	X	Government capital disbursements other than investments, current prices
LF	X	Labour force
ms_i	X	Import share from partner i
MSV	X	Imports of services, constant prices
PCGV	X	Government final consumption expenditure deflator
PISK	X	Changes in inventories deflator
PNIT	X	Indirect taxes less subsidies deflator
PXGSUSDi	X	Exports of goods and services of partner i in USD deflator
RPRM	X	Risk premium
RSCRB	X	Capital stock scrapping rate of the private sector
RSSCB	X	Ratio of employers contributions to pension funds to wages in the private sector
RTIND	X	Indirect taxes, as a percentage of total domestic expenditure
RTYB	X	Direct taxes on business, as a percentage profits and other non-wage income
RTYH	X	Direct taxes on households, as a percentage of current receipts of households
SDIG	X	Statistical discrepancy of government gross fixed capital formation, current prices
SF	X	Stock/flow reconciliation of public debt

TREND	X	Linear time trend
TROPH	X	Non-social security transfers paid by households, current prices
TRPBPH	X	Private employers contributions to pension funds, current prices
TRPG	X	Other current transfers paid by government, current prices
TRPGPH	X	Government employers contributions to pension funds, current prices
TRRG	X	Other current transfers received by government, current prices
TSUB	X	Subsidies on products, current prices
UWG	X	Wage rate of the public sector normalised to the base year
XSV	X	Exports of services, constant prices
YPEPGX	X	Other government public expenditure, current prices
YPERG	X	Property income received by government, current prices

Appendix 2– Unit root tests

The order of integration *d* of the variables involved in the model stochastic equation was determined using the Augmented Dickey Fuller test (Dickey and Fuller, 1979), based on the following auxiliary regression:

$$\Delta y_t = \alpha + \delta t + \varphi y_{t-1} + \sum_{j=1}^{p} \Delta y_{t-j} + u_t$$

where the null hypothesis of unit root is tested by verifying the null H_0: φ=0 against the alternative H_1: φ<0.

In order to select the appropriate deterministic component to include in the auxiliary regression we adopted the strategy suggested by Elder and Kennedy (2001),[31] that takes advantage of *a priori* information on the trending behaviour of the series. Taking *p*=0 we can certainly rule out two outcomes:

1) $\Delta y_t = a + ct + \varepsilon_t$ with $a \neq 0$, $b = 0$ and $c \neq 0$ (because it implies an explosive behaviour);

2) $\Delta y_t = by_{t-1} + \varepsilon_t$ with b < 0 (because it implies a stationary process around an equilibrium exactly equal to zero).

Against this background, if the behaviour of the series is:

- **trending**. The auxiliary DF regression is $\Delta y_t = a + by_{t-1} + ct + \varepsilon_t$ and the hypothesis to test is $b = 0$: if it cannot be rejected it follows that the series has a unit root (the unlikely result $c \neq 0$ is ruled out), while its rejection implies that the series is stationary around a deterministic trend.
- **non trending**: The DF auxiliary regression is $\Delta y_t = a + by_{t-1} + \varepsilon_t$ and the hypothesis to test is, as above, $b = 0$: if it can not be rejected then there is a unit root without drift term ($a \neq 0$ is ruled out as the series is non trending); while if it is rejected it follows that the series is stationary around a constant.

If there is little or no *a priori* information on the trending behaviour of the series, the strategy is less straightforward, although it is still quite simple:

- Step 1. Estimate $\Delta y_t = a + by_{t-1} + ct + \varepsilon_t$ and test the null hypothesis that $b = 0$ by using DF critical values: if the null can be rejected then go to step 2a; if it cannot be rejected, then go to step 2b.
- Step 2a. As $b < 0$ *there is no unit root*. The presence of a deterministic trend can be tested in the model $\Delta y_t = a + by_{t-1} + ct + \varepsilon_t$ with standard *t* testing on $c = 0$.
- Step 2b. Given that $b = 0$ *there is a unit root*. The presence of a drift can be tested in the model $\Delta y_t = a + \varepsilon_t$ with a standard *t* test on $a = 0$.

Elder and Kennedy's strategy is summarised in Table A.2. Notice that when the behaviour of the series is unknown (i.e., there are serious doubts of the growth status of the variable), results of step 1 above will determine if step 2a or step 2b should be considered.

[31] Hacker and Hatemi-J (2010) gives an exposition of Elder and Kennedy's strategy and confront it with a well-known sequential strategy proposed by Elder (2004) advocating for the use of the former, especially when *a priori* information on the series can be used to remove non-credible outcomes.

Table A.2 – Elder and Kennedy (2001) unit root testing strategy.

Behaviour	Model	Hypothesis	Can reject H0	Cannot reject H0
Trending	$\Delta y_t = a + by_{t-1} + ct + \varepsilon_t$	H_0: b = 0	Stationary around deterministic trend	Unit root with drift
Non trending	$\Delta y_t = a + by_{t-1} + \varepsilon_t$	H_0: b = 0	Stationary around a constant	Unit root without drift
Unknown (step 2a)	$\Delta y_t = a + by_{t-1} + ct + \varepsilon_t$	H_0: c = 0	Stationary around deterministic trend	Stationary around a constant
Unknown (step 2b)	$\Delta y_t = a + \varepsilon_t$	H_0: a = 0	Unit root with drift	Unit root without drift

In Table A.3 the behaviour of the series is reported in the second column, while the ADF statistic, their associated *p*-values and the number of lags used in the auxiliary ADF regression, are reported for both the levels of the series and the first differences.

Table A.3 – Unit root (ADF type) tests.

		Levels			First differences		
Variable	Behaviour	ADF	*p*-value	lags	ADF	*p*-value	lags
AGE	non trending	-2.03	0.275	2	-2.01	0.043	1
ln(APL)	trending	-2.22	0.470	0	-3.98	0.003	0
ln(CPV)	trending	-0.71	0.967	4	-2.99	0.042	0
ln(ETB)	non trending	-1.72	0.416	1	-3.51	0.001	0
FPR	trending	-3.85	0.021	1	-3.96	0.003	0
ln(GDP)	trending	-1.26	0.887	3	-0.48	0.887	2
ln(GDPBV)	trending	-0.76	0.963	0	-4.52	0.001	0
ln(GDPV)	trending	-0.57	0.977	0	-4.24	0.001	0
ln(GDPVUSD)	trending	0.27	0.998	0	-4.46	0.001	0
ln(GDPVUSDB)	trending	-1.69	0.738	0	-4.98	0.000	0
ln(GDPVUSDC)	trending	-2.39	0.380	1	-2.27	0.187	0
ln(GDPVUSDD)	trending	-1.92	0.624	1	-4.70	0.000	0
ln(GDPVUSDE)	trending	-0.95	0.940	0	-5.92	0.000	0
ln(GDPVUSDF)	trending	-2.64	0.265	1	-2.88	0.056	0
ln(GDPVUSDG)	trending	-1.23	0.892	1	-3.44	0.015	0
ln(GDPVUSDH)	trending	-3.18	0.102	0	-5.85	0.000	0
ln(GGFLQ)	trending	-0.91	0.947	0	-5.33	0.000	0
IRGOV	non trending	-1.26	0.642	1	-4.3	0.000	0
IRL	non trending	-1.68	0.437	1	-4.70	0.000	0
IRLR	non trending	-2.05	0.264	0	-6.76	0.000	0
IRS	non trending	-1.12	0.700	0	-7.58	0.000	0
ISKV	non trending	-1.25	0.647	3	-7.56	0.000	2
ln(KBV)	trending	-1.26	0.888	2	-1.30	0.621	2
KGR	non trending	-1.37	0.590	2	-4.92	0.000	0
ln(MGSV)	trending	-1.75	0.716	0	-6.73	0.000	0
ln(MGUSDV)	trending	-2.04	0.563	0	-6.37	0.000	0
ln(MGUSDVB)	trending	-1.60	0.776	0	-6.39	0.000	0
ln(MGUSDVC)	trending	-0.34	0.987	0	-6.09	0.000	0
ln(MGUSDVD)	trending	-3.07	0.127	0	-6.25	0.000	0
ln(MGUSDVE)	trending	0.37	0.998	0	-5.45	0.000	0
ln(MGUSDVF)	non trending	-3.49	0.013	0	-6.89	0.000	1
ln(MGUSDVG)	trending	-2.39	0.380	0	-6.41	0.000	0
ln(MGUSDVH)	trending	-2.40	0.375	0	-6.76	0.000	0
MPK	non trending	-1.51	0.520	0	-7.20	0.000	0
ln(PCP)	trending	-1.75	0.712	1	-1.47	0.539	0
ln(PCPNET)	trending	-1.23	0.891	2	-1.51	0.520	0
ln(PGDP)	trending	-1.70	0.736	1	-1.38	0.587	0
ln(PIB)	trending	-0.93	0.945	1	-2.26	0.188	0
ln(PIBNET)	trending	-1.01	0.934	1	-2.24	0.195	0
ln(PIGNET)	trending	0.53	0.999	0	-1.78	0.385	2
ln(PMGS)	trending	-0.96	0.940	1	-4.1	0.002	0
ln(PSBRQ)	non trending	-2.57	0.106	0	-8.60	0.000	0
ln(PXGS)	trending	-0.82	0.957	1	-3.22	0.024	0
ln(REERB)	non trending	-0.75	0.824	0	-5.35	0.000	0
ln(REERC)	non trending	-3.22	0.026	0	-7.24	0.000	0
ln(REERD)	non trending	-1.50	0.526	0	-5.34	0.000	0
ln(REERE)	non trending	-1.54	0.504	0	-6.89	0.000	0
ln(REERF)	non trending	-1.94	0.310	0	-7.11	0.000	0

Table A.3 (cont'd) – Unit root (ADF type) tests.

		Levels			First differences		
Variable	Behaviour	ADF	*p*-value	lags	ADF	*p*-value	lags
ln(REERG)	non trending	-2.00	0.287	0	-6.04	0.000	0
ln(REERH)	non trending	-1.51	0.517	0	-5.81	0.000	0
ln(SSPG)	trending	-0.08	0.994	1	-2.50	0.121	0
ln(ULC)	trending	-0.93	0.944	1	-2.61	0.098	
UNR	non trending	-1.43	0.561	1	-3.76	0.000	0
ln(UWB)	trending	0.14	0.997	1	-1.86	0.348	1
ln(VABV)	trending	-0.79	0.960	0	-4.58	0.001	0
ln(XGSV)	trending	-2.14	0.511	0	-5.70	0.000	0
ln(XGUSDV)	trending	-2.22	0.469	0	-6.49	0.000	0
ln(XGUSDVB)	trending	-1.80	0.685	0	-5.48	0.000	0
ln(XGUSDVC)	trending	-0.20	0.991	1	-3.94	0.004	0
ln(XGUSDVE)	trending	-2.75	0.223	1	-5.51	0.000	0
ln(XGUSDVF)	trending	-2.60	0.281	1	-4.15	0.002	0
ln(XGUSDVG)	trending	-3.56	0.045	0	-6.97	0.000	0
ln(XGUSDVH)	trending	-2.27	0.442	0	-6.72	0.000	0
ln(YDH)	trending	-0.35	0.987	1	-1.30	0.625	0

Appendix 3– Cointegration tests

We report in this section the results of the cointegration tests on the models stochastic equations. As explained in the test, our strategy is to carry out a CRADF test: if the null of no-cointegration can be rejected, it means that a cointegrating equation with no structural breaks exists and no further models are explored; if the null cannot be rejected, we applied the GH tests. In the latter case, we tested the non cointegration null against the four GH alternatives (*C model*, *C/T model*, *C/S model* and *G model*). In case of multiple rejections, we chose the model with more sensible economic properties. The results of the CRADF and GH tests are reported in Table A.4. The CRADF column reports the Engle and Granger *cointegrating-residual ADF* tests for the presence of cointegration with no structural breaks. The columns *C model, C/T model, C/S model* and *G model* contain the Gregory and Hansen (GH) cointegration tests for the presence on cointegration with a single structural break and the associated break dates. The significance level of the cointegration statistics is indicated by *, ** and *** (significance at the 10%, 5% and 1%, respectively).

If the CRADF or GH tests fail to reject the null of non cointegration, we test for the presence of two structural breaks using the Hatemi-J cointegration tests. The results are reported in Table A.5. The strategy adopted in the two-break case is the same as the one shown for the GH models. As above, the columns *C model*, *C/T model*, *C/S model* and *G model* contain the Hatemi-J statistics and the break dates. We indicate in bold our preferred specification.

Table A.4 – Cointegration tests with no structural breaks (CRADF) and with a structural break of unknown timing (C, C/T, C/S and G model).

	CRADF		C model			C/T model			C/S model			G model		
			stat		*break*	*stat*		*break*	*stat*		*break*	*stat*		*break*
CPV	-2.67		**-5.51**	*******	**1994**	-4.82		1994	-5.34	*	1994	-5.25		1984
GDPBV ‡	-2.91		-4.10		1967	-5.30	**	1974	-4.10		1974	-5.20		1974
MGUSDVB	-2.78		**-5.51**	*******	**1978**	-5.44	**	1978	-5.31	*	1984	-6.01	**	1980
MGUSDVC	-2.54		-4.09		1992	-4.67		2005	-4.07		1992	-5.65		2001
MGUSDVD	-3.08		**-4.76**	*****	**1981**	-5.00		1981	-4.83		1981	-5.76	*	1993
MGUSDVE	-2.28		**-5.03**	******	**1984**	-6.49	***	1984	-5.22		2003	-7.52	***	1984
MGUSDVF	**-5.20**	*******	-5.83	***	1977	-5.84	***	1977	-6.10	***	1977	-6.10	**	1977
MGUSDVG	-1.58		-3.83		2005	-6.08	***	2004	**-5.49**	*****	**1999**	-6.40	**	2002
MGUSDVH	-1.17		-4.41		2001	-4.38		2001	-3.78		2002	-5.16		1994
PCPNET	-2.36		-3.53		1972	-4.05		1991	-4.10		1996	-4.40		1991
PIBNET	-1.14		-3.60		2003	-4.20		1994	**-5.70**	******	**1990**	-5.20		1986
PIGNET	-2.30		-5.37	***	1973	-5.65	***	1973	**-5.44**	******	**1977**	-6.10	***	1977
PXGS	-2.07		-3.55		1984	-3.96		1994	-3.45		1994	-4.65		1993
SSPG	-3.43		-5.63	**	2004	-6.02	**	1994	-5.85	*	1999	-6.76	**	1987
XGUSDVB	-2.56		-3.94		1983	-4.18		1983	**-5.53**	******	**1986**	-6.10	**	1988
XGUSDVC	-0.68		-2.51		1987	-3.44		1987	-2.98		1984	-4.51		1984
XGUSDVD	-2.06		-4.51		1985	**-5.12**	*****	**1982**	-4.49		1985	-5.06		1982
XGUSDVE	**-3.81**	*****	-4.52		1992	-4.52		1984	-5.81	**	1983	-5.62		1993
XGUSDVF	**-4.25**	******	-5.25	**	2001	-5.70	**	1979	-6.15	***	1986	-7.33	***	1984
XGUSDVG	-3.58		**-5.18**	******	**1977**	-5.16	*	1993	-5.08		1977	-5.69		1993
XGUSDVH	-2.32		**-5.48**	*******	**1993**	-5.21	*	1993	-5.43	*	1993	-4.76		1993

Notes: The significance level of the statistic is indicated by *, ** and *** and they represent, respectively, significance at the 10%, 5% and 1%. The chosen model is indicated in bold. ‡ the GDPBV sample is 1960-2007 (as explained in the text).

Table A.5 – Cointegration tests with two structural breaks of unknown timing (C, C/T, C/S and G model).

	C model		C/T model		C/S model			G model	
	stat	*breaks*	*stat*	*breaks*	*stat*		*breaks*	*stat*	*breaks*
GDPBV ‡	-4.73	1967;1986	-5.48	1974;1995	-5.90	*	1974:1999	**-5.83**	**1971:1997**
MGUSDVC	**-5.49**	**1987;1994**	-5.55	1986;2005	-5.71		1988;2003	-7.03	1979;2000
MGUSDVH	**-5.10**	**1985;1998**	-5.91	1985;1998	-5.79		1993;2005	-6.52	1985;1995
PCPNET	-4.53	1972;2004	-5.13	1972;1993	**-6.35**	*****	**1976;1996**	-6.03	1973;2000
PXGS	-4.50	1971;2004	-5.72	1973;1986	**-6.18**		**1978;1997**	-7.51	1979;2002
XGUSDVC	-4.12	1986;2005	-4.58	1981;1989	-5.98		1985;2004	**-7.62**	**1985;1999**

Notes: The significance level of the statistic is indicated by *, ** and *** and they represent, respectively, significance at the 10%, 5% and 1%. The chosen model is indicated in bold. ‡ the GDPBV sample is 1960-2007 (as explained in the text).

Appendix 4 – Model structure

This appendix contains an exposition of the model structure. Stochastic equations are reported in functional form. Full estimation results are given in Appendix 5. Unless otherwise stated, all variables are contemporaneous (except in stochastic equations which may also be lagged). The subscript *b* stands for the base year of prices, which in this version of the model is 2005. Exogenous variables are written in boldface.

In the trade equations/identities, the suffix *i* represents a generic block of partners: *i* = B (Core countries: Austria, Belgium, Finland, France, Germany, Luxembourg, Netherlands), C (Periphery countries: Greece, Ireland, Portugal, Spain), D (United States), E (Non-euro countries: Denmark, Sweden, Switzerland, United Kingdom), F (OPEC), G (BRIC), H (rest of the world).

Supply

[1.1] GDPBV = *f* (KBV, ETB, **TREND**)
[1.2] GAPB = (GDPBV − *f* (KBV, ETB, **TREND**)) / GDPBV × 100
[1.3] VABV = GDPV − VAGV − (TIND − **TSUB**) / **PNIT**
[1.4] VAGV = CGW / **UWG** + **CFKG** / PIG
[1.5] ETB = *f* (GDPV, UWB / PIB, **TREND**, ALFA)
[1.6] ET = ETB + **ETG**
[1.7] APL = GDPV / ET
[1.8] APK = VABV / KBV
[1.9] MPK = **ALFA** × APK
[1.10] UNR = 1 − ET / **LF**
[1.11] KBV = KBV(-1) * (1 + KGR)
[1.12] KGR = *f* (GDPV, IRLR, MPK, RSCRB, RPRM)
[1.13] PROF = GDP − WSSS − TIND + **TSUB**

Demand

[2.1] CPV = *f* (YDHR, **FPR**)
[2.2] IBV = KBV − (1 − RSCRB) × KBV_{-1}
[2.3] ISKV = *f* (VABV)
[2.4] XGSV = XGV + XSV
[2.5] MGSV = MGV + MSV
[2.6] XGS = XG + XSV × PXGS
[2.7] MGS = MG + MSV × PMGS
[2.8] GDP = CPV × PCP + CG + IBV × PIB + IG + ISKV × **PISK** + XGS − MGS
[2.9] GDPV = CPV + CGV + IBV + IG / PIG + ISKV + XGSV − MGSV

Trade

[3.1] GDPVUSD = GDPV × **EXCHUD,*b***
[3.2] PXGSUS*i* = PXGS × **EXCHU*i*** / **EXCHU*i*,*b***
[3.3] REER*i* = PXGSUS*i* / **PXGSUSD*i***
[3.4] XGUSDV*i* = *f* (**GDPVUSD*i***, REER*i*)
[3.5] MGUSDV*i* = *f* (GDPVUSD, REER*i*)
[3.6] XG*i* = XGUSDV*i* × PXGSUS*i* / **EXCHU*i***
[3.7] MG*i* = MGUSDV*i* × **PXGSUSD*i*** / **EXCHU*i***
[3.8] TB_*i* = XG*i* − MG*i*
[3.9] XGV*i* = XGUSDV*i* / **EXCHU*i*,*b***
[3.10] MGV*i* = MGUSDV*i* / **EXCHU*i*,*b***
[3.11] XGV = $\sum XGVi$
[3.12] MGV = $\sum MGVi$
[3.13] XG = $\sum XGi$
[3.14] MG = $\sum MGi$

[3.15] TB = XG − MG
[3.16] TBQ = TB / GDP

Wages and prices

[4.1] PMGS $= \prod(\boldsymbol{PXGSUSDi} \;/\; (\boldsymbol{EXCHUi} \,/\, \boldsymbol{EXCHUi,b}))^{ms_{i,b}}$
[4.2] ULC = (WSSS/ET)/APL
[4.3] PCPNET = *f* (PMGS, ULC, GAPB)
[4.4] PCP = PCPNET × (1 + **RTIND**)
[4.5] PIBNET = *f* (PMGS, ULC)
[4.6] PIB = PIBNET × (1 + **RTIND**)
[4.7] PIGNET = *f* (PIBNET)
[4.8] PIG = PIGNET × (1 + **RTIND**)
[4.9] PXGS = *f* (PMGS, ULC)
[4.10] PGDP = GDP / GDPV
[4.11] UWB = *f* (APL, PCP, PGDP, UNR, FLEX, ALFA)

Income

[5.1] WAGEB = UWB × ETB × WRB_b
[5.2] WAGE = WAGEB + CGW
[5.3] WSSS = WAGE + TRPBTH
[5.4] TRPBTH = SSCB + **TRPGPH**
[5.5] TRRH = SSPG + **TRPG** + **TRRHX**
[5.6] YOTH = GGINTP + YPEX
[5.7] YPEX = *f* (GDP)
[5.8] YRH = WSSS + YOTH + TRRH
[5.9] TRPH = TRSSH + **TROPH**
[5.10] YDH = YRH − TYH − TRPH
[5.11] YDHR = YDH/PCP

Public sector

[6.1] SSPG = *f* (GDPBV, PGDP, **AGE**, UNR)
[6.2] CGW = **UWG** × **ETG** × $\mathbf{WRG_b}$
[6.3] CGNW = **CINT** + **CFKG** + **YPEPGX**
[6.4] CG = CGW + CGNW
[6.5] IG = **IGG** + **SDIG**
[6.6] CGV = CG / PCGV
[6.7] GGINTP = IRGOV × GGFL / 100
[6.8] TYH = **RTYH** × YRH
[6.9] TYB = **RTYB** × PROF
[6.10] TIND = **RTIND** × (CPV × PCP + CG + IBV×PIB + IG) / (1 + **RTIND**)
[6.11] SSCB = **RSSCB** × WAGEB
[6.12] SSRG = TRPBTH + **SDSSRG**
[6.13] TRSSH = SSRG − **TRPBPH**
[6.14] KPG = **IGG** + **KXG**
[6.15] YPG = CG + GGINTP + SSPG + **TSUB** + **TRPG**
[6.16] YRG = TYH + TYB + TIND + SSRG + **TRRG** + **YPERG**
[6.17] CDG = YPG − YRG
[6.18] CAPOG = KPG − **KRG**
[6.19] PSBR = CDG + CAPOG
[6.20] PSBRQ = 100 × PSBR / GDP
[6.21] GGFL = $GGFL_{-1}$ + PSBR + **SF**
[6.22] GGFLQ = 100 × GGFL / GDP

Interest rates

[7.1] IRS = f (GAPB, PGDP)
[7.2] IRL = f (IRS, PSBRQ)
[7.3] IRLR = IRL – 100 × (PGDP – $PGDP_{-1}$) / $PGDP_{-1}$
[7.4] IRGOV = f (IRL, IRS)

Appendix 5– Stochastic equations

We report in this appendix the estimation output of the stochastic equations, along with their tracking in the full dynamic simulation of the model on the 1980-2013 sample.

The cointegrating statistics of the long-run equations are provided in Appendix 3 above.

Each short-run equation is followed by the standard misspecification diagnostics: *SC*(*i*) is the Breusch-Godfrey's serial correlation LM test with *i* lags; *HET* is White's heteroskedasticity test (with no cross-product terms); *FF* is Ramsey's functional form (RESET) test (with the squared of the fitted values); *NOR* is Jarque-Bera's Normality test. Except for *NOR*, diagnostics statistics are reported in their *F* form. When *SC*(*i*) or *HET* produced a significant statistic, Newey-West or White corrected covariance matrices have been used.

The simulations results for the period 1980-2013 are plotted taking growth rates for stock and flow variables, and the original values for variables expressed as a GDP ratios or in percentage points (such as the interest or unemployment rates).

At the end of the Section, we provide the simulation tracking of a few relevant variables modelled through identities, rather than stochastic equations: *APL* (average productivity of labour), *GGFLQ* (public debt-to-GDP ratio), *GGINTPQ* (government interest expenditure-to-GDP ratio), *PSBRQ* (public sector borrowing requirement-to-GDP ratio), *TBQ* and *TBQ_i* (the overall and bilateral trade balances), *YDHR* (the households' real disposable income), and *UWBR* (the real unit wage).

Eq. [1.1] Private sector gross domestic product, real terms

Long run

Dependent Variable: LOG(GDPBV/ETB)
Method: Least Squares
Sample: 1960 2013
Included observations: 54
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.819	0.675	1.213	0.231
LOG(KBV/ETB)	0.467	0.175	2.672	0.010
LOG(KBV/ETB)*IFGT1971	0.073	0.019	3.922	0.000
LOG(KBV/ETB)*IFGT1997	0.120	0.026	4.552	0.000
TREND	0.040	0.011	3.708	0.001
TREND*IFGT1971	-0.028	0.007	-4.185	0.000
TREND*IFGT1997	-0.016	0.004	-4.390	0.000
TREND*IFGT2008	-0.001	0.000	-6.911	0.000

R-squared	0.998	Mean dependent var	3.723
Adjusted R-squared	0.998	S.D. dependent var	0.413
S.E. of regression	0.018	Akaike info criterion	-5.079
Sum squared resid	0.015	Schwarz criterion	-4.784
Log likelihood	145.125	Hannan-Quinn criter.	-4.965
F-statistic	4054.518	Durbin-Watson stat	1.290
Prob(F-statistic)	0.000	Wald F-statistic	8864.025
Prob(Wald F-statistic)	0.000		

Short run

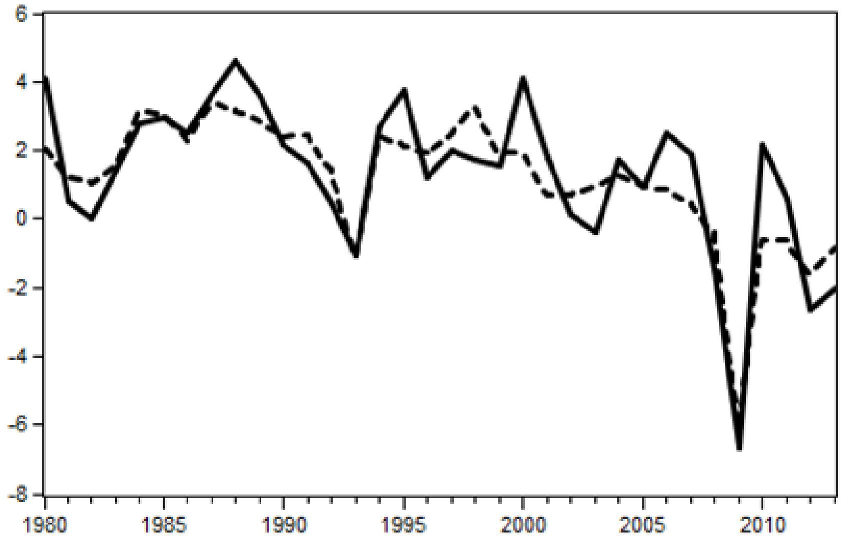
Dependent Variable: DLOG(GDPBV)
Method: Least Squares
Sample (adjusted): 1962 2013
Included observations: 52 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.007	0.003	-2.435	0.019
DLOG(KBV)	3.311	0.373	8.874	0.000
DLOG(ETB)	0.416	0.138	3.027	0.004
D09	-0.048	0.010	-4.858	0.000
D75	-0.041	0.010	-4.090	0.000
DLOG(KBV(-1))	-1.944	0.384	-5.060	0.000
DLOG(ETB(-1))	-0.363	0.139	-2.605	0.013
D71+D72	-0.033	0.007	-4.814	0.000
Z_EQGDPBV(-1)	-0.480	0.087	-5.544	0.000

R-squared	0.923	Mean dependent var	0.025
Adjusted R-squared	0.909	S.D. dependent var	0.030
S.E. of regression	0.009	Akaike info criterion	-6.419
Sum squared resid	0.004	Schwarz criterion	-6.081
Log likelihood	175.897	Hannan-Quinn criter.	-6.290
F-statistic	64.593	Durbin-Watson stat	1.709
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.558	0.446	0.936	Value	1.138
p-value	0.577	0.814	0.497	Probability	0.566

Simulation



Eq. [1.5] Private sector employment

Long run

Dependent Variable: LOG(ETB)-LOG(GDPV)+ALFA*LOG(UWB/PIB)
Method: Least Squares
Sample: 1960 2013
Included observations: 54
HAC standard errors & covariance (Prewhitening with lags = 0 from SIC maxlags = 3, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.544	0.006	-627.232	0.000
IFGT1971	-0.244	0.025	-9.604	0.000
IFGT1997	-0.786	0.034	-23.115	0.000
TREND	-0.029	0.001	-25.813	0.000
TREND*IFGT1971	0.015	0.002	9.297	0.000
TREND*IFGT1997	0.021	0.001	20.889	0.000

R-squared	0.994	Mean dependent var	-4.091
Adjusted R-squared	0.993	S.D. dependent var	0.219
S.E. of regression	0.019	Akaike info criterion	-5.031
Sum squared resid	0.017	Schwarz criterion	-4.810
Log likelihood	141.846	Hannan-Quinn criter.	-4.946
F-statistic	1471.079	Durbin-Watson stat	1.210
Prob(F-statistic)	0.000	Wald F-statistic	5046.220
Prob(Wald F-statistic)	0.000		

Short run

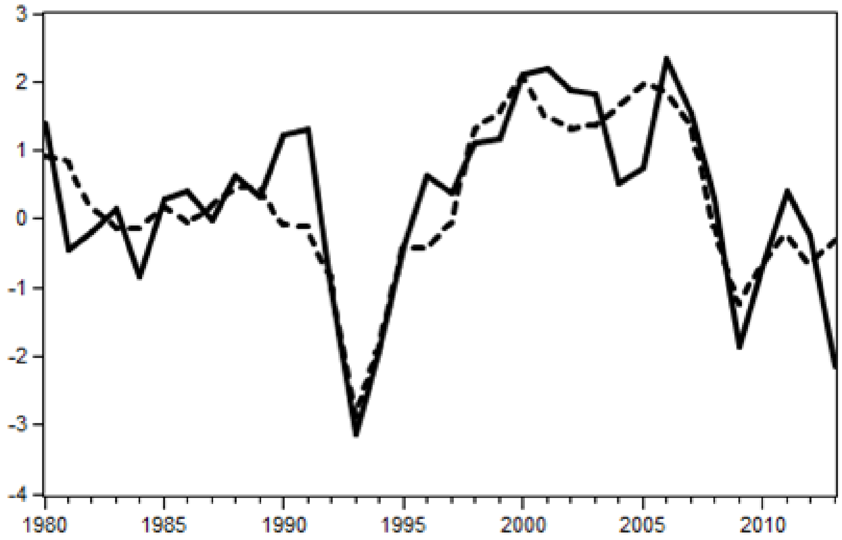
Dependent Variable: DLOG(ETB)
Method: Least Squares
Sample: 1970 2013
Included observations: 44

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.004	0.002	-1.789	0.082
DLOG(GDPV)	0.281	0.058	4.817	0.000
DLOG(UWB/PIB)	-0.121	0.041	-2.933	0.006
IFGT1997	0.012	0.003	4.749	0.000
IFGT2007	-0.011	0.004	-2.860	0.007
DLOG(ET(-1))	0.270	0.091	2.962	0.005
D93	-0.018	0.007	-2.604	0.013
Z_EQETB(-1)	-0.127	0.065	-1.972	0.056

R-squared	0.790	Mean dependent var	0.003
Adjusted R-squared	0.749	S.D. dependent var	0.012
S.E. of regression	0.006	Akaike info criterion	-7.255
Sum squared resid	0.001	Schwarz criterion	-6.930
Log likelihood	167.604	Hannan-Quinn criter.	-7.134
F-statistic	19.351	Durbin-Watson stat	2.093
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	1.058	0.714	0.823	1.668	0.166
p-value	0.358	0.618	0.575	0.205	0.920

Simulation



Eq. [1.12] Capital accumulation in the private sector, real terms

Long run

Dependent Variable: KGR
Method: Least Squares
Sample (adjusted): 1961 2013
Included observations: 53 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.052	0.003	16.609	0.000
IFGT1971	-0.022	0.003	-6.313	0.000
IFGT1997	-0.016	0.001	-11.132	0.000
(MPK-(IRLR/100+RSCRB+0.1))*IFGT1971	0.165	0.017	9.581	0.000
(MPK-(IRLR/100+RSCRB+0.1))*IFGT1997	0.272	0.044	6.180	0.000

R-squared	0.892	Mean dependent var	0.029
Adjusted R-squared	0.883	S.D. dependent var	0.016
S.E. of regression	0.006	Akaike info criterion	-7.459
Sum squared resid	0.001	Schwarz criterion	-7.273
Log likelihood	202.668	Hannan-Quinn criter.	-7.388
F-statistic	99.391	Durbin-Watson stat	1.052
Prob(F-statistic)	0.000	Wald F-statistic	105.424
Prob(Wald F-statistic)	0.000		

Short run

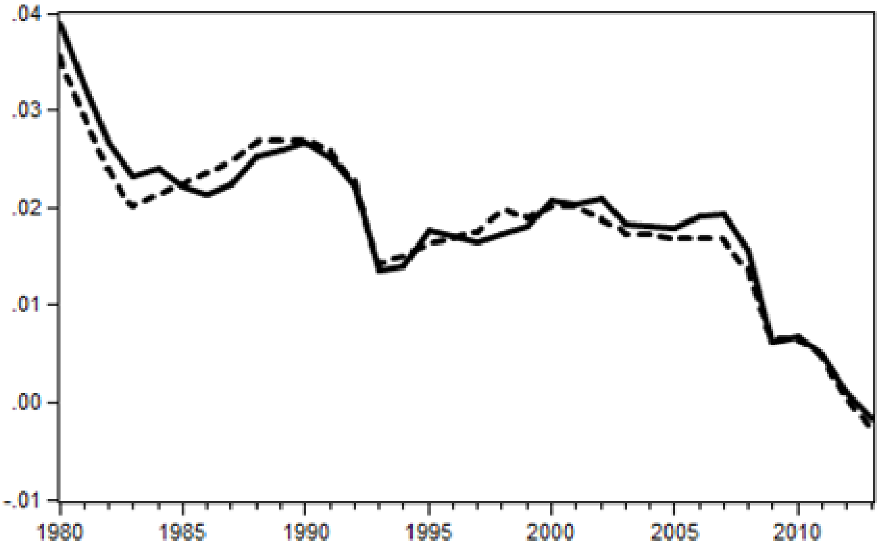
Dependent Variable: D(KGR)
Method: Least Squares
Sample: 1970 2013
Included observations: 44
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.005	0.001	-8.127	0.000
D(MPK-(IRLR/100+RSCRB+0.1))	0.037	0.013	2.910	0.006
DLOG(GDPV)	0.092	0.014	6.529	0.000
@YEAR>1983	0.003	0.001	5.446	0.000
@YEAR=1993	-0.006	0.001	-9.684	0.000
Z_EQKGR(-1)	-0.115	0.065	-1.770	0.085

R-squared	0.787	Mean dependent var	-0.001
Adjusted R-squared	0.758	S.D. dependent var	0.003
S.E. of regression	0.002	Akaike info criterion	-9.973
Sum squared resid	0.000	Schwarz criterion	-9.729
Log likelihood	225.399	Hannan-Quinn criter.	-9.882
F-statistic	27.998	Durbin-Watson stat	1.704
Prob(F-statistic)	0.000	Wald F-statistic	293.860
Prob(Wald F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.168	0.693	4.253	4.272	0.857
p-value	0.846	0.632	0.004	0.046	0.651

Simulation



Eq. [2.1] Private consumption, real terms

Long run

Dependent Variable: LOG(CPV)
Method: Least Squares
Sample: 1960 2013
Included observations: 54
HAC standard errors & covariance (Prewhitening with lags = 1 from SIC maxlags = 3, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.216	0.349	-3.479	0.001
IFGT1994	0.060	0.023	2.652	0.011
LOG(YDH/PCP)	1.011	0.032	32.061	0.000
FPR	2.074	0.400	5.180	0.000

R-squared	0.998	Mean dependent var	13.207
Adjusted R-squared	0.998	S.D. dependent var	0.433
S.E. of regression	0.020	Akaike info criterion	-4.890
Sum squared resid	0.021	Schwarz criterion	-4.742
Log likelihood	136.017	Hannan-Quinn criter.	-4.833
F-statistic	8068.134	Durbin-Watson stat	0.887
Prob(F-statistic)	0.000	Wald F-statistic	1185.784
Prob(Wald F-statistic)	0.000		

Short run

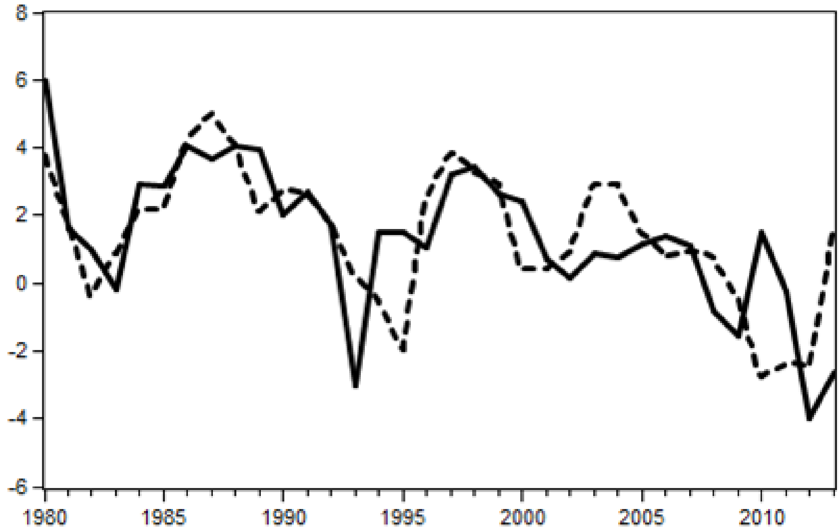
Dependent Variable: DLOG(CPV)
Method: Least Squares
Sample (adjusted): 1963 2013
Included observations: 51 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008	0.003	3.107	0.003
DLOG(YDH/PCP)	0.724	0.103	7.048	0.000
DLOG(CPV(-1))	0.304	0.098	3.115	0.003
DLOG(CPV(-2))	-0.148	0.074	-1.988	0.053
Z_EQCPV(-1)	-0.344	0.083	-4.126	0.000

R-squared	0.793	Mean dependent var	0.025
Adjusted R-squared	0.776	S.D. dependent var	0.026
S.E. of regression	0.012	Akaike info criterion	-5.849
Sum squared resid	0.007	Schwarz criterion	-5.660
Log likelihood	154.150	Hannan-Quinn criter.	-5.777
F-statistic	44.189	Durbin-Watson stat	2.085
Prob(F-statistic)	0.000	Wald F-statistic	63.854
Prob(Wald F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	1.303	1.075	0.390	0.019	0.820
p-value	0.282	0.388	0.815	0.890	0.664

Simulation



Eq. [2.3] Changes in inventories, real terms

Variation

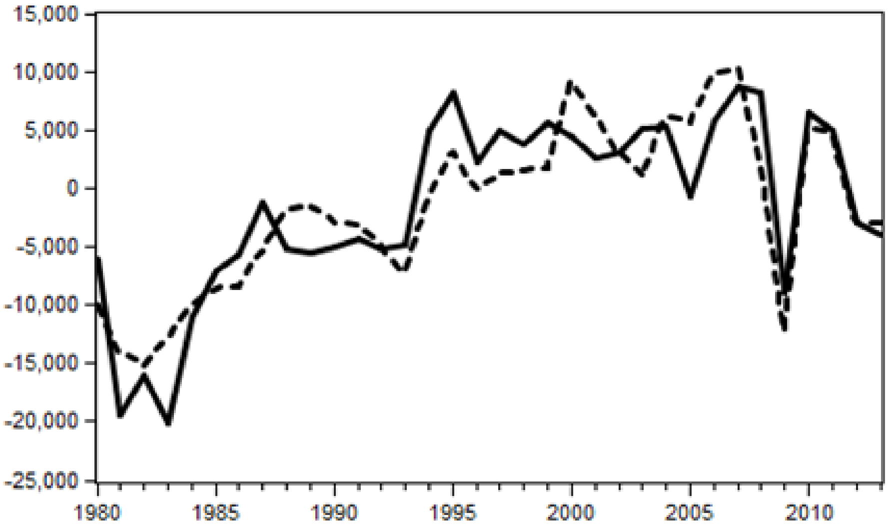
Dependent Variable: D(ISKV)
Method: Least Squares
Sample (adjusted): 1961 2013
Included observations: 53 after adjustments
HAC standard errors & covariance (Prewhitening with lags = 0 from SIC
maxlags = 3, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-30274.163	3775.914	-8.018	0.000
D(VABV)	0.226	0.043	5.234	0.000
ISKV(-1)	-0.899	0.100	-9.006	0.000
VABV(-1)	0.042	0.005	8.825	0.000
IFGT1976	-12453.174	1945.430	-6.401	0.000

R-squared	0.751	Mean dependent var	114.543
Adjusted R-squared	0.731	S.D. dependent var	8153.509
S.E. of regression	4230.801	Akaike info criterion	19.628
Sum squared resid	859184699.289	Schwarz criterion	19.814
Log likelihood	-515.136	Hannan-Quinn criter.	19.699
F-statistic	36.282	Durbin-Watson stat	1.888
Prob(F-statistic)	0.000	Wald F-statistic	29.254
Prob(Wald F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.524	0.859	2.305	0.375	1.842
p-value	0.596	0.516	0.072	0.543	0.398

Simulation


15,000
10,000
5,000
0
-5,000
-10,000
-15,000
-20,000
-25,000
1980
1985
1990
1995
2000
2005
2010

Eq. [3.4.B] Exports of goods to Core (partner B), real terms

Long run

Dependent Variable: LOG(XGUSDVB)
Method: Least Squares
Sample: 1970 2013
Included observations: 44
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-17.241	0.919	-18.764	0.000
LOG(GDPVUSDB)	1.847	0.059	31.420	0.000
LOG(REERB)	-0.576	0.199	-2.890	0.006
LOG(REERB)*IFGT1986	-0.691	0.150	-4.599	0.000

R-squared	0.992	Mean dependent var	11.278
Adjusted R-squared	0.991	S.D. dependent var	0.472
S.E. of regression	0.045	Akaike info criterion	-3.291
Sum squared resid	0.080	Schwarz criterion	-3.128
Log likelihood	76.394	Hannan-Quinn criter.	-3.230
F-statistic	1583.768	Durbin-Watson stat	1.105
Prob(F-statistic)	0.000	Wald F-statistic	1059.962
Prob(Wald F-statistic)	0.000		

Short run

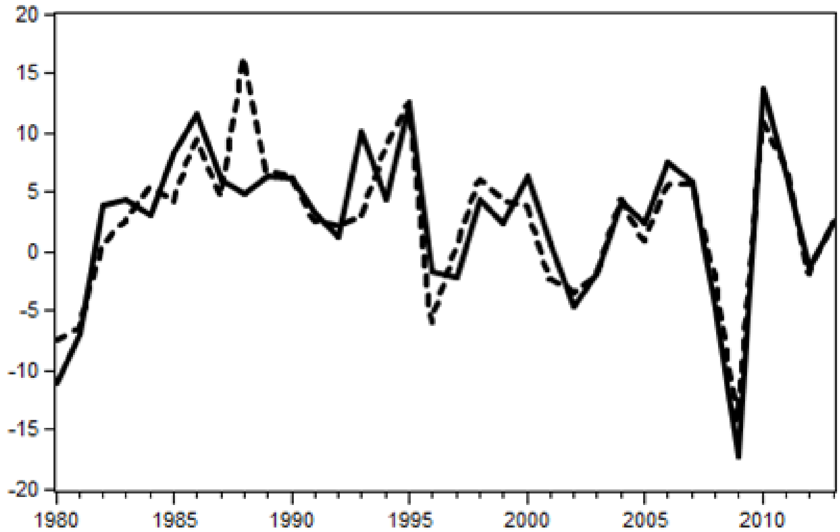
Dependent Variable: DLOG(XGUSDVB)
Method: Least Squares
Sample (adjusted): 1971 2013
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.018	0.007	-2.607	0.013
DLOG(GDPVUSDB)	2.997	0.265	11.316	0.000
DLOG(REERB)	-0.956	0.132	-7.245	0.000
D73	-0.154	0.032	-4.770	0.000
D74	-0.095	0.028	-3.396	0.002
Z_EQXGUSDVB(-1)	-0.532	0.104	-5.120	0.000

R-squared	0.858	Mean dependent var	0.036
Adjusted R-squared	0.839	S.D. dependent var	0.067
S.E. of regression	0.027	Akaike info criterion	-4.252
Sum squared resid	0.027	Schwarz criterion	-4.006
Log likelihood	97.413	Hannan-Quinn criter.	-4.161
F-statistic	44.667	Durbin-Watson stat	2.234
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	1.254	0.985	0.399	6.206	0.124
p-value	0.298	0.442	0.846	0.017	0.940

Simulation



Eq. [3.4.C] Exports of goods to Periphery (partner C), real terms

Long run

Dependent Variable: LOG(XGUSDVC)
Method: Least Squares
Sample: 1970 2013
Included observations: 44
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-16.796	0.651	-25.816	0.000
IFGT1985	-12.257	1.176	-10.424	0.000
IFGT1999	1.983	0.111	17.785	0.000
LOG(GDPVUSDC)	1.861	0.048	38.907	0.000
LOG(REERC)	-0.434	0.155	-2.806	0.008
LOG(GDPVUSDC)*IFGT1985	0.926	0.085	10.932	0.000
LOG(REERC)*IFGT1985	-1.488	0.278	-5.356	0.000
TREND*IFGT1999	-0.052	0.003	-19.678	0.000

R-squared	0.998	Mean dependent var	9.529
Adjusted R-squared	0.998	S.D. dependent var	0.930
S.E. of regression	0.046	Akaike info criterion	-3.165
Sum squared resid	0.076	Schwarz criterion	-2.841
Log likelihood	77.635	Hannan-Quinn criter.	-3.045
F-statistic	2524.053	Durbin-Watson stat	2.342
Prob(F-statistic)	0.000	Wald F-statistic	6333.503
Prob(Wald F-statistic)	0.000		

Short run

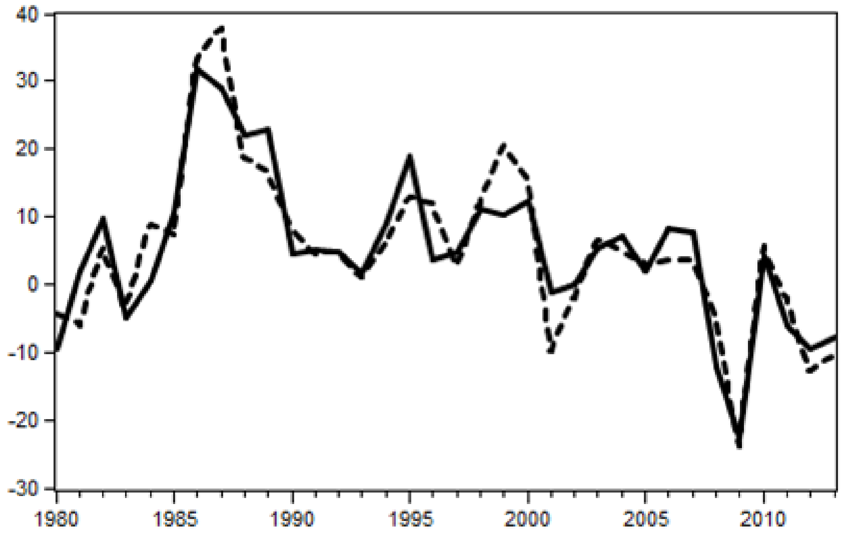
Dependent Variable: DLOG(XGUSDVC)
Method: Least Squares
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.013	0.011	-1.226	0.228
DLOG(GDPVUSDC)	2.660	0.434	6.126	0.000
DLOG(REERC)	-1.050	0.218	-4.817	0.000
DLOG(XGUSDVC(-1))	0.343	0.088	3.888	0.000
D86	0.283	0.040	7.009	0.000
DLOG(GDPVUSDC(-1))	-0.953	0.469	-2.035	0.050
D09	-0.125	0.045	-2.758	0.009
Z_EQXGUSDVC(-1)	-1.225	0.169	-7.246	0.000

R-squared	0.897	Mean dependent var	0.054
Adjusted R-squared	0.875	S.D. dependent var	0.109
S.E. of regression	0.039	Akaike info criterion	-3.499
Sum squared resid	0.051	Schwarz criterion	-3.168
Log likelihood	81.470	Hannan-Quinn criter.	-3.377
F-statistic	42.118	Durbin-Watson stat	2.075
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.497	0.753	2.185	Value	1.139
p-value	0.613	0.591	0.061	Probability	0.566

Simulation



Eq. [3.4.D] Exports of goods to USA (partner D), real terms

Long run

Dependent Variable: LOG(XGUSDVD)
Method: Least Squares
Sample: 1970 2013
Included observations: 44
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-47.651	6.089	-7.826	0.000
IFGT1982	0.300	0.067	4.473	0.000
LOG(GDPVUSDD)	3.694	0.408	9.044	0.000
LOG(REERD)	-1.035	0.129	-8.053	0.000
TREND	-0.062	0.012	-5.035	0.000

R-squared	0.978	Mean dependent var	9.682
Adjusted R-squared	0.976	S.D. dependent var	0.570
S.E. of regression	0.089	Akaike info criterion	-1.904
Sum squared resid	0.306	Schwarz criterion	-1.702
Log likelihood	46.896	Hannan-Quinn criter.	-1.829
F-statistic	436.358	Durbin-Watson stat	1.474
Prob(F-statistic)	0.000	Wald F-statistic	512.012
Prob(Wald F-statistic)	0.000		

Short run

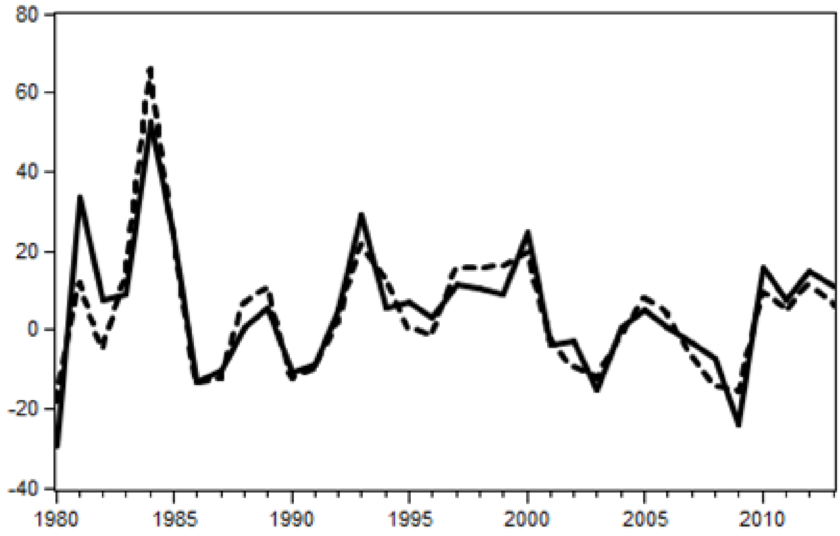
Dependent Variable: DLOG(XGUSDVD)
Method: Least Squares
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.070	0.018	-3.990	0.000
DLOG(GDPVUSDD)	3.862	0.505	7.644	0.000
DLOG(REERD)	-0.929	0.137	-6.789	0.000
DLOG(XGUSDVD(-1))	0.203	0.073	2.793	0.008
Z_EQXGUSDVD(-1)	-0.699	0.131	-5.355	0.000

R-squared	0.819	Mean dependent var	0.038
Adjusted R-squared	0.799	S.D. dependent var	0.148
S.E. of regression	0.067	Akaike info criterion	-2.470
Sum squared resid	0.164	Schwarz criterion	-2.263
Log likelihood	56.877	Hannan-Quinn criter.	-2.394
F-statistic	41.736	Durbin-Watson stat	1.958
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.616	0.889	0.447	1.180	1.312
p-value	0.546	0.500	0.774	0.284	0.519

Simulation



Eq. [3.4.E] Exports of goods to Non-euro (partner E), real terms

Long run

Dependent Variable: LOG(XGUSDVE)
Method: Least Squares
Sample: 1970 2013
Included observations: 44
HAC standard errors & covariance (Prewhitening with lags = 1 from SIC maxlags = 3, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-17.118	0.824	-20.787	0.000
LOG(GDPVUSDE)	1.857	0.054	34.073	0.000
LOG(REERE)	-1.524	0.430	-3.545	0.001

R-squared	0.980	Mean dependent var	10.140
Adjusted R-squared	0.979	S.D. dependent var	0.571
S.E. of regression	0.083	Akaike info criterion	-2.077
Sum squared resid	0.282	Schwarz criterion	-1.956
Log likelihood	48.704	Hannan-Quinn criter.	-2.032
F-statistic	999.773	Durbin-Watson stat	0.934
Prob(F-statistic)	0.000	Wald F-statistic	747.990
Prob(Wald F-statistic)	0.000		

Short run

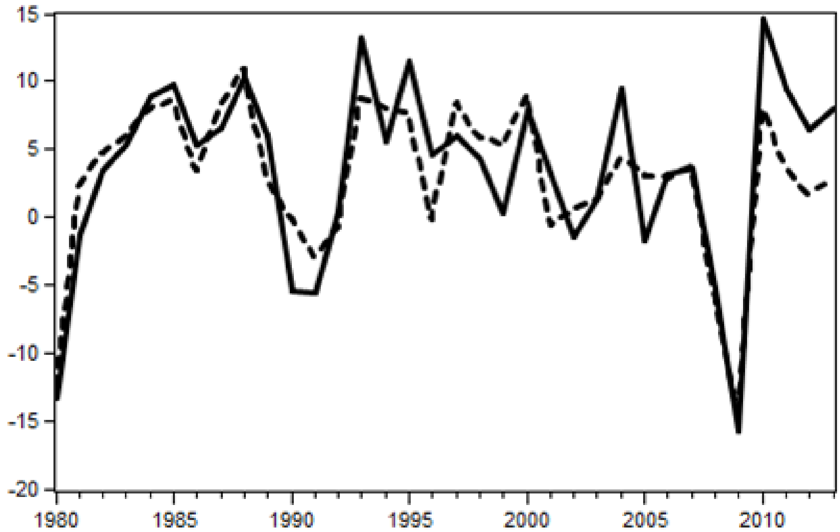
Dependent Variable: DLOG(XGUSDVE)
Method: Least Squares
Sample (adjusted): 1971 2013
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.017	0.014	1.263	0.214
DLOG(GDPVUSDE)	2.224	0.414	5.370	0.000
DLOG(REERE)	-0.748	0.236	-3.176	0.003
D80	-0.386	0.072	-5.394	0.000
IFGT1993	-0.031	0.015	-2.043	0.048
Z_EQXGUSDVE(-1)	-0.219	0.106	-2.064	0.046

R-squared	0.648	Mean dependent var	0.046
Adjusted R-squared	0.600	S.D. dependent var	0.077
S.E. of regression	0.048	Akaike info criterion	-3.086
Sum squared resid	0.087	Schwarz criterion	-2.840
Log likelihood	72.346	Hannan-Quinn criter.	-2.995
F-statistic	13.615	Durbin-Watson stat	1.785
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.591	1.189	1.412	1.421	0.302
p-value	0.559	0.336	0.243	0.241	0.860

Simulation



Eq. [3.4.F] Exports of goods to OPEC (partner F), real terms

Long run

Dependent Variable: LOG(XGUSDVF)
Method: Least Squares
Sample: 1970 2013
Included observations: 44
HAC standard errors & covariance (Prewhitening with lags = 0 from SIC maxlags = 3, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.103	1.590	3.839	0.000
LOG(GDPVUSDF)	0.266	0.115	2.317	0.026
LOG(REERF)	-0.675	0.095	-7.080	0.000

R-squared	0.853	Mean dependent var	9.399
Adjusted R-squared	0.846	S.D. dependent var	0.528
S.E. of regression	0.207	Akaike info criterion	-0.244
Sum squared resid	1.762	Schwarz criterion	-0.122
Log likelihood	8.359	Hannan-Quinn criter.	-0.198
F-statistic	118.723	Durbin-Watson stat	0.964
Prob(F-statistic)	0.000	Wald F-statistic	39.668
Prob(Wald F-statistic)	0.000		

Short run

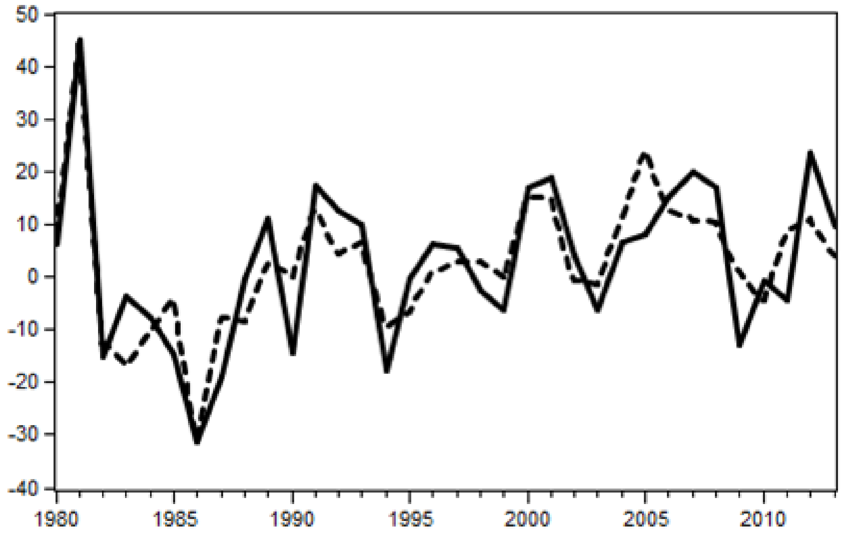
Dependent Variable: DLOG(XGUSDVF)
Method: Least Squares
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.044	0.022	-2.028	0.050
DLOG(REERF)	-0.160	0.049	-3.275	0.002
D81	0.359	0.080	4.510	0.000
D86	-0.227	0.091	-2.494	0.017
DLOG(GDPVUSDF(-1))	1.890	0.364	5.198	0.000
Z_EQXGUSDVF(-1)	-0.290	0.077	-3.782	0.001

R-squared	0.803	Mean dependent var	0.051
Adjusted R-squared	0.776	S.D. dependent var	0.165
S.E. of regression	0.078	Akaike info criterion	-2.131
Sum squared resid	0.219	Schwarz criterion	-1.883
Log likelihood	50.751	Hannan-Quinn criter.	-2.040
F-statistic	29.354	Durbin-Watson stat	2.088
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.586	0.549	0.321	1.019	2.522
p-value	0.562	0.738	0.897	0.320	0.283

Simulation



Eq. [3.4.G] Exports of goods to BRIC (partner G), real terms

Long run

Dependent Variable: LOG(XGUSDVG)
Method: Least Squares
Sample: 1970 2013
Included observations: 44
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-11.096	0.716	-15.504	0.000
IFGT1977	-0.270	0.098	-2.745	0.009
LOG(GDPVUSDG)	1.374	0.052	26.493	0.000
LOG(REERG)*(@YEAR>1993)	-1.202	0.482	-2.493	0.017

R-squared	0.955	Mean dependent var	8.927
Adjusted R-squared	0.952	S.D. dependent var	0.848
S.E. of regression	0.186	Akaike info criterion	-0.435
Sum squared resid	1.390	Schwarz criterion	-0.273
Log likelihood	13.569	Hannan-Quinn criter.	-0.375
F-statistic	283.027	Durbin-Watson stat	1.263
Prob(F-statistic)	0.000	Wald F-statistic	316.213
Prob(Wald F-statistic)	0.000		

Short run

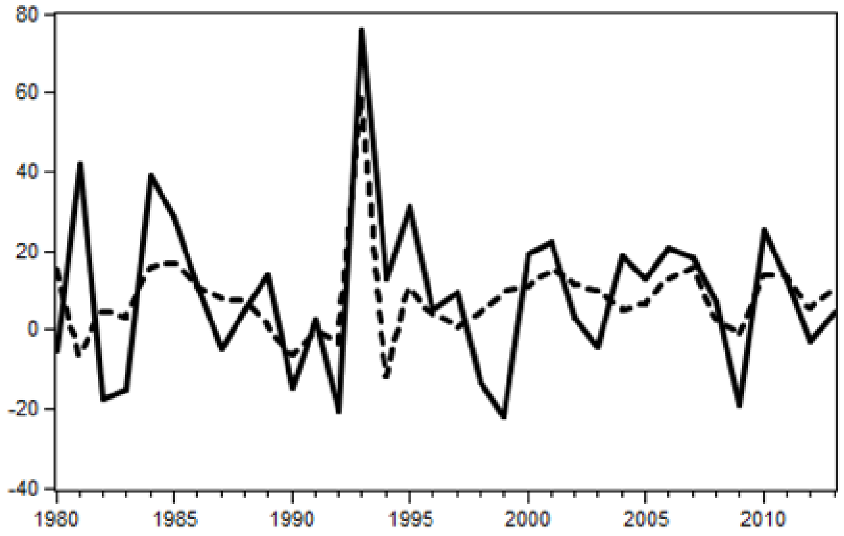
Dependent Variable: DLOG(XGUSDVG)
Method: Least Squares
Sample (adjusted): 1971 2013
Included observations: 43 after adjustments
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.063	0.067	-0.936	0.355
DLOG(GDPVUSDG)	2.390	0.973	2.457	0.019
D77	-0.424	0.022	-19.037	0.000
D93	0.390	0.062	6.303	0.000
Z_EQXGUSDVG(-1)	-0.467	0.140	-3.340	0.002

R-squared	0.513	Mean dependent var	0.066
Adjusted R-squared	0.462	S.D. dependent var	0.194
S.E. of regression	0.142	Akaike info criterion	-0.954
Sum squared resid	0.769	Schwarz criterion	-0.749
Log likelihood	25.507	Hannan-Quinn criter.	-0.878
F-statistic	10.020	Durbin-Watson stat	2.084
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	1.364	0.987	1.695	0.348	0.805
p-value	0.269	0.441	0.171	0.559	0.669

Simulation



Eq. [3.4.H] Exports of goods to rest of the world (partner H), real terms

Long run

Dependent Variable: LOG(XGUSDVH)
Method: Least Squares
Sample: 1970 2013
Included observations: 44

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-14.497	1.510	-9.599	0.000
IFGT1993	0.448	0.046	9.659	0.000
LOG(GDPVUSDH)	1.553	0.094	16.585	0.000
LOG(REERH)	-0.470	0.177	-2.649	0.012

R-squared	0.987	Mean dependent var	10.749
Adjusted R-squared	0.986	S.D. dependent var	0.707
S.E. of regression	0.083	Akaike info criterion	-2.057
Sum squared resid	0.274	Schwarz criterion	-1.895
Log likelihood	49.262	Hannan-Quinn criter.	-1.997
F-statistic	1031.507	Durbin-Watson stat	1.609
Prob(F-statistic)	0.000		

Short run

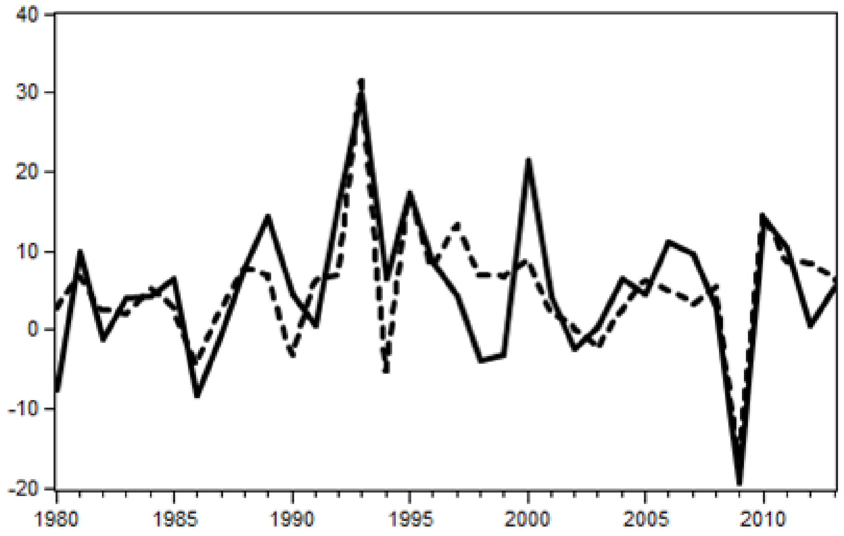
Dependent Variable: DLOG(XGUSDVH)
Method: Least Squares
Sample (adjusted): 1971 2013
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.056	0.010	5.742	0.000
DLOG(REERH)	-0.593	0.172	-3.448	0.001
D09	-0.222	0.063	-3.518	0.001
D93	0.181	0.065	2.773	0.009
Z_EQXGUSDVH(-1)	-0.373	0.121	-3.071	0.004

R-squared	0.588	Mean dependent var	0.051
Adjusted R-squared	0.545	S.D. dependent var	0.091
S.E. of regression	0.061	Akaike info criterion	-2.643
Sum squared resid	0.142	Schwarz criterion	-2.438
Log likelihood	61.816	Hannan-Quinn criter.	-2.567
F-statistic	13.569	Durbin-Watson stat	1.991
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.001	0.120	1.016	5.134	3.288
p-value	0.999	0.987	0.412	0.029	0.193

Simulation



Eq. [3.5.B] Imports of goods from Core countries (partner B), real terms

Long run

Dependent Variable: LOG(MGUSDVB)
Method: Least Squares
Sample: 1970 2013
Included observations: 44
HAC standard errors & covariance (Prewhitening with lags = 0 from SIC maxlags = 3, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-18.359	1.342	-13.679	0.000
IFGT1978	-0.211	0.069	-3.047	0.004
LOG(GDPVUSD)	2.119	0.098	21.602	0.000
LOG(REERB)	1.034	0.110	9.396	0.000

R-squared	0.991	Mean dependent var	11.297
Adjusted R-squared	0.990	S.D. dependent var	0.556
S.E. of regression	0.055	Akaike info criterion	-2.888
Sum squared resid	0.120	Schwarz criterion	-2.726
Log likelihood	67.540	Hannan-Quinn criter.	-2.828
F-statistic	1467.553	Durbin-Watson stat	1.453
Prob(F-statistic)	0.000	Wald F-statistic	1330.986
Prob(Wald F-statistic)	0.000		

Short run

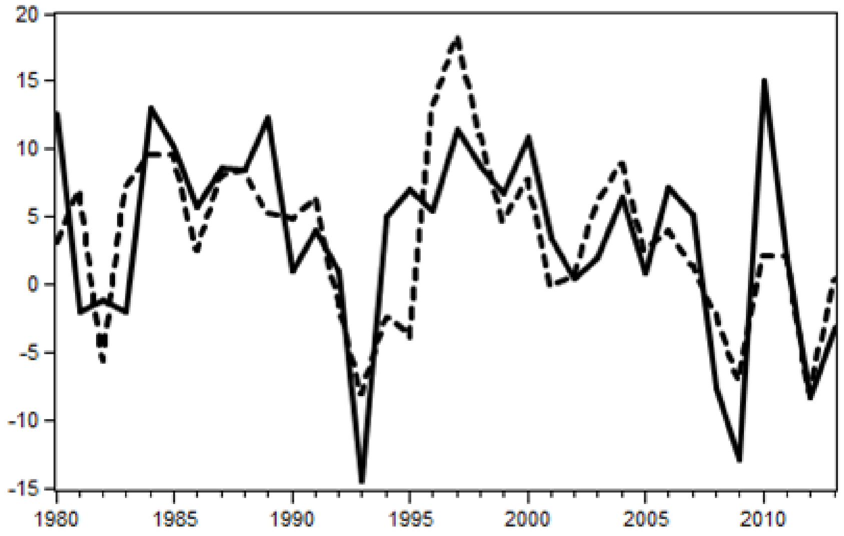
Dependent Variable: DLOG(MGUSDVB)
Method: Least Squares
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.009	0.006	-1.540	0.133
DLOG(GDPVUSD)	3.827	0.205	18.652	0.000
DLOG(REERB)	0.851	0.109	7.839	0.000
DLOG(MGUSDVB(-1))	0.449	0.084	5.355	0.000
DLOG(GDPVUSD(-1))	-2.439	0.307	-7.933	0.000
D72	0.068	0.024	2.786	0.009
D09	0.075	0.028	2.653	0.012
Z_EQMGUSDVB(-1)	-0.217	0.095	-2.274	0.029

R-squared	0.938	Mean dependent var	0.038
Adjusted R-squared	0.925	S.D. dependent var	0.086
S.E. of regression	0.023	Akaike info criterion	-4.496
Sum squared resid	0.019	Schwarz criterion	-4.165
Log likelihood	102.412	Hannan-Quinn criter.	-4.375
F-statistic	72.859	Durbin-Watson stat	2.397
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	1.506	1.128	0.921	Value	2.186
p-value	0.237	0.368	0.503	Probability	0.335

Simulation



Eq. [3.5.C] Imports of goods from Periphery countries (block C), real terms

Long run

Dependent Variable: LOG(MGUSDVC)
Method: Least Squares
Sample: 1970 2013
Included observations: 44
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-35.976	1.487	-24.197	0.000
IFGT1987	0.179	0.055	3.231	0.003
IFGT1994	0.239	0.041	5.822	0.000
LOG(GDPVUSD)	3.176	0.108	29.499	0.000
LOG(REERC)	1.979	0.201	9.828	0.000

R-squared	0.994	Mean dependent var	9.087
Adjusted R-squared	0.994	S.D. dependent var	0.998
S.E. of regression	0.079	Akaike info criterion	-2.128
Sum squared resid	0.244	Schwarz criterion	-1.925
Log likelihood	51.818	Hannan-Quinn criter.	-2.053
F-statistic	1699.749	Durbin-Watson stat	1.404
Prob(F-statistic)	0.000	Wald F-statistic	1659.348
Prob(Wald F-statistic)	0.000		

Short run

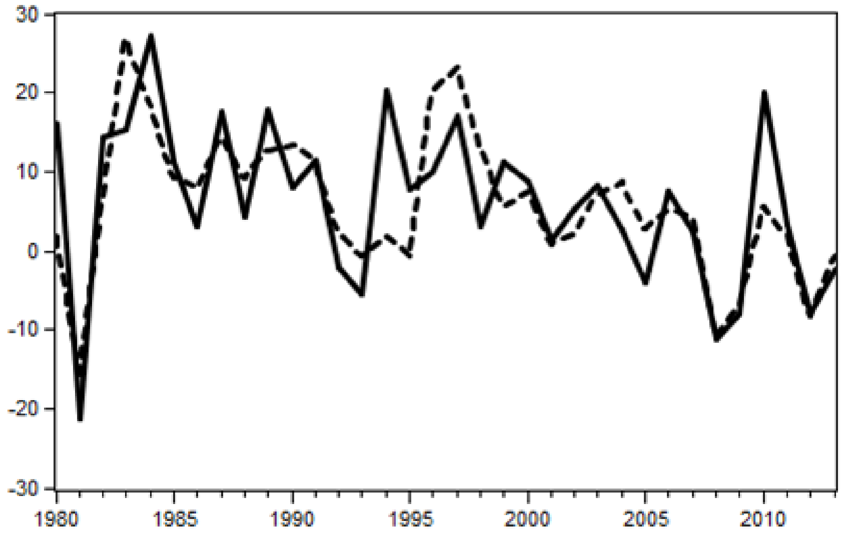
Dependent Variable: DLOG(MGUSDVC)
Method: Least Squares
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.028	0.011	2.629	0.013
DLOG(GDPVUSD)	3.282	0.380	8.638	0.000
DLOG(REERC)	0.734	0.273	2.691	0.011
DLOG(MGUSDVC(-1))	0.209	0.103	2.031	0.050
DLOG(GDPVUSD(-1))	-1.444	0.410	-3.523	0.001
D81	-0.234	0.048	-4.892	0.000
D08	-0.125	0.048	-2.588	0.014
Z_EQMGUSDVC(-1)	-0.560	0.115	-4.850	0.000

R-squared	0.847	Mean dependent var	0.066
Adjusted R-squared	0.816	S.D. dependent var	0.108
S.E. of regression	0.046	Akaike info criterion	-3.142
Sum squared resid	0.073	Schwarz criterion	-2.811
Log likelihood	73.973	Hannan-Quinn criter.	-3.020
F-statistic	26.897	Durbin-Watson stat	1.745
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.392	0.490	1.147	Value	1.638
p-value	0.679	0.781	0.358	Probability	0.441

Simulation



Eq. [3.5.D] Imports of goods from USA (block D), real terms

Long run

Dependent Variable: LOG(MGUSDVD)
Method: Least Squares
Sample: 1970 2013
Included observations: 44

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-10.380	2.093	-4.959	0.000
IFGT1981	-0.315	0.056	-5.612	0.000
LOG(GDPVUSD)	1.404	0.149	9.442	0.000
LOG(REERD)	0.389	0.126	3.082	0.004

R-squared	0.942	Mean dependent var	9.139
Adjusted R-squared	0.937	S.D. dependent var	0.337
S.E. of regression	0.084	Akaike info criterion	-2.024
Sum squared resid	0.284	Schwarz criterion	-1.861
Log likelihood	48.520	Hannan-Quinn criter.	-1.963
F-statistic	215.485	Durbin-Watson stat	1.349
Prob(F-statistic)	0.000		

Short run

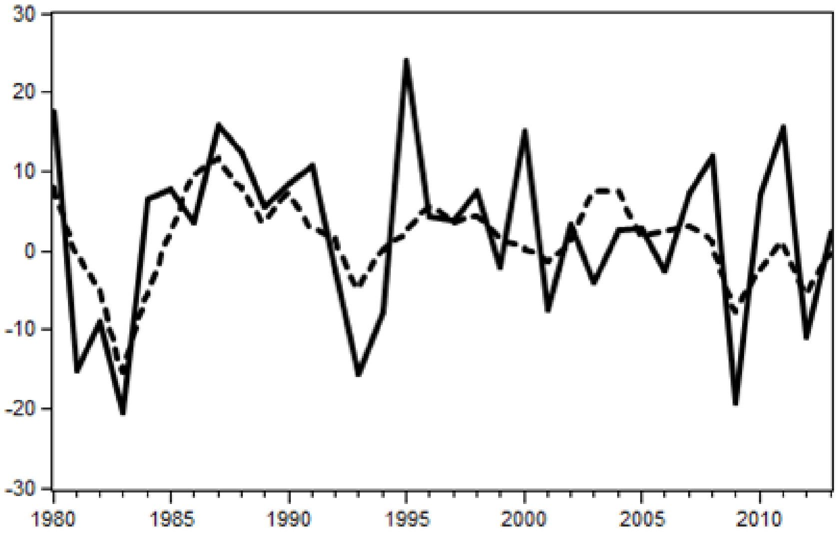
Dependent Variable: DLOG(MGUSDVD)
Method: Least Squares
Sample (adjusted): 1971 2013
Included observations: 43 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.017	0.018	-0.967	0.340
DLOG(GDPVUSD)	1.941	0.462	4.199	0.000
DLOG(REERD)	0.294	0.174	1.683	0.100
Z_EQMGUSDVD(-1)	-0.581	0.091	-6.362	0.000

R-squared	0.547	Mean dependent var	0.022
Adjusted R-squared	0.512	S.D. dependent var	0.110
S.E. of regression	0.077	Akaike info criterion	-2.202
Sum squared resid	0.231	Schwarz criterion	-2.038
Log likelihood	51.332	Hannan-Quinn criter.	-2.141
F-statistic	15.706	Durbin-Watson stat	1.465
Prob(F-statistic)	0.000	Wald F-statistic	28.604
Prob(Wald F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	3.041	1.476	0.398	0.044	0.445
p-value	0.060	0.223	0.755	0.834	0.800

Simulation



Eq. [3.5.E] Imports of goods from Non-euro countries (block E), real terms

Long run

Dependent Variable: LOG(MGUSDVE)
Method: Least Squares
Sample: 1970 2013
Included observations: 44

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-16.098	0.888	-18.121	0.000
IFGT1984	0.236	0.035	6.676	0.000
LOG(GDPVUSD)	1.827	0.064	28.491	0.000
LOG(REERE)	-0.456	0.150	-3.036	0.004

R-squared	0.992	Mean dependent var	9.896
Adjusted R-squared	0.991	S.D. dependent var	0.555
S.E. of regression	0.052	Akaike info criterion	-2.998
Sum squared resid	0.107	Schwarz criterion	-2.836
Log likelihood	69.952	Hannan-Quinn criter.	-2.938
F-statistic	1636.585	Durbin-Watson stat	1.584
Prob(F-statistic)	0.000		

Short run

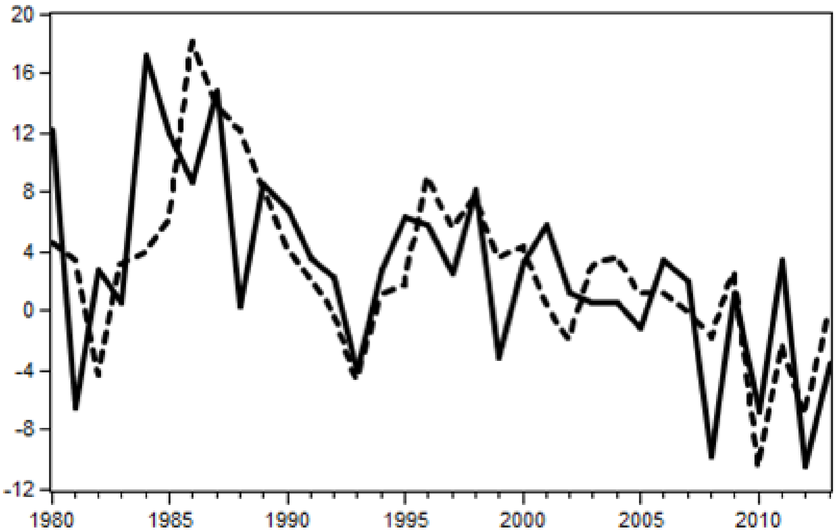
Dependent Variable: DLOG(MGUSDVE)
Method: Least Squares
Sample (adjusted): 1971 2013
Included observations: 43 after adjustments
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.018	0.007	-2.459	0.019
DLOG(GDPVUSD)	2.773	0.362	7.657	0.000
DLOG(REERE)	0.348	0.192	1.808	0.079
D09	0.148	0.028	5.319	0.000
Z_EQMGUSDVE(-1)	-0.373	0.169	-2.200	0.034

R-squared	0.704	Mean dependent var	0.034
Adjusted R-squared	0.673	S.D. dependent var	0.072
S.E. of regression	0.041	Akaike info criterion	-3.442
Sum squared resid	0.064	Schwarz criterion	-3.237
Log likelihood	78.998	Hannan-Quinn criter.	-3.366
F-statistic	22.592	Durbin-Watson stat	2.226
Prob(F-statistic)	0.000	Wald F-statistic	19.530
Prob(Wald F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	1.054	0.797	2.030	0.534	0.526
p-value	0.359	0.560	0.110	0.470	0.769

Simulation



Eq. [3.5.F] Imports of goods from OPEC (partner F), real terms

Long run

Dependent Variable: LOG(MGUSDVF)
Method: Least Squares
Sample: 1970 2013
Included observations: 44
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.696	1.321	9.610	0.000
LOG(GDPVUSD)	-0.171	0.093	-1.843	0.073
LOG(REERF)	0.160	0.040	4.019	0.000

R-squared	0.492	Mean dependent var	10.357
Adjusted R-squared	0.467	S.D. dependent var	0.168
S.E. of regression	0.122	Akaike info criterion	-1.297
Sum squared resid	0.614	Schwarz criterion	-1.176
Log likelihood	31.541	Hannan-Quinn criter.	-1.252
F-statistic	19.856	Durbin-Watson stat	1.445
Prob(F-statistic)	0.000	Wald F-statistic	18.137
Prob(Wald F-statistic)	0.000		

Short run

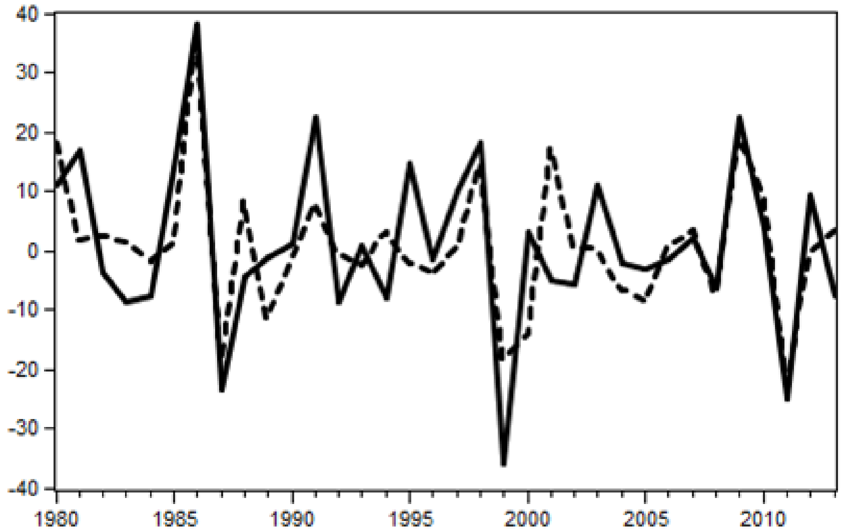
Dependent Variable: DLOG(MGUSDVF)
Method: Least Squares
Sample (adjusted): 1971 2013
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.004	0.015	-0.283	0.779
DLOG(REERF)	0.379	0.062	6.111	0.000
D74	0.443	0.119	3.735	0.001
D10	0.243	0.100	2.441	0.019
Z_EQMGUSDVF(-1)	-0.815	0.129	-6.323	0.000

R-squared	0.696	Mean dependent var	-0.007
Adjusted R-squared	0.664	S.D. dependent var	0.166
S.E. of regression	0.096	Akaike info criterion	-1.740
Sum squared resid	0.350	Schwarz criterion	-1.536
Log likelihood	42.420	Hannan-Quinn criter.	-1.665
F-statistic	21.738	Durbin-Watson stat	1.799
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.461	0.315	0.382	3.953	0.792
p-value	0.634	0.900	0.820	0.054	0.673

Simulation



Eq. [3.5.G] Imports of goods from BRIC (partner G), real terms

Long run

Dependent Variable: LOG(MGUSDVG)
Method: Least Squares
Sample: 1970 2013
Included observations: 44

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.342	7.095	-0.753	0.456
TREND	0.044	0.014	3.225	0.003
IFGT1999	-1.853	0.610	-3.037	0.004
LOG(GDPVUSD)	0.926	0.522	1.774	0.084
LOG(REERG)	0.744	0.233	3.188	0.003
TREND*IFGT1999	0.049	0.015	3.370	0.002

R-squared	0.993	Mean dependent var	9.010
Adjusted R-squared	0.992	S.D. dependent var	1.274
S.E. of regression	0.111	Akaike info criterion	-1.430
Sum squared resid	0.469	Schwarz criterion	-1.186
Log likelihood	37.454	Hannan-Quinn criter.	-1.340
F-statistic	1121.867	Durbin-Watson stat	1.588
Prob(F-statistic)	0.000		

Short run

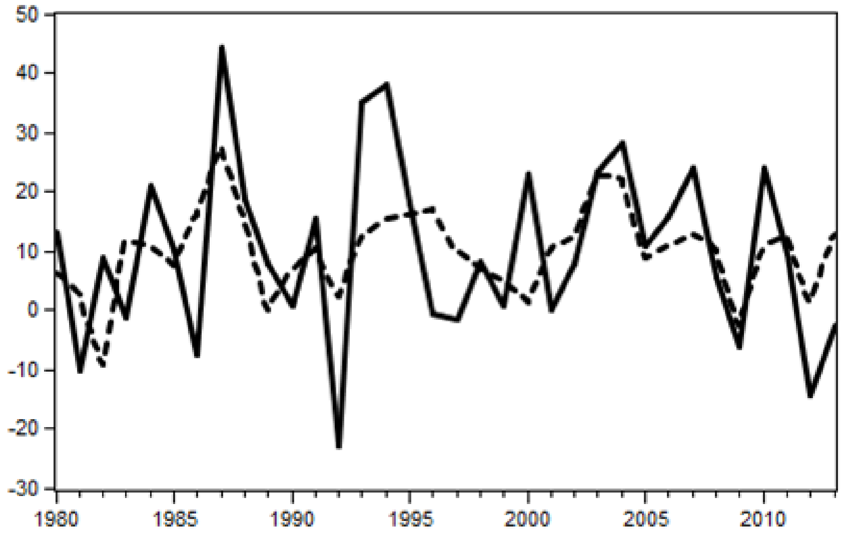
Dependent Variable: DLOG(MGUSDVG)
Method: Least Squares
Sample (adjusted): 1971 2013
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.034	0.028	-1.222	0.229
DLOG(GDPVUSD)	3.295	0.669	4.923	0.000
DLOG(REERG)	0.429	0.165	2.597	0.013
IFGT1992	0.124	0.032	3.873	0.000
Z_EQMGUSDVG(-1)	-0.837	0.143	-5.871	0.000

R-squared	0.611	Mean dependent var	0.093
Adjusted R-squared	0.570	S.D. dependent var	0.138
S.E. of regression	0.091	Akaike info criterion	-1.855
Sum squared resid	0.312	Schwarz criterion	-1.650
Log likelihood	44.878	Hannan-Quinn criter.	-1.779
F-statistic	14.895	Durbin-Watson stat	2.070
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.524	0.331	0.680	0.774	3.117
p-value	0.597	0.891	0.610	0.385	0.210

Simulation



Eq. [3.5.H] Imports of goods from rest of the world (partner H), real terms

Long run

Dependent Variable: LOG(MGUSDVH)
Method: Least Squares
Sample: 1970 2013
Included observations: 44
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-11.523	2.496	-4.616	0.000
IFGT1985	-0.433	0.076	-5.730	0.000
IFGT1998	0.336	0.060	5.597	0.000
LOG(GDPVUSD)	1.554	0.187	8.332	0.000
LOG(REERH)	1.193	0.237	5.040	0.000
TREND	0.015	0.005	3.259	0.002

R-squared	0.986	Mean dependent var	10.594
Adjusted R-squared	0.984	S.D. dependent var	0.691
S.E. of regression	0.088	Akaike info criterion	-1.895
Sum squared resid	0.295	Schwarz criterion	-1.652
Log likelihood	47.688	Hannan-Quinn criter.	-1.805
F-statistic	522.169	Durbin-Watson stat	1.796
Prob(F-statistic)	0.000	Wald F-statistic	681.560
Prob(Wald F-statistic)	0.000		

Short run

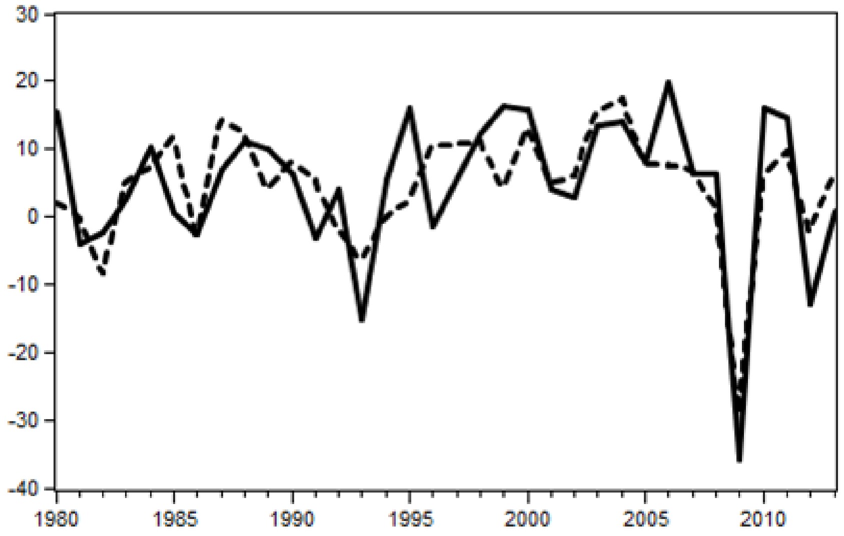
Dependent Variable: DLOG(MGUSDVH)
Method: Least Squares
Sample (adjusted): 1971 2013
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.144	0.031	-4.624	0.000
DLOG(GDPVUSD)	3.864	0.453	8.525	0.000
DLOG(REERH)	0.475	0.155	3.065	0.004
TREND	0.004	0.001	5.276	0.000
D09	-0.227	0.056	-4.064	0.000
D86	-0.194	0.055	-3.495	0.001
Z_EQMGUSDVH(-1)	-0.305	0.108	-2.838	0.007

R-squared	0.863	Mean dependent var	0.047
Adjusted R-squared	0.840	S.D. dependent var	0.116
S.E. of regression	0.047	Akaike info criterion	-3.150
Sum squared resid	0.078	Schwarz criterion	-2.863
Log likelihood	74.728	Hannan-Quinn criter.	-3.044
F-statistic	37.799	Durbin-Watson stat	2.152
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.168	0.304	1.213	0.157	0.239
p-value	0.846	0.906	0.322	0.695	0.887

Simulation



Eq. [4.3] Private consumption deflator, pre-tax

Long run

Dependent Variable: LOG(PCPNET)
Method: Least Squares
Sample: 1960 2013
Included observations: 54
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.579	0.029	-20.131	0.000
IFGT1978	0.419	0.031	13.719	0.000
LOG(PMGS)	0.292	0.022	13.128	0.000
LOG(PMGS)*IFGT1978	-0.136	0.086	-1.580	0.121
LOG(ULC)	0.589	0.018	33.071	0.000
LOG(ULC)*IFGT1978	0.376	0.064	5.839	0.000
LOG(ULC)*IFGT1998	-0.268	0.028	-9.491	0.000

R-squared	1.000	Mean dependent var	-1.345
Adjusted R-squared	1.000	S.D. dependent var	1.210
S.E. of regression	0.021	Akaike info criterion	-4.790
Sum squared resid	0.020	Schwarz criterion	-4.532
Log likelihood	136.337	Hannan-Quinn criter.	-4.691
F-statistic	29961.692	Durbin-Watson stat	0.783
Prob(F-statistic)	0.000	Wald F-statistic	42094.797
Prob(Wald F-statistic)	0.000		

Short run

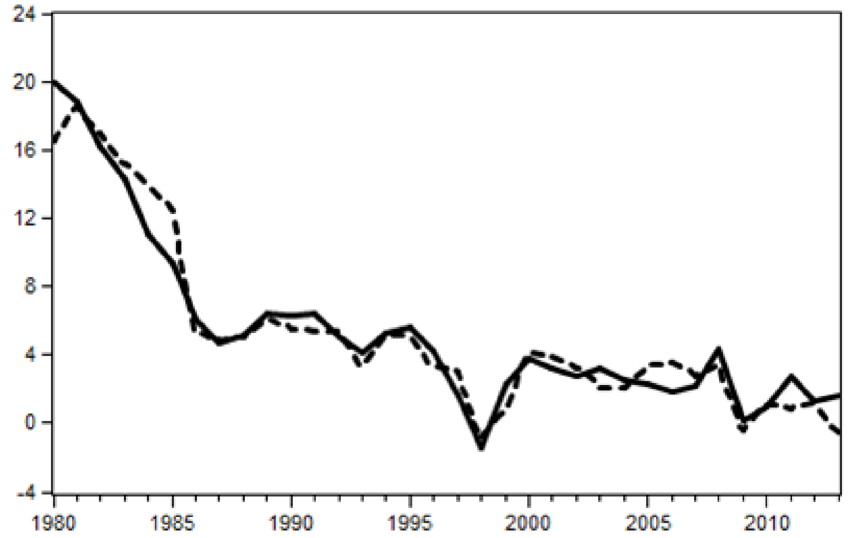
Dependent Variable: DLOG(PCPNET)
Method: Least Squares
Sample (adjusted): 1963 2013
Included observations: 51 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005	0.002	2.980	0.005
DLOG(PMGS)	0.177	0.031	5.801	0.000
DLOG(ULC)	0.471	0.064	7.363	0.000
DLOG(PCPNET(-1))	0.236	0.110	2.153	0.037
DLOG(PCPNET(-2))	0.254	0.072	3.540	0.001
DLOG(ULC(-1))	-0.195	0.072	-2.690	0.010
D93	-0.026	0.006	-4.739	0.000
GAPB/100	0.267	0.079	3.380	0.002
Z_EQPCPNET(-1)	-0.347	0.102	-3.405	0.001

R-squared	0.975	Mean dependent var	0.064
Adjusted R-squared	0.971	S.D. dependent var	0.054
S.E. of regression	0.009	Akaike info criterion	-6.357
Sum squared resid	0.004	Schwarz criterion	-6.016
Log likelihood	171.095	Hannan-Quinn criter.	-6.226
F-statistic	207.973	Durbin-Watson stat	1.863
Prob(F-statistic)	0.000	Wald F-statistic	377.236
Prob(Wald F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	2.741	2.539	0.529	Value	5.358
p-value	0.077	0.045	0.828	Probability	0.069

Simulation



Eq. [4.5] Private gross fixed capital formation deflator, pre-tax

Long run

Dependent Variable: LOG(PIBNET)
Method: Least Squares
Sample: 1960 2013
Included observations: 54
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.182	0.021	-8.757	0.000
IFGT1986	0.021	0.021	1.006	0.319
LOG(PMGS)	0.357	0.032	11.195	0.000
LOG(ULC)	0.662	0.035	18.694	0.000
LOG(PMGS)*IFGT1986	-0.098	0.010	-9.394	0.000

R-squared	1.000	Mean dependent var	-1.292
Adjusted R-squared	1.000	S.D. dependent var	1.209
S.E. of regression	0.016	Akaike info criterion	-5.291
Sum squared resid	0.013	Schwarz criterion	-5.107
Log likelihood	147.870	Hannan-Quinn criter.	-5.220
F-statistic	71748.905	Durbin-Watson stat	1.530
Prob(F-statistic)	0.000	Wald F-statistic	69257.532
Prob(Wald F-statistic)	0.000		

Short run

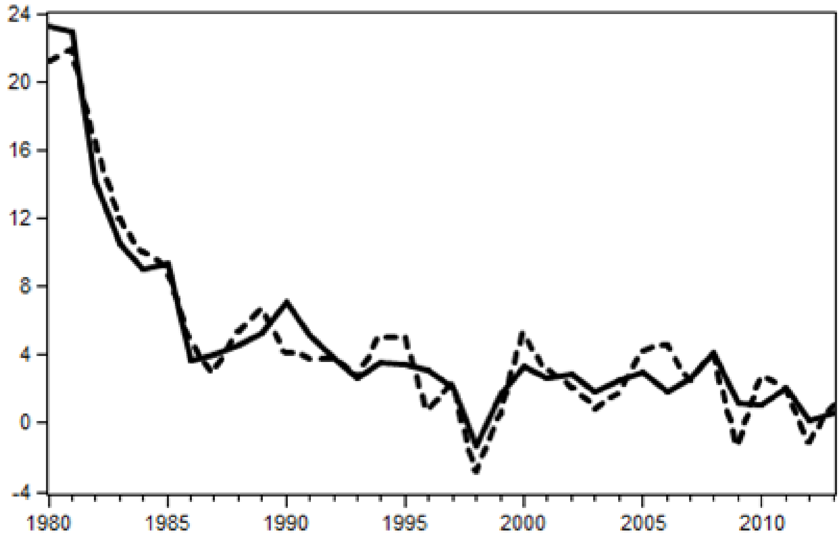
Dependent Variable: DLOG(PIBNET)
Method: Least Squares
Sample (adjusted): 1961 2013
Included observations: 53 after adjustments
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001	0.003	0.324	0.747
DLOG(PMGS)	0.326	0.020	16.580	0.000
DLOG(ULC)	0.655	0.037	17.919	0.000
D86+D87	0.057	0.006	9.274	0.000
D93	-0.036	0.003	-12.152	0.000
D12	-0.026	0.002	-11.217	0.000
Z_EQPIBNET(-1)	-0.747	0.133	-5.604	0.000

R-squared	0.965	Mean dependent var	0.063
Adjusted R-squared	0.960	S.D. dependent var	0.063
S.E. of regression	0.012	Akaike info criterion	-5.806
Sum squared resid	0.007	Schwarz criterion	-5.546
Log likelihood	160.861	Hannan-Quinn criter.	-5.706
F-statistic	211.064	Durbin-Watson stat	1.984
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	4.765	2.658	0.299	2.426	7.808
p-value	0.013	0.036	0.934	0.126	0.020

Simulation



Eq. [4.7] Public gross fixed capital formation deflator, pre-tax

Long run

Dependent Variable: LOG(PIGNET)
Method: Least Squares
Sample: 1967 2013
Included observations: 47
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.164	0.019	-8.800	0.000
IFGT1977	0.177	0.019	9.309	0.000
LOG(PIBNET)	1.003	0.008	129.956	0.000
LOG(PIBNET)*IFGT1977	0.084	0.009	8.830	0.000

R-squared	1.000	Mean dependent var	-1.069
Adjusted R-squared	1.000	S.D. dependent var	1.083
S.E. of regression	0.010	Akaike info criterion	-6.210
Sum squared resid	0.005	Schwarz criterion	-6.052
Log likelihood	149.927	Hannan-Quinn criter.	-6.150
F-statistic	165689.197	Durbin-Watson stat	0.718
Prob(F-statistic)	0.000	Wald F-statistic	126456.033
Prob(Wald F-statistic)	0.000		

Short run

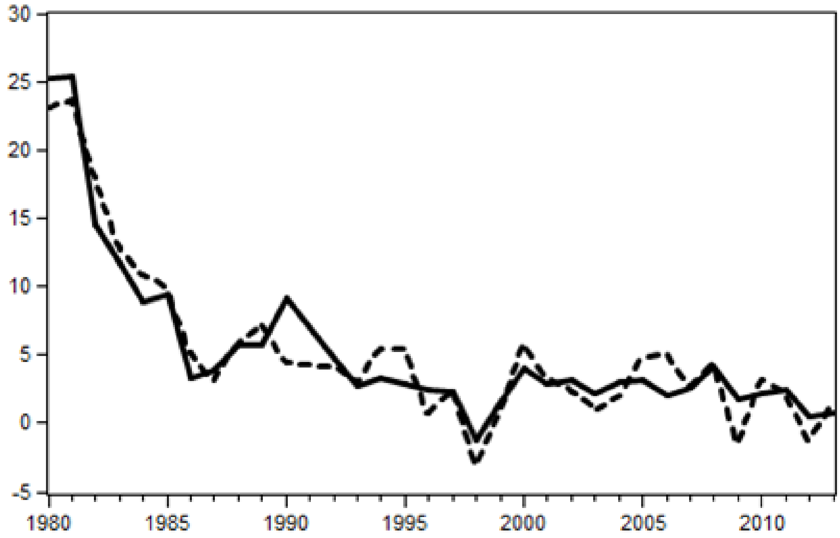
Dependent Variable: DLOG(PIGNET)
Method: Least Squares
Sample (adjusted): 1968 2013
Included observations: 46 after adjustments
HAC standard errors & covariance (Prewhitening with lags = 1, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000	0.002	0.184	0.855
DLOG(PIBNET)	1.098	0.020	55.726	0.000
DLOG(PIGNET(-1))	0.037	0.007	4.991	0.000
DLOG(PIBNET(-1))	-0.060	0.012	-5.099	0.000
D70	-0.034	0.002	-19.078	0.000
D74	-0.041	0.004	-11.330	0.000
Z_EQPIGNET(-1)	-0.162	0.062	-2.620	0.012

R-squared	0.993	Mean dependent var	0.071
Adjusted R-squared	0.992	S.D. dependent var	0.067
S.E. of regression	0.006	Akaike info criterion	-7.183
Sum squared resid	0.002	Schwarz criterion	-6.905
Log likelihood	172.215	Hannan-Quinn criter.	-7.079
F-statistic	875.938	Durbin-Watson stat	1.309
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	3.761	2.313	0.323	0.468	1.843
p-value	0.033	0.065	0.921	0.498	0.398

Simulation



Eq. [4.9] Export deflator

Long run

Dependent Variable: LOG(PXGS)
Method: Least Squares
Sample: 1960 2013
Included observations: 54

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.363	0.022	-16.747	0.000
IFGT1978	0.398	0.023	17.040	0.000
IFGT1997	-0.031	0.010	-3.155	0.003
LOG(PMGS)	0.724	0.027	26.537	0.000
LOG(ULC)	0.094	0.027	3.436	0.001
LOG(PMGS)*IFGT1978	-0.209	0.046	-4.537	0.000
LOG(ULC)*IFGT1978	0.387	0.037	10.580	0.000
LOG(ULC)*IFGT1997	-0.307	0.036	-8.488	0.000

R-squared	1.000	Mean dependent var	-1.009
Adjusted R-squared	1.000	S.D. dependent var	1.072
S.E. of regression	0.017	Akaike info criterion	-5.165
Sum squared resid	0.013	Schwarz criterion	-4.870
Log likelihood	147.446	Hannan-Quinn criter.	-5.051
F-statistic	29761.069	Durbin-Watson stat	1.135
Prob(F-statistic)	0.000		

Short run

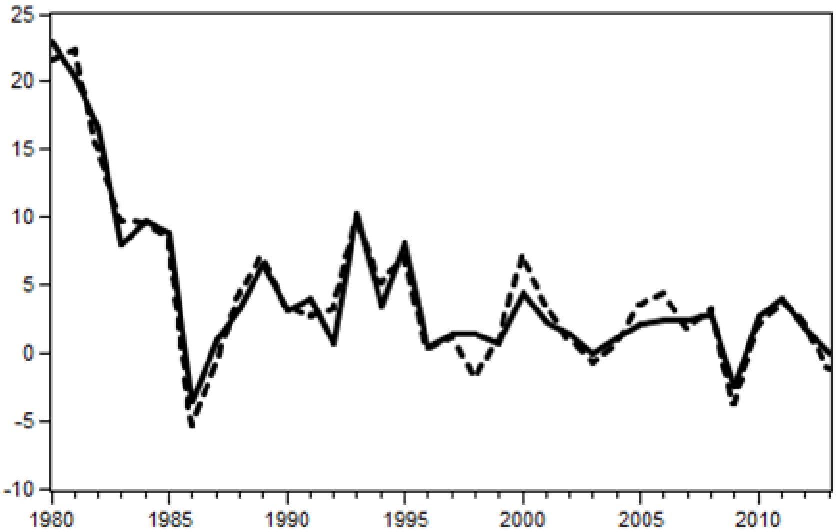
Dependent Variable: DLOG(PXGS)
Method: Least Squares
Sample (adjusted): 1962 2013
Included observations: 52 after adjustments
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.003	0.003	-0.894	0.376
DLOG(PMGS)	0.533	0.036	14.761	0.000
DLOG(ULC)	0.278	0.066	4.236	0.000
D73	-0.041	0.013	-3.216	0.002
D75	-0.053	0.015	-3.505	0.001
DLOG(PXGS(-1))	0.173	0.057	3.047	0.004
Z_EQPXGS(-1)	-0.311	0.216	-1.439	0.157

R-squared	0.967	Mean dependent var	0.054
Adjusted R-squared	0.963	S.D. dependent var	0.067
S.E. of regression	0.013	Akaike info criterion	-5.723
Sum squared resid	0.008	Schwarz criterion	-5.460
Log likelihood	155.795	Hannan-Quinn criter.	-5.622
F-statistic	219.985	Durbin-Watson stat	2.041
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.511	0.571	2.139	2.268	1.458
p-value	0.604	0.721	0.067	0.139	0.482

Simulation



Eq. [4.11] Wage rate in the private sector

Long run

Dependent Variable: LOG(UWB/PGDP)-LOG(APL)-LOG(1-ALFA)
Method: Least Squares
Date: 11/29/14 Time: 18:26
Sample: 1960 2013
Included observations: 54

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IFGT1971	0.497141	0.029232	17.00676	0.0000
IFGT1997	-0.494136	0.084486	-5.848733	0.0000
TREND	0.008563	0.002627	3.259066	0.0021
IFGT1971*TREND	-0.018677	0.002754	-6.780696	0.0000
IFGT1997*TREND	0.021461	0.002400	8.942576	0.0000
FLEX	0.072187	0.034310	2.103981	0.0408
C	-3.733407	0.124002	-30.10759	0.0000

R-squared	0.959726	Mean dependent var	-3.224416
Adjusted R-squared	0.954585	S.D. dependent var	0.147438
S.E. of regression	0.031420	Akaike info criterion	-3.962304
Sum squared resid	0.046400	Schwarz criterion	-3.704473
Log likelihood	113.9822	Hannan-Quinn criter.	-3.862869
F-statistic	186.6696	Durbin-Watson stat	0.887313
Prob(F-statistic)	0.000000		

Short run

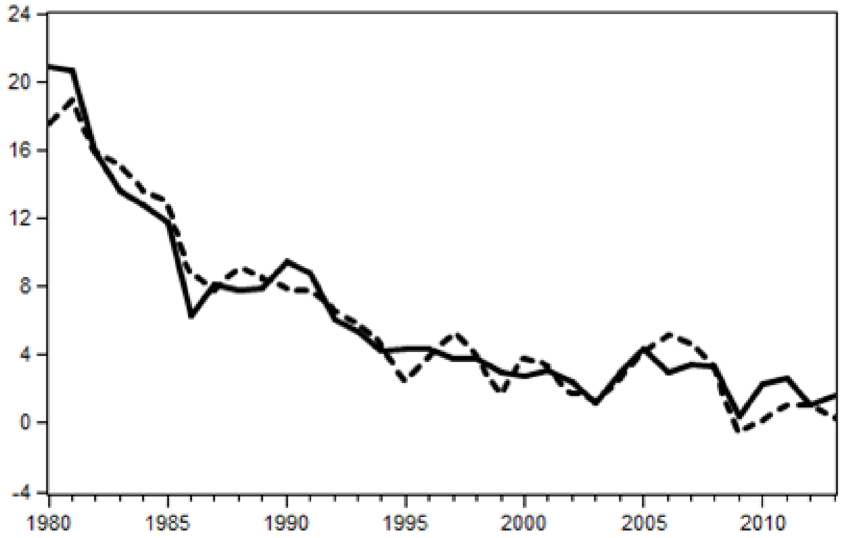
Dependent Variable: DLOG(UWB)
Method: Least Squares
Date: 11/29/14 Time: 18:34
Sample (adjusted): 1962 2013
Included observations: 52 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.039616	0.013927	2.844637	0.0067
DLOG(UWB(-1))	0.405700	0.101914	3.980803	0.0002
DLOG(PCP)	0.537079	0.129919	4.133942	0.0002
DLOG(APL)	0.466823	0.088228	5.291077	0.0000
UNR	-0.423478	0.153266	-2.763023	0.0083
D77	0.047178	0.007075	6.668546	0.0000
Z_EQUWB(-1)	-0.413732	0.107375	-3.853148	0.0004

R-squared	0.935759	Mean dependent var	0.089542
Adjusted R-squared	0.927194	S.D. dependent var	0.064607
S.E. of regression	0.017433	Akaike info criterion	-5.136297
Sum squared resid	0.013675	Schwarz criterion	-4.873629
Log likelihood	140.5437	Hannan-Quinn criter.	-5.035596
F-statistic	109.2483	Durbin-Watson stat	1.597826
Prob(F-statistic)	0.000000	Wald F-statistic	2239.118
Prob(Wald F-statistic)	0.000000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	1.32	1.84	4.74	0.79	1.48
p-value	0.27	0.12	0.00	0.37	0.47

Simulation



Eq. [5.7] Self-employment and property income (other than government debt) received by households

Long run

Dependent Variable: LOG(YPEX)
Method: Fully Modified Least Squares (FMOLS)
Date: 11/29/14 Time: 15:14
Sample (adjusted): 1961 2013
Included observations: 53 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth
= 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(GDP)	0.867276	0.005860	148.0040	0.0000
C	0.680014	0.074228	9.161200	0.0000

R-squared	0.999171	Mean dependent var	11.57443
Adjusted R-squared	0.999155	S.D. dependent var	1.400432
S.E. of regression	0.040716	Sum squared resid	0.084545
Long-run variance	0.004642		

Cointegration Test - Engle-Granger
Date: 11/29/14 Time: 15:15
Equation: EQ$YPEX
Specification: LOG(YPEX) LOG(GDP) C
Cointegrating equation deterministics: C
Null hypothesis: Series are not cointegrated
Automatic lag specification (lag=1 based on Schwarz Info Criterion,
maxlag=10)

	Value	Prob.*
Engle-Granger tau-statistic	-2.523132	0.2835
Engle-Granger z-statistic	-16.06704	0.0886

*MacKinnon (1996) p-values.

Short run

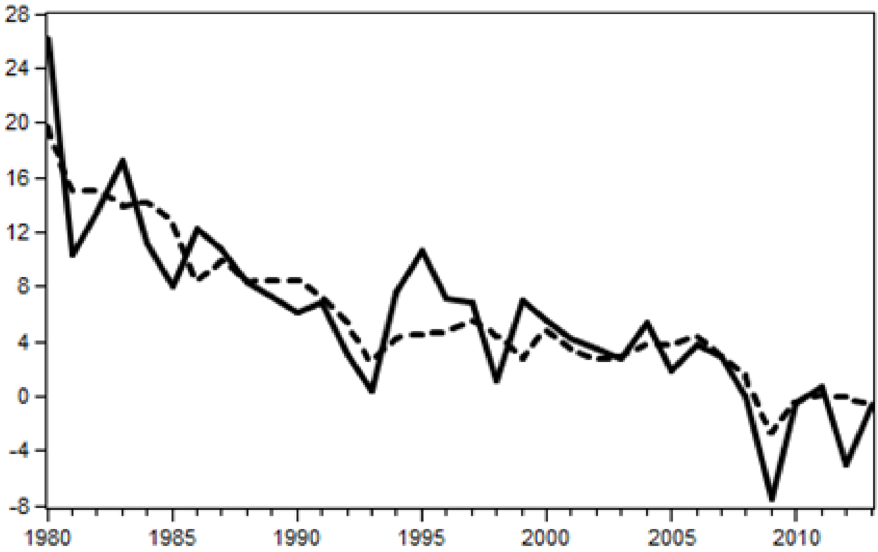
Dependent Variable: DLOG(YPEX)
Method: Least Squares
Sample (adjusted): 1961 2013
Included observations: 53 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002	0.006	-0.318	0.752
DLOG(GDP)	0.876	0.052	16.862	0.000
Z_EQYPEX(-1)	-0.147	0.086	-1.711	0.093

R-squared	0.863	Mean dependent var	0.077
Adjusted R-squared	0.857	S.D. dependent var	0.062
S.E. of regression	0.023	Akaike info criterion	-4.622
Sum squared resid	0.027	Schwarz criterion	-4.510
Log likelihood	125.481	Hannan-Quinn criter.	-4.579
F-statistic	157.000	Durbin-Watson stat	1.519
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	2.266	1.971	2.312	2.381	1.600
p-value	0.115	0.101	0.110	0.129	0.449

Simulation



Eq. [6.1] Social security benefits

Long run

Dependent Variable: LOG(SSPG)
Method: Least Squares
Sample: 1960 2013
Included observations: 54
HAC standard errors & covariance (Prewhitening with lags = 0 from SIC maxlags = 3, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.449	0.290	-11.915	0.000
IFGT2004	0.093	0.032	2.870	0.006
LOG(GDPBV*PGDP)	1.104	0.011	96.636	0.000
AGE	0.725	0.356	2.035	0.047
UNR	1.750	0.388	4.513	0.000

R-squared	0.999	Mean dependent var	10.667
Adjusted R-squared	0.999	S.D. dependent var	1.888
S.E. of regression	0.044	Akaike info criterion	-3.318
Sum squared resid	0.095	Schwarz criterion	-3.134
Log likelihood	94.579	Hannan-Quinn criter.	-3.247
F-statistic	24290.100	Durbin-Watson stat	1.037
Prob(F-statistic)	0.000	Wald F-statistic	12108.756
Prob(Wald F-statistic)	0.000		

Short run

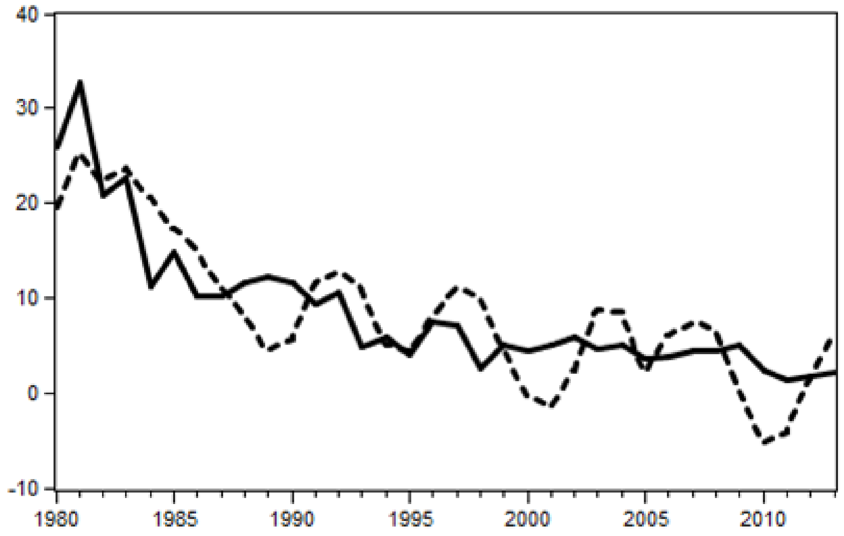
Dependent Variable: DLOG(SSPG)
Method: Least Squares
Sample (adjusted): 1962 2013
Included observations: 52 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010	0.007	1.466	0.150
DLOG(GDPBV*PGDP)	0.606	0.094	6.438	0.000
D(UNR)	1.581	0.589	2.684	0.010
DLOG(SSPG(-1))	0.375	0.090	4.187	0.000
D65	0.090	0.025	3.539	0.001
D79	-0.077	0.026	-2.963	0.005
Z_EQSSPG(-1)	-0.573	0.087	-6.622	0.000

R-squared	0.893	Mean dependent var	0.108
Adjusted R-squared	0.879	S.D. dependent var	0.071
S.E. of regression	0.025	Akaike info criterion	-4.446
Sum squared resid	0.027	Schwarz criterion	-4.183
Log likelihood	122.584	Hannan-Quinn criter.	-4.345
F-statistic	62.792	Durbin-Watson stat	2.212
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.837	0.578	2.440	1.028	0.799
p-value	0.440	0.717	0.040	0.316	0.671

Simulation



Eq. [7.1] Nominal short term interest rate

ARDL

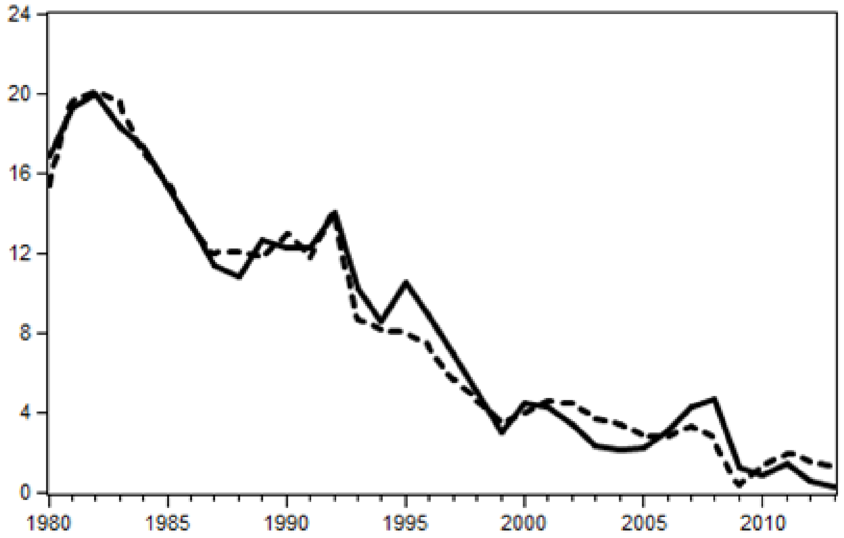
Dependent Variable: D(IRS)
Method: Least Squares
Sample: 1970 2013
Included observations: 44
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.221	0.296	-0.747	0.460
IRS(-1)	-0.716	0.092	-7.813	0.000
@PC(PGDP)	0.591	0.069	8.507	0.000
D(IRS(-1))	-0.267	0.091	-2.952	0.006
D92	4.900	0.327	14.961	0.000
IRS(-1)*IFGT1980	0.308	0.052	5.964	0.000
GAPB*IFGT1980	0.450	0.165	2.725	0.010
D09	-1.765	0.367	-4.809	0.000

R-squared	0.830	Mean dependent var	-0.086
Adjusted R-squared	0.797	S.D. dependent var	2.275
S.E. of regression	1.024	Akaike info criterion	3.049
Sum squared resid	37.769	Schwarz criterion	3.373
Log likelihood	-59.074	Hannan-Quinn criter.	3.169
F-statistic	25.161	Durbin-Watson stat	2.146
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	1.007	0.744	1.244	4.556	1.349
p-value	0.376	0.597	0.305	0.040	0.509

Simulation



Eq. [7.2] Nominal long term interest rate

ARDL

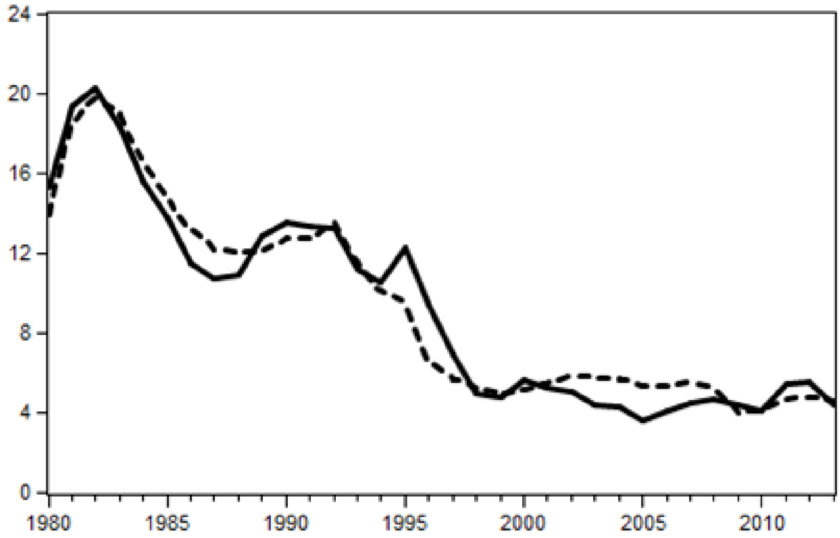
Dependent Variable: D(IRL)
Method: Least Squares
Sample (adjusted): 1962 2013
Included observations: 52 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.031	0.265	3.896	0.000
D(IRS)	0.422	0.050	8.516	0.000
IRL(-1)	-0.376	0.084	-4.458	0.000
IRS(-1)	0.211	0.069	3.075	0.004
PSBRQ(-1)	0.105	0.050	2.097	0.042
D(IRL(-1))	0.379	0.075	5.028	0.000
D96	-2.184	0.712	-3.067	0.004
D81	2.662	0.747	3.561	0.001

R-squared	0.809	Mean dependent var	-0.013
Adjusted R-squared	0.779	S.D. dependent var	1.436
S.E. of regression	0.676	Akaike info criterion	2.194
Sum squared resid	20.087	Schwarz criterion	2.495
Log likelihood	-49.055	Hannan-Quinn criter.	2.310
F-statistic	26.620	Durbin-Watson stat	1.974
Prob(F-statistic)	0.000		

Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	0.058	0.597	0.386	7.664	1.494
p-value	0.944	0.702	0.906	0.008	0.474

Simulation



Eq. [7.4] Effective interest rate on government liabilities

Long run

Dependent Variable: IRGOV
Method: Least Squares
Sample: 1960 2013
Included observations: 54
HAC standard errors & covariance (Prewhitening with lags = 1 from SIC maxlags = 3, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.976	0.312	3.127	0.003
IFGT1983	1.853	0.680	2.726	0.009
(IRS+IRL)/2	0.425	0.043	9.962	0.000
((IRS+IRL)/2)*IFGT1983	0.171	0.100	1.706	0.094

R-squared	0.927	Mean dependent var	6.202
Adjusted R-squared	0.922	S.D. dependent var	2.872
S.E. of regression	0.801	Akaike info criterion	2.466
Sum squared resid	32.104	Schwarz criterion	2.613
Log likelihood	-62.583	Hannan-Quinn criter.	2.523
F-statistic	210.311	Durbin-Watson stat	1.212
Prob(F-statistic)	0.000	Wald F-statistic	237.340
Prob(Wald F-statistic)	0.000		

Short run

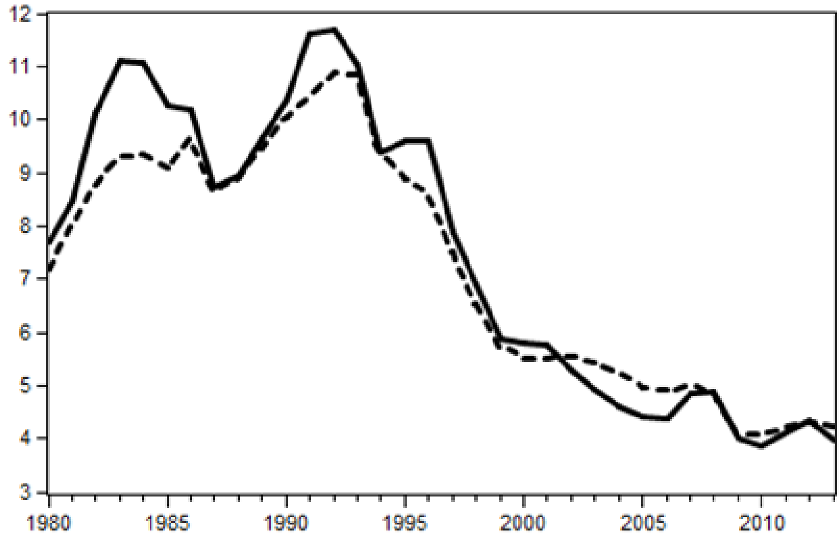
Dependent Variable: D(IRGOV)
Method: Least Squares
Sample (adjusted): 1962 2013
Included observations: 52 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.224	0.061	3.683	0.001
D(((IRS+IRL)/2))	0.113	0.031	3.600	0.001
D(IRGOV(-1))	0.256	0.075	3.395	0.001
IFGT1996	-0.314	0.110	-2.851	0.007
D87	-1.499	0.336	-4.464	0.000
D85	-1.166	0.354	-3.298	0.002
D94	-1.119	0.359	-3.113	0.003
IFGT1996*D(((IRS+IRL)/2))	0.277	0.088	3.132	0.003
Z_EQIRGOV(-1)	-0.236	0.065	-3.613	0.001

R-squared	0.800	Mean dependent var	0.014
Adjusted R-squared	0.763	S.D. dependent var	0.668
S.E. of regression	0.325	Akaike info criterion	0.747
Sum squared resid	4.548	Schwarz criterion	1.085
Log likelihood	-10.433	Hannan-Quinn criter.	0.877
F-statistic	21.528	Durbin-Watson stat	1.656
Prob(F-statistic)	0.000		

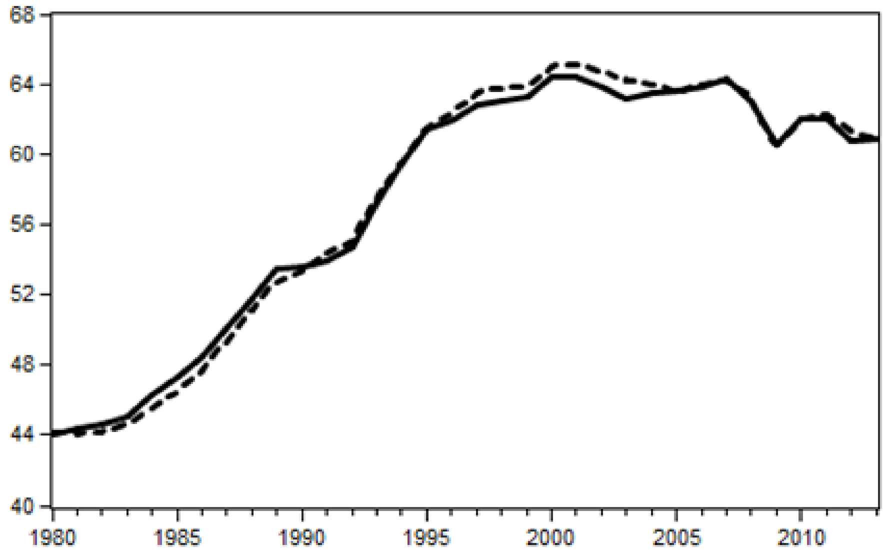
Diagnostics	*SC(2)*	*SC(5)*	*HET*	*FF*	*NOR*
Statistic	2.442	0.919	1.381	0.964	15.994
p-value	0.100	0.479	0.232	0.332	0.000

Simulation



Other variables

APL



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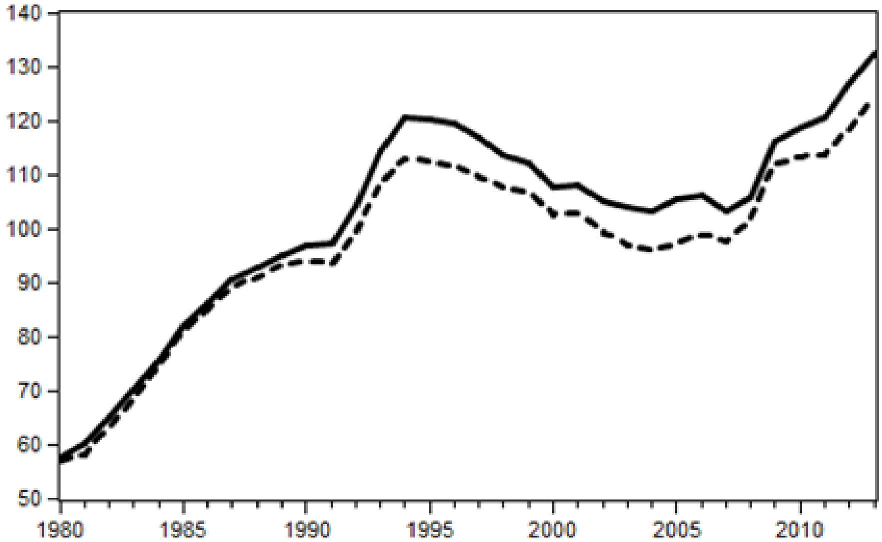

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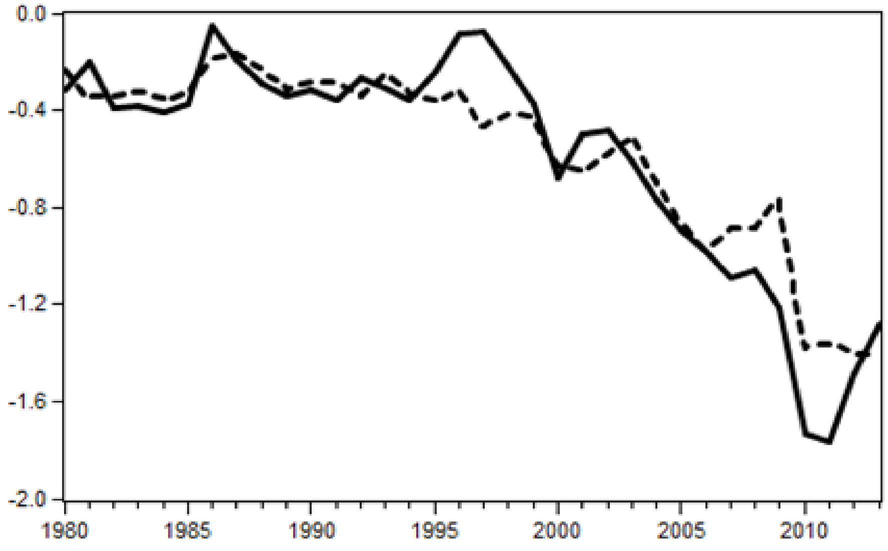
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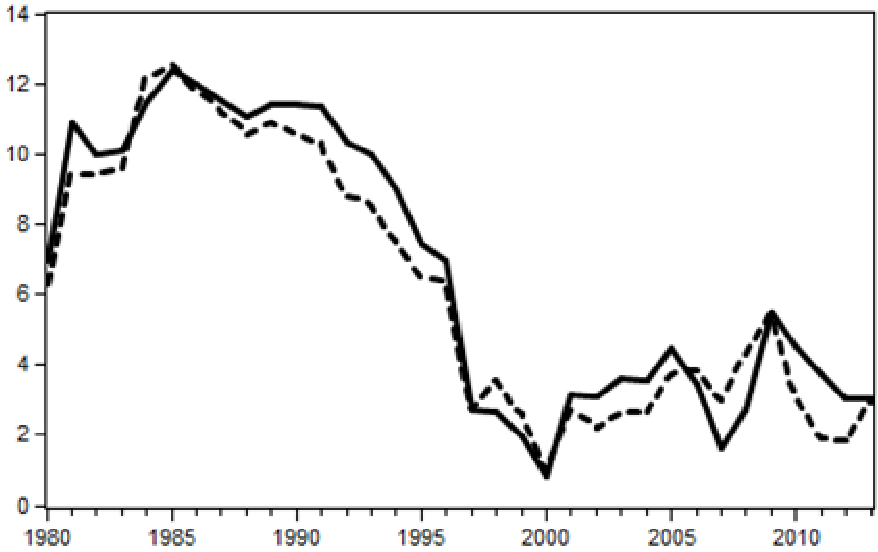
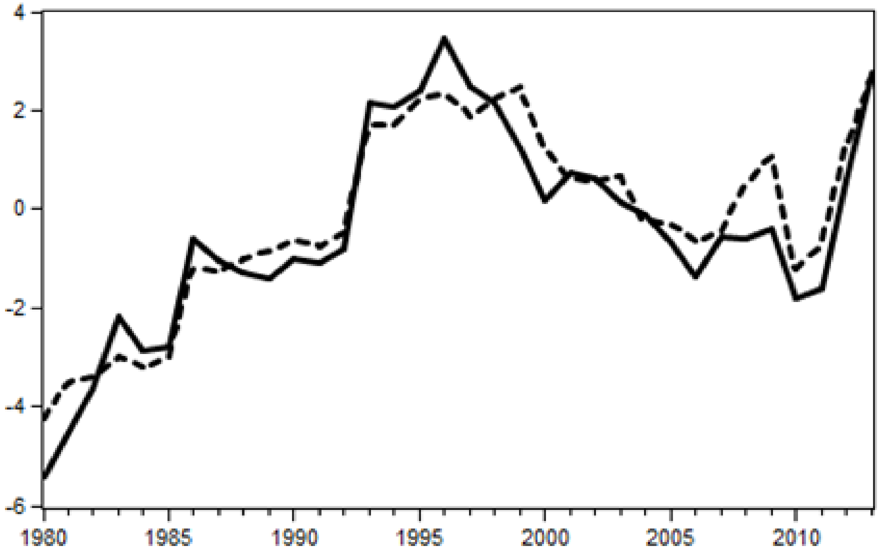
-0.4
-0.8
-1.2
-1.6
-2.0
1980
1985
1990
1995
2000
2005
2010

PSBRQ



TBQ



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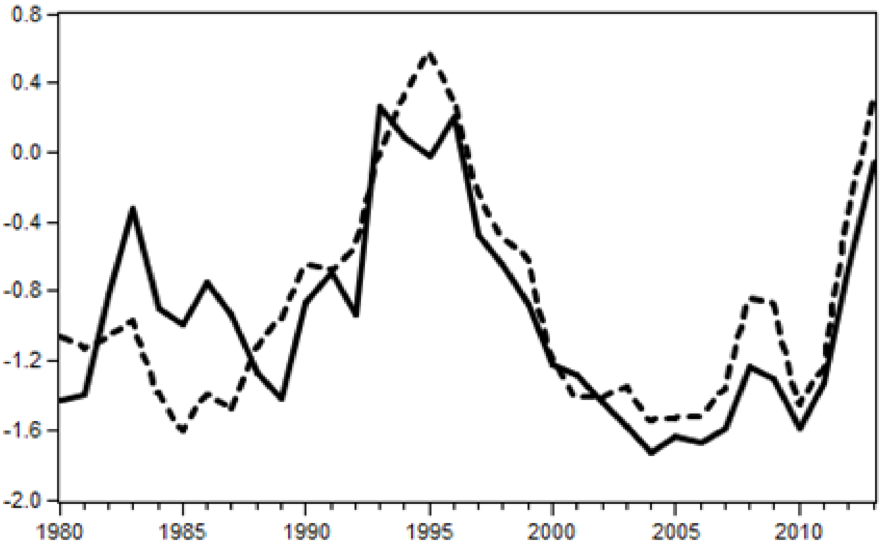

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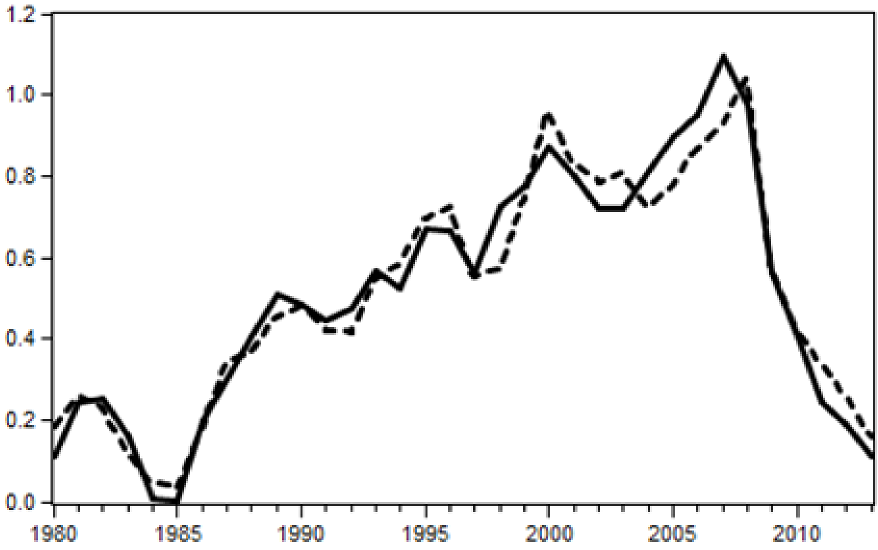

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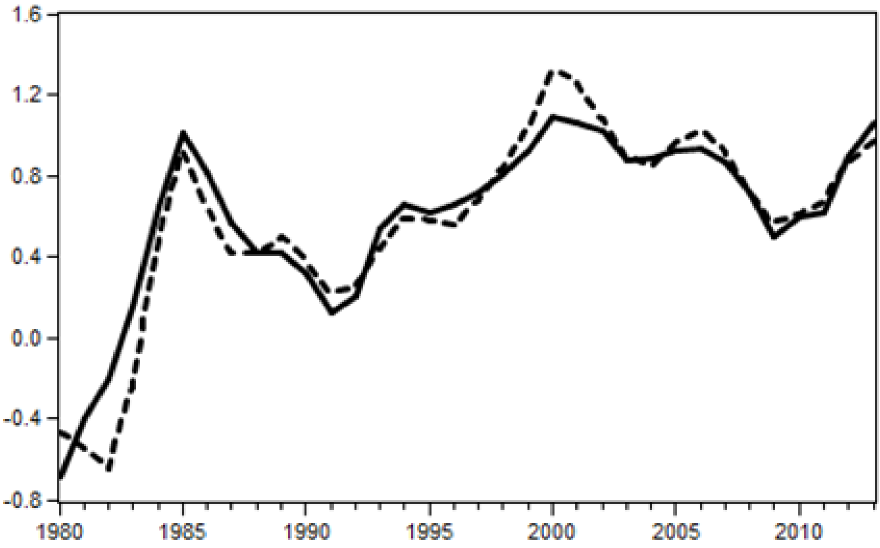

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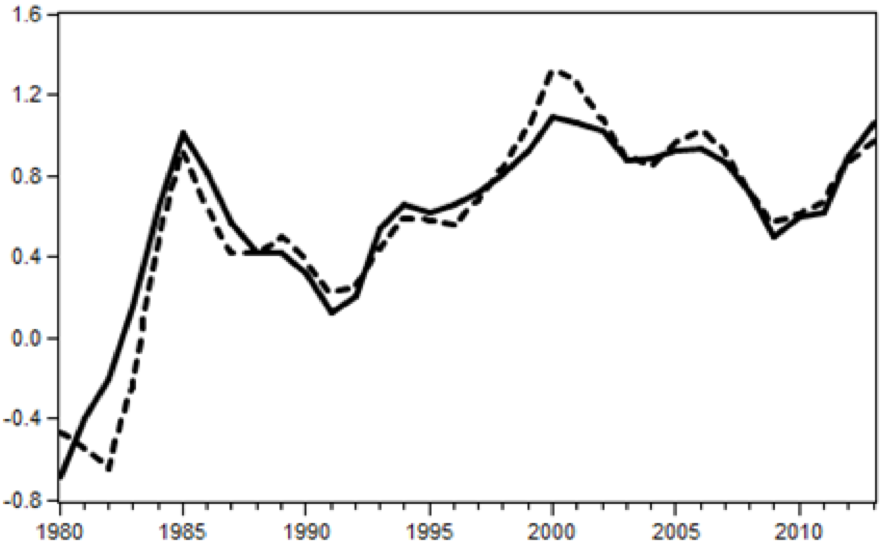

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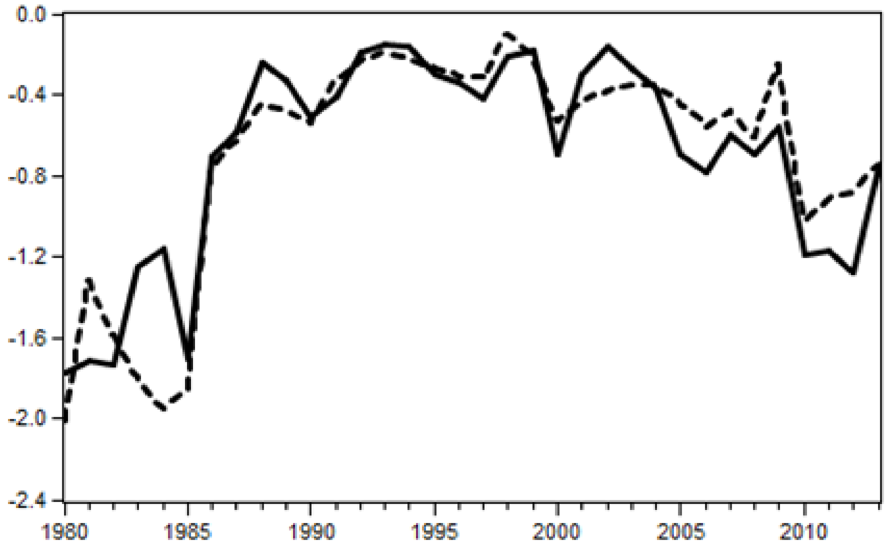

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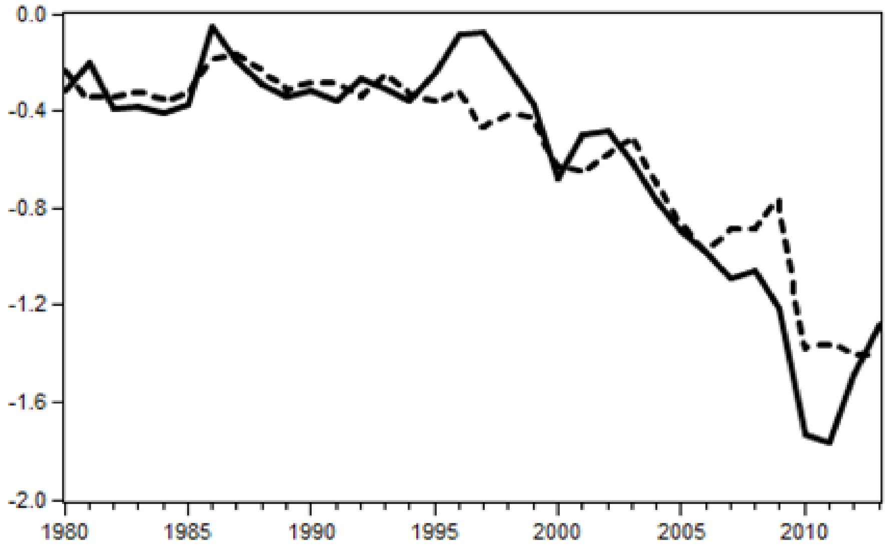

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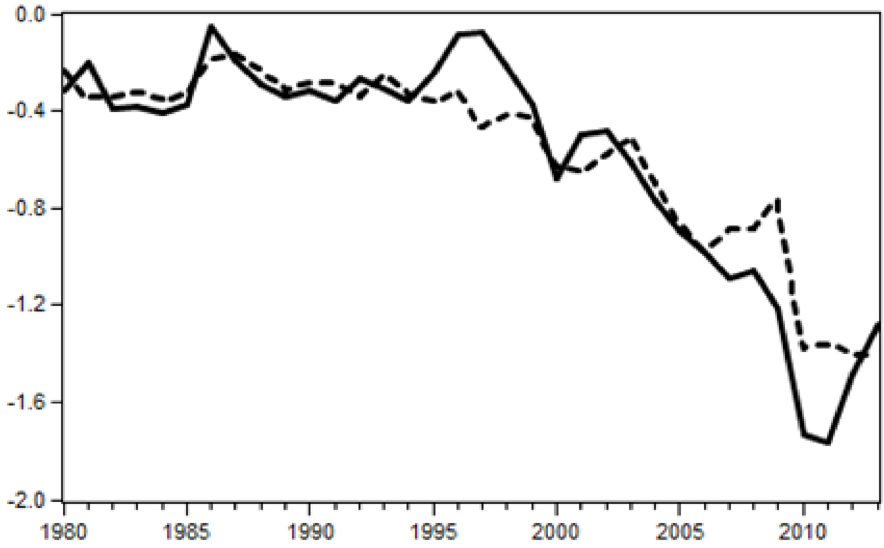

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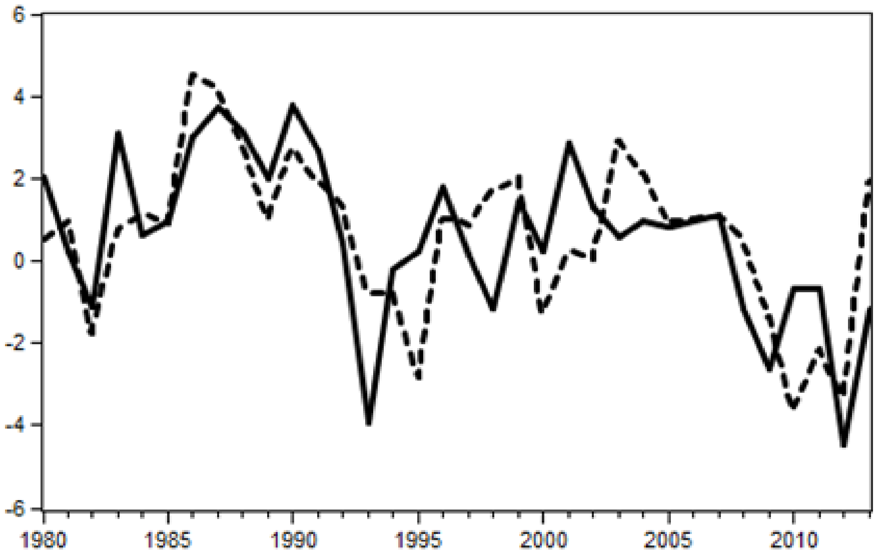

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