Analisi e valutazioni delle politiche economiche

ITALIAN FISCAL POLICY REVIEW 2015

a cura di Sergio Ginebri

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Preface

Three years ago we started a new research project on evaluation and appraisal of fiscal policy. Despite the large availability of information and assessments on national fiscal policies, we detected for Italy the need of a public meeting where academics, professionals, policy makers may gather together, delivering their evaluations on fiscal decisions, on their expected impacts on economic structure and social welfare of the country, and on feasible alternatives.

Public discussion on fiscal policy is often focused either on the simulated evolution of public finance aggregates, or on the evaluation of single policy interventions and their theoretical consistency with efficiency and values. We wanted to bring together macroeconomists and public economists by focusing on: the effects of fiscal policy on demand, supply, potential output, growth, welfare; the drivers of simulation results; the broad policies which are the most salient in the previous year budget law and the assessment of their coherence with the stated objectives, the impact on public and private efficiency, the effect on social justice by income and opportunity allocation.

In October 2015 we organized a successful conference at Roma Tre University on the assessment of the Budget Law approved by Italian Parliament in December 2014. Therefore, we were in a bit paradoxical situation: Italian government was putting forward its Budget Law for the year 2016 and we were calling people to discuss the previous year Budget Law. Our bet had been that the time distance between our conference and the establishment of the policies we were focusing on added up to the interest of our initiative. Apparently we had been right.

We are now publishing a volume which draws on analyses and evaluations discussed at our 2015 conference. We publish it in English because we know that the scholars, forecasters, policymakers we brought together

within our research project would be interested not only in discussing Italian fiscal policy but also the fiscal policies implemented in other European countries. This curiosity stems from the existence of a common European fiscal governance which binds all the national fiscal policies and makes the analysis of the differences and the similarities among them quite interesting. Our new bet is that a similar curiosity exists in other European countries and we aim at meeting it.

We expect the present one to be the first of a series of similar books. In October 2017 a new conference will take place in Roma Tre on the Italian Budget Law approved in December 2016, and we are planning a second issue of the series.

B. Bises, E. Felli, S. Ginebri, E. Granaglia, P. Liberati, A. Scialà

Introduction

The Budget Law for 2015 was the first one approved by the Renzi cabinet and was presented as a turnaround of Italian fiscal policy. Italian economy had gone through a severe recession in the previous years and GDP was expected to fall in year 2014 as well. The budget law for 2015 was meant to give a boost to employment and output growth, and that was carried out by a combination of demand impulses, social contribution temporary cuts, permanent reductions of taxes on business. The main measure on the expenditure side was the stabilization of the € 80 monthly bonus for employees whose income was € 26,000 or less (see Table 1 in the *Appendix* at the end of the chapter for the financial impact of each measure). Other remarkable new measure on the expenditure side was the reform of social benefits which expanded the access to safety nets in the case of unemployment. On the revenue side, the measure whose financial impact was the greatest was the suspension of the safeguard clause introduced in the Budget Law for 2014, which dictated an increase of income tax in the year 2015. The other measures on the revenue side were directed at raising labour demand and cutting taxes on business: cost of labour was made deductible from the taxable base for the purposes of the regional tax on productive activity (IRAP); partial exemption from the payment of social-welfare contributions for the new full-time, open-ended contracts signed in 2015 was introduced over a time period of three years; a streamlined new taxation system for self-employed was established.

Most of the expansionary measures were financed by increases of revenues and cuts of expenses, such as new procedures of VAT payment aimed at fighting tax evasion, and cuts to budget transfers to public sector local bodies. In aggregate, the cumulative amount of incremental resources generated in year 2015 by Budget Law was equal to 28.2 € billions, equivalent to 1.7% of GDP (see Table 2 in *Appendix*); whereas, the expansionary

measures in the same year added up to 34 € billions, equivalent to 2.1% of GDP. In the end the net expansionary impulse of the budget law was limited, equivalent to 0.4% of GDP. In the initial version of budget law the expansionary impact was significantly larger and government was advocating its need in order to react to: the GDP fall in the previous two years, the expectation of a GDP loss in year 2014 as well, and the large negative output gap. The European Commission judged the initial version of the budget law not consistent with the convergence towards the medium term objective for structural balance, and as a consequence the net expansionary budget was reduced.

When the budget law was presented the net borrowing was expected to decrease marginally from 3.0% of GDP in 2014 to 2.9% in 2015, and the GDP growth rate to raise from -0.3% in 2014 to 0.6% in 2015 (see Table 3 in *Appendix*). Net of cycle effects, the budget balance was forecasted to be stable at -0.9% of GDP from 2014 to 2015. Therefore, despite the announcement of an expansionary budget balance, the fiscal stance was expected to be neutral and the output recovery was mainly driven by economic cycle. The assessment on fiscal stance, however, is somewhat different when actual date on growth and budget balance are taken into account. As a matter of fact, net borrowing fell in 2015 to 2.6% of GDP, and the cyclically adjusted budget balance showed a small reduction as well, from -0.8% to -0.7%. Therefore, fiscal stance was not even neutral but slightly restrictive in the end.

The main features of the Italian fiscal policy over the past few years are sketched out in the chapter by Cossaro, De Novellis, Signorini, Tomasini. Furthermore, the structural characteristics of public debt and its sustainability are analysed. In 2015, the Italian general government deficit fell below 3 per cent of GDP for the first time since the start of the crisis after a three-year period in which it had stabilised at around that threshold. Compared to the negative peak recorded in 2009, the Italian fiscal policy has therefore succeeded in accomplishing an extensive correction, resulting in a drop of public deficit by almost 3 percentage points of GDP in 6 years. Despite such efforts, the consequences of the crisis, sluggish growth and high interest rates, prevented Italy's debt-to-GDP ratio from decreasing, so that in 2015 it rose to 132.7 per cent. The objective of stabilising and possibly reducing public debt represents a difficult trade-off for Italian fiscal policy: restrictive policies aimed at further reducing the deficit risk to jeopardise the already low nominal and real GDP growth, further delaying the decrease in the debt-to-GDP ratio.

Bazzoli, De Poli, Fiorio focus on the distributive impact of the main economic policies introduced by the Renzi government in years 2014 and 2015, namely the '80-euro' and 'new-born baby' benefits, the changed capital income taxation, the labour market reforms and the change in the main residence taxation. They evaluate the impact of these measures on income inequality, since Italy has one of the highest income inequality among European developed countries. Their results show that the redistributive effects of these policies were very limited: all income deciles were affected and the differential impacts were very small. For instance, the '80 euro bonus', by being means-tested at the individual and not at the household level, was distributed also to households in top deciles, showing scope for better targeting of transfer policies. The unique policy which could have reduced income inequality would be the labour market reform, according to the authors. Hoverer, this conclusion needs to be more deeply investigated. The labour market reform was successful in transforming temporary labour contracts in open-ended ones. But its effect on aggregate employment is questionable. Furthermore, even though we assumed that the reform produced both a boost of aggregate employment and a reduction of temporary jobs, the concentration of new employment among workers in the bottom deciles is uncertain, especially in the Italian labour market, where the labour market participation is low and many individuals show a discontinuous and intermittent access to market. As a matter of fact, in 2015 28,7% of population was at risk of poverty or social exclusion[1], and that was slightly higher than the 28,3% recorded in 2014.

After having evaluated both the macroeconomic and the distributive impact of the budget policy for year 2015, the book focuses on two salient issues: first, the relationship among tax design, growth and employment; second, the measurement of potential output, which is one of the building blocks of European fiscal governance.

Lucifora, Moriconi argue that for most OECD countries, the legacy of the Great Crisis is given by a higher public debt and a slower rate of growth compared to the pre-crisis period. Countries are confronted with limited action for fiscal policy and the need to combine fiscal consolidation measures with policies to curb unemployment. While there is a vast literature showing the negative effect of the tax wedge on labour income and unemployment, less is known about the role of tax progressivity. They argue that, for a given level of average labour income taxation, a more

[1] ISTAT, *Condizioni di vita e reddito*. Anno 2015, 6 dicembre 2016.

progressive tax schedule has beneficial effects on both aggregate employment and unemployment, whilst it reduces average labour productivity. The impact of progressivity on employment, in theoretical models, comes from a wage moderating effect that boosts the labour demand and from a composition effect since it shifts the tax burden away from groups of workers whose employment is the most responsive to taxation.

Felli's contribution raises the following question: What the economic growth would have been in Italy had the observed tax structure changed at some point in time? The answer to that question is obtained by simulating the impact of a revenue neutral sizeable shift from income taxes to consumption taxes. The test is performed using a dynamic stochastic structural model in the Cowles Commission tradition. Simulation results suggest that a move from income taxes to consumption taxes is desirable from both a growth and fiscal standpoint.

As mentioned above, the initial expansionary impulse of Budget Law for 2015 was significantly reduced after that European commission evaluated that balance budget in year 2015 would not be consistent with the medium-term budgetary objective, drawing on the measure of potential output and of structural budget. That episode shows the crucial role assumed by the procedures to compute potential output within the European governance.

Fantacone, Garalova, Milani remind that in year 2015 European Commission adopted new guidelines and made some corrections to the fiscal targets, which after the introduction of the Fiscal Compact are based on the concept of general government structural balance. They argue that, theoretically, a target constructed taking into account the cyclical effects should allow the functioning of the automatic stabilizer of the public balance. However, in the recent past that mechanism failed to work for two main reasons: i) notwithstanding the deep recession, all the Mediterranean countries had to apply restrictive fiscal policies in order to reduce their structural balance, as requested by the zero target fixed by the medium-term budgetary objective; ii) the method used by the European Commission to estimate the output gap, i.e. the gap between current and potential GDP used to calculate the structural budget balance, is biased. In fact, they show that the Non-Accelerating Wage Rate of Unemployment, one of the main component of the potential GDP, is pro-cyclical, and as a consequence not adequate to evaluate structural balance.

Finally, Fioramanti casts light on the concept of potential output, the highest level of production an economy can sustain without incurring in

inflationary pressure. Unfortunately, potential output is not observable and must be estimated. There are many techniques to obtain a guess value of the potential of an economy, each of which with pros and cons. The methodology adopted by the European Commission and EU Member States, while consistent with most of the recent economic and econometric theory, is still not robust enough to give a unique and irrefutable measure on which to base EU's fiscal framework. Should the fiscal governance continue to be based on this concept, further extension of the methodology must be implemented in order to obtain more robust estimates.

Appendix

Table 1 – *Main measures in Budget Law for year 2015 and their impact on General Government Net Borrowing in year 2015 (in euro bn)*

Revenues	
Deduction of labour cost from IRAP tax base	-2.7
Social contributions relief for open-ended contract	-1.9
Suspension of safeguard clause - 2014 Stability Law	-3.0
Streamlined taxation system for self-employed	-0.8
Measures to fight VAT evasion	2.6
Expenditure	
€ 80 bonus	9.5
Reform of the social safety nets	1.7
Budget cut for public sector local bodies	-3.3

(Source: MEF, Economic and Financial Document 2015,
Section I Italy's Stability Programme, April 2015)

Table 2 – *Budget Law for year 2015: cumulative financial impact in year 2015*

	€ bn	% of GDP
Incremental resources	28.2	1.7
Higher revenues	11.7	
Lower current expenditure	13.6	
Lower capital expenditure	2.9	
Use of resources	34.0	2.1
Lower revenues	11.8	
Higher current expenditure	17.5	
Higher capital expenditure	4.7	
Effects on net borrowing	-5.8	-0.4

(Source: UpB, La legge di stabilità 2015 nel quadro programmatico dei conti pubblici, Focus tematico n. 2, April 2015)

Table 3 – *Macroeconomic framework and general government budget balances*

	2013	2014	2015
GDP growth rate at costant prices			
NdA DEF 2016	-1.7	0.1	0.7
NdA DEF 2015	-1.7	-0.4	0.9
NdA DEF 2014	-1.9	-0.3	0.6
Output gap in % of GDP			
NdA DEF 2016		-4.4	-3.5
NdA DEF 2015	-4.8	-4.8	-4.4
NdA DEF 2014	-4.3	-4.3	-3.5
Net borrowing in % of GDP			
NdA DEF 2016		-3.0	-2.6
NdA DEF 2015	-2.9	-3.0	-2.6
NdA DEF 2014	-2.8	-3.0	-2.9
Primary surplus in % of GDP			
NdA DEF 2016		1.6	1.5
NdA DEF 2015	1.9	1.6	1.7
NdA DEF 2014	2.0	1.7	1.6
Cyclically adjusted budget balance in % of GDP(*)			
NdA DEF 2016		-0.8	-0.7
NdA DEF 2015	-0.7	-0.7	-0.3
NdA DEF 2014	-0.7	-0.9	-0.9
Cyclically adjusted primary surplus in % of GDP(*)			
NdA DEF 2016		3.8	3.5
NdA DEF 2015	4.2	4.0	4.0
NdA DEF 2014	4.2	3.8	3.7

(*) net of one-off measures

(Source: MEF, Nota di Aggiornamento del Documento di Economia e Finanza, various years)

Lucia Cossaro, Fedele De Novellis, Sara Signorini,
Stefania Tomasini

European constraints and macroeconomic evaluation of Italian fiscal policy in 2015

Summary and conclusions

In 2015, the Italian general government deficit fell below 3 per cent of GDP for the first time since the start of the crisis after a three-year period in which it had stabilised at around that threshold.

Compared to the negative peak recorded in 2009, the Italian fiscal policy has therefore succeeded in accomplishing an extensive correction, resulting in a drop of public deficit by almost 3 percentage points of GDP in 6 years. Despite such efforts, the consequences of the crisis, sluggish growth and high interest rates, prevented Italy's debt-to-GDP ratio from decreasing, so that in 2015 it had risen to 132 per cent. Hence, it is not surprising that the European Commission affirms in its assessment of the Italian public debt in the 2015 Country Report: «High public debt is a major source of vulnerability for the Italian economy and, given its large size, it is considered of primary importance for world markets».

The objective of stabilising and possibly reducing public debt represents for Italian fiscal policy a difficult trade-off: restrictive policies aimed at further reducing the deficit risk to jeopardise the already low nominal and real GDP growth, further delaying the decrease in the debt-to-GDP ratio.

Despite the difficult compliance with the debt rule, in our view the consideration that Italy's economic conditions are not compatible with greater fiscal discipline remains crucial.

Structural reforms to promote long-term growth and boost investment are correctly considered as priorities, combined with a use of the flexibilities recognised by the Stability and Growth Pact (SGP) in order to

keep public finance prospects on a sustainable track. However, despite the reforms implemented in recent years, the prospects of the Italian economy remain uncertain.

Uncertain growth prospects are the main factor affecting future fiscal sustainability. Over the last few years, Italian public debt's financing conditions have clearly improved, but a decisive role in the reduction of sovereign interest rates was played by the ECB monetary policy. However, financial markets confidence could deteriorate again in the coming years. The low-GDP-growth and low-inflation scenario that is expected for the near future makes it challenging to bring public debt back to the pre-crisis level.

Therefore, the main risk for Italy's economic outlook is that of an extended period of stagnation. This means that, despite the consolidation efforts made in the last years, fiscal policy in Italy has to remain very cautious and will have to skate on thin ice, trying to support growth, keeping, at the same time, fiscal consolidation on track.

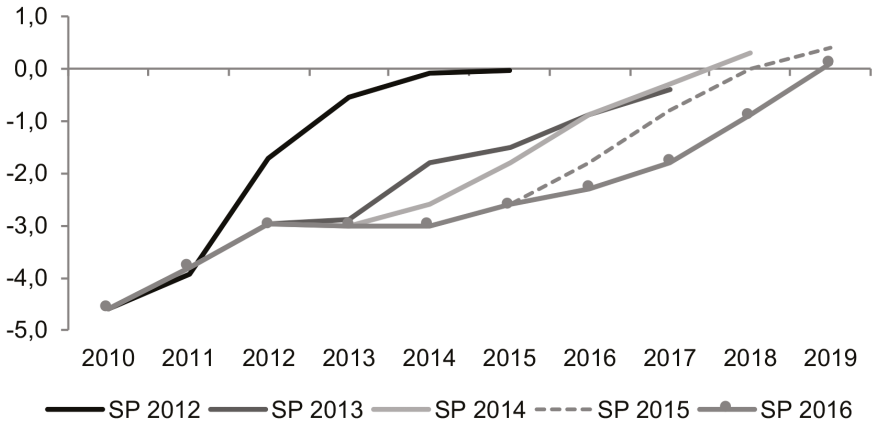
In this work we aim to retrace the main features of the Italian fiscal policy over the past few years (paragraphs 1-2) and then to conduct an in-depth analysis of the structural characteristics of public debt that could affect its sustainability (paragraph 3).

1. *European fiscal rules and flexibility: downward revision of policy objectives*

Since 2011, the main goal of Italian fiscal policy has been to reduce public deficit. In 2015, for the first time since the beginning of the crisis, public deficit in terms of GDP fell below the 3 per cent Maastricht target. Despite the improvements in the past few years though, its level is still relatively far from attaining a balanced budget, that is the ultimate objective according to official documents.

The revision of the objectives in Italy's Stability Programmes of the last few years indicates that the deficit achieved in 2015 derives from a progressive postponement of the balanced budget objective which, according to the 2012 Stability Programme, was to be attained precisely in 2015 (see Figure 1).

Fig. 1 – *The revision of public finance objectives in Italy: policy scenario public deficit in % of GDP*



(Source: authors' own calculations on Stability Programmes (SP), various years)

The postponement of the balanced budget objective and the stabilisation of public deficit below 3 per cent of GDP have led the Italian government to face up to the restrictions stemming from European regulations.

The Fiscal Compact rules define for each country an annual fiscal adjustment path leading to their budgetary target, known as Medium-Term Budgetary Objective (MTO), that is set in structural terms to ensure a sound fiscal position. Every year the objective is defined in terms of improvement of the structural balance compared to the previous year. The entity of the adjustment (that can range from zero to more than one percentage point of GDP) is defined according to the macroeconomic situation of the country and its level of public debt: the better the economic situation and the higher the debt-to-GDP ratio, the greater the correction required.

In these past few years, postponing the balanced budget objective has caused deviations from the path defined by the Fiscal Compact and, in order to allow for the endorsement of this possibility by European authorities without incurring in an Excessive Deficit Procedure (EDP), the Italian government has called upon a variety of exceptions contained in European treaties, under which temporary deviations from the adjustment path are permitted in special cases. A note by the European Commission dated January 2015 provided a guideline on how to apply possible exceptions to the requirement of pursuing the objectives stated by the Fiscal Compact, defining them more clearly and therefore emphasising the subject of flexibility within the rules.

The recent history of the relations between the Italian government and

the European Commission has therefore experienced long negotiations, correlated to the attempt to use all possible margins to loosen the path for containing the deficit.

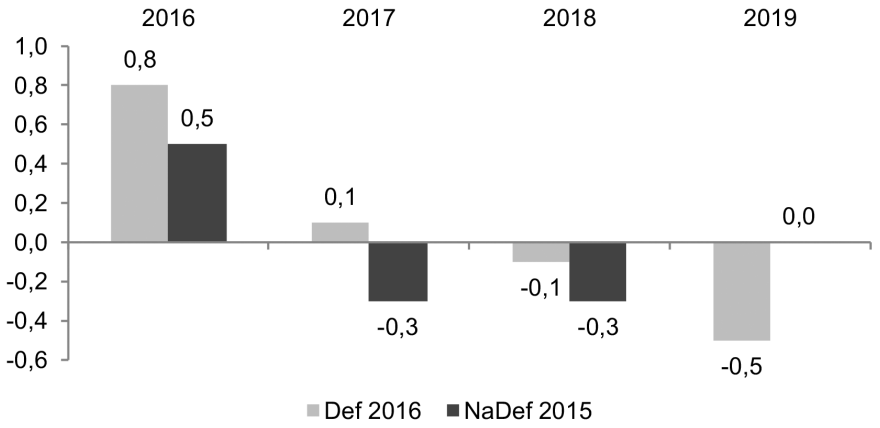
Specifically, in 2015, the European Commission granted to Italy a deviation, with respect to the objective of amending its structural balance equal to 0.4 GDP percentage points, owing to the exceptional circumstances of Italian economy (enduring recession and risk of further downward revisions of growth for 2015, high negative output gap). Additional flexibility was allowed for 2016, driven by Italy's commitment to the implementation of a set of structural reforms, provided that the latter (i) were relevant, (ii) had a positive long-term impact on public finances, and (iii) would be fully accomplished within the forecast period. These structural reforms address several aspects, such as administrative simplification, justice system reform, competitiveness, labour market, fiscal reform and public spending review. According to official estimates their impact on growth should be significant, so that Italy has been allowed to correct the structural balance by only 0.1 GDP percentage point, instead of the required 0.5 points of GDP.

A further deviation will most probably be granted also for the adjustment path in 2017, but to which extent it remains uncertain, depending on the Commission's assessment of Italy's 2017 Stability programme and of the measures included in the 2017 Budgetary Law.

In any case, as it has happened in the past, the fiscal policy scenario of the Italian government plans to postpone a reversal of the fiscal stance for one more year.

Therefore, should the Commission provide a positive appraisal of the envisaged fiscal policy scenario over the coming years, the overall fiscal policy for 2015-2019 will eventually be only mildly expansionary, even though it is the result of the gradual postponement of more ambitious objectives. If no other changes occur, the fiscal stimulus will be positive for the economy only in the 2016-2017 period, whereas it will reverse in the following years, as shown in Figure 2.

Fig. 2 – *Planned fiscal stimulus - annual change in structural primary balance, as a % of GDP*



(Source: authors' own calculations on the 2016 Economic and Financial Document (DEF) and 2015 Update of the Economic and Financial Document (NaDEF))

Nevertheless, the strategy of delaying fiscal targets defines a turnaround compared to the fiscal policy restrictive trends followed by the Italian government in recent years, although it is not the first European country that has experienced a loosening of its fiscal convergence plans in the past few years. In the second half of the 2000s various countries deviated from their fiscal targets, with Germany being the only one with a structural balanced budget at the beginning of the recession. In 2011, this evidence called for the introduction of a set of more restrictive rules, via the 'Six Pack' reforms, which led to the negotiation of the European Fiscal Compact. Up until now, the Fiscal Compact rules have remained formally binding, and the relaxation of constraints has been accomplished via the introduction of scope for derogations. As a result, the overlapping of different rules and exceptions to the rule itself has generated a substantial opacity of the entire system of regulations, with a concrete risk of undermining its credibility (Pisani-Ferry, 2016)[1].

In other words, the benefit expected from a system of strict rules mainly lies in the gains in terms of credibility of the commitment to the targets, at the cost of a loss of margins for discretionary policies. Actually, the main risk now is a decrease in credibility with little degrees of freedom in adopting discretionary policies, if not within the flexibility margins permitted by the regulations.

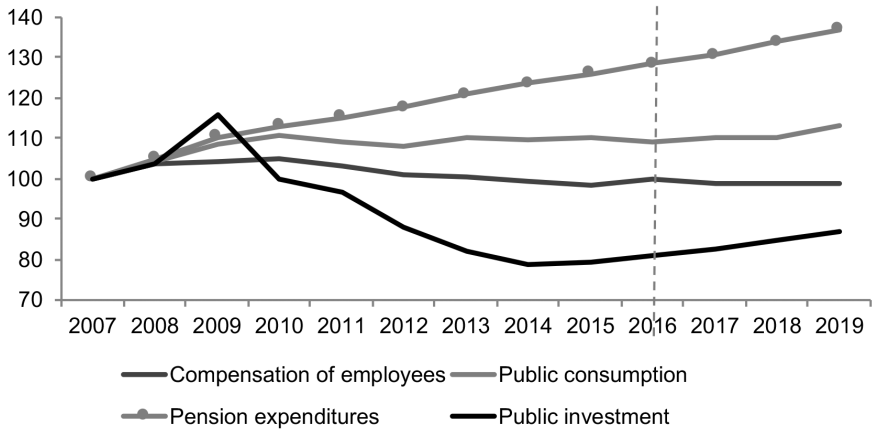
[1] J. Pisani-Ferry, *The Eurozone's Zeno paradox – and how to solve it*, in VOX, <voxeu.org> (last access 05.12.2016), 2016.

2. *Fiscal policy recent trends: decrease in fiscal pressure and spending review*

Besides trying to mitigate fiscal targets, Italian fiscal policy has also tried to modify its budget composition and, specifically, to change the levels of revenues and expenditures, with the purpose of reducing their weight on GDP.

Some of the measures for reducing primary expenditure were particularly effective. However, the various interventions had different degrees of effectiveness depending on the inherent features of each public expenditure item (see Figure 3).

Fig. 3 – *Public expenditure: evolution of main items - Index: 2007=100*



(Source: authors' own calculations, Istat, 2016 Economic and Financial Document)

The 'Fornero reform', which aimed at controlling pension expenditures via the gradual increase of the required age for retirement, was not enough to curb the lively spending dynamics (based on unchanged legislation), so that the expenditure levels have kept rising, on average, at a rate above 2 per cent per year.

On the other hand, given the relative low rigidity of capital expenditure compared to current expenditure, investment spending was cut and showed an unprecedented decline. This choice entails extremely negative repercussions on the country's infrastructure, and thus on the level of potential GDP.

As in the case of public investments, compensation of employees has also shown an extensive downturn, as a result of the rather stringent measures to

curb the public wage bill during the crisis years, via freezing of public wages and limitations to the turnover of public employees (only a small share of the retired personnel was allowed to be replaced every year).

Despite the increasing emphasis placed on spending review policies and on containment measures, public consumption expenditure kept on raising. Nevertheless, growth rates of intermediate consumption slowed down significantly in nominal terms and fell considerably in real terms, which is an unprecedented event in the last twenty years.

Last, total public expenditure trends have been affected significantly by the major reduction in interest expenditure, that is benefiting from the ECB expansionary monetary policy. This component is especially relevant for Italian public expenditure, given the higher public debt as compared to other countries.

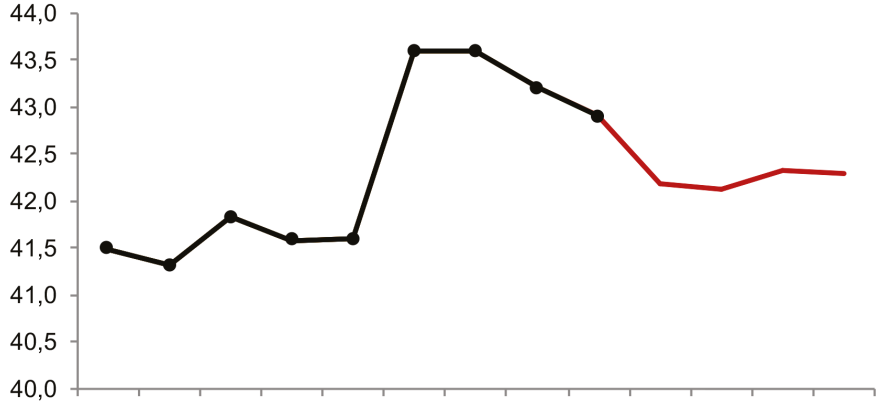
The decrease of total public expenditure as a share of GDP should continue in coming years, according to the government's forecast scenario (based on unchanged legislation), as published in 2016 Economic and Financial Document (DEF)[2] and as confirmed in the Update to the 2016 DEF[3], that also consider the effects of the 2016 Stability Law.

Measures on the expenditure side have been coupled with a gradual, yet significant, reduction of the tax burden, which started already in 2014 and should be completed over the coming years.

Starting with the 80 euros monthly bonus, i.e. the labour income tax reduction aimed at sustaining the income of worse off employees in a critical stage of the economic cycle, a wide set of measures has been implemented with the purpose of reducing the tax burden both on households and firms. Over the five-year forecast horizon (up to 2019) tax-burden-reducing measures will amount to more than 30 billion euros (based on the *ex-ante* government quantification). The overall tax burden as a percentage of GDP has partly been reduced in the last two years. It remains in any case high, not much lower than the peak reached in 2012, if compared to the levels experienced in the first half of the 2000s. A further decline is expected in coming years, also because a substantial part of the impact of past interventions on revenues has still to emerge between 2016 and 2017 (see Figure 4).

[2] Documento di Economia e Finanza 2016.
[3] Nota di Aggiornamento del Documento di Economia e Finanza 2016.

Fig. 4 – *Tax burden before and after the crisis – including the 80 EUR bonus*



(Source: authors' own calculations, ISTAT, and 2016 Economic and Financial Document)

Given their heterogeneity, the set of adopted and planned tax-reducing measures may seem partly uncoordinated or, as criticisms often addressed to government choices say, mainly inspired by the 'political' objective of reaching a large portion of the population in order to gain broader consent. Nevertheless, the set of interventions actually appears to be mostly inspired by a common rationale, which is closely linked to the one behind the adopted job-market policies. In fact, several government measures insist upon reducing the tax wedge, i.e. the gap between the cost of labour sustained by the employer and the net salary received by the employee. In 2017, more than 70 per cent of the overall (*ex-ante*) impact of legislated measures is aimed at shifting the tax burden away from labour, of which the most relevant are the Irpef (labour income tax) reduction for low income earners (the 80 euros bonus), the cut in Irap (regional corporate income tax) through the full deduction of the labour component from the tax base (limited to the cost of permanent employees) and the social security exemption for new permanent employees in 2015. A second tranche was introduced for new permanent employees hired in 2016, lower in terms of duration and amount.

Such measures have been adopted in parallel with the change in labour market legislation brought about by the so-called 'Jobs Act', which introduced the progressive entitlement employment contracts. All these elements aimed to promote the hiring of new, permanent employees, by reducing their cost and making the firing cost certain.

The amount of resources allocated for the reduction of the tax wedge and the changes in job market regulations should, according to the intentions of the government, activate the creation of new jobs and increase the share of permanent positions. In 2015 and 2016 the creation of new jobs has been significant; even if, after the expiration of the first tranche of the incentives on social contributions, the creation of new jobs has slowed down, the demand for labour increased more than GDP, resulting in a reduction of productivity growth.

As to the impact of the mentioned tax reductions on domestic demand, the expansionary impulse has been partially compensated by other measures, a mix of expenditure cuts and increase in other taxes, that amount to almost one third of the tax reductions (based on the *ex-ante* government quantification).

Moreover, in the unchanged-legislation scenario, the planned deficit targets have been guaranteed by resorting to the stratagem of foreseeing a 'safeguard clause', defined for 2017 by a 0,9 per cent of GDP VAT hike. By their very nature such safeguard clauses should not be considered as an actual tax increase, since they only represent formal coverage to achieve fiscal targets, while the government is committed to gradually repeal them. The 2016 Economic and Financial Document announced its intention to sterilise the safeguard clauses, as it had done already for the clauses that insisted on 2015-2016, by partially replacing them with a mix of other measures, such as fight against tax evasion, spending review and the revision of tax expenditures. With its 2017 Draft Budgetary Plan the government confirmed its intention of repealing the clause for 2017 and therefore the 2017 deficit objective was revised downwards. At the moment, the negotiation with the European authorities and the parliamentary discussion on the 2017 Budgetary law are still ongoing, so it is not yet clear what the actual composition of the fiscal manoeuvre will be.

It is anyway certain that, should spending review policies prove to be less effective than expected, or should further downward revisions of the deficit targets be denied by European authorities, the described tax reductions will have to be almost entirely financed via the increase of other taxes.

3. *Deficit vs. Debt: the good and the bad. The position of Italian debt in the EMU and the rules of the Fiscal Compact*

The Italian fiscal policy, based on the postponement of the balanced budget target and on keeping the deficit close but below 3 per cent of GDP, makes it clear that the government medium-term strategy relies on (i) relative soundness of Italian public accounts, (ii) interruption of the fiscal consolidation and (iii) some relief to aggregate demand.

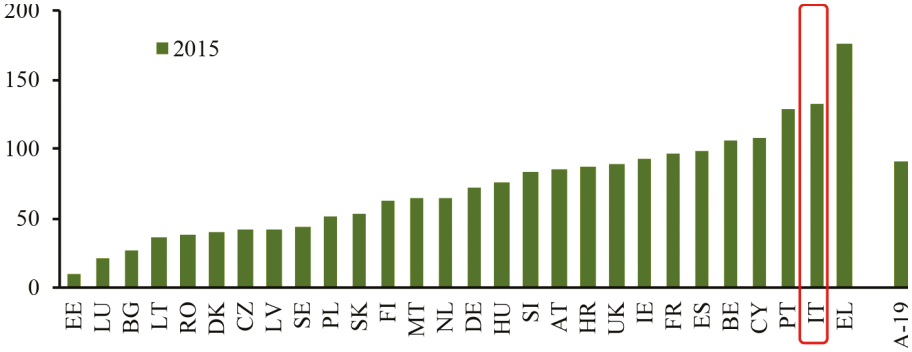
Besides, an important contribution to the consolidation of Italian public finances in the past few years has derived from the drop in interest rates, related to the zero rate policy embraced by the ECB and to the decrease in the BTP-Bund spread resulting from the Quantitative easing. Because of high debt-to-GDP ratio, Italian public finances are more sensitive to the level of interest rates than other countries.

However, the fall in interest rates also reflects the weak inflation dynamics, close to zero for three years. If the net effect of falling inflation and dropping interest rates is apparently favourable for the deficit, it is also true that what matters for debt stabilisation is the level of interest rates in real terms, that could become much less favourable if a situation of persistently very low inflation or even deflation should materialise.

It is no coincidence that Italy is experiencing serious difficulties in complying with European regulations, especially with reference to the debt rule. In 2015, debt-to-GDP ratio was at 132 percent, second only to Greece out of the 28 Member States of the European Union (Figure 5).

In the recent past Italy experienced an Excessive Deficit Procedure, which was initiated in 2009 and withdrawn in 2013. From 2016 onwards the debt rule defined in the Fiscal Compact will become fully operational, after the 2013-2015 transition period in which full respect of the Minimum Linear Structural Adjustment (MLSA) to the debt benchmark was required.

Fig. 5 – *General Government debt-to-GDP ratio in the EU Member States (%)*



(Source: Eurostat)

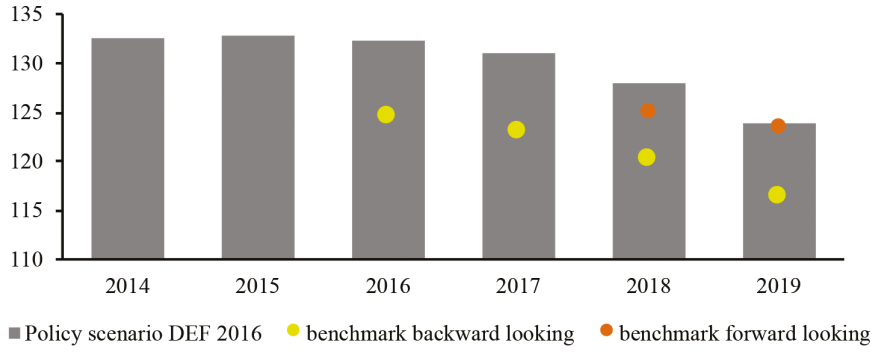
The MLSA would have required an annual improvement in the structural balance by 0.9 per cent of GDP, a rule which has never been fully complied with (Table 1); the further adjustment that should have been attained is estimated at approximately 2 percentage points of GDP. As in the case of deficit, both in 2014 and in 2015 the deviation from the convergence path was justified by the government in the light of the so-called 'relevant factors', i.e. continuing adverse macroeconomic conditions and risks of deflation. In this context, and given the implementation of structural reforms able to increase potential growth on one side, and the respect for the preventive arm of the SGP in terms of deficit restriction on the other, the European Commission deemed fit to consider as not significant the deviation from the debt rule and did not proceed to initiate an excessive deficit procedure.

Table 1 – *MLSA and structural variation required for full compliance with the debt rule (Policy scenario, 2016 Economic and Financial Document)*

	2013	2014	2015
Minimum linear structural adjustment (a)	0.9	0.9	0.9
Variation inherited from the previous year (b)		0.5	1.5
Planned variation of the structural balance (c)	0.4	-0.1	0.2
Further necessary variation (d)=(a+b-c)	0.5	1.5	2.1

Starting from 2016, the convergence of Italian debt towards the target value will be assessed on the basis of rules of compliance with the benchmark. Figure 6 indicates the value of the debt-to-GDP ratio predicted by the 2016 Economic and Financial Document as compared with the benchmarks in both its formulations, namely 'backward looking' and 'forward looking'.

Fig. 6 – *General Government debt/GDP (%) - forecasts vs benchmark*



(Source: authors' own calculations, MEF)

In 2016, the debt reduction rule was not satisfied. The gap is expected to be relevant both with respect to the 'backward looking' criterion and in relation to the 'forward looking' benchmark, since the forecast for nominal GDP growth remains modest until 2018. Also in this case, the government's position is that relevant factors justify the deviation of debt from the decrease required by the rule. The first relevant factor is the risk of stagnation and deflation, to which are added, inter alia, the insufficient coordination of fiscal consolidation in the Euro Area, the effects of restrictive fiscal policies on growth, immigration costs, the consideration that primary surplus is in any case high, also as compared to other countries, and Italy's good position in relation to the S2 long-term sustainability indicator (see paragraph 3.3 below).

In order to appraise the feasibility of the Fiscal Compact required path, as well as the sustainability of Italian public debt, it is useful to take into account all the relevant aspects of debt dynamics. Therefore, an outlook on the factors determining the evolution of the debt-to-GDP ratio will be provided, according to standard indicators in debt analysis;

also debt composition (in terms of maturity, creditor base and currency of denomination) will be analysed, in order to provide further information about its riskiness/vulnerability[4]; last, the sustainability indicators used in the Debt Sustainability Analysis framework of the European Commission will be described.

It must be pointed out that in general it is not possible to define an upper limit above which public debt is no longer sustainable[5], since the sustainability of a high level of debt depends on several factors, including the level of development of financial markets, the government's credibility to implement structural reforms, the degree of risk aversion and the attractiveness of investments alternative to government bonds.

However, it is clear that high levels of debt are associated with greater risks in that they generate vulnerability[6]; the greater exposure to market turmoil and to changes in interest rates may result in confidence crises and can increase the financial costs for the government via interest expenditure. These greater costs are also transferred to the borrowing conditions for households and businesses, affecting consumption and investment. Recent history has proven it.

3.1 *Dynamics of debt and sustainability: an analysis of the evolution of the debt-to-GDP ratio*

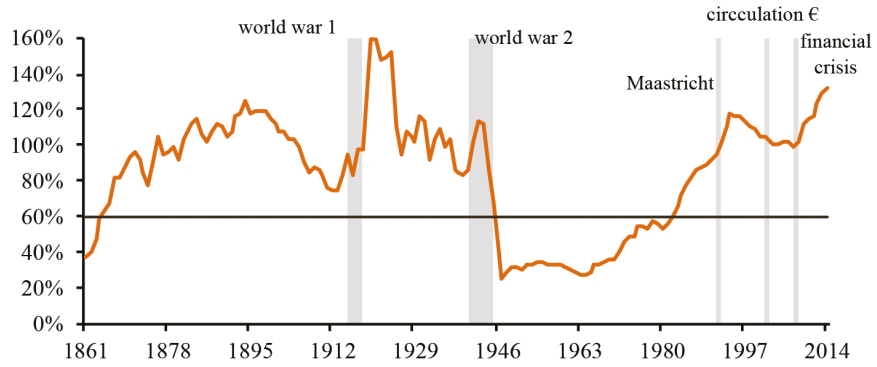
Although the levels of debt recorded in recent years are not new in the history of our country (Figure 7), it is also true that the current conditions represent an exceptional situation in many ways. In the past, only during war times Italy experienced such levels of debt-to-GDP ratio coupled with such a speed of its increase.

[4] Three variables of debt structure are considered in DG ECFIN's DSA: i) the share of short-term debt in total public debt (y-o-y change, at original maturity); ii) the share of debt held by non-residents in total public debt, and iii) the share of debt denominated in a foreign currency in total public debt.

[5] As the Japanese case clearly shows, with a public debt at 240 per cent of GDP in 2015, and over 140 per cent since 2000.

[6] G. Eggertsson, P. Krugman, *Debt, Deleveraging, and the Liquidity Trap*, in «The Quarterly Journal of Economics», vol. 127, 3, 2012.

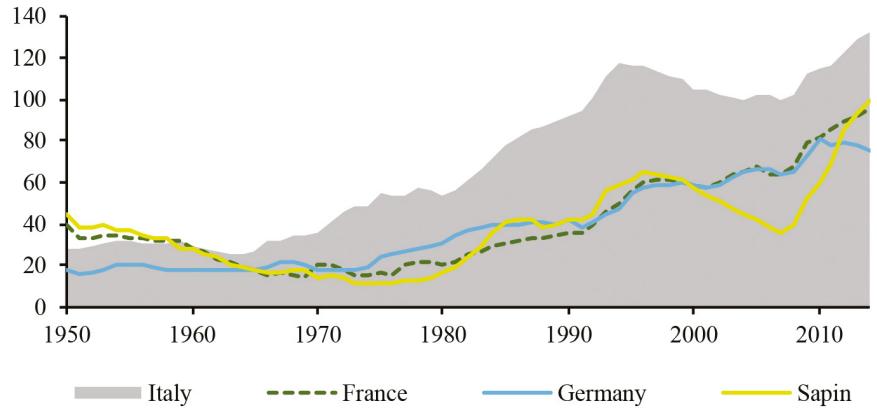
Fig. 7 – *General Government debt/GDP (%)*



(Source: Banca d'Italia and ISTAT)

Italian public debt has been relatively high for the best part of its history, also compared to other main European countries, as it is shown in Figure 8. However, the comparison with other countries' debt evolution from the 90s to the present day shows how the overall debt increase in Italy has been relatively slower. The crisis that started in 2007 played a key role in this increase and in the different intensity experienced by the countries. The recession, the sovereign debt crisis and the resulting increase in the cost of debt, the bank bail-outs, the public resources allocated both to counter-cyclical policies and to the stability of the euro area, were reflected in a rise in public debt of 28 percentage points of GDP for the entire EMU. The increase registered by Italian debt is only slightly above this value.

Fig. 8 – *Debt/GDP (%), comaprison across European countries*



(Source: authors' own calculations, IMF and Eurostat)

Debt-to-GDP evolution can also be examined with reference to its dynamic equation[7], that quantifies the impact on debt dynamics that stems from three underlying factors: economic growth, average cost of debt, primary balance.

Table 2 illustrates the contribution of the different determinants since 1951. It clearly shows how the accumulation of the debt-to-GDP ratio was particularly relevant in the 80s, due to the persistence of primary deficits in the presence of favourable growth conditions, that allowed to more than neutralise the cost of debt financing.

[7] The change in the government gross debt-to-GDP ratio can be decomposed as follows: $\Delta bt = -pbt + [(rt-gt)/(1 + gt)*bt-1] + sft$.
In each period (t) it is expressed as the sum of: the current primary balance (-pb); the snowball effect (second term on the right-hand side), which captures the joint impact of interest payments on the accumulated stock of debt and of real GDP growth and inflation on the debt ratio; the stock-flow adjustments (sf) relates to that part of the change in the debt-to-GDP ratio which is not reflected in the deficit (government financial transactions or privatisation receipts for example).

Table 2 – *Debt-to-GDP ratio changes and its drivers (percentage points; cumulative values for each period)*

				Italy				Euro area
	1951 1959	1960 1969	1970 1979	1980 1989	1990 1999	2000 2006	2007 2014	2007 2014
Change in debt	2.7	2.1	20.1	33.7	19.8	-7.1	29.8	28.8
Primary balance	15.9	7.5	45.9	44.4	-26.2	-13.7	-11.6	7.6
Snow ball effect	-22.7	-25.2	-51.5	-12.4	42.8	7.8	33.5	13.1
Stock-flow adjustment	9.5	19.8	25.7	1.7	3.2	-1.3	7.9	8.1

(Source: authors' own calculations, Banca d'Italia, ISTAT, and Eurostat-Ameco)

The 90s marked a break in the underlying dynamics of Italian public debt. Fiscal consolidation measures in the first half, and the interest rates convergence to low levels, due to the introduction of the common currency (the so-called Euro-dividend) in the second half of the 90s, were responsible for the deceleration in the debt-to-GDP ratio growth. The contributions of the determinants were therefore reversed with respect to the previous decade: the return to surplus of the primary balance was associated with a less favourable gap between the average cost of debt and the GDP growth.

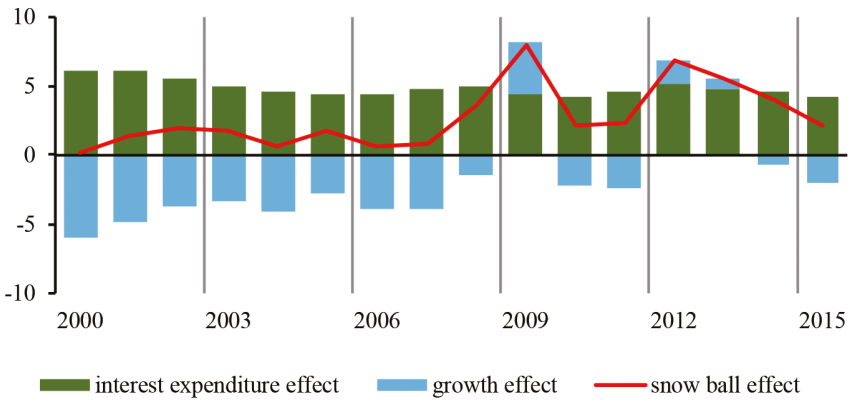
Even during the recession, the contribution of primary balance to the decrease in the debt-to-GDP ratio was significant (-11.6 pp), an especially virtuous result if compared to the other European countries. In fact, while the total increase of Italian debt was similar to the one registered in the euro area as a whole, the relative weight of the determinants proved to be very different. In our country the snow ball effect was decisive, reflecting the greater depth of the recession, the low rate of inflation and the greater cost of public debt; conversely, the primary balance component, that reduced the debt in the case of Italy, contributed to increase the debt of the area.

Further investigation (Figure 9) breaks down the impact of the snow ball effect into its two determining factors: effect of expenditure in relation to the burden of pre-existing debt and effect of GDP growth. In the last eight years the accumulation of debt is clearly resulting from the lack of GDP

growth, given that the impact of the cost of pre-existing debt is similar to the one experienced in previous years. As recalled by the Bank of Italy,

> «If real GDP had grown, since the beginning of the crisis, at a similar rate to the previous ten years and the deflator had risen in line with the euro area's inflation target, by a purely mechanical effect the debt would now be just 3 points, not 33 points, higher than in 2007»[8].

Fig. 9 – *Snow ball effect broken down into: interest expenditure effect and growth effect (%)*



(Source: authors' own calculations, Banca d'Italia and ISTAT)

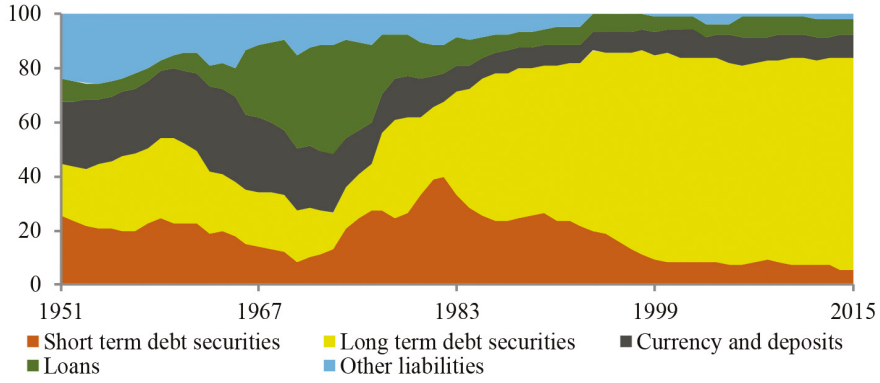
3.2 *The structure of public debt*

A different composition of public debt according to instruments and holding sectors implies different levels of vulnerability. Large increases in the share of short-term public debt provide an indication of higher rollover risk at any given debt level in terms of a government's reliance on temporary market financing. A large share of public debt held by non-residents may capture vulnerabilities in terms of volatility of capital holdings as shown by the literature, though it can also signal strong confidence in a well-performing economy. Finally, a large share of debt denominated in a foreign currency provides an indication of risks related to exchange rate fluctuations[9].

[8] Banca d'Italia, *Preliminary testimony on the 2016 Document on the Economy and Finance*, Testimony of the deputy Governor of the Bank of Italy, Luigi Federico Signorini.
[9] European Commission, *Fiscal Sustainability Report 2015*, p. 79.

The structure of Italian debt has undergone significant changes in the course of time. In terms of instruments, the share of government bonds has grown and then remained stable between 80 and 85 per cent. Simultaneously, securities issues have gradually shifted to the medium/long term segment that in 2015 represented a near 80 per cent of total debt, a particularly high share within the EMU, the highest among the major countries.

Fig. 10 – *Public debt: composition according to instruments (shares in % of the total)*



(Source: authors' own calculations, Banca d'Italia and ECB)

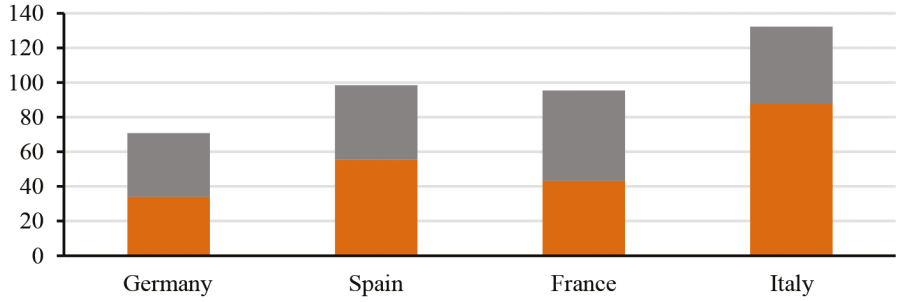
Accordingly, the average life of debt increased to just under eight years at the end of 2010, the maximum level of the time series, and was equal to 7 years at the end of 2015; again, one of the highest levels in an international comparison.

Liabilities other than securities make up of 16 per cent of public debt, and among these, liquid liabilities are especially high, representing a further element of stability in the case of turmoil on financial markets. In fact, during the crisis extensive use of liquidity was made to limit the issues. Nevertheless, at the end of 2014 in Italy the share was still at high levels compared to that of other major European economies.

Last, the share of public debt held by non-residents was 38 per cent at the end of 2015. Over the years, a steadily increasing trend has been observed from 1997 to 2010, bringing debt held by non-residents up to 50 per cent. The confidence crisis of 2011 affected the preferences of foreign investors, that rapidly divested their Italian securities until the share dropped to a minimum of 37 per cent at the end of 2012.

Compared to the rest of Europe, the share of Italian debt held by non-residents is relatively low (Figure 11) and, according to the European Commission evaluations, it is consistent with a relatively low risk level. Similarly, the foreign exchange risk is extremely low, as measured by the debt issued in other currencies, that in Italy represents only 0.2 per cent of the total debt, with 2.2 per cent in France and 3.6 per cent in Germany.

Fig. 11 – *Public Debt-to-GDP ratio by holders*



(Source: Eurostat)

3.3 *Fiscal sustainability indicators*

Figure 12 outlines the position of the European countries with reference to the three sustainability and risk indicators processed by the European Commission on the basis of the 2015 Autumn Forecasts[10]. The data are also reported in Table 3. The colours green, yellow and red identify the different risk levels, respectively low, medium and high.

As noted above, for the risk of short-term fiscal stress S0[11] a low level is generally reported; the indicator is below the critical threshold (0.43) for all countries.

[10] The update of the FSR will be likely available on winter 2016-2017.

[11] S0 measures, for the year following the current year, the likelihood of risks on the sustainability of the debt on the basis of 28 variables broken down into two sub-groups: fiscal and macro-financial; threshold values are identified for the single variables and sub-groups and the entity of the deviation from them is appraised. Whereas indicators S1 and S2 quantify the required fiscal adjustment ('sustainability gaps'), indicator S0 follows the so-called 'signal-approach'.

With reference to the other indicators the situation is more composite. Indicator S1, that identifies medium-term risk, i.e. the gap to be bridged in order to reach the target of the debt-to-GDP ratio equal to 60 per cent by 2030, shows that 40 per cent of the countries shows low risk conditions and, among the others, the countries with high risk conditions are more numerous. With reference to S2, that measures the gap between the current primary surplus and the surplus required for ensuring the intertemporal balance over an infinite time horizon, most countries occupy medium/high risk positions[12]. As illustrated in Table 3, the overall evaluation on the basis of the three indicators shows that only in a minority of countries the level of risk for sustainability is low; among major countries, Germany is featured in this sub-group.

Despite the high level of debt, the results relative to Italy do not raise relevant concerns in terms of sustainability as compared to the other countries.

Fig. 12 – *Sustainability indicators, overall results*

(Source: European Commission, *Fiscal Sustainability Report 2015*)

The risk is low when the short-term is considered, with S0 below the threshold and in line with the European average. Risk appears even lower for the long-term indicator, with S2 at the lowest level out of all EU countries. Conversely, the computation of S1 detects a high risk and this is sufficient to obtain an overall negative assessment, as in the case of France, Spain and Belgium, *inter alia*.

[12] Values S2 and S1 are constructed by identifying the two sources of risk associated with the long-term sustainability of public finances: (i) the initial budgetary position (IBP), that calculates the correction of the primary balance required for the stabilisation of the debt-to-GDP ratio and derives, therefore, from the level of the structural primary balance and from the inherited stock of debt; and (ii) the costs of ageing (CoA) that measures the deterioration expected in the primary balance resulting from the increase in age related expenditure. S1 deviates from S2 since it also considers the debt requirement (DR), namely the adjustment required for attaining 60 per cent by 2030.

Unlike what has been calculated for these countries, however, what determines the reversal of the risk assessment for Italy is the consideration in S1 of the adjustment required so that the debt-to-GDP ratio may reach 60 per cent by 2030. Since the starting level is very far from this target, the adjustment is particularly onerous, the most burdensome among all countries. The other components of S1 and S2 quantify as low the risk stemming from other sources: the initial balance position and the expected increase in age-related expenditure. The level of the primary surplus and the reforms already implemented on pension expenditure place Italy among the virtuous countries, with much better results as compared with the average level of the area, thus confirming that what matters is not only the management of the public balance but the cost, in the broadest sense, of the high level of debt attained.

Table 3 – *Fiscal sustainability and overall assessment*

	S0 indicator Overall SHORT-TERM risk category	S1 indicator Overall risk category S1 indicator Overall risk category	S2 indicator LONG-TERM risk category	Debt sustainability analysis - overall risk assessment
BE	0.10	3.8	2.5	HIGH
BG	0.21	-1.2	2.4	LOW
CZ	0.11	-0.6	3.2	LOW
DK	0.25	-3.3	1.2	LOW
DE	0.02	-0.8	1.7	LOW
EE	0.19	-4.0	0.7	LOW
IE	0.38	2.7	1.0	HIGH
ES	0.21	2.5	0.1	HIGH
FR	0.17	4.4	0.6	HIGH
HR	0.26	4.5	-0.8	HIGH
IT	0.21	4.2	-0.9	HIGH
LV	0.34	-2.1	0.9	LOW
LT	0.18	0.5	2.9	LOW
LU	0.09	-4.4	4.2	LOW
HU	0.16	-0.6	1.5	MEDIUM
MT	0.13	-0.2	4.6	LOW
NL	0.19	0.6	4.5	MEDIUM
AT	0.07	1.3	2.7	MEDIUM
PL	0.27	1.0	3.5	MEDIUM
PT	0.24	4.7	0.7	HIGH
RO	0.14	1.4	4.4	HIGH
SI	0.08	3.0	6.8	HIGH
SK	0.21	-0.7	3.5	LOW

(Source: European Commission, *Fiscal Sustainability Report 2015*)

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The impacts of the Renzi government's economic policies on income distribution

1. *Introduction*

Since 2014 the Italian government reacted to the double dip recession experienced since the start of the Great Recession by introducing some policies aimed at encouraging private consumption and stimulating economic growth. The main purposes of the government were to reform the labour market in order to reduce the unemployment rate and to give benefits to some households in order to foster consumption.

In this study we focus on the effects of the Renzi government's main economic policies introduced in 2014 and in 2015. In particular, we consider the introduction of two benefits, the new born bonus ('*Bonus Bebè*') and the '80 euro bonus'; the increase of capital income taxation; the elimination of the property tax on main residences and the increase in the employment rate as a consequence of the labour market reform (Jobs act), which was introduced jointly with a reduction in the social security contribution for firms.

We aim at evaluating the redistributive impact of these measures on income inequality, since Italy has one of the highest income inequality in the European developed countries (Eurostat, 2014).

Our analyses are carried out using EUROMD, the tax-benefit microsimulation model of the European Union, based on data derived from the Italian version of EU-SILC (the European Union Statistics on Income and Living Conditions) collected in 2012. EUROMOD simulates benefits and

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taxes at individual and household level and computes household disposable income. We simulate a counterfactual scenario, using as benchmark household income in 2015 in the absence of policies. We use that counterfactual scenario to evaluate changes in disposable income distribution brought about by the implementation of the new policies.

The remainder of this contribution is structured as follow: in Section 2 we describe the above mentioned policies implemented in 2014 and 2015 by the Italian government, in Section 3 we describe the data and the methodology, briefly presenting the microsimulation model. Section 4 shows the results in terms of the impact of fiscal policies on income distribution and poverty. Finally, Section 5 summarises the main findings.

2. *Tax and benefit policies in Italy by the early Renzi government*

During its first year in charge the Renzi government was active in proposing new policies to increase tax revenues and stimulate domestic demand.

The government introduced in 2015 two new progressive transfers aimed at increasing domestic demand. The first one, often named '80 euro bonus', was temporarily introduced in May 2014 but then was made permanent starting from January 2015. According to this benefit, employees with a taxable income lower than 26,000 euro and higher than 8,000 euro receive up to 80 euro per each month in occupation. The benefit linearly decreases from 80 euro if yearly income is above 24,000 euro and expires at 26,000 euro.

The second benefit is the so called 'new born bonus'. The aim of this policy is to reduce child poverty and to increase means-tested benefits to households. The recipients are families with children born between 1st January 2015 and 31st December 2017 and with the value of the Indicator of the economic situation (ISEE)[3] lower than 25,000 euro. The bonus amounts to 80 euro per month, paid for the first three years of a child's life. For an ISEE indicator below 7,000 euro per year, the amount is doubled to 160 euro per month.

During 2015, the Renzi government approved a reform of the labour market ('Jobs act'), which also has an effect on fiscal revenues. This reform was implemented to increase the employment rate and in particular the share of permanent contracts. The main novelty is the introduction of the

[3] The ISEE (Indicator of the economic situation) is an index that estimates the economic situation of families. It takes into account household income, properties (such as houses, assets, dividends) and the composition of the family.

progressive entitlement employment contracts, reducing the cost of firing for firms and hence reducing also the disincentive to hire new workers with long-term contracts. The reform was combined with a temporary cut of social security contribution for firms who hire employees with this new contract. The social security cut amounted to 8,060 euro per year for a maximum duration of three years. To be eligible, firms should hire a worker who was not employed with a permanent contract in the past six months. This policy does not directly affect the workers' income as firms most likely do not share the transfer with their workers, given its temporary duration. However, it is intended to enhance the opportunities to enter into the labour market, therefore increasing individual disposable income.

Starting from July 2014 the Italian government also raised capital income taxation. In particular, the tax on interests paid on corporate bonds and on bank and postal accounts, on dividends and on capital gains was increased from 20% to 26% and the tax on private pension returns was increased from 11% to 20%.

Finally, building and real estate income taxation was reformed. In 2014 the property tax, which had experienced a series of changes over recent years, was cancelled and a new tax on indivisible services TASI (*Tassa sui Servizi Indivisibili*) was introduced, both on the main residence and other building and real estate properties. Starting from 2016 no tax is due by main residence owners.

In this work we simulate all these policies assessing their redistributive effects.

3. *Data and main assumptions used*

To study the impact of fiscal policy in Italy, we use EUROMOD, the European Union tax-benefit microsimulation model. EUROMOD's updating and development has been supported by funding from the DG-Employment European Union Programme for Employment and Social Security (PROGRESS), starting from 1996. Tax-benefit models are based on household micro-data and calculate disposable income after the simulation of taxes, social security contributions and benefits for each household in the dataset. EUROMOD is a static model, designed to evaluate the immediate 'morning-after' effect of policy changes and it does not incorporate the possible effects of behavioural changes (Sutherland, 2001). This model can be used to analyse whether the change in public

policies has contributed to reducing or to increasing income inequality (Figari and Sutherland, 2013). The input data derive from the Italian sample of the European Union Statistics on Income and Living Conditions (IT-SILC) released in 2012. However, using updating factors for income sources, 2015 income is obtained.

In order to evaluate the impact of the measures described in the previous section, we simulate a counterfactual analysis, comparing the scenario after the introductions of the policies with what would have happened in the absence of these measures. In this study, we assume that most of the fiscal policies implemented in Italy had no behavioural effect. This is equivalent, in our case, to assume that the decision to have a child is independent of a monthly 80-euro transfer for three years, or that the allocation of savings among financial instruments, insurance policies and housing properties is independent of taxation. Those assumptions do not seem too demanding to us, as – for their size – these policies are unlikely to have strong behavioural effects. However, the assumption of no behavioural effect of simulated policies is more demanding in some other case, and especially when the simulated policies are explicitly aimed at affecting the labour supply. In particular, the 80-euro monthly transfer might increase the probability to take a job offer for very low wages; furthermore, fiscal incentives to reduce labour costs could increase labour demand and allow some people to exit their unemployment status. To keep the analysis simple, we decided to simulate the effect of the labour market reform by randomly assigning a new job to previously unemployed workers according to statistics on the increased employment rate published by Istat. Given the data used when this exercise was run (February 2016), our simulations cannot disentangle between the two different components of the labour market reform, namely the Jobs Act and the reduction in the social security contribution for firms.

The New born bonus is given to households with a new born baby, in relation to the value of ISEE. Since we are analysing the effect of policies in 2015 but we are drawing on SILC 2012 dataset, we consider as eligible all families with a child born in 2011, which is the last available year of the survey. The ISEE indicator has been computed within Euromod by taking into account the income of all household members, their assets and the composition of the household (number of members and their characteristics).

To simulate the redistributive effects of capital income taxation changes we used the recalibrated incomes as described in Bazzoli *et al.* (2017). This calibration of capital income is necessary to allow for the well-known underestimation of capital income in recall interviews. Capital income taxation is recalibrated by using the Bank of Italy statistics on wealth by Italian households.

The simulation of the employment effect of the Jobs act is complex as this policy was introduced jointly with a transfer to firms to reduce the cost of social security contributions for new permanent contracts. In fact, it is not possible to disentangle the effect on employment of the new progressive entitlement employment contract from that of the reduction of employment costs. Moreover, additional complications arise from the choice of the statistics to be used to measure the size of the employment change (Anastasia *et al.*, 2015). In this study, we use data by Italian institute of statistics (ISTAT), which show an employment increase by 0.6 percentage points from 2014 to 2015. We are assuming that this increase is all due to the labour market reform with no role for the economic trend. According to Istat, from 2014 to 2015 the number of employed people increased by about 186 thousand units, mostly among over 44 years, increasing the occupation rate from 55.7% to 56.3%. Hence, we randomly change the employment status to a corresponding share of people over 44 years who were unemployed in our sample. We assign them an employment income equal to the median of the employment income of individuals in our sample with the same age and level of education.

4. *Results*

In this section we present the effects of the policies described above on disposable household income. The analysis is presented in terms of individual income changes according to deciles of the equivalent income distribution. Equivalent income is the ratio of the household income to the equivalence scale, according to the «modified OECD scale», where the first adult in the household is given value of 1, each additional adult a value of 0.5 and each child under 14 years old a value of 0.3.

Figure 1 presents the overall effect of the reforms described in Section 2 in terms of change of disposable income in euro. A large increase in disposable income is given by the '80 euro bonus'. Interestingly, the amount of the benefit increases up to the seventh decile and decreases only in the last deciles, although it was designed as means-tested and aimed at low income people. In our simulations individuals in the first decile increase their yearly income by 44 euro on average, while those in the seventh decile by 206 euro. This evidence shows that targeting the 80 euro bonus to individual income instead of household income allows relatively well-off families to receive it and undermines the potential equity-enhancing effect of this measure (Figari and Fiorio, 2015).

The average impact of the 'new born' bonus on the individual disposable income is small and equal to about 9 euro in the first six deciles; it then decreases and goes next to zero in the last decile. This is not surprising as this policy was means-tested on (ISEE-corrected) household income.

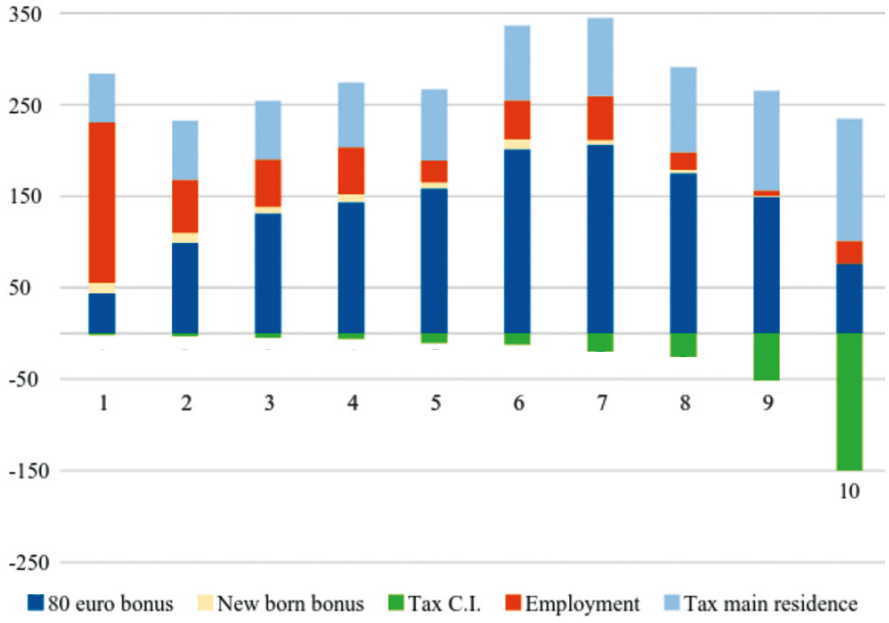
The increase of income brought about by the elimination of the property tax on the main residence is greater for better-off families, suggesting a regressive overall effect. This is not unexpected as the percentage of own dwelling owners, and their cadastral value, is well-known to rise with income. Our simulations show that families in the top decile had more than three times the absolute income gain than families in the first decile.

The effect of the reform of capital income taxation, on the contrary, had a clear progressive effect. Households with higher level of income, with larger amount of capital incomes, ended up paying more after the reform. Our calculations suggest that, on average, the disposable income decreases of 150 euro for people in the tenth decile and 52 euro for people in the ninth decile.

Finally, assuming that the number of employed people increased by 186 thousand units because of the labour market reforms, we estimate that the poorest households, and in particular those in the first decile, receive the greatest benefit from the reform (the average benefit amounts to 175 euro).

In order to interpret this last result, two caveats should be made clear. The estimated increase in the employment rate is likely to be an upper bound as part of it is due to the economic trend. Second, we simulated the change in employment randomly assigning new jobs to unemployed workers regardless of the level of income. However, as the unemployment rate in our sample is the highest in the first decile, by randomly assigning a change of status (from unemployed to employed) we are artificially allocating a larger share of new jobs to workers in the first decile.

Fig. 1 – *Change in individual disposable income. Distribution by equivalent income deciles*

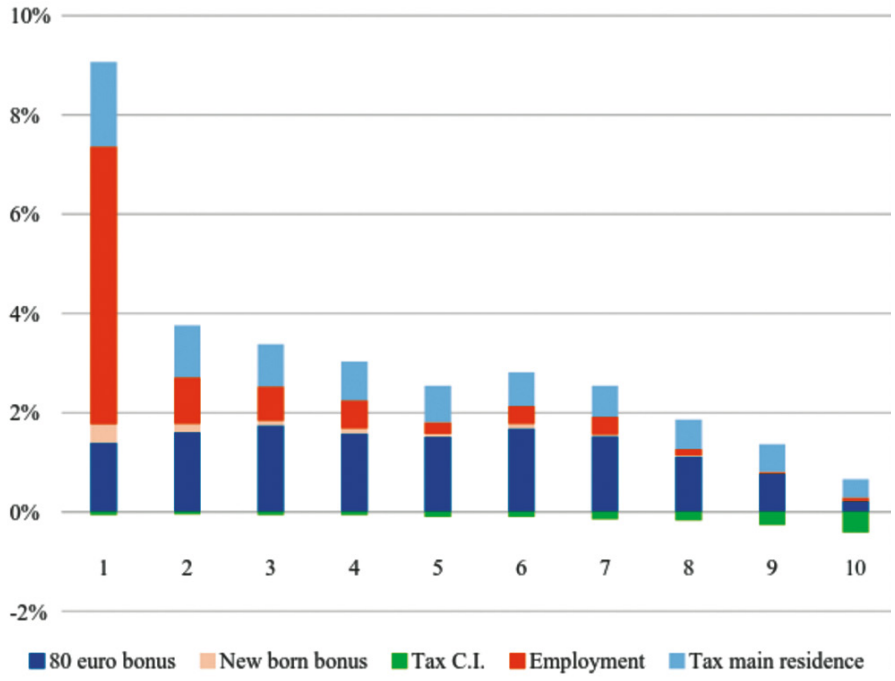


(Source: own calculations using EUROMOD)

Overall, according to our estimates, the greatest benefits from the policies introduced by the Renzi government are received by individuals in the 6th and 7th decile. The richest households, namely those in the last decile, with a median household income of 77,058, on average gain less than 85 euro per year. In the other deciles, people increase their disposable income between 200 and 300 euro. The policies with the greatest redistributive effect are the reform of capital income taxation, which decreases income of the richest, and the labour market reform, which increases income of the poorest.

So far, we presented the effect of the policies in terms of absolute income variation. Figure 2 shows the effect in terms of percentage variation of individual disposable income. In this way, we consider that the same absolute income variation has a different impact on individuals in lower or in the upper deciles. People in the first decile increase their disposable income by 9%, while individuals in the other deciles experience an income increase of less than 4%, which decreases with income. The income variation in the last decile is almost null (+0.2%).

Fig. 2 – *Percentage variation in individual disposable income. Distribution by equivalent income deciles*



(Source: own calculations using EUROMOD)

Table 1 presents some measures of income distribution and poverty, before and after the simulated policy reforms. Starting from the no reform simulation, we incrementally introduce each policy reform and compute the value of the income distribution indices at each step. Therefore, the impact of the whole policy reform package is computed in the last simulation and the contribution of each policy reform can be derived by comparing the values of the indices at each step with those at the previous step. The first column of the table (named Benchmark) describes the no reform simulation, the second shows the values of the indices after the introduction of '80-euro' and 'new-born baby' benefits, the third includes the effect of the changed capital income taxation, the fourth the effect of increased probability of occupation for unemployed and the last the change in the main residence taxation. To assess the changes in inequality we used the ratio between the 90th and the 10th percentile and the Gini index. The table shows that before the introduction of the policies the

income of the 90th percentile was four time the income of the 10th, while this ratio decreases to 3,86 after the introduction of all these policies. This result is roughly confirmed also by the Gini indicator. It means that benefits, employment policies and change in taxation have most likely slightly reduced inequality, although the size of the reduction is very small and likely to be statistically not different from zero. Finally, we investigate the effect of these polices on poverty. The poverty rate, that is the share of persons under the poverty line, computed as the 60% of the median income. Overall, the policies introduced decreased from 18,5% to 17,2%, the largest contribution given by the larger transfers and by the increased employment opportunities provided.

Table 1 – *Measures of income distribution, inequality and poverty after the introduction of some policies*

	Benchmark	Benefits	Benefits and capital income taxation	Benefits, capital income tax and employment	Benefits, capital income tax, employment and main residence taxation
Ratio (percentile 90°/10°)	4.00	3.92	3.91	3.88	3.86
Gini	0.33	0.32	0.32	0.32	0.32
Poverty rate	18.5	17.9	17.9	17.5	17.2

(Source: own calculations using EUROMOD)

5. *Conclusion*

This study provided the estimate of the impact of the main economic policies introduced by the early Renzi government, namely the '80-euro' and 'new-born baby' benefits, the changed capital income taxation, the labour market reforms and the change in the main residence taxation.

Our results showed that these measures, with the only exception of the labour market reform, affected all income deciles with marginal differences. Overall, our analysis shows that the redistributive effects of these policies are very limited. For instance, the '80 euro bonus', by being means-tested at the individual and not at the household level, was distributed also to households in top deciles, showing scope for better targeting of transfer policies.

The main distributional result pointed out by our analysis is a reduction of the poverty index, mostly driven by the simulated increase of disposable income of households at the bottom decile. This is due to the fact that poorest families account for the largest share of unemployed workers, who are likely to largely benefit by an increase in the number of job offers. This result is however to be taken with caution, as the effect of the Jobs Act reform could fade away as the reduction in the cost of social contribution is withdrawn. Moreover, at present there is no clear evidence on the actual size of the occupational change and of its distribution among the population of unemployed workers, which could jeopardize the reliability of our simulations.

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Robert Waldmann

Discussion of Martina Bazzoli, Silvia De Poli, Carlo V. Fiorio
Fiscal policy in year 2015 and income distribution

Martina Bazzoli, Silvia De Poli and Carlo Fiorio presented a micro-simulation of the effects on the Italian income distribution of four fiscal reforms introduced in 2015 and one proposed for 2016. The enacted reforms are:

1. a tax credit of 80 Euros a month for payroll employees with incomes under 24,000 euros per year which is phased out over the range 24,000 to 26,000 – the so called 'Renzi' bonus
2. a tax credit of 80 Euros a month per child under the age of 3 for familees with income under 24,000 euros per year, which is doubled for families with incomes under 7,000 euros per year – the so called 'bebè' bonus
3. an increase in capital income taxation
4. a three year exemption of employers from payroll taxes for new employees hired on permanent employment contracts who were not so employed in the previous year – the hiring subsidy.

The proposed reform is a reduction of taxes on principal residences.

The investigation is principally a static micro simulation using 2012 IT-SILC data, although the incentive effects of the hiring subsidy are considered. The effects are simulated by decile of income.

One striking result is that the benefits of the 'Renzi' bonus increase markedly in income for low incomes peaking at the 6th decile of individual income. This reflects the fact that many people in lower deciles are not employed. The 'Renzi' bonus makes sense if one perceives the problem in the Italian labour market to be insufficient labour supply. It doesn't make so much sense as an antipoverty or redistributive effort.

The total effect of income by decile of the 'bebè' bonus is quite small, reflecting the low birth rate. However, it is relatively high for the lowest decile of individual income. This reform does seem to direct income to households in great need which, by defnition, include young children. This is extremely important given quasi experimental evidence of extremely long lasting benefits of such transfers in the USA.

In the analysis of the temporary payroll tax holiday for people newly hired on indefinite term contracts, the static accounting approach makes no sense. The sensible approach of Bazzoli *et al.* is to compare the rate of such hires in comparison to fixed term contract hires before and after the reform. As they note, there is no convincing way to control for the business cycle. The only control is the rate of hiring for fixed term contracts. Similarly this approach does not make it possible to distinguish the effects of the temporary payroll tax holiday and the relaxation of restriction on dismissals of workers with indefinite term contracts.

This gives an estimated effect in which it is not possible to have great confidence. This is extremely important, because the point estimate is that this reform helped 379,000 unemployed people in 2016. The micro simulation suggests benefits overwhelmingly concentrated in the poorest decile with an average expected increase in income of over 9% for individuals in that decile.

The discussion of the proposed possible reform of real estate taxes is necessarily speculative. It is not at all encouraging. The microsimulation with available data makes it clear that the expected average benefits of the tax cuts increase in income. If the lost revenues were replaced by other real estate taxes including taxes on rental housing and the taxes on rental housing were shifted to tenants, then the effect of the reform would be to increase inequality. The analysis is a warning of the risks of ignoring tax incidence.

Notably, the discussion of the reforms of payroll and of real estate taxes shift the approach from the strict static accounting analysis of Renzi and 'bebè' bonuses. Static analysis has the great strength that it summarizes available data and does not rely on theoretical assumptions. It can be complemented by cautious speculation about behavioral effects.

The effects of the Renzi bonus in the Lucifora and Moriconi model[1] are clear – the bonus increases labour supply – it provides an advantage to the worker of reaching an agreement with the potential employer. In that model (and many others) it will cause a reduction in the contracted pretax wage. This means that it would cause increased employment. As noted

[1] Refer to Lucifora and Moriconi's chapter in the present book.

in the analysis of the effects of the three year exemption from payroll taxes, any benefits of such an effect of the bonus are strongly directed at workers who would otherwise be unemployed and have extremely low incomes.

Finally redistribution of income has an effect on aggregate demand. There is strong evidence that lower income households have a higher propensity to consume out of physical wealth plus the present value of labour income. This effect should not be eliminated by monetary policy either in an economy with interest rates at the zero lower bound or in an economy without an independent monetary policy. That is to say, it can't be assumed that effects of Italian taxes on Italian aggregate demand are negligeable. This casual speculation supports the conclusions of the authors.

Claudio Lucifora[1], Simone Moriconi[2]

Progressive Taxation and Unemployment: Evidence from OECD countries[3]

1. *Introduction*

For most OECD countries, the legacy of the Great Crisis is given by a higher public debt and a slower rate of growth compared to the pre-crisis period. Countries are confronted with limited action for fiscal policy and the need to combine fiscal consolidation measures with policies to curb unemployment. While there is a vast literature showing the negative effect of the tax wedge on labour income and unemployment, less is known about the role of tax progressivity. In this chapter, we argue that, for a given level of average labour income taxation, a more progressive tax schedule has beneficial effects on both aggregate employment and unemployment, whilst it reduces average labour productivity.

We first review the mechanisms that operate under unemployment-reducing effect of tax progressivity. One channel by which tax progressivity may affect unemployment is through a 'wage moderation effect', since any increase in pre-tax earnings leads to a reduced gain in after-tax earnings, which triggers a reduction in labour cost and a rise in labour demand. A further channel works through a 'composition effect', as a more progressive

[1] Università Cattolica del Sacro Cuore, IZA.
[2] Università Cattolica del Sacro Cuore.
[3] This chapter draws extensively on joint work with Etienne Lehmann and Bruno van der Linden. We received useful comments on a previous version of this chapter from Pierre Cahuc, Giacomo Corneo, Gianluca Femminis, Sergio Ginebri and Robert Waldmann. We also wish to thank participants at the Conference *Le decisioni di politica fiscale per il 2015. Impatti e valutazioni* held at the Università di Roma Tre. Usual caveats apply.

tax schedule – by reducing the tax burden on low-skilled relative to high-skilled workers – has positive effect on the employment of low-skilled workers relative to high-skilled workers. In other words, even if tax progressivity may reduce the incentive to work and lower labour productivity, the overall cumulative effect on employment may still be positive. We test the above proposition using data for 21 OECD countries over 1998-2008 period. We measure the overall level of labour income taxation using both the average tax-wedge for a single worker and a tax progressivity indicator comparing the coefficients of residual income progression (CRIP) at 67% and 167% of the average wage.

We find that higher average labour taxation has a detrimental effect on unemployment, while tax progressivity reduces the unemployment rate and increases the employment rate. We also show that the effect on the employment rate holds even in the presence of labour supply responses.

The rest of the chapter is organized as follows. In section 2, we review the literature on taxation and unemployment. Stylized facts and the data used in the empirical analysis are presented in section 3. In section 4 we outline the empirical strategy, and in section 5 we describe the main set of results. Finally, section 6 concludes and discusses the policy implications.

2. *Literature Review*

The extensive literature on the relationship between labour taxation and employment performance starts with Bean *et al.* (1986), who do not find any significant correlation – in the mid-1980s – between European unemployment and labour taxes. A number of subsequent studies – towards the end of the 1990s – argued that the lack of correlation reported in Bean *et al.* (1986) was driven by the use of cross-sectional data. Evidence from studies using panel data, however, remains mixed. Nickell and Layard (1999), using data for 20 OECD countries over the five-years periods 1983-1988 and 1989-1994, find a short-run tax elasticity of 0.2, which disappears in the long run. The authors interpret the long-run results as evidence of a shift of the tax burden on workers in the long-run. Blanchard and Wolfers (2000), using data for the EU15 for the period 1960-1995, do not find any statistically significant impact of labour taxation on unemployment. Daveri and Tabellini (2000), using data for 14 OECD countries over the period 1965-1995, shows that the tax elasticity is likely to differ according to the prevailing type of welfare model. In particular, the tax elasticity to unemployment

is close to 0.5 in Continental European countries, while little evidence of positive statistically significant tax elasticity is found in Anglo-Saxon and Nordic countries. Some more recent papers try to address a number of methodological problems (such as panel unit roots, heterogeneous-cross sectional correlation, etc.) to improve the precision and consistency of the estimates, still the evidence remains mostly inconclusive (see e.g. Planas *et al.*, 2007; Berger and Everaert, 2010; Berger and Heylen, 2009).

Related strands of the literature suggest that the ambiguity of the estimated impact of labour taxation on labour costs and unemployment in unionized markets may be explained by the underlying heterogeneity in the labour tax wedge measure used in empirical studies. One dimension of heterogeneity in the effects of the tax wedge on employment and unemployment outcomes concerns its composition and, in particular, the relative weight of personal income taxes, employers' and employees' social security contributions. An alternative dimension concerns its measured impact on pre-tax wages along the earnings distribution which is related to the degree of progressivity of the system of labour income taxation in each country. Most empirical studies reviewed above assume the 'invariance of incidence proposition' (IIP), suggesting that any change in the composition of the tax wedge should not affect labour costs since the switch is supposed to leave the wedge between the producer costs and the net take-home wage unchanged. A remarkable exception in this literature is the paper by Arpaia and Carone (2004), who investigate the impact of both level and composition of labour taxes on labour costs using a balanced panel of 15 EU countries for the period 1979-2000. In line with results of Nickell and Layard (1999), they find a positive tax elasticity (in the short run) and show that the elasticity is driven by employers' social security contributions and personal income taxes and not by employees' social security contributions which is in contrast with the IIP hypothesis. However, Arpaia and Carone (2004) find that in the long-run the 'IIP' is re-established.

The literature on the impact of tax progressivity on pre-tax wages generally distinguishes a 'wage moderation' effect and a 'labor supply' effect. The wage moderation effect occurs because, at a given level of the average tax rate, when the marginal tax rate increases, the price in terms of foregone employment of a higher take-home pay goes up. This allows the union to buy more employment through wage moderation, since any given reduction in the pre-tax wage leads to a smaller change in the after-tax wage. Conversely, tax progressivity may reinforce the income effect over the substitution effect via a labour supply effect, and thus increase

leisure lowering labour supply. Increased progressivity translates into lower unemployment if, and only if, the wage moderation effect prevails over the labour supply effect. Malcomson and Sartor (1987), Holmlund and Kolm (1995) and Lockwood and Manning (1993) provide empirical evidence consistent with such hypothesis showing the prevalence of the wage moderation effect for Italy, Sweden and the UK. Newell and Symons (1993), conversely report that the change in unemployment – occurred between the 1970s and the 1980s in OECD countries – is an increasing function of the change in marginal tax rates over the same period. Other papers in the literature find that wage moderation and labour supply effect balance differently depending on workers' characteristics. Hansen, Pedersen, and Sløk (2000) present empirical evidence, for Danish blue-collar and white-collar workers, which is consistent with a reduction of tax progressivity that raises blue-collar pre-tax wages, while it is statistically insignificant for white-collar wages. Lockwood, Sløk, and Tranaes (2000) obtain somewhat different results as they find that unskilled workers' pre-tax wages are more sensitive to an increase in tax progressivity, as long as there are strong unions and labour supply is sufficiently inelastic. The opposite holds true for skilled workers since they show a more elastic labor supply and are less likely to be unionized. Sørensen (1999) uses a simulation model of the effects of a tax cut on low income earners and shows that tax cuts for low-paid workers are more likely to raise employment and welfare if they are financed through a higher marginal income tax rate. Finally, Sonedda (2009), using Italian data for the period 1974-1995 shows that not only do changes in an individual's supply of working hours matter, but also that changes in the aggregate labor-force participation decisions play a significant role in explaining the relationship between the dynamics of unemployment and labor tax progressivity. The unemployment rate could then be reduced, at least in the short run, by either increasing the marginal payroll tax rate or lowering the marginal personal income tax rate faced by the representative agent.

Other contributions, both theoretical and empirical, investigate the effects of tax progressivity in the presence of different types of labour market imperfections. Brunello and Sonedda (2007) assess the interdependence of union wage claims and argue that a unions' strategic interaction effect reinforces the labour supply effect (against the wage moderation effect) when the degree of centralization of the wage bargain is intermediate – as in the case of industry-level bargaining – while it is irrelevant under decentralized

and fully centralized bargaining. Under the hypothesis of collective wage bargaining, Koskela and Schöb (2007) also show that while a higher tax progression leads to wage moderation, a revenue-neutral increase in tax progressivity has a negative effect on employment when the individual effort is imperfectly observable. Within an efficiency-wage framework, Koskela and Schöb (2009) show instead that an increase in tax progressivity generated by a revenue-neutral tax reform moderates the wages and workers' efforts but has an ambiguous effect on employment that depends on the magnitude of the pre-reform total tax wedge.

3. *Data and stylized facts*

In this study, we rely on country level panel data to test the existence of an employment-enhancing effect of tax progressivity. In practice, we use information drawn from different data sources, for the period 1997-2008 covering 21 OECD countries[4]. The data set combines information on taxation, labour market institutions, indicators of labour market performance and other socio-economic characteristics. Our indicator of labor market performance is the harmonized unemployment rate (UNR) drawn from the OECD economic outlook[5]. The first measure of labour taxation we use is the 'average tax rate' (ATR) for a single individual measured at different points of the earnings distribution, namely: 67% of the average wage, the average wage (i.e. 100%) and 167% of the average wage, provided by the OECD tax database[6]. These encompass income taxation by central and local governments and employers and employees social security. contributions. From the above information, we compute tax retention rates (in percentage points) as follows,

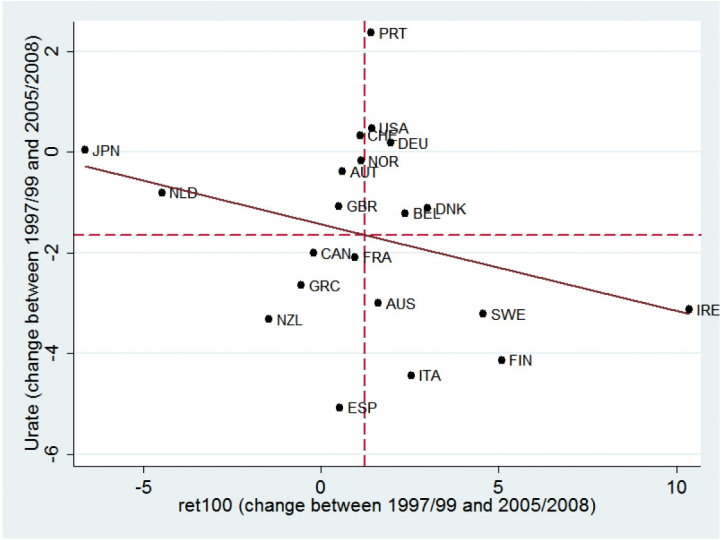
$$\mathbf{ret}j_{i,t} = 1 - \frac{T(j \times AW_{i,t})}{j \times AW_{i,t}} = 1 - ATRj_{i,t} \qquad \textbf{for} \qquad j \in \{67\%, 100\%, 167\%\} \qquad (1)$$

where AWi,t is the average wage in country i and year t. The first measure of taxation we consider is the natural logarithm of the retention rate at the

[4] The countries we consider are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States.
[5] The OECD harmonized unemployment rate is defined as the number of unemployed persons divided by the labour force.
[6] Notice that these indicators are harmonised over time and across OECD countries.

average wage, *ln(ret100)*, which we use as proxy of the average tax burden on labour. To get an idea of the relationship between the average burden of taxation on labour and the unemployment, in Figure 1 we plot the change in the retention rate *(ret100)* against the change in the unemployment rate *(Urate)* between the 1997-1999 and the 2005-2008 sub-periods. The figure shows a negative correlation between tax retention rates and unemployment rates, which is consistent with the positive relationship found in empirical studies between labour taxation and unemployment (see e.g. Layard and Nickell, 1999). In other words, countries that reduced their labour taxation (i.e. increasing the average retention rate) – such as Sweden, Finland, or Ireland in the sample period considered – experienced a significant reduction in unemployment. Conversely, unemployment is found to be persistent in countries that did not reduce, or even increased, their labor taxes (e.g. Japan, Netherlands, or some Mediterranean countries).

Fig. 1 – *Average taxation and unemployment*



Note: tax retention rate at the average wage *(ret100)* and unemployment rate *(Urate)* by country. Changes over the 1997-2008 periods.

(Sources: OECD Tax Database, OECD Taxing wages and authors' calculation)

The second measure we use is the tax progressivity indicator, based on the global 'coefficient of residual income progression' (CRIP) as defined by Lehmann *et al.* (2015). In practice we measure tax progressivity, as follows:

$$\Psi_{w_0}^{w_1} \equiv \ln\left(\frac{1-\frac{T(w_1)}{w_1}}{1-\frac{T(w_0)}{w_0}}\right) \qquad (2)$$

Where $T(w_1)$ and $T(w_0)$ are the average tax rates at wage levels w1 and w0, respectively. Accordingly, this global CRIP is equal to the (log of) the ratio of the retention rates at wages levels w_1 and w_0 with $w_1 > w_0$. As discussed in Lehmann *et al.* (2015), the choice of the global CRIP is robust to a number of measurement issues (e.g. wage measurement error that may cause shifts between tax brackets), which may arise using a local CRIP definition, as the latter mainly captures progressivity in the neighbourhood of a given wage level.

In our case w_0 and w_1 are measured at 67% and 167% of the average wage, respectively, and we define the tax progressivity indicator as the logarithm of the ratio of retention rates at 67% and 167% of the average wage, *ln(ret67i,t/ret167i,t)*. This tax progressivity indicator is the inverse of the global CRIP, as in (2)[7].

Table 1 reports country means and standard deviations of the average retention rate, ret100, in column [1], and the tax progressivity indicator, *ret67/ret167* in column [2][8]. In column [3], we use the tax progressivity indicator to rank countries in our sample according to the intensity of redistributive labor taxation in column. Generally speaking, Continental and Nordic European countries stand out for the high intensity of redistributive labor taxation, with low average retention rates (below the OECD average of 62%), and high propensity to redistribute (above the OECD average). Conversely, Anglo-Saxon, Mediterranean European, and non EU countries display relatively low intensity of redistributive taxation, with large retention rates (well above 60%) and low levels of progressivity.

[7] Notice that, as discussed in Lehmann *et al.* (2015), there are no theoretical reasons for choosing an inverse, instead of a direct CRIP measure for the tax progressivity indicator. However, since a rise in the global CRIP is associated with a less progressive tax schedule, the interpretation of empirical results is more straightforward when the inverse CRIP measure is used.

[8] We computed an aggregate index, which is increasing in the average level of taxation (thus decreasing with *ret100*) and increasing in the tax progressivity index.

Table 1 – *Intensity of redistributive taxation in OECD countries*

Country	average retention rate [1]	progressivity index [2]	country ranking [3]
Australia	71.3 (0.97)	1.175 (0.029)	13
Austria	54.8 (0.47)	1.214 (0.025)	5
Belgium	44.7 (1.07)	1.312 (0.014)	1
Canada	68.2 (0.59)	1.097 (0.019)	18
Denmark	57.2 (1.39)	1.214 (0.006)	6
Finland	54.6 (2.22)	1.223 (0.004)	4
France	52.2 (0.62)	1.287 (0.078)	2
Germany	48.9 (0.91)	1.204 (0.027)	3
Greece	64.3 (0.85)	1.101 (0.018)	15
Ireland	73.5 (4.38)	1.316 (0.028)	7
Italy	53.2 (1.62)	1.155 (0.022)	9
Japan	74.3 (3.21)	1.052 (0.005)	21
Netherlands	56.1 (4.86)	1.071 (0.029)	12
New Zealand	79.3 (1.05)	1.098 (0.019)	20
Norway	63.2 (0.48)	1.167 (0.013)	10
Portugal	67.2 (0.64)	1.139 (0.003)	14
Spain	62 (0.57)	1.137 (0.013)	11
Sweden	51.9 (2.07)	1.147 (0.019)	8
Switzerland	70.7 (0.49)	1.104 (0.004)	19
UK	69.1 (0.86)	1.114 (0.017)	16
United States	69.9 (0.69)	1.118 (0.004)	17
Total	62.2 (9.56)	1.164 (0.078)	

Notes: country means and standard deviations in parenthesis. Progressivity index in column [2] is defined as *ret67/ret167*. Ranking in column [3] is based on an aggregate indicator of redistributive taxation computed as a decreasing function of *ret100* and an increasing function of the progressivity index.

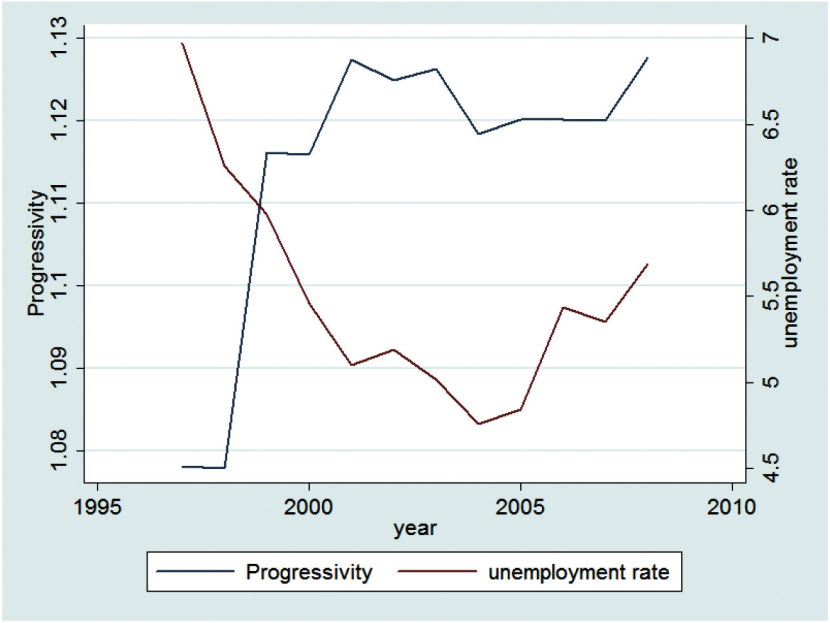
Before turning to the empirical analysis, we discuss a number of case studies selecting countries that experienced substantial tax reforms over the sample period considered.

3.1 *Case studies*

The United Kingdom

In the UK, the Blair government in the late nineties reformed the National Insurance Contributions (NICs) and the Income Tax. In fact, until April 1999, below a low earning limit, no NICs were due, implying that there was a jump in contributions at that level (called the 'entry rate'). In April 1999, the 'entry rate' was abolished and the starting rate of the income tax was cut from 20% to 10%. According to Adam *et al.* (2010), in 2000-2001 nearly 3 million people were liable for the income tax at this reduced rate. These reforms induced a particular rise of the retention rate at the 67% level which, as can be seen in Figure 2, led to a sharp increase in the progressivity index. The 10% starting rate band was increased above indexation starting from April 2001, which led to a further rise in the progressivity index. In 2003, the government raised NICs and froze personal allowance, which led to a small decrease in progressivity. Overall, the reforms led to a persistent increase in progressivity over the sample period, such an increase in progressivity was associated to a steady decrease in the unemployment rate of about 1.5 percentage points (i.e. from 7% in 1997 to about 5.5% in 2008).

Fig. 2 – *Tax progressivity and unemployment: the case of UK*



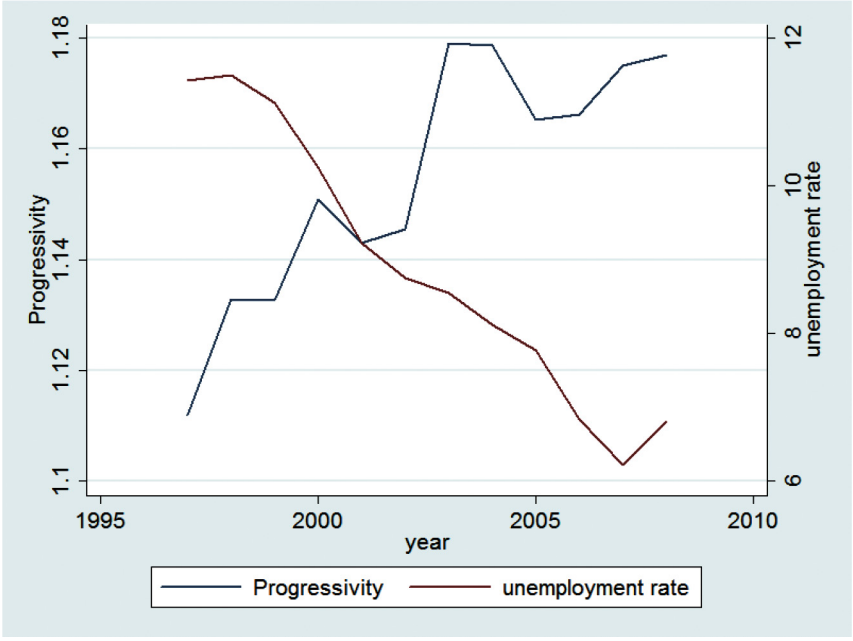
(Notes: authors' calculations on OECD data)

Italy

In Italy, a steady increase in tax progressivity occurred over the sample period. This was the result of successive reforms introduced by governments of different political colours, – i.e. the consecutive left-wing governments by Prodi, D'Alema and Amato, the right-wing Berlusconi government, and the second Prodi government (Baldini *et al.* 2006). In 1998-2000, the Prodi and D'Alema governments engaged in a comprehensive reorganisation of the Personal Income Tax (PIT) system. They reduced the number of tax brackets from 7 to 5, changed the tax rates and introduced a set of progressive tax credits. During the 2001-2006 legislature, the Berlusconi government carried out a structural reform of PIT, balancing progressivity and neutrality objectives. In 2003, it reduced the statutory tax rates on medium and low incomes, replaced tax credits with a 'no-tax area' and protection clauses for specific tax payer categories. In 2006, the new Prodi government partly restored the old system – i.e. increased the number of tax brackets from 4 to 5, and replaced the 'no-tax area' by the progressive tax

credits. The government also put special effort in the reduction of employer's Social Security Contributions. Overall, reforms carried out during this period increased the retention rate at the 67% of the average wage and decreased the retention rate at the 167% of the average wage, inducing a steady increase in the progressivity[9]. As shown in Figure 3, the increase in tax progressivity also resulted in a reduction in unemployment of about 5 percentage points, from about 12% in 1997 to 7% in 2008.

Fig. 3 – *Tax progressivity and unemployment: the case of Italy*



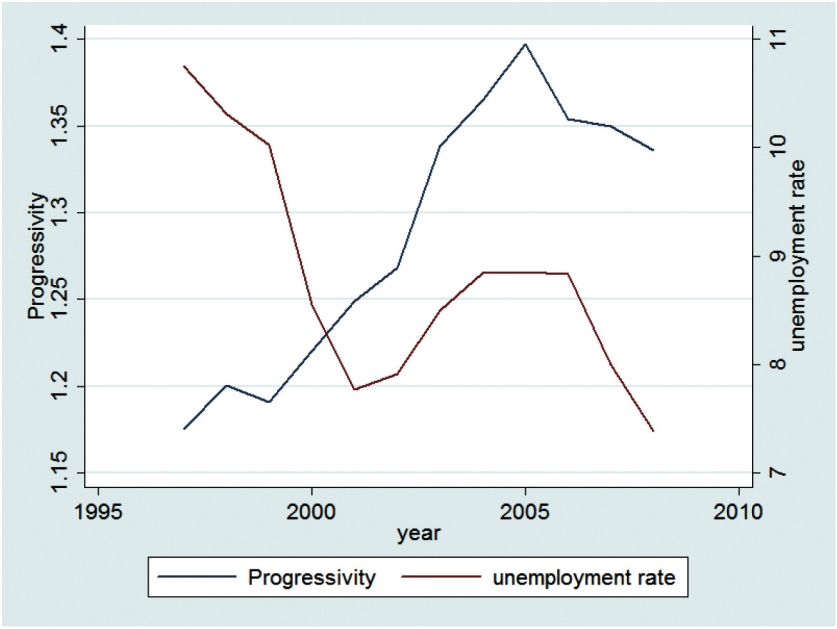
(Notes: authors' calculations on OECD data)

[9] Some minor reforms carried out during the period went in the opposite direction: in 2001, the Amato government introduced tax credits for medium-high incomes, which considerably increased retention rates at 167% of the average wage (Baldini *et al.* 2006, Tondani and Mancini 2006). In 2005, the Berlusconi government further reduced the number of tax brackets from 5 to 4, revised the tax rates and introduced new exemptions for medium and high incomes. These amendments reduced the retention rates at 67% of the average wage and increased retention rates at 167% of the average wage, which reduced the degree of progressivity with respect to 2004 (see also Tondani and Mancini, 2006).

France

France also experienced a considerable increase in progressivity over the sample period. This trend, however, was mainly the consequence of substantial cuts on employers social security contributions for workers paid at the minimum wage: a policy implemented in France since 1993 (see Kramarz and Philippon 2001, Bunel and L'Horty 2012, Lehmann *et al.* 2013, for an overview and evaluations of these reforms). While the employers' social security contributions rate is typically around 40% of the posted wage in France, this rate was only 22% in 1997 and 14% since 2005 for workers paid at the minimum wage level, while it progressively vanishes at 1.6 times the minimum wage. France also implemented a working tax credit targeted at low income earners called the *Prime pour l'emploi* (PPE). The PPE was launched in 2001 and progressively extended through the period (Lehmann *et al.* 2013). Unlike the EITC in the US or the WFTC in the UK, the French PPE was also generous for singles without kids. These reforms resulted in a rise of tax progressivity, mostly triggered by larger retention rates for singles paid 67% of the average wage. As shown in Figure 4 during the same period France also experienced a 3.5 percentage points reduction in the unemployment rate, from about 11% in 1997 to 7.5% in 2008.

Fig. 4 – *Tax progressivity and unemployment: the case of France*



(Notes: authors' calculations on OECD data)

4. *The Empirical strategy*

We use information drawn from different data sources, over the period 1997-2008 and for 21 OECD countries. As discussed above, our measures of labour taxation are based on average tax rates (ATR) of single individuals at different points of the earnings distribution, namely: 67% of the average wage, the average wage (i.e. 100%) and 167% of the average wage, provided by the OECD tax database[10]. They encompass income taxation by central and local governments and employers and employees social security contributions. From the above information, we compute the tax retention rates – as shown in (1) –, and the tax progressivity indicator *ln(ret67/ret167)* – i.e. the inverse of the global CRIP measure as in

[10] These indicators are harmonized over time and across OECD countries and constructed using information drawn from the OECD Tax database and extended the relevant time series back to 1997 using information from OECD Taxing Wages. Details on the two database and their harmonization are given in Lehmann *et al.* (2015).

(2) above. In practice, we adopt the following specification:

$$U_{it} = b \ln(ret100_{i,t-1}) + c \ln(ret67_{i,t-1}/ret167_{i,t-1}) + \mathbf{d}\,\mathbf{Z_{i,t-1}} + \mathbf{e}\,\mathbf{X_{i,t-1}} + \delta_i + \lambda_t + \varepsilon_{it}. \quad (3)$$

where U_{it} is the unemployment rate of country i and year t. The vector includes a baseline set of labour market institutions, namely, the average unemployment benefits replacement rate, union density, and an index of the degree of coordination in wage bargaining. The vector includes cyclical control variables, such as the output gap, the degree of trade openness, and the long-term interest rate on government's bonds. Finally, and indicate, respectively, country and time fixed effects, while is the error term. Our parameters of interest are the estimates of coefficients b and c on our tax indicators. As tax reforms take time to produce their effects, we enter the tax indicators with a one-year lag. According to our theoretical predictions we expect both a rise in the retention rate (a decrease in the average tax rate) and a more progressive tax schedule to reduce the unemployment rate (i.e. $b<0$, and $c<0$).

Table 2 – *Labour taxation, progressivity and the unemployment rate*

	[1]	[2]	[3]	[4]
ln(ret100)	-1.96	-4.06*	-4.96*	-6.31**
	(2.27)	(2.29)	(2.54)	(2.65)
ln(ret67/ret167)				-6.23**
				(2.61)
Output gap		-0.41***	-0.42***	-0.42***
		(0.07)	(0.07)	(0.06)
Trade-to-GDP ratio		0.04***	0.04***	0.04***
		(0.01)	(0.01)	(0.01)
Long-term interest rate		-0.21	-0.24*	-0.29**
		(0.15)	(0.13)	(0.13)
Replacement rate			0.04	0.05*
			(0.02)	(0.03)
Union density			0.10*	0.12**
			(0.06)	(0.06)
Wage coordination			-0.45**	-0.46**
			(0.19)	(0.19)
Constant	15.32	24.17**	25.50**	31.58***
	(9.66)	(9.88)	(11.22)	(11.72)
R sq.	0.86	0.89	0.89	0.90
N	231	231	231	231

Notes: OLS Estimates. The dependent variable is the standardised unemployment rate.
All specifications also include country-fixed effects, and time-fixed effects.
Robust standard errors in parentheses. Significance levels: *: 10%, **: 5%, ***: 1%

5. *Results*

Table 2 presents the econometric results. Estimates are performed by Ordinary Least Squares with robust standard errors in parentheses. Specification in column [1] includes only the average retention rate, plus country and time fixed effects. In column [2], we also add the output gap and the long-term interest rate on government bonds to control for the confounding effect of the business and the economic cycle, and the trade-to-GDP ratio to account for

the changing patterns of countries' exposure to international trade and degree of competitiveness. In column [3], the specification further includes a set of labor market institutions, such as the unemployment benefits' replacement rate, union density and an aggregate indicator of coordination in wage bargaining. These are typically regarded as factors that affect workers' outside option and bargaining power, respectively, thus determining labor market rigidities that induce unemployment in the economy. Estimates in this column, are in line with the baseline specification adopted in the unemployment literature (Nickell and Layard, 1999; Bassanini and Duval, 2009. See Arpaia and Mourre, 2010 for a review) and suggest a positive association between labour taxation and unemployment, statistically significant at conventional levels. Note that estimates in column [3] may hide an unemployment effect triggered by the shift of the tax burden along the wage distribution, thus in column [4] we also include the tax progressivity indicator to account for this effect. This is our preferred specification, which we will use to assess the association of taxation with unemployment. Results show that both the average retention rate and the progressivity index are negatively associated with the unemployment rate, in line with our theoretical priors, and the coefficients are statistically significant. In terms of economic magnitude, our results imply that a one percentage point increase in the average retention rate (i.e. one percentage point reduction in the average tax wedge on labour) implies a reduction in the unemployment rate – for the average OECD country – between 0.07 (Column 2) and 0.12 (Column 5) percentage points (i.e. an order of magnitude that is in line with the estimates reported in the literature, see Arpaia and Mourre, 2010).

As far as progressivity is concerned, to get a sense of an increase in progressivity we consider the effect of a half-percentage point decrease in the average tax rate at 67% of the average wage, jointly with a half-percentage point increase in the average tax rate at 167% of the average wage. Such a tax reform in our data implies a rise in the tax progressivity indicator by 0.016 points, which is associated to a reduction in unemployment of approximately 0.095 percentage points (Column 4)[11].

These results suggest that one percentage point decrease in the labour tax wedge has an impact on unemployment, whose order of magnitude is on the lower bound of the range identified by previous findings which are

[11] The mean of ret100 over the sample is 62.19%. So, from estimates in column [4], when ret100 rises by one percentage point, the change in the unemployment rate amounts to -6.31/ 62.19 *1 = 0.101 percentage points. The mean of ret67 and ret167 over the sample are respectively 66.35%, and 57.42%. The combined effect of a 0.5 percentage points shift from 67% to 167% of average wage on unemployment is -6.23* (0.5/57.4+0.5/66.4)=-0.099.

between 0.1 (Nickell *et al.*, 2005) and 0.5 (Daveri and Tabellini (2000) for Continental-European countries). Also, these estimates suggest that a similar favourable effect may be obtained by keeping the average tax wedge on labour constant, and shifting the tax burden from lower to higher incomes.

In Table 3, we perform a number of sensitivity exercises on our preferred specification (i.e. Table 2, column [4]). In Row 1, we include in the set of institutional controls the OECD Index of Employment Protection Legislation (EPL), as this is likely to affect workers' flows in/out of unemployment. In Row 2, we include the OECD indicator of Active Labor Market Policies (ALMP), which may affect the extent of workers' participation, and their probability of finding a job. In Row 3, we add a control for the change in inflation, while in Row 4 we replace the time dummies with a time trend. In row 5, we exclude from the analysis some countries which show, over the sample period, large changes in the structure of taxation, namely: the Netherlands, Japan, and Ireland. Finally, to capture the medium-run effects and to partially smooth the year-to-year variations, we replicate the estimation using three years averages, which implies a fall in the number of observations from 231 to 84. All these robustness checks confirm the baseline set of results, even though in some cases the coefficients are estimated with a lower precision.

Table 3 – *Sensitivity analysis*

	Unemployment rate			
	ln(ret100)	ln(ret67/ret167)	R^2	Observations
1. control for EPL	-7.35*** (2.74)	-6.17** (2.56)	0.90	231
2. control for ALMP	-6.30** (2.67)	-6.14** (2.58)	0.90	231
3. control change in inflation	-6.84** (2.72)	-6.15** (2.58)	0.90	231
4. include time trend	-5.85** (2.70)	-6.80** (2.97)	0.88	231
5. exclude Netherlands, Ireland, Japan	-6.31** (2.65)	-6.23** (2.61)	0.90	231
6. Three years averages	-8.94* (4.53)	-7.08 (4.63)	0.93	84

Notes: OLS Estimates. The dependant variable is the standardised unemployment rate.
All specifications also include country-fixed effects, and time-fixed effects.
Robust standard errors in parentheses. Significance levels: *: 10%, **: 5%, ***: 1%

6. *Conclusions and policy implications*

In this paper we have investigated the association between labour income taxation and unemployment. While theoretical models in the literature are consistent in the prediction that tax progressivity increases employment and reduces unemployment, there are only few empirical studies that have investigated the issue of progressivity and consensus on the likely effects on labour market performance is lacking. The expected effect of progressivity on employment, in theoretical models, comes from a 'wage moderating effect' that boosts the labour demand and from a 'composition effect' since it shifts the tax burden away from groups of workers whose employment is the most responsive to taxation. Our empirical analysis was conducted using a panel data of 21 OECD countries for the 1997–2008 period. Two indicators of labour income taxation are at the core of the empirical analysis: a standard measure of income tax wedge computed for a single individual

at the average wage, and a new measure of global tax progressivity based on a comparison between the fiscal wedges at 67 and 167% of the average wage. The main finding is that, while the average tax burden is negatively correlated with labour market performance, tax progressivity can be beneficial for both employment and unemployment, increasing the former and reducing the latter. The above evidence suggest that governments when designing fiscal consolidation policies should take into account the efficiency gains of a more progressive tax schedule – particularly in countries with low tax progressivity – on labour market performance *via* a positive effect on employment and a reduction in unemployment. This is likely to be particularly relevant for countries with high public debt to GDP ratio and high unemployment rates, such it is the case for many European countries after the financial crisis, that are likely to be constrained in the implementation of fiscal policies by the EU fiscal compact.

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Robert Waldmann

Discussion of Claudio Lucifora and Simone Moriconi, Progressive Taxation and Unemployment: Evidence from OECD countries[1]

Theory

Based partly on their work presented in Lehmann, Lucifora, Moriconi and Van der Linden (2014) Claudio Lucifora and Simone Moriconi argue that progressive taxation can lead to higher employment by causing workers to moderate their wage demands when bargaining over wages and effort. The intuition is that, with more progressive wage taxation, firms and workers find it advantageous to agree to lower effort and lower wages. This intuition is confirmed by rigorous analysis of a Diamond-Mortensen-Pissarides search model (Diamond 1982; Mortensen and Pissarides 1999) with endogenous observable effort.

I think the theoretical analysis can be extended in two ways: consideration of a variable capital labour ratio and consideration of on-the-job search.

As is standard in the literature, each firm is assumed to hire no more than one worker – the firms in the model are jobs not enterprises. This extreme assumption is generally considered to be innocuous because it is assumed that, even if one enterprise hires many workers, the interaction with each worker can be considered separately. Two issues are raised: how do non labour costs depend on work effort and how does collective bargaining cause effects of policy different from those found in the model with individual bargaining.

[1] I would like to thank Marco Fioramanti and Elena Granaglia for helpful comments.

Costs other than labour costs are modelled as a flow of search costs paid by firms with job vacancies – this includes not only the cost of search as such but also the user cost of capital which is idle because no worker is employed. When a (realistic) firm with multiple employees is considered, it is implicitly assumed that the amount of capital required depends only on the number of workers and not on work effort. If work effort includes hours worked (and not just a variable pace of work) this might not be a valid assumption.

Another way of putting this is that progressive taxation will encourage job sharing, with more workers each working fewer hours, if this is technologically feasible. In the extreme implausible case, which is standard in macroeconomic models, the average and marginal products of labour depend only on the ratio of total hours worked. In the matching model, this would require identification of work effort with hours worked and the assumption that the cost of creating a vacancy (both the capital investment and the firm's search costs) is proportional to the amount a newly hired worker will work.

In this case, this alternative model is interesting, because the basic conclusion – that progressive taxation causes higher employment and lower effort, is markedly strengthened. Any increase in non labour costs caused by increased work effort increases the effect of work effort on employment.

Interestingly in the (larger) empirical section, Lucifora and Moriconi note that wage bargaining in almost all of the 21 OECD countries they consider is principally collective and include union density and an index of coordination in wage bargaining as control. It is certainly possible to analyze the effects of progressive taxation in models of collective bargaining. In fact the classic MacDonald Solow (1981) article can be interpreted as an analysis of progressive taxation (although they described it as a model of tax based incomes policies). The logic is similar to the logic of this paper, but the analysis is different. I don't think that a modified MacDonald Solow model with endogenous effort would be qualitatively different from the search model with endogenous effort. It is clear that progressive taxation causes higher output for a wider range of parameters (for the reasons mentioned in the paragraph above).

I think a more interesting modification of the model would be consideration of on-the-job search. As is standard in the literature, it is assumed that workers do not seek alternative jobs, so each worker matches with only one firm. In some countries, there is a high rate of employment to employment transitions (Akerlof, Rose and Yellen, 1988). This is a fairly important issue with fairly clear implications for the effects of tax progressivity.

First consider a model in which workers have the same productivity in any job. For even greater simplicity, assume that work effort is exogenous (so aside from on the job search the model is a standard search model).

In this case, on the job search is pure rent seeking – production can't be increased if a worker finds a second job. It is necessary to model bargaining in the case in which a worker is choosing between two potential employers (the current employer and an alternative employer). The natural simplest model is that of the so called glove game in which the worker extracts the entire surplus due to the matches. Even if the firms make take it or leave it offers, the only Nash equilibrium occurs when each offers the worker the entire surplus.

This means that the risk to a firm that a worker will find an alternative job offer is identical to the risk of an exogenous separation. Even if the worker ends up staying with the current employer, the employer will earn zero profits. This means that it is easy to calculate the effect of on the job search on the value to the firm of a match and on equilibrium market tightness.

Assume that workers can choose different intensities of on the job search with a cost of search effort and a matching probability. Assume that the probability of matching is concave in effort and satisfies the Inada condition so there is an internal solution. Since the purpose of on the job search is to obtain a higher wage, the intensity of on the job search declines in the marginal tax rate (averaged over the range from the Nash bargained wage to the entire surplus). The result of lower effort and lower wages also holds for on the job search effort. However, the effects on output, employment and welfare are completely different.

In the model sketched above, on the job search is pure rent seeking. An increase in the progressivity of the tax will unambiguously cause higher employment and will not affect output per employed worker. This means that in the simplest model with on the job search, increased tax progressivity unambiguously causes increased output.

Were endogenous work effort to be reintroduced, tax progressivity would cause both lower work effort and lower on the job search effort. This means the overall impact on output is ambiguous.

In a more sophisticated model of on the job search, workers' productivity differs at different firms depending on the quality of the match. In this case on the job search is not pure rent seeking. It causes improved matches and higher output. Again, this makes the sign of the effect of tax progressivity on output ambiguous.

Finally (and somewhat tangentially) on the job search reduces the duration of employment relationships. This complicates the hold-up problem

which causes lower than optimal investment in training (Ricci and Waldmann 2015). This is another mechanism through which progressive taxation can cause increased production.

The result of both the rigorous theoretical section of 'Tax Wedge, Tax Progressivity and the Impact on Unemployment' and the informal theoretical discussion here is, as usual, that theory gives only modest guidance to the econometrician – there is no clear presumption about the sign of the effect of tax progressivity on GDP.

Empirics

As the Lucifora and Moricone note, it is odd that such a vast majority of empirical work on taxation and employment is based on individual micro-data. The general equilibrium issues raised by the theoretical section of the paper can't be addressed using only micro data. To address these issues, it is necessary to use the many fewer aggregate data points which are available – the paper uses data on 21 OECD countries from 1997 through 2008.

The empirical section of the paper adds an index of progressivity – the logarithm of the ratio of retention rates at 67% and 167% of the average wage, to a fairly standard model of aggregate unemployment which includes the retention rate at average income (that is the tax wedge). As expected given earlier research, a lower tax wedge is associated with lower unemployment and higher employment. As predicted given the theoretical model, given the tax wedge higher progressivity is associated with lower unemployment and higher employment. These results are quite robust.

Lucifora and Moriconi stress the possible bias in the OLS results due to endogenous tax rates. They instrument the tax variables with three instruments: a measure of fiscal consolidation estimated by Devries et al. (2011) (taxconsol) a standard index of left/right orientation of governments (leftism) and the share of people who report no trust in the civil service (notrustcivil).

There are reasons for concern about each of these instruments, even though tests of over identifying restrictions do not reject the null that they are valid instruments. It is reassuring that the sign and significance of OLS and IV estimates are the same. However, the IV estimated coefficients are much larger than the OLS coefficients. The absence of a plausible explanation of why OLS estimates would be biased towards zero must increase concern about the instruments.

Taxconsol is not available for four countries – Greece, New Zealand,

Norway and Switzerland. Except for a robustness check, the variable is set to zero. Since other countries enacted tax increases, this could be a problem. The variables are imputed for those four countries in a reassuring robustness check. I think an additional robustness check of comparing OLS and IV for the subset of 17 countries would be worth reporting.

OLS and IV regressions including the tax wedge but not tax progressivity show much larger coefficients when the tax wedge is instrumented by taxconsol and leftism. Tax consolidation itself is endogenous. An important point is that approaching the Maastricht treaty deadline is strongly associated with tax consolidation but should not have caused high unemployment or low employment. However, disappointing growth causes persistent deficits and eventually tax consolidation. Importantly disappointing growth may be chronic, not a recession, and may not be captured by the output gap control variable. The fact that instrumenting with taxconsol and leftism causes a much larger coefficient on the tax wedge seems to me to cast more doubt on the IV than on the OLS estimates. Here it is very important to know how good an instrument leftism is – the tests of overidentifying restrictions rely on the difference between the reduced form regression coefficient of the dependent variable on taxconsol and leftism. Both must be strong instruments for the test to have reasonable power.

The progressivity index is included in a regression in which the tax wedge is instrumented, then there is a regression in which both are instrumented and notrustcivil is added to the list of instruments.

Again it is striking that the coefficient on progressivity is much larger when the variable is instrumented. Again it isn't obvious which estimate is more trustworthy.

Taxconsol is obviously correlated with the tax wedge. It may also be correlated with the progressivity index (first state coefficients are not reported). If it is, there has to be concern about whether the association depends on the exact form of the progressivity index; given the actual history of tax systems, it is clear that identification would be achieved in large part by the choice of the levels 67% and 167%. For this reason, it would be interesting to see how important correlation of taxconsol and the progressivity index is to the results. This can be done by instrumenting only tax progressivity and instrumenting it only with leftism and notrustcivil.

Leftism (of the majority coalition) may be correlated with leftism in industrial relations and increased union militancy should cause higher unemployment according to the model which focuses on wage bargaining.

This would be a much greater concern if the data set included more 20th century observations. I tend to guess that this isn't an important issue in the sample period – I am more concerned that the centre left and centre right were so similar in those years that the variable is a weak instrument. However, it seems fairly easy to include the ratio of hours of work lost due to strikes to total hours as an additional control variable.

It is also conceivable that leftism is correlated with higher employment through the Keynesian effects of higher government expenditures. The inclusion of the output gap as a control variable is reassuring. The magnitude of the coefficient on progressivity increases by roughly one standard error when the output gap is excluded from the regression. This is a statistically insignificant hint that the conceivable problem is a problem.

No trust civil may be correlated with measurement error. It is almost certainly correlated with the scale of the underground economy and so might be correlated with overestimates of unemployment and underestimates of unemployment. If this is a problem, the IV estimates of coefficients on tax progressivity will be biased more than the OLS estimates. The J-tests of overidentifying restrictions could detect this problem, but, again they depend on leftism being highly partially correlated with the tax variables.

In general, the highly novel conclusion that tax progressivity causes lower unemployment and higher employment is strongly supported by the empirical work. It is easy to think of objections to each single regression but the robust pattern over many different specifications is quite convincing.

The data contain some evidence that, as expected, higher tax progressivity corresponds to lower effort. The OLS and IV coefficients of GDP per employed worker on tax progressivity is negative and the IV coefficient is statistically significant. All concerns about the instruments discussed above are relevant to this regression too.

One aspect of the theoretical model is that effort is an abstract concept which doesn't correspond to an observable variable. Clearly at least one aspect of work effort – hours worked – can be measured. The model has a fairly clear implication that, across countries, more progressive taxation should be correlated with lower average hours worked. In fact, this is observed (Prescott 2004).

If it is assumed that effort is observable, it is easy to generalize the model to separate total effort into hours worked and effort per hour as this division matters for worker welfare but not output. Firms and workers would agree on the efficient pace of work which minimizes worker disutility per

unit of output. The effect of tax progressivity on output per hour worked is, in general, ambiguous. However, for the most obvious utility functions, increased progressivity causes lower output per hour. This weak suggestion of a slightly more general model can be tested given available data. It seems potentially worth the effort (barely).

The data correspond to the non implication that the effect of tax progressivity on output is ambiguous – the OLS and IV estimates of the effect have opposite signs and neither is statistically significant. This empirical result is reminiscent of the conclusions of a related literature. There are larger data sets of the top marginal tax rate on labour income. Top rates increase both in the average tax wedge and in progressivity. They are not correlated with the growth of GDP per capita in standard growth regressions. It happens to be true that higher top marginal tax rates within the range observed in OECD countries in the 21st century are (weakly) partially correlated with higher per capita GDP growth (Milasi 2013). This corresponds to the sign of the statistically insignificant coefficient on tax progressivity.

The weaker empirical results on productivity and output correspond both to the theoretical model and to the related empirical literature.

In sum there is a simple theoretical argument, which is actually strengthened when some key assumptions are relaxed, that higher tax progressivity causes lower unemployment and higher employment. This prediction is strongly supported by empirical analysis of aggregate data.

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Ernesto Lorenzo Felli[1]

An uchronia tale – What the economic growth would have been in Italy had the tax structure changed in the eighties

1. *Introduction*

One of the oldest and still controversial issue in the economic analysis of taxation (and consequently of discretional fiscal policy), both on theoretical and empirical grounds, is the appropriate mix of income and consumption taxes which maximizes welfare, and whether and how it affects economic growth. More recently, the issue of a revenue neutral shift from direct to indirect taxation has become a key-issue of the policy discussion. Especially in Europe, where the fiscal consolidation is likely to turn into pro-cyclical fiscal policies, and thus the neutral tax shift is viewed as a potential mean to maintain fiscal discipline while preserving long term growth, and, possibly, giving some impulse to short run aggregate demand.

In what follows I expose the main results of a research program aimed to assess, theoretically and empirically, the macroeconomic effects of switching the tax burden from productive inputs to consumption (see Felli *et al.,* 2011). The analysis is limited to Italy, but we shall extend both coverage and methodology.

The theoretical reference framework is an endogenous growth model of the AK type with elastic labor supply (see Turnovsky 2000, for a reference). To explore the impact of tax composition on Italy economic performance, a dynamic stochastic structural macroeconomic model (in the Cowles Commission tradition) of the Italian economy is exploited. This model, called Merman (Felli and Gerli, 2002), is centered around a supply block where an endogenous TFP function of causal order zero is

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formulated and estimated. In the estimated equation (displaying an error correction specification), a tax ratio variable, representing the tax structure in Italy, and expressed as the fraction of direct to indirect taxes, is comprised among the regressors (human capital, labor market rules, and other institutional and policy factors). The results of the simulations based on Italian official national accounts provide an argument for the reduction of the direct to indirect tax ratio. Indeed, differently from previous studies that find only a slight link between taxes and growth, our investigation reveals that even a revenue neutral switch from direct to indirect taxes is likely to generate efficiency gains, which lead to higher growth rates of *per capita* GDP. I argue that, in this special case of rerunning history simulations, the basic objection of the Lucas critique to structural econometrics does not apply, or at least its scope is of second order.

The channel through which a change in the tax composition affects economic growth can be described as follows. Ceteris paribus, that is keeping the government spending unchanged, a reduction in income tax (direct taxation), completely financed through an increase in consumption tax (indirect taxes), induces a net increase in labor supply – the lower wage tax increases work effort – and consequently in employment, which in turn raises the productivity of capital and implies a higher equilibrium growth rate. In other words, the positive effect on the growth rate of a lower wage tax dominates the opposite effect of a higher consumption tax. In the theoretical model (see *Appendix*), this result crucially depends on the relative size of two parameters: the fraction of time devoted (allocated) to leisure, l, and the leisure 'elasticity' in the individual utility function, ψ , which measures how much leisure affects the individual welfare. Provided that l is of a sizeable amount (as it happens in the real world), the income (wage) tax effect prevails, so that the proposed tax shift reduces leisure and stimulates growth. As it is shown in the *Appendix* (Proof 5), the inequality, ensuring that the effect of the income tax reduction dominates, must hold to avoid an explosive growth path, and in fact it is satisfied along the balanced growth path, given the transversality condition and the non-increasing returns to scale of the production function. Numerical solutions of the (theoretical) model confirm this result. Even Turnovsky (2000), in a model belonging to the same class of that illustrated in the *Appendix*, performs numerical solutions of his model and finds a strong support for the dominance of the income tax effect – he parametrizes $l = 0.77$, a plausible value given that the observed yearly fraction on total hours devoted to work is around 2000/8760 = 0.23 (hence $l = 0.77$), so that ψ should

have an implausible high size (e.g. 3.4) in order to be at least equal to *l*.

The paper is organized as follows. In the following section 2, I briefly review some results of the theoretical and empirical literature on the relationship between the tax structure and the economic performance. In section 3 the simulation exercise is outlined. Section 4 presents the main results and section 5 concludes. An appendix exposing the theoretical model follows.

2. *Theoretical and Empirical Background*

A broad class of endogenous growth models, either of the Lucas' type (adding human capital to the neoclassical prototype) or the AK type, found that the tax structure, and thus fiscal policy, matter for economic growth. Among others, I refer here only to a limited number of theoretical papers where there is some indication that a switch from direct to indirect taxation could have some positive growth rate effects: King and Rebelo (1990), Pecorino (1993), Rebelo and Stokey (1995), Milesi-Ferretti and Roubini (1998), Coleman (2000), Turnovsky (2000).

Empirical references on the same issue are: Dalby (2001), European Commission (2006), Martinez-Vazquez, Vulovic and Liu (2009). A recent survey of empirical analyses on tax structure and growth is Shinohara (2014).

On a policy standpoint, is to be mentioned the recent short paper of Martin Feldstein (2015). Feldstein strongly argues for a fiscal policy focused on revenue neutral fiscal incentives, enacted by the individual Eurozone countries, to end the Euro crisis. Feldstein, which seems more concerned on the demand side effects of a given tax shift, writes:

> «an individual Eurozone country could commit to raise its value added tax rate by two percentage points a year for the next five years with the extra revenue returned in the form of lower income tax rates. The prospect of future increases in the value added tax would stimulate consumers to spend before prices rise and would also raise the rate of consumer price inflation».

The rerunning-history simulations I present here show that the tax structure shock determines a transitory demand effect (accompanied by a modest pressure on the inflation rate) but a permanent effect on the 'equilibrium' growth rate.

3. *Rerunning history: modeling the tax shift*

Given the theoretical reference model (closed economy), I do not take into account fiscal devaluation issues[2]. The simulation exercise is modeled so as to test the macroeconomic effects of a revenue neutral shift from income taxes to consumption taxes. The shock occurs in 1980 and is one time-shock: it is represented by a decrease of around 1.3% of Gdp in direct taxes and a correspondent increase in indirect taxes – see Graphs 1 and 2. Therefore, even the tax ratio, defined as the fraction of direct taxes to indirect taxes, decreases. In the Merman model (Felli and Gerli, 2002), the tax revenues are endogenous and the tax rates are the implicit values obtained from these revenues and from the estimated taxable base. Then the tax ratio is endogenous too. This of course raises a problem for our exercise, that finally was settled by using a 'policy' tax rate in the simulations: that is, the tax rate endogenously varies with the cycle in the benchmark or baseline solution of the model but it remains constant after the shock in the alternative scenarios (of course, endogenous tax revenues are made compatible with the shocked tax rates). This solution defines what I call a 'history compatible-equilibrium path': it is the increase in the volume and the rate of growth of Gdp compatible with the effective history of Italian economy if only one event of this history was changed – the shift from direct to indirect taxation. After the shock, tax rates stands stationary at the new respectively lower and higher level and do not change (i.e. do not follow the observed historical distribution in the data). This is what I mean by 'history compatible-equilibrium path'. We see this solution as the closest representation, in the context of our framework, of a dynamic equilibrium.

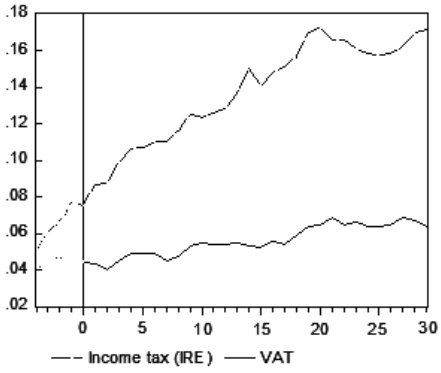
A final remark is worth mentioning and deals with a working definition of direct and indirect taxes. The conventional approach is to define as direct taxes those that may be adjusted to the individual features of the taxpayer and indirect taxes those that are levied on transactions irrespective of the circumstances of buyers and sellers. Thus, wage and income taxes can be classified as direct taxes and the same for most taxes on assets and wealth as long as there is a potential adjustment for individual characteristics. As far as, for example, property taxes on owner-occupied housing may be adjusted for the individual or household attributes of owners, these levies are classified as direct taxes. That is not always the case. Property taxes on motor vehicle, commercial buildings and the like, that

[2] In any case, we performed some simulations where, as tax shifting policy, social security contributions and not income taxes have been shocked. The results obtained in this case are in line, but less intense, with those obtained shocking the direct taxes.

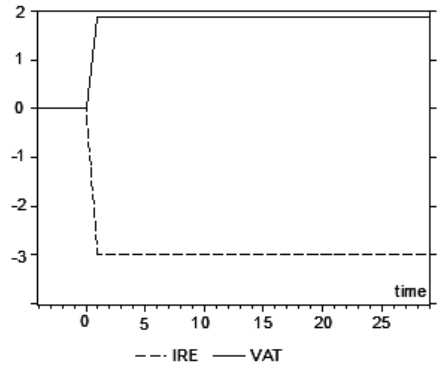
are not easily adjustable for individual characteristics, can be considered indirect taxes, together with most taxes on transactions with differentiated rates – value added tax (VAT), sales, excises, custom tariff, etc. But, as pointed out by Atkinson (1977), there are 'transitional' taxes between the two categories: for example a tax like IRAP (Regional Tax on Productive Activities), conventionally classified as an indirect tax, being proportional to sales revenues, could be in principle easily adapted to individual attributes and transformed into a direct tax. This latent ambiguity in such a tax, led us to consider IRAP among the direct taxes.

The tax ratio variable has a negative estimated coefficient in the TFP equation of the model – this *per se* is an evidence that distortionary taxation has a negative impact on efficiency and that the tax mix matters. In other words, the empirical evidence seems to suggest that, even on a single equation basis, a disproportionate fraction of taxes impinging on the productive inputs is an obstacle to efficiency.

Graph 1 – *Effective income and VAT tax rates*



Graph 2 – *Income and VAT tax rates difference (shocked - historical values) % points*



4. *Simulation results*

The results obtained by introducing the tax shift into our model are presented in terms of deviations (ratios) from the control (benchmark) solution, that is the baseline simulation which tracks the historical path of Italian economy as it is replicated by our structural model (all the exogenous variables are taken unchanged over the simulation period). The disturbed simulation re-runs this history after imposing a one time-shock on the 'policy' tax ratio.

The main results of our exercise are summarized in the table 1 and in graphs 3, 4 and 5, where the deviation from the baseline is expressed for each variable in terms of the ratio between the 'shocked' and the 'control' estimated values.

The overall economic effects of the tax shift seem quite noteworthy both from a qualitative and quantitative standpoint. The tax shift produces a positive effect on the economy in terms of output, employment, capital stock and aggregate demand, both in level and rate of growth, together with a general improvement in fiscal balances, that is a decrease of deficit and debt, and a moderate increase of inflation.

The cumulated output effect is remarkable in terms of both the level and the growth rate. Given a 'multiplier effect'[3] of 7.5, the output level increases by 3.1% with respect to the control solution after 30 years from the shock. The dynamic behavior described by the disturbed simulation shows an irregular path during the four years after the tax shift shock – which accounts for almost two third of the long run effect – and then a continuously regular increasing profile. The output jump in the first year after the shock reaches about 4 percentage points, followed by a strong fall in the two subsequent years – Graph 3. The reason for this path can be explained by considering that in the Merman model the output depends on the endogenous TFP, which is influenced by the fiscal policy (the tax mix), *coeteris paribus*[4]. Therefore, the strong and immediate output-response to the shock depends on the effect of the tax shift on TFP. In terms of cumulated rates of growth, the output shows a deviation of 5.2 percentage points at the end of the simulation period – see Table 1.

Since the dynamic structural econometric models do not encompass

[3] The multiplier effect has been calculated as the percentage change of each variable for one percentage point decrease in the tax ratio.

[4] The other variables affecting TFP, that remain unchanged in this simulation, are human capital, labor market arrangements, wage bargaining rules, legal, political and education systems, core infrastructures etc. For a complete description of the model see Felli and Gerli (2002).

the notion of a dynamic equilibrium path, it is useful to use the average compound growth rate in order to compare our results with those of the theoretical model. The average compound growth rate of output is 0.1 percentage points higher than the benchmark (control) solution – a result lower but close to that of other empirical studies and to the numerical solution of the theoretical model[5]. This is a crucial result, since it gives empirical support to the prediction of the theoretical model that the shift from direct to indirect tax can be interpreted as a lever of economic growth.

The simulated increase in aggregate output is caused by the increasing volumes of inputs employed in the productive system, capital and labor. In particular, employment (triggered by the lower wage taxation that stimulates both supply and demand of labor) shows a high long run multiplier effect with an increase of 6.4% in the cumulated growth rates during the simulation period. The increase in terms of employees is even higher, reaching a deviation of 9.9 percentage points with respect to the baseline solution. Even more important for employment is the attainment of a higher long run 'equilibrium' growth rate. The impulse-response dynamics shows a strong acceleration during the first 4-5 years following the tax shift, and a quite regular increasing path during the subsequent 10 years (see graph 4). As a result, the economic system enjoys a boost of more than one million of additional jobs and a decrease of about 2 percentage points in the unemployment rate. The higher long run level and 'equilibrium' growth rate of employment concerns mainly the employees.

The capital accumulation, too, shows a remarkable improvement, attaining an 'equilibrium' growth path higher of 0.15 percentage points. The accelerator effect works in such a way to produce a regular upper trend in the aggregate capital accumulation (see graph 4).

This improvement in the supply side of the economy has a twofold effect on the demand side[6]. On one hand, it affects the domestic components of aggregate demand, final consumption and gross fixed investment. On the other hand, it affects net exports. In fact, the trade balance shows the following dynamics. In the short run exports are boosted by the shock. Afterwards, imports will react to the rise in aggregate demand. As a result

[5] For example, Turnosvky obtains an increase of 0.3 percentage points in the rate of growth, reducing income tax rates from 28% to 20%, which requires the introduction of a consumption tax of 13% to leave the current deficit unchanged.

[6] In the Merman model used in these simulations, the output is supply-determined by means of a classical production function augmented for TFP. Therefore, output and demand do not match. Inventory variations 'solve' the accounting equilibrium, in terms of GDP, between aggregate supply and aggregate spending.

the trade balance suffers a negative impact of about 2% in terms of GDP.

As far as the domestic components of aggregate demand are concerned, the rise in the aggregate disposable income, primarily caused by the simulated boost in employment, quantitatively affects aggregate private consumption and investment in a quite different way, which is again consistent with the outcome of the theoretical model. In fact, the simulated consumption performance is much lower than the investment one (in both levels and growth rates), implying a switching effect from consumption to saving.

The (long run) multiplier for private consumption is the lowest among the components of internal aggregate demand. The multiplier effect on investment determines an improvement in the cumulated rate of growth around 10%, with a new equilibrium growth path very close to the one observed for employment. These figures are consistent with the accumulation of capital stock produced by the disturbed simulation, once depreciation is taken into account.

The described positive growth effects produced by the tax shift occur without significant prices tensions. In the shocked simulation, the increase in the inflation rates is negligible. At the end of the simulation period, the cumulated inflation rate is between 1.1-1.3 percentage point higher.

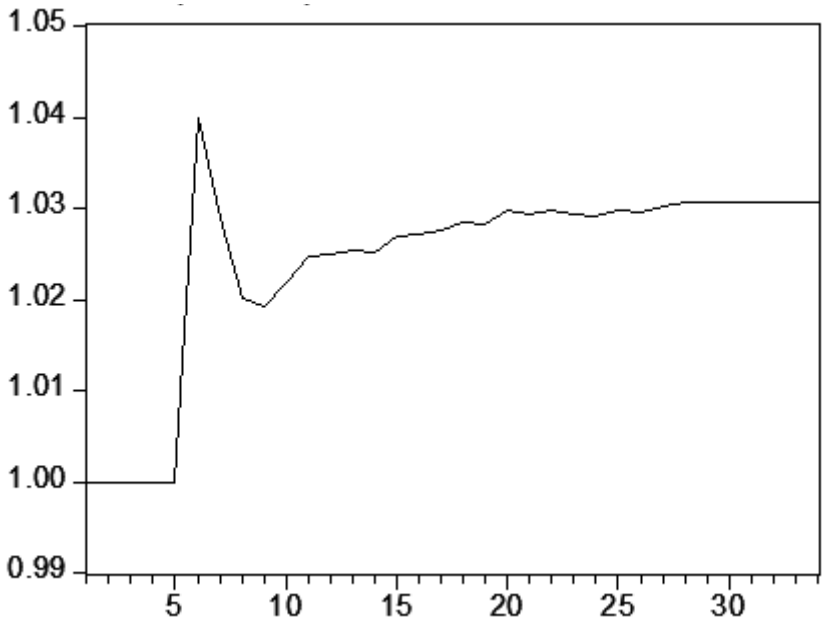
A concluding remark concerns the effects of the tax shock on fiscal balances and public indebteness. The consolidation of public finance is the foremost indirect result which is obtained by the combined effect of the GDP boost and of the increase in the revenues side of the government budget.

In fact, the overall increase in government revenues is noteworthy: the new equilibrium growth rate path of the government revenues – GDP ratio is higher (0.2 percentage points) with respect to the baseline simulation. In the disturbed simulation, this effect produces a cumulated increase in this ratio of 3.1 percentage points (an yearly average increase of 0.33 percentage points) at the end of the simulation period. The joint effect of the rise in output and government revenues determines an average yearly reduction of deficit and debt ratios (-1.8 and -0.2 percentage points respectively, Table 1). In terms of the cumulated effects, at the end of the simulation period, the government debt to GDP ratio shows an impressive reduction of 32 percentage points.

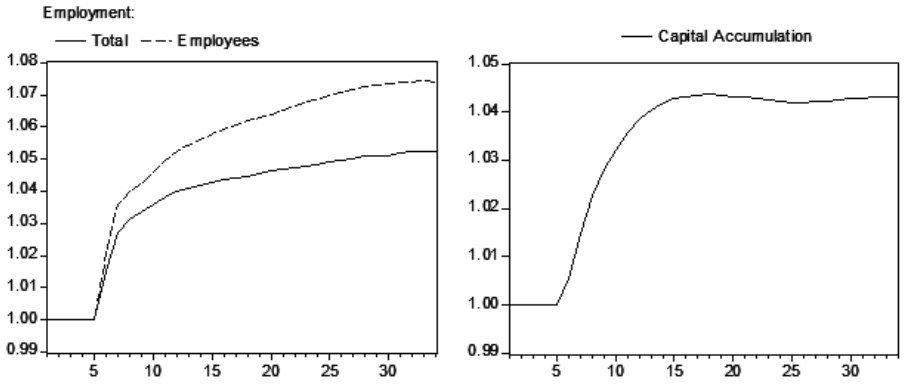
Table 1 – *Cumulated Results (30years): Deviations from baseline simulation*

	Growth Rates	*Average Compound Growth Rates*
Output	5.2	0.10
Total employment	6.4	0.18
Employees	9.9	0.25
Capital stock	9.4	0.15
Aggregate demand	1.6	0.03
Consumption	1.4	0.03
Investment	9.6	0.19
Consumer Price	0.11	0.001
	Average % points Difference in levels	
Government Deficit/GDP	-1.8	
Government Debt/GDP	-0.2	

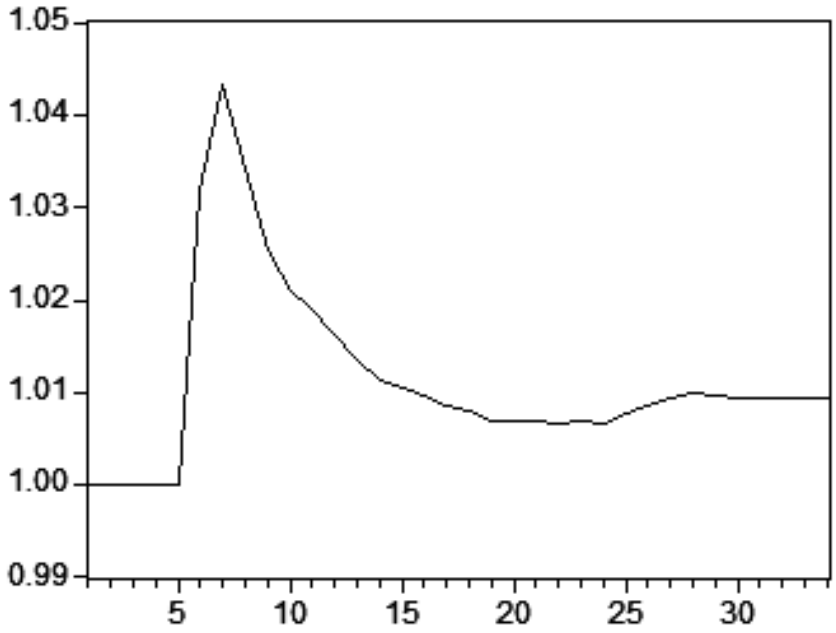
Graph 3 – *Outut Deviations from baseline*



Graph 4 – *Productive Factors - Deviations from baseline*



Graph 5 – *Aggregate demand - Deviations from baseline*



5. Concluding remarks

Even with all its limitations and caveat, the analysis I presented here shows that the option of a fiscal policy of revenue neutral tax incentives is a least to be seriously considered among all those conceivable. If pursued, this strategy might reignite growth, maintaining at the same fiscal discipline. If this approach is even politically feasible, it is completely another story.

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Ernesto Lorenzo Felli

Appendix – The theoretical framework

A1. *Households*

The economy consists of N identical individuals, each of whom has an infinite planning horizon and possesses perfect foresight. Population remains fixed over time. We shall denote individual quantities by lower case letters, and aggregate quantities by corresponding upper case letters, so that $X = Nx$. We assume that the representative agent is endowed with a unit of time that can be allocated either to leisure, l, or to work, $1-l$ [$0 < l < 1$]. Each individual has utility U given by[7]:

$$U = \int_{t=0}^{\infty} e^{-\rho t} \frac{\left(c_t l_t^{\psi}\right)^{1-\sigma}}{1-\sigma} dt \qquad (1)$$

with

$$\sigma > 0, \psi > 0, \psi(1-\sigma) < \min(1, \sigma)$$

where parameter ψ measures the impact of leisure on the welfare of the private agent, parameter σ is related to the intertemporal elasticity of substitution, s say, by $s = 1/\sigma$, and the first two inequalities ensure the

[7] The CIES utility function (1) satisfies the requirements identified by Ladron-de-Guevara, Otiguera and Santos [23] and is used also by Milesi-Ferretti and Roubini [31] in a similar exercise.

normality of consumption and leisure while the last inequality ensures the concavity of the utility function, in terms of the decreasing marginal utility of both consumption and leisure as well as the negativeness of the hessian matrix.

The instantaneous budget constraint a consumer faces is:

$$\dot{k}_t = r_t k_t(1-\tau_k) + w_t(1-l_t)(1-\tau_w) - c_t(1+\tau_c) \quad (2)$$

$$\lambda(1+\tau_c) = e^{-\rho t} c^{-\sigma} l^{\psi-\psi\sigma} \quad (3)$$

where k is the individual's capital stock, assumed to be infinitely durable. Households derive their income by renting entrepreneurs their capital stock and by supplying labor *1- l* to firms in the production sector, taking the interest rate r and the wage w as given. Both the incomes and consumption are taxed. The capital income tax rate, labor income tax rate and consumption tax rate are τ_k, τ_w and τ_c, respectively. For the sake of a simpler notation, in the following we omit the subscript *t*.

The shadow value of wealth is denoted by λ. Optimization implies:

$$\lambda(1+\tau_c) = e^{-\rho t} c^{-\sigma} l^{\psi-\psi\sigma} \quad (4)$$

$$\lambda w(1-\tau_w) = e^{-\rho t} c^{1-\sigma} \psi l^{\psi-\psi\sigma-1} \quad (5)$$

So the contemporaneous substitutability between c and l is

$$c = \frac{w(1-\tau_w)l}{\psi(1+\tau_c)} \quad (6)$$

In optimum *l*, hence the dynamic optimum implies:

$$-\rho - \sigma\frac{\dot{c}}{c} = \frac{\dot{\lambda}}{\lambda} = -r(1-\tau_k)$$

or

$$\frac{\dot{c}}{c} = \frac{r(1-\tau_k)-\rho}{\sigma} \tag{7}$$

We also have the transversality condition:

$$\lim_{t\to\infty} \lambda k \exp(-\rho t) = 0 \tag{8}$$

A2. *Firms*

Output of the individual firm, *y*, is determined by the Cobb-Douglas production function:

$$y = \alpha' G^{\beta}(1-l)^{\phi}k^{1-\beta} \equiv \alpha'\left(\frac{G}{k}\right)^{\beta}(1-l)^{\phi}k$$
$$0 \le \beta \le 1, 0 < \phi < 1, \phi \le \beta \tag{9}$$

where G denotes the flow of services from government as in Barro [4] and Turnovsky [41]. We assume that these services are not subject to congestion so that G is a pure public good[8].

The individual firm faces positive, but diminishing, marginal physical products in all factors, non-increasing returns to scale in the private factors, capital and labor, but constant returns to scale in private and in government production expenditure. We shall assume that government claims a fraction, *g*, of aggregate output, *Y*, for its purchases, in accordance with:

[8] In the production function (9) public services (e.g. bureaucratic services, infrastructural services, property rights, etc.) are complementary with the private inputs so that a raise in *G* increases the marginal productivities of both *K* and *L*.

$$G = gY \tag{10}$$

Equation (10) represents the 'size' of the government. Its determinants will be analyzed in detail the next subsection. Thus combining (9) with (10), and $Y = Ny$, aggregate output in the economy is given by:

$$Y = \left(\alpha g^{\beta}\right)^{\frac{1}{1-\beta}} (1-l)^{\frac{\phi}{1-\beta}} K, \; \alpha = \alpha' N^{\beta} \tag{11}$$

and is proportional to the aggregate capital stock, i.e.,

$$\frac{Y}{K} = \left(\alpha g^{\beta}\right)^{\frac{1}{1-\beta}} (1-l)^{\frac{\phi}{1-\beta}} \tag{12}$$

thereby leading to an equilibrium ongoing, endogenously determined, growth. Thus the aggregate production function is an AK technology, in which the productivity of capital depends positively upon the fraction of time devoted to work and the share of productive government expenditure. We shall assume further that labor productivity is diminishing in the aggregate, leading to the additional constraint, $\varphi < 1-\beta$.

Profit maximization leads to the equilibrium wage rate and return to capital satisfying the marginal product conditions:

$$w = \frac{\partial y}{\partial (1-l)} = \phi \frac{y}{1-l} \tag{13}$$

$$r = \frac{\partial y}{\partial k} = (1-\beta)\frac{y}{k} \tag{14}$$

A3. *Government*

We rule out a market for government bonds and assume that the government runs a balanced budget at every stage of time. The revenues from income taxes and consumption taxes are used to finance the government expenditure. The government budget constraint is:

$$G = rK\tau_k + wN(1-l)\tau_w + C\tau_c \tag{15}$$

Using (6), (10), (13) and (14) the government budget constraint becomes

$$\begin{aligned} g &= (1-\beta)\tau_k + \phi\tau_w + \tau_c\frac{c}{y} \\ &= (1-\beta)\tau_k + \phi\tau_w + \tau_c\frac{\phi(1-\tau_w)l}{\psi(1+\tau_c)(1-l)} \end{aligned} \tag{16}$$

A4. *Market Equilibrium*

The social resource constraint is

$$Y = C + \dot{K} + G \tag{17}$$

Substituting (10) for G in (17), after some rearrangement, we obtain the dynamic for aggregate capital stock:

$$\frac{\dot{K}}{K} = \left(1 - g - \frac{C}{Y}\right)\frac{Y}{K} \tag{18}$$

To ensure a positive growth rate in capital stock we should have

$$\frac{C}{Y} < 1 - g$$

Note that by (7) and (14) we get the dynamic for aggregate consumption:

$$\frac{\dot{C}}{C} = \frac{(1-\beta)\frac{Y}{K}(1-\tau_k) - \rho}{\sigma} \tag{19}$$

A competitive equilibrium for the economy outlined above can be defined as follows.

Definition 1. Given the initial K_0 an equilibrium for the economy consists of a sequence of allocations such that:

i) households maximize their utility solving problem (1);
ii) firms maximize their profits and conditions (13) and (14) hold;
iii) government budget (16) holds.

We can now state the following.

Proposition 1. If the economy follows a balanced growth path (henceforth BGP) variables grow at a constant rate, and in particular employment is constant at a value . Along this path, rate of growth of capital and consumption, γ, is then given by:

$$\gamma = \frac{(1-\beta)(1-\tau_k)\left(\alpha g^{\beta}\right)^{\frac{1}{1-\beta}}\left(1-\tilde{l}\right)^{\frac{\phi}{1-\beta}} - \rho}{\sigma} \tag{19}$$

Along the BGP, the dynamics of consumption and capital rely only on labor supply:

$$\frac{\dot{C}}{C} - \frac{\dot{K}}{K} = \left(\frac{1}{l} - \frac{\phi}{1-\beta}\right)\frac{\dot{l}}{1-l} \tag{19}$$

Proof. By using (13) and totally differentiating (6) we get:

$$\frac{\dot{c}}{c} = \frac{\dot{y}}{y} + \frac{\dot{l}}{l(1-l)}$$

From this, we deduce that along a BGP, the rates of growth of c and y will be the same. Since aggregate and per capita variables growth the same rate, given a constant N, the growth rate of aggregate C and Y will also be the same in the BGP. Therefore, the ratio of consumption to output C will be Y constant in the BGP. Totally differentiating (12), we get:

$$\frac{\dot{K}}{K} = \frac{\dot{Y}}{Y} + \frac{\phi}{1-\beta}\cdot\frac{\dot{l}}{1-l}$$

Hence in the BGP consumption, capital and output all grow at the same rate. Substituting (12) into (19) we obtain the BGP growth rate γ. Subtracting (29) from (28) we obtain:

$$\frac{\dot{C}}{C} - \frac{\dot{K}}{K} = \left(\frac{1}{l} - \frac{\phi}{1-\beta}\right)\frac{\dot{l}}{1-l}$$

where $1/l - \varphi/(1-\beta) > 0$, since $0<l<1$ and $\varphi<1-\beta$. [1]

Combining (20) and (21), we can deduce the dynamic of leisure as follows:

$$\dot{l} = \frac{\left(\frac{\dot{C}}{C} - \frac{\dot{K}}{K}\right)(1-l)}{\frac{1}{l} - \frac{\phi}{1-\beta}} =$$

$$= \frac{(1-l)}{\frac{1}{l} - \frac{\phi}{1-\beta}}\left(\frac{(1-\beta)\frac{Y}{K}(1-\tau_k) - \rho}{\sigma} - \left(1 - g - \frac{C}{Y}\right)\frac{Y}{K}\right) =$$

$$= \frac{B(l)}{A(l)} \qquad (22)$$

where

$$A(l) \equiv \frac{1}{l} - \frac{\phi}{1-\beta}$$

and

$$B(l) \equiv \left[\frac{(1-\beta)(1-\tau_k)(\alpha g^{\beta})^{\frac{1}{1-\beta}}(1-l)^{\frac{\phi}{1-\beta}} - \rho}{\sigma} + \right.$$
$$\left. - \left(1 - g - \frac{\phi(1-\tau_w)l}{\psi(1+\tau_c)(1-l)}\right)(\alpha g^{\beta})^{\frac{1}{1-\beta}}(1-l)^{\frac{\phi}{1-\beta}}\right](1-l)$$

Since $A(l)$ is always strictly positive for all values of l, the equation (22)

is defined for all values of l between 0 and 1. Along the BGP l is constant, so the numerator B(l) will be zero, i.e., where is the BGP level of leisure. To study the dynamic nature of the BGP leisure we have to sign of, calculated at the fixed point, implicitly defined by $B() = 0$. If this derivative is positive, the fixed point is a 'repeller' and the BGP is locally determinate, in the sense that if l were close to but not exactly equal to then l would diverge further from. Thus, the BGP with is a (locally) unique equilibrium path and we can say that there is no (local) indeterminacy in this case. If instead is negative, then is an 'attractor', that is if l is near it will eventually approach it. So there is local indeterminacy, i.e. a continuum of equilibrium trajectories all converging to the fixed point (see Pelloni and Waldmann [36]). We have:

$$\frac{d\dot{l}(\tilde{l})}{d\tilde{l}} = \frac{B'(\tilde{l})}{A(\tilde{l})} - \frac{A'(\tilde{l})B(\tilde{l})}{A^2(\tilde{l})} = \frac{B'(\tilde{l})}{A(\tilde{l})}$$

(since B() = 0).

We can now state the following.

Proposition 2. If a BGP equilibrium defined by $B() = 0$ exists, to ensure its local determinacy we should have:

$$\frac{1}{1-\beta}\left(1-g-\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)(1-\tilde{l})}-\frac{(1-\beta)(1-\tau_k)}{\sigma}\right)+\frac{(1-\tau_w)}{\psi(1+\tau_c)(1-\tilde{l})}>0$$

And if it is local determinate, it is also unique, so there is no transitional dynamics to it.

Proof. We have:

$$B'(\tilde{l}) = \frac{Y}{K}\left[\left(1+\frac{\phi}{1-\beta}\right)\left(1-g-\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}-\frac{(1-\beta)(1-\tau_k)}{\sigma}\right)\right.$$
$$\left.+\frac{\phi(1-\tau_w)}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}\right]+\frac{\rho}{\sigma} \qquad (*)$$

Notice that along the BGP, since aggregate consumption and aggregate capital grow at the same rate, by (18) and (19) we have

$$\begin{aligned}\frac{\rho}{\sigma} &= \left(\frac{(1-\beta)(1-\tau_k)}{\sigma} - (1-g) + \frac{C}{Y}\right)\frac{Y}{K} \\ &= \left(\frac{(1-\beta)(1-\tau_k)}{\sigma} - (1-g) + \frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}\right)\frac{Y}{K}\end{aligned}$$

so:

$$\frac{(1-\beta)(1-\tau_k)}{\sigma} - (1-g) + \frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)} > 0.$$

Substituting this for ρ/σ in *(*)* we get:

$$B'(\tilde{l}) = \frac{Y}{K}\left[\frac{\phi}{1-\beta}\left(1-g-\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)} - \frac{(1-\beta)(1-\tau_k)}{\sigma}\right) + \right.$$

$$\left. + \frac{\phi(1-\tau_w)}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}\right]$$

To ensure that this condition is positive we need:

$$\frac{1}{1-\beta}\left(1-g-\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)} - \frac{(1-\beta)(1-\tau_k)}{\sigma}\right) + \frac{(1-\tau_w)}{\psi(1+\tau_c)\left(1-\tilde{l}\right)} > 0$$

So if is always positive, we can deduce that if BGP exists and is local determinate it is unique as from the phase diagram of (22) since we can easily see that there is no way for *B(l)/A(l)*, which is a continuous function, to cross the horizontal axis from below two times in a row. $\frac{1}{2\pi}$

A5. *Comparative statics*

In this section our analysis focuses on the effects on labor supply and growth rate of the following fiscal experiments. Accordingly, some key results of the literature on taxation and growth will be presented as a way of introducing our contribution later on. Particularly, we will tackle the following exercises of comparative statics:

i) *A ceteris paribus* increase in any of the tax rate τ_k, τ_w and τ_c.
ii) *A ceteris paribus* compensatory switch in distortionary taxation through an increase in τ_c fully compensated by a simultaneous reduction in τ_w.

A6. *Effects of an increase in distortionary taxation*

Notice that an increase in τ_k, τ_w and τ_c produce the same macroeconomic effects. This result is standard in the endogenous growth literature (see Turnovsky [41]-[42]) and can be summarized by the following two propositions.

Proposition 3. The equilibrium labor supply effect of an increase in any one of the taxes is negative, i.e.

$$\frac{d\tilde{l}}{d\tau_i} < 0$$

with $i = w; c; k$.

Proof. Equilibrium leisure can be expressed as the solution to $B() = 0$. The effect of our tax program on leisure can be deduced by using the total derivative of $B() = 0$ with respect to leisure and the tax given the other taxes unchanged. We then have:

$$\frac{d\tilde{l}}{d\tau_k} = -\frac{\frac{\partial B(\tilde{L})}{\partial \tau_k}}{B'(\tilde{L})} =$$

$$= \frac{(1-\beta)\left(1-\tilde{l}\right)}{\sigma\phi\left[\frac{1}{1-\beta}\left(1-g-\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}-\frac{(1-\beta)(1-\tau_k)}{\sigma}\right)+\frac{(1-\tau_w)}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}\right]} < 0$$

$$\frac{d\tilde{l}}{d\tau_c} = -\frac{\frac{\partial B(\tilde{L})}{\partial \tau_c}}{B'(\tilde{L})} =$$

$$= \frac{(1-\tau_w)\,\tilde{l}}{\psi\,(1+\tau_c)^2\left[\frac{1}{1-\beta}\left(1-g-\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)(1-\tilde{l})}-\frac{(1-\beta)(1-\tau_k)}{\sigma}\right)+\frac{(1-\tau_w)}{\psi(1+\tau_c)(1-\tilde{l})}\right]} < 0$$

$$\frac{d\tilde{l}}{d\tau_w} = -\frac{\frac{\partial B(\tilde{L})}{\partial \tau_w}}{B'(\tilde{L})} =$$

$$= \frac{\tilde{l}}{\psi\,(1+\tau_c)\left[\frac{1}{1-\beta}\left(1-g-\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)(1-\tilde{l})}-\frac{(1-\beta)(1-\tau_k)}{\sigma}\right)+\frac{(1-\tau_w)}{\psi(1+\tau_c)(1-\tilde{l})}\right]} < 0$$

Since the denominators of these equations are all positive, so as their numerators, the equilibrium leisure will increase if there is an increase in any one of these taxes, which means that the balanced labor supply will decrease if any one of the taxes is raised. Comparing the last two equations, we can see that the dampening effect on equilibrium labor supply of τ_c is smaller than that of τ_w, with the former just being $(1-\tau_w)/(1-\tau_c)$ proportional to the latter. $\frac{1}{2\pi}$

Proposition 4. The equilibrium growth effect of an increase in any one of the taxes is negative.

with $i = w; c; k$.

Proof. The growth effect of tax τ_k can be derived from (20) as:

$$\frac{d\gamma}{d\tau_k} = \frac{\partial \gamma}{\partial \tau_k} + \frac{\partial \gamma}{\partial \tilde{l}}\frac{d\tilde{l}}{d\tau_k} =$$

$$-\frac{1-\beta}{\sigma}\frac{Y}{K}\left[1+\frac{1-\tau_k}{\sigma\left[\frac{1}{1-\beta}\left(1-g-\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)(1-\tilde{l})}-\frac{(1-\beta)(1-\tau_k)}{\sigma}\right)+\frac{(1-\tau_w)}{\psi(1+\tau_c)(1-\tilde{l})}\right]}\right] < 0$$

The growth effect of tax τ_c is:

$$\frac{d\gamma}{d\tau_c} = \frac{\partial\gamma}{\partial\tilde{l}}\frac{dl}{d\tau_c} =$$

$$-\frac{Y}{K\left(1-\tilde{l}\right)} \cdot \frac{\phi\left(1-\tau_k\right)\left(1-\tau_w\right)\tilde{l}}{\sigma\psi\left(1+\tau_c\right)^2\left[\frac{1}{1-\beta}\left(1-g-\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}-\frac{(1-\beta)(1-\tau_k)}{\sigma}\right)+\frac{(1-\tau_w)}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}\right]} < 0$$

We can derive the growth effect of tax τ_w as:

$$\frac{d\gamma}{d\tau_w} = \frac{\partial\gamma}{\partial\tilde{l}}\frac{d\tilde{l}}{d\tau_w} =$$

$$-\frac{Y}{K\left(1-\tilde{l}\right)} \cdot \frac{\phi\left(1-\tau_k\right)\tilde{l}}{\sigma\psi\left(1+\tau_c\right)\left[\frac{1}{1-\beta}\left(1-g-\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}-\frac{(1-\beta)(1-\tau_k)}{\sigma}\right)+\frac{(1-\tau_w)}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}\right]} < 0$$

Comparing the last two equations, we can find that the dampening effect on balanced growth of tax τ_c is only a proportion of *(1-*τ_w*)/(1-* τ_c*)* of that of tax τ_w, therefore the growth reducing effect of τ_c is smaller than that of τ_w. $\frac{1}{2\pi}$

The implications from the level and growth effects of the taxes is that decreasing labor income taxes as well as increasing consumption tax will improve equilibrium labor supply and growth rate, however the effect on the ratio of consumption to output is ambiguous. To analyze the tax-structure shift and its growth effect we assume that *g* is fixed. We attempt to discuss with *g* unchanged, the effect of any tax-structure variation on growth and welfare.

A.7 *Effects of a tax shift between* τ_w *and* τ_c

In the present experiment, we assume that the fiscal authority reduces income tax andreplaces it with an increase in consumption tax such that capital taxation τ_k and government budged remain unchanged. From the government budget constraint (16) and given *g* and τ_k unchanged, the tax-structure switch follows the following rule:

$$dg = F'_{\tau_w} \cdot d\tau_w + F'_{\tau_c} \cdot d\tau_c = 0$$

where we derive from (16) with respect to τ_w to get

$$F'_{\tau_w} \equiv \frac{dg}{d\tau_w} = \phi - \frac{\phi}{\psi}\frac{\tau_c}{1+\tau_c}\frac{\tilde{l}}{1-\tilde{l}} + \frac{\phi}{\psi}\frac{\tau_c}{1+\tau_c}\frac{1-\tau_w}{\left(1-\tilde{l}\right)^2}\frac{d\tilde{l}}{d\tau_w} \tag{23}$$

and with respect to τ_c to get

$$F'_{\tau_c} \equiv \frac{dg}{d\tau_c} = \frac{\phi}{\psi}\frac{1-\tau_w}{1+\tau_c}\frac{1}{1-\tilde{l}}\left(\frac{\tilde{l}}{1+\tau_c} + \frac{\tau_c}{1-\tilde{l}}\frac{d\tilde{l}}{d\tau_c}\right) \tag{24}$$

While we can immediately see that , we need some manipulations to get the sign of . First we compute , then we plug it into (23) we deduce[9]:

$$F'_{\tau_w} = \phi + \frac{\phi}{\psi}\frac{\tau_c}{1+\tau_c}\frac{1}{1-\tilde{l}}\left(\frac{1-\tau_w}{1-\tilde{l}}\frac{d\tilde{l}}{d\tau_w} - \tilde{l}\right)$$

$$= \phi\left[1 + \frac{\tau_c\tilde{l}\left(\frac{(1-\beta)(1-\tau_k)}{\sigma} - 1 + g + \frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}\right)}{(1-\beta)\psi(1+\tau_c)\left(1-\tilde{l}\right)\Theta}\right] \tag{25}$$

with

$$\Theta \equiv \frac{1}{1-\beta}\left(1 - g - \frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)} - \frac{(1-\beta)(1-\tau_k)}{\sigma}\right) +$$

$$+ \frac{(1-\tau_w)}{\psi(1+\tau_c)\left(1-\tilde{l}\right)} = \frac{B'\left(\tilde{l}\right)}{\phi Y/K} > 0$$

[9] See equation the proof of proposition 3 for the details of the calculation.

The proof for Proposition 2 in the appendix ensures that $\Theta>0$. Therefore, the term in square bracket in (25) is positive. So, even the sign of is positive. The accommodation between τ_w and τ_c in a revenue-neutral tax-structure shift experiment is then:

$$\left.\frac{d\tau_w}{d\tau_c}\right|_{\bar{g},\bar{\tau}_k} = -\frac{F'_{\tau_c}}{F'_{\tau_w}} < 0 \qquad (26)$$

which means that a unit decrease in labor income tax rate should be compensated by/unit increase in consumption tax rate to keep government size in this model unchanged.

The following proposition summarizes the previous results and states that a revenue neutral switch between income tax and consumption tax is good for long run growth of output *per capita*.

Proposition 5. Along the BGP, a revenue-neutral switch in distortionary taxation through a reduction in τ_w accompanied by a simultaneous compensatory hike in τ_w, keeping capital taxation unchanged, implies:

$$sign\left(\left.\frac{d\gamma}{d\tau_c}\right|_{\bar{g},\bar{\tau}_k,\tau_w \ adjusts}\right) = sign\left(\frac{\tilde{l}}{\psi\left(1-\tilde{l}\right)} - 1\right) \qquad (27)$$

i.e. it will increase equilibrium labor supply and growth rate *iff*

Proof. Notice that

$$\left.\frac{d\gamma}{d\tau_c}\right|_{\bar{g},\bar{\tau}_k,\tau_w \ adjusts} = \frac{\partial\gamma}{\partial\tilde{l}}\frac{d\tilde{l}}{d\tau_w}\left.\frac{d\tau_w}{d\tau_c}\right|_{\bar{g},\bar{\tau}_k,\tau_w \ adjusts} + \frac{\partial\gamma}{\partial\tilde{l}}\frac{d\tilde{l}}{d\tau_c}$$

where the first item on the RHS is positive while the second item is negative. Using proof pf Proposition 3 and 4 and (26) we get:

$$\left.\frac{\partial\gamma}{\partial\tilde{l}}\frac{d\tilde{l}}{d\tau_w}\frac{d\tau_w}{d\tau_c}\right|_{\bar{g},\bar{\tau}_k,\tau_w \ adjusts} =$$

$$= \frac{\frac{Y}{K}\frac{\phi}{\psi}\frac{1-\tau_k}{\sigma}\frac{\tilde{l}}{1-\tilde{l}}\frac{1-\tau_w}{1+\tau_c}\left(\frac{\tilde{l}}{1+\tau_c}+\frac{\tau_c}{1-\tilde{l}}\frac{d\tilde{l}}{d\tau_c}\right)}{\psi\left(1+\tau_c\right)\left(1-\tilde{l}\right)\Theta+\frac{\tau_c\tilde{l}}{1-\beta}\left(\frac{(1-\beta)(1-\tau_k)}{\sigma}-1+g+\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}\right)}$$

$$= \frac{\frac{Y}{K}\frac{\phi}{\sigma}\frac{(1-\tau_k)(1-\tau_w)\tilde{l}^2}{\psi(1+\tau_c)^2\left(1-\tilde{l}\right)}\left(1+\frac{\tau_c}{1-\tilde{l}}\frac{1-\tau_w}{\psi(1+\tau_c)\Theta}\right)}{\psi\left(1+\tau_c\right)\left(1-\tilde{l}\right)\Theta+\frac{\tau_c\tilde{l}}{1-\beta}\left(\frac{(1-\beta)(1-\tau_k)}{\sigma}-1+g+\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}\right)}$$

Using the proof of Proposition 4 for we finally deduce

$$\left.\frac{d\gamma}{d\tau_c}\right|_{\bar{g},\bar{\tau}_k,\tau_w \ adjusts} =$$

$$= \frac{\frac{Y}{K}\frac{\phi}{\sigma}\frac{(1-\tau_k)(1-\tau_w)\tilde{l}^2}{\psi(1+\tau_c)^2\left(1-\tilde{l}\right)}\left(1+\frac{\tau_c}{1-\tilde{l}}\frac{1-\tau_w}{\psi(1+\tau_c)\Theta}\right)}{\psi\left(1+\tau_c\right)\left(1-\tilde{l}\right)\Theta+\frac{\tau_c\tilde{l}}{1-\beta}\left(\frac{(1-\beta)(1-\tau_k)}{\sigma}-1+g+\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}\right)}$$

$$-\frac{Y}{K\left(1-\tilde{l}\right)}\cdot\frac{\phi\left(1-\tau_k\right)\left(1-\tau_w\right)\tilde{l}}{\sigma\psi\left(1+\tau_c\right)^2\Theta}$$

$$= \frac{Y\phi\left(1-\tau_k\right)\left(1-\tau_w\right)\tilde{l}}{K\sigma\psi\left(1+\tau_c\right)^2\left(1-\tilde{l}\right)}\left[\frac{\left(\tilde{l}+\frac{\tau_c\tilde{l}}{1-\tilde{l}}\frac{1-\tau_w}{\psi(1+\tau_c)\Theta}\right)}{\psi\left(1+\tau_c\right)\left(1-\tilde{l}\right)\Theta+\frac{\tau_c\tilde{l}}{1-\beta}\left(\frac{(1-\beta)(1-\tau_k)}{\sigma}-1+g+\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}\right)}-\frac{1}{\Theta}\right]$$

$$= \frac{Y\phi\left(1-\tau_k\right)\left(1-\tau_w\right)\tilde{l}}{K\sigma\psi\left(1+\tau_c\right)^2\left(1-\tilde{l}\right)}\cdot\frac{\left(\frac{\tilde{l}}{\psi\left(1-\tilde{l}\right)}-1\right)\psi\left(1+\tau_c\right)\left(1-\tilde{l}\right)\Theta}{\Theta\left[\psi\left(1+\tau_c\right)\left(1-\tilde{l}\right)\Theta+\frac{\tau_c\tilde{l}}{1-\beta}\left(\frac{(1-\beta)(1-\tau_k)}{\sigma}-1+g+\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)\left(1-\tilde{l}\right)}\right)\right]}$$

$$= \frac{Y\phi(1-\tau_k)(1-\tau_w)\tilde{l}\left(\frac{\tilde{l}}{\psi(1-\tilde{l})}-1\right)}{K\sigma(1+\tau_c)\left[\psi(1+\tau_c)\left(1-\tilde{l}\right)\Theta+\frac{\tau_c\tilde{l}}{1-\beta}\left(\frac{(1-\beta)(1-\tau_k)}{\sigma}-1+g+\frac{\phi(1-\tau_w)\tilde{l}}{\psi(1+\tau_c)(1-\tilde{l})}\right)\right]}$$

Notice that the sign of this equation is due to the sign of . We can prove that this term is positive, given the transversality condition (8) and the non increasing return to scale of the production function *(φ ≤ β)*. Transversality condition (8) requires that the growth rate is less than the net interest rate, i.e., $\gamma < r(1-\tau_k)$. Using for γ we can express γ equal to as in (18). Using (14) for r we have net interest rate equal to $(1-\beta)(1-\tau_k)Y$. Therefore we establish

$$1-g-\frac{C}{Y} < (1-\beta)(1-\tau_k)$$

in which we substitute (16) for g to obtain:

$$\frac{\tilde{l}}{\psi\left(1-\tilde{l}\right)} > \frac{\beta-\phi\tau_w}{\phi(1-\tau_w)} = 1+\frac{\beta-\phi}{\phi(1-\tau_w)}$$

Since $\varphi \le \beta$ we can easily find that

$$\frac{\tilde{l}}{\psi\left(1-\tilde{l}\right)} > 1$$

which is infact a necessary condition for the economy to avoid an explosive growth path. This condition holds iff. This completes the proof. $\frac{1}{2\pi}$

In this economy, therefore, a revenue-neutral tax switch can permanently affect the labor supply, thereby raising capital productivity and stationary growth rate. The fall in income tax brings about a raise of the return on labor, inducing people to work more. This effect is partially offset by the higher tax on consumption, which induce a switch in favor of leisure. The dominant effect depends crucially upon parameter ψ, which measures how much leisure affects individuals' welfare.

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European fiscal stance: between rigidity and rigid flexibility

1. *Introduction*

The European Commission (EC, 2015) has recently adopted a new framework aimed at making the best use of flexibility within the existing rules of the Stability and Growth Pact (SGP). These new guidelines seem to loosen the so-called austerity that appeared in Europe in the second half of 2011. More specifically, some corrections are made on the fiscal targets, which after the introduction of the Fiscal Compact are based on the concept of general government structural balance, i.e. the nominal balance adjusted for cyclical components, as well as one-off factors. Theoretically, a target constructed taking into account the cyclical effects should allow the functioning of the automatic stabilizer of the public balance. This is because in a recession the structural deficit is typically smaller than the nominal one, thus, caeteris paribus, also the fiscal corrections should be smaller. However, in the recent past this mechanism failed to work for two main reasons: i) notwithstanding the deep recession, all the Mediterranean countries had to apply restrictive fiscal policies in order to reduce their structural balance, as requested by the zero target fixed by the Medium-term Budgetary Objective (MTO); ii) the methods used by the European Commission to estimate the output gap, i.e. the gap between current and potential GDP used to calculate the structural budget balance, is biased. In fact, we find that the Non-Accelerating Wage Rate of Unemployment (NAWRU), one of the main component of the potential GDP, is pro-cyclical, and as a consequence not adequate to evaluate structural balance.

In this chapter we highlight some methodological errors present in the Commission's approach. In Section 2 we define the fiscal rule based on structural balance. In Section 3 we discuss the role of NAWRU in the European

fiscal rules. In Section 4 we report the new Guidelines in the interpretation of the European fiscal rules, which tried to answer to faultiness of the existing methods. In Section 5 we conclude.

2. *The structural balance as a target for fiscal policy*

The Fiscal Compact sets the target of fiscal policy in terms of structural balance. The latter derives from the decomposition of the nominal general government balance which values are observable and detected by the National Statistical Offices, into the structural and the cyclical component, both not observable.

In the methodology adopted by the EC, the cyclical component is extrapolated from the output-gap and then subtracted from nominal balance in order to estimate the structural component. However, for countries with high public debt, the MTO imposes that the target value of structural balance is set to zero. Thus, the equilibrium level of government balance is determined solely by the size of the output gap, and therefore only by the automatic stabilizers. Any value that exceeds such level should be eliminated through restrictive fiscal policy.

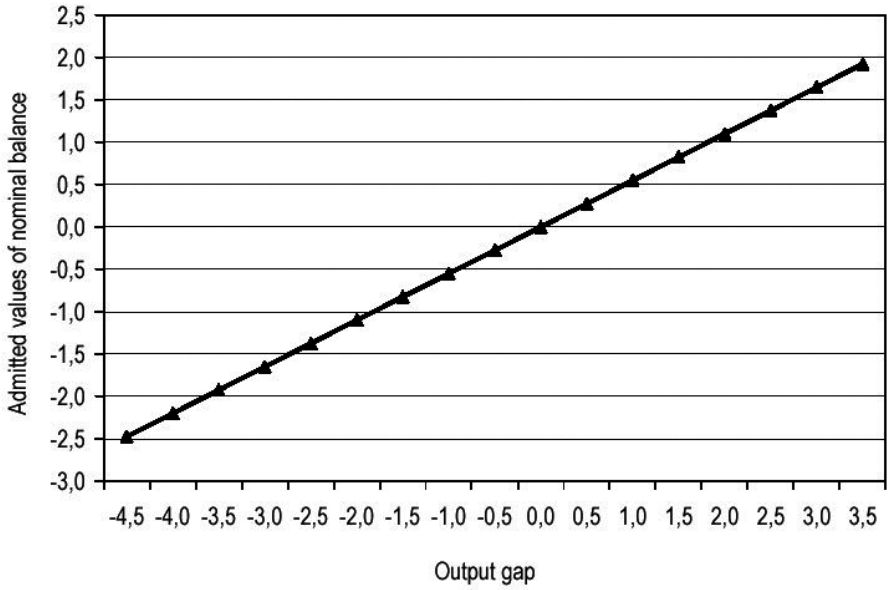
The meaning of this rule is twofold. On the one hand, the rigorous approach is imposed, as in a steady-state equilibrium with zero output gap the fiscal balance should be zero. On the other hand, there is the recognition of the stabilization role of fiscal policy, that can move counter-cyclically registering deficits in the presence of negative output gaps and, symmetrically, surpluses in the presence of positive output gap.

Before focusing our attention on the estimation methodology, we offer some insight on the structural balance time series in Italy. Firstly, we calculate the minimum and maximum values of the structural debt according to the historical data. Secondly, we have a closer look to the trend of the structural balance from 1965 on.

A representation of the theoretical nominal balance admitted according to the European rules is shown in Figure 1. The series is calculated using the output gap estimations of the EC. The data sample covers the period from 1965 to 2013. According to the EC's estimation, the output gap minimum and maximum points are -4.5 and 3.3% in 1965 and 1989 respectively. Considering this range as representative also of the future economic cycle, the extreme values of Italian nominal government balance may vary from a minimum of -2.5% in terms of GDP to a maximum of 2%. According to

the theoretical relationship between output gap and nominal balance, the 3% limit is already incorporated in the functioning of the rule. Focusing our attention on the surplus values, we can see that the maximum value shown in Figure 1 (1.9%) is very close to the value of 1925, when the Italian nominal balance recorded a surplus of 1.7%. It should also be noted that, in more than 150 years, the Italian government budget has been in surplus only 16 times, the last being in 1925.

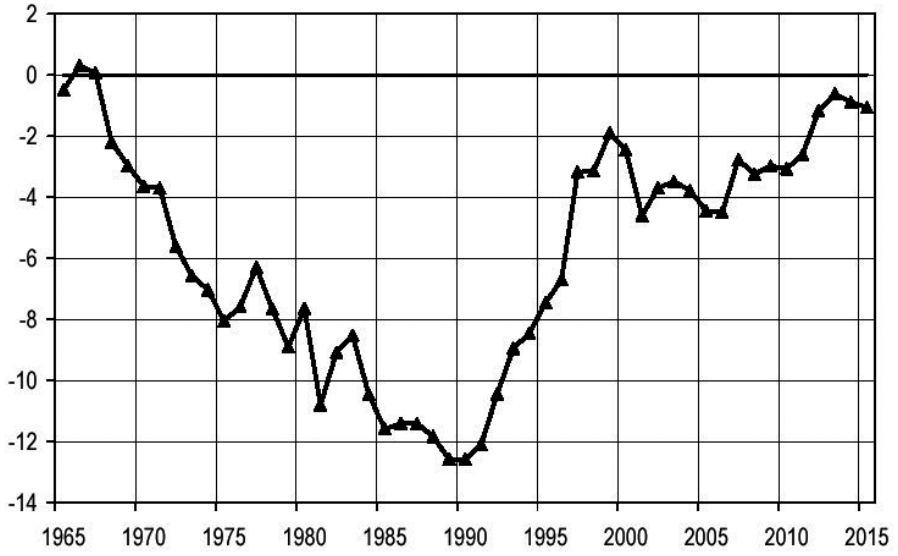
Fig. 1 – *Admitted nominal debt values in the presence of different levels of output gap*



(Source: own calculations on EC and AMECO data)

Figure 2 reports time series of the structural balance calculated from 1965 to 2015. The series is calculated on IMF data for the nominal debt and the EC estimates of the output gap. During this relatively long period, the structural balance has been zero only once, in 1966, and has remained above -0.5% only in 1965 (-0.6% in 2013). Following the sharp correction during the past few years, the current level of structural balance has stabilized at relatively low levels.

Fig. 2 – *Structural balance in Italy 1965-2016*



(Source: own calculations on EC and IMF data)

3. *The role of NAWRU in the European fiscal rule*

The approach for calculating the potential output is commonly agreed at EU level. More specifically, the EC estimates the potential GDP through a function of three factors: i) labour, ii) capital and iii) total factor productivity (tfp). The contribution of the labour depends, positively, on the participation rate, the hours worked and on the working age population, while is affected negatively by the NAWRU.

An increase of the NAWRU at time *t+1* implies the reduction of the labour input and therefore of the potential GDP. If at time t the economy is in recession – which implies a negative output gap – the reduction of the potential at *t+1* decreases the absolute value of the output gap, causing a deterioration in the structural balance. Therefore, during negative phases of the economic cycle there is a direct relationship between NAWRU and structural balance, for which the higher is the NAWRU, the higher is the level of structural balance. Hence, as suggested by the fiscal rule, further budgetary measures should be implemented in order to reduce the deficit.

This approach has an important counter-intuitive policy implication:

an increase in structural unemployment must be followed by a tightening in fiscal policy. In other words fiscal policy assumes a pro-cyclical bias.

Moreover, the calculation of the output gap plays a crucial role because it is the output gap value that determinates the amount of the observed deficit attributed to the cyclical state of the economy. The shortcoming of this approach is that the fiscal rule is anchored to an unobservable variable, subject to measurement uncertainty.

Since the NAWRU provides information on the inflationary pressures, it is a useful indicator for monetary policy, as proposed in the seminal work by Modigliani and Papademos (1975) and, in the later version of time-varying techniques, by Gordon (1997).

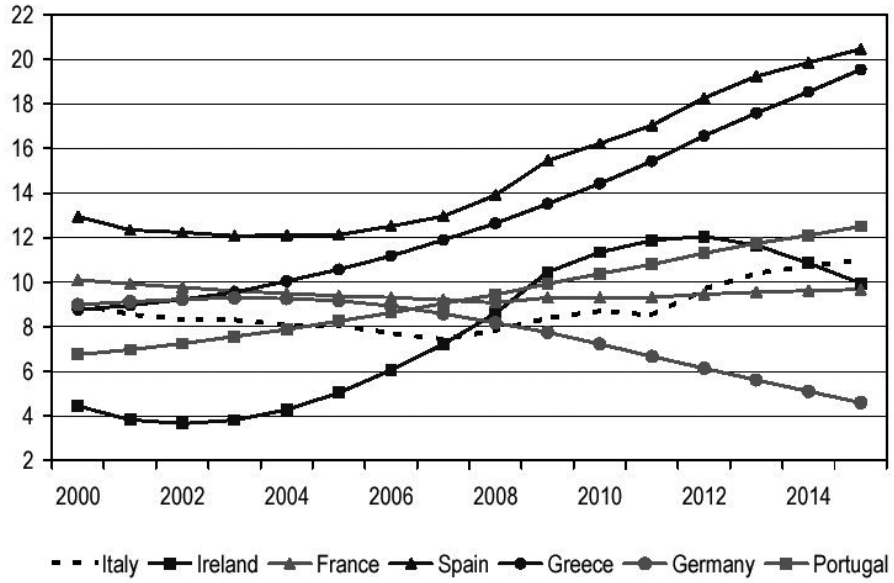
Much less obvious is the use of NAWRU within a fiscal rule framework, since an acceleration of inflation can loosen the constraint on the public budget. This occurs because of the presence of fiscal drag, the reduction of the real value of debt or the increase in nominal GDP, which drives an increase in fiscal revenues. It is not clear, therefore, why a rise in the NAWRU should automatically lead to a tightening of fiscal policy.

As we have seen, the NAWRU is measured by the EC through the estimation of a Phillips curve, but taking into account the values of R-squared of these estimates (EC, 2010) shows a wide range of values that is between the maximum of Austria (0.65) and the lowest in Italy (0.02). The figure reported for the Eurozone as a whole is 0.13, in line with the findings for the United States (0.16). On average, this values are extremely low, showing that for some countries (besides Italy, surely Portugal, but also Belgium and Germany, for which the R-squared is less than 0.3) the Phillips curve estimated by the EC is not representative of the relationship inflation-unemployment underlying the determination of the structural balance. The fact that R-squared is so low even for the United States highlights the doubts on the general validity of the methodological scheme proposed by the EC. What is surprising is that these bad econometric results have not been set aside, but are currently used to determine the fiscal effort required to single countries, a choice that reduces the credibility of the European fiscal rule.

To understand better this aspect, we consider the data reported in Figure 3, which shows the level of NAWRU attributed to some countries by the EC's estimates in 2014. According to these data, the stability of inflation would require unemployment rates close to 20% in Greece and Spain, more than 12% in Portugal and 10.7% in Italy. Clearly, these calculations are not informative to the policy maker, who in the Italian case

would have, for example, to choose whether to reduce unemployment to below 10% or preserve price stability. A trade-off that appears even grotesque considering that the deflationary environment in which the Eurozone has slipped would suggests the need to promote, not to avoid, a price increase. At this regard it should also be noted that the information extracted from the NAWRU and incorporated into the European fiscal rule are in conflict with the current policy of the ECB, which is promoting an increase in inflation expectations.

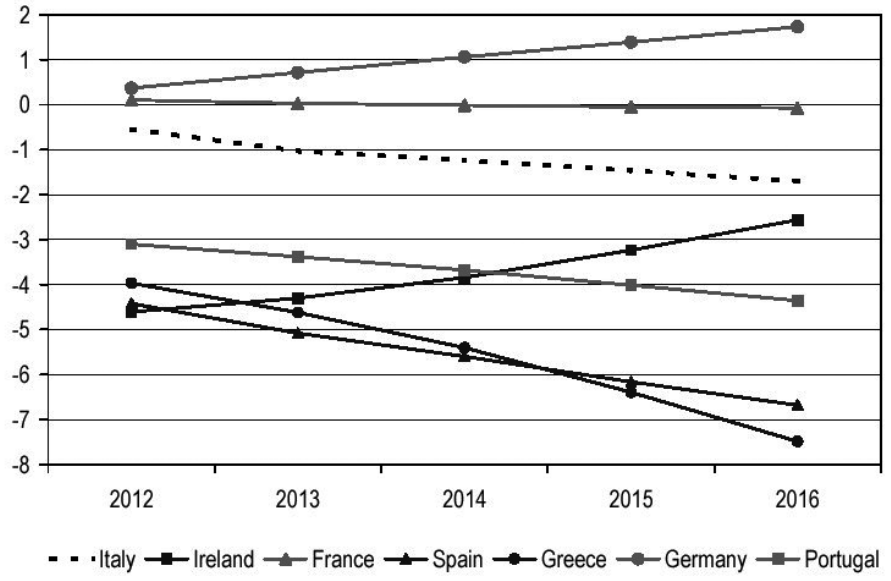
Fig. 3 – *Euro area countries: European Commission's NAWRU estimates*



(Source: EC 2014)

The use of these 'bad estimates' influences the calculation of the output gap in many countries. Figure 4 shows how the size of the output gap would change if the structural unemployment rate is set equal to the average level observed in the decade before the financial crisis (1997-2007), when the stability of inflation was still preserved. The differences are very strong for all the peripheral countries: the output gap in 2014 would be by 5.5 points wider in Greece and Spain, by 3.7 points in Portugal and Ireland, by 1.2 points in Italy. The differences are even more pronounced in the years 2015-2016.

Fig. 4 – *Euro area countries: an alternative measure of output gap (difference with respect to the European Commission's estimates)*



Notes: estimated on the base of the average unemployment rate in the period 1997-2007, wich was equal to 6.7% in Germany, 5.3% in Ireland, 10.3% in Greece, 11.9% in Spain, 9.6% in France, 8.9% in Italy and 6.6% in Portugal.

(Source: our elaborations on EC, Economic Forecast data)

The comparison of the current estimates of the NAWRU with the average of the decade preceding the crisis – thus with a reference to the long-run – leads to focus on the excess of volatility of the indicator proposed by the EC. The NAWRU is estimated using a Kalman filter, i.e. a statistical algorithm, applied to the Phillips curve. This implies that the measure of potential GDP is subject to continuous revision over time, depending on the update of the historical series (this is a property common to all statistical filters, which are nothing if not a method of interpolation of the original series). The economic analysis makes extensive use of indicators of potential output variable in time and, since Gordon's (1977) contribute, also NAWRU measures that show a certain degree of variability are commonly used. To be useful as part of a scheme of fiscal policy based on a fixed rule, however, these variability should remain within a restricted fluctuation band. Otherwise, economic policy could be subject to abrupt changes,

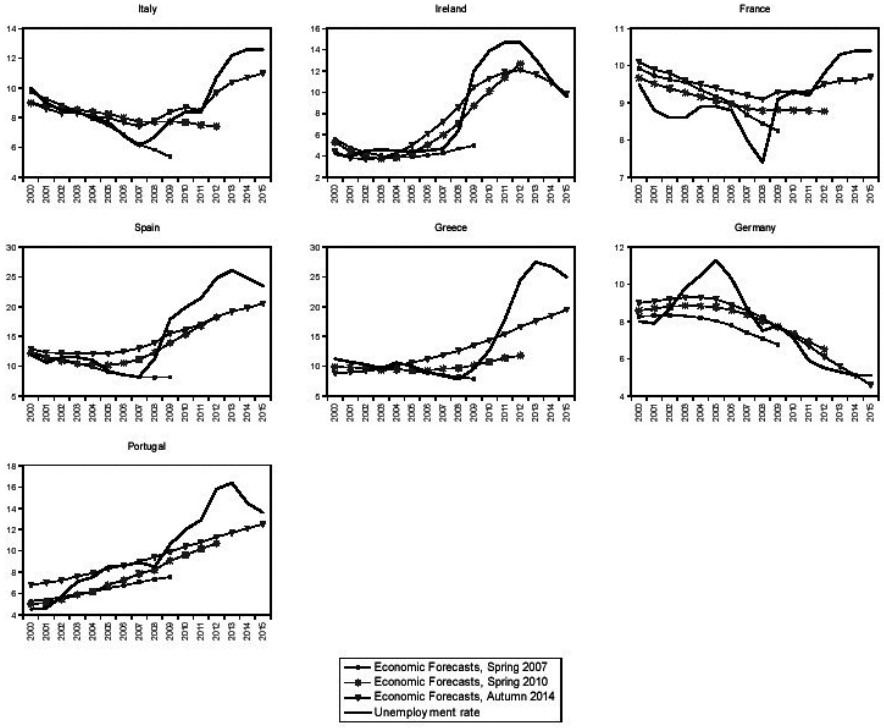
incurring in risks of overshooting, as in the case of wide shock, statistical filters lose their stabilizing function. This emerges clearly from Figure 5, where we show the large and sudden increase occurred to the NAWRU of peripheral countries in the aftermath of the European recession. This means that, according to the EC's estimates, much of the actual increase of unemployment has structural nature and that would be impossible to compress it if not at the cost of causing an acceleration in prices. Such a model establishes the impossibility for the peripheral countries to return to pre-crisis situation.

The European methods prove inadequate in ensuring a credible breakdown of structural and cyclical public debt. It is a failure that goes beyond that part of indeterminacy that is impossible to eliminate from the statistical methods of decomposition of the time series. The key element, culpably neglected, is that the measurements proposed by the EC contain an element of non-linearity, which reduces the ability to distinguish the cycle from the trend in the presence of large and persistent shock. Unlike the EC (2013) and Orlandi (2012), we conduct an empirical analysis by implicitly introducing another dimension to the panel linked to different revisions of the estimates of NAWRU in Economic Forecasts half yearly presented by the EC in the period between 2007 and 2014 (Fantacone F., Garalova P. and Milani C., 2015).

We find that the cyclical component incorporated in the European Commission's NAWRU estimates is stronger in the last period of the financial crisis (2011-2013) and mainly among peripheral countries. A one point reduction in output gap (negative cycle), evaluated by the EC through a simple Hodrick-Prescott filter, implies an increase in the peripheral countries' NAWRU of 0.374 points (at 5% of significance level). For core countries the effect is smaller and not significant.

In the pre-crisis period (2002-2007), we find that the cyclical effect on NAWRU is for both core and peripheral countries negative and significant.

Fig. 5 – *The revised NAWRU estimates during the European recession*



(Source: our elaborations on EC, Economic Forecast data)

The estimates for the first post-crisis period (2008-2010) show that the cyclical component is smoothly negative for core countries, while for peripheral countries the EC's NAWRU estimates does not depend on the output gap.

4. *The new Guidelines in the interpretation of the European fiscal rules*

The conclusion of our previous empirical paper (Fantacone F., Garalova P. and Milani C., 2015) is that the NAWRU estimated by the EC is being affected by cyclical components, resulting in a pro-cyclical effect of the estimates of potential GDP[1].

[1] Looking at the analysis of Estrella and Mishkin (2000), it can be said that with the methodology proposed by D'Auria *et al.* (2010) is estimated a short term NAWRU instead of calculating, as would more properly carried out, a long term one.

Doubts about the EC methodology have been raised by the Italian Ministry of Economy and Finance too (see IMEF, 2015), thus, during the Presidency of the Council of the European Union between July and December 2014, the Italian Government put pressure on the new EC, headed by Jean-Claude Juncker, to change the Stability and Growth Pact (SGP).

This political pressure, supported by empirical evidence on the faultiness in the EC methodology used to estimate structural balances, has not produced a revision of the SGP, too difficult to obtain in few months, but just a more flexible interpretation of the existing rules. The flexibility varies depending on whether a Member State (MS) is in the preventive or the corrective arm of the SGP[2]. More specifically, with the communications of January and October 2015 (EC, 2015a, 2015b), the EC introduces three different clauses:

i) Investment clause. Under this clause is established that national contributions to the European Fund for Strategic Investments (EFSI), created under the Investment Plan for Europe (the so-called Juncker plan), will not be taken into account by the EC when defining the fiscal adjustment under either the preventive or the corrective arm of the SGP. Moreover, for MSs

> «in the preventive arm of the Pact can deviate temporarily from their MTO or adjustment path towards it to accommodate investment, provided that: their GDP growth is negative or GDP remains well below its potential; the deviation does not lead to an excess over the 3% deficit reference value and an appropriate safety margin is preserved; investment levels are effectively increased as a result; the deviation is compensated within the timeframe of the Member State's Stability or Convergence Programme» (EC, 2015a, p. 9).

ii) Structural reform clause. Under this clause, and for MSs in the preventive arm of the Pact, the EC

> «will take into account the positive fiscal impact of structural reforms under the preventive arm of the Pact, provided that such reforms (i) are major, (ii) have verifiable direct long-term positive budgetary effects, including by raising potential sustainable growth, and (iii) are fully implemented» (EC, 2015a, p. 12).

[2] MSs are included in the preventive or corrective arm of the SGP on the basis of the level of nominal fiscal budget in terms of GDP. Those with a ratio higher than 3% are in the corrective arm. Based on 2015 data, these MSs are Croatia, Cyprus, Portugal, Slovenia, France, Ireland, Greece, Spain and the UK.

For those MSs in the corrective arm of the Pact, the EC

> «will take into account the existence of a dedicated structural reform plan, providing detailed and verifiable information, as well as credible timelines for adoption and delivery, when recommending a deadline for the correction of the excessive deficit or the length of any extension to that deadline» (EC, 2015a, p. 14).

iii) Refugee clause. Under this clause, and thanks to the flexibility imbedded in the Pact in order to react to unforeseen circumstances and unusual events, the expenditure incurred to manage the refugee crisis will not be taken into account by the EC when defining the fiscal adjustment (EC, 2015b). However, costs will be evaluated case-by-case and on the basis of documented evidence.

The communication of January 2016 takes also into account the cyclical conditions of the economy. The EC has set a matrix with a more precise relationship between cyclical position and fiscal adjustment making a distinction between 'exceptionally bad times' (real growth lower than 0% or output gap lower than -4%), 'very bad times' (output gap between -4% and -3%), 'normal times' (output gap between -1.5% and 1.5%) and 'good times' (output gap greater than 1.5%). The corresponding annual fiscal adjustment for the MSs which debt to GDP ratio exceeds 60% is 0.25 percentage points (pp) during exceptionally bad times, 0.25 pp if the growth is below the potential and 0.5 pp if the growth is above the potential during 'very bad times', greater than 0.5 in 'normal times' and greater than 0.75 in 'good times'.

5. *Conclusions*

In the midst of the recession generated by the sovereign debt crisis, the Eurozone countries have redefined the fiscal targets in terms of structural balance. In this way, they tried to balance the needs of rigidity, that remained prevalent, with the recognition of a stabilizing role of the public budget. This step has not, however, been accompanied by an adequate reflection on the methodologies with which to estimate the many unobservable variables that are at the basis of the measurement of debt structure. The solution that has been chosen is entrusting these measurements to the Output Gap Working Group that estimates the output gap

of the Member States. So, in the new fiscal rules have been incorporated methodologies that, until then, had been designed to provide a broad indication of the economic discussion, without any claim to assume a normative value. Such neglect has taken away credibility to the goals of structural balance.

The analysis carried out in this chapter have highlighted the many limits of the measurements proposed by the European Commission, which are not econometrically significant, too unreliable over time and strongly influenced by the state of the economic cycle. Particularly affected by this distortion appear to be the peripheral countries of the euro area, which at the height of the financial crisis that has affected them have undergone a revision of the estimates of NAWRU far more severe than that of the core countries. This point is particularly critical, since the use of the structural balance is motivated by the desire to isolate the changes induced on the public finances from fluctuations in the economic cycle, as to focus surveillance on discretionary component of the public budget. In fact, the persistence of strong elements of cyclicity in the calculation of the structural balance has resulted in an extension of the fiscal tightening and Eurozone slipping into deflation. The new Guidelines on the Stability and Growth Pact implicitly recognize the inadequacy of the analytical system adopted and can facilitate the recovery of the stabilizing function of public budgets. However, the higher flexibility is subject to uncertainty about the interpretations of existing rules. Besides, the new Guidelines add other procedures, complicating even more the already complex sets of rules.

In any case, two years have been lost, allowing some Eurozone countries, mainly the Mediterranean ones, high product losses and high social costs. The weakness of the European model, however, goes beyond the inadequacy found in the methods of estimation of the structural variables. It is the general rule, which requires the achievement of a balanced budget, to be a problem. At present, only Germany and Luxembourg record public balances in equilibrium and this means that all other countries should follow programmatic paths providing a gradual reduction in debt. Overall, Europe is therefore engaged in a fiscal effort of very large proportions, something that is certainly not alien to the detachment that is causing among the growth rates of the US and the Eurozone.

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Marco Fioramanti[1]

Potential Output, Output Gap and Fiscal Stance: is the EC estimation of the NAWRU too sensitive to be reliable?

1. *Introduction*

Potential output (PO), the highest level of production an economy can produce with the full utilization of available resources without incurring in inflationary pressures, is a key concept in the European Union (EU) economic governance. Its estimates are the starting point to assess the cyclical conditions of Member States (MSs) of the EU and to derive structural deficits which are key to evaluate the compliance with the EU fiscal framework and in particular with respect to the Stability and Growth Pact (SGP). Once PO has been estimated the cyclical position of a country, the output gap, can be calculated as a difference between actual and potential output (in percentage of PO). The output gap, together with the semi-elasticity of the budget balance to the cycle are first used to net-out headline budget balance (BB) from the cyclical components. Then, to obtain the Structural budget balance (SB) which is the reference measure of the fiscal position of a MS, temporary measures (one-offs) are also subtracted from the headline deficit. In formula:

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$$SB = BB - \varepsilon \cdot OG - oneoffs \quad (1)$$

where ε is the semi-elasticity of the budget balance to the cycle and $OG = \frac{Actual\ GDP}{PO} - 1$. While all the elements in (1) but the PO are measured or estimated from observable phenomena[2], PO is not observable and different techniques can be used to make a guess of the potential of an economy. Unfortunately different techniques can – and most of the time do – produce very different estimates of PO and, as a consequence, different results for the fiscal position of a MS can be obtained. Furthermore, even the same technique and representation of the unobserved process describing PO can produce quite different results depending on assumptions on initial conditions, number of observations, software program and many other tiny technical details.

This is what actually happens with the methodology in use by the European Commission and by all the MSs[3] and this is the focus of this chapter.

2. *The evolution of the EC methodology to the estimation of output gap*

2.1 *Legal background*

The Stability and Growth Pact was introduced in 1997 with the Amsterdam Resolution of the European Council to strengthen the monitoring and coordination of national fiscal and economic policies with the goal of enforcing the deficit and debt limits established by the Maastricht Treaty. The original public finance targets of the SGP were set on observable headline budget balance and debt (3% and 60% respectively). In 1998 two council regulations[4] modified the preventive and corrective arms of the pact to take into account the cyclical position of MSs and in 2005 two additional regulations[5] changed the main target variable of the surveillance process to a country-specific Medium Term Objective (MTO) expressed in structural terms. In particular the country specific MTO takes into account: i) the debt-stabilizing balance for a debt ratio

[2] For the estimation of the semi-elasticity of budget balance see Mourre *et al.* (2014) and Price *et al.* (2014).
[3] Given the relevance of the object, a dedicated working group, the Output Gap Working Group of the Economic Policy Committee, was set back in that days to develop a common analytical framework.
[4] COUNCIL REGULATIONS N. 1466/1997 and 1467/1997.
[5] COUNCIL REGULATIONS N. 1055/2005 and 1056/2005.

equal to 60% of GDP; ii) a supplementary debt-reduction effort in case the debt ratio exceeds 60% of GDP; iii) a fraction of the adjustment needed to cover the present value of the future increase in age-related government expenditure[6]. The SGP has been recently modified and reinforced by the Six-pack in 2011 and the Two-Pack (2014)[7]. The Treaty on Stability, Coordination and Governance (TSCG) (2013) has further reinforced the commitment, for those countries who signed it, for sound public finances, leaving the structural balance as the main reference target.

The compliance with the SGP's deficit criterion is now based on two pillars: the MTO and the expenditure benchmark. To make a long story short, for those MSs who signed the TSCG the MTO corresponds to a SB not lower than -0.5% of GDP and, the expenditure benchmark, a growth rate of real primary expenditure not exceeding the 10-year average growth rate of potential GDP[8].

As can be seen, the estimation of potential output is key in monitoring the fiscal compliance to the SGP.

2.2 *Technical background*

Several methodologies can be used to calculate potential output, from pure statistical filtering to structural time series models as shown for example in Cerra and Saxena (2010)[9]. The European Commission and MSs adopt the production function approach[10]. Potential output is supposed to be a function of capital (*K*), labour (*L*) and total factor productivity (*TFP*). The production function is a Cobb-Douglas with constant return to scale with labour share α=0.65. In formula:

$$Y = TFP^{*}L^{\alpha}\cdot K^{1-\alpha}$$

[6] For additional details on the calculation of the MTO see the code of conduct on the *Specifications on the implementation of the Stability and Growth Pact and Guidelines on the format and content of Stability and Convergence Programmes* available online <http://goo.gl/I2itxd> (last access 07.12.2016).
[7] For an overview of the EU Fiscal Governance see <http://goo.gl/mKFAhx> (last access 07.12.2016).
[8] These targets are further qualified depending on whether MSs are at the MTO or converging toward it and whether the business cycle is in normal or not. For further details see European Commission (2016a) and European Commission (2015).
[9] For an application to the specific case of Italy see Bassanetti *et al* (2010).
[10] See Havik *et al.* (2014).

The single factors of PO are calculated in the following way:

- Potential capital is assumed to be equal to actual capital and is obtained using the perpetual inventory method. For older MSs, the initial condition is $K_0=K_{1960}=3\cdot GDP_{1960}$. The assumption that potential capital is equal to actual capital is justified by the fact that in every year investment is just a tiny fraction of capital and the actual value of this latter is already smooth;

- Smoothed TFP is obtained using a Bayesian bivariate Kalman filter. Starting from actual TFP obtained as a Solow residual, trend TFP is extracted using a trend-cycle decomposition in which the univariate structural model for TFP is augmented with an equation relating TFP with an indicator of capacity utilization as described in Planas *et al.* (2013);

- Labour is the (smoothed) total amount of hours worked, obtained as:

$$L = (POPW\cdot PARTS\cdot(1-NAWRU))\cdot HOURS$$

  where POPW is the working age population in 15-74, PARTS is the smoothed participation rate, HOURS is the smoothed average of per-capita hours worked and NAWRU is the non-accelerating wage rate of unemployment. PARTS and HOURS are forward extended for six years first using a simple ARIMA model and then smoothed using the Hodrick-Prescott filter. POPW is taken as it is. NAWRU is computed estimating, via maximum-likelihood, a bivariate Kalman filter in a trend-cycle decomposition augmented with economic information coming from the accelerationist version of Phillips curve.

- On top of the extensions above, a set of rules to allow the output gap to close in the three years after the last year of forecast is added to the procedure.

The main data source is AMECO, the Annual Macro-ECOnomic database of the European Commission's DG-ECFIN containing both historical and forecasted variables. PO calculation takes as given both historical data coming from Eurostat and forecasted values. For these latter, each forecaster

uses its own forecast. In what follows the generic term 'data' is used to refer to the set containing both historical and forecasted value. *POPW* is taken from the Eurostat Population Projection (Europop2013)[11].

3. *EC methodology for the NAWRU*

To analyse the sensitivity and reliability of PO I now limit the focus on the calculation of *NAWRU* for three main reasons: *i)* many critiques to the estimation of *NAWRU* are also valid for *TFP*; *ii)* the pre-estimation setup of NAWRU is more frequently changed than the one of *TFP*; *iii)* despite its complexity, the estimation of *NAWRU* is tractable with commercial software, while for *TFP* this is almost impossible without excellent programming skills. In fact, EC uses a software developed in-house named 'GAP' which interacts with an Excel interface to make the estimation process user-friendly. For TFP, the Bayesian estimate makes the process extremely complex and in need of additional inputs and procedures[12].

To enrich the analysis with a practical example a country-specific exercise will be developed and discussed, without loss of generality. Italy will be the guinea pig.

The trend-cycle decomposition for unemployment via the Unobserved Component Model is supposed to be of the form:

$$u_t = T + C = u_t^* + (u - u^*)_t \quad (2)$$

where u^*_t represents the trend-*NAWRU* and $(u\text{-}u^*)_t$ the cycle-unemployment gap. Trend unemployment is supposed to follow a second-order random walk of the form:

$$u_t^* = u_{t-1}^* + \mu_{t-1} + a_{pt} \text{ were } \mu_t = \mu_{t-1} + a_{\mu t} \quad (3)$$

with a_{pt} and $a_{\mu t}$ being white noise disturbances with variances V_p *and* V_μ respectively. The cyclical component evolves according to an AR(2) process:

$$(u - u^*)_t = \varphi_1 (u - u^*)_{t-1} + \varphi_2 (u - u^*)_{t-2} + a_{ct} \quad (4)$$

and a_{ct} is, again, a white noise with variance V_c. Stationarity condition requires that $\varphi_1 > 1$ and $\varphi_2 > 0$.

[11] Eurostat produces new population projection every 3 years.
[12] See Planas and Rossi (2015).

This univariate model is augmented with the accelerationist version of the Phillips curve:

$$\Delta\pi_t = \mu_\pi + \beta_0(u-u^*)_t + \beta_1(u-u^*)_{t-1} + \beta_2(u-u^*)_{t-2} + a_{\pi t} \quad (5)$$

where $\Delta\pi_t$ is the change in the wage inflation rate[13] and $a_{\pi t}$ is the usual white noise disturbance with variance V_π. (5) can be extended with additional components, i.e. exogenous variables, lagged unemployment growth, ARs or MAs terms, but these latter are not always incorporated because of their lack of statistical significance. Furthermore, both trend and cycle can be modelled in some other ways[14], but in the rest of the paper (2)-(5) are used, because this is the special case adopted for Italy, with little loss of generality.

The state space representation of (2)-(5) is:

$$\text{State equation} \begin{bmatrix} u_t^* \\ (u-u^*)_t \\ (u-u^*)_{t-1} \\ (u-u^*)_{t-2} \\ \mu_t \end{bmatrix} =$$

$$= \begin{bmatrix} 1 & 0 & 0 & 0 & 1 \\ 1 & \varphi_1 & \varphi_2 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u_{t-1}^* \\ (u-u^*)_{t-1} \\ (u-u^*)_{t-2} \\ (u-u^*)_{t-3} \\ \mu_{t-1} \end{bmatrix} + \begin{bmatrix} a_{pt} \\ a_{ct} \\ 0 \\ 0 \\ a_{\mu t} \end{bmatrix}$$

[13] More specifically, the underlying variable in the AMECO database is the nominal compensation per employee, total economy (HWCDW).

[14] In particular trend can even be modeled as first order random walk or damped trend, cycle can also be modeled as AR(0) AR(1) or AR(2) with complex roots.

Measurement equation

$$\begin{bmatrix} u_t \\ \Delta\pi_t \end{bmatrix} =$$

$$= \begin{bmatrix} 0 \\ \mu_\pi \end{bmatrix} + \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & \beta_0 & \beta_1 & \beta_2 & 0 \end{bmatrix} \begin{bmatrix} u_t^* \\ (u-u^*)_t \\ (u-u^*)_{t-1} \\ (u-u^*)_{t-2} \\ \mu_t \end{bmatrix} + \begin{bmatrix} 0 \\ a_{\pi t} \end{bmatrix}$$

The state space model is estimated by maximum likelihood via the Kalman recursion using the diffuse Kalman filter for the initialization[15].

The likelihood function is rarely well shaped and many local maxima can be found. The usual way to proceed for the estimation is to start with an initial guess (starting values) of the parameters to be estimated based on previous studies and experience. Furthermore, some restrictions are usually imposed on the bounds of the variances. A solution adopted by most studies is to fix the signal-to-noise ratio (i.e. the ratio of the variance of the residuals of the transition and the measurement equation) in order to have a smooth NAWRU, as suggested by Gordon (1997) and applied for example by Richardson *et al.* (2000) to the OECD countries and Fabiani and Mestre (2004) to the euro area.

The EC follows a different, and more invasive, approach. A first loose constraint is that variances cannot be greater than 1.2 times the variance of the reference variable[16]. Then, variance bounds are further restricted – both from above and from below – to reach three main goals: i) minimize the RMSE between the most recent estimate of the NAWRU time series and the previous estimate of the same time series based on older data; ii) obtain a good level of significance of β_0 in (5); iii) maximize the log likelihood. This procedure is a mechanical iterative procedure implemented 'by hand'[17].

[15] See the reference in footnote 7.
[16] That is V(Du) for Vp,Vμ and Vc, VΔπ for V(Dπ).
[17] For a tentative of automatization of the procedure via a grid-search algorithm see *Ministero dell'Economia e delle Finanze* (2015), pp. 18-22.

4. *Too sensitive to be reliable*

The problem of the accuracy of PO estimate is well known in literature. For example Proietti *et al.* (2004) extensively analyse the sensitivity of PO to model specification. Another source of estimation uncertainty is data revision. If the underlying data change potential output changes as well, as documented in Fioramanti *et al.* (2015). In addition, the filtering procedure is also applied by the EC and MSs to the forecasted data which, in most of the cases, are not the same between the EC and MSs. The elements above are sources of 'macroscopic' uncertainty and their natural consequence is that PO estimate is different or changes over time because the underlying data are different. Here the focus is on the 'microscopic' sources of uncertainty in the EC's approach which rises even if the underlying data and the model specification are the same. In particular, this uncertainty is the result of: *i)* difference in the forecast horizon; *ii)* small change in the upper and lower bounds of the variances; *iii)* initialization of the Kalman filter. These are 'micro' sources of uncertainty because small changes can produce very different results and, as a consequence, policy implications.

Using the most recent EC data, from the winter 2016 forecast[18], how small changes can produce relevant differences will be shown. The policy implications will be discussed in the next section.

4.1 *Forecast horizon*

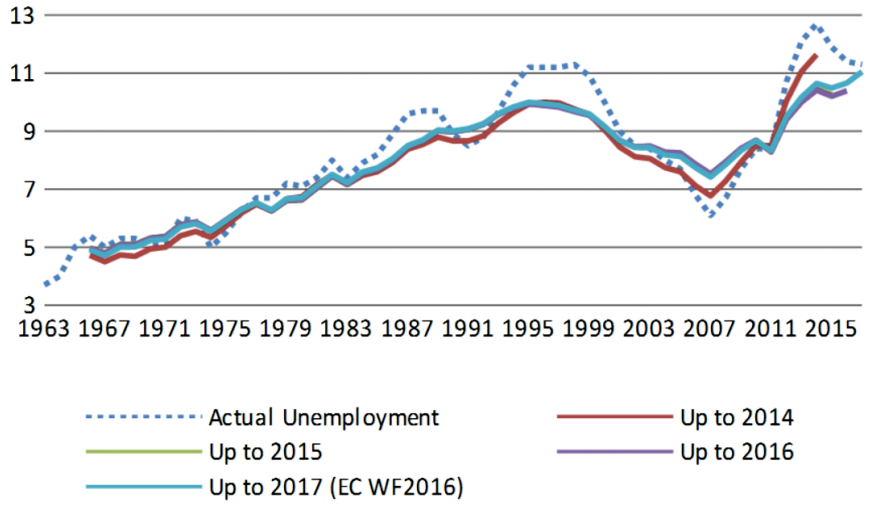
The EC forecast horizon is usually from time t up to *t+1* (winter and spring) or *t+2* (autumn). The code of conduct of the Stability (and Convergence) Program (SCP) requires the MSs to submit to the EC the forecast for a large number of economic variables at least up to *t+3*[19]. Usually, the Italian government presents his Stability Program in April with forecast up to *t+4*.

Figure 1 shows the different NAWRU estimates obtained using the same underlying data – from the European Commission (2016b) –, model, program and variance bounds, but using different forecast horizons. Let's suppose we are in 2013, but we have 4 different forecast horizon from *t+1* to *t+4*. The forecast for unemployment and inflation are the same two series for all the smoothing procedure, but they are recursively

[18] European Commission (2016b).
[19] See footnote 6.

used to smooth unemployment up to *t+1*, *t+2* and so on up to *t+4*.

Fig. 1 – *NAWRU at different forecast horizont*



(Source: Author's calculation on European Commission data)

As can be seen from the figure, even using the same dataset, but with different horizons, produces large differences in NAWRU. In particular, the larger difference is in 2014 comparing NAWRUs obtained from forecast up to 2014 and up to 2016, with a difference of 1.2 percentage points (pps). Given the rule of thumb that 1 pp more of NAWRU translates in 1/3 more of structural balance[20], the difference above converts in 0.4 pp of SB. Why this is so? Because actual unemployment peaked in 2014 and then started decreasing. Using the full sample of forecasts, the smoother anticipates the change in the direction of actual unemployment from 2015 onward and starts smoothing the NAWRU well before 2014 (in 2011). Nothing is going wrong here and the filter is correctly doing is job flattening the series of unemployment around the turning points. On the other hand, using data up to 2014 provides no information to the Kalman filter on the turning point in 2015. Comparing NAWRU estimates coming from two different forecasters with different forecast horizon (i.e. EC and the Italian Ministry of Economy

[20] This is the results of multiplying labour elasticity in the Cobb-Douglas (0.65) by the semi-elasticity of the budget balance to the cycle (0.54).

and Finance) can give quite different results even if the underlying forecast for the unemployment are the same where the two forecast horizons overlap.

4.2 *Variance bounds*

In reviewing the performance of the PF methodology used by the EC, McMorrow *et al.* (2015) state that

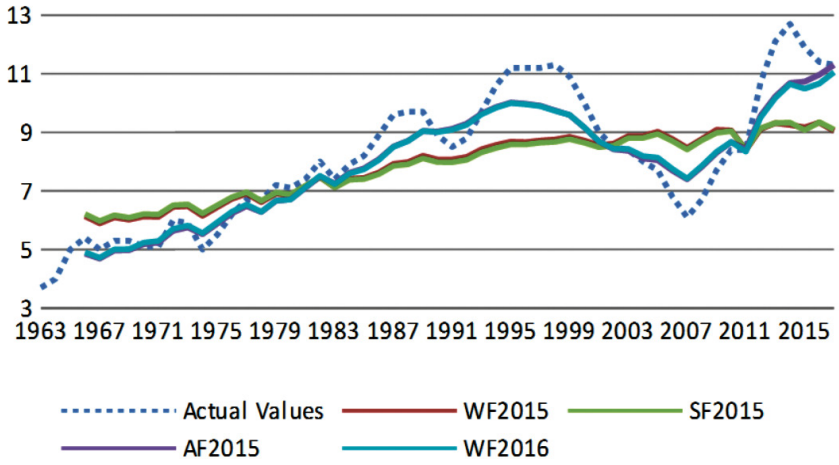
> «[…] the PF methodology is superior to both the HP filter and the methods used in other international organisations. This vindicates the decision to adopt it for estimating output gaps as the 'commonly agreed' reference method to be used in EU fiscal surveillance procedures»[21].

The metrics to assess the quality of the estimations are the size of the revisions and the real-time reliability. As for the revisions, there seems to be a circular reasoning here: as stated in section 3, having a small RMSE between the current and previous estimates is one of the goals. Minimizing revisions in PO, TFP and NAWRU are thus 'constraints' imposed to the procedure and not a genuine property of the technique.

To give evidence on this issue, Figure 2 plots actual unemployment coming from the latest EC winter forecast and different estimates of NAWRU using the same underlying data, but applying different variance bounds and in particular those used in different forecast rounds by the EC itself, from winter 2015 to winter 2016 and reported in Table 1.

[21] p. 19.

Fig. 2 – *NAWRU with different variances bounds*



(Source: Author's calculation on European Commission data)

The larger difference in the last part of the sample is found in 2017 comparing the NAWRU obtained using the parameters from winter 2015 and autumn 2015 and the result is a difference of 2.2 pps; using the usual 1/3 rule of the thumb produces a difference in the SB of 0.7 pp. As can be seen from Table 1 this huge difference is produced by a mere 0.001 difference in V_μ and by 0.01 difference in V_c upper bounds[22]. These upper and lower bounds are very critical because they determine the degree of smoothness of the NAWRU (V_c), the possibility of jumps in the NAWRU (V_p) and the degree of non-linearity of the trend of the NAWRU (V_μ) and especially because in most of the cases the bounds are binding.

[22] In both cases the upper bounds are binding.

Table 1 – *Variance bounds in different forecast rounds*

		Lower Bound	Upper Bound
Winter 2015	Vp	0.00	0.080
	Vμ	0.00	0.020
	Vc	0.00	0.115
	Vπ	0.00	8.1614E-04
Spring 2015	Vp	0.00	0.080
	Vμ	0.00	0.021
	Vc	0.00	0.121
	Vπ	0.00	8.1614E-04
Autumn 2015	Vp	0.00	0.080
	Vμ	0.00	0.021
	Vc	0.00	0.105
	Vπ	0.00	8.1614E-04
Winter 2016	Vp	0.00	0.100
	Vμ	0.02	0.035
	Vc	0.00	0.110
	Vπ	0.00	8.1614E-04

In this special case, what is even more puzzling is the fact that all the statistics related to the goodness of fit (t-values, log-likelihood and R-squared) would have favoured the adoption of the Spring 2015 variance bounds also in Winter 2016. On the other hand, this choice would have produced a flat NAWRU with little cycle and a very large RMSE with respect to the previous estimate. This evidence suggest that the minimization of the RMSE was the driving criterion for the choice of the bounds in Winter 2016.

In the special case of the choice of variance bounds the issue of EC's time consistency has a central role. Suppose the EC has a procedure which disregards the RMSE criterion and only takes into accounts goodness of fit measures such that at every forecast round variance bounds are chosen according to these measures. Let's now suppose that at time t the EC opens an Excessive Deficit Procedure (EDP) for a country because, according to the estimates of *NAWRU->PO->OG->SB*, this country had an excessive deficit in *t-1*. After a couple of years, with a possible turning point in the forecast horizon, new estimates show that in *t-1* that country,

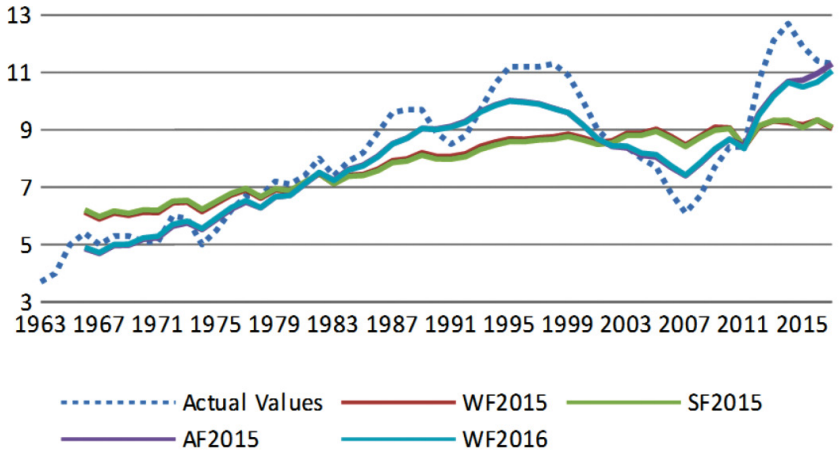
in fact, did not experience an excessive deficit. What would then be the reaction of the country in question? Would the EC be still credible in the future? All in all, the fine tuning of the variance bounds to minimize the RMSE seems to be a shield protecting the EC's time consistency rather than a technique to improve the estimate of potential output toward the 'true' value.

4.3 *Software packages*

So far all the estimation have been implemented in GAP. Another source of micro sensitivity is related to the software packages used to estimate the NAWRU and in particular in the way the Kalman filter is initialized. Figures 3 to 5 report actual unemployment and NAWRU estimates using 4 different software packages, that is, the one provided by the EC and 3 commercial programs[23]. As in the previous exercises, also in this case the dataset is the same – winter Forecast 2016. Because the likelihood can be very irregular with many local maxima, once the estimates from GAP have been obtained, estimated parameters and/or variances from GAP are used as starting values in the other three commercial programs and, where possible[24], inequality constraints for the variance bounds are imposed (Figure 3)[25].

[23] The four software and versions are GAP 4.4, Stata 14.1, RATS 8.2, eViews 9.5.
[24] In Stata inequality constraints are not permitted in the pre-defined procedure.
[25] Inequality constraints are those in Table 1 WF2016.

Fig. 3 – *NAWRU unconstrained estimates*

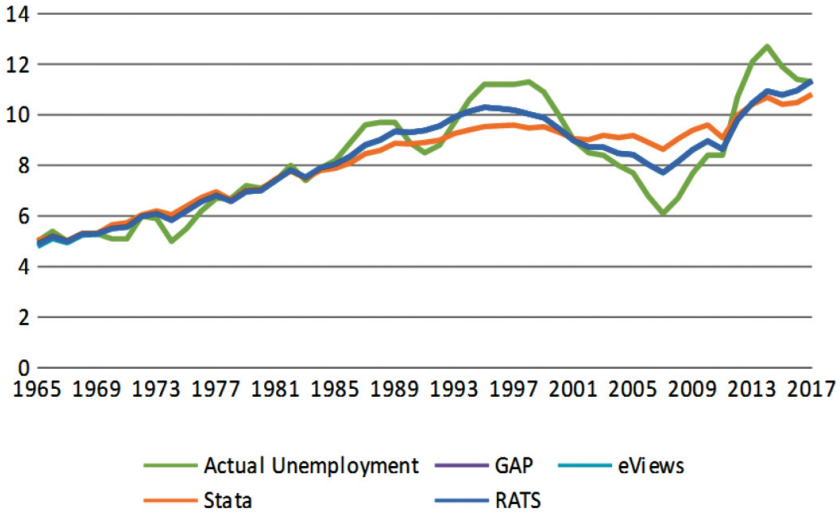


(Source: Author's calculation on European Commission data)

In addition to this initialized and 'loosely' constrained implementations, two sets of additional replications are implemented. In the first set, in addition to starting values and inequality constraints, the parameters other than variances are constrained to be those obtained from EC's software, while variances are freely estimate in the range defined by the upper and lower bounds (Figure 4). In the second set of estimates, NAWRU is estimated using EC's starting values, constraining variances to those obtained using GAP and leaving all the other parameters free (Figure 5). Except for RAT and GAP which produce almost the same estimate, and hence the overlapping lines in the figures, given the constraint and starting values, Figures 3 to 5 show that estimated NAWRU can be very different depending on the software program used and this difference is exacerbated around turning points[26].

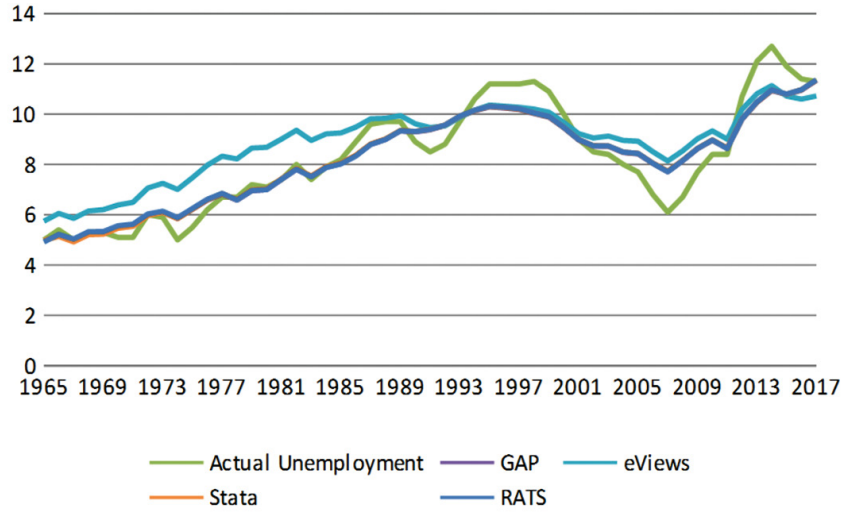
[26] The lack of a visible line in the Figures means that the results from two or more software programs overlaps almost perfectly.

Fig. 4 – *NAWRU constrained parameters*



(Source: Author's calculation on European Commission data)

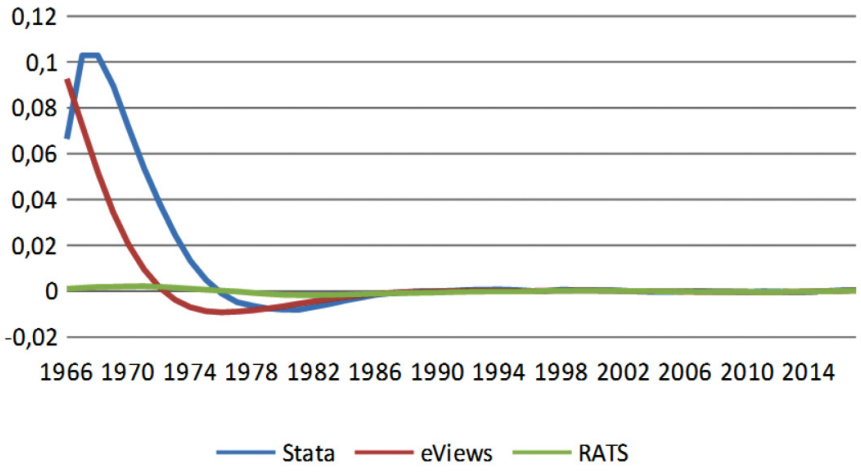
Fig. 5 – *NAWRU constrained variances*



(Source: Author's calculation on European Commission data)

The source of these differences is, very likely, the way the Kalman filter is initialized. GAP uses the diffuse Kalman filter, the same as RATS and this is very likely the reason why the two programs produce the same results. eViews and Stata use a slightly different implementation[27]. Figure 6 shows the differences in NAWRU estimates between the three commercial programs and GAP with all the commercial software package's parameters and variances constrained to equal those coming from GAP[28]. Except for RATS, at the beginning of the sample/smoothing process the differences with GAP can be significant even for a fully constrained model. The point is not that EC and MSs could use different software and get different results. GAP is freely available and is actually the official program to use for PO estimates. The point is that all the measure of the NAWRU we have seen are equally reasonable.

Fig. 6 – *Fully constrained models*



(Source: Author's calculation on European Commission data)

[27] For technical details refer to the software manuals.
[28] Stata needs at least one parameter or variance to be free.

5. *Policy implications and conclusions*

We have seen that there are a lot of possible sources of microscopic differences which can produce quite large consequences in terms of policy implications. These 'microscopic' differences add to the uncertainty coming from 'macroscopic' differences – i.e. data revision, differences in forecast and model specifications. The implementation of the Stability and Growth Pact, with the preventive and corrective arms, hinges on the calculation of the structural balance and, hence, potential output and the output gap. But potential output and its components, like the NAWRU, are not observable and must be estimated. Furthermore these estimates are based not only on historical data, but also on forecasts. Potential output is a very useful concept and is a powerful tool to understand which direction the economy is taking. Nonetheless, its unobservability and sensitivity to even small changes in underlying data, model assumptions, horizons and initial conditions make it a very weak and not reliable tool for fiscal surveillance in the European Union in which even a decimal point in SB can make the difference.

It is worth to emphasize that what really matters for the fiscal governance for those countries which are not at their MTO but along the path toward the MTO is not the SB per se, but the 'change' in the SB that must satisfy the convergence criterion. Large differences in the estimates of the SB can be associated with small differences in the estimated change in SB. Nonetheless, having a more robust measure of the cyclical position of a country implies less uncertainty around the estimate of the change in the SB.

How can the EC methodology be improved? Some recent researches have shown some possible paths. Blanchard *et al.* (2015) stress the possibility that in the latest twenty years or so the inflation-unemployment relation, the Phillips curve, has moved back to a 'level Phillips curve' rather than an 'accelerationist Phillips curve', with an increasing importance of the inflation target set by central banks and a weakening in the relation between inflation and the unemployment gap. They also stress the possibility that, during and after the financial crises, hysteresis and super-hysteresis[29] have characterized the post-recession period. Possible roles for anchored expectation and hysteresis are also confirmed by Rusticelli *et al.* (2015) and Rusticelli (2015), with the latter stressing the effect of a long lasting unemployment on workers employability.

Some progresses in these directions have been made during recent years

[29] While hysteresis affects the level of output, super-hysteresis affects the 'rate of growth' of output.

in the EC methodology. In 2014 the EC has introduced the possibility to move to a New-Keynesian Phillips curve in which rational expectations on price development replace adaptive expectations. The motivation behind this change is that «rational expectation avoids producing excessively pro-cyclical NAWRU […]»[30]. The issue of the excess of pro-cyclicality has been raised by many authors and commentators[31], but apparently in the wrong way. The point is not that the NAWRU is too pro-cyclical; it is that the pro-cyclical behaviour is not estimated, but the consequence of the fine tuning on the bounds of the variances. Long-lasting unemployment and/or supply shocks can produce hysteresis and pro-cyclicality, but the EC methodology has no tool (variable in the Phillips curve equation) to capture this phenomenon. For example, introducing the effect of long term unemployment might improve the week economic relation between inflation and unemployment registered during the latest decade. The proof of this weakening in the relation is in the EC owns estimates: in recent years in the special case of Italy the R^2 of the estimate has always been under 0.1.

Changing the methodology is a very demanding process because every change has to be endorsed and adopted by the EC and all the MSs in the Output Gap Working Group of the Economic Policy Committee. Nonetheless, the effort is necessary to restore the credibility on the EU's fiscal governance framework and to guarantee a fair treatment of all MSs.

[30] European Commission (2014), box 1.1.
[31] See for example Fantacone *et al.* (2016).

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The macroeconomic and distributive impact of the Italian budget policy implemented in year 2015 is the book focus. On one hand, we argue that fiscal consolidation policies jeopardize GDP growth, already very low, and end up delaying the decrease of public debt/GDP ratio. On the other hand, we argue that implemented policies did not bring about any improvement in Italian distributive inequality, which is one of the highest in Europe. Furthermore, two salient issues regarding fiscal policies are addressed: first, the relationship among tax design, growth and employment. Given the total amount of tax revenues, an increase in tax progressivity is shown to boost employment, and a tax shift from income to consumption to raise growth and employment. The second focus is on the measurement of potential output, which is one of the building blocks of European fiscal governance. Two sections show that the European commission methodology is not only scarcely robust or but also inadequate.

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