Fiscal Stabilization and the Credibility of the U.S. Budget Sequestration Spending Austerity

Ruiyang Hu[1], Carlos E. Zarazaga*,[2]

Abstract

The credibility of fiscal stabilization programs plays a critical role in their macroeconomics outcomes, yet formal assessments of that credibility are typically missing from analyses of the economic consequences and effectiveness of those programs. This paper remedies that omission for the most recent fiscal consolidation attempt in the U.S.: the 2011-mandated budget sequestration spending cuts in discretionary spending slated to begin in 2013. The credibility of those cuts is assessed with a novel methodology that draws on the "event-study" and Business Cycle Accounting traditions. The paper finds that the fiscal austerity program had little, if any, credibility around the time it was scheduled to become effective and that studies that don't take this lack of credibility into account might overestimate the quantitative impact of the budget sequestration on key macroeconomic variables by a factor of three or more. These findings expose the dangers of extrapolating policy lessons extracted from the budget sequestration experience to other fiscal stabilization programs, without gauging first their credibility. Properly adapted and extended, the methodology the paper developed with that purpose could prove useful for the systematic assessment of the credibility of other fiscal stabilization programs, of the impact of their credibility on aggregate outcomes and, ultimately, of the chances of those programs to successfully eliminate structural fiscal imbalances.

Keywords: Fiscal stabilization; U.S. government spending cuts; Credibility; Event-study Business Cycle Accounting

JEL Classification: E62, E65, H30, H50, H60

1. INTRODUCTION

Government debt escalated significantly following the Great Recession in five of the Group of Seven (G7) advanced economies. In France, Italy, Japan, the United Kingdom, and the United States, general government net debt, as reported by the International Monetary Fund, rose by 30 to 50 percentage points of GDP between 2007 and 2015. That debt represented at least 80% of GDP in those G7 nations at the end of the period, an amount large enough to prompt concerns about the sustainability of governments' fiscal policies.

Of particular interest, the U.S. general government net debt nearly doubled, from about 40 percent of GDP in 2007, to 80 percent of GDP in 2012. This surge cannot be attributed solely to the cyclical increase of fiscal deficits in economic downturns, even with the especially deep 2008–09 Great Recession. It was also a byproduct of structural fiscal imbalances predating that contraction.

The Congressional Budget Office (CBO), a non-partisan federal agency, in a December 2007 report documented that the fiscal policy regime then in place implied an explosive path for the U.S. government debt.[3] A subsequent report by that same agency (CBO, 2010), found that the Great Recession simply exacerbated preexisting fiscal imbalances.

Concerned with the negative long-run consequences of those structural

---

The views expressed herein are those of the authors and should not be interpreted as reflecting those of the Federal Reserve Bank of Dallas or of the Federal Reserve System.

*Corresponding author

Email addresses: rhu@mail.smu.edu (Ruiyang Hu), carlos.zarazaga@dal.frb.org (Carlos E. Zarazaga)

[1]Southern Methodist University.

[2]Federal Reserve Bank of Dallas, Research Department, 2200 N. Pearl St, Dallas, TX 75206, USA.

[3]The CBO obtains the projections of fiscal variables implied by the prevailing policy regime with assumptions captured by an "alternative scenario." The rather close correspondence of that scenario with current policy, rather than with "current law," is documented more explicitly in analyses of the U.S. fiscal situation by the Peterson Foundation. See, for example, Peterson Foundation (2012).

imbalances, the Congress passed the Budget Control Act of 2011. An interesting feature of the law was the inclusion of a contingent clause that, starting in 2013, triggered a decade of government consumption expenditure reductions cumulatively totaling the equivalent to about 10% of nominal GDP in 2011. This provision has come to be known generically as "budget sequestration," because its implementation entailed the revocation, or sequestration, of previously authorized expenditures.

The magnitude of the spending cuts has rekindled a debate in academic and policy forums about attempts to correct structural fiscal imbalances by reducing government expenditures and the effects of those cuts on economic activity. An International Monetary Fund (2010) study, for example, disputed results reported by Alesina and Perotti (1995) that those effects have been positive in several expenditure-based fiscal stabilization programs. Often forgotten in the heat of the discussion is the qualification, hinted at by McDermott and Wescott (1996), that the output effects of those programs depend critically on the extent to which economic agents expect the scheduled spending cuts to be enforced.

It follows that any analysis of the effects of the fiscal stabilization that the Budget Control Act meant to achieve should be informed by an assessment of the credibility of the spending cuts it prescribed. This is precisely the goal of the paper, accomplished with a novel methodology, in principle applicable to other fiscal stabilization experiences, and for that reason potentially of interest in its own right.

The design of the methodology was guided by the implication of a wide class of economic models that different degrees of credibility of future spending cuts affect economic agents' decisions differently, inducing a corresponding quantitatively distinctive response in key macroeconomic variables. It should be possible, therefore, to infer with well-accepted statistical tools which of the alternative credibility spending cuts scenarios are more likely to have accounted for the observed performance of those variables over the

relevant period.

The methodology proceeds to make that inference by combining two approaches typically used in isolation in the economic literature: an "event study" approach, common in finance and exploited by Ramey and Shapiro (1998) to study the effects of government spending policy shocks, and a "Business Cycle Accounting" (BCA) approach, originally developed by Chari, Kehoe, and McGrattan (2007) to study economic fluctuations within the analytical framework of general equilibrium models.

The motivation for incorporating an event-study perspective was the prospect of obtaining a cleaner reading of the credibility of the spending cuts by limiting attention to evidence around the time of their initiation. The focus on a narrow window of time reduces the chances of contamination of responses of macroeconomic variables to that "policy event" from rare though sizable unanticipated shocks from other sources. This advantage was particularly handy, because the U.S. economy started to register the consequences of a large and persistent negative shock to oil prices in 2014. This development, as well as the chronology of events discussed in greater detail later, buttress support for confining the evidence relevant for this paper to the years 2012 and 2013.

The reason for looking at the evidence with a BCA approach was its ability to accommodate, within a general equilibrium framework, diverse views of the features and frictions of the economic environment responsible for macroeconomic variables' responses to shocks and policy regime changes—a desirable attribute for enhancing confidence in the inferences obtained with the methodology. Additionally, the BCA approach renders itself to a state-space representation of the economy that exactly replicates the data. This feature, along with the event-study approach, was key to making inferences about the credibility of alternative budget sequestration spending cuts scenarios with well-accepted likelihood-based techniques. In that regard, this paper is the first to show how the BCA approach, initially conceived for other

purposes, can also be applied to the study of economic policy issues.

In order to increase the accuracy of those techniques, this paper dealt with the measurement issues raised by Gomme and Rupert (2007) by adopting their "private sector economy" approach to the mapping between the model and the data. A lack of consensus about the magnitude of two macroelasticities controlling the size of the transitional effects induced by the budget sequestration—the intertemporal elasticity of substitution in consumption and the labor supply Frisch elasticity—was resolved by assessing the credibility of alternative spending cut scenarios for several combinations of values for those parameters.

The main finding of the paper is that for all those combinations and by the standards of the maximum likelihood criterion, the budget sequestration spending cuts scheduled for 2014 and beyond enjoyed little, if any, credibility during the 2012–13 event-study window. For the reasons hinted earlier, it will be important to keep that finding in mind when drawing policy conclusions from discrepancies between the predicted and observed outcomes of attempts to correct fiscal imbalances with spending austerity.

But that is not the only reason to take the finding into account. Scholars and policymakers will also find it useful for correctly identifying the factors ultimately responsible for economic outcomes observed during the budget sequestration period. The contribution of the paper along this dimension is illustrated by numerical experiments that show that in the model economy spending cuts for an amount equivalent to 1% of GDP, spanned the same length of time as those prescribed by the budget sequestration, have virtually no effect on the level of economic activity if they lack credibility beyond the current period. However, they shave as much as 0.7 percentage points from output growth if fully credible. It follows that studies that ignore the finding of this paper may incorrectly transfer to that fiscal austerity package at least part of the responsibility that other factors may have had in the slowdown that the U.S. economy experienced, according to Cashin, Lenney, Lutz, and

Peterman (2017), around the time the spending cuts were triggered

More generally, the results reported by studies evaluating the responses of macroeconomic variables to expenditure-based fiscal consolidation programs might be misinterpreted absent a formal assessment of the credibility of the prescribed spending cuts. This paper proposes a methodology suitable for such an assessment.

The rest of the paper is organized as follows. Section 2 reviews background material, chronology of events, and measurement issues that motivated many of the assumptions and details of specification of the model presented in Section 3. Section 4 describes the adapted event-study BCA approach and statistical tools the paper exploits to make inferences about the credibility of the budget sequestration spending cuts. Section 5 reports the findings. Section 6 offers final remarks.

2. BACKGROUND MATERIAL

2.1. THE BUDGET SEQUESTRATION: RELEVANT DETAILS AND TIMELINE OF EVENTS

This section provides background information on features of the budget sequestration spending cuts and the timeline of events leading up to it that informed many of the modeling choices made in the paper.

The reluctance of the U.S. Congress to authorize the debt ceiling increase that the Treasury had requested on January 6, 2011, was the first significant development leading to enactment of the fiscal austerity package that motivates this paper. A large number of legislators, concerned with the rapidly growing government debt projected by the CBO in the already cited reports, decided to withhold the routinely granted debt ceiling increase authorization until the request was accompanied by measures to halt debt growth.

Lack of consensus on those measures brought the U.S. to the verge of default. On July 14, 2011, the credit rating agency Standard & Poor's downgraded U.S. government debt. The prospect of a debt crisis forced lawmakers

to finally reach a compromise, embodied in the 2011 Budget Control Act enacted on August 2, 2011. The legislation assigned to a bipartisan committee of lawmakers the task of proposing fiscal deficit reduction measures totaling $1.5 trillion (equivalent to about 10% of nominal GDP at the time) over the upcoming decade. But it also contained a provision of interest for this paper; the stipulation that failure of the committee to submit the corresponding proposal or the Congress to subsequently act on it by January 15, 2012, would result in imposition of spending caps on discretionary budget authority, starting January 2, 2013 and continuing through fiscal year 2021.

If triggered, the contingent clause just described would reduce fiscal deficits by $1.2 trillion (inclusive of savings in interest payments on government debt) with the rather blunt expedient of across-the-board spending cuts, evenly split between discretionary defense and non-defense programs.

The Joint Committee announced on November 11, 2011, that it could not submit a deficit reduction package by the deadline. This development may have been significant enough for the economic decisions of households and businesses in 2012 to reflect the anticipation of the budget sequestration spending cuts starting the following year. But it is also likely that economic agents dismissed the activation of those cuts, convinced that the extreme fiscal austerity they implied would encourage legislators to reach yet another last-minute agreement in the course of ongoing negotiations to extend temporary tax cuts enacted in 2001 and 2003. Such perception may have been reinforced by public statements from Congress and even the President on their determination to find a compromise. Those hopes became unreachable, however, after the American Tax Relief act passed at the dawn of 2013, which postponed the spending cuts by just two months.

Given this chronology, the paper had to consider the contingency that economic agents started to incorporate the budget sequestration in their decisions as early as in 2012, or possibly later, when they were actually launched in 2013.

Other details of implementation of the budget sequestration influenced the specification of the model economy. One is that the automatic spending cuts fell mostly on government budget lines allocated to purchases of goods and services, not to payrolls. This made it possible to improve the accuracy of the mapping between the concept of output in the model economy and its empirical counterpart by removing from GDP, as reported by the National Income and Product Accounts (NIPA), the general government's value added with the "private sector economy" procedure advocated by Gomme and Rupert in the abovementioned paper.

Another relevant aspect of the budget sequestration is that it would bring discretionary spending to record low levels, suggesting it is appropriate to interpret the cuts as a decade-long policy regime change rather than the manifestation of a cyclical decline.[4] Accordingly, the ratio of government absorption of goods and services to private sector output is modeled in section 3.3.1 as consisting of two components: a deterministic one, capturing the temporary spending policy change, and an exogenous one, capturing run-of-the-mill fluctuations of the ratio around its historical mean.

Finally, the additional tax of 3.8% on net investment income—a form of capital income taxation—introduced by the Health Care and Education Reconciliation Act of 2010 carries implications for the evidence examined by the paper, because it was scheduled to take effect also in 2013.

2.2. SPENDING CUTS IN REAL TERMS IMPLICITLY TARGETED BY THE BUDGET SEQUESTRATION

The second column of Table 1 documents the sequence of spending cuts in *nominal* terms implicitly prescribed by the Budget Control Act, according to the CBO's (2013) analysis. Given that the main motivation of the legis-

[4]More specifically, in table 1-1 of CBO (2012), discretionary spending at the end of the sequestration period, in 2021, is projected to represent 5.7% of GDP, the lowest level observed since at least 1972.

lation's contingent clause was to stabilize government debt relative to the size of the economy, it seems plausible to assume that the nominal level of the prescribed spending cuts was chosen to achieve a specific deficit reduction target as a percentage of GDP. In that case, the unusual clause must have taken into account that the relative importance of those cuts would be ultimately determined by the projected growth of nominal output, in turn determined by inflation and real output growth rates.

Table 1: Annual budget sequestration spending cuts

Year	$ billion (*)	per unit of 2012 nominal output	per unit of period output
2013	35	0.0025	0.00238
2014	75	0.0053	0.00491
2015	85	0.0060	0.00534
2016	89	0.0063	0.00538
2017	90	0.0064	0.00523
2018	90	0.0064	0.00502
2019	89	0.0063	0.00478
2020	88	0.0062	0.00454
2021	87	0.0062	0.00431
(*) Congressional Budget Office (2013), p. 11 and Table 1-5, p. 27.			

Thus, it makes sense to postulate that U.S. lawmakers counted on the Federal Reserve to keep the inflation rate close to the 2% annual target, as required for the budget sequestration spending cuts to deliver their underlying fiscal stabilization goal.[5] The calibration of the model economy, presented later, suggests that it was realistic to project annual real output growth rates of around 2%. The two rates combined imply a 4% annual growth rate of nominal output over the budget sequestration period.

Accordingly, the spending cuts in real terms per unit of output implicitly

[5]This assumption is consistent with the projections of several inflation rate indicators adopted by the CBO, as reported in Table B-1, p. 64, of the same publication cited as the source of the data for Table 1.

targeted by the Budget Control Act, presented in the last column of Table 1 were "reverse engineered" with the rather standard procedure of dividing their nominal counterparts by the private sector nominal GDP in 2012 and subsequently deflating the resulting figures by the projected nominal growth rate of output inferred above.[6]

Notably, by 2012 output had barely begun to register the downward pull towards its lower long-run trend exerted by the capital income tax rate increase mentioned in the previous section. The derivation of the spending cuts as fraction of GDP in the last column of Table 1 implicitly projects, therefore, output growing along its prior trend. In the context of the computational technique adopted by this paper, it is appropriate to interpret that ratio as coinciding with the *level* of the spending cuts in real terms that budget sequestration would have targeted for an economy with a constant unitary steady-state level of output. Note that it would conflict with the paper's purpose to assume that economic agents expected strict enforcement of the targeted spending cuts.

3. THE MODEL ECONOMY

In line with a well-established tradition in the macroeconomic literature, preferences, technology, and government policies in the actual economy are assumed to be consistent with balanced growth. All real variables were obtained by dividing, when applicable, their nominal counterparts by the price index of non-durable goods and services. They are also detrended, where appropriate, preserving the correspondence between the actual and the model economy with standard procedures. Other details of the mapping between the model and the data can be found in Appendix A.

[6]Nominal private sector GDP in 2012 was \$14,126 billion, as estimated from the NIPA prepared with the comprehensive methodological revision introduced in 2013.

3.1. THE TYPICAL HOUSEHOLD'S CHOICE PROBLEM

The representative household is assumed to order its preferences over infinite streams of consumption and the fraction of available time devoted to work with a time-separable utility function in the Constant Frisch Elasticity (CFE hereafter) class. Accordingly, it solves the following maximization problem:

$$\underset{\{c_t,\, h_t,\, k_{t+1}\}}{Max}\; E\sum_{t=s}^{\infty}[\beta(1+\gamma)^{1-\sigma}(1+\eta)]^t\frac{c_t^{1-\sigma}[1-\kappa\,(1-\sigma)\,h_t^{1+\frac{1}{\varphi}}]^{\sigma}-1}{1-\sigma} \tag{1}$$

subject to the following constraints:

$$\begin{aligned} c_t+(1+\tau_t^x)x_t &= (1-\tau_t^h)w_th_t+r_tk_t-\tau^k(r_t-\delta)k_t+ni_t+\tau_t && (2)\\ x_t &= (1+\eta)(1+\gamma)k_{t+1}-(1-\delta)k_t && (3)\\ 1 &= l_t+h_t && (4)\\ h_t &= h_t^{pr}+h_t^{pu} && (5) \end{aligned}$$

In the objective function (1), $\beta>0$ is the discount factor, η the working age population annual growth rate, γ the annual growth rate of total factor productivity, t a time index, c_t detrended consumption per working age person, h_t the fraction of available time each working age individual is actually *at* work (as opposed to just on payroll), $\sigma>0$ the inverse of the *labor-held constant* intertemporal elasticity of substitution in consumption (IES hereafter), $\kappa>0$ a parameter that controls the household's valuation of consumption relative to leisure, and φ the constant Frisch elasticity of aggregate labor supply.[7]

In the household's budget constraint (2), x_t is gross private domestic

[7]Recall that the multiplication of the discount factor β by the factor $(1+\gamma)^{(1-\sigma)}(1+\eta)$ is the result of removing from aggregate consumption the deterministic annual secular growth rate $(1+\gamma)(1+\eta)$.

investment, w_t the wage rate in terms of consumption per unit of the available time the stand-in household is actually at work in the marketplace, r_t the rental price of private sector capital k_t, τ^k the tax rate on income from that capital, δ the depreciation rate, and τ_t lump-sum transfers (taxes if negative.)

In the tradition of the BCA methodology, the variables τ_t^x, τ_t^h and ni_t represent three of the four "wedges" that stand in for frictions that distort equilibrium allocations in the actual economy. In particular, labor market distortions will be captured by the *labor wedge* $1 - \tau_t^h$, introduced in the form of the time-varying labor income tax rate τ_t^h, whereas financial markets distortions will be captured by the *investment wedge* $1/(1+\tau_t^x)$. The variable ni_t, which stands for net imports, is the *external sector wedge*, introduced in the minimalist manner proposed by Trabandt and Uhlig (2011) to mitigate the lack of correspondence between an otherwise closed economy model and the actual open U.S. economy. The empirical implementation of the model will take into account that in balanced growth the ratio of ni_t to output should be characterized by a stationary stochastic process with unconditional mean niy. Section 4.1 will provide further details about this process, as well as of those governing the evolution over time of the labor wedge factor τ_t^h and of the investment wedge factor τ_t^x.

Equation (3) is the law of motion of capital.

Equation (4) states the time constraint that the stand-in household can distribute its total available time, normalized to 1, among non-market activities, l_t, (generically labeled as "leisure") and work in the marketplace, h_t.

Equation (5) states that the household can split the fraction of time at work between private sector firms, h_t^{pr}, and the public sector, h_t^{pu}. The time at work in the latter is distributed, in turn, between government agencies, h_t^{gc}, and government-owned enterprises, h_t^{ge}.

3.2. PRIVATE SECTOR FIRMS' MAXIMIZATION PROBLEM

The privately-owned firms of the model economy maximize profits by combining labor and capital services acquired in perfectly competitive markets to produce output with a Cobb-Douglas production function, the constant returns to scale feature of which permits the following representation of private sector output per working age population, y_t^{pr}:

$$y_t^{pr} = Ae^{(1-\theta)z_t} k_t^{\theta} \left(h_t^{pr}\right)^{1-\theta}, \tag{6}$$

where θ is the proportion of the remuneration to capital services in the private sector value added, and z_t is a stochastic technology shifter, the fourth wedge of the model economy, corresponding conceptually to the *efficiency wedge* in the terminology proposed by Chari, Kehoe, and McGrattan in the paper already mentioned.

3.3. PUBLIC SECTOR POLICIES

Given the difficulties in modeling explicitly the behavior underlying the economic decisions made by public sector agencies and government enterprises, the variables under their control are assumed to be exogenously determined.

3.3.1. GOVERNMENT BUDGET CONSTRAINT AND THE SEQUESTER

Fiscal solvency is imposed in the model by the restriction that any change in the government purchases of goods and services (excluding labor services counted in government value added) must be offset by a corresponding change in net revenues. Thus, in the model the government absorption of output exclusively produced by the private sector, denoted ga_t, will be assumed to be equal every period to revenues from all sources minus transfer payments, as indicated by the following government budget constraint:

$$ga_t = \tau_t^h w_t (h_t^{pr} + h_t^{pu}) - w_t h_t^{gc} + \tau^k (r_t - \delta) k_t + s_t^{ge} - \tau_t, \tag{7}$$

where s_t^{ge} denotes the surpluses (deficits, if negative) of government-run enterprises, and τ_t lump-sum transfers. For consistency with the treatment of the private sector, variables in the government budget constraint are measured, when applicable, in units of the consumption good per working age population.

For the reasons given in section 2.1, the variable ga_t is interpreted as the sum of a systematic, exogenous stochastic component, ega_t, and of a non-systematic, deterministic component, pga_t:

$$ga_t = ega_t + pga. \tag{8}$$

The stochastic component is assumed to evolve over time in a manner consistent with balanced growth, as captured by the following autoregressive representation:

$$\ln \frac{ega_t}{y_t^{pr}} = (1 - \rho_{ga}) \ln gy + \rho_{ga} \ln \frac{ega_{t-1}}{y_{t-1}^{pr}} + \sigma_{gy} \varepsilon_t^{gy}, \tag{9}$$

where gy and σ_{gy} are scalars, and ε_t^{gy} is a random variable with a standard normal distribution.

The non-systematic, deterministic component pga_t will capture in the quantitative implementation of the model the policy regime change of limited duration introduced by the budget sequestration spending cuts.

3.3.2. PUBLIC SECTOR LABOR DEMAND

General government and government enterprises' demand for labor services is also assumed to be characterized by an autoregressive process, with the following representation:

$$\ln h_t^{pu} = (1 - \rho_{hpu}) \ln h_{ss}^{pu} + \rho_{hpu} \ln h_{t-1}^{pu} + \sigma_{hpu} \varepsilon_t^{hpu} \tag{10}$$

where h_{ss}^{pu} and σ_{hpu} are scalars and ε_t^{hpu} is a random variable characterized by a standard normal distribution.

3.3.3. GOVERNMENT ENTERPRISES VALUE ADDED

The value added by government enterprises, va_t^{ge}, included in the private business sector in NIPA, should grow at the same rate as private sector output along a balanced growth path, as captured by the following stochastic process:

$$\ln \frac{va_t^{ge}}{y_t^{pr}} = \ln vy + \sigma_{vy}\varepsilon_t^{ge} \tag{11}$$

where vy and σ_{vy} are scalars, and ε_t^{ge} is a random variable characterized by a standard normal distribution.

3.3.4. RESOURCE CONSTRAINT

It is useful to make explicit the resource constraint that results from consolidating the household's budget constraint (2) with the government budget constraint (7), after taking into account that, for consistency with the NIPA methodology, output in the model economy originates in private sector firms according to (6) and in government-owned enterprises according to (11), as well as that the operating surpluses of the latter are obtained by subtracting labor costs, $w_t h_t^{ge}$, from their outputs:

$$c_t + (1+\tau_t^x)x_t = \left[1 + \frac{va_t^{ge}}{y_t^{pr}} - \frac{ga_t}{y_t^{pr}} + \frac{niy_t}{y_t^{pr}}\right] Ae^{(1-\theta)z_t} k_t^{\theta} (h_t^{pr})^{1-\theta}.$$

3.4. MODEL CALIBRATION

It is unlikely that any well-established statistical tool could reliably estimate the large number of parameters of the model economy with the limited available data, at most 37 annual observations, from 1977 to 2013, for the aggregate variables of interest. The values of as many parameters as possible were calibrated, therefore, to those for which steady-state relationships between variables and parameters of the model replicate the relevant observed long-run relationships of the actual economy.

Table 2 lists the parameter values obtained with that calibration approach, assuming that the long-run features of the U.S. economy, prior to

the fiscal policy changes discussed in section 2.1, are adequately captured by relevant averages for the period 1977-2007. The first year of this period was determined by the availability of the economic series necessary to adjust the data with the "private sector" methodology succinctly described also in that section. The observations after 2007 were deliberately excluded to avoid the contamination of those averages with the unusually large, but temporary deviations from their historical norm that many variables experienced during the Great Recession and its aftermath.

Table 2: Calibrated parameters and value of associated macroeconomic relationships

η (working-age annual population net growth rate)	0.0126
γ (TFP annual net growth rate)	0.0078
δ (depreciation rate)	0.0621
i (before-tax annual net rate of return on private capital)	0.0858
x/y^{pr} (investment-output ratio)	0.2121
k/y^{pr} (private capital–private sector output ratio)	2.5681
θ (private capital income share)	0.38
gy (fraction of private sector output absorbed by general government)	0.0825
vy (government enterprises value added–private sector output ratio)	0.0156
σ_{vy} (standard deviation of vy)	0.0856
niy (net exports–private sector output ratio)	0.026
h_{ss}^{pu} (fraction of time worked in public sector)	0.03
h_{ss}^{pr} (fraction of time worked in private sector)	0.21
τ_{ss}^{x} (investment wedge)	0
τ_{ss}^{h} (labor income tax rate)	0.23
τ_{t}^{k} (capital income tax rate)	0.35
y_{ss}^{pr} (private sector output)	1.0

The only parameters not calibrated with the data for the period just mentioned are the steady-state labor and capital income tax rates, set to the values that Kydland and Zarazaga (2016) found to be consistent with the

level of fiscal revenues the U.S. government historically collected. Beginning in 2013, though, the capital income tax rate is 3.8 percentage points higher, to incorporate the effects of the Health Care and Education Reconciliation Act of 2010 mentioned in section 2.1.

Missing from Table 2 are the model parameters by their nature not identifiable from steady state relationships. Three types of parameters fall in this class: 1) the coefficients of stationary stochastic processes that drop out from the model equations in steady state, 2) the IES and the Frisch elasticity, and 3) the parameters β and κ, determined through steady-state relationships by the values of the two macroelasticities just mentioned.

Parameters in the first group were estimated with the techniques discussed in the next section. A different approach was followed, however, for those in the second group. Given that the values of the IES and, particularly, of the Frisch elasticity, are the subject of heated debate, the paper explored the credibility of the budget sequestration spending cuts for two values of the IES and five different values of the Frisch elasticity invoked as empirically relevant in a number of studies:

– For the IES (the reciprocal of parameter σ): 0.5, and 1.

– For the Frisch elasticity (parameter φ): 0.5, 1.0, 1.9, 2.5, and 3.0.

The first Frisch elasticity value, 0.5, is the median estimate inferred from microeconomic studies. The values 1.0, 1.9, and 3.0 were taken from Kimball and Shapiro (2008), Hall (2009), and Prescott (2004), respectively. The value 2.5 was added for completeness.

4. INFERRING THE CREDIBILITY OF THE BUDGET SEQUESTRATION WITH AN EVENT-STUDY BCA APPROACH

The methodology developed by the paper was implemented in the five steps described below. An expanded, more detailed version of those steps can be found in Appendix B.

4.1. STATE-SPACE REPRESENTATION

As previously mentioned, the BCA approach renders itself easily to a parsimonious state-space representation of the model economy, suitable for the estimation with well-established statistical techniques of unobserved state variables and model parameters not set with other procedures.

To that end, the methodology here exploits the linear mapping between observables and state variables obtained by approximating the economic agents' decision rules with a first order Taylor expansion around the non-stochastic steady state relevant for the corresponding implementation step. With the further assumption that the transition from one state to the other is governed by a linear Markov process, the state-state representation of the model economy can be formalized by the *transition equation*

$$S_t = TS_{t-1} + Q\omega_t, \tag{12}$$

and the *measurement equation*

$$Y_t = DS_{t-1} + C\omega_t. \tag{13}$$

The $7x1$ column vector S_t contains the end-of-period state variables, ordered as follows:

$$S_t = [k_{t+1} - k_{ss},\ \ln \frac{ega_t}{y_t^{pr}} - \ln gy,\ \ln h_t^{pu} - \ln h_{ss}^{pu},\ z_t - z_{ss},\ \frac{ni_t}{y_t^{pr}} - niy,\ \tau_t^h - \tau_{ss}^h,\ \tau_t^x - \tau_{ss}^x]',$$

where a subindex "ss" identifies the steady state value of the period t variable immediately to the left.[8]

The $7x1$ column vector ω_t contains the period t innovations to the stochastic processes of the model economy:

[8] For consistency with the timing convention adopted in the law of motion of capital (3), the capital stock at the end of period t is denoted in the vector S_t as the beginning of period $t+1$ capital stock, k_{t+1}.

$$\omega_t = [\varepsilon_t^{gy},\, \varepsilon_t^{hpu},\, \varepsilon_t^{ge},\, \varepsilon_t^{z},\, \varepsilon_t^{ni},\, \varepsilon_t^{\tau h},\, \varepsilon_t^{\tau x}]', \tag{14}$$

where the first three elements have been identified in equations (9), (10), and (11), and the remaining ones correspond to the innovations to the four wedges, z_t, ni_t, τ_t^h, and τ_t^x, respectively. The variance-covariance of these innovations, denoted Σ, rules out correlation of the first three elements of ω_t with all others, but not among the last four.

The $7x7$ matrix T contains the stand-in household's decision rule governing capital accumulation in the first row and zeros in the other rows, except in the position corresponding to the autocorrelation coefficient of each of the stochastic processes governing the evolution of exogenous state variables. Likewise, the $7x7$ matrix Q contains the corresponding coefficients of the linearized equilibrium decision rule for the capital stock in the first row and the standard deviations of all the exogenous stochastic processes in the others.[9]

The $7x1$ column vector Y_t captures the observable variables, as follows:

$$Y_t = [y_t^{pr} - y_{ss}^{pr}\,,\, c_t - c_{ss}\,,\, x_t - x_{ss},\, h_t^{pr} - h_{ss}^{pr},\, \ln\frac{ega_t}{y_t^{pr}} - \ln gy,\, \ln h_t^{pu} - \ln h_{ss}^{pu},\, \ln\frac{va_t^{ge}}{y_t^{pr}} - \ln vy]'. \tag{15}$$

The $7x7$ matrix D consists, therefore, of decision rules coefficients in the first four rows, and of autoregression coefficients or zeros in the other, as necessary to conform with the corresponding elements of Y_t. Similarly, the $7x7$ matrix C contains, in the first four rows, the decision rules coefficients on the innovations ω_t and, in each of the last three rows, a single non-zero element capturing, in the appropriate column, the standard deviation of the variable in the corresponding row of Y_t.

[9] Interactions between these processes were ruled out for the reasons insinuated earlier: the limited data available would have prevented the reliable estimation of the large number of parameters implied by a less parsimonious specification.

4.2. ESTIMATION OF UNKNOWN STATES AND PARAMETERS

The second step in the implementation of the methodology for assessing the credibility of the budget sequestration spending cuts proceeds to estimate the relevant state variables and parameters by maximum likelihood estimation. To that effect, the paper applied the Kalman filter to the 1977-2010 data.[10]

The observations for the Great Recession were included in the estimation step because, by most accounts, that deep contraction was characterized by the virulent manifestation of otherwise difficult to identify frictions. The additional observations, therefore, could be particularly informative of parameter values of the stochastic processes for the wedges meant to capture those frictions in the model economy.

On the other hand, observations after 2010 were excluded, because they could no longer be safely regarded as generated by time series with the stationary property typically assumed in applications of the Kalman filter. In particular, 2011 macroeconomic variables in the U.S. started registering the transitional dynamic effects induced by the economic agents' anticipation of the capital income tax rate increase that the 2010 legislation mandated beginning in 2013.

As follows from the discussion in section 3.4, the estimation step had to be performed for each of the ten combination of values for the IES and Frisch elasticity. The resulting set of estimates, along with the previously calibrated parameters, completely parameterize the ten joint distributions of the observable variables required as input in subsequent implementation steps of the methodology.

Before proceeding, it is fair to ask whether the empirical performance of the model along some relevant dimension is acceptable enough to trust

[10] Following standard practice, initial conditions were set equal to the steady state value of the relevant variables whenever necessary to start the estimation algorithm.

assessments of the credibility of the budget sequestration spending cuts obtained with it. Given the presence of BCA ingredients in that methodology, it makes sense to assess the empirical performance of the model by its ability, precisely, to mimic the business cycle statistics of the actual economy for the endogenous variables included in the vector of observables Y_t. Using this criterion, the model performs reasonably well, as documented in Table 3 for the representative pair of macroelasticities IES = 0.5, Frisch elasticity = 0.5.[11]

Table 3: Business Cycle Statistics: Model and Data

	Standard deviation (%)	
Variable	Data	Model
y_t^{pr}	2.17	1.71
c_t	1.82	1.33
h_t^{pr}	2.02	1.70
x_t	6.75	6.05

4.3. INCORPORATING THE TAX REGIME CHANGE

As suggested earlier, the inferences on the extent to which economic agents expected the targeted spending cuts to be actually enforced could suffer from inaccuracies without explicitly taking into account the transitional dynamic effects induced by the capital income tax rate increase that 2010 legislation scheduled for 2013.

The step of the methodology described in this section does precisely that with the algorithm suggested by Juillard (2006), that is, by treating variables that capture policy changes in the future as additional state variables and computing again the equilibrium decision rules, as before, with a first-order Taylor approximation procedure. Accordingly, the state-space representation

[11] Of course, not all pairs of macroelasticities perform equally well in all dimensions. The complete set of business cycle statistics for all such pairs are available upon request.

of the model is modified as follows:

$$S_t = \mathfrak{T}S_{t-1} + \mathfrak{Q}\omega_t + M(\tau^k_{t+1} - \tau^k_{new}), \tag{16}$$

$$Y_t = \mathfrak{D}S_{t-1} + \mathfrak{C}\omega_t + R(\tau^k_{t+1} - \tau^k_{new}), \tag{17}$$

where $t = 2011$, M and R are matrices of coefficients with dimensions $7x1$, and τ^k_{new} represents the new capital income tax rate of 0.388 effective since 2013. The matrices $\mathfrak{T}$, $\mathfrak{Q}$, $\mathfrak{D}$, and $\mathfrak{C}$ had the same dimensions as the matrices T, Q, D, and C, respectively, identified in the previous steps. The elements of these two set of matrices are the same when corresponding to parameters or statistical moments estimated in the previous step, but different when corresponding to coefficients of the decision rules associated with the new steady state implied by the permanently higher capital income tax rate.[12]

4.4. INCORPORATING THE BUDGET SEQUESTRATION CUTS

The step in this section incorporates into the model the effects of the temporary policy regime change induced by the budget sequestration spending cuts. The application of the same computational device used to incorporate the foreseen capital income tax increase results in the following state-space representation of the model for the years included in the event-study window:

$$S_t = \mathfrak{T}S_{t-1} + \mathfrak{Q}\omega_t + \mathfrak{M}_t\Psi\Delta_{2013}, \tag{18}$$

and

$$Y_t = \mathfrak{D}S_{t-1} + \mathfrak{C}\omega_t + \mathfrak{P}_t\Psi\Delta_{2013}, \tag{19}$$

[12] Strictly speaking, the variable $\tau^k_{t+1} - \tau^k_{new}$ in the expanded state-space representation should consist of a vector containing all future capital income tax rates that deviate from the higher one prevailing in the new steady state, reflecting the fact that current period investment decisions depend on all future after-tax rates of return on capital. But given that $\tau^k_{t+1} = \tau^k_{new}$ starting in 2012, the notation above takes into account that in practice that hypothetical vector contains only a single non-zero element.

where $t = 2012,\ 2013$, $\mathfrak{M}_t$ and $\mathfrak{P}_t$ are matrices of dimensions $7x9$, Δ_{2013} is a $9x1$ column vector whose elements are the deviations of the targeted spending cuts from their steady state level, and Ψ is a $9x9$ diagonal matrix, whose role will be discussed shortly.

Notice that the matrices $\mathfrak{T}$, $\mathfrak{Q}$, $\mathfrak{D}$, and $\mathfrak{C}$ are the same as those in the previous section because the budget sequestration spending cuts were scheduled to last for a limited time and shouldn't have, therefore, an ever-lasting impact on the steady state equilibrium of the economy. Accordingly, the steady state value of the spending cuts is set to zero. Taking into account the implications of the normalization of output to a unitary steady-state level, the deviations of the level of the targeted spending cuts from their steady state value to be entered in the vector Δ_{2013} are simply the values in the last column of Table 1.

The matrix Ψ has the effect of generating alternative "credibility scenarios," characterized by spending cuts that differ by a certain percentage from those targeted by the 2011 Budget Control Act. The differences, ranging from 0% to 100%, are representative of those that economic agents may have foreseen materializing around the time the budget sequestration procedure was launched. As mentioned in the introduction, the design of the methodology has been guided by the idea that the relative ability of those alternative scenarios to account for the observed performance of key macroeconomic variables will provide the information necessary to gauge the credibility inspired by that fiscal austerity measure.

Concretely, the matrix Ψ constructs a large number of budget sequestration scenarios by means of two parameters in its diagonal that control the size of the spending cuts actually entered in equations (18) and (19). The first parameter, ψ_0, in the first row of the matrix diagonal, controls the size of the spending cuts for the year 2013; the second one, ψ_1, in the other rows of the diagonal, does the same for the spending cuts from 2014 onwards. Each of these parameters takes on the values corresponding to each of 101

evenly separated points in the interval [0,1]. This parametric approach gives rise rather parsimoniously to 10,201 plausible credibility scenarios that will "compete" to account for the evidence in the last step of the methodology.

The timing of events provides justification to apply to the targeted spending cuts for 2013 a different "credibility parameter" than was used for subsequent years. Since the budget sequestration was effectively launched in the first quarter of 2013, households and businesses may have considered that it was too late to accommodate modifications to the cuts prescribed for that year in the same year's legislative agenda. The same constraint didn't apply to the spending cuts for subsequent years.

4.5. ASSESSING THE CREDIBILITY OF THE BUDGET SEQUESTRATION

The last stage of the methodology gauges the credibility of the targeted spending cuts by computing the likelihood of the data for all the scenarios previously constructed. For the reasons given when discussing the timeline of events in section 2.1, it was important to make inferences about that credibility not only as of the year 2013, when the budget sequestration was slated to be began, but also as of the prior year, 2012. To that end, the last stage of the methodology was applied sequentially to each of these two years by a procedure that can be described as implementing the following set of instructions:

1. Back out the vector (14) of realized exogenous shocks that replicate the data exactly for the year 2012 for each spending cut scenario and combination of macroelasticities from (19):

$$\omega_{i,m} = \mathfrak{C}_i^{-1} Y_m - \mathfrak{C}_i^{-1} \mathfrak{D}_i S_{i,m-1} - \mathfrak{C}_i^{-1} \mathfrak{P}_{i,m} \Psi_j \Delta_{2013},$$

   where the subindex m stands for the year 2012, the subindex i indicates that the elements of the matrix or vector bearing it correspond to those associated with the particular combination i of values of the IES and the

Frisch elasticity, and the subindex j identifies the particular credibility scenario under inspection, out of the 10,201 considered.[13]

2. Calculate the likelihood of the data for each spending cuts scenario and combination of macroelasticities, keeping in mind that the parameters of the likelihood function have been kept fixed at the values obtained in the estimation step.[14]
3. Identify the scenario with the greatest likelihood and associated credibility parameters ψ_0 and ψ_1.
4. Compute the state variables at the end of 2012 implied by the scenario with the greatest likelihood identified in the previous step and repeat steps 1)–3) for the year 2013.

5. FINDINGS

5.1. CREDIBILITY OF THE BUDGET SEQUESTRATION

The application of the last step of the methodology just described to the year 2012 suggests that the spending cuts as of that date had no credibility whatsoever. Specifically, for all the macroelasticity values considered, the value of the likelihood function implied by that year's observables attained

[13] Since there are seven equations (one for each of the seven observables) and seven unknowns (seven exogenous shocks), this step is generally feasible, except in the rare case in which $\mathfrak{C}_i$ happens to be singular.

[14] More specifically, the likelihood of the observables can be computed quite straigthforwardly with the formula [13.4.1] on page 385 in Hamilton (1994), after exploiting the isomorphism between the dynamic system of equations (12) and (13) and the system $\xi_{t+1} = F\xi_t + G\omega_{t+1}, Y_t = A'x_t + H'\xi_t$, where $\xi_{t+1} \equiv \begin{bmatrix} S_t - \mathfrak{M}\Delta_t & \omega_{t+1} \end{bmatrix}'$, $F \equiv \begin{bmatrix} \mathfrak{T} & \mathfrak{Q} \\ 0 & 0 \end{bmatrix}$, $G \equiv \begin{bmatrix} 0 & I \end{bmatrix}'$, I is an identity matrix, $A' \equiv \mathfrak{B}_i$, $x_t \equiv \Delta_t$, and $H' \equiv \begin{bmatrix} \mathfrak{D} & \mathfrak{C} \end{bmatrix}$. To avoid misunderstandings, note that in Hamilton's book the matrix Q denotes the variance-covariance matrix of the state variables, while in the paper, that notation is reserved for the matrix of coefficients of the shocks in the transition equation. For consistency with the treatment of estimated parameters, the variance-covariance matrix of the state variables is assumed throughout to be the same as that estimated with the procedure described in section 4.2.

its maximum when the two parameters controlling the size of the spending cuts fed into the decision rules are zero, that is, when $\psi_0 = \psi_1 = 0$.

In light of this result, the paper assessed the credibility of the spending cuts as of the following year, 2013, with an identical procedure, assuming that the state variables at the beginning of that year reflected economic decisions made in 2012, with the expectation that the announced policy regime change would be canceled. The corresponding likelihood function in this case is maximized, also for all macroelasticity values considered, for the scenario in which economic agents behaved as if expecting that the targeted spending cuts would be fully implemented in 2013, but very little or not at all from 2014 onwards. That is, for the scenarios identified by a value of 1 for the parameter ψ_0 and a value of 0 or close to it for the parameter ψ_1. This finding is formally summarized in Table 4, which reports the credibility parameters that maximize the likelihood function along with the corresponding value of that function.

Table 4: Spending Cuts Scenario that Maximizes the Log Likelihood of 2013 Observables

Intertemporal elasticity of substitution ($\boldsymbol{\sigma}$) = **1**			
Frisch elasticity (φ)	ψ_0	ψ_1	Likelihood
0.5	1	0	5.7889
1.0	1	0	5.7266
1.9	1	0	5.6542
2.5	1	0	5.6229
3.0	1	0	5.6002
Intertemporal elasticity of substitution ($\boldsymbol{\sigma}$) = **2**			
Frisch elasticity (φ)	ψ_0	ψ_1	Likelihood
0.5	1	0.26	5.5842
1.0	1	0.09	5.4881
1.9	1	0	5.3654
2.5	1	0	5.3083
3.0	1	0	5.2696

Overall, the interpretation of these results is that in 2012 economic agents were highly skeptical that the budget sequestration would be triggered in 2013, perhaps counting on legislation then under consideration to at least postpone the spending cuts indefinitely.

That perception seems to have changed somewhat in 2013, when the failure of the American Taxpayer Relief Act to postpone the budget sequestration for more than two months may have convinced economic agents that the targeted spending cuts scheduled for that year would be indeed implemented. But according to the results in Table 4, households and businesses remained skeptical that the spending cuts targeted for the following years would be executed. It turns out that subsequent developments validated those doubts: legislation passed on the last month of 2013 (the Bipartisan Budget Act) reduced the nominal spending cuts prescribed until then for 2014 and 2015 by $37 billion and $ 18 billion, respectively, later on the Bipartisan Budget Act of 2015 had the same effect on the years 2016 and 2017, in the amounts of $50 billion and $30 billion, respectively,[15] and finally the Tax Cuts and Jobs Act of 2018 cancelled altogether the discretionary spending cuts for the remaining years stipulated in the Budget Control Act of 2011.

5.2. QUANTITATIVE EFFECTS OF CREDIBILITY

The formal inferences about the credibility of the budget sequestration just reported are somewhat unsatisfactory, because they don't give explicit guidance on the differential quantitative effect that alternative credibility scenarios have on macroeconomic variables.

That issue can be addressed with a numerical experiment inspired by the usual practice of inferring the quantitative properties of dynamic stochastic general equilibrium models from their implied impulse response functions. The technique involves tracking the response of endogenous macroeconomic

[15] See CBO (2014), p. 21 and CBO (2016), p. 10.

variables to each of the innovations, often of a size equivalent to 1% of steady-state output, to the exogenous shocks present in the model economy.

This naturally suggested that the analogous impulse response exercise relevant for this paper is one that studies the change in the endogenous macroeconomic variables in the vector of observables Y_t induced, on impact, by different degrees of credibility on a policy announcing future spending cuts equivalent to 1% of the model economy steady-state output, covering the time period that budget sequestration spanned.

This intuition was accomplished by setting the nine elements of the vector Δ_{2013} equal to the value of 0.01 (capturing spending cuts of a size equivalent to 1% of the calibrated level of steady-state output) and simulating the outcomes of the model economy for two representative credibility scenarios. In the first scenario, the announced spending cuts are assumed to be fully credible, while in the second only the first period spending cuts are foreseen to be actually enforced. In terms of the parametric approach to representing different degrees of credibility introduced in the previous section, the first scenario is captured by setting $\psi_0 = \psi_1 = 1$, and the second one by setting $\psi_0 = 1$ and $\psi_1 = 0$.

Table 5 illustrates the potential quantitative impact of policy credibility on the endogenous observable variables implied by simulating model predictions for 2013 with all innovations to the exogenous shocks shut down and the values of the IES and the Frisch elasticity set to 1.0 and 3.0, respectively. The table's second column reports the percentage change in the level of the corresponding variable in the first column predicted by the model for the full credibility scenario, relative to the predicted level of the same variable in absence of a government spending policy regime change. The third column documents the analogous percentage for the low credibility scenario.

Table 5: Response of macroeconomic variables to announced future spending cuts

	% change relative to level in absence of policy change	
Variable	**Full credibility**	**Low credibility**
y^{pr}_{2013}	-0.7	-0.2
c_{2013}	0.7	0.2
h^{pr}_{2013}	-1.2	-0.3
x_{2013}	-0.8	4.5

As is apparent from the table, different degrees of credibility have a significant quantitative impact on macroeconomic variables. In particular, according to the model, fully credible spending cuts can shave as much as 0.7% percentage points from output growth, whereas not credible cuts induce a much more limited response from output. The differential quantitative impact on this and other macroeconomic variables of alternative degrees of credibility in a fiscal austerity program predicted by the model is behind the inferences about the credibility of the budget sequestration reported in the previous section.

6. CONCLUDING REMARKS

Nations confronting structural fiscal imbalances typically attempt to correct them with stabilization programs that significantly alter the existing fiscal policy configuration through steep taxation increases and/or drastic government spending reductions.

The variety of outcomes associated with such programs, even those without obvious differences in design or scope, has prompted lively debates in academic and policy forums. Often lost in these exchanges is an important caveat: The outcome of a given fiscal stabilization program is not independent of its credibility, because it has been well-established that forward-looking households and businesses will not make the same decisions when

expecting a given fiscal stabilization program to be fully implemented as initially announced as when anticipating that the program will be partially or fully repudiated later.[16]

In the light of this implication, the scarcity of formal attempts to establish the credibility of fiscal policy stabilization experiences is surprising. Motivated by the need to address that apparent void in the literature, this paper formally assessed the credibility of a recent fiscal stabilization attempt: that initiated by the budget sequestration spending cuts triggered in the U.S. by the Budget Control Act of 2011.

In the absence of readily available methodologies to make such an assessment, the paper developed a novel one, merging an "event-study" approach, typically used to study the effects of fiscal shocks, and a "business cycle accounting" approach, originally developed to address economic fluctuations questions.

The resulting blended methodology made it possible to assess the credibility of the spending cuts targeted by the Budget Control Act with a well-known statistical metric, the maximum likelihood criterion.

An important step for the application of that metric was the construction of a rather comprehensive set of "spending cuts scenarios." Leaving minor details aside, each scenario is characterized by forward-looking economic agents which, in the abstraction of the model, make their economic decisions, starting either in 2012 or 2013, with the expectation that the actual spending cuts will be a fraction of those implicitly targeted by the Budget Control Act.

The scenarios device made it possible to exploit the wedges introduced by the BCA approach to capture, in an expedient fashion, the presence in the economy of frictions not explicitly modeled. In order to replicate the data exactly for each of the IES and Frisch elasticity values considered, the

[16] The connection between the credibility and outcomes of fiscal and monetary policies has been made particularly apparent by the prolific literature on the time-inconsistency problem uncovered by Kydland and Prescott (1977) and Calvo (1978).

configuration of the innovations to those wedges must change across credibility scenarios. The more likely the configurations of the resulting innovations, the higher the value of the likelihood function induced by the state-space representation of the model economy.

That intuition was formally captured by ranking the credibility scenarios in 2012 and 2013, for each of the 10 possible combinations of macroelasticities considered, by the value of the corresponding likelihood function.

By that standard, the paper's finding can be succinctly summarized as stating that the budget sequestration spending cuts had little to no credibility, regardless of the IES and Frisch elasticity values considered.

Confidence in this finding is unavoidably subject to the limitations of the evidence, confined to that available over the narrow window of time that could be reasonably considered by the event-study approach deemed as the most appropriate for assessing the credibility of the budget sequestration in its initial stages. Limited information notwithstanding, the methodology proposed in the paper is arguably validated by the fact that the lack of credibility it detected in the budget sequestration spending cuts, as they were launched, is consistent with the ultimate fate of that discretionary spending austerity policy, first relaxed and then halted altogether halfway through its partial execution by subsequent legislation documented in the paper.

Furthermore, a numerical experiment performed in the paper eloquently demonstrates that there can be significant qualitative and/or quantitative differences in the response of macroeconomic variables to fiscal austerity between the case in which the spending cuts in discretionary spending categories are expected to be carried out as originally announced and the case in which the fiscal rebalancing attempt is expected to fizzle out rather quickly.

The findings of the paper suggest, therefore, that studies interested in evaluating the macroeconomic effects of the budget sequestration might reach misleading conclusions without taking its lack of credibility into account. Since this implication is likely to be valid for all fiscal stabilization programs,

an assessment of those programs' credibility might prove helpful in settling the policy debates prompted by their different outcomes. The methodology the paper developed to that end for a specific fiscal rebalancing plan is potentially useful, properly adapted and extended, for also assessing the credibility of other fiscal stabilization programs, the impact of their credibility on macroeconomic outcomes and, ultimately, the chances of success of the corresponding programs in eliminating structural fiscal imbalances.

Acknowledgements
We are particularly grateful to Nathan Balke for his useful suggestions at several stages of the research project leading up to this paper, which benefitted as well from the suggestions received from participants at the 2017 Annual International Conference on Macroeconomic and International Finance, University of Crete, Greece, the 2017 Annual Meeting of the Society for Economic Dynamics, Edinburgh, United Kingdom, and the 2017 Joint Annual Conference of the Latin American and Caribbean Economic Association and the Latin American Meeting of the Econometric Society, Buenos Aires, Argentina.

References

Alesina, A. and R. Perotti (1995): "Fiscal Expansions and Fiscal Adjustments in OECD Countries," *Economic Policy* 10 (21): pp. 205–248.

Calvo, G. A.: "On the Time Consistency of Optimal Policy in a Monetary Economy," *Econometrica* 46,(6): pp. 1411-1428

Cashin, D., J. Lenney, B. Lutz, and W. Peterman (2017): "Fiscal Policy and Aggregate Demand in the U.S. Before, During and Following the Great Recession," Finance and Economics Discussion Series 2017-061. Washington: Board of Governors of the Federal Reserve System.

Chari, V.V., P. J. Kehoe and E. R. McGrattan (2007): "Business Cycle Accounting," *Econometrica* 75 (3): pp. 781-836.

Congressional Budget Office (2007):"The Long-Term Budget Outlook," December.

——————————— (2010): "The Long-Term Budget Outlook," June, p. 14.

——————————— (2012): "An Update to the Budget and Economic Outlook: Fiscal Years 2012-2022," August.

——————————— (2013): "The Budget and Economic Outlook: Fiscal Year 2013-2023." February.

——————————— (2014): "The Budget and Economic Outlook: Fiscal Year 2014-2024." February.

——————————— (2016): "The Budget and Economic Outlook: Fiscal Year 2016-2026." January.

Gomme, P. and P. Rupert (2007): "Theory, measurement and calibration of macroeconomic models," *Journal of Monetary Economics* 54: 460-497.

Hall, R. E. (2009): "Reconciling Cyclical Movements in the Marginal Value of Time and the Marginal Product of Labor," *Journal of Political Economy* 117 (2): 281-323.

Hamilton, J. D. (1994):"Time Series Analysis," Princeton University Press, Princeton, New York.

International Monetary Fund (2010): "World Economic Outlook: Recovery, Risk, and Rebalancing."

Juillard, M. (2006): "Policy Change and DSGE models," manuscript.

Kimball, M. S. and M. D. Shapiro (2008): "Labor Supply: Are the Income and Substitution Effects Both Large or Both Small?," National Bureau of Economic Research. Working Paper 14208.

Kydland, F. E. and E. C. Prescott (1977): "Rules Rather than Discretion: The Inconsistency of Optimal Plans," *Journal of Political Economy* 85 (3): 473-492.

Kydland, F. E. and C. E. J. M. Zarazaga (2016): "Fiscal Sentiment and the Weak Recovery from the Great Recession: A Quantitative Exploration," *Journal of Monetary Economics* 79: pp. 109-125.

McDermott, C. John and R. F. Wescott (1996): "An Empirical Analysis of Fiscal Adjustments," IMF Staff Papers 43 (4): pp. 725-753.

Peterson Foundation (2012):"Government Accountability Office Fall 2012 Budget Outlook," URL: http://www.pgpf.org/analysis/government-accountability-office-fall-2012-budget-outlook.

Prescott, E. C. (2004): "“Why Do Americans Work So Much More Than Europeans?” *Federal Reserve Bank of Minneapolis Quarterly Review* 28: pp. 2–13.

Ramey, V., and M. D. Shapiro (1998):"Costly capital reallocation and the effects of government spending," *Carnegie-Rochester Conference Series on Public Policy* 48: pp. 145-194

Trabandt, M. and H. Uhlig (2011): "The Laffer curve revisited," *Journal of Monetary Economics* 58(4): 305-327.