ARE THE EFFECTS OF FISCAL CHANGES DIFFERENT IN TIMES OF CRISIS AND NON-CRISIS? THE FRENCH CASE

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1 Goal of the paper and motivation

This paper shows that the impact of changes in budgetary variables on real GDP, investment, consumption and employment varies in sign and magnitude in times of crisis and non-crisis. To this end, a regime-switching process is embedded in standard macroeconomic equations in order to take into account different budgetary regimes. Our purpose is threefold.

First, we aim at reconsidering the non-monotonic effects of fiscal policy over the business cycle by distinguishing, on the one side periods of severe recessions or depressions (crises) and, on the other side, "normal" periods (expansions or moderate recessions). For illustration purpose, we consider the French case, since our study can help in judging the quantitative impact of the fiscal package ("plan de relance") undertaken by the French fiscal authorities in 2008, considering both Keynesian and non-Keynesian effects may be observed at different times.

Secondly, we consider the nonlinear response of a variety of fiscal measures targeted to private consumption, business investment, private employment, in addition to the real GDP. Indeed, non-monotonic responses to fiscal changes are likely to be more precisely estimated if we consider the components of the GDP but not only the real GDP itself. The reason is that, the nonlinear response of the GDP to fiscal changes most of the time can be explained by the private sector's behavior (because any policy modifies market confidence, expectations among the public about future outcome and accordingly the agents' decisions).

Thirdly, and more importantly, we are searching for nonlinear fiscal impacts in the form of regime-switching effects. Doubts about the successfulness of the recent massive fiscal interventions in the world rely on the recognition that there are fiscal regimes and that the latter alternate in a stochastic way. Regime-switching approaches to modeling fiscal policy have been an important aspect of the theoretical literature in endogenous growth models. Fiscal policy regimes have been identified as Keynesian or Ricardian regimes, low debt-output or high debt-output regimes, passive and active regimes, etc.[1]

The key idea is that the economy is unstable – and unpredictable – in terms of its reaction to budgetary changes (that is stochastic changes over time in the multipliers) due to two features. The first feature is the time-varying nature of fiscal policy reaction functions. Fiscal interventions vary over time in terms of magnitude and in terms of the instrument used (tax or spending) according to governments' policy objectives, to the macroeconomic environment and to the state of public finances (fiscal space).[2] Since changes in fiscal policy switch in stance and nature due to political

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[1] In a pioneering paper, Sutherland (1997) shows that high public debt during times of crisis may reverse the effects of fiscal policy in an exogenous stochastic growth model. Davig (2004) derives regime-switching macroeconomic equilibria from an endogenous growth model in which agents face a signal extraction problem on forthcoming fiscal policies. Minea and Villieu (2008) propose an endogenous growth model *à la* Barro which exibit a regime-switching effect of fiscal deficits on economic growth, depending on public debt ratio.

[2] There are examples in the literature of regime-switching tests of fiscal behaviors (see Favero and Monacelli, 2005; Thams, 2006; and Claeys, 2008).

and economic circumstances, they are better understood by relating them to different regimes. The second feature is the changing nature of the cyclical response to fiscal changes because agents' reaction to budgetary policy depends upon elements that are not under the direct control of the governments themselves (liquidity constraints, adjustment costs, leverage effects, Barro-Ricardo effects, credit market imperfection, etc.

A common modeling approach, mainly empirical, usually used by researchers, consists in providing evidence of asymmetric effects of fiscal changes on the economy between regimes that are defined according to a prior belief by the researcher: expansion and recession phases in the business cycle, times of fiscal contractions and fiscal expansions, regimes of active and passive budgetary rules, large and persistent or small and non-persistent fiscal impulses, times of binding liquidity constraints and "good" times, etc. The models contain dummy variables that capture structural breaks or threshold functions allowing for a dependence of fiscal multipliers to the level of an exogenous variable (for instance public debt ratio).[3]

An alternative approach, mainly theoretical, relies on the simulations of general equilibrium-based models in which fiscal rules (determining spending, taxes, or debt) are governed by a two-state Markov chain variable and agents make a probabilistic inference regarding the future rule and state of the economy to take their decisions. These models are based on the assumption of asymmetric information between governments and the private sector (firms and households). The latter thus use Bayesian procedures to learn the regime generating the expected future variables on which they base their investment and consumption decisions (debt/output ratio, tax, or spending).[4]

This paper adopts the second approach. Since, we search to differentiate the budgetary effects on the macroeconomic variables between times of crisis and non-crisis, we can assume that the root cause of the differing fiscal effects is the high uncertainty facing the public and private sectors. Crises appear occasionally, suddenly, with no specific regularity; they are characterized by huge depressions that make them different from standard business cycle troughs. Further, their duration is not predictable. For governments, in such a context, fiscal policy requires more flexibility and decisions are influenced by the forecasts of the future state of the economy. Their belief can be represented by probabilities. For the private sector, profit- and consumption-maximizing decisions are influenced by fiscal policy and, as shown in the aforementioned papers, agents solve a signal extraction problem when the information on both the state of the economy and fiscal policy is incomplete and asymmetric. These decisions are well described in a probabilistic framework involving Markov-switching variables.

Though we adopt the Markov-switching framework to study the non-monotonic effects of fiscal policy in times of crisis and non-crisis, our approach differs from those of the previous papers in the literature in the sense that it is not theoretical. Instead, we add to the previous literature by considering econometric models. Simulations derived from micro-founded models provide us with qualitative features, which need to be completed with quantitative measures. We thus consider a set of reduced-form equations that can be derived from the Markov-switching general equilibrium models mentioned in footnote 1, and, we estimate them.

We estimate time-varying probability Markov-switching models (TVPMS) to see whether the effects of fiscal policy on the real economy vary in France between times of crisis and non-crisis. These two regimes are identified endogenously, so that we do not need to preliminary separate episodes of huge contractions and expansions of the business cycle. Further, we are able to identify the variables influencing the probability of a switch between regimes. We assume

[3] For typical examples, we refer the reader to Perotti (1999); Giavazzi *et al.* (2000 and 2005); Minea and Vilieu (2008); and Tagkalakis (2008).

[4] See Dotsey (1994); Ruge-Murcia (1995); Dotsey and Mao (1997); and Davig (2004).

temporary variations in the budgetary variables and focus our attention on the effectiveness of fiscal measures at stimulating aggregate demand and output in the short run. This seems realistic as during exceptionally severe crises governments' fiscal measures consist of temporary interventions and are centered on Keynesian demand management and fine-tuning of the business cycle. Prices and the exchange rate are thus assumed to be fixed and fiscal changes only cause aggregate demand variables to fluctuate.

We examine the effects of various types of taxes and various targets for government spending. A common wisdom for modeling the effects of shocks is to compute impulse response functions after "shocking" the non-systematic component (innovations) of the budgetary variables. Another way to proceed, used in this paper, consists in introducing a stochastic process in the coefficients of estimated equations where the parameters are regime-dependent and where the manner in which regime shifts occur is specified by a probability distribution function defining the probability of transition from either regime to another. In this type of models, changes in the budgetary variables are considered as intra-regime shocks. For instance, a typical question is: what is the short-run impact of a 1 per cent change in government spending on the output if the likelihood that the economy is in a crisis regime is high? In this alternative approach, the uncertainty is not due to the fact that shocks are unanticipated, but to the fact that even when they are expected, the current state of the economy is not observed *ex ante*.

Finally, we do not distinguish between the discretionary and non-discretionary changes in the fiscal variables, but consider the effects of changes in the budgetary variables taken as a whole. Indeed, the effectiveness of fiscal changes depends upon both discretionary stimulus and the size of automatic stabilizers.

The paper is structured as follows. Section 2 presents the estimated equations. Section 3 discusses the econometric methodology of time-varying transition Markov-switching models. Section 4 presents the results, while Section 5 elaborates on some policy implications. Finally, Section 6 concludes.

2 Benchmark equations

In this section we lay out the equations that are estimated to study the nonlinear effects of budgetary policies between times of crisis and non-crisis. We consider four endogenous variables: first, private GDP; second, private consumption; third, business investment and fourth, employment. Each variable is fairly standard in macroeconomic models, the difference here being that we want to see which circumstances are most likely to give rise to a non-monotonic response of these variables to budgetary changes, be they positive (expansionary fiscal policy) or negative (consolidations).

Our reduced-form equations are linearised versions of the solutions derived from the theoretical set-ups mentioned in footnote 1, which introduce Markov-switching stochastic processes in micro-founded models of the economic growth. One difference is however the nature of the regimes that we consider. Since the theoretical models often focus on fiscal regimes, the regimes are defined accordingly. For instance, Davig (2004) distinguishes between a low debt/output regime and a high debt/output regime. Dotsey (1994) makes a difference between a low tax regime and a high tax regime. Here, the regimes are those of crisis and non-crisis. We neither impose any *ex ante* restriction about what is called a "crisis", nor on the years when the latter occurs. We simply keep in mind that, usually, a crisis is characterized, first by severe depressions (drop of the output and of the main components of aggregate demand) and secondly by shifts in key macroeconomic and policy variables (public debt ratio, taxes and spending, output gap, credit demand, etc). Since, we do not know *ex ante* the regime ("crisis" or "non-crisis") generating the observed changes in the real GDP, consumption, investment or employment, we assume that the agents make a probabilistic inference on their occurrence, regarding the state of some key macroeconomic and policy variables (called transition variables) which reflect the "circumstances" under which the economy is likely or not likely to switch from either regime to the other.

Since the Markov-switching models are defined under the assumptions that all our variables are stationary, we consider the first differences of the exogenous/endogenous variables and the transition variables alike.[5] Besides, since our intention is to study the regime-switching effects of fiscal policy, in our benchmark equations, we assume that the switching between regimes is only driven by the fiscal variables (in addition to the lagged terms of the endogenous variables). Our equations include lags on the endogenous variables in order to capture costs of adjustments or partial adjustment dynamic behaviors.

2.1 Real private GDP

From standard arguments, changes in real private GDP y_t, are explained by control variables, namely the variations in the degree of openness, $open_t$, the real short-term interest rate, i_t , and budgetary variables F_t:

$$\Delta y_t = \varphi_1(s_t) + \lambda(s_t)\Delta y_{t-1} + \varphi_2 \Delta open_{t-i} + \varphi_3 \Delta i_{t-j} + \varphi_4(s_t)\Delta F_t + \sigma_y \xi_t \tag{1}$$

i, j (in indexes) are lags selected according to information criteria (AIC/BIC) and specification tests on the residuals (serial correlation and remaining nonlinearities). Δ denotes first differences. ΔF_t is a vector of contemporaneous and lagged changes of the budgetary variables. ξ_t is a stochastic disturbance with a variance σ_y. In our regressions, the best estimates (according to criteria described in the next section) were obtained when the growth rate or public debt or debt/GDP ratio were chosen as the transition variables.

2.2 Real private consumption

We estimate the following equation, whose dependent variable is the first difference of private real consumption:

$$\Delta c_t = \rho_0(s_t) + \rho_1(s_t)\Delta c_{t-1} + \rho_2 \Delta w_t + \rho_3(s_t)\Delta transf_t + \sigma_c \vartheta_t \tag{2}$$

ϑ_t is an error term with a variance σ_c^2. ω_t is a vector of contemporaneous and lagged values of households' real disposable income. Nominal income is defined as the sum of wages, households' other revenues (including financial revenues) and individual enterprises' EBITDA (earnings before interests, taxes, depreciation and amortization). $transf_t$ is a vector of contemporaneous and lagged values of transfers. Nominal transfers are positive if they are paid to households (for instance, social payments) and negative if they are paid by households (for instance contribution to social security). The "best" transition variable in our regressions is changes in unemployment. This equation can be derived from a theoretical model where households aim at maximizing a utility function upon consumption and labor, for given values of their revenues, taxes and transfers. We assume that labor supply is inelastic to the real wages in a context of high unemployment rate.

[5] We applied unit root tests to our series, in a preliminary step, and concluded in favor of a rejection of the null of no unit root when they were in level. To avoid too many tables, the results are not reported but available upon request to authors.

2.3 Real business investment

We consider business investment and private employment equations that are assumed to be derived from profit maximization subject to a Cobb Douglass type production function with the inputs of capital and labor. We consider changes in firms' real investment rate, $\Delta invest_t$, as a function of contemporaneous and lagged changes in real GDP, Δy_t , *in* the real long-term interest rate, ΔR_t (both variables are in the vector of control variables X_t) and the following fiscal variables enter in the vector F_t : changes in corporate taxes, variations in subsidies and government spending. *j, k* and *l* are lags determined by information criteria. The equation is the following:

$$\Delta invest_t = \theta_0(s_t) + \theta_1(s_t) invest_{t-1} + \theta_2 \Delta X_t + \theta_4(s_t)\Delta F_t + \sigma_{inv}\omega_t \tag{3}$$

ω_t is an error term with a variance σ_{inv} , ΔX_t is the vector of contemporaneous and lagged changes of the control variables and ΔF_t is the vector of contemporaneous and lagged changes of the budgetary variables. The transition variable is the output gap (a proxy for the capacity utilization level).

2.4 Employment

Changes in private employment, ΔL_t , depend on the growth rate of current and past real GDP, represented by the vector Δ $[(RGDP)]_t$ (on the variations of the unit labor costs (ratio of unit wages to labor productivity $(\Delta \frac{wages_{t-1}}{PROD_{t-1}})$). Adjustment costs are modeled by the lagged endogenous variable and we also consider public investment, $INVEST_{t-j}$. *i* and *j* are lags. Fiscal policy is assumed to influence two explanatory variables: on the one hand, the unit labor cost varies with, for instance, the employers' contribution to social security or taxes on labor demand; on the other hand, public investment is strongly correlated with government current expenditure and can be considered as an element of public demand. The transition variable is the variations of the output gap. The equation is the following:

$$\begin{aligned}([(\Delta L)])_t &= \tilde{\varphi}_0(s_t) + \tilde{\varphi}_1(s_t)[(\Delta L)]_{t-1} + \tilde{\varphi}_2[(\Delta RGDP)]_t + \\ &+ \tilde{\varphi}_3(s_t)\left[\Delta\left(\frac{[(wages)]_{t-i}}{[(PROD)]_{t-i}}\right)\right] + \tilde{\varphi}_4(s_t)[(\Delta INVEST)_{t-j} + \sigma_L \vartheta_t]\end{aligned} \tag{4}$$

ϑ_t is the error term with a variance σ_L^2.

3 Time-varying probability Markov-switching models

3.1 Definition

We consider an endogenous variable y_t which "visits" two regimes, one corresponding to times of crisis and the other to "normal times". The occurrence of a regime is referred by a variable s_t that takes two values: 1 if the observed regime is 1 and 2 if it is regime 2.[6] We assume that t=1,..,T.

[6] We do not discuss here the question as whether the number of states is equal to or different from 2. This is an assumption in our case. However, several methodologies have been proposed to deal with the testing of the number of states to which we refer the interested reader (see, among others, Hamilton, 1991; Hansen, 1992; and García, 1998).

The observation of either regime 1 or 2 at time t depends upon the regimes visited by the endogenous variable during the previous periods, that is s_t is conditioned by s_{t-1} , s_{t-2} , …, s_{t-k} . At any time $\tau<t$, the regime that will be observed at time t is unknown with certainty. We thus introduce a probability P of occurrence of s_t given the past regime. Assuming, for purpose of simplicity, that s_t is a first-order Markov-switching process, we define:

$$P\left\{\frac{s_t}{s_{t-1}\ , s_{t-2}\ , \ldots, s_{t-k}}\right\} = P\left\{\frac{s_t}{s_{t-1}}\right\} \tag{5}$$

We further assume that the transition from one regime to the other depends upon a set of "transition" variables described by a vector z_t so that:

$$P\left\{\frac{s_t}{s_{t-1}}\right\} = P\left\{\frac{s_t}{s_{t-1}}\ , z_t\right\} \tag{6}$$

The relation between z_t and s_t is given by:

$$s_t = \begin{cases} 1, & if \quad \eta_t < a(s_{t-1}) + z_t{}'b\,(s_{t-1}) \\ 2, & if \quad \eta_t \geq a(s_{t-1}) + z_t{}'b\,(s_{t-1}) \end{cases} \tag{7}$$

where η_t is distributed as a Φ law. We accordingly define the transition probabilities as follows:

$$\begin{cases} P\left\{s_t = \dfrac{1}{s_{t-1} = j}\ , z_t\right\} = p_{1j}(z_t) = \Phi\left(a_j + z_t{}'b_j\right) \\ P\left\{s_t = \dfrac{2}{s_{t-1} = j}\ , z_t\right\} = p_{2j}(z_t) = 1 - \Phi\left(a_j + z_t{}'b_j\right) \end{cases} \tag{8}$$

where Φ is either the standard Logistic or Normal cumulative distribution function.[7]

Since the dynamics of the endogenous variable is assumed to be regime-dependent, then any influence of explanatory variables, represented by a vector x_t , may differ across regimes. We thus consider the following relationship:

$$y_t = \begin{cases} x_t{}'\beta_1(s_t) + \sigma_1(s_t)\,\varepsilon_t\ , & \textit{with a probability } p_1(z_t) \\ x_t{}'\beta_2(s_t) + \sigma_2(s_t)\,\varepsilon_t\ , & \textit{with a probability } p_2(z_t) \end{cases} \tag{9}$$

where $\varepsilon_t \sim$ N(0,1). $p_1(z_t)$ and $p_2(z_t)$ are the posterior (or unconditional probabilities) of regimes 1 and 2. The usual probabilistic properties for the ergodicity and the invertibility of (9) applies if we assume that y_t , x_t and z_t are covariance-stationary.

The above model can be generalized to a higher number of states (see Kim *et al.*, 2008) and encompasses several classes of Markov-switching models previously proposed in the literature (Goldfeld and Quandt, 1973; Diebold *et al.*, 1994; Filardo, 1994; and Hamilton, 1989).

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7 Any functional form of the transition probabilities that maps the transition variables into the unit interval would be a valid choice for a well-defined log-likelihood function: logistic or Probit family of functional forms, Cauchy integral, piecewise continuously differentiable variables. The choice of a Logistic and Normal law is common wisdom in the applied literature.

3.2 Estimation and methodological issues

The above model is estimated via maximum likelihood (henceforth ML) with relative minor modifications to the nonlinear iterative filter proposed by Hamilton (1989). We define the following vectors: $\Omega_t = (x_t , z_t)$ the vector of observations of x and z up to period t; $\xi_t = (y_t , y_{t-1} , \ldots, y_1)$; $\theta_t = (\beta_1 , \sigma_1 , a_1 , b_1 , \beta_2 , \sigma_2 , a_2 , b_2)$.

The conditional likelihood function of the observed data ξ_t is defined as:

$$L(\theta) = \prod_{t=1}^{T} f\left(\frac{y_t}{\Omega_t}, \xi_{t-1}; \theta\right)$$

$$f\left(\frac{y_t}{\Omega_t}, \xi_{t-1}; \theta\right) = \sum_i \sum_j f\left(\frac{y_t}{s_t} = i, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta\right) \tag{10}$$

where:

$$\times P\left(s_t = i, s_{t-1} = \frac{j}{\Omega_t}, \xi_{t-1}; \theta\right) \tag{11}$$

The weighting probability in (11) is computed recursively by applying Bayes's rule:

$$P\left(s_t = i, s_t = \frac{j}{\Omega_t}, \xi_{t-1}; \theta\right) = P\left(s_t = \frac{i}{s_{t-1}} = j, z_t\right) P\left(s_{t-1} = \frac{j}{\Omega_t}, \xi_{t-1}; \theta\right) = P_{ij}(z_t) P\left(s_{t-1} = \frac{j}{\Omega_t}, \xi_{t-1}; \theta\right) \tag{12}$$

We also have:

$$P\left(s_t = \frac{i}{\Omega_{t+1}}, \xi_t; \theta\right) = P\left(s_t = \frac{i}{\Omega_t}, \xi_t; \theta\right)$$

$$\frac{1}{f\left(\frac{y_t}{\Omega_t}, \xi_{t-1}; \theta\right)} \sum_j f\left(\frac{y_t}{s_t} = i, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta\right)$$

$$\times P\left(s_t = i, s_{t-1} = \frac{j}{\Omega_t}, \xi_{t-1}; \theta\right) \tag{13}$$

To complete the recursion defined by the equations (11) and (12), we need the regime-dependent conditional density functions:

$$f\left(\frac{y_t}{s_t} = 1, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta\right) = \frac{\Phi\left(\frac{y_t - x_t' \beta_1}{\sigma_1}\right) \Phi\left(a_j + z_t' b_j\right)}{\sigma_1 P_{1j}(z_t)} \tag{14a}$$

$$f\left(\frac{y_t}{s_t} = 2, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta\right) = \frac{\Phi\left(\frac{y_t - x_t' \beta_2}{\sigma_2}\right) \Phi\left(a_j + z_t' b_j\right)}{\sigma_2 P_{2j}(z_t)} \tag{14b}$$

The parameters of equations (8) and (9) are thus jointly estimated with ML methods for mixtures of Gaussian distributions. As compared with other estimators (for instance, the EM algorithm or the Gibbs sampler),[8] the ML estimator has the advantage of computational ease. As shown by Kiefer (1978), if the errors are distributed as a normal law, then the ML yields consistent and asymptotically efficient estimates. Further, the inverse of the matrix of second partial derivatives of the likelihood function at the true parameter values is a consistent estimate of the asymptotic variance-covariance matrix of the parameter values.

The influence of z_t on P_{1j} and P_{2j} gives information about the way the transition variables influence the probability of being in either regime or another. For instance, if regime 1 is the crisis regime, a positive (resp. negative value) of b_1 (resp. b_2) implies that the transition variable raises the probability of evolving in a time of crisis.

The optimal combination of the lags on the control and transition variables is determined by computing information criteria (Akaike and Schwarz) for each estimated model. To assess the fit of the estimated models to the data, we apply Ljung-Box tests to the expected standardized residuals as well as tests of remaining non-linearities (Hinich and Patterson's, 1989) Portmanteau bispectrum test and Tsay's 1996 test). The expected residuals are the weighted residuals with the weights equal to the probability of observing regimes 1 and 2 at each date.

4 Data and results

We apply the model to France. Data are quarterly, span the years from 1970 to 2009, and are taken from the OECD database. Time series for public finance variables were available at a yearly frequency and were interpolated to get quarterly observations. In order to avoid spurious dynamics stemming from the interpolation method, we simply estimate a "trend" between two observations. Except when their values are negative, the data are transformed into logarithm. Further, we take the first differences to cope with non-stationarity (unit root tests, available upon request to the authors, showed that the data contain a stochastic trend). We select the best estimated equations according to the information criteria (AIC/BIC), the inexistence of serial correlation in the residuals, the likelihood ratio test for TVPMS (the null hypothesis is constant probabilities). For each model, the initial values are those of a linear regression of the endogenous variables on the control and fiscal variables.

To avoid endogeneity biases due to the correlation between the endogenous variables budgetary variables, we use a two-step approach by first estimating a VAR system in level composed of the variables of the different equations.[9] Then, in a second step, we consider the forecasted in-sample values of the explanatory variables to apply the TVPMS model. As the second stage is linear in the variables, the two-step approach is applicable.

4.1 Real private GDP equation

Table 1a through 1c report the estimates obtained for the GDP equation. All the variables are expressed in real terms (they are deflated by the GDP deflator). The transition variable is the fourth-order moving average of the differentiated logarithmic real debt or debt ratio. The model detects two regimes corresponding respectively to periods of crisis (huge troughs in the real GDP cycle) and "normal periods" (expansions or moderate recessions). The model improves over a

8 See Diebold *et al.* (1994) and Filardo and Gordon (1993).

9 By applying a Johansen test, we checked that the variables were cointegrated in levels.

Figure 1

Posterior-smoothed Probability of Regime 2
(Huge Falls in Real GDP)
(budgetary variable: government spending)

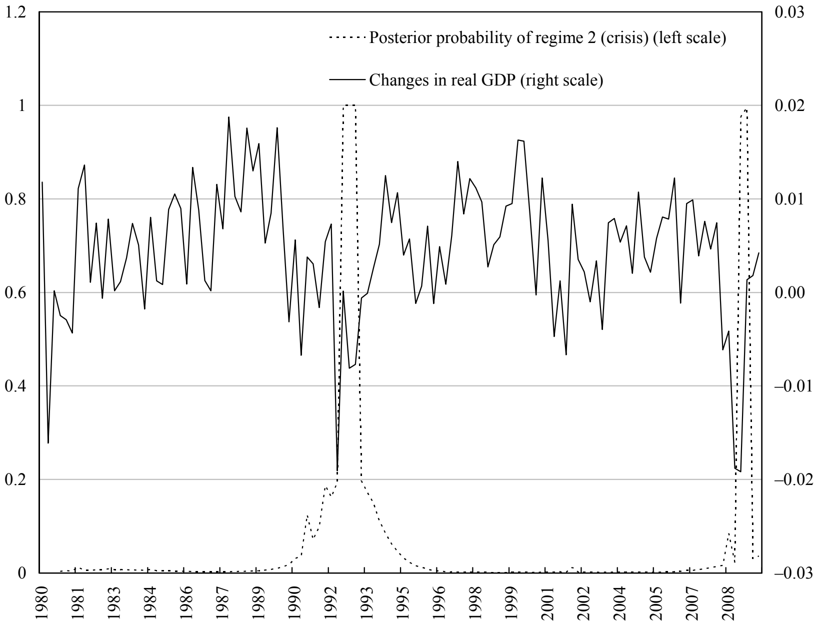
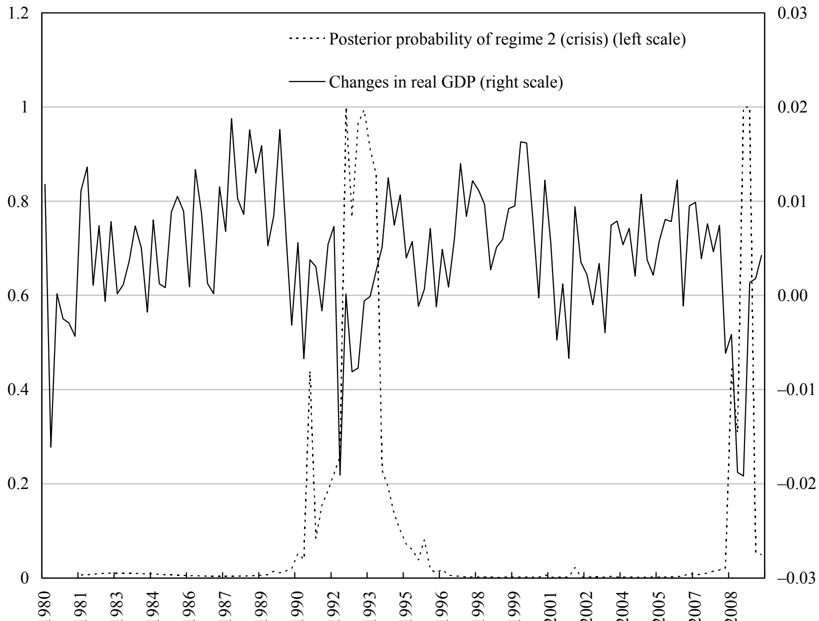


Figure 2

Posterior-smoothed Probability of Regime 2
(Huge Falls in Real GDP)
(budgetary variable: government spending – potential growth)

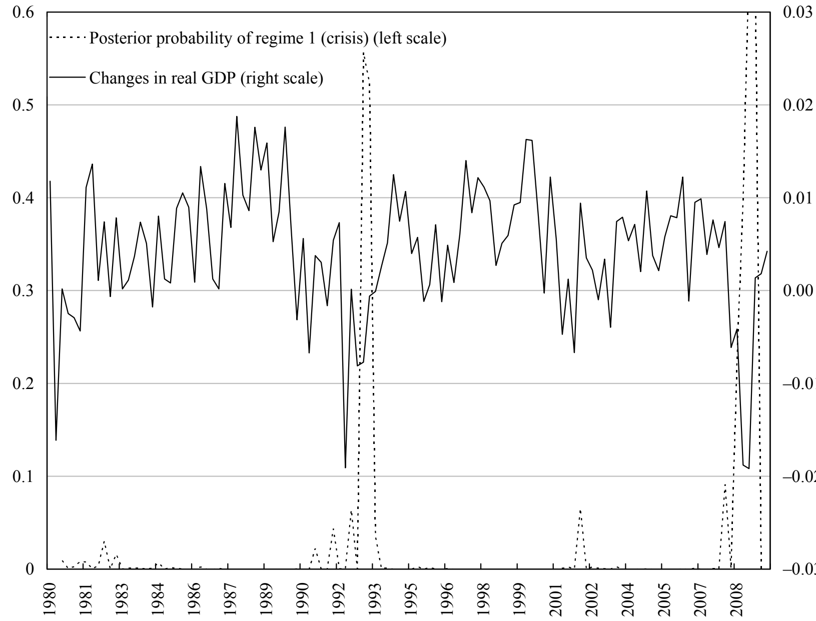


simple constant probability model *à la* Hamilton. Indeed, the likelihood ratio test for TVPMS is significant (the *p*-value lies under 5 per cent), thereby indicating a rejection of the hypothesis of constant transition probabilities. Figures 1 through 3 report the smoothed posterior probabilities of either regime 1 or 2 and we see that the smoothed probabilities approach 1 for the two years corresponding to the troughs of 1992/1993 and 2009. The model thus dichotomizes between a regime of crisis (regime 2) and a regime of non-crisis (regime 1). This is shown in Table 1a by the intercepts that are respectively negative (–0.013) and positive (0.005) in each regime. These intercepts capture the average GDP growth within each regime.

In Table 1a, evidence of an asymmetric effect of public expenditure is assessed by two different coefficients for regimes 1 and 2. Although both regimes are Keynesian (the estimated coefficients are positive), the impact of changes in government spending on the real GDP is higher when the economy is in crisis (regime 2) with a differing effect of 13 per cent (in comparison with regime 1). An increase in

Figure 3

Posterior-smoothed Probability of Regime 1
(Huge Falls in Real GDP)
(budgetary variable: government revenues / GDP)



public expenditure is therefore efficient to boost real GDP growth, in both times of crisis and non-crisis even though the impact is superior during crises. The control variables have the expected signs. A higher degree of openness increases the real private GDP, while a rise in the real short-term interest rate reduces it (though the latter does not appear to be statistically significant).

Changes in public debt across a year appeared to be the best transition variable (according to various criteria: residual tests, AIC/BIC criteria, remaining non-linearities tests). This variable provides information on the fact that any increase in the stock of debt may be interpreted by the private sector as a phenomenon paving the way to possible solvability and sustainability problems in the future. This can decrease the "performance" of the expenditure multiplier if the expectations yield Ricardian behaviors (people save the additional revenues stemming from the new expenditure to pay the future taxes). In terms of our econometric model, the probability of being in a "strong" multiplier regime (regime 2) should decrease if Ricardian behaviors are at work. In this case, we would expect a negative sign of the coefficient b_2 (and a positive sign of b_1) in equation (8). As is seen in Table 3, this is not the case.

On the other hand, a positive growth rate of the stock of debt implies a higher volume of expenditure, which could raise the magnitude of the impact on the real GDP if private investment and consumption fully and positively respond to public spending. In this case, we would instead expect a positive value of the coefficient b_2 and a negative value of b_1 (with at least one of both coefficients being statistically significant). To say it another way, a rise in public debt lowers the probability of being in regime 1, a regime in which public expenditure have the less significant impact on real GDP growth. This is the case here, as evidenced by the estimated coefficients. This would mean that, in France, there seems not to be Ricardian effects associated with an increase in the stock of debt. Such anti-Keynesian effects do not appear when we consider the aggregate real GDP. Instead, during the crisis regimes, increasing debt provides a fiscal space that reinforces the effects of government spending on the real GDP.

We further consider the difference between the growth rate of government expenditure and that of potential output, as an explanatory fiscal variable (instead of changes in government spending). The idea is that in the medium term, a large part of public expenditure is supposed to change according to potential GDP growth (in this case expenditure ratio to GDP remains

Table 1a

Real GDP – TVPMS Model for France, 1979:01-2009:04
(budgetary variable: Δ government spending)

Explanatory Variable	Coefficient	*T*-ratio	*p*-value
Intercept (regime 1)	0.005	2.26	0.023
Intercept (regime 2)	–0.013	–5.13	0.0
AR(1) coefficient (regime 1)	0.335	3.43	0.0
AR(1) coefficient (regime 2)	–0.196	–0.99	0.322
Residual standard error (regime 1)	0.005	14.60	0.0
Residual standard error (regime 2)	0.003	2.01	0.04
Δ government spending (*t*–2) (regime 1)	0.248	2.753	0.005
Δ government spending (*t*–2) (regime 2)	0.370	3.947	0.0
Δ degree of openness (*t*–1)	0.047	1.828	0.067
Real interest rate (*t*–1)	–0.0008	–1.019	0.308
Transition variable : Δ debt (*t*–1) (smoothed)			
a_1	8.77	2.59	0.009
a_2	–1.35	–0.25	0.799
b_1	–255.18	–1.847	0.064
b_2	67.44	0.322	0.746
Likelihood ratio test for TVPMS (null hypothesis: constant probabilities) Chi-squared(2): 8.834 with significance level 0.01206			
Tests on residuals Ljung-Box statistics (autocorrelation of order k): LB(k) LB(1): 1.134 significance level: 0.286 LB(2): 1.552 significance level: 0.46 LB(3): 1.568 significance level: 0.666 Linearity tests Hinich bispectral test (statistics and *p*-value): –3.285 0.99 Tsay test (statistics and *p*-value): 2.917 0.001			

constant). Then, a positive difference reflects a discretionary budgetary expansion, while a negative difference means an active fiscal consolidation.

Table 1b lists the estimates corresponding to this case. Again regimes 1 and 2 are respectively classified into “non-crisis” and “crisis” phases (see also Figure 2). However, the above conclusions change. Indeed, if we consider the effects of discretionary public spending (and not the combined effects of the discretionary and automatic stabilizers components of government expenditure, as is the case in Table 1a) the estimates suggest a non-monotonic effect of government spending with a positive and significant impact of the real GDP during crises, but no impact during non-crisis periods. An explanation may be the following. During crises, liquidity constraints are important and reinforce the impact of government expenditure on the activity. During non-crisis periods, crowding-out effects (a decreased in private investment due to the fact that government spending use up resources that would be available otherwise to the private sector) moderate the positive impact of the discretionary policy (this is confirmed further by the estimation of our investment equation). Another point that appears in Table 1b is that the delays of transmission of public spending to the activity differ whether we consider only the discretionary component ofpublic spending or public expenditure as a whole. In the first case, the transmission to the activity takes a longer time (the optimal lag for the government spending variable is 5 in Table 1b, while it is 2 in Table 1a).

Table 1c shows estimates when the budgetary variable is the ratio of government revenues to GDP. The estimates are consistent with two different regimes characterized respectively by huge falls of real GDP (regime 1) and increases or moderate decreases in real GDP (regime 2) – see also Figure 3. The fiscal effect on GDP is statistically null in the second regime, but negative and statistically significant in the first. Accordingly, raising fiscal revenues is not harmful for the economy in times of “non-crisis”, but may reduce production when the economy evolves in a crisis phase. Conversely, tax cuts can help to exit from a depression. How can we explain the asymmetric effect of tax revenues of the real GDP? Tax revenues affect production indirectly through their impact on aggregate expenditure (because they involve changes in disposable income, the cost of factors, wealth, etc). If the government reduces taxes with the goal of warding off a huge recession or depression, the increased disposable income of the private sector will be partly consumed and partly saved depending upon the propensity to consume, invest, import, etc. If these propensities are higher in times of crisis as compared with times of non-crisis (due for instance to liquidity constraints), then we can expect a stronger impact when the economy is evolving in a huge trough of the business cycle.

The control variables have the expected signs, respectively positive for the degree of openness and negative for the real short-run interest rate (though the latter does not carry a statistically significant sign).

4.2 Real private consumption

Table 2 shows the results for real private consumption when the unemployment rate is the transition variable. The theoretical literature points that, among the circumstances in which consumption may respond non-monotonically to fiscal variables, the uncertainty about the state of the economy is an important factor.

In France, we *do not* find any non-monotonic effect of fiscal policy on real private consumption between regimes of strong falls in consumption (crisis) and regimes of non-crisis, be the instruments taxes on income or social security transfers. The regimes identified by the model are plotted in Figures 4a and 4b. We see that the first regime is described as one in which consumption evolves in a trough. As indicated by the coefficients in Table 2, income taxes have no

Table 1b

Real GDP – TVPMS Model for France, 1979:01-2009:04

(budgetary variable: Δ spendgap = Δ government spending – Δ potential output)

Explanatory Variable	**Coefficient**	***T*-ratio**	***p*-value**
Intercept (regime 1)	0.004	2.424	0.015
Intercept (regime 2)	–0.009	–3.823	0.0001
AR(1) coefficient (regime 1)	0.148	1.422	0.155
AR(1) coefficient (regime 2)	–0.177	–0.654	0.512
Residual standard error (regime 1)	0.005	14.16	0.0
Residual standard error (regime 2)	0.004	3.45	0.0
***Δ* spendgap (*t*–5) (regime 1)**	0.05	1.01	0.31
***Δ* spendgap (*t*–5) (regime 2)**	0.296	2.45	0.014
Δ degree of openness (*t*–1)	0.073	3.025	0.002
Real interest rate (*t*–1)	0.0005	0.570	0.568
Transition variable : *Δ* debt (*t*–2) (smoothed)			
a_1	8.62	2.62	0.008
a_2	0.316	0.068	0.945
b_1	–270.62	–1.843	0.065
b_2	26.23	0.134	0.893

Likelihood ratio test for TVPMS (null hypothesis: constant probabilities)
Chi-squared(2): 5.331 with significance level 0.0695

Tests on residuals

Ljung-Box statistics (autocorrelation of order k): LB(k)
LB(1): 1.474 significance level: 0.224
LB(2): 2.492 significance level: 0.287
LB(3): 4.116 significance level: 0.249

Linearity tests
Hinich bispectral test (statistics and *p*-value): 2.429 0.0075
Tsay test (statistics and *p*-value): 0.983 0.476

Table 1c

Real GDP – TVPMS Model for France, 1979:01-2009:04

(budgetary variable: Δ (Government revenues / GDP))

Explanatory Variable	Coefficient	*T*-ratio	*p*-value
Intercept (regime 1)	–0.010	–3.272	0.001
Intercept (regime 2)	0.006	3.345	0.0008
AR(1) coefficient (regime 1)	0.0209	0.069	0.944
AR(1) coefficient (regime 2)	0.186	2.11	0.034
Residual standard error	0.005	14.957	0.0
Δ government revenues/GDP (*t*–1) (regime 1)	–0.257	–2.19	0.027
Δ government revenues/GDP (*t*–1) (regime 2)	–0.044	–1.032	0.302
Δ degree of openness (*t*–1)	0.058	2.293	0.021
Real interest rate (*t*–1)	–0.0008	–0.922	0.356
Transition variable : Δ debt ratio (*t*–1)			
a_1	1.019	0.759	0.44
a_2	5.743	3.798	0.0001
b_1	–24.47	–0.777	0.436
b_2	–111.11	–2.511	0.012

Likelihood ratio test for TVPMS (null hypothesis: constant probabilities)
Chi-squared(2): 6.278 with significance level 0.043

Tests on residuals

Ljung-Box statistics (autocorrelation of order k): LB(k)
LB(1): 1.093 significance level: 0.295
LB(2): 3.001 significance level: 0.222
LB(3): 4.35 significance level: 0.226

Linearity tests
Hinich bispectral test (statistics and *p*-value): –0.343 0.634
Tsay test (statistics and *p*-value): 2.04 0.021

Table 2

Real Private Consumption – TVPMS Model for France, 1970:01-2009:04

Explanatory Variable	Coefficient	*T*-ratio	*p*-value
Intercept (regime 1)	0.00031	0.348	0.727
Intercept (regime 2)	0.006	5.986	0.0
AR(1) coefficient (regime 1)	0.027	0.164	0.869
AR(1) coefficient (regime 2)	–0.243	–2.08	0.037
Residual standard error	0.003	10.41	0.0
Δ income taxes(t) (regime 1)	–0.0068	–0.300	0.763
Δ income taxes(t) (regime 2)	0.044	1.369	0.170
Δ transfers (*t*–1) (regime 1)	0.149	2.319	0.02
Δ transfers (*t*–1) (regime 2)	0.142	1.768	0.076
Δ social security(*t*) (regime 1)	–0.113	–1.919	0.054
Δ social security(*t*) (regime 2)	–0.02	–0.401	0.688
Δ real disposable income	0.139	2.158	0.03
Transition variable: unemployment rate (smoothed)			
a_1	–0.234	–0.354	0.723
a_2	1.319	2.02	0.043
b_1	163.83	2.793	0.0052
b_2	–22.97	–0.543	0.586
Likelihood ratio test for TVPMS (null hypothesis: constant probabilities) Chi-squared(2): 8.238 with significance level 0.0162			
Tests on residuals Ljung-Box statistics (autocorrelation of order k): LB(k) LB(1): 0.244 significance level: 0.62 LB(2): 1.695 significance level: 0.428 LB(3): 1.805 significance level: 0.613 Linearity tests Hinich bispectral test (statistics and *p*-value): –1.968 0.975 Tsay test (statistics and *p*-value): 2.079 0.019			

effects on real private consumption while the effects of transfers appear to be symmetric as we find a coefficient of quite similar size for both crisis and non-crisis regimes (around 0.14). Only the contributions to social security are associated with an asymmetric impact on consumption with a negative outcome only during times of crises.

The probability of being in a crisis regime increases with the unemployment rate, as expected (b_1 carries a positive sign). Finally, the real disposable income positively influences private consumption.

To summarize, only spending increases in the form of transfers to households raise the real private consumption (we have a Keynesian outcome for this variable), but the impact is symmetric. The finding that taxes have no significant effects on consumption can be interpreted with reference to several approaches of the economic literature. For instance, if we consider the effect of tax cuts, we can think that, during crises, there are non-Keynesian effects due to precautionary saving (as the unemployment rate increases) that offset the positive effect on

Figure 4a

Posterior-smoothed Probability of Regime 1 (Huge Falls in Private Consumption)

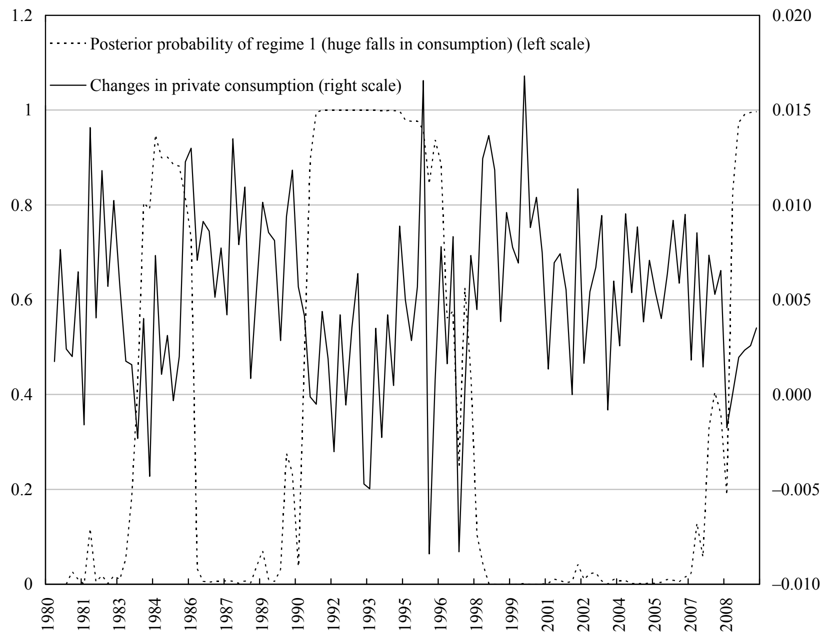
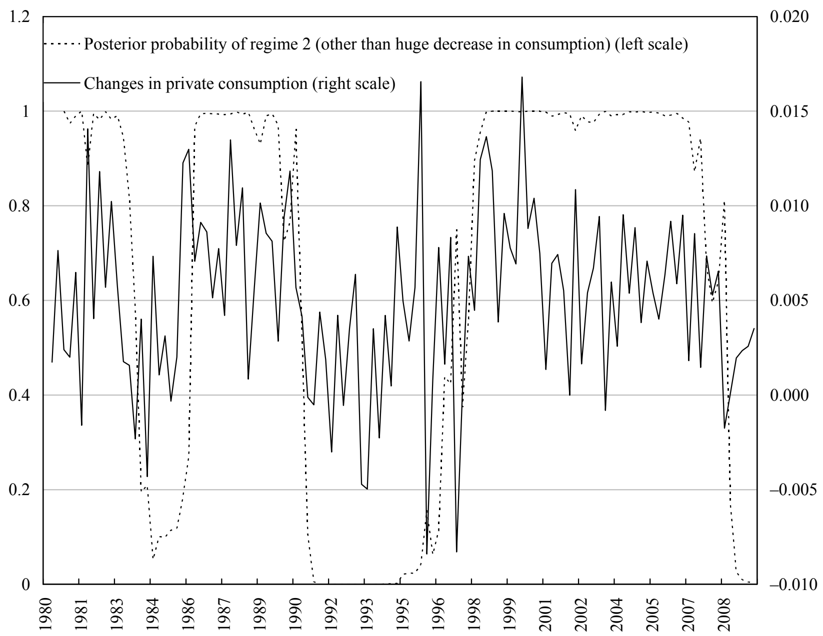


Figure 4b

Posterior-smoothed Probability of Regime 2 (Other Periods than Huge Falls in Private Consumption)



consumption. The size of precautionary saving may be more or less important depending upon whether households face strong liquidity constraints or not. Tax cuts are "consumed" if households are highly constrained (a situation observed during crises) and saved otherwise. This can explain why we obtain a negative sign for the income tax variable in the regime of crisis (–0.0068), but a positive one for the non-crisis regime (0.044). It is possible that the unemployment rate (which is our transition variable) determines whether households take or not their decision of consumption expenditure (in response to a tax decrease or increase) regarding their perceived permanent disposable income. When the unemployment is growing moderately or is decreasing (non-crisis regime), households are more inclined to smooth consumption in comparison with a situation in which the unemployment rate is increasing fast (as is observed in a crisis regime). In the latter case, consumption is constrained by their current income and this reduces the effect of precautionary saving.

4.3 Business investment

The estimates for business investment are reported in Table 3 and the smoothed posterior probabilities of being in either a regime of sustained increases in investment (regime 1) or in a regime of prolonged decreased (regime 2) are shown in Figures 5a and 5b. As seen in Figure 5a, the probability of the second regime "jumps" to 1 around some years that are generally considered as being times of crisis or important recessions : second oil price shock years, the year 1983 which was characterized by a restrictive budgetary policy, 1993, 2001-02 and, as expected, 2009. Conversely, in Figure 5a, we observe that the probability of being in regime 1 increases during the times when business evolves on an ascending trend The outcome of cuts in corporate taxes is an increase in investment in times of booming investment (regime 1). We indeed obtain a statistically significant coefficient of –0.08. Conversely, to mitigate an investment downturn, the instrument of direct tax does not prove efficient as the coefficient is statistically not different from 0 at the 5 per cent level of significance. One reason may be that, during the phases of a depressed activity, firms are more sensitive to demand-side variables than to fiscal discretionary measures.

Our results also point to a significant crowding-out effect of government spending on business investment only in times of booming investment (regime 1) (the coefficient is around –0.39). As is known from theory, there are several channels at play here. The reduction in business investment may occur because the spending is accompanied by a tax increase. As, we have just seen, any increase in corporate taxes does not have a significant impact on firms' investment behavior periods of booming investment (regime 1). Another mechanism is a reduction in private investment following a higher government borrowing. We tried to use the debt ratio as a transition variable to see whether this variable influences the reaction of business investment to government spending, but it appears not to be conclusive in explaining the asymmetries observed in the data. Crowding-out effects appears to be moderate during recessions or depressions (here non-significant in regime 2) because government spending expands the demand facing the private sector (through the multiplier) thereby implying an accelerator effect that is strong when firms suffers from unused capacities (stronger during the crises than during expansions). In the regression, we can see that the coefficients related to the impact of the real GDP are big in comparison to the others (the coefficients of lagged GDP terms sum to 1.56).

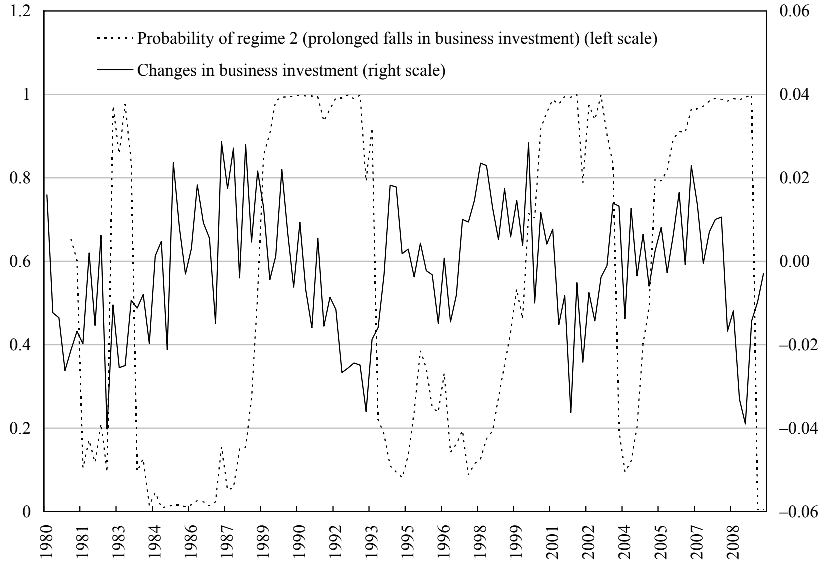
Government subsidies also appear to have an asymmetric impact on business investment with possible non-Keynesian effects in the second regime (crisis). The subsidies do not influence private investment during expansion phases – the coefficient is not statistically significant in regime 1 – but reduce it during recessions. One explanation can be that, during recessions, in addition to reducing capacities, firms also proceed to other internal adjustments (for instance, they deleverage to clean up their balance sheets or reduce their debts).

Turning our attention to the impact of the control variables, we see that the real GDP has an expected positive influence, while the real long-run interest rate acts negatively.

The diagnostic tests show that, while there are no residual correlations (the *p*-value of the Ljung-Box statistics are above 5 per cent), the residuals still contain remaining nonlinearities (both the Hinich and Tsay tests reject the null hypothesis of linearity). Accordingly, the investment behavior may obey to other type of nonlinearities.[10]

Figure 5a

Posterior-smoothed Probability of Regime 2 (Prolonged Decrease in Business Investment) and Changes in Business Investment

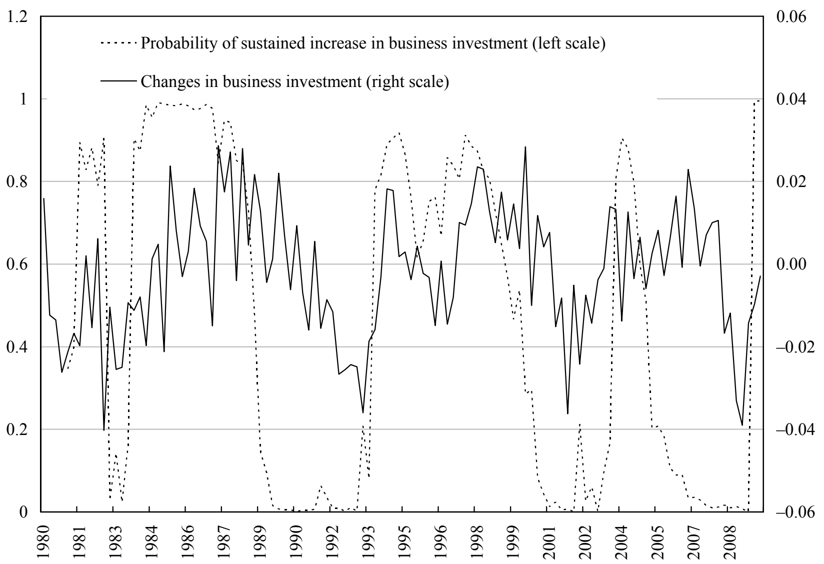


4.4 *Private employment*

We now consider the asymmetric impact of unit labor costs and public investment on private employment. The different ways the enterprises respond to the increase in public demand can lead to asymmetric reactions of private employment to changes in public investment. On the one hand, if, in response to higher total demand, they extend their existing capacity level with the same technology, this leads an upward shift of labor demand. On the

Figure 5b

Posterior-smoothed Probability of Regime 1 (Sustained Increase in Business Investment) and Changes in Business Investment



[10] For instance, since this variable is more volatile than the other components of total demand, nonlinearities may exist in the variance. However, considering these nonlinearities here would make the model cumbersome to estimate).

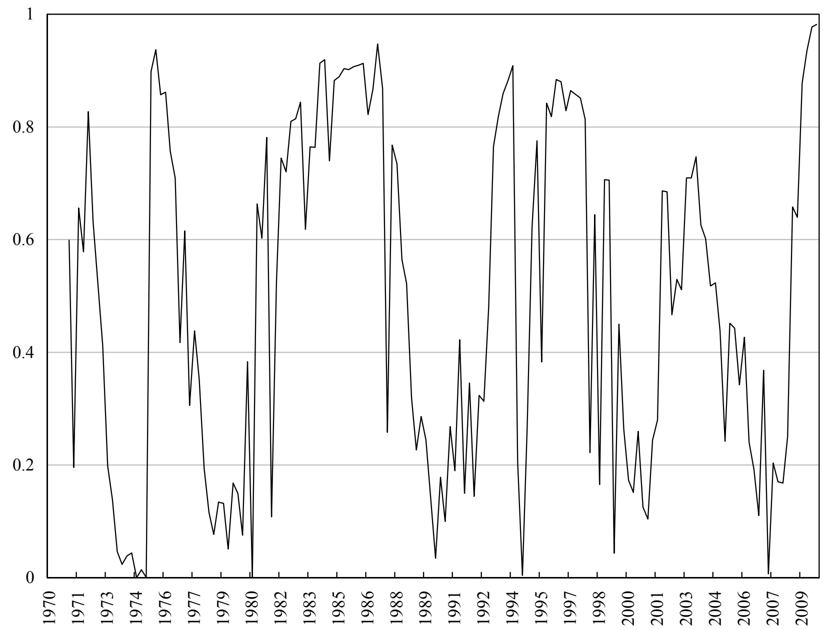
Table 3

Business Investment – TVPMS Model for France, 1970:01-2009:04

Explanatory Variable	Coefficient	*T*-ratio	*p*-value
Intercept (regime 1)	0.008	2.55	0.01
Intercept (regime 2)	–0.003	–0.77	0.438
AR(1) coefficient (regime 1)	0.012	0.11	0.905
AR(1) coefficient (regime 2)	0.276	2.57	0.01
Residual standard error	0.01	14.57	0.0
Δ corporate taxes (*t*–3) (regime 1)	**–0.08**	**–2.21**	**0.027**
Δ corporate taxes (*t*–3) (regime 2)	**0.022**	**0.76**	**0.442**
Δ subsidies (*t*–2) (regime 1)	**0.048**	**1.27**	**0.201**
Δ subsidies (*t*–2) (regime 2)	**–0.17**	**–3.04**	**0.0023**
Δ government spending (*t*–3) (regime 1)	**–0.394**	**–2.422**	**0.015**
Δ government spending (*t*–3) (regime 2)	**–0.357**	**–1.16**	**0.244**
Δ real GDP (*t*–2)	0.430	1.928	0.053
Δ real GDP (*t*–3)	1.13	5.25	0.0
Real long-run interest rate (*t*–2)	–0.001	–3.38	0.0
Transition variable: output gap			
a_1	2.07	2.73	0.006
a_2	2.59	3.80	0.0
b_1	–1.063	–1.52	0.127
b_2	1.036	2.58	0.009
Likelihood ratio test for TVPMS (null hypothesis: constant probabilities) Chi-squared(2): 9.524 with significance level 0.0085			
Tests on residuals Ljung-Box statistics (autocorrelation of order k): LB(k) LB(1): 0.212 significance level: 0.644 LB(2): 5.532 significance level: 0.063 LB(3): 5.716 significance level: 0.126 Linearity tests Hinich bispectral test (statistics and p-value): –3.313 0.99 Tsay test (statistics and *p*-value): 2.624 0.0029			

Figure 6

Posterior-smoothed Probability of Regime 1 (Times of Crisis)



other hand, if the additional investments incorporate labor saving technology, this leads negative employment effects. The positive demand-side effects are, in general, the result of higher expected profits. These are likely to occur during crises if, for instance, firms are facing strong liquidity constraints. Conversely, enterprises can choose to take advantages of the productivity gains associated with booms or expansions and accordingly to save labor.

A fall in unit labor costs (measured by the ratio of unit wages to total productivity) can lead to an increase in employment as long as labor demand is sensitive to these costs. In our estimations, reported in Table 4, we retrieve these different effects.

Figure 6 shows that the posterior probability of being in regime 1 is around 1 for the years that are usually identified as years of crises (for instance the 2009 crisis, 1992-93 or the years following the two oil price shocks of the seventies and eighties). The estimated autoregressive coefficients, in Table 4, accord well with the fact that episodes of huge negative variations in private employment occur much more rarely than those of moderate diminutions or increases. The latter are more frequently observed so that the corresponding state is very persistent.

In the second regime (non-crisis), a decrease in unit labor costs comes along with an increase in private employment (the negative coefficient, –0.12, indicates a negative relationship between the two variables), while during times of crisis a fall in unit labor costs is accompanied by decreases in labor demand (as illustrated by the positive coefficient, 0.03). This findings reflects the inability of downward pressure in the cost of labor to stimulate employment if, at the same time, total demand is decreasing importantly as is the case in times of crisis.

The results also show asymmetric effects as regards the impact of public investment. We find that any increase results in higher employment in times of crisis (the coefficient carries a positive sign of 0.01), but a fall in non-crisis times. It may be the case that public investment appears as "manna" to firms when they face outlet constraints and that they trade-off between labor and productivity in non-crisis times.

As regards the other coefficients, we find that the higher the value of the output gap (the higher the value of actual production above potential output), the less likely the probability of evolving in the first regime (crisis), which accords with the fact that in the latter firms have many

Table 4

Private Employment – TVPMS Model for France, 1970:01-2009:04

Explanatory Variable	**Coefficient**	***T*-ratio**	***p*-value**
Intercept (regime 1)	–0.002	–4.91	0.0
Intercept (regime 2)	–0.0008	–2.83	0.004
AR(1) coefficient (regime 1)	0.579	13.76	0.0
AR(1) coefficient (regime 2)	1.144	11.83	0.0
Residual standard error (regime 1)	0.00078	11.90	0.0
Residual standard error (regime2)	0.00073	7.57	0.0
Δ unit labor cost (*t*–3) (regime 1)	**0.033**	**4.19**	**0.0**
Δ unit labor cost (*t*–3) (regime 2)	**–0.122**	**–8.38**	**0.0**
Δ public investment (*t*–3) (regime 1)	**0.016**	**3.25**	**0.001**
Δ public investment (*t*–3) (regime 2)	**–0.028**	**–3.64**	**0.0002**
Δ real GDP (*t*–1)	0.10	6.68	0.0
Transition variable : output gap			
a_1	0.916	2.00	0.044
a_2	–0.741	–1.40	0.161
b_1	–0.829	–2.134	0.032
b_2	0.132	0.523	0.60
Likelihood ratio test for TVPMS (null hypothesis: constant probabilities) Chi-squared(2): 5.766 with significance level 0.0559			
Tests on residuals Ljung-Box statistics (autocorrelation of order k): LB(k) LB(1): 2.366 significance level: 0.123 LB(2): 2.416 significance level: 0.298 LB(3): 3.907 significance level: 0.27 Linearity tests Hinich bispectral test (statistics and *p*-value): 1.621 0.0525 Tsay test (statistics and *p*-value): 2.053 0.0182			

unused capacities (b_1 is negative and statistically significant). The coefficient of the real GDP carries the expected positive sign.

5 Policy implications

The French recovery plan in the aftermath of the crisis was driven by some reductions in taxes and by a raise of public expenditure. Government spending increases accounts for the lion's share of this plan, so that we can say that it was mainly spending-oriented. However, beyond the crisis fiscal sustainability objectives will come back into the policymakers' agenda. This raises several important questions. Do we have reason to doubt the effectiveness of the standard Keynesian policy, as suggested by some economists? Do we observe nonlinear effects in the response of real GDP, private consumption, investment and employment to changes in taxes or spending (for instance, is the response of the economy likely to be weaker or higher during the crisis to a fiscal stimulus, than during the exit-crisis period)? To what extend will it be possible to conciliate both objectives of achieving fiscal sustainability and sustaining economic growth beyond the crisis?

These questions are important because France should begin a process of major fiscal adjustment (4 points off the cyclically-adjusted balance over a period of 3 years are enrolled in the revised stability program presented in January 2010). A central issue is whether such adjustment may have a relatively limited negative effect on growth. Our model can help to shed new light on this point by showing two distinct regimes associated with multipliers with different value or even sign.

What can we conclude about the effects of budgetary variables on the real GDP in France? First, there is evidence of asymmetric effects for both the multiplier of government expenditure and the fiscal multiplier, with differing effects during the phases of crisis and non-crisis. The following table summarizes our findings regarding the impact of the budgetary variables.

In light of the recent crisis, our results show that using the expenditure as the main instrument of the budgetary policy in order to cope with the drop of the real GDP and the employment rate was probably a better choice than a policy favoring recovery through fiscal cuts. Though tax cuts reduce the risk of a depression by raising the real GDP, the spending multiplier is larger than the one associated with tax cuts. Further, if we consider fiscal stimulus aimed at consumers and enterprises, a decrease in the direct taxes (corporate taxes or income taxes) is likely not to raise either consumption or private investment in times of crises. For reasons explained earlier, the propensity to spend out of such taxes may be offset by non-Keynesian effects. In the current juncture, transfers to households may help to support consumption which has the greatest contribution to GDP. However, direct subsidies to enterprises, in the current environment may not help due to the sharp fall in demand and the uncertainty facing the firms about how good the economic will be in the future (this explains the negative sign associated with the variable reflecting changes in subsidies).

Our estimates take into account the fact that the reactions of the economy to fiscal measures can be influenced by the growth rate of government debt. Ricardian behaviors are likely to affect the magnitude of the fiscal multiplier only and this explains why we find a higher value for the multiplier of expenditure in comparison with that of fiscal. This means that the budgetary instrument used to influence the economy during crisis and non-crisis is not neutral in terms of the probability of being in either regime or the other. Should a government cut taxes, while increasing its indebtedness, that this strategy would be interpreted as signaling future tax increases, thereby implying a higher likelihood of driving the economy out of an expansion phase. In contrast, in presence of a crisis, raising the expenditure while borrowing more might be interpreted as a way of

Table 5

Effects of Budgetary Variables
(times of crisis and non-crisis)

	Non-crisis Regime		Crisis Regime	
	Coefficient	***T*-stat**	**Coefficient**	***T*-stat**
	Impact on Real GDP			
Δ government expenditure	**0.25**	**2.75**	**0.37**	**3.94**
Δ government expenditure – *Δ* real potential GDP	0.05	1.01	**0.296**	**2.45**
Δ public revenue	–0.044	–1.032	**–0.257**	**–2.19**
	Private Employment			
Δ unit labor cost	**–0.122**	**–8.38**	**0.033**	**4.19**
Δ public investment	**–0.028**	**–3.64**	**0.016**	**3.25**
	Business Investment			
Δ corporate taxes	**–0.08**	**–2.21**	0.022	0.76
Δ subsidies	0.048	1.27	**–0.17**	**–3.04**
Δ government spending	**–0.394**	**–2.42**	–0.357	–1.16
	Private Consumption			
Δ income taxes	–0.0068	–0.300	0.044	1.37
Δ transfers	**0.149**	**2.32**	**0.142**	**1.77**
Δ social security	**–0.113**	**–1.92**	–0.02	–0.40

Note: The data in bold figure out the effects that are significant.

increasing a Government room for manœuvre, which will stimulate the economy in escaping from a recession. Extrapolating these results, it seems that the increase in public spending corresponding to a large part of the stimulus plans in 2009 (during a recession period) was likely to give way to a rise in GDP growth. On the contrary, the use of the tax cuts would not have produced significant results on GDP growth.

Beyond the crisis, sustainability concerns will be essential for the French government. This could be achieved as follows. The French government could increase the scope for automatic stabilizers and therefore make the discretionary spending measures reversible. Regarding our results, such a strategy could allow to reduce deficits without negative effects on the economy since in times of non-crisis, the multiplier associated with changes in the differences between changes in government spending and the growth rate of potential output is not statistically significant.

Considerations could also be given to higher taxes since they do not seem to be a threat for a decrease in the real GDP in the short term (we found no significant effects associated with government revenues in non-crisis time). But, the government would need to target the tax increases. This consideration is important given the ongoing debate on the "fiscal shield". On the one hand, higher direct taxes on firms could force them to cut investment and employment, as reflected by the negative coefficients associated with corporate taxes and the unit labor costs in the non-crisis regime. On the other hand considering increase in direct taxes on consumers would probably not shift their spending.

6 Conclusion

It should be reminded that the only empirical models likely to give directly policy implications are structural, such as macro-econometric models or simulation models like DSGE type (but they are accused of ideas based on *a priori*). The models based on reduced forms (which include all VAR models) are simply intended to give a certain number of facts on which we can base the formulation of economic policy. From this point of view, our study based on TVPMS models allows to highlight several interesting points. The analysis of the role of fiscal variables on some major macroeconomic variables through a TVPMS model clearly shows asymmetry in the effects of fiscal variables depending upon whether one is in periods of crisis or good times. These nonlinearities are both frequent (as they exist on all behaviors analyzed: GDP, private consumption, business investment and private employment) and significant.

In particular, if one considers the aggregate GDP, public expenditure has a stronger impact during crisis and the expenditure multiplier is greater than the tax multiplier. The consequence is that, during a crisis, a stimulus plan expenditure-oriented might be more efficient than a recovery plan based on measures of tax relief. The effect of tax-oriented measures is significant when the endogenous variables are private investment and employment.

When households are sensitive to the unemployment situation, tax cuts do not affect increase consumption spending, while transfers are playing a significant role. In terms of economic policy, assuming for example that the government's exit strategy consists in stimulating private consumption, it has to choose between two instruments: on the one hand, an increase in transfer expenditure financed by borrowing and, on the other hand lower taxes paid by households.

On the firms side, our results show that direct taxes changes induce a (stimulus) effect in the investment rate only during non-crisis periods. A rise in subsidies has a negative influence during crises, as firms reduce their production capacity.

Increased public spending appears to have a strong multiplier effect at the aggregate level, but with crowding-out effects observed on private investment in non-crisis times. Finally, the estimates suggest that employment policies should be asymmetric: fiscal measures aiming at reducing unit labor costs could be efficient in good times, while an increase in public employment is preferable during crisis.

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