Fiscal multipliers in times of crisis and non-crisis: are they different? The French case

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Summary:

The purpose of this paper is to investigate on France whether the effects of fiscal stimulus and consolidations vary across the period under review between "normal" times and periods of crisis (or between what we call recessions and expansions period for ease of reference). This is done by the estimation of a Markov switching model with time-varying transition probabilities (TVPMS) applied to the first-difference of GDP, private consumption, business investment and private employment. Such a model is relevant to account for parameter shift in fiscal multipliers or dividers when the regimes (positive and negative increases in the endogenous variables) are governed by an unobserved Markov chain process. Such models have at least three advantages over other nonlinear models in which the response of the economic variables with respect to fiscal balances are asymmetric. Firstly, the two regimes are identified endogenously. Secondly, they allow determining the economic pre-conditions that influence the probability of a switch from one regime to another. Thirdly, the switch from a "pure" Keynesian regime to the other one (theoretically a neoclassical regime) or the reverse, may happen at any time, so that the time of the changes is not forced a-priori (for instance, we do not separate the sample into two parts with respect to a given time; the approach thus differs from structural breaks models).

Our results reports significant asymmetric effects of fiscal variables on the macroeconomic variables in France, especially with changing magnitude (possibly signs) accounting for the presence of both Keynesian and non-Keynesian (possibly neoclassical) regimes. We find that, 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 variable is consumption, but with a relatively low multiplier. That's may be the reason why the effect is dissolved at the aggregate level and could not be observed on GDP growth. More precisely, our results show that when households take into account public debt changes in their decisions, a rise in public transfers improve their consumption growth rate with strong Keynesian effects, while the direct tax multiplier is not significant. Conversely, when households are sensitive to the unemployment situation, tax cuts increase consumption during downturns, while transfers are not playing any 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 other hand lower taxes paid by households. According to our results, the second approach has the largest multiplier effects. On the firms side, our results show that direct taxes changes induce a (stimulus) effect in the investment rate only during recessions. A rise in subsidies mainly plays a role during expansions, and has little influence during crisis, as firms reduce their production capacity. Increased public spending appears to have a greater multiplier effect on private investment without crowding out effects observed during expansions. 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.

Key words : Fiscal multipliers – Markov switching – Economic crisis
JEL : E62 –H5 – C59

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PRELIMINARY VERSION

1.- Introduction

The impact of the recovery plans undertaken by the European government in the turmoil of the subprime crisis is an intensively debated issue in the policy circles. In particular, the crisis has re-energized researches on the question of the asymmetric effects of fiscal policies, in regard to the daunting challenges for the European countries. Indeed, fiscal impulses or adjustments can have different sign and magnitudes over the business cycle. This happens in several manners: different magnitudes of the multiplier with respect to Keynesian and non-keynesian effects, state-dependent impacts (the size of the multiplier is conditioned by the strength of liquidity constraints, credit markets imperfections, the fraction of rule-of-thumb consumers, the costs of adjustment, etc), time-varying signs depending upon whether Real Business Cycle channels of transmission are predominant (wealth effects due to distortionary taxation) or whether the fiscal shock is transmitted to the economy through Keynesian channels. All these effects have been documented for the output and other macroeconomics indicators such as investment and consumption[5].

In addition to a vast literature on these topics, a number of papers have also documented that, in the circumstance of an economic crisis, fiscal policy may have different effects than during "normal" circumstances. In particular, the sign of the fiscal multiplier has been shown to depend upon the initial level of debt and deficits (government spending can work out expansionary at low levels of debt and deficits, but turns out to be recessionary at high levels of debts and deficits, which occurs in times of crises)[6].

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5 See Attanasio (1999), Blanchard and Perotti (2002), Gali et al. (2004), Giavazzi et al. (2005), Kamps (2006), Perotti (2005), Tagkalakis (2008) and for a recent survey Beetsma (2008).

6 See Perotti (1999).

Today, the above topics are again on the agenda of the European policymakers and the Brussels authorities alike.

Firstly, in the turmoil of the crisis, many governments have rushed into massive expansionary fiscal plans. Secondly, in the aftermath of the crisis, governments are urged to consolidate public finances to comply with the Maastricht Treaty and turn back to sustainable public ratios. In both situations, despite the profusion of models used in the projections of the impact of the changes in fiscal balances, the implications for the macroeconomic variables still remain uncertain, to the extent that the impact depends upon the assumptions made on the environment in which the recovery and consolidation plans are undertaken. Notably, the consequences on the economic activity of fiscal policies are conditioned by the strength of Ricardian (or non-Keynesian) behaviours, which tend on the one hand to limit stimulus programmes efficiency (less than expected positive impacts on output, consumption, investment, employment) and on the other hand to limit the negative impact of fiscal consolidations on GDP growth. Considering that the strength of Ricardian behaviours depends on many variables (credit market constraints, initial level of government deficit-to-GDP ratio and debt-to-GDP ratio, level of risk premia (the latter capturing how the government fiscal is perceived by the financial markets)[7]), it is particularly important today to know whether the sign and magnitude of fiscal multipliers change according to macroeconomic and business conditions over the cycle.

The purpose of this paper is to investigate on France whether the effects of fiscal stimulus and consolidations vary across the period under review between “normal” times and periods of crisis (or between what we call recessions and expansions period for ease of reference). This is done by the estimation of a Markov switching model with time-varying transition probabilities (TVPMS) applied to the first-difference of GDP, private consumption, business investment and private employment. Such a model is relevant to account for parameter shift in fiscal multipliers or dividers when the regimes (positive and negative increases in the endogenous variables) are governed by an unobserved Markov chain process. Markov switching models have already been successfully used to characterize and account for regime changes that occur in the relationship between fiscal and macroeconomic variables[8]. They have at least three advantages over other nonlinear models in which the response of the economic variables with respect to fiscal balances are asymmetric. Firstly, the two regimes (in our case Keynesian vs non-Keynesian behavior) are identified endogenously (one does not need to

7 For an example of the framework used to analyze these issues, the reader may refer to Straub and Tchakarov (2007), Roeger and in’t Veld (2009).

8 See for instance, Baharumshah and Lau (2007), Höppner et al. (2000).

preliminary separate episodes of fiscal contractions and expansions to study their different effects[9]). Secondly, they allow determining the economic pre-conditions that influence the probability of a switch from one regime to another. This is important in regards to the theoretical literature reporting many factors influencing either one regime or the other (liquidity and borrowing constraints, Ricardian behaviors through the expectations channels, wealth effects, etc.). Thirdly, the switch from a "pure" Keynesian regime to the other one (theoretically a neoclassical regime) or the reverse, may happen at any time, so that the time of the changes is not forced a-priori (for instance, we do not separate the sample into two parts with respect to a given time; the approach thus differs from structural breaks models).

Our goal is to show that the existence of Ricardian effects (or at least non-keynesian) cannot be rejected in France. Indeed, our results reports significant asymmetric effects of fiscal variables on the macroeconomic variables in France, especially with changing magnitude (possibly signs) accounting for the presence of both Keynesian and non-Keynesian (possibly neoclassical) regimes on GDP, private consumption, investment and employment. The switch from one regime to the other is dependant from the transition probabilities, which are themselves dependant from the selected transition variable. Thus, by comparing the quarters associated with the probabilities of either regime with business cycle dates, we do not find clear evidence that fiscal multipliers and dividers change their magnitude according to downturns or expansions (as estimated by the methods of calculation of output gap).

The plan of the paper is as follows. The next section sets up the empirical equations that are estimated and Section 3 discusses the methodology of time-varying transition probabilities Markov switching models. Section 4 presents the data and discusses the estimation results. Section 5 concludes.

2. – Benchmark equations

In this section we lay out the equations that are estimated to study the asymmetric effects of budgetary policies. We consider four variables: first, real private GDP[10]; second real private consumption; third, real business investment and fourth, (total?) employment. Each variable is fairly standard in macroeconomic models, the difference here being that we want to see which

9 For some illustrations of the « two-step » methodology, the reader can refer to the collection of Papers on fiscal consolidation in Banca d'Italia (2007), Giavazzi et al. (2000), Perotti (1999).

10 Real GDP is corrected by public consumption, so that our results are not altered by the fact that public consumption is both a part of GDP and of public spending.

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), choosing among the variables of public finances those which are most likely to influence the four individual behavior.

The "circumstances" are captured by transition variables. Because 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[11]. Besides, since our intention is to study the non-monotonic effect of fiscal policy, in our benchmark equations, we assume that the switching between regimes is only driven by the fiscal variables. Finally, because the nonlinear effects could differ depending upon whether one considers budgetary multipliers or "dividers", we considers the values of fiscal variables corresponding respectively to positive and negative variations in the fiscal balance.

The different reduced form equations can be considered as stemming from a standard Keynesian structural model of a developed economy in the form of aggregate demand and aggregate supply equations. We only consider a few behavioral equations of such a model, namely those related to the real sphere (except export and imports). We consider that there is a public sector with taxes revenues and government expenditures. Our equations include lags on the endogenous variables in order to capture costs of adjustments or partial adjustment dynamic behaviors. We consider a possible influence of variables that are expected in a nonlinear manner through asymmetric effects on the fiscal policy.

Consumption is modeled as a simple linear Keynesian consumption function with the real disposable income as the main control variable. It is augmented with habit-persistence behavior and fiscal variables such as direct taxes and transfers. 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.

Both the investment and employment equations are assumed to be derived from profit maximization subject to a Cobb Douglass type production function with the inputs of capital and labor. The maximization behavior leads to linear functions in which capital and labor demands

11 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.

depends upon total demand (the real GDP) and the costs of factors (respectively the real long-run interest rate and the unit labor cost relative to labor productivity). Since the employment and investment equations are estimated separately, we neglect the cross-equation restrictions imposed by the theory. The equations are completed with fiscal variables that influence the costs of production and the accelerator in the case of the investment.

Finally, the real private GDP corresponds to the reduced form obtained from a macroeconomic model (after combining the different behavioral equations and the different identities (one difference here being that we do not consider the equation of total GDP, but only private GDP).

We now briefly present the estimated equations and the theoretical expected signs for each coefficient and the usual interpretations adopted by the economic literature.

2.1.- Real private GDP

From standard arguments, change in (the logarithm of) real private GDP, y_t , is 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 (ratios of fiscal revenues and government expenditure to GDP, respectively t_t and g_t, and the ratio of fiscal balance to GDP, b_t):

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

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. F_t is a vector of contemporaneous and lagged changes of the budgetary variables. ξ_t is a stochastic disturbance with a variance σ_y^2. The asymmetric effects of fiscal variables on the real private GDP are assumed to depend on the growth rate of public debt, which is our transition variable. This choice is based on the theoretical literature on Ricardian behaviors stemming from expectations by the private sector on the future stream of governments' indebtedness.

2.2.- Real private consumption

We estimate the following equation, whose dependent variable is the first-difference of the logarithm of households' real consumption:

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

ζ_t is an error term with a variance σ_c^2. w_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 transition variables are the contemporaneous or lagged changes of unemployment, $\Delta unempl_{t-i}$, and changes in public debt $\Delta debt_{t-j}$. These variables can induce Barro-Ricardo type behaviors. Further, in a context of recessions with higher unemployment, households may choose to deleverage thereby implying a downside variation in consumption even if transfers are increasing. The optimal combination of lags is selected in the model using information criteria.

2.3.- Investment

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 (control variables) and the following fiscal variables: permanent changes in the taxes on firms' profits, $\Delta taxes_{t-k}$, variations in subsidies, $\Delta subv_{t-j}$, and government spending, $\Delta spending_{t-l}$. *j, k and l* are lags determined by information criteria. X_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 equation is the following:

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

ω_t is an error term with a variance σ_{inv}^2, The transition variables are the output-gap (a proxy for the capacity utilization level) and changes in public debt.

2.4.- Employment

Changes in private employment, ΔL_t, depends on the growth rate of current and past real GDP, approximated by the vector ($\Delta RGDP_t$), on the variations of the ratio of unit labor cost to labor productivity ($\Delta ULC_{t-i}/PROD_{t-i}$). Adjustment costs are modeled by the lagged endogenous variable and we also consider public employment, $EMPLOY_{t-j}$. *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 employment 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 unemployment rate. The equation is the following:

$$\Delta L_t = \phi_0 s_t + \phi_1 s_t \Delta L_{t-1} + \phi_2 \Delta RGDP_t + \phi_3 s_t [\Delta(ULC_{t-i}/PROD_{t-i})] + \phi_4 s_t \Delta EMPLOY_{t-j} + \sigma_L \varepsilon_t \quad (4)$$

ε_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 (so-called improperly recession periods for ease of reference) and the other to "normal times" (so-called improperly expansions periods for ease of reference). 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[12]. We assume that *t=1,..,T*.

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 not known 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

$$P\{s_t/s_{t-1}, s_{t-2}, \ldots, s_{t-k}\} = P\{s_t/s_{t-1}\} \quad (5)$$

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

$$P\{s_t/s_{t-1}\} = P\{s_t/s_{t-1}, z_t\} \quad (6)$$

Assuming a Logit specification[13] for the occurrence of z_t on s_t, we have:

12 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, Garcia (1992), Hamilton (1991), Hansen (1992)).

13 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. We consider here the Normal law because this choice is common wisdom in the applied literature.

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

where η_t follows a Logit distribution. We accordingly define the transition probabilities as follows:

$$\begin{cases} P\{s_t = 1/s_{t-1} = j\,, z_t\} = p_1(z_t) = \Phi\left(\mathrm{a_j} + \mathrm{z_t^{'}b_j}\right) \\ P\{s_t = 2/s_{t-1} = j\,, z_t\} = p_2(z_t) = 1 - \Phi\left(\mathrm{a_j} + \mathrm{z_t^{'}b_j}\right) \end{cases}, \tag{8}$$

where Φ is the standard Logit cumulative distribution function.

Consider a vector x_t of control variables influencing the endogenous variable y_t. We define

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

where $\varepsilon_t \backsim N(0,1)$. 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[14].

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), Hamilton (1989)).

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 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; $\xi_t = (y_t, y_{t-1}, \dots, y_1)$; $\theta = \left(\beta_1, \sigma_1, a_1, b_1, \beta_2, \sigma_2, a_2, b_{2,}\rho\right)$.

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

$$L(\theta) = \prod_{t=1}^{T} f(y_t/\Omega_t\,, \xi_{t-1}; \theta) \tag{10}$$

where

$$f(y_t/\Omega_t\,, \xi_{t-1}; \theta) = \sum_i \sum_j f(y_t/s_t = i, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta) \times P(s_t = i, s_{t-1} = j/\Omega_t\,, \xi_{t-1}; \theta) \tag{11}$$

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

14 See Hamilton (1989).

$$
\begin{aligned}
&P(s_t = i, s_t = j/\Omega_t, \xi_{t-1}; \theta) \\
&= P(s_t = i/s_{t-1} = j, z_t) P(s_{t-1} = j/\Omega_t, \xi_{t-1}; \theta) \\
&= P_{ij}(z_t) P(s_{t-1} = j/\Omega_t, \xi_{t-1}; \theta)
\end{aligned} \tag{12}
$$

We also have

$$
\begin{aligned}
&P(s_t = i \quad /\Omega_{t+1}, \xi_t; \theta) = P(s_t = i \quad /\Omega_t, \xi_t; \theta) \\
&\frac{1}{f(y_t/\Omega_t, \xi_{t-1}; \theta)} \sum_j f(y_t/s_t = i, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta) \\
&\times P(s_t = i, s_{t-1} = j/\Omega_t, \xi_{t-1}; \theta)
\end{aligned} \tag{13}
$$

To complete the recursion defined by the equations (11) and (12), we need the regime-dependent conditional density functions[15]

$$
f\left(y_t/\mathrm{s_t} = 1, \mathrm{s_{t-1}} = \mathrm{j}, \Omega_\mathrm{t}, \xi_{\mathrm{t-1}}; \theta\right) = \frac{\phi\left(\frac{y_t - x_t' \beta_1}{\sigma_1}\right) \Phi\left(\frac{a_j + z_t' b_j - \rho\left(\left(y_t - x_t' \beta_1\right)/\sigma_1\right)}{\sqrt{1-\rho^2}}\right)}{\sigma_1 P_{1j}(z_t)} \tag{14a}
$$

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

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[16]), 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 rises 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 nonlinearities (Hinich and Patterson (1989)'s Portmanteau bispectrum test

15 ρ is the coefficient of correlation between εt and ηt which is assumed here to be zero. This assumption is made in order to keep our estimation tractable, since the unrestricted model yielded problems of convergence.

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

and Tsay (1996)'s 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

This approach is applied to French quarterly data taken from the OECD database and span the years from 1970 to 2009. 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, show that the data contain a stochastic trend).

For each behavior, 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.

4.1.- Results for France

4.1.1.- Real private GDP equation

In the French case, few studies have managed to highlight the Ricardian effects. However, an asymmetry in the behavior of fiscal multipliers is suspected and some economic forecasts implicitly include non-Keynesian behavior from households during periods of fiscal consolidation. The topic is all the more important that 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). The question 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 / dividers with different value or even sign.

Table 1a reports the estimates obtained for the GDP equation. All the variables are deflated by the GDP deflator. The transition variable is the fourth-order moving average of the differentiated logarithmic real debt[17].

The model detects two regimes corresponding respectively to periods of crisis (thereafter called recessions, with a negative and non-significant intercept) and "normal periods" (thereafter called expansions, with positive intercept). Indeed, the likelihood ratio test for TVPMS is highly significant. According to that result, the hypothesis of constant transition probabilities (H0) can be rejected. We observe that the second regime is locally explosive (with an autoregressive coefficient higher than 1, namely 1.39), thereby reflecting the fact that recessions are characterized by huge troughs with a duration higher those of the expansion phases.

This result is not surprising considering that our methodology does not rely on the identification of cycles, which would imply alternating periods of expansion and slowdown of the same length and same scale. On the contrary, the model identifies phases of good (or "normal") times and periods of crisis but does not assign statistical properties on frequency, duration and magnitude of these schemes.

Evidence of an asymmetric effect of the public expenditure multiplier is assessed by two different coefficients for regimes 1 and 2. It is much higher when the economy is in crisis than when it is in good times. Indeed, we see that one coefficient is statistically significant and positive at the 5% level of significance (0.46) while the latter is statistically equal to zero. Any increase in public expenditure during periods of sluggish activity is therefore efficient to boost real GDP growth. On the contrary, a change in public expenditure (whatever the sign) during good times cannot be regarded as a significant variable to explain the evolution of growth.

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 the real private GDP.

To allow for the possibility of an influence of the budgetary policy on the switches between the two regimes, we consider the variations of public debt across a year as our transition variable. This variable provides information on the fact that any increase in the stock of debt is interpreted by the private sector as a phenomenon paving the way to possible solvability and sustainability problems in

17 We also tried different specifications by considering the debt ratio. However, the results were worse than those obtained with the first-difference of the real debt.

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). On the other hand, a positive growth of the stock of debt results from a higher volume of expenditure, which could raise the magnitude of the multiplier if business investment and employment 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). A rise in public debt lowers the probability to be in the regime n°1, in which public expenditure have no significative impact on GDP growth. Indeed, as is evidenced by the estimated coefficients, the second effect seems to be predominant in France. 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.

Table 1a.- ΔReal GDP equation – Budgetary variable : ΔGvt expenditure
Estimates of TVPMS and specification tests – FRANCE
Transition variable: Δ(fourth-order moving average of real debt)
R1 : regime 1, R2: regime 2

Variable	Coeff	T-Stat	P-value
1. Intercept(R1)	0.0098	5.86860	0.00000000
2. Intercept(R2)	-0.0029	-1.04048	0.29811742
3. AR(1) coefficient(R1)	0.1518	1.86248	0.06253491
4. AR(1) coefficient(R2)	1.398	3.73795	0.00018553
5. Residual standard error	0.0056	17.59575	0.00000000
6. ΔGvt expenditure (t-1)(R1)	**-0.0272**	**-0.38862**	**0.69755447**
7. ΔGvt expenditure (t-1)(R2)	**0.46641**	**3.32057**	**0.00089833**
8. ΔOpenness (t-2)	0.07016	2.23534	0.02539508
9. Real interest rate (t-2)	-0.0020	-2.86756	0.00413652
10. a1	8.99959	1.83560	0.06641627
11. a2	-4.5266	-0.80147	0.42285997
12. b1	-0.000231	-1.60561	0.10835986
13. b2	0.000164	0.92544	0.35473694

Likelihood Ratio Test for TVPMS (null hypothesis : constant probabilities)
Chi-Squared(2)= 10.140312 with Significance Level 0.00628144

Ljung-box statistics: 3.97347 Significance Level: 0.40961
Hinich Linearity test (statistic and p-value) -3.542593 0.999802
Tsay Linearity test (statistics and p-value))= 0.88390 0.57803219

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 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 “expansion” and “recession” phases and the above conclusions remained unchanged. It means that the intensity of the spending multiplier remains unchanged whatever the magnitude of the change in public expenditure.

In these two regressions, the residuals contain no serial correlations (according to the Ljung-Box statistics) and there are no remaining nonlinearities according to the p-values derived from the Tsay and Hinich tests.

Table 1b.- Real GDP equation – Budgetary variable : ΔGvt expenditure – Δpotential real GDP
Transition variable: Δ(fourth-order moving average of real debt)
Estimates of TVPMS and specification test – FRANCE
R1 : regime 1, R2: regime2

Variable	Coeff	T-Stat	P-value
1. Intercept(R1)	0.009914	12.45338	0.00000000
2. Intercept(R2)	-0.003287	-1.44676	0.14796389
3. AR(1) coefficient (R1)	0.208430	2.51535	0.01189140
4. AR(1) coefficient(R2)	1.494959	3.78671	0.00015266
5. Residual standard error	0.005687	14.04143	0.00000000
6. ΔBudgetary variable (t)(R1)	**0.006329**	**0.09284**	**0.92602914**
7. ΔBudgetary variable (t)(R2)	**0.499326**	**3.85420**	**0.00011611**
8. ΔOpenness (t-2)	0.063875	1.96458	0.04946314
9. Real interest rate (t-2)	-0.002104	-907.50606	0.00000000
10. a1	4.237538	3.02821	0.00246009
11. a2	-281.8572	-0.00620	0.99505332
12. b1	-0.485338	-1.71690	0.08599686
13. b2	902.634730	0.00638	0.99490610

Likelihood Ratio Test for TVP(null hypothesis : constant probabilities)
Chi-Squared(2)= 9.440146 with Significance Level 0.00891453

Ljung-box statistics: 5.94924 with Significance Level: 0.20297
Hinich linearity test (statistic and p-value) : -1.755027 0.960373
Tsay linearity test (statistic and p-value) : 0.63982 0.82603640

Table 1c shows estimates when the budgetary variable is government revenues. The estimates are consistent with two different regimes respectively characterized by crisis (regime 1) and good times (regime 2). There is a discrepancy between the duration of both regimes. Indeed, the model dichotomizes into very short-lived “recessions” (the autoregressive coefficient is not statistically

significant in regime 1) and “expansions” of higher length (we obtain a positive statistically significant coefficient of 0.16 for regime 2). The fiscal multiplier is statistically null in the first regime and statistically negative in the second. Accordingly, reducing fiscal revenues does not affect the economy during the phases of crisis, but significatively reduces production when the economy evolves in expansion phases. As we have seen from the estimates involving the variable of public expenditure, it provides evidence of an asymmetric effect of fiscal policy on the real GDP.

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).

Table 1c.- ΔReal GDP equation – Budgetary variable : ΔGvt revenues
Estimates of TVPMS and specification tests – FRANCE
Transition variable: Δ(fourth-order moving average of real debt)
R1 : regime 1, R2: regime 2

Variable	Coeff	T-Stat	P-value
1. Intercept(R1)	-0.0075295	-1.85326	0.06384581
2. Intercept(R2)	0.0080156	4.49013	0.00000712
3. AR(1) coefficient (R1)	0.4426103	1.48357	0.13792319
4. AR(1) coefficient(R2)	0.1680156	2.00400	0.04507020
5. Residual standard error	0.0052997	15.37435	0.00000000
6. ΔGvt revenues (t-4)(R1)	0.1948747	0.65129	0.51485765
7.ΔGvt revenues (t-4)(R2)	-0.1625815	-2.63513	0.00841044
8. ΔOpenness(t-2)	0.0640817	3.02648	0.00247416
9. Real interest rate(t-3)	-0.0008891	-1.16244	0.24505553
10. a1	1.4494803	0.67925	0.49697674
11. a2	11.5528842	2.16490	0.03039509
12. b1	-30.92947	-0.58757	0.55682143
13. b2	-319.2082	-1.65742	0.09743514

Likelihood Ratio Test for TVP(null hypothesis : constant probabilities)
Chi-Squared(2)= 10.914171 with Significance Level 0.00426597

Ljung-box statistics: 7.16371 with significance Level: 0.12749
Hinich linearity test (statistic and p-value) 1.1860078 0.1178096
Tsay linearity test (statistic and p-value) : 0.79470 0.67279416

An increase in the growth rate of debt may reveal greater probability of an increase in future taxes. This creates Ricardian behavior, thereby decreasing the probability of evolving in a regime whereby the fiscal multiplier has the strongest effect (in this case, the coefficient b_2 should be negative as shown in our estimates). In contrast to our observation for the multiplier of expenditure, the model with fiscal revenues suggests a plausible influence of Ricardian behaviors in determining the effects of fiscal revenues on the activity.

This model is well estimated with neither serial correlation, nor remaining nonlinearities in the residuals.

What can we conclude about the effects of budgetary multipliers 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 recessions and expansions.

	"Expansion" or good times regime		"Recession" or period of crisis regime	
NS : non significative	Coefficient	T-stat / P-value	Coefficient	T-stat / P-value
	A negative coefficient indicates ricardian effects (a reduction in public spending corresponds to a rise in real GDP growth			
Δ Public expenditure	0 (NS)	0.4 / 0.69	**0.46**	3.3 / 0.001
Δ Public expenditure – Δ real potential GDP	0 (NS)	0.09 / 0.92	**0.49**	3.85 / 0.0001
	A positive coefficient indicates ricardian effects (a rise in public revenue corresponds to a rise in real GDP growth)			
Δ Public revenue	**-0.16**	-2.6 / 0.008	0.19 (NS)	0.65 / 0.51

One interesting finding is a "mirror" effect with expenditure affecting the GDP during recessions and the fiscal revenues having a significant influence during the phases of expansions. So, decreasing the latter has no effect on the real GDP during recessions, but a positive effect during expansions. In contrast, increasing government expenditure stimulates the economy only during crisis. In light of the recent crisis, using the expenditure as the instrument of the budgetary policy might have been more efficient than trying to induce a recovery through fiscal measures. A second interesting finding concerns Ricardian behaviors. We consider here the reactions of the private sector to increases in 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 revenues. This would mean that the budgetary instrument used to influence the economy during slumps and booms 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 futures tax increases, thereby implying a higher likelihood of driving the economy out of an expansion phases. In contrast, in presence of a crisis, raising the expenditure while borrowing more might be interpreted as a way of 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.

4.1.2.- Real private consumption

Table 2a and 2b show the results for real private consumption considering two different transition variables: the unemployment rate or public debt. The growth rate of real consumption (CPI-based) is linked to the real disposable income and is also influenced by the following budgetary variables: taxes on income paid by households, transfers and payments received by households and households' contributions to social security. In contrast to the results obtained for the aggregate GDP, these more disaggregated budgetary variables allow for non-Keynesian effects that exist because their impact on households' consumption is driven by how their reaction is tied to their saving rate and the growth rate of public debt.

In Table 2a, changes in consumption are strongly significant in the second regime as compared with those in the first one. In fact, we do observe smallest variations in regime 1. The model identifies this regime as corresponding to the years of the two oil shocks, 1983-1985, 1990-1994 and 2008 (Figure 1 gives the posterior probability of being in the first regime). These years coincide with periods usually seen as those of recessions. We accordingly consider regime 1 as corresponding to a situation in which the probability of being in or entering a recession phase in high; we identify regime 1 as a regime of recession and thus regime 2 for other periods combining expansion and stable periods.

We find an asymmetric effect of the taxes on income. The estimates indicate that a decrease in the income taxes raise households' consumption in recessions and have no effect in expansions. Indeed, as is seen, the corresponding coefficients are respectively -0.15 and 0.0053 in regimes 1 and 2, which correspond to a typical Keynesian effect. On the contrary, as regards the impact of the transfers, we find anti-keynesian effect in regime 1 (recessions, negative coefficient), though the latter is not statistically significant. This finding does not necessarily reflect Ricardian behaviors, but may simply illustrate the fact that the share of transfers in households' total income is low and thus a very high variation is needed to impact significantly their consumption. In contrast, Keynesian effects are strong and statistically significant during expansions (regime 2) (the point estimate is 0.18). This means that a 1% increase of transfers to households triggers an increase in real private consumption by 0.18% in time of expansions. Concerning the impact of households' contribution to social security,

we expect a negative sign, since consumers are likely to adjust their consumption downward as their provision for social insurance benefits increases. This is shown in our estimates by the negative coefficient of -0.05 in the expansion regime though it is not statistically significant. Meanwhile, we find a positive and strong coefficient for the regime of recession (0.32). Such a positive coefficient can be explained by the fact that the influence of the exogenous variables is conditioned by the transition variable, which is, here, the changes observed in the unemployment rate. If social contributions are increasing in time of rising unemployment rates (this is the case during recessions), then unemployment benefits may offset the negative impact of social contributions on consumption. The coefficient captures "composition" effects in the sense that the households contributing to the provision of social security are not necessarily those benefiting from unemployment benefits. Therefore the positive sign that we find is not implausible.

Table 2a.- ΔReal private consumption
Budgetary variables : Δincome taxes, Δtransfers, Δcontribution to social security
Estimates of TVPMS and specification tests – FRANCE
Transition variable: Δ(unemployment rate)
R1 : regime 1, R2: regime 2

Variable	Coeff	T-Stat	P-value
1. Intercept (R1)	0.003049	4.08663	0.00004377
2. Intercept (R2)	0.005376	46.71089	0.00000000
3. AR(1) coefficient (R1)	-0.227751	-2.82527	0.00472414
4. AR(1) coefficient (R2)	-0.281266	-2.58075	0.00985855
5. Residual standard error	0.004618	15.63462	0.00000000
6. ΔIncome taxes (t)(R1)	**-0.151528**	**-2.69363**	**0.00706779**
7. ΔIncome taxes (t)(R2)	**0.008187**	**0.30193**	**0.76270367**
8. ΔTransfers (t-1)(R1)	**-0.095408**	**-1.46154**	**0.14386762**
9. ΔTransfers (t-1)(R2)	**0.187689**	**5.84998**	**0.00000000**
10. ΔSocial security (t)(R1)	**0.325105**	**5.39430**	**0.00000007**
11. ΔSocial security (t)(R2)	**-0.050176**	**-1.52612**	**0.12697923**
12. ΔReal disposable income	0.153569	3.17112	0.00151854
13. a1	-140.383395	-0.04340	0.96537935
14. a2	0.958872	1.14693	0.25141152
15. b1	27166.307315	0.04400	0.96490460
16. b2	-127.096410	-2.27036	0.02318602

Likelihood Ratio Test for TVP (null hypothesis : constant probabilities)
Chi-Squared(2)= 21.590909 with Significance Level 0.00002049

Ljung-box statistics: 1.54117 with Significance Level: 0.81932
Hinich linearity test (statistics and p-value): -0.755083 0.774900
Tsay linearity test (statistics and p-value) : 1.56647 0.10085698

Those results (we still refer to Table 2a) are obtained when the transition variable is the unemployment rate (logarithmic changes). We see that any increase in these variable rises the likelihood of being in regime 1 (recessions), but decreases the probability of being in an expansion

regime. Although big, the coefficient b1 is statistically equal to zero, while b2 is significant. Another transition variable, which may also influence the probabilities to switch between the two regimes (changes in debt) yields different results (see Table 2b). Indeed, the finding of an asymmetric effect of income taxes is not confirmed. More than that, the impact is never statistically significant in either regime or another. This time, transfers play the predominant role with the coefficient carrying a positive sign in both expansion and recession phases. The basic pattern observed in Table 2a as regards the influence of social contributions is essentially the same here. Albeit less importantly, the composition effect between this variable and the transition variable implies a positive sign (the coefficient is not significant at the 5% level). However, the coefficient seems to us to be perversely signed. The transition variable carries the expected negative sign in the second regime (expansion), since an increase in public indebtedness reduces the size of the multiplier.

Table 2b.- ΔReal private consumption
Budgetary variables : Δincome taxes, Δtransfers, Δcontribution to social security
Estimates of TVPMS and specification tests – FRANCE
Transition variable: Δ(fourth-order moving average of real debt)
R1 : regime 1, R2: regime 2

Variable	*Coeff*	*T-Stat*	*P-value*
1. Intercept (R1)	-0.0001647	-0.25283	0.80039929
2. Intercept (R2)	0.0064173	10.62760	0.00000000
3. AR(1) coefficient (R1)	-0.3412710	-2.53257	0.01132284
4. AR(1) coefficient (R2)	-0.3765256	-3.47444	0.00051192
5. Residual standard error	0.0043150	16.16516	0.00000000
6. ΔIncome taxes (t)(R1)	**0.0487842**	**1.27865**	**0.20102110**
7. ΔIncome taxes (t)(R2)	**0.0346062**	**0.90173**	**0.36719778**
8. ΔTransfers (t-1)(R1)	**0.1907128**	**2.80183**	**0.00508129**
9. ΔTransfers (t-1)(R2)	**0.2168799**	**2.47594**	**0.01328863**
10. ΔSocial security (t)(R1)	**0.1125984**	**1.78633**	**0.07404530**
11.ΔSocial security (t)(R2)	**-0.0399295**	**-0.96202**	**0.33603793**
12. ΔReal disposable income	-0.0218857	-0.35692	0.72114820
13. a1	1.0697168	1.23981	0.21504405
14. a2	3.9480701	3.52777	0.00041908
15. b1	55.5538519	0.99817	0.31819558
16. b2	-120.7958098	-1.95711	0.05033465

Likelihood Ratio Test for TVP (null hypothesis : constant probabilities)
Chi-Squared(2)= 6.597033 with Significance Level 0.03693792

Ljung-box statistics : 1.26346 Significance Level: 0.86754
Hinich linearity test (statistics and p-value) : -5.362785 1.000000
Tsay linearity test (statistics and p-value) : 2.48030 0.00445267

To summarize our findings, there seems to evidence that cutting the income taxes could help in curbing low consumption during time of sluggish activity, while the role of transfers appears to be

more limited. Besides, the way in which a rise in the provision to social security from households can affect consumption depends upon the structure of “cohorts” of consumers (number of contributors to social security relative to the number of eligible recipients notably during times of increasing unemployment).

4.1.3- Real private investment

The results for the investment rate are shown in Table 3. The model dichotomizes into regimes of positive and negative changes in the investment rates (corresponding respectively to positive and negative intercepts) though the changes and the degree of adjustment can be considered as being of equal magnitude in both regimes. However, as shown in Figure 2, the probability of being in regime 2 is near 1 for the years usually considered as being that of recessions : second oil price shock years, mid eighties (restrictive fiscal policy by the second Mauroy government), the years 1992-1993, 2001 and as expected 2007-2008. We accordingly identified the second regime as being one of recessions and the first as one of expansions. As is seen, fiscal policies have asymmetric effects.

Firstly, the outcome of cuts in corporate taxes is an increase in investment during recessions only. Indeed, we obtain a statistically negative coefficient -0.47 for the second regime, while the coefficient is not statistically significant for the first regime. To account for the fact that only those variations that are perceived to be permanent induce changes in the firms’ behavior, we have smoothed the first-differences in tax corporate changes by considering their recursive means. The idea is that any increase or decrease in corporate tax is significant if it modifies “the trend”. Our results thus would mean that, to mitigate an investment downturn, the instrument of direct taxes induces a stimulus in the investment rate that is large enough only during recessions. The asymmetric effect of tax variations is also in accordance with the common wisdom in economic theory that, during expansions, firms face less financial constraints and are thus less likely to spend their additional disposable income than during recessions.

Our results also point to a second interesting result concerning the asymmetric impact of government spending. A key question is whether the latter raises private investment or whether it yields the so-called crowding-out effects. According to our estimates, an increase in spending results in higher private investment during recessions (we obtain a statistically positive coefficient of 0.01 for the second regime), while it comes at the expense of private investment during expansions (a statistically negative coefficient of 0.02 is found for the first regime). One explanation of this asymmetry is that, for private investment to increase (following a budgetary stimulus through higher

public spending), the economy must not already be at full capacity level. Indeed, the signs of b_1 and b_2 indicate that the higher the output-gap (synonymous of a decrease in capacity utilization level), the higher the probability of being in the second regime ($b_2>0$) and the weaker that of being in regime 1 ($b_1<0$). So, when there are less unused capital resources, it is difficult to expand capital in respond to a higher global demand, while the inverse situation occurs with low capacity level. In light of the 2007/2008 crisis, these results would imply that the increase in government spending proposed in the stimulus plan may have been appropriate given the sharp decrease in the capacity utilization level. Conversely, their effect on private investment could decelerate beyond the crisis. We also tried to use debt ratio as a transition variable, but the latter did not appear to be significant in explaining the asymmetric effects in the model. Our explanation is that, in contrast to other countries, investment project are financed in a significant proportion through banking intermediation, thereby implying that "crowding out effect" through the interest rate channel may be low.

Government subsidies also appear to have an asymmetric effect on private investment by raising it during expansions, but reducing it during recessions. One explanation can be that, during periods of crisis, in addition to reducing capacities (which is reflected in a rising output-gap), firms also proceed to other internal adjustment (for instance, they deleverage or clean up their balance sheets). Therefore, any additional income to them may result into anti-Keynesian effects.

Turning our attention to the impact of the control variables, we see that the real GDP have 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 statistic is above 5%), the residuals still contain remaining nonlinearities (both the Hinich and Tsay tests rejects the null hypothesis of linearity). Accordingly, the investment behavior may obey to other type of nonlinearities (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.- ΔInvestment rate (Investment / capital stock)

Budgetary variables : Δpermanent corporate tax(t-3), ΔGovernment subsidies (t-5), ΔGovernment spending (t-4)
Estimates of TVPMS and specification tests – FRANCE
Transition variable: Output-gap (t-2)
R1 : regime 1, R2: regime

Variable	Coeff	Std Error	T-Stat	Signif
1. Intercept (R1)	0.00443032		0.69392	0.48773545
2. Intercept (R2)	-0.00357941		-0.81798	0.41336918
3. AR(1) coefficient (R1)	0.42859735		4.21521	0.00002495
4. AR(1) coefficient (R2)	0.47129502		4.51417	0.00000636
5. Residual standard error	0.00952284		13.23591	0.00000000
6. ΔCorporate taxes (t-3) (R1)	**-0.08003063**		**-0.10822**	**0.91381959**
7. ΔCorporate taxes (t-3)(R2)	**-0.47442377**		**-2.51662**	**0.01184866**
8. Δsubsidies (t-5) (R1)	**0.26708853**		**3.70971**	**0.00020749**
9. Δsubsidies (t-5) (R2)	**-0.30370464**		**-2.88010**	**0.00397552**
10. ΔGovernment spending (t-4) (R1)	**-0.02229822**		**-4.34811**	**0.00001373**
11. ΔGovernment spending (t-4) (R2)	**0.01379874**		**2.44751**	**0.01438483**
12. ΔReal GDP (-2)	**0.85896252**		**4.52215**	**0.00000612**
13. ΔReal GDP (-2)	**-0.00055449**		**-2.39533**	**0.01660538**
14. ΔReal long-run interest rate	0.15273936		0.81192	0.41683489
15. a1	-1.07302992		-2.23593	0.02535664
16. a2	-19.81568511		-18.28196	0.00000000
17. b1	-0.67709237		-2.12334	0.03372525
18. b2	7.19839076		39.43768	0.00000000

Likelihood Ratio Test for TVP (null hypothesis : constant probabilities)
Chi-Squared(2)= 6.733629 with Significance Level 0.03449936
Ljung-box statistics: 3.41563 Significance Level: 0.49082
Hinich linearity test (statistics and p-value) : 9.848914 0.000000
Tsay linearity test (statistics and p-value) : 3.34748 0.00019935

4.1.4- Employment in the private sector

The estimates, in Table 4, suggest the existence of two regimes which are differentiated by the smoothness of adjustment of employment. In the second regime employment adjusts in a more sluggish manner than in the first one. The respectively positive and negative signs of b_1 and b_2 indicate that an increase in the unemployment rate raises the probability of being in regime 1 and reduces the probability of being in the second regime. This suggests that regime 1 could be identified as one of crisis and regime 2 as one of good times. The difference between the coefficients (0.604 for regime 1 and 0.935 for regime 2) mirrors the asymmetry in employment adjustment, as it is common wisdom in the empirical literature that recession phases are characterized by sharp deterioration in the employment, while labor hiring occurs sluggishly during expansions.

The outcome of reducing the unit labor costs is different in recession from the situation observed during expansions. In the first regime, fiscal measures aiming at reducing these costs would not stimulate labor demand (indeed, albeit negative the estimated coefficient is not statistically significant). It would be more successful to increase public employment (we obtain a high coefficient of 0.3). To summarize, the estimates suggest that employment policies should be asymmetric. During recessions, demand stimulation policies (such as those based on increase in public employment) could be activated, while during expansions measures that modify the cost of labor would be more successful in raising employment in the private sector. As is seen, the real GDP is not statistically significant, due to the colinearity of this variable with public employment.

Just as with investment, we see that there are remaining nonlinearities in the residuals, as indicated by the Hinich bispectral test. Again, this suggests some difficulties in modeling the demand for factors.

Table 4.- Δemployment in the private sector
Variables influenced by fiscal policies : Δ unit labor cost (t-1), Δpublic employment (t-1)
Estimates of TVPMS and specification tests – FRANCE
Transition variable: Unemployment rate (t-1)
R1 : regime 1, R2: regime

Variable	Coeff	Std Error	T-Stat	Signif
1. Intercept (R1)		0.0005143	0.41293	0.67965444
2. Intercept (R2)		0.0004734	0.53190	0.59479847
3. AR(1) coefficient (R1)		0.6044606	6.15829	0.00000000
4. AR(1) coefficient (R2)		0.9352739	22.87567	0.00000000
5. Residual standard error		0.0010284	16.06613	0.00000000
6. Δlabor cost (t-1) / prod (t-1) (R1)		**-0.0045657**	**-0.33859**	**0.73491583**
7. Δlabor cost (t-1) / prod (t-1) (R2)		**-0.0393435**	**-6.04639**	**0.00000000**
8. Δpublic employment (t-1) (R1)		**0.3083268**	**2.37424**	**0.01758492**
9. Δpublic employment(t-1) (R2)		**0.0080525**	**0.23496**	**0.81424083**
10. Δ real GDP(t)		0.0088644	0.47151	0.63727942
11. a1		-0.0859187	-0.06709	0.94651224
12. a2		3.6092818	3.79782	0.00014597
13. b1		160.2777527	0.76887	0.44196970
14. b2		-31.6038686	-2.00082	0.04541231

Likelihood Ratio Test for TVP (null hypothesis : constant probabilities)
Chi-Squared(2)= 6.356228 with Significance Level 0.04166417

Ljung-box statistics: 7.11559 Significance Level: 0.12990
Hinich linearity test (statistics and p-values): 5.0374857 0.0000002
Tsay linearity test (statistics and p-values) : 1.38856 0.16679277

5.- Conclusion

First, 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 elasticities depending on 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. However, they do not highlight Ricardian effects, but only non-keynesian.

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 variable is consumption, but with a relatively low multiplier. That’s may be the reason why the effect is dissolved at the aggregate level and could not be observed on GDP growth. More precisely, our results show that when households take into account public debt changes in their decisions, a rise in public transfers improve their consumption growth rate with strong Keynesian effects, while the direct tax multiplier is not significant. Conversely, when households are sensitive to the unemployment situation, tax cuts increase consumption during downturns, while transfers are not playing any 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 other hand lower taxes paid by households. According to our results, the second approach has the largest multiplier effects. On the firms side, our results show that direct taxes changes induce a (stimulus) effect in the investment rate only during recessions. A rise in subsidies mainly plays a role during expansions, and has little influence during crisis, as firms reduce their production capacity. Increased public spending appears to have a greater multiplier effect on private investment without crowding out effects observed during expansions. 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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