Exit Strategies[*]

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Abstract

We study alternative scenarios for exiting the post-crisis fiscal and monetary accommodation using the model of Angeloni and Faia (2010), that combines a standard DSGE framework with a fragile banking sector, suitably modified and calibrated for the euro area. Credibly announced and fast fiscal consolidations dominate – based on simple criteria – alternative strategies incorporating various degrees of gradualism and surprise. The fiscal adjustment should be based on spending cuts or else be relatively skewed towards consumption taxes. The phasing out of monetary accommodation should be simultaneous or slightly delayed. We also find that, contrary to widespread belief, Basel III may well have an expansionary macroeconomic effect.

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"By one door you enter, by another you exit".

PETRONIUS, Satyricon

1st Century AD

1 Introduction

The more experience we gain with this crisis and its aftershocks, the clearer it becomes that withdrawing the policies put in place in response to it and neutralizing their side effects will confront policymakers with more serious and long lasting problems than the crisis itself. Fiscal policy is at the center of this new challenge. In all industrial countries, public sector deficits expanded sharply since the second half of 2008. The deterioration resulted from the combined effect of automatic stabilizers, on both the expenditure and revenue sides, and discretionary measures, hastily introduced to support the financial, corporate and household sectors. The extent and nature of the official support varied across countries, but the overall effect was impressive by all standards. Budget deficits increased by about 5 percent of GDP between 2008 and 2009 in both the US and the euro area. Long run simulations by the IMF (see e.g. Cottarelli and Viñals [21]) show that the debt dynamics will, under favorable circumstances, lead to increases in public debt ratios in the order of 40 percent or more in the next 6 to 8 years in the advanced countries; a public debt explosion without precedents in peacetime. An orderly exit from such imbalance will require sustained consolidation effort for decades, and in the meantime public finances will remain highly vulnerable to further shocks.

While the fiscal problem stands out as paramount, the question of how to revert the anti-crisis measures and return to normal policy setting (the "exit strategy" problem, as frequently referred to) is not limited to budgets. Central banks moved close to zero-level interest rates virtually everywhere in late 2008, and a number of enhanced monetary and credit support programs were enacted. Exiting the monetary expansion entails a dilemma. On the one hand, delaying the exit can help the recovery and lends a hand to fiscal management by reducing the interest burden. On the other, however, the exceptionally strong and protracted monetary expansion fuels moral hazard and risk in the financial sector, as demonstrated convincingly by an increasing flow of evidence (see a brief survey in Angeloni, Faia and Lo Duca [4]). In the long run, an excessive monetary expansion can become an obstacle to the restoration of balanced financial and economic conditions. Moreover, an exit issue exists also for financial sector policies, in two senses. First, the publicly funded bank liquidity and capital support measures need to be reversed. Second, financial

sector reforms, undertaken in all major countries under the leadership of the G20, the FSB and the Basel Committee, need to be completed in a foreseeable future. Here again, timing and modalities are essential: financial reforms should help strengthen financial structures without endangering or delaying the global recovery.

In analyzing exit strategies, several interconnected factors must be taken into consideration. The fiscal adjustment is heavily influenced by the timing and modality of monetary exit, but the reverse is also true, because fiscal consolidation will affect a number of macro-variables that are in the informational radar screen of central bankers. In addition, the pace of financial reform will influence how easily and quickly the monetary and liquidity support can be lifted. And so on. That is why exit strategies should not be examined one at a time, but in combination, and this is also the reason why a suitably comprehensive analytical framework is so useful to approach the problem[1].

In this paper we contribute to this discussion by analyzing and comparing a number of policy alternatives within a macro-DSGE model that embodies, in a simplified way, all essential ingredients. While aware of the pitfalls inherent in model-dependent analyses, we believe that the intricacy of the linkages referred to above can *only* be approached with the help of a model. Not *only one* model, however. Investigating the robustness to alternative modelling structures, while beyond our ambitions of this paper, is a key development of this research agenda.

We use an adapted version of the model proposed by Angeloni and Faia [3], henceforth AF. AF integrate a risky banking sector, modelled using ideas from Diamond and Rajan ([27] [28]) in a standard DSGE macro framework, and use this construct to analyse the transmission of monetary and other shocks in an economy with fragile banks. Banks determine their leverage and balance sheet risk endogenously, and can be subject to minimum capital requirements. For the purpose of this paper we adjust and extend the model in three directions. First, we add a detailed fiscal sector, including policy functions for public spending, labour and consumption taxes, as well as debt accumulation. This detail is needed to study alternative mixes of fiscal consolidation strategies and to account for debt dynamics. Second, we augment the bank capital accumulation equation of the AF model by adding publicly funded bank recapitalisation. This is useful not only to study exit from financial policies, but also to realistically model the initial impact of the crisis and its effect on bank leverage and risk. Thirdly, we rewrite the model in linear form and apply newly developed methods to analyse and compare complex sequences of shocks and policy responses, with different timing and informational assumptions. This allows to approach questions that are typical in the

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[1]The interaction between monetary and fiscal policy is analyzed in our framework within the specification of a type of "open loop" game and under deterministic setting. This reduces the complexity in terms of the number of possible equilibria which can arise.

current discussions on exit strategies, such as gradualism versus preemptive action, sequencing and delay (who should exit first, fiscal or monetary policy? what is the cost or benefit from delaying?) and communication policy (should the exit strategy be pre-announced)?

While we are not aware of any paper approaching the issue of exit strategies in the fashion we do, our paper is closely related to several strands of recent literature. The first is, naturally, that combining banking, finance and macro modelling and studying the role of monetary policy in preventing and in managing a financial crisis. The second relevant field of literature is that on the effects of fiscal policy, including the role of gradualism versus front-loading, announcement, as well as the tax-expenditure mix of fiscal consolidations. The third is the work on monetary and fiscal regimes, including the effects of endogenous regime switching. These and other links with the literature are briefly recapitulated in a section below.

Our main conclusions can be summarized as follows. First of all, exit strategies are important: undertaking an exit strategy, almost of any form, is beneficial in terms of our criteria (intertemporal consumption and output; stability of inflation and bank risk) relative to the status quo (i.e., the indefinite continuation of the post-crisis policy course). Exit strategies are not all alike, however. Active fiscal strategies, geared to an ambitious debt consolidation target and credibly communicated in advance, dominate gradual, unannounced ones. The composition of fiscal policy matters. Spending-based fiscal strategies are superior to tax-based ones in most cases. Among the tax-based ones, strategies tilted towards consumption taxes perform relatively well. The effect of sequencing (monetary policy moving before fiscal, or the reverse) are more nuanced. Among thee active and pre-announced strategies, those where monetary and fiscal policies move together are almost equivalent to those where fiscal moves first. Strategies where monetary policy leads seem less effective. We also analyse, in a qualitative way, how our model economy reacts to the transition to Basel III (the new capital accord recently agreed by the Basel Committee on Bank Supervision). We find that the "countercyclical buffer", a main feature of the new standard which foresees that banks can release capital in a recession but must build it up in booms, has a powerful stabilizing macroeconomic effect, as desired. Moreover, and more surprisingly, we find that a permanent increase in bank capitalization can be expansionary in our model (rather than contractionary, as typically argued) for plausible parameter values. The expansionary effect stems from the increase in the supply of bank capital induced by regulation, assuming (as we do) that all proceeds of bank capitalists are reinvested.

A unifying message from our results could be stated as follows: a successful exit from the exceptional post-crisis accommodation requires not a mere return to old policy regimes, but a transition to a new approach. On the fiscal side, its main ingredients are a more credible commitment

to intertemporal sustainability, more front-loaded adjustment, and clearer communication of long term targets. On the monetary side, taking into account the effects of central bank action on moral hazard and risk taking in the financial sector. On financial policies, the explicit consideration of their macroprudential dimension. Far from being a travel in reverse, the exit strategies problem offers a chance of, and solicits, a qualitative change of the way macroeconomic policies are conducted.

The rest of the paper is organized as follows. Section 2 reviews the related literature and highlights the areas where this paper contributes. Section 3 describes the model and the simulation methodology we use to study and compare exit strategies. Section 4 describes the calibration of the model and the policy regimes, and the methodology for designing and simulating the exit strategies. Section 5 describes our baseline path, which includes two elements: the initial shock (the "crisis") and the immediate policy responses. Our aim here is to formulate a realistic set of impulses that generate in the model a response in the main macro variables that roughly mimics that observed in the euro area in the two years following the onset of the financial crisis. The next step, in section 6, is to analyse a number of alternative strategies of exit from fiscal and monetary accommodation (paths of the main macro variables following alternative combination of changes in the existing fiscal and monetary rules), and compare their performance against the baseline. To do this we use visual inspection and quantitative ad hoc criteria. The final step, in section 7, is to examine the phasing in of Basel III. Finally, section 8 concludes.

2   Links to the literature

In the aftermath of the crisis most of the literature on fiscal and monetary policy focused on analyzing how effective unconventional monetary and fiscal policy could be in managing the crisis. In all countries governments have let fiscal automatic stabilizers play with full force and most have also passed discretionary stimulus packages. Monetary policy has adopted a proactive expansionary stance, particularly in the US where, since the aggravation of the crisis in late 2008, the reference interest rate has remained stable at the zero lower bound.

In this context, a number of papers have analyzed the effects of fiscal packages, particularly their output multipliers. The first analysis of this type, by authors close to the Obama administration, is contained in the paper by Romer and Bernstein [44]: those authors have argued that large fiscal stimuli can be extremely beneficial as fiscal multipliers are significantly larger than one. Their conclusions have recently been challenged by several authors, who have revised estimates of the fiscal multipliers offering less favorable scenarios (see Cogan et al. [18], Cwik and Wieland [23],

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Uhlig [48] among others). Christiano, Eichenbaum and Rebelo [17] argue that fiscal multipliers might be larger than one when the interest rate is at the zero lower bound. On the effects of government spending on the macroeconomy there is also a vast empirical literature, which however is only marginally related to our paper.

In the US much of the discussion has focused on how the Federal Reserve should reabsorb liquidity avoiding inflationary pressure. The paper by Gertler and Karadi [32] considers the effects of "news shocks" for the case in which the monetary authority decides to abandon unconventional measures. A recent paper by Chari [15] analyzes three alternative strategies for draining reserves: (1) paying interest on excess reserves, (2) managing interest rates on short-term deposits, and (3) selling back financial assets such as mortgage-backed securities. He concludes that the best course would be a blend of the three.

Our paper is also related to the literature on policy regimes. Troy and Leeper [25] estimates Markov-switching policy rules for the United States and finds that monetary and fiscal policies fluctuate between active and passive behavior. Troy, Leeper and Walker [26] apply the same framework to study the consequences of alternative means to resolve the "unfunded liabilities" problem—the projected exponential growth in federal Social Security, Medicare, and Medicaid spending with no known plan for financing the transfers. Aside from the literature on discretionary policy in which changing policy in every periods involves game theoretic interactions between agents and government, standard DSGE models could not so far accommodate unexpected change in policy: a recent methodology developed by Juillard [37] takes important steps in this direction.

As the model we use introduces banks into DSGE models, our paper is also related to the recent literature on this topic, which includes Gertler and Karadi [32], Gertler and Kiyotaki [33], Meh and Moran [41], Covas and Fujita [22], He and Krishnamurthy [34], Bunnermeier and Sannikov [12], Gerali et al. [31], Angelini et al. [2], Darrein Paries et al. [24].

Finally, our paper is related to recent work by Corsetti et al. [20] which analyzes the effects of fiscal stimulus and fiscal exit in deep recessions when the interest rate is at the zero lower bound. They show, by using a standard New Keynesian model without banks, that debt consolidation through the credible announcement of future spending cuts generally amplifies the expansionary effects of a fiscal stimulus.

3 The Model

The starting point is the model developed in AF [3] who introduce banks following Diamond and Rajan ([27], [28]) into a conventional DSGE model with nominal rigidities. To this we add a fiscal

sector which sets government expenditure following an operational rule which responds to past spending and government debt. Government spending is financed through a mix of labour and consumption taxes and government debt. Monetary policy follows a standard Taylor rule in the baseline scenario.

There are five type of agents in this economy: households, financial intermediaries, non-financial good producers, capital producers and monopolistic firms. Financial intermediaries fund projects by raising money from depositors and bank capitalists. Projects are subject to an idiosyncratic shock, which introduces the possibility of runs. As in Diamond and Rajan [27] [28] the bank capital structure is determined by bank managers, who act on behalf of outside investors (depositors and bank capitalists combined) by maximizing their overall return. Once the project's uncertain outcome is realized, bank capitalists claim the residual value after depositors are paid out. If the return on bank assets is low and the bank is not able to pay depositors in full there is a run on the bank, in which case the bank capital holders get zero while depositors get the market value of the liquidated loan. Finally, we assume that monopolistic firms in the production sector face quadratic adjustment costs on prices: such an assumption allows to generate non-neutral effects of monetary policy.

3.1 Households

There is a continuum of identical households who consume, save and work. Households save by lending funds to the financial intermediaries, both in the form of deposits and bank capital. To allow aggregation within a representative agent framework we follow Gertler and Karadi [32] and assume that in every period a fraction γ of household members are bank capitalists and a fraction $(1-\gamma)$ are workers/depositors. Hence households also own financial intermediaries[2]. Bank capitalists remain engaged in their business activity next period with a probability θ, which is independent of history. This finite survival scheme is needed to avoid that bankers accumulate enough wealth to ease up the liquidity constraint. According to this structure a fraction $(1-\theta)$ of bank capitalists exit in every period. A corresponding fraction of workers become bank capitalists every period, so that the share of bank capitalists, γ, remains constant over time. Workers earn wages and return them to the household; similarly bank capitalists return their earnings to the households. However, bank capitalists earnings are not used for consumption but are given to the new bank capitalists and reinvested as bank capital. Consumption and investment decisions are made by the household, pooling all available resources.

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[2]As in Gertler and Karadi [32] it is assumed that households hold deposits with financial intermediaries that they do not own.

As mentioned before and following Diamond and Rajan [27] [28] the bank capital structure is determined by the bank managers, who maximize the returns of both depositors and bank capitalists. Bank managers are simply workers in the financial sector. Hence, household members can either work in the production sector or in the financial sector. We assume that the fraction of workers in the financial sector is negligible, hence their wage earnings are not included in the budget constraint.

Households maximizes the following discounted sum of utilities

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{1}{1-\sigma}(C_t - \gamma C_{t-1}^a)^{1-\sigma} + \nu \log(1 - N_t) \right)$$

where C_t denotes consumption, C_t^a denotes aggregate past consumption, and N_t denotes labour hours. The introduction of habit persistence in consumption through the dependence of the utility from past aggregate consumption serves the purpose of smoothing fluctuations in consumption thereby rendering the dynamic path of variables empirically more plausible, particularly under our initial crisis scenario. Households save and invest in government bonds, B_t, bank deposits, D_t, and bank capital. Deposits and government bonds pay a gross nominal return R_t one period later. Finally, households are also the owners of the monopolistic competitive sector, hence they receive real profits for an amount, Θ_t. The budget constraint reads as follows:

$$(1 + \tau_t^c)C_t + \frac{B_{t+1}}{P_t} + \frac{D_{t+1}}{P_t} = (1 - \tau_t^n)\frac{W_t}{P_t}N_t + R_t\frac{B_t}{P_t} + R_t\frac{D_t}{P_t} + \tau_t + \Theta_t$$

where τ_t^c and τ_t^n are taxes on consumption purchases and labour income, respectively. τ_t denotes a lump-sum transfer[3].

The following optimality conditions (alongside with a No-Ponzi conditions) hold (after aggregation):

$$\lambda_t = (C_t - \gamma C_{t-1})^{-\sigma}\frac{1}{1 + \tau_t^c} \tag{1}$$

$$\lambda_t = \beta E_t \left\{ \lambda_{t+1}\frac{R_t}{\pi_{t+1}} \right\} \tag{2}$$

$$\frac{W_t}{P_t} = \nu \left[(1 - N_t)\lambda_t(1 - \tau_t^n) \right]^{-1} \tag{3}$$

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[3]In assuming that the interest rate on bonds is equal to the deposit rate we disregard the existence of government bond spreads. As pointed out to us by Jan Vlček (IMF), this issue can be very important: ambitious fiscal consolidations might significantly dampen these spreads reducing costs of re-financing and elevating further the long-term benefits of fiscal consolidation. In this respect our paper probably underestimates the effect of ambitious fiscal exit strategies. The inclusion of bond spreads is an extension that we leave to future work.

3.2 Banks

There is in the economy a large number (L_t) of uncorrelated investment projects. The project lasts two periods and requires an initial investment. Each project's size is normalized to unity (think of one machine) and its price is Q_t. The projects require funds, which are provided by the bank. Likewise, banks have no internal funds, but receive finance from two classes of agents: holders of demand deposits and bank capitalists. Total bank loans (equal to the number of projects multiplied by their unit price) are equal to the sum of deposits (D_t) and bank capital, (BK_t). The aggregate bank balance sheet is:

$$Q_t L_t = D_t + BK_t \tag{4}$$

The capital structure (deposit share, equal to one minus the capital share) is determined by bank manager on behalf of the external financiers (depositors and bank capitalists). The manager's task is to find the capital structure that maximizes the combined expected return of depositors and capitalists, in exchange for a fee. Individual depositors are served sequentially and fully as they come to the bank for withdrawal; bank capitalists instead are rewarded pro-quota after all depositors are served. This payoff mechanism exposes the bank to runs, that occur when the return from the project is insufficient to reimburse all depositors. As soon as they realize that the payoff is insufficient they run the bank and force the liquidation of the project. The timing is as follows. At time t, the manager of bank k decides the optimal capital structure, expressed by the ratio of deposits to total loans, $d_{k,t} = \frac{D_{k,t}}{Q_{k,t} L_{k,t}}$, collects the funds, lends, and then the project is undertaken. At time $t+1$, the project's outcome is known and payments to depositors and bank capitalists (including the fee for the bank manager) are made, as discussed below. A new round of projects starts.

Generalizing Diamond and Rajan [27], [28], we assume that the return of each project for the bank is equal to an expected value, $R_{A,t}$, plus a random shock, for simplicity assumed to have a uniform density with dispersion h (the assumption yields a convenient closed form solution but is not essential; see AF [3] for the case of a normal distribution). Therefore, the project j outcome is $R_{A,t} + x_{j,t}$, where $x_{j,t}$ spans across the interval $[-h; h]$ with probability $\frac{1}{2h}$. We assume h to be constant across projects.

Given our assumption of identical projects and banks, for notational convenience from now on we can omit project and bank subscripts. Until the end of this subsection we will omit time subscript as well.

Each project is financed by one bank. Our bank is a *relationship lender*: by lending it acquires a specialized non-sellable knowledge of the characteristics of the project. This knowledge determines

an advantage in extracting value from it before the project is concluded, relative to other agents. Let the ratio of the value for the outsider (liquidation value) to the value for the bank be $0 < \lambda < 1$. Again we assume λ to be constant.

Suppose the ex-post realization of x is negative and consider how the payoffs of the three players are distributed depending on the ex-ante determined value of the deposit ratio d and the deposit rate R.

There are three cases.

Case A: Run for sure. The outcome of the project is too low to pay depositors. This happens if $R_A + x < Rd$. Payoffs in case of run are distributed as follows. Capitalists receive the leftover after depositors are served, so they get zero in this case. Depositors alone (without bank) would get only a fraction $\lambda(R_A + x)$ of the project's outcome; the remainder $(1 - \lambda)(R_A + x)$ is shared between depositors and the bank depending on their relative bargaining power. As Diamond and Rajan [27], we assume this extra return is split in half (other assumptions are possible without qualitative change in the results[4]). Therefore, depositors end up with

$$\frac{(1 + \lambda)(R_A + x)}{2}$$

and the bank with

$$\frac{(1 - \lambda)(R_A + x)}{2} \tag{5}$$

Case B: Run only without the bank. The project outcome is high enough to allow depositors to be served if the project's value is extracted by the bank, but not otherwise. This happens if $\lambda(R_A + x) < Rd \leq (R_A + x)$. In this case, the capitalists alone cannot avoid the run, but with the bank they can. So depositors are paid in full, Rd, and the remainder is split in half between the banker and the capitalists, each getting $\frac{R_A + x - Rd}{2}$. Total payment to outsiders is $\frac{R_A + x + Rd}{2}$.

Case C: No run for sure. The project's outcome is high enough to allow all depositors to be served, with or without the bank's participation. This happens if $Rd \leq \lambda(R_A + x)$. Depositors get Rd. However, unlike in the previous case, now the capitalists have a higher bargaining power because they could decide to liquidate the project alone and pay the depositors in full, getting $\lambda(R_A + x) - Rd$; this is thus a lower threshold for them. The banker can extract $(R_A + x) - Rd$, and again we assume that the capitalist and the bank split this extra return in half. Therefore, the

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[4]Depositors and bank managers have equal bargaining power because neither can appropriate the extra rent without help from the other. Diamond and Rajan [27] mention also another case in which the depositors, after appropriating the project, bargain directly with the entrepreneur running the project. If the entrepreneur retains half of the rent, the result is obviously unchanged. If not, the resulting equilibrium is more tilted towards a high level of deposits, because depositors lose less in case of bank run.

bank gets:
$$\frac{[(R_A + x) - Rd] - [\lambda(R_A + x) - Rd]}{2} = \frac{(1 - \lambda)(R_A + x)}{2}$$
This is less than what the capitalist gets. Total payment to outsiders is:
$$\frac{(1 + \lambda)(R_A + x)}{2}$$

We can now write the expected value of total payments to outsiders as follows:

$$\frac{1}{2h} \int\limits_{-h}^{Rd - R_A} \frac{(1 + \lambda)(R_A + x)}{2} dx + \frac{1}{2h} \int\limits_{Rd - R_A}^{\frac{Rd}{\lambda} - R_A} \frac{(R_A + x) + Rd}{2} dx + \tag{6}$$

$$+ \quad \frac{1}{2h} \int\limits_{\frac{Rd}{\lambda} - R_A}^{h} \frac{(1 + \lambda)(R_A + x)}{2} dx$$

The three terms express the payoffs to outsiders in the three cases described above, in order. The banker´s problem is to maximize expected total payments to outsiders by choosing the suitable value of d.

The solution to the above maximization yields the following solution for the level of deposits for each unit of loans:

$$d = \frac{1}{R} \frac{R_A + h}{2 - \lambda}. \tag{7}$$

Since the second derivative is negative, this is the optimal value of d. For analytical details characterizing the solution the reader is reminded to the paper by AF [3]. In their paper the authors also show that the above result holds for a variety of assumptions also in terms of different probability distribution for the underlying idiosyncratic shock.

The optimal deposit ratio depends positively on h, λ and R_A, and negatively on R. An increase of R reduces deposits because it increases the probability of run. Moreover, an increase in R_A raises the marginal return in the no-run case (the third effect just mentioned), while it does not affect the other two effects, hence it raises d. An increase in λ reduces the cost in the run case (first effect), while not affecting the others, so it raises d. The effect of h is more tricky. At first sight it would seem that an increase in the dispersion of the project outcomes, moving the extreme values of the distribution both upwards and downwards, should be symmetric and have no effect. But this is not the case. When h increases, the probability of each given project outcome $\frac{1}{2h}$ falls. Hence the expected loss stemming from the change in the relative probabilities (sum of the first two effects) falls, but the marginal gain in the no-run case (third term) does not, because the upper

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limit increases. The marginal effect is $\frac{R}{2}$, because depositors get the full return, but half is lost by the capitalist to the banker. Hence, the increase of h has on d a positive effect, as R_A.

In the aggregate, the amount invested in every period is $Q_t L_t$. The total amount of deposits in the economy is

$$D_t = \frac{Q_t L_t}{R_t} \frac{R_{A,t} + h}{2 - \lambda} \tag{8}$$

and the bank's optimal capital is:

$$BK_t = (1 - \frac{1}{R_t} \frac{R_{A,t} + h}{2 - \lambda}) Q_t L_t \tag{9}$$

Projects are financed by the intermediary for an amount:

$$Q_t L_t = Q_t K_t \tag{10}$$

The above expressions suggest that following an increase in R_t the optimal amount of bank capital increases on impact (for given R_A). The effect of other factors in general equilibrium is more complex, depending on several counterbalancing factors affecting R_A and R, as the later results will show.

3.2.1 A measure of bank fragility

A natural measure of bank riskiness is the probability of a run occurring. This can be written as:

$$br_t = \frac{1}{2h} \int\limits_{-h}^{Rd - R_A} dx = \frac{1}{2}\left(1 - \frac{R_A - Rd}{h}\right) = \frac{1}{2} - \frac{R_A(1 - \lambda) - h}{2h(2 - \lambda)} \tag{11}$$

Note that for low values of λ and h, $\frac{R_A + h}{2 - \lambda}$ falls below $R_A + h$ and the marginal equilibrium condition 7 and the last equality of 11 cease to hold. Deposits can never fall below the level where a run becomes impossible. Some degree of bank risk is always optimal in this model.

A discounted function of this measure will also be used later on to assess the performance of the various entry/exit combination policies.

3.2.2 Accumulation of bank capital and bank recapitalization

Equation 7 is the level of bank capital desired by the bank manager, for any given level of investment, $Q_t L_t$ and interest rate structure $(R_t, R_{A,t})$. We assume that bank capital is provided by the bank capitalist. After remunerating depositors and paying the competitive fee to the bank manager, a return accrues to the bank capitalist, and this is reinvested in the bank as follows:

$$BK_t = \theta[BK_{t-1} + RTK_t Q_t K_t] \tag{12}$$

where RTK_t is the unitary return to the capitalist. The parameter θ is a decay rate, given by the bank survival rate already discussed. RTK_t can be derived as follows:

$$RTK_t = \frac{1}{2h} \int\limits_{R_t d_t - R_{A,t}}^{h} \frac{(R_{A,t} + x) - R_t d_t}{2} dx_t = \frac{(R_{A,t} + h - R_t d_t)^2}{8h} \tag{13}$$

Note that this expression considers only the no-run state because if a run occurs the capitalist receives no return. The accumulation of bank capital obtained substituting 13 into 12:

$$BK_t = \theta[BK_{t-1} + \frac{(R_{A,t} + h - R_t d_t)^2}{8h} Q_t K_t] \tag{14}$$

In face of a crisis scenario banks also receive some transfers in the form of bank recapitalization, BKG_t. Hence the above equation now reads as follows:

$$BK_t = \theta(BK_{t-1} + RTKQ_t K_t) + BKG_t$$

3.3 Producers

Each firm i has monopolistic power in the production of its own variety and therefore has leverage in setting the price. In changing prices it faces a quadratic cost equal to $\frac{\vartheta}{2}(\frac{P_t(i)}{P_{t-1}(i)} - 1)^2$, where the parameter ϑ measures the degree of nominal price rigidity. The higher ϑ the more sluggish is the adjustment of nominal prices. In the particular case of $\vartheta = 0$, prices are flexible. Each firm assembles labour (supplied by the workers) and (finished) entrepreneurial capital to operate a constant return to scale production function for the variety i of the intermediate good:

$$Y_t(i) = A_t F(N_t(i), \tilde{K}_t(i)) \tag{15}$$

Each monopolistic firm chooses a sequence $\{\tilde{K}_t(i), L_t(i), P_t(i)\}$, taking nominal wage rates W_t and the rental rate of capital Z_t, as given, in order to maximize expected discounted nominal profits:

$$E_0\{\sum_{t=0}^{\infty} \Lambda_{0,t}[P_t(i)Y_t(i) - (W_t N_t(i) + Z_t \tilde{K}_t(i)) - \frac{\vartheta}{2}\left[\frac{P_t(i)}{P_{t-1}(i)} - 1\right]^2 P_t]\} \tag{16}$$

subject to the constraint $A_t F_t(\bullet) \leq Y_t(i)$, where $\Lambda_{0,t}$ is the households' stochastic discount factor.

Let's denote by $\{mc_t\}_{t=0}^{\infty}$ the sequence of Lagrange multipliers on the above demand constraint. The following first order conditions for profit maximization hold (after aggregation):

$$\frac{W_t}{P_t} = mc_t A_t F_{N,t} \tag{17}$$

$$\frac{Z_t}{P_t} = mc_t A_t F_{\tilde{K},t} \tag{18}$$

$$U_{c,t}(\pi_t - 1)\pi_t = \beta E_t \{U_{c,t+1}(\pi_{t+1} - 1)\pi_{t+1}\} + U_{c,t} A_t F_t(\bullet)\frac{\varepsilon}{\vartheta}(mc_t - \frac{\varepsilon - 1}{\varepsilon}) \tag{19}$$

The latter equation is a non-linear forward looking New-Keynesian Phillips curve, in which deviations of the real marginal cost from its desired steady state value are the driving force of inflation.[5]

3.4 Capital sector

A competitive sector of capital producers combines investment (expressed in the same composite as the final good, hence with price P_t) and existing capital stock to produce new capital goods. This activity entails physical adjustment costs. Such costs are modelled so as to mimic correctly the initial drop in investment under the crisis scenario. First, capital adjustment costs depend on the change in investment according to the following equation:

$$CAC_t = S\left(\frac{I_t}{I_{t-1}}\right) I_t \tag{20}$$

where $S(1) = 0$ and $S'(1) = 0$. The capital accumulation equation is then given by:

$$K_{t+1} = K_t(1 - \delta) + \left[1 - S\left(\frac{I_t}{I_{t-1}}\right)\right] I_t \tag{21}$$

Second, we also consider variable capital utilization. Producers use $\tilde{K}_t = u_t K_t$, which is the effective utilization of the capital stock. The capital utilization rate is determined endogenously. The capital producer maximizes real profits

$$\frac{Z_t}{P_t} u_t K_t - I_t - \Psi(u_t)K_t \tag{22}$$

subject to the capital accumulation equation. Notice that $\Psi(u_t)K_t$ are costs associated with variations in the degree of capital utilization. The first order conditions for profit maximization read as:

$$Q_t = \frac{\pi_{t+1}}{R_{A,t+1}}\left(\frac{Z_{t+1}}{P_{t+1}}u_{t+1} - \psi(u_{t+1}) + Q_{t+1}(1 - \delta)\right) \tag{23}$$

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[5]Woodford [49].

$$Q_t \left(1 - S\left(\frac{I_t}{I_{t-1}}\right)\right) = Q_t S'\left(\frac{I_t}{I_{t-1}}\right)\left(\frac{I_t}{I_{t-1}}\right) - \frac{\pi_{t+1}}{R_{A,t+1}} Q_{t+1} S'\left(\frac{I_{t+1}}{I_t}\right)\left(\frac{I_{t+1}}{I_t}\right)^2 + 1 \qquad (24)$$

$$\frac{Z_t}{P_t} = \Psi'(u_t) \qquad (25)$$

3.5 Equilibrium conditions

Equilibrium in the final good market requires that the production of the final good equals the sum of private consumption by households, investment, public spending, and the resource costs that originate from the adjustment of prices and capital:

$$Y_t = C_t + I_t + G_t + \Psi(u_t)K_t + \frac{\vartheta}{2}(\pi_t - 1)^2 \qquad (26)$$

3.6 Monetary Policy and the Fiscal Sector

We assume that monetary policy is conducted by means of an interest rate reaction function of this form:

$$\ln\left(\frac{R_t}{R}\right) = (1 - \phi_r)\left[\phi_\pi \ln\left(\frac{\pi_t}{\pi}\right) + \phi_y \ln\left(\frac{Y_t}{Y}\right)\right] + \phi_r \ln\left(\frac{R_{t-1}}{R}\right) \qquad (27)$$

All variables are deviations from the target or steady state (symbols without time subscript).

Fiscal policy is also described by feedback rules that determine government spending, real government debt $B_t^r = B_t/P_t$ and the composition of taxes. In order to pin down to which extent an increase in government spending is financed by raising consumption and /or labour taxes or by issuing new bonds, we follow Uhlig [48] and consider a rule of the following form

$$\hat{\tau}_t^n + \hat{\tau}_t^c = \psi_T(\hat{B}_t^r + \hat{\tau}_t^n + \hat{\tau}_t^c) \qquad (28)$$

Notice that all variables are expressed as deviation from steady state. For $\psi_T = 1$ an increase in government spending is solely tax-financed leaving real government debt unchanged. On the contrary, for $\psi_T = 0$ an increase in government spending is completely financed by new debt.

The composition of taxes is determined with the help of the following tax rule:

$$\hat{\tau}_t^n = \psi_\tau(\hat{\tau}_t^c + \hat{\tau}_t^n) \qquad (29)$$

The parameter ψ_τ determines to which extent tax financing is done by raising labour taxes τ_t^n instead of consumption taxes τ_t^c. Notice that the limiting case $\psi_\tau = 0$ implies that the direct (labour) tax rate sticks to its steady state value and tax financing is done solely by raising indirect (consumption) taxes. For $\psi_\tau = 1$, tax financing is completely shifted to labour taxes leaving consumption taxes unchanged.

Finally, we follow Corsetti, Meier and Müller [19] and consider the following government spending rule

$$\hat{G}_t = \rho_g \hat{G}_{t-1} - \gamma_B \hat{B}_t^r + \varepsilon_t^g \tag{30}$$

where ε_t^g is an exogenous shock. The parameter γ_B measures the strength of the endogenous response of government spending to debt.

The linearized government budget constraint which closes the fiscal side of the economy is given by

$$\hat{B}_t^r = \frac{1}{\beta} \hat{B}_{t-1}^r + \frac{1}{\beta} \frac{B^r}{Y} (\hat{R}_{t-1} - \hat{\pi}_t) + \frac{G}{Y} \hat{G}_t + \frac{BKG}{Y} B\hat{K}G_t \tag{31}$$
$$- \frac{\tau^c C}{Y} (\hat{C}_t + \hat{\tau}_t^c) - \frac{\tau^n w N}{Y} (\hat{\tau}_t^n + \hat{w}_t + \hat{N}_t) + \frac{\tau}{Y} \hat{\tau}_t$$

4   Calibration

Preferences and production. Time is measured in quarters. We set the intertemporal elasticity of consumption to $\sigma = 1.4$ which is roughly the value estimated by Smets and Wouters [46] for the Euro area. We calibrate the elasticity of labour supply, ν, to 1.425 as this induces a steady state number of hours worked of 0.3. As it is standard in New Keynesian models we calibrate the elasticity of demand, ε, to 6 as this induces a mark-up of 1.2. The discount factor is calibrated to 0.99 so that the annual interest rate is 4%. Following Smets and Wouters [46] we set the degree of habit formation, γ, to 0.5.

We assume a Cobb-Douglas production function $F(\bullet) = K_t^\alpha (N_t)^{1-\alpha}$, with $\alpha = 1/3$. The quarterly aggregate capital depreciation rate δ is 0.025. Following Smets and Wouters [46] the adjustment cost parameter, $\phi_I = 1/S''$, is set to 1/6, while the utilization cost parameter, $\phi_u = \Psi'/\Psi''$, is set to 1/0.2.

In order to parameterize the degree of price stickiness ϑ, we observe that by log-linearizing equation 17 we can obtain an elasticity of inflation to real marginal cost (normalized by the steady-state level of output)[6] that takes the form $\frac{\varepsilon-1}{\vartheta}$. This allows a direct comparison with empirical studies on the New-Keynesian Phillips curve such as Gali and Gertler [30] and Sbordone [45] using Calvo-Yun approach. In those studies, the slope coefficient of the log-linear Phillips curve can be expressed as $\frac{(1-\hat{\vartheta})(1-\beta\hat{\vartheta})}{\hat{\vartheta}}$, where $\hat{\vartheta}$ is the probability of not resetting the price in any given period in the Calvo-Yun model. For any given values of ε, which entails a choice of the steady state

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[6]To produce a slope coefficient directly comparable to the empirical literature on the New Keynesian Phillips curve this elasticity needs to be normalized by the level of output when the price adjustement cost factor is not explicitly proportional to output, as assumed here.

level of the markup, we can thus build a mapping between the frequency of price adjustment in the Calvo-Yun model $\frac{1}{1-\hat{\vartheta}}$ and the degree of price stickiness ϑ in the Rotemberg setup. The recent New Keynesian literature has usually considered a frequency of price adjustment of four quarters as realistic. Recently, Bils and Klenow [8] have argued that the observed frequency of price adjustment in the US is higher, in the order of two quarters. As a benchmark we use a slightly higher value consistent with the estimates of Smets and Wouters [46] and parameterize $\frac{1}{1-\hat{\vartheta}} = 5$, which implies $\hat{\vartheta} = 0.8$. Given $\varepsilon = 6$, the resulting stickiness parameter satisfies $\vartheta = \frac{Y\hat{\vartheta}(\varepsilon-1)}{(1-\hat{\vartheta})(1-\beta\hat{\vartheta})} \approx 30$, where Y is steady-state output.

Bank parameters. To calibrate h we have calculated the average dispersion of corporate returns from the data constructed by Bloom et al. [10], which is around 0.3, and multiplied this by the square root of 3, the ratio of the maximum deviation to the standard deviation of a uniform distribution. The result is 0.5. We set the value of h slightly lower, at 0.45, a number that yields a more accurate estimate of the steady state value of the bank deposit ratio[7].

One way to interpret λ is to see it as the ratio of two present values of the project, the first at the interest rate applied to firms' external finance, the second discounted at the bank internal finance rate (the money market rate). A benchmark estimate can be obtained by taking the historical ratio between the money market rate and the lending rate. In the US over the last 20 years, based on 30-year mortgage loans, this ratio has been around 3 percent. This leads to a value of λ around 0.6. In the empirical analyses we have chosen 0.45. Finally we parameterize the survival rate of banks at 0.97.

Fiscal policy parameters. The constant fraction of public spending, G is calibrated so as to match $G/Y = 0.23$. Steady state taxes are set to $\tau^c = 0.17$ and $\tau^n = 0.41$ which are values calculated for the Euro area by Trabandt and Uhlig [47]. The steady state value of government debt is set to $B^r/Y = 0.7$.

For the initial crises scenario, the fiscal feedback rules are calibrated as follows. ψ_τ is set to 2/3 implying a mix of direct and indirect taxes consistent with the composition of taxes in the Euro area.[8] The responsiveness of government spending to debt is set to $\gamma_B = 0$ implying, as standard

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[7]The bank capital accumulation equation 12, once we substitute in the optimal deposit ratio 8, and the return accruing to the bank capitalist 13, yields a quadratic equation in R_A. Solving the quadratic equation for given values of the parameters, one obtains a root for R_A equal to 1.03 (3 percent on a quarterly basis). The corresponding value of d is 95 percent, and bk is 5 percent. Notice that the bank capital accumulation equation includes the money that households transfer in every period to new bankers, given by a fraction of the value of the project: $\phi Q_t K_t$. The steady state value that helps to pin down the return on asset, R_A, is 0.075. Since such term is negligible we have omitted that in the dynamic.

[8]Notice that total fiscal revenues in the euro area are about 45 percent of GDP, of which about two thirds are composed by direct taxes and social security contribution on individuals and corporations. The remaining fraction is indirect taxes. Both direct taxes and social security contributions can be regarded as labour-related levies.

in most of the literature, an exogenous process for government spending. The autocorrelation of government spending is assumed to be 0.9 which is consistent with the estimates by Smets and Wouters [46] for the Euro area. The calibrated value $\psi_T = 0.1$ is chosen to ensure attainability of public debt in the very long run.

Monetary policy parameters. We distinguish between passive and active monetary policy. Passive monetary policy means that the nominal interest rate will stick to its steady state value $R_t = R$. In order to ensure determinacy, an abandoning of the monetary feedback rule is only feasible when the monetary authority credibly announces an exit from this passive policy and a switch to an active feedback rule to happen in the future. This active feedback rule is assumed to be a standard Taylor rule with a coefficient on inflation, ϕ_p, equal to 1.5 and a coefficient on output, ϕ_y, equal to 0.5/4. The parameter ϕ_r is set equal to zero in the baseline calibration.

4.1 Constructing the exit strategies

We simulate the model assuming an initial crisis scenario, which is set up to mimic closely the actual situation experienced during the 2007-2008 crisis. Starting from this scenario we evaluate the effects of different combination of exit strategies in terms of both monetary and fiscal policy.

We evaluate alternative monetary and fiscal exit strategies that differ with respect to the degree of activism, the sequencing of events, and the composition of fiscal adjustment. Finally, we distinguish between policy changes that are credibly pre-announced and policy changes that happen unexpectedly.

For the monetary exit, we assume that a switch from passive to active monetary policy will take place when there is an upward pressure on prices. Technically, we compute the expected path of the nominal interest rates under different credibly announced exit dates. Thereby, we do not take into account that a fiscal exit might happen but assume fiscal policy to be described by our baseline calibration. We then chose that specific exit date when the Taylor rule is calling for an increase in the nominal interest rate. Under our baseline calibration and under the baseline crisis scenario, extensively discussed in the next section, this specific exit date is $t = 13$ (after three years). We call this an announced monetary exit. We also consider an unanticipated monetary exit. In this case, the monetary exit that is announced to happen at $t = 13$ unexpectedly happens one year earlier, i.e. at $t = 9$.

For the analysis of fiscal exit strategies we also distinguish between anticipated and unanticipated exit, between the degree of activism (passive, active, super-active), and among different compositions of fiscal adjustment. As in case of monetary policy, our baseline crisis scenario is based on the assumption of a passive policy ($\psi_T = 0.1$, $\gamma_B = 0$). In contrast to the monetary exit

where a switch from passive to active is part of the information set of private agents, the passive fiscal policy is expected to last forever.

An unanticipated fiscal exit now means that, at some point in time, the fiscal authority unexpectedly switches to activism. If we assume that monetary and fiscal policy move together this happens at $t = 13$. If fiscal policy moves first, this happens at $t = 9$. In the case of an anticipated fiscal exit, the fiscal authority credibly announces at $t = 0$ that it will switch to activism at $t = 13$ ($t = 9$).

With respect to the questions of sequencing as well announcement versus surprise our setup allows to compare the following scenarios. For the case of surprise changes, we first look at a joint movement of monetary and fiscal policy. Thereby, a pre-announced monetary exit at $t = 13$ goes along with an unanticipated fiscal exit at $t = 13$. If fiscal policy moves first, the unanticipated fiscal exit happens at $t = 9$ whereas the announced monetary exit takes place at $t = 13$. In the case that monetary policy moves first, the monetary exit unexpectedly takes place in period $t = 9$ whereas the unanticipated fiscal exit will take place at $t = 13$. For the case of announced changes, we compare a joint announced exit at $t = 13$, an announced fiscal exit at $t = 9$ together with an announced monetary exit at $t = 13$ (fiscal moves first), and an announced monetary exit at $t = 9$ together with an announced fiscal exit at $t = 9$ (money moves first).

To inspect the different degrees of fiscal activism, we consider either an isolated change in the tax rule (increasing the parameter ψ_T) or an isolated change in the government spending rule (increasing the parameter γ_B). We define the different degrees of activism as follows. An active fiscal policy has the property that the deviation of the debt-to-output ratio from its pre-crisis level is reduced to a maximum of one percent in period $t = 200$. In case of a super-active policy the debt stabilization objective of "at most one percent" is reached in period $t = 40$ (or 10 years[9]). Under the assumption of an announced monetary exit at $t = 13$ and an unanticipated fiscal exit at the same time, the following calibration of the fiscal policy parameters ψ_T and γ_B yields these results: in the case of an isolated change in the tax rule and a passive spending rule, $\psi_T = 0.22$ implies an active fiscal exit, whereas $\psi_T = 0.52$ implies a super-active fiscal exit. In the case of an isolated change in the spending rule combined with a passive fiscal rule, $\gamma_B = 0.008$ and $\gamma_B = 0.04$ implies an active and super-active fiscal exit, respectively.

Finally, we look at the effects of different types of taxation. Whereas in our baseline scenario

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[9]The IMF staff has designed long term scenarios of fiscal consolidation for the advanced G20 countries (see [36]). The scenarios are based on a target of returning to a debt to output ratio below 60 percent by 2030. They assume that the exit process starts in 2011, when the debt ratio for the aggregate they consider, is projected to be above 80 percent. In their scenario, the debt level would return to this level around 2021, i.e 10 years after the fiscal exit starts. Hence, our super-active strategy is consistent with the IMF projections.

we assume $\psi_\tau = 2/3$, we also explore the limiting cases $\psi_\tau = 0$ and $\psi_\tau = 1$. Thereby, we assume that alongside with an announced or unannounced switch from passive to active /super-active monetary and fiscal policy at $t = 13$, the composition of taxes changes. The case $\psi_\tau = 0$ implies that at $t = 13$, the labour tax rate jumps to its steady state level and the government's budget is consolidated solely by raising indirect (consumption) taxes. In the other limiting case $\psi_\tau = 1$, the fiscal consolidation is done by raising direct (labour) taxes.

4.2 Numerical Methodology

The different exit strategies are simulated using the deterministic simulation routine. The usage of deterministic simulations allow us to compare anticipated to unanticipated policy changes. In the case of anticipated policy changes, agents know already when the solution of the model is computed (at $t = 0$) that a policy change will happen at some future date $T > 0$. In the case of unanticipated policy changes, agents expect policy to stay passive forever (this is obviously not possible for monetary policy). We then proceed as follows. We deterministically simulate the model under the assumption that policy stays passive. We then pick values for all endogenous variables at some specific date $t = T$ and use these values as initial values in a model simulation with a modified fiscal (or monetary) policy rule. Finally, we combine the time paths of the initial simulation up to time $t = T$ with the time paths of the "exit simulation" from $T + 1$ onwards. This results in time paths of all endogenous variables under the assumption of an unanticipated policy change in period $t = T$.

We believe that our modeling strategy is the natural counterpart to our anticipated exit strategy. In the latter case, due to the assumption of perfectly credible pre-announcement, rational agents attach no weight to the probability that a policy change might <u>not</u> happen at the announced implementation date. In the surprise scenario, on the other hand, agents attach no weight to the probability that a policy change might happen in the future, but believe policy maker's to follow the announced (passive) feedback rules.

5 Baseline: crisis and initial stimulus

Our baseline simulation incorporates two elements: a set of shocks to the financial system, reproducing the initial factors that generated the crisis, and a number of policy interventions, representing the supporting measures (monetary, fiscal and financial) adopted as an immediate response to the financial turmoil. Our aim here is to model, in a stylized way and according with the model's specification, the main forces that drive the behavior of the macroeconomic variables after the crisis

but before the exit strategies are initiated.

The first set of shock ("the crisis") includes three components: a persistent increase in the riskiness of investment for banks (parameter h); a persistent decrease in the early liquidation value of bank investment (parameter λ); a destruction of bank capital. The first expresses the increase in risk perception observed since late 2007 and particularly in late 2008. We calibrated this shock so as to mimic the increase in the euro area average implicit stock market volatility in the last quarter of 2008. The second expresses the increase in the relative riskiness of non-prime borrowers in non-intermediated (bond) debt markets over the same period. We calibrated so as to match the increase in spread between A and AA corporate bond yields in the euro area. The third shock, the reduction of bank capital, is calibrated so as to gradually attain an overall bank capital deterioration equal to the value of euro area bank asset write-downs estimated by the ECB Financial Stability Review (see [29]).

Formally the three shocks are written as follows:

$$\hat{h}_t = 0.85\hat{h}_{t-1} + \varepsilon_t^h, \quad \text{where } \varepsilon_0^h = 0.2222,$$

$$\hat{\lambda}_t = 0.85\hat{\lambda}_{t-1} + \varepsilon_t^\lambda, \quad \text{where } \varepsilon_0^\lambda = -0.2222,$$

$$\hat{BK}_t = -\frac{d}{1-d}\hat{d}_t + \hat{Q}_t + \hat{K}_t + \hat{u}_t^{BK},$$

$$\hat{u}_t^{BK} = 0.95\hat{u}_{t-1}^{BK} + \varepsilon_t^{BK}, \quad \text{where } \varepsilon_0^{BK} = 0.2.$$

The second set of factors introduced in the baseline ("the initial stimulus"), is a set of policy measures intended to provide a first response to the contractionary effect of the crisis and to the increase in bank risk. First, we assume that the short term interest rate is brought down to zero for a pre-announced number of quarters (12 in our base case). The second policy assumption is that fiscal policy adopts a proactive output stabilization stance, with public expenditures responding to output and not to past debt, and taxes constituting only a small shares of expenditures financing. Formally, the tax and spending rules are set in a "passive" mode ($\gamma_B = 0$, $\psi_T = 0.1$), the tax split is calibrated to reproduce the euro area average ($\psi_\tau = 2/3$) and government spending increases by 5 percent of GDP ($\varepsilon_0^g = 0.05Y$).

Finally, the third policy is a bank capital support policy. We assume that the government intervenes to refinance the bank capital when their capital/asset ratio is below the steady state. the recapitalization increases the budget deficit an is financed by taxes or debt, according to the above rules. Formally:

$$\hat{BKG}_t = 0.7\hat{d}_t$$

Subject to these shocks and these policy rules, the model produces profiles for the main

variables depicted in figure 1.

Note, first, the strong contractionary effect on aggregate demand and output. Personal consumption peaks two quarters later at close to -3 percent. Investment peaks at a much lower level, around -15 percent. Output drops around 5 percent before recuperating. Inflation drops by about 5 percent relative to steady state, then quickly rises back. The public debt ratio rises quickly by 30 percent in the first two years, then rises more slowly; in the long run, as shown in figure 2, it returns very slowly back to baseline given the very weak debt adjusting stance incorporated in the policy functions. The budget deficit, as a ratio to output, rises by more than 4 percent. In the financial sector, leverage and bank riskiness rise, mainly reflecting the impact effect of bank capital destruction (equal to 30 percent). Bank recapitalization by the public sector kicks in immediately, helping a more rapid recovery of bank balance sheets.

In table 1, the shock values of the main macro variables in the model are compared with data observed in the euro area or projected (the source is the Spring 2010 Economic Outlook of the OECD) in the period 2008-2010. By a rough approximation, we suppose that the first year after shock can be assumed to be the average value of 2009; this is not precise, evidently, because the eruption of the financial crisis was not concentrated in a single quarter but rather spread out in the period (roughly) between August 2007 and October 2008. Moreover, the entries are not directly comparable, because the OECD data are mainly levels or percentage changes (except for the second line) whereas the model generated numbers are deviations from the steady state. The numbers become comparable only if the starting value is close to the steady state (a realistic assumption for 2008) and the steady state value does not vary significantly in the period concerned. All these caveats considered, the impression we bet from the table is that the values produced by the model are quite realistic, though they somewhat overestimate the economic slump. GDP declined by 4.1 in 2009, while the model predicts -5 percent. Consumption and investment fell by 1 and 10.7 percent, against -3 and -12.6 in the model. In the following year (2010), the model under-predicts relative to the forecast of OECD. Investment dropped by 2.2 percent, while the model predicts -0.6. On public finance, the match is acceptable; public debt is predicted by the model to increase to 79 and 89, respectively, in the first and second year after the shock, against actual values equal to 86 and 92 percent. The budget deficit rose by 4.3 in 2009, while the model says 3.5.

6   Exit from fiscal and monetary stimulus

We focus our attention on four interrelated questions. The first concerns the *speed* at which the policy stimulus is withdrawn. Specifically we examine alternatives concerning how fast fiscal

consolidation is achieved, represented by more or less "active " (in terms of debt adjustment speed) fiscal policy reaction functions. The second concerns the *composition* of fiscal adjustment; we compare programs based on spending cuts or tax increases, and within the latter we consider policies more tilted towards labour taxes or consumption taxes. The third area is *announcement vs. surprise*. We posit that the fiscal exit takes place some time after the initial shock: in most cases 12 quarters. This lag is based on the observation that, in most countries, a significant adjustment of public budget is not expected to take place before three years after the peak of the financial turmoil (2011 vs. 2008). In this sequential setting we compare the outcome of cases where the policy change credibly pre-announced with cases in which it is unexpected. Lastly, we examine the issue of policy *sequencing and delaying*. Specifically we compare options where fiscal and monetary policy return to a more restrictive mode together or sequentially, and in this latter cases case, the consequences of fiscal or monetary policy moving first.

We present our results in three formats. Figures 3, 5, 7, 9 and 11 show the response profiles of the main macro variables, under five hypotheses concerning fiscal and monetary exit, over a short to medium term horizon (30 quarters, which given the exit lag means about 4 and half years after the exit starts). This time horizon is useful to observe the macro variable at a business cycle frequency. Figures 4, 6, 8, 10 and 12 show the same profiles over the long term (200 quarters). A time length of 50 years allows to better appreciate certain low frequency phenomena, like for example public debt accumulation and consolidation. Finally, in table 2 we show the values of the performance indicators illustrated in section 3.2, for the exit strategies shown in the figures plus a number of others (32 in total) obtained mixing different characteristics of speed, adjustment composition, announcement, and sequencing. Figures and the table together give a sense of how alternative exit strategies, embodying different answers to the four questions above, compare with one another.

To start with, in figure 3 we assume that fiscal accommodation is lifted unexpectedly after 12 quarters, based on an expenditures-based adjustment program. We show two alternative strategies, as described in detail in section 3.2; an "active" mode where public spending reacts to public debt with a higher coefficient, and a "super-active" one where the reaction of public spending to output is calibrated so as to bring public debt back to baseline within 10 years. These two strategies are plotted against the no-exit case.

The decline in public spending leads to a contraction of output, despite some crowding in of private consumption. The fall of output and employment increases marginal product and, in equilibrium, real marginal costs. Hence inflation rises on impact. Responding to the higher inflation profile, monetary policy (which also exits the crisis mode at $t = 13$) increases real rates, moderately

in the active case and more sharply in the super-active case. The monetary restriction reduces bank risk, in presence of a risk-taking channel of monetary policy – see AF for details. The short-medium term outcome is (moderately) less output, more inflation and more monetary restriction, a safer financial system and, of course, less public spending and lower budget deficit and debt accumulation. As a result of the latter, tax rates, driven by their reaction functions, move back to steady state more quickly. The long term effects of the strategies are better appreciated in figure 4. There we see that the policy activism is rewarded by higher output and consumption beyond $t = 30$, more so with the super-active mode. The long term implications for public finance are radically different. While the budget deficit falls below the steady state under both strategies, as expected, under the active mode the deficit has to stay low for a much longer time (relative to super-active) and yet achieves a lower performance in terms of debt reduction. The super-active strategy trades in a more intense, but short lived, spending squeeze for a slower debt dynamics and permanently lower labour and consumption tax rates.

Performance measures for these and other strategies are reported in table 2 (lines 0, the no-exit case, and 2 and 4). In the table we distinguish the short to medium term performance (first 20 quarters) from the overall performance, where the long run effects (though more heavily discounted) tend to dominate. The criteria we choose to measure performance are output (discounted deviations from the no-exit case), consumption (measured in the same way as output), bank risk (measured as the root sum discounted squared deviations), and inflation (again, root sum discounted squared deviations).

Note, first, that the no-exit strategy entails very substantial costs relative to the no-crisis, no-policies steady state. The total discounted consumption loss in the first 20 quarters is 37 percent of yearly consumption, and the total loss is 93 percent. Measured at annual rate, the permanent consumption loss is around 1 percent. The output loss is only slightly smaller. In terms of bank risk and inflation, the root sum squared deviation from the steady state values are 5 and 10 percent respectively.

Shadings in the table denote more significant improvements and deterioration of performance (respectively, 25 percent up or 10 percent down), relative to no-exit. By these standards, the active and super-active unannounced spending based exit strategies do not produce significant changes relative to no-exit in the short to medium run. In the long run they do, however: in particular, the super-active strategy improves consumption and output (respectively, 67 and 39 percent).

Figures 5 and 6 compare a tax-based and a spending-based strategy, both unannounced and super-active. For the first we assume that the composition of tax revenues is equal to the euro area average (two thirds and one third respectively for labour and consumption taxes). The tax-based

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strategy reduces output and consumption significantly in the short run. Labour taxes produce a leftward shift in the labour supply curve that raises marginal costs, hence inflation. Monetary policy reacts with a significant increase in interest rates (remember that there is no interest rate smoothing in our monetary policy rule after exit; smoothing would dampen all responses but produce no qualitative changes). Relative to the spending strategy, the tax-based one obtains a more front-loaded debt reduction at the cost of a larger output and consumption loss, which is significant in the short to medium term (table 2, lines 3 and 4). In the long run, the tax-based strategy is still successful in augmenting consumption and output, but less than the spending-based one. There is also a significant loss in terms of inflation stabilization.

Figure 7 compares a mix-tax strategy with tax strategies tilted towards labour an consumption taxes – still in the super-active, unannounced mode. We see that the consumption tax allows to overcome some of the drawbacks of the labour tax. The short run consumption loss is lower and the inflation overshooting also lower. The sharp monetary contraction is avoided, and also the sharp deviation of bank risk from the desired baseline value. Note, however, that the consumption tax-based strategy is about as successful as the labour and the mixed ones in terms of public finance targets. Contrary to a first impression suggested by figure 7, panel [4;2], over a long horizon the debt consolidation process is only slightly less front-loaded; see same panel of figure 8. If we compare the performance of these strategies in table 2, rows 7 and 8 compared with 3, we see that the loss generated by a labour tax-based strategy is significant at short horizons. The labour tax-based, super-active unannounced exit strategy actually reduces consumption in the first 20 quarters by 21 percent relative to the no-exit one, and there is also a loss of 12 and 32 percent for bank risk and inflation. In the longer run such loses are mitigated, but there is still an under-performance in terms of inflation.

We move now to figures 9 and 10, showing the consequences of announcing the fiscal exit. We are still considering spending-based super-active strategy. The improvement in macro performance from announcement is very significant, as seen in the charts. Announcement reduces the initial output loss from about 5 percent to about 2 percent, and the consumption loss from more than 3 percent to about 1. Note that this exercise is counter-factual, because we assume that pre-announcement takes place immediately after the crisis and together with the launch of the supporting policies; in fact, such announcement did not take place in any country. We also observe that pre-announcement avoids the spike in inflation observed in the spending strategy at the time of exit. Hence, a sharp monetary restriction is avoided too, in favor of a much milder one. Though public spending declines less, debt consolidation is faster, as we can appreciate in panel [4;2] of figure 9 and figure 10. After about 30 to 40 quarters announced and unannounced strategies

tend to coincide, but in the earlier period the gain from announcement is very significant. All this is clearly reflected in the performance measures of table 2; see lines 12 and 4. The announced, super-active strategy based on spending results in significant improvement in performance based on all criteria, at both short and long term horizon.

We can now examine figure 11 and 12, where we compare scenarios where monetary policy moves first versus scenarios where fiscal policy leads. The scenarios are the following: in the "money leads" one, monetary policy unexpectedly exits at $t = 9$ instead of 13. In the "fiscal leads", fiscal unexpectedly exits at $t = 9$ while monetary policy exits at 13, as expected. The "move together" scenario correspond to the "announced" scenario of figure 9. While the differences are not sharp, the "money first" approach seems to perform somewhat worse in terms of consumption, output and also inflation, relative to the other two. Debt accumulation is also worse, as one would expect given the effect of higher interest rates on the debt servicing burden. The "fiscal leads" and the "move together" are almost indistinguishable. Under the microscope, the scenario where fiscal moves first is seen to be marginally better in terms of short term consumption crowd-in and speed of debt consolidation. In table 2 we see that there are three "sequenced" strategies (where the two policies move at different times) that attain a significant improvements over no-exit in all criteria and at both time horizons: fiscal first, announced super-active tax based (line 23); fiscal first, announced super-active spending based (line 24); and money first, announced super-active spending based (line 32).

Three additional observations emerge from a bird's eye examination of table 2.

First of all, we note that there is a marked concentration of shaded cells indicating significant improvement in the consumption and output columns in the section "all quarters". This means that nearly all exit strategies, regardless of their characteristics, improve markedly over the no-exit case in terms of long term output and consumption performance. In the short term, the advantage is more mixed.

Second, as already noted, the announced strategies are clearly superior to all others. There is no surprise strategy among the six "champions". The best surprise strategy is the one in line 20 – a super-active spending one where fiscal policy and monetary policy move together.

Thirdly, the choice between "sequenced" and "simultaneous" strategies is unclear. We have seen that there are three sequenced strategies that score significantly better in all criteria. Three "simultaneous" strategies share the same property: announced, super-active tax based (line 11); announced, super-active spending based (line 12); and announced, super-active labour tax based (line 18). Among the six "champions" there are relevant differences. The labour tax-based (and to a lesser extent, tax-mix) strategies perform distinctly worse in terms of consumption and output,

particularly in the short term. On the contrary they often do better on bank risk, mainly because they entail a stronger monetary restriction at the time of exit. The three spending-based strategies tend to dominate the others, but typically not by large amounts. Among the spending ones, the "fiscal first" and the "move together" tend to dominate the "monetary first", but only at short to medium term horizons.

7   Phasing in Basel III

The Basel Committee on Bank Supervision approved in September 2010 a reform of the bank capital standards comprising three main elements[10]: an *increase in the level* of bank capital requirements; a *stricter definition* of capital, amounting de facto to a further increase in required capital for given bank exposure; a *countercyclical buffer*, ranging between zero and 2.5 percent of risk-weighted assets, requiring banks to raise extra capital in phases of strong credit expansion. These provisions will be complemented by a leverage requirement, setting a limit to the build up of debt as a ratio of Tier 1 capital, further requirements on bank liquidity and by additional capital charges on systemically relevant banks. The new provisions will be phased in gradually to avoid negative consequences on bank balance sheets; in the words of the Basel Committee, to "help ensure that the banking sector can meet the higher capital standards through reasonable earnings retention and capital raising, while still supporting lending to the economy."[11]

A thorough quantitative examination of the impact of Basel III on the macroeconomy goes beyond the scope of this paper. Our more limited aim is to offer some qualitative elements to help understand how Basel III may interact with the removal of the accommodative stance of macropolicies. Basel III and macro-exit strategies are linked in more than one way. On one hand, the tightening of capital requirements may, if the recovery is still hesitant, unduly strain bank balance sheets, constrain the supply of lending and ultimately endanger the recovery itself. This view was recently and forcefully expressed by the banking industry[12]. On the other, as typically voiced by the supervisory community, strengthening bank prudential standards should, in the present conditions of high uncertainly, contribute to restore confidence on the prospective solidity of banks and hence revive the supply of bank capital from market sources. The scope for rebalancing fiscal and monetary policies depends in part by the intensity and timing of these contrasting effects.

We focus our analysis to two aspects of particular relevance from a macro perspective: the newly introduced "countercyclical buffer" and the increase in capital requirements. These two

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[10]See Basel Committee [5]. The three elements are nicely summarised by Caruana [13].

[11]See details on the transitional arrangements at http://www.bis.org/press/p100912b.pdf.

[12]See Institute for International Finance [35].

aspects of the reform act in a different way. The first does not necessarily change the average capitalization of the system, but introduces an automatic anticyclical component intended to dampen the cyclical movements of aggregate output. If introduced at a time when negative output gaps prevail, the countercyclical buffer should help the economy recover more quickly, reducing the need for other forms of policy accommodation. The second element instead alters the bank balance sheets in equilibrium: banks move to a new steady state and also the economy's capital stock and output may permanently change.

To examine the impact of the countercyclical buffer we conduct a counterfactual experiment in which such buffer is assumed to have been in place from the start, when the crisis hit. The minimum regulatory capital ratio bk_t^{MIN} is modeled so as to be sensitive to the cycle, as follows:

$$bk_t^{MIN} \equiv \frac{BK_t^{MIN}}{Q_t K_t} = const + b_0^c \left(\frac{Y_t}{Y}\right)^{b_1^c} \tag{32}$$

AF [3] show that equation 32 mimics the cyclical property of capital requirements under Basel II, if b_1^c is equal to $-\frac{1}{2}$. Here we assume an opposite coefficient, equal to $\frac{1}{2}$. A positive b_1^c implies that banks build up, rather than release, capital when output rises above the steady state level. Roughly speaking, a coefficient equal to $\frac{1}{2}$ implies that, if the cyclical volatility of output is around 2 per cent (a realistic number for the euro area), the standard deviation of the required capital ratio is about one percent. This is broadly consistent with a Basel III "buffer" ranging between zero and 2.5 percent.

AF [3] also show that when a minimum capital ratio is imposed, the actual bank capital ratio bk_t^{ACT} is given by:

$$bk_t^{ACT} = bk_t + \frac{1}{R_t}\frac{1-\lambda}{2-\lambda}bk_t^{MIN}$$

where bk_t is the capital ratio in the absence of constraint, i.e. when $bk_t^{MIN} = 0$. Using 7 we can write

$$bk^{ACT} = \left(1 - \frac{1}{R}\frac{R_A + h}{2 - \lambda}\right) + \frac{1}{R}\frac{1-\lambda}{2-\lambda}bk^{MIN} \tag{33}$$

The bank capital accumulation equation 14 is modified as follows:

$$BK_t = \theta[BK_{t-1} + \frac{(R_{A,t} + h - R_t d_t^{ACT})^2 - (bk_t^{MIN})^2}{8h}Q_t K_t] \tag{34}$$

which reduces to the standard formula if $bk_t^{MIN} = 0$.

In figures 13 and 14, the Basel III profile is compared with a "baseline" without fiscal exit, as illustrated earlier. The buffer has a clear dampening effect on the economic cycle, particularly strong on investment but significant on output as well. The consumption profile is higher throughout.

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The expansionary effect reduces the overshooting of the debt to output ratio, that peaks at a much lower level (about 27 percent above the steady state, rather than about 37 percent of the baseline). Consequently, tax rates are lower throughout. Note that bank leverage (proxied by the deposit ratio) is actually lower in the Basel III scenario, and bank capital higher, in the short run, somewhat surprisingly given that under Basel III banks are allowed to release part of the capital buffer in a recession. Bank risk on the contrary is higher for a few quarters after the shock, as a result of a lower expected return on bank assets.

To analyse the effect of a permanent increase in required capital, consider equations 33 and 34 in the steady state. Considering that $R_t d_t^{ACT} = \frac{R_{A,t}+h}{2-\lambda} - \frac{1-\lambda}{2-\lambda} bk_t^{MIN}$, equation 34 can be written

$$8h(1-\theta)bk^{ACT} = \theta \left\{ \left(\frac{1-\lambda}{2-\lambda} \right)^2 (R_A + h + bk^{MIN})^2 - (bk^{MIN})^2 \right\} \tag{35}$$

where $bk^{ACT}, R_A, R, bk^{MIN}$ are intended as steady state values. Considering that the steady state value of R does not depend on bk^{MIN}, the two equations 33 and 35 determine bk^{ACT} and R_A for any given value of the policy determined bk^{MIN}.

Any given change of the regulatory ratio bk^{MIN} determines a change in the model's steady state. To see how bk^{ACT} and R_A change when bk^{MIN} changes, take differentials of the two equations:

$$\delta bk^{ACT} + \frac{1}{R(2-\lambda)} \delta R_A = \frac{1}{R} \frac{1-\lambda}{2-\lambda} \delta bk^{MIN} \tag{36}$$

$$8h(1-\theta)\delta bk^{ACT} = 2\theta \left\{ \left(\frac{1-\lambda}{2-\lambda} \right)^2 (R_A + h + bk^{MIN})(\delta R_A + \delta bk^{MIN}) - bk^{MIN}\delta bk^{MIN} \right\}$$

The second equation can also be written

$$4h(1-\theta)\delta bk^{ACT} = \Phi(\delta R_A + \delta bk^{MIN}) - \theta bk^{MIN}\delta bk^{MIN} \tag{37}$$

where $\Phi \equiv \theta \left(\frac{1-\lambda}{2-\lambda} \right)^2 (R_A + h + bk^{MIN}) > 0$.

We can write the two equations in matrix form

$$\begin{bmatrix} 1 & \frac{1}{R(2-\lambda)} \\ 4h(1-\theta) & -\Phi \end{bmatrix} \begin{bmatrix} \delta bk^{ACT} \\ \delta R_A \end{bmatrix} = \begin{bmatrix} \frac{1}{R}\frac{1-\lambda}{2-\lambda} \\ \Phi - \theta bk^{MIN} \end{bmatrix} \delta bk^{MIN}$$

Premultiplying by the inverse of the matrix on the LHS ("the matrix") we obtain the solution

$$\begin{bmatrix} \delta bk^{ACT} \\ \delta R_A \end{bmatrix} = -\frac{1}{\Phi + \frac{4h(1-\theta)}{R(2-\lambda)}} \begin{bmatrix} -\Phi & -\frac{1}{R(2-\lambda)} \\ -4h(1-\theta) & 1 \end{bmatrix} \begin{bmatrix} \frac{1}{R}\frac{1-\lambda}{2-\lambda} \\ \Phi - \theta bk^{MIN} \end{bmatrix} \delta bk^{MIN}$$

On the RHS we have the determinant of the matrix (a negative number), then the adjoint matrix. We can readily establish the following relations:

$$\text{Sign of } \left(\frac{\delta bk^{ACT}}{\delta bk^{MIN}} \right) = \text{Sign of } \left[\frac{\Phi(1-\lambda)}{R(2-\lambda)} + \frac{\Phi - \theta bk^{MIN}}{R(2-\lambda)} \right] \tag{38}$$

$$\text{Sign of } \left(\frac{\delta R_A}{\delta bk^{MIN}} \right) = -\text{Sign of } \left[(\Phi - \theta bk^{MIN}) - \frac{4h(1-\theta)(1-\lambda)}{R(2-\lambda)} \right] \tag{39}$$

Note that $\Phi - \theta bk^{MIN}$ is positive if bk^{MIN} is zero or small (i.e. in the plausible range; our steady state value is -0.973+1.02= 0.047). Only when bk^{MIN} becomes very large can $\Phi - \theta bk^{MIN}$ become negative (in fact, implausibly large; the threshold is around 15 to 20 percent). Hence, the sign in 38 is positive, i.e., an increase in the minimum capital ratio raises the actual capital ratio in steady state.

The sign of the derivative in 39 is in principle uncertain, but note that the second term in square bracket on the RHS is very small, since $(1-\theta)$ is close to zero. Hence, for bk^{MIN} not too large, the sign of 39 is negative. For reasonable parameter values, in this model an increase in the minimum capital ratio decreases the steady state return on bank assets, R_A, and is therefore expansionary.

The following intuition may help to understand this result. When the minimum capital ratio is raised, for plausible parameter values bank capital accumulation tends to increases (equation 37). If the increase is sufficiently high relative to bk^{MIN}, R_A declines (equation 36). The increase in required capital by reducing deposit liabilities generates sufficient new returns to capital to be more than fully financed. In steady state this can happen for parameters in the plausible range. In the short term, however, this does not happen because the increase in capital takes place immediately while the capitalist return, being a flow, cumulates slowly. Unlike a permanent one, therefore, a temporary increase in bk^{MIN} increases R_A and is unambiguously contractionary.

Figure 15 shows some numerical relations between bk^{MIN} and the steady state of the model. As the capital requirement is raised, bank capitalization increases and bank risk decreases, as one would expect. Moreover, aggregate investment and output increase, as a result of the decline in the real bank lending rate. The economy settles on a higher level of capital, consistent with the Cobb Douglas technology. Roughly, a 1 percent increase in the required capital ratio increases economic capital by 20-40 percent in steady state, depending on starting conditions.

8   Conclusions

Research on exit strategies is an infant industry; in spite of its intrinsic interest and concrete policy relevance, very few authors have explored the topic yet. To our knowledge, this is the only paper that approaches the issue directly considering all three policy areas – fiscal, monetary and financial.

Our analysis should be refined in many respects. First, as already noted , the analysis of Basel III is incomplete: the new capital standards should be calibrated accurately, once more details are available, for the effects on the macroeconomy to be better understood. This will require, as we have shown, exploring the dynamics across different steady states, an area of macro-modelling if increasing interest after the crisis but still underexplored. Second, our linear approximation to the nonlinear model could be misleading when studying the interaction among different policies; our analyses should be re-run using the full nonlinear version of the AF model. Third, as suggested in the introduction, the robustness of our result should be checked by using alternative models. Unfortunately there are not many models yet that incorporate risky banks into micro-founded macroeconomic frameworks, but the number is rising. This is, indeed, a fast-growing industry.

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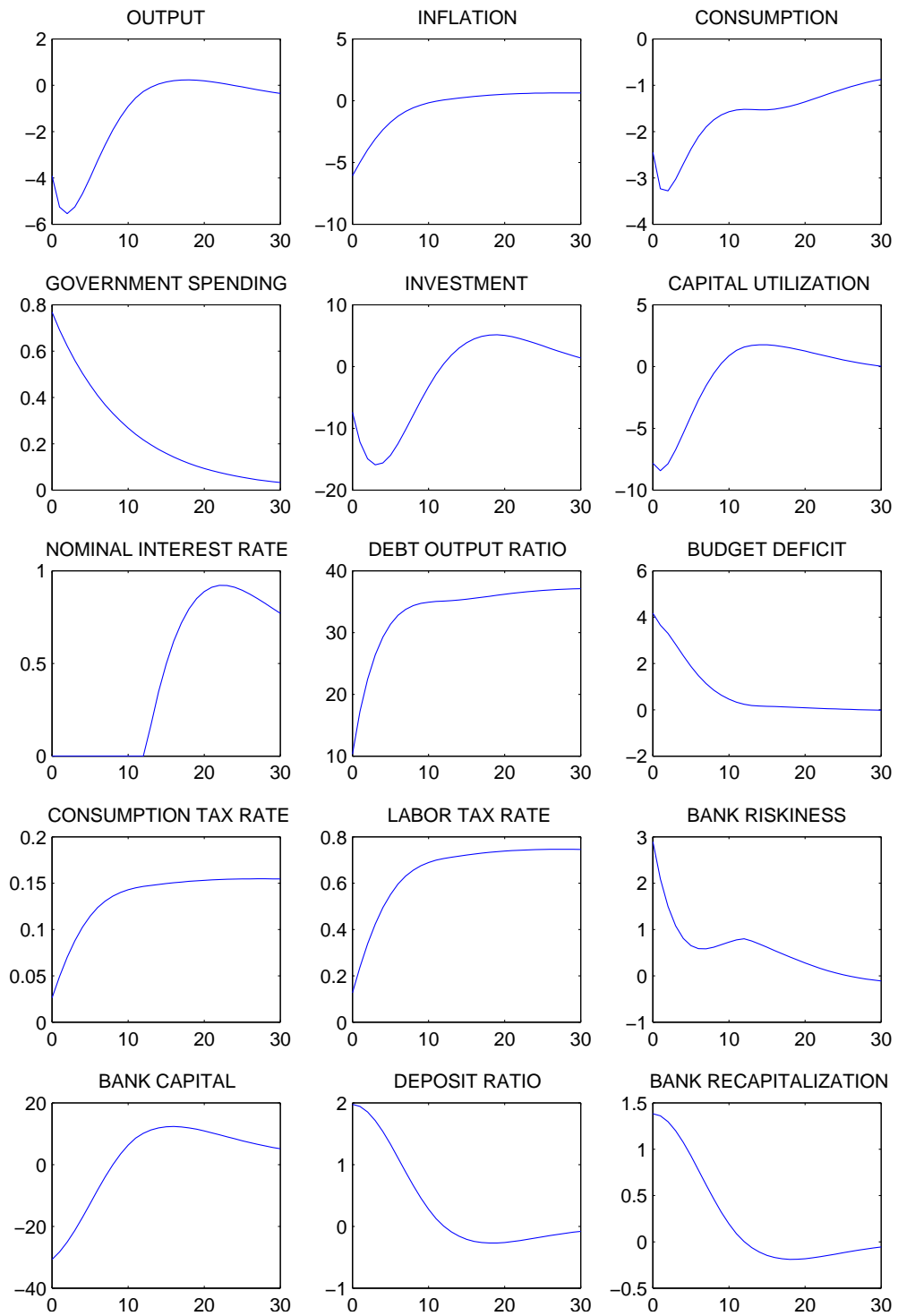[49] Woodford, Michael, 2003. *Interest and Prices.*
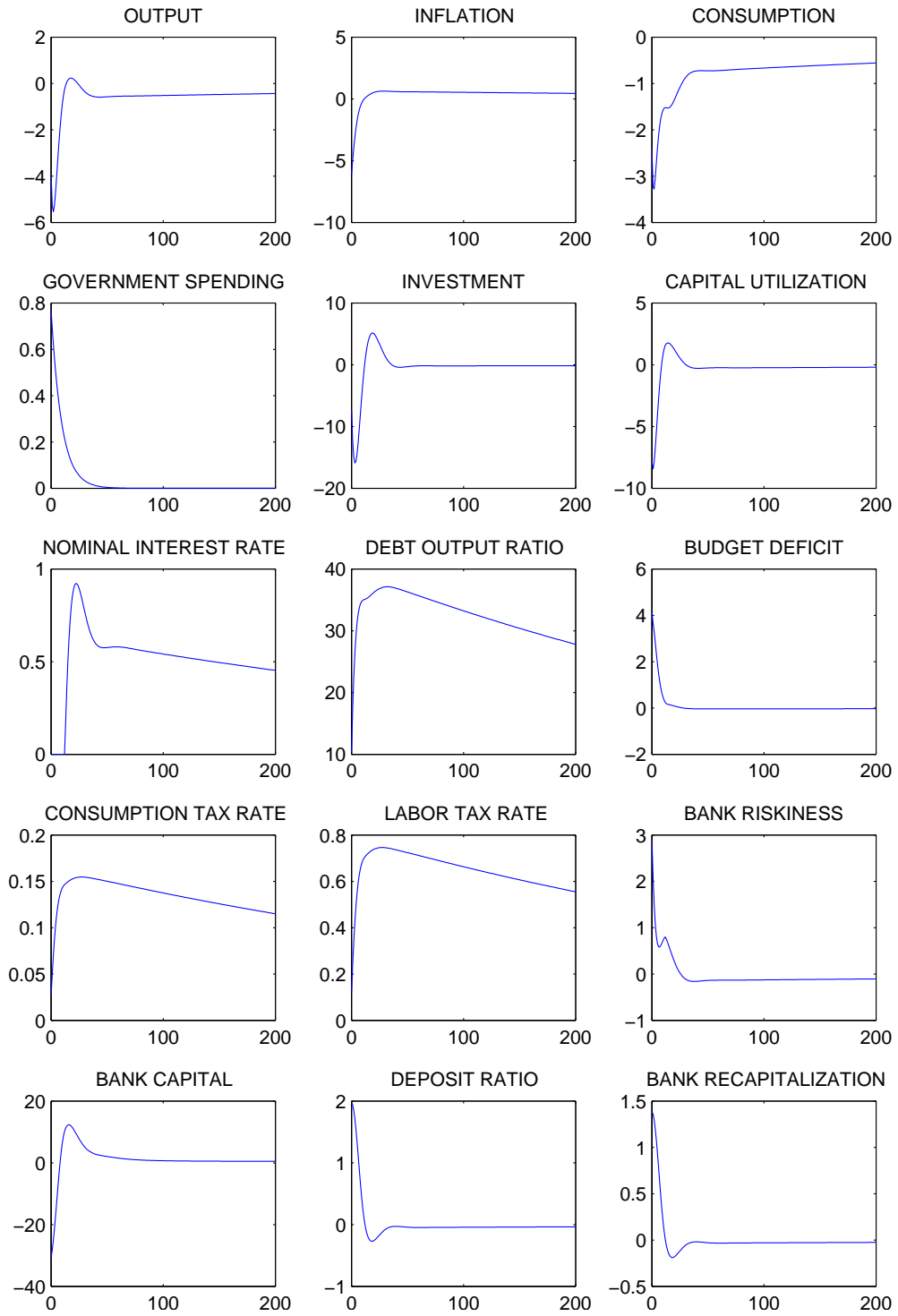
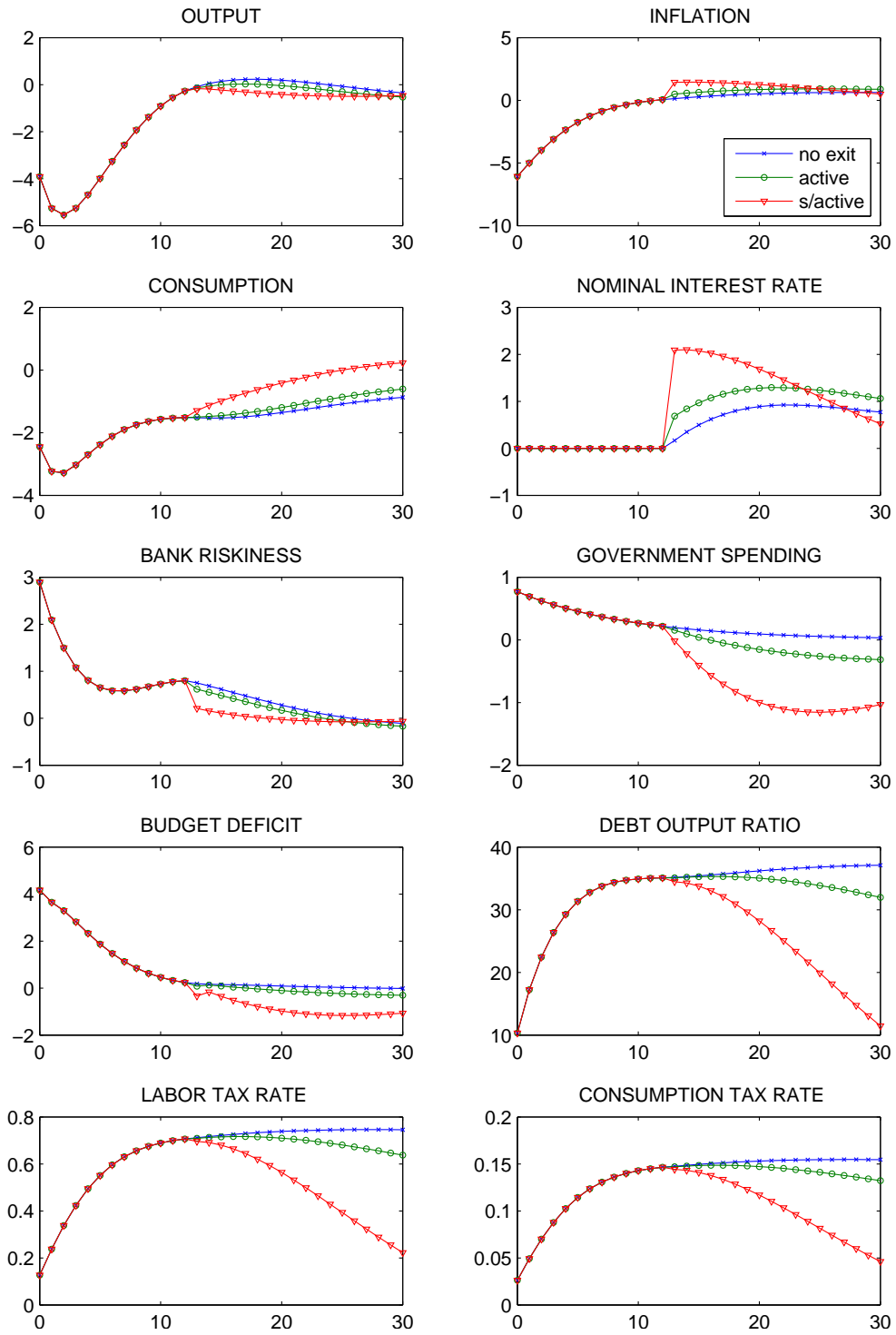Figure 1: Crisis and initial stimulus

Figure 2: Crisis and initial stimulus

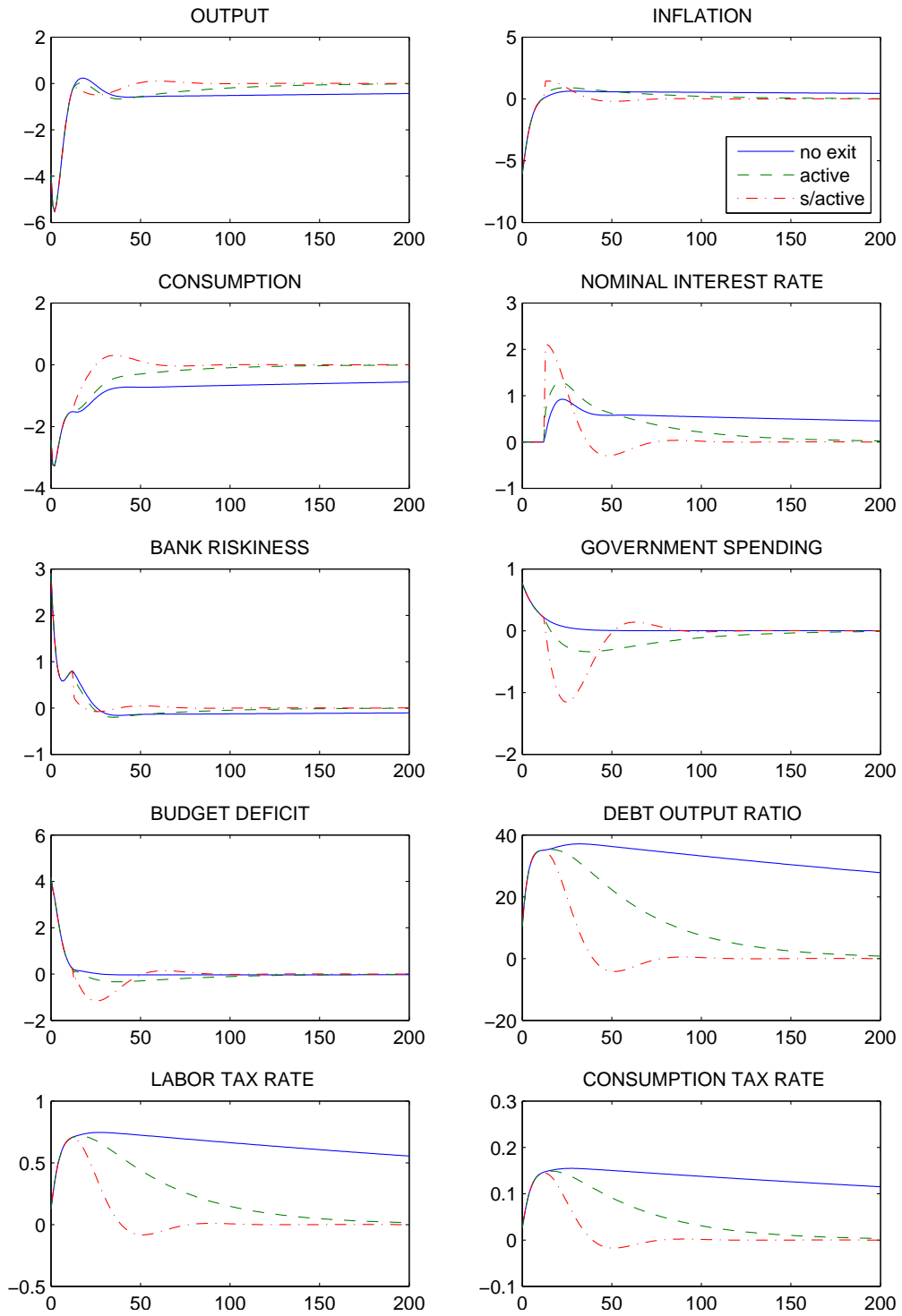Figure 3: Unannounced active versus super-active spending rule
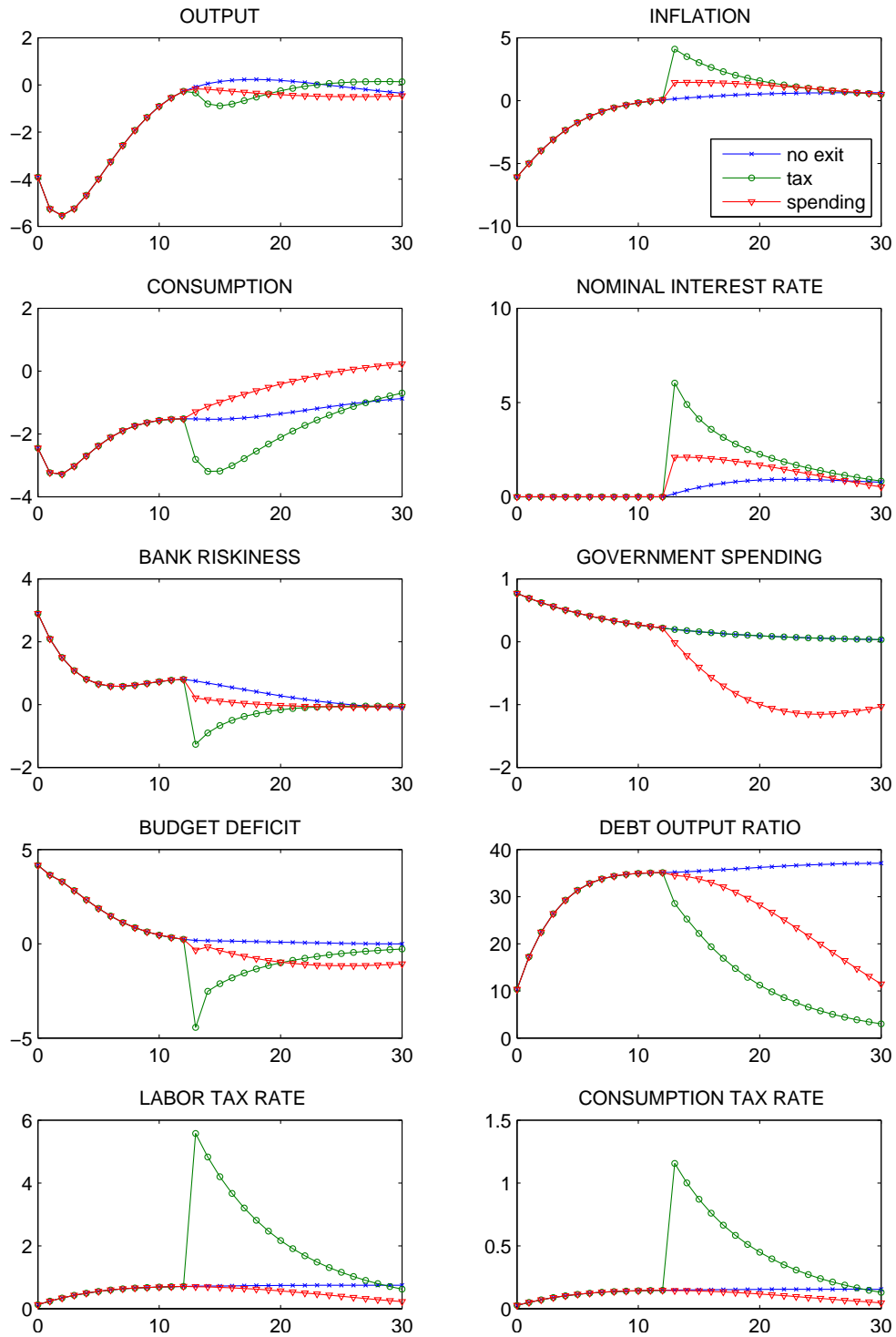
Figure 4: Unannounced active versus super-active spending rule

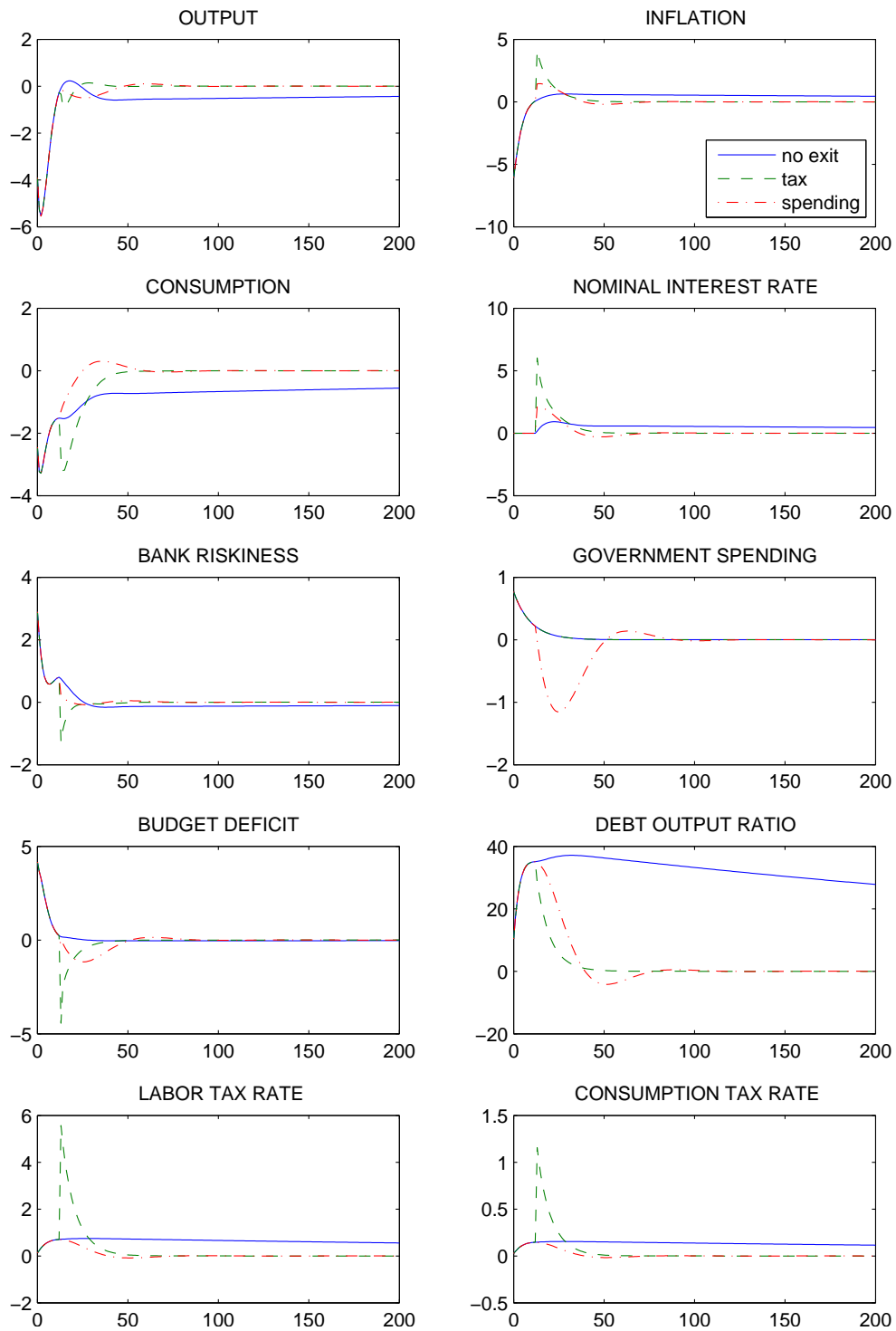Figure 5: Tax-based versus spending-based strategy, both unannounced and super-active

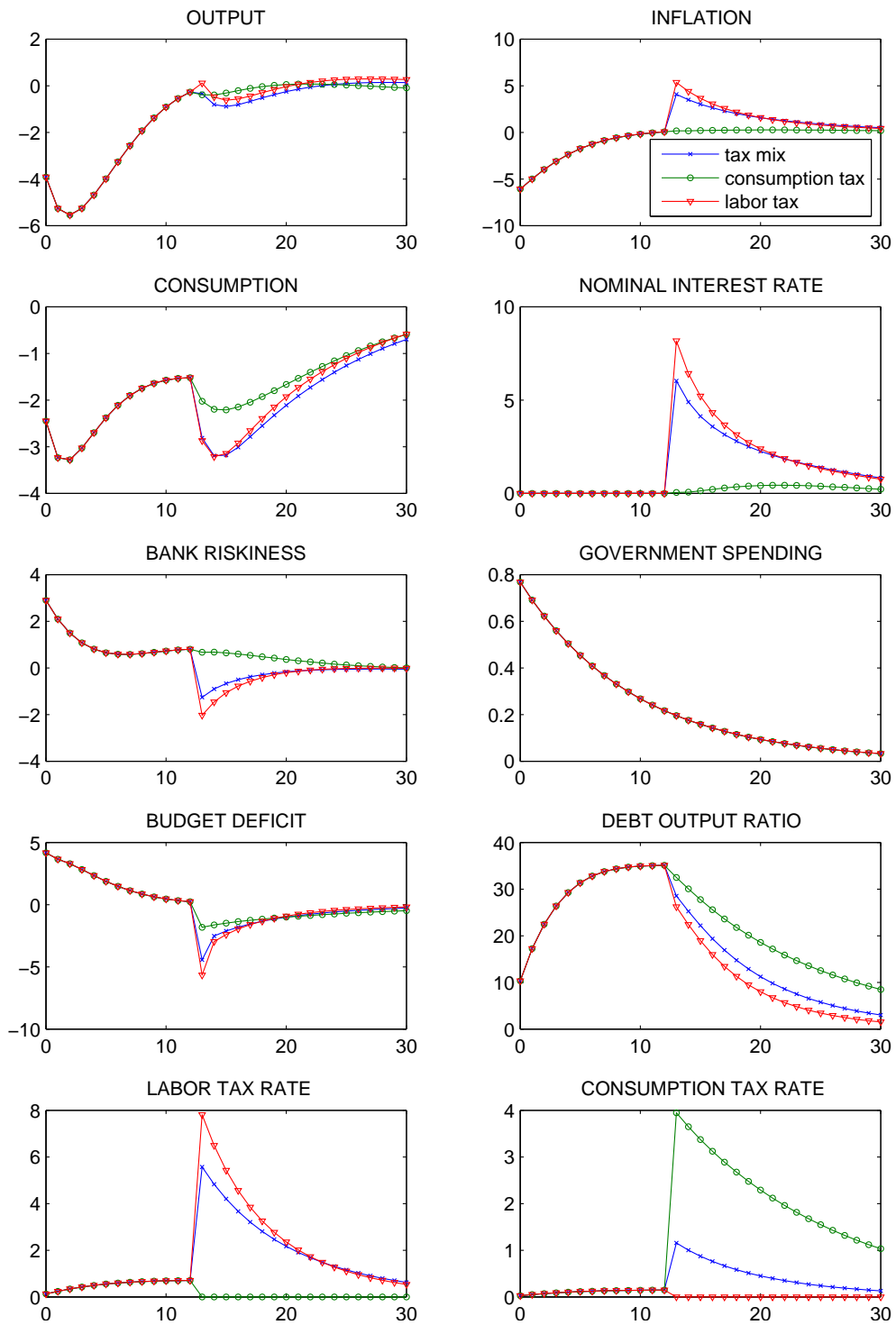Figure 6: Tax-based versus spending-based strategy, both unannounced and super-active

Figure 7: Mix-tax strategy versus tax strategies tilted towards labor and consumption taxes – all in super-active, unannounced mode
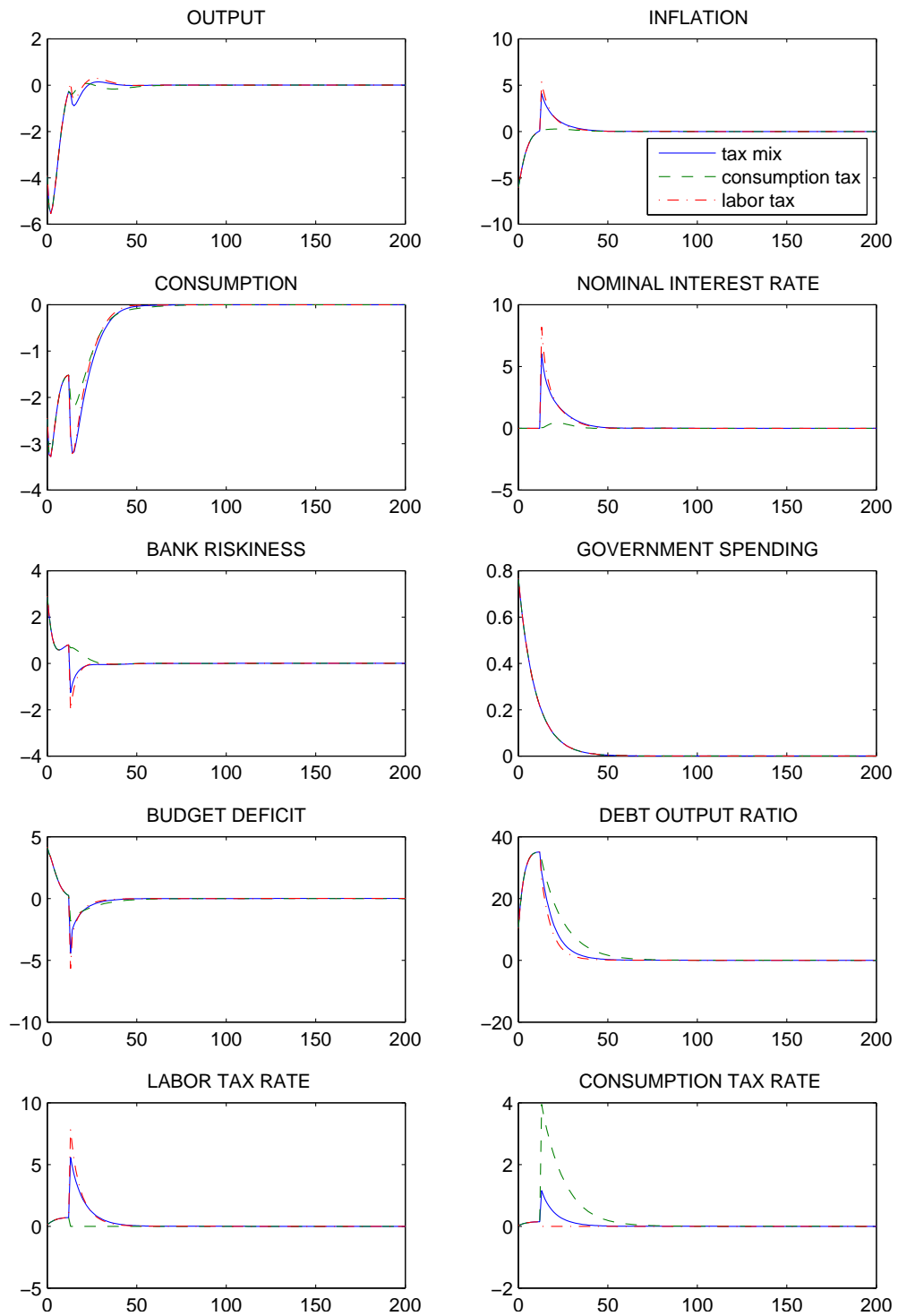
Figure 8: Mix-tax strategy versus tax strategies tilted towards labor and consumption taxes – all in super-active, unannounced mode
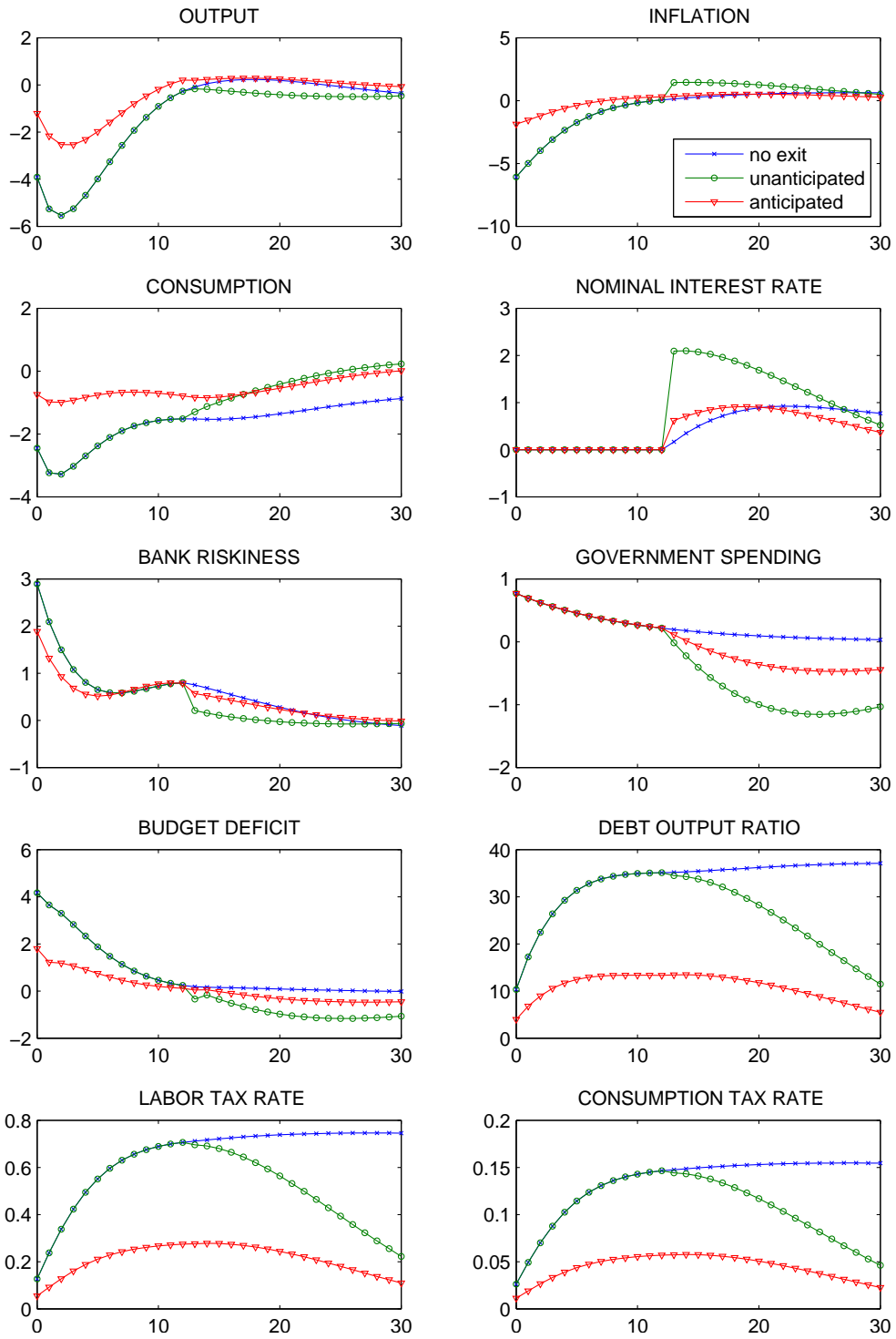
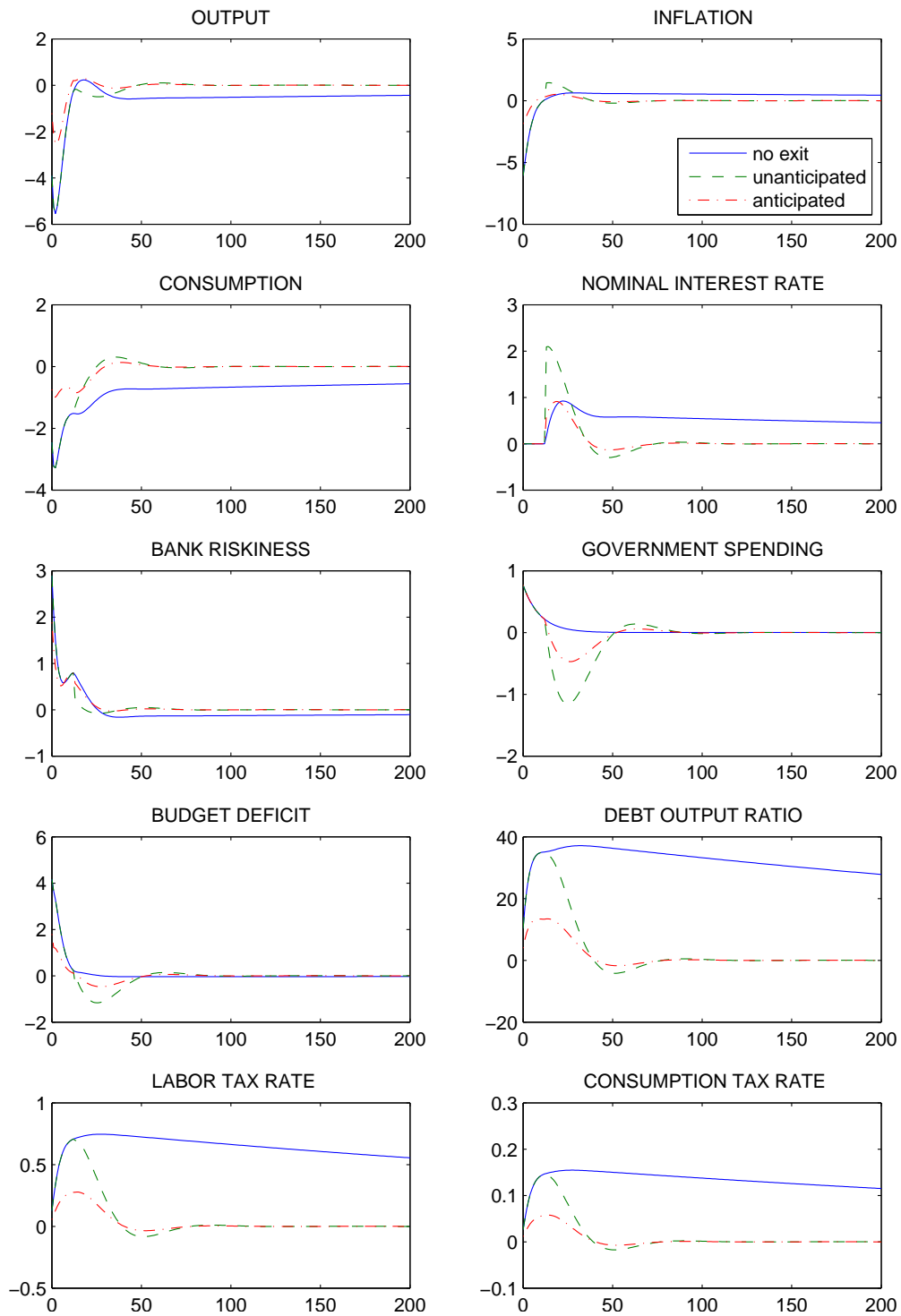Figure 9: Announced versus unannounced spending-based super-active strategy

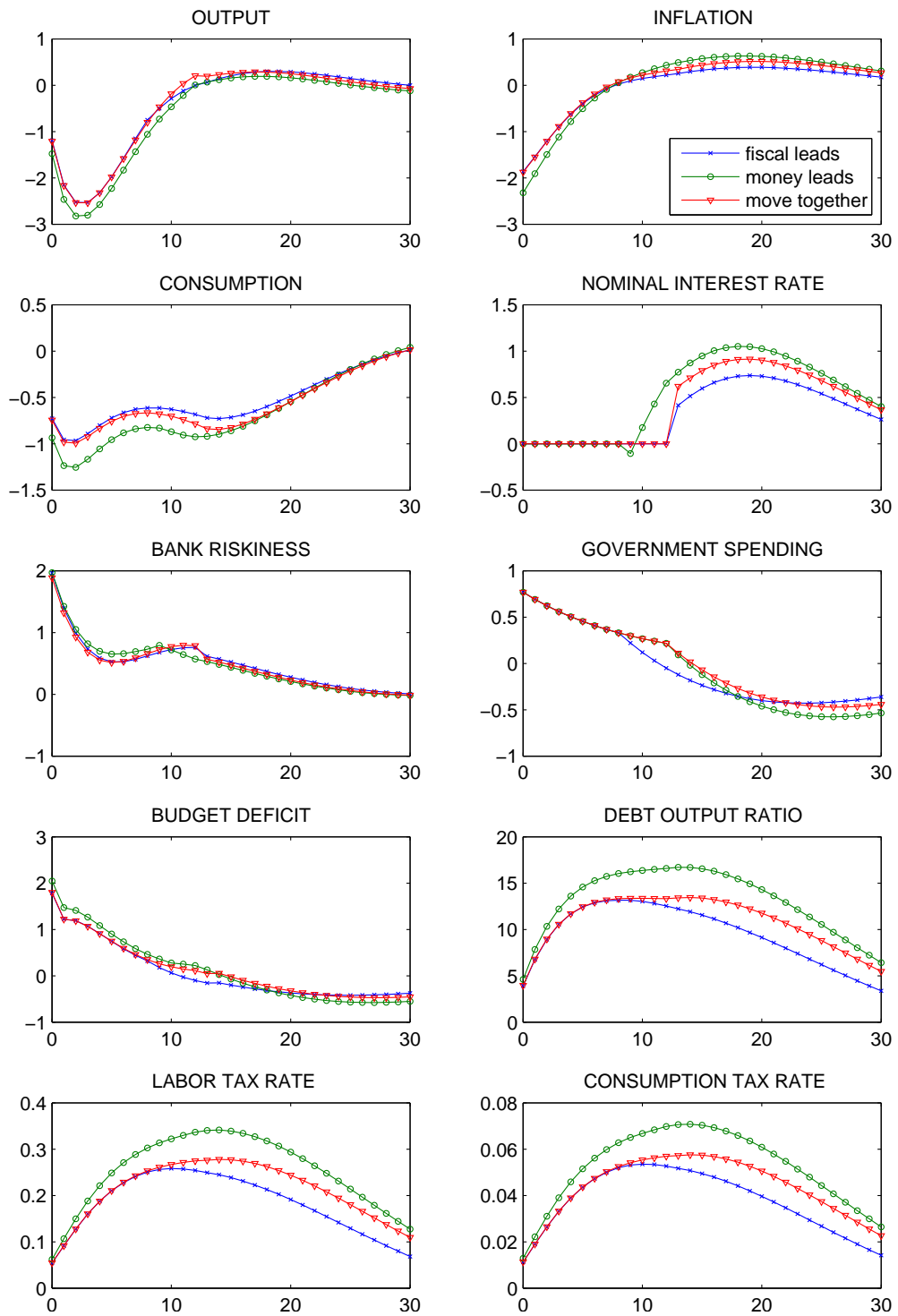Figure 10: Announced versus unannounced spending-based super-active strategy
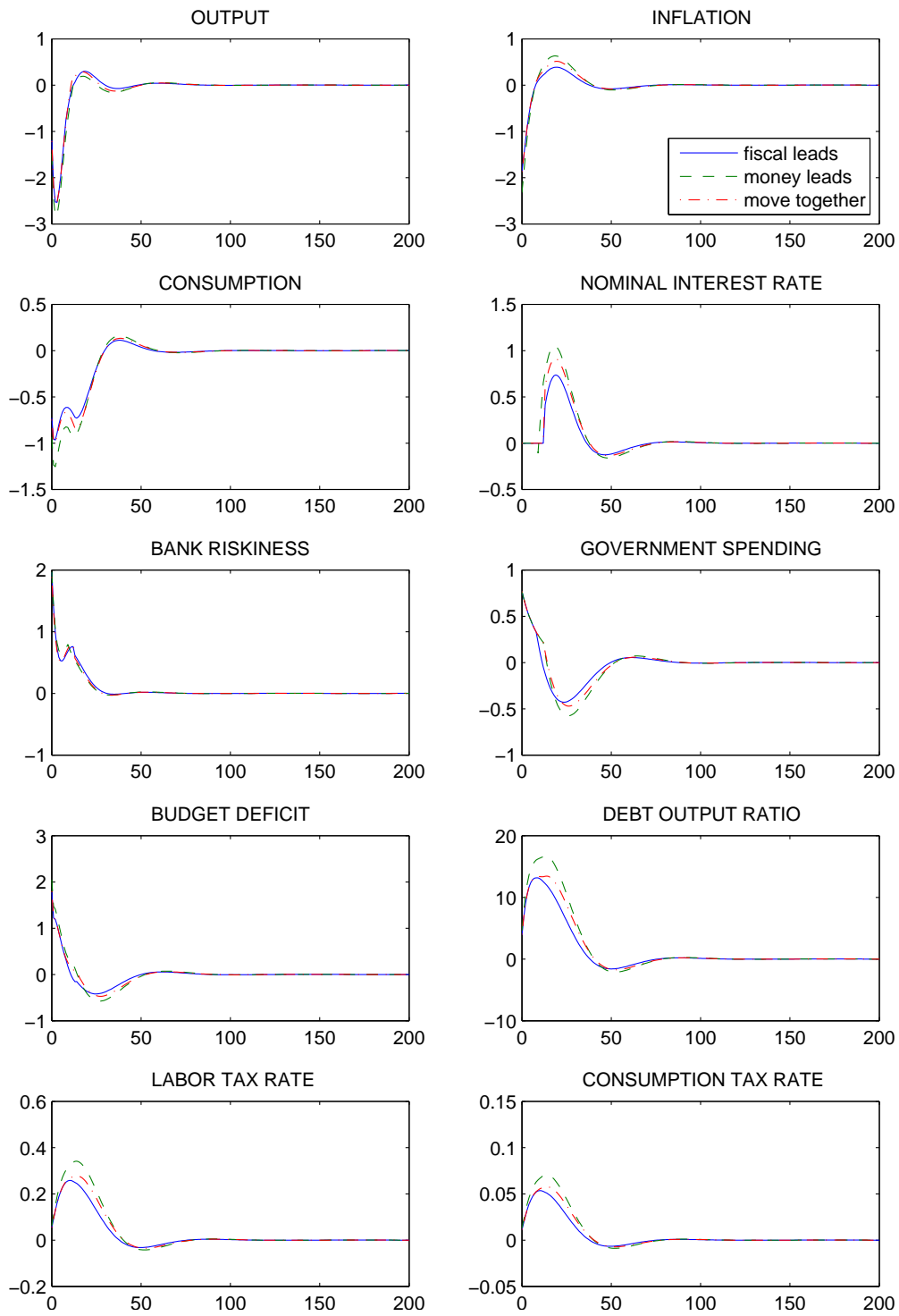
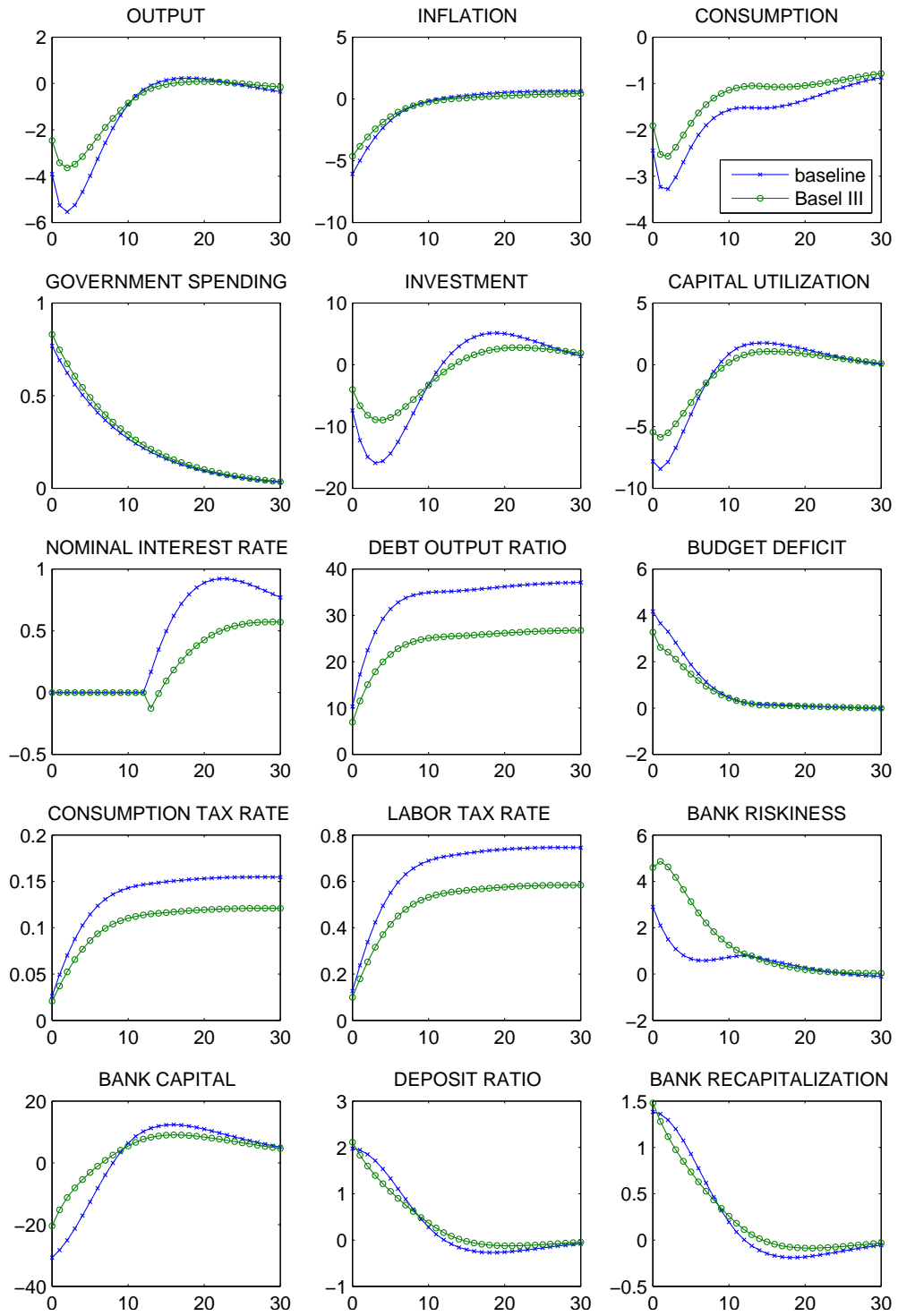Figure 11: Sequencing and delaying

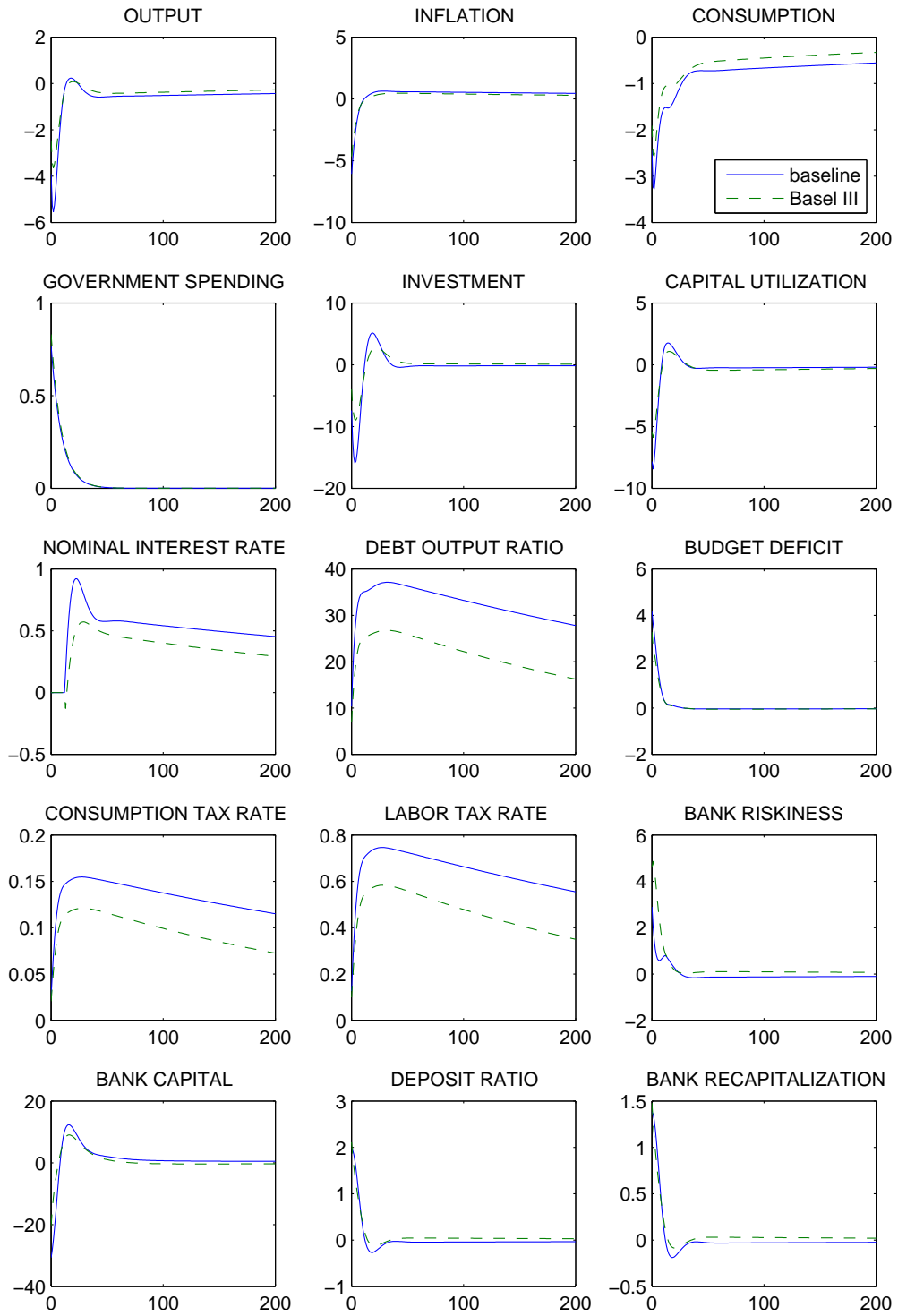Figure 12: Sequencing and delaying

Figure 13: Basel III

Figure 14: Basel III
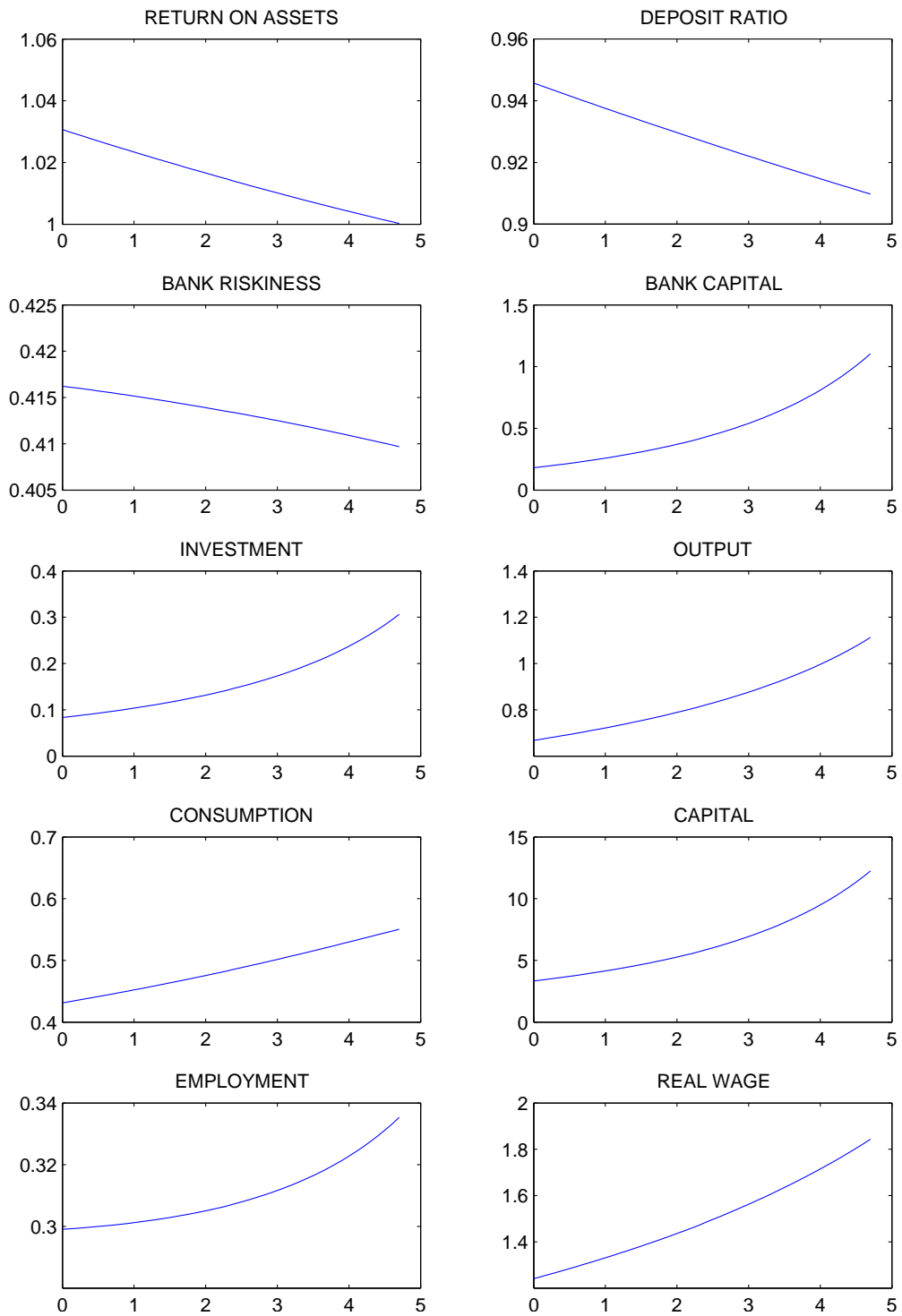
Figure 15: Minimal capital requirements and the steady state

Figure 1: MATCHING THE CRISIS

Sources:	OECD Econ Outlook May 2010 (1)			Model: years after shock (2)	
Periods:	2008	2009	2010	1	2
GDP	0,5	-4,1	-1,2	-5,0	-3,6
GDP, % dev. from potential	0	-5,1	-4,7	-5,0	-3,6
Private consumption	0,3	-1	0,1	-3,0	-2,3
Private investment	-0,9	-10,7	-2,2	-12,6	-13,2
Employment	1	-1,8	-0,9	-3,4	-2,9
Consumption deflator	2,8	-0,1	1,4	-4,5	-1,6
Public debt,% GDP	75,8	86,3	92,4	79,3	88,7
Public sector deficit, % GDP	2	6,3	6,5	3,5	1,7
(1) Percentage changes from previous year except when otherwise indicated. (2) Deviations from steady state					

Figure 2: COMPARISON OF ALTERNATIVE EXIT STRATEGIES

Horizon				20 quarters				All quarters			
Criterion				Cons.	Output	Bank risk	Inflation	Cons.	Output	Bank risk	Inflation
No exit				-37	-37	5	10	-93	-74	5	11
n.	Exit strategy:			Gain/loss in percent				Gain/loss in percent			
1	Fiscal and monetary together	Unanticipated, active	Tax	-11	-10	4	-4	8	10	4	-6
2			Spending	2	-2	2	-1	42	19	3	1
3		Unanticipated, super-active	Tax	-22	-12	-2	-22	36	44	0	-14
4			Spending	10	-6	4	-5	67	39	7	1
5		Unanticipated, active	Cons. tax	3	3	-1	0	41	42	1	9
6			Labor tax	-17	-16	4	-9	-2	1	3	-17
7		Unanticipated, super-active	Cons. tax	-9	-5	0	0	43	44	2	10
8			Labor tax	-21	-8	-12	-32	39	50	-9	-22
9		Announced, active	Tax	-8	-9	14	10	11	13	14	6
10			Spending	25	24	13	29	54	41	14	29
11		Announced, super-active	Tax	36	43	38	56	64	75	39	57
12			Spending	61	61	28	68	84	80	30	69
13		Announced, active	Cons. tax	39	44	10	39	61	68	12	44
14			Labor tax	-39	-43	17	-11	-18	-18	12	-23
15		Announced, super-active	Cons. tax	50	59	17	61	72	81	19	65
16			Labor tax	39	46	41	52	66	78	42	54
17	Fiscal first	Unanticipated, active	Tax	-11	-8	2	-4	14	17	3	-3
18			Spending	6	-1	1	-1	45	23	2	2
19		Unanticipated, super-active	Tax	-5	8	3	-16	48	57	6	-5
20			Spending	25	-1	2	-5	72	47	5	4
21		Announced, active	Tax	20	25	23	42	37	43	24	39
22			Spending	29	26	13	32	57	44	15	33
23		Announced, super-active	Tax	54	65	39	78	74	87	40	78
24			Spending	64	59	26	69	86	81	27	71
25	Monetary first	Unanticipated, active	Tax	-4	-3	1	-2	8	10	1	-7
26			Spending	0	-1	1	-1	40	19	1	1
27		Unanticipated, super-active	Tax	-10	-5	-8	-17	36	43	-8	-15
28			Spending	3	-1	1	-3	65	37	3	0
29		Announced, active	Tax	-7	-7	15	11	12	14	14	7
30			Spending	33	34	17	37	59	48	18	37
31		Announced, super-active	Tax	-45	-48	-2	-16	24	28	0	-10
32			Spending	54	51	25	60	82	74	26	61

Gains (+) or losses (-), in percent, of the corresponding exit strategy in terms of the given criterion, relative to the no exit scenario. The values for the no exit scenario are calculated relative to the steady state. For consumption and output the criterion is the discounted present value of the future values of the corresponding variable. For bank risk and inflation the criterion is the root discounted square deviation. The shaded cells denote a gain of at least 25 percent. The dotted cells denote a loss of at least 10 percent.