Fiscal Policy in a Financial Crisis: Standard Policy versus Bank Rescue Measures[†]

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The recent financial crisis has led to an intense debate about the efficacy of fiscal stimulus. This debate centers on temporary increases in government purchases and social transfers, and on tax cuts. See, e.g., Drautzburg and Uhlig (2010); Forni and Pisani (2010); Leeper, Traum, and Walker (2011); and Coenen et al. (2012) for model-based evaluations of these standard fiscal policy instruments.

However, a key aspect of fiscal policy in the crisis was massive government support for the banking system, e.g., in the form of purchases of bank assets and of bank recapitalizations by governments. In several countries, these "unconventional" fiscal interventions were larger than the changes in standard fiscal instruments during the crisis. Surprisingly, the macroeconomic effects of these bank support measures have, so far, received little attention in the literature. Our article seeks to fill this gap, using a quantitative dynamic general equilibrium model with a banking sector. In our economy, bank capital is an important state variable. We model government support for the banking system as a transfer to banks that is financed by higher taxes. State aid to banks boosts bank capital, and it lowers the spread between the bank lending rate and the deposit rate, which stimulates investment and output. Investment drops sharply in financial crises. Thus, government support for banks helps to stabilize a component of aggregate demand that is especially adversely affected by financial crises. By contrast, many conventional fiscal stimulus measures (e.g., government purchases of goods and services) crowd out investment. The GDP multiplier of state aid to banking is in the same range as conventional government spending multipliers.

I. Fiscal Measures in the Global Financial Crisis

Conventional fiscal stimulus (increases in government purchases and social transfers; tax cuts) amounted to 1.98 percent [1.77 percent] of US GDP in 2009 [2010]. In the European Union (EU), conventional stimulus represented 0.83 percent [0.73 percent] of GDP in 2009 [2010]. US and EU bank rescue measures mainly occurred in 2009. In the United States, government-funded purchases of bank assets and bank recapitalizations represented 1.6 percent and 3.1 percent of GDP, respectively, in 2009. In the EU, asset purchases and recapitalizations represented 2.8 percent and 1.9 percent of GDP, respectively, also in 2009. In both the United States and the European Union, these two types of bank support measures thus amounted to 4.7 percent of GDP in 2009. (See in't Veld and Roeger 2012 and Laeven and Valencia 2011.)

II. The Model

We provide intuition about the macroeconomic effects of state aid to banking, using an augmented Real Business Cycle (RBC) model that builds on Kollmann, Enders, and Müller (2011).[1] The private sector consists of a worker, an entrepreneur, and a banker. The entrepreneur hires the worker, accumulates physical capital, and produces a homogeneous good. The banker collects deposits from the worker and makes one-period loans to the entrepreneur.

[1] Sandri and Valencia (2011) study the *welfare* effect of state bank aid, using a more stylized macro model.

A. *Preferences, Technologies, Budget Constraints*

The **worker** chooses consumption c_t^W, hours worked N_t, and bank deposits D_{t+1} to maximize $E_t \sum_{s=0}^{\infty} \beta^s [\log(c_{t+s}^W) + \Psi^D \log(D_{t+1+s}) - \Psi^N N_{t+s}]$, where $0 < \beta < 1$ is the subjective discount factor (Ψ^D, $\Psi^N > 0$ are parameters). Her period t budget constraint is $D_{t+1} + T_t^W + c_t^W = w_t N_t + D_t R_t^D$, where w_t is the wage rate, T_t^W is a lump sum tax levied by the government, and R_t^D is the gross interest rate on deposits. We assume that deposits provide utility (liquidity services) to the worker—this ensures that the equilibrium deposit rate is smaller than the lending rate.

The **entrepreneur** maximizes $E_t \sum_{s=0}^{\infty} \beta^s \log(d_{t+s}^E)$, where d_t^E is her dividend income (and consumption) at t. The entrepreneur's period budget constraint is $L_t R_t^L - \Delta_t + I_t + T_t^E + d_t^E = L_{t+1} + Q_t - w_t N_t$, where Q_t, I_t, and T_t^E are output, physical investment, and a lump sum tax. The technology is $Q_t = K_t^{\alpha} N_t^{1-\alpha}$, $K_{t+1} = K_t(1 - \delta) + I_t$, $0 < \alpha, \delta < 1$, where K_t is physical capital and δ the depreciation rate. L_t is the bank loan received by the entrepreneur in $t - 1$ at gross rate R_t^L. At t, the entrepreneur defaults by an exogenous amount $\Delta_t \geq 0$ on the sum owed to the bank, $L_t R_t^L$.

At date t, the **bank** takes deposits D_{t+1} and makes loans L_{t+1}. The bank faces a capital requirement: bank capital $L_{t+1} - D_{t+1}$ should not be smaller than a fraction γ of assets L_{t+1}. This constraint may reflect a legal requirement, or market pressures. The bank can hold less capital than the required level, but this is costly. Let $x_t \equiv (L_{t+1} - D_{t+1}) - \gamma L_{t+1}$ denote the bank's "excess" capital. The bank bears a real cost $\phi(x_t)$ as a function of x_t. ϕ is a convex function with $\phi(x_t) > 0$ for $x_t < 0$; $\phi(0) = 0$ Thus, for $x_t < 0$ the bank incurs a positive cost. At t, the bank also bears a real operating cost $\Gamma \cdot (D_{t+1} + L_{t+1})$, where $\Gamma > 0$ is a parameter. We model state aid for banking as a government subsidy S_t to the bank. (E.g., when the bank faces loan default, the government may purchase maturing loans from the bank, at *face value*—S_t then is the difference between the face value and the fair value of the loans.) The bank's period t budget constraint is:

$$(1) \quad L_{t+1} + D_t R_t^D + \Gamma \cdot (D_{t+1} + L_{t+1})$$
$$+ \phi(x_t) + T_t^B + d_t^B$$
$$= L_t R_t^L - \Delta_t + D_{t+1} + S_t,$$

where T_t^B is a lump-sum tax, while d_t^B is the bank's dividend. The banker consumes the dividend. She chooses loans and deposits to maximize lifetime utility $E_t \sum_{s=0}^{\infty} \beta^s \log(d_{t+s}^B)$ subject to (1). The bank's decision problem has these first-order conditions:

$$(2) \quad R_{t+1}^D E_t \beta d_t^B / d_{t+1}^B = 1 - \Gamma + \phi'(x_t),$$
$$R_{t+1}^L E_t \beta d_t^B / d_{t+1}^B = 1 + \Gamma$$
$$+ (1 - \gamma)\phi'(x_t).$$

A linear approximation of (2) gives:

$$(3) \quad R_{t+1}^L - R_{t+1}^D \cong 2\Gamma - \gamma\phi'(x_t).$$

If the bank raises deposits *and* loans by one unit, her operating cost increases by 2Γ; excess bank capital falls by γ, which increases the penalty $\phi(x_t)$ by $-\gamma\phi'(x_t)$. (3) shows that the loan spread $R_{t+1}^L - R_{t+1}^D$ covers the marginal cost $2\Gamma - \gamma\phi'(x_t)$. Under *strict* convexity of ϕ (i.e., $\phi'' > 0$), the marginal benefit of excess bank capital $-\phi'$ is a decreasing function of excess capital, and thus the spread is likewise a *decreasing* function of (excess) bank capital. The sensitivity of the spread to changes in bank capital is governed by ϕ''. Note that $x_t \cong (cr_t - \gamma)L$, where $cr_t \equiv (L_{t+1} - D_{t+1})/L_{t+1}$ is the bank capital ratio (L is the steady state loan stock). A 1 percentage point rise in the capital *ratio* lowers the loan spread by $4\gamma\phi''L$ percentage points per annum.

The **government** buys G_t units of output. Government outlays are funded using the lump sum taxes: $G_t + S_t = T_t$, where $T_t \equiv T_t^W + T_t^E + T_t^B$. Each agent bears a *constant* share of the total tax burden (equal to her share in steady consumption): $T_t^z = \lambda^z T_t$ for $z = W, E, B$.

Market clearing in the output market requires $Q_t = c_t^w + d_t^E + d_t^B + I_t + G_t + \Gamma \cdot (L_{t+1} + D_{t+1}) + \phi(x_t)$.

B. *Model Solution and Calibration*

We use a linear approximation to solve the model and calibrate it to quarterly US data (1990–2010). The steady state bank capital ratio is set at 5 percent. Steady state excess bank capital is zero. The steady state deposit and loan rates are set at 1.28 percent and 3.44 percent per annum (p.a.), respectively, and the steady state ratio of loans to annual GDP is set at 50 percent. We set

TABLE 1—DYNAMIC EFFECTS OF GOVERNMENT SUPPORT FOR BANK IN RBC MODEL

	GDP	C	I	Loans	Deposits	cr	R^L	R^D	$R^L - R^D$
Panel A. Baseline model									
yr = 1	1.17	−0.32	6.01	1.44	0.29	1.10	0.09	0.34	−0.25
yr = 2	0.83	−0.01	3.70	3.15	1.61	1.47	−0.01	0.32	−0.33
yr = 4	0.29	0.27	0.62	4.22	3.25	0.92	−0.09	0.12	−0.21
Panel B. Model variant without *operative bank capital requirement* ($\phi'' = 0$)									
yr = 1	0.18	−0.01	0.83	0.27	−1.00	1.21	0.02	0.02	0.00
yr = 2	0.17	0.03	0.68	0.58	−1.45	1.94	0.00	0.00	0.00
yr = 4	0.13	0.07	0.40	0.90	−1.11	1.92	−0.01	−0.01	0.00

Notes: A fiscal measure representing 1% of annual GDP in year 1 is considered. Row labeled "*yr = t*" shows year *t* responses, computed as the average of responses in each quarter of year *t*. Columns labeled *GDP*, *C*, etc. show responses of corresponding variables. *C*: total consumption; *I*: investment; *cr*: bank capital ratio; $R^L [R^D]$ loan [deposit] rate. Responses of the bank capital ratio and of interest rates (per annum) are in percentage points. Responses of other variables are shown as % deviations from steady state values.

$\phi''(0)$ such that a 1 percentage point rise in the bank capital ratio lowers the loan spread by 20 basis points (bp) p.a., consistent with time series regressions of the loan rate spread on aggregate bank capital reported by Kollmann, Enders, and Müller (2011).[2] In steady state, bank state aid is zero, and government purchases represent 20 percent of GDP. The calibration of technology is conventional: $\alpha = 0.3$; $\delta = 0.025$.

III. Policy Experiments

We discuss transitory state aid for the bank and compare it to a rise in government purchases.

A. *Transitory Government Support to Bank (Table 1)*

We consider a transfer to the bank during year 1 that is equivalent to 1 percent of steady state annual GDP (distributed equally over four quarters). Table 1 reports dynamic effects of that measure. Panel A shows results for the baseline model. In that model, state bank aid triggers a sizable rise in hours worked, GDP, and investment. Hours (not shown in table) rise because of the negative wealth effect of the higher tax paid by the worker, and because the rise in the deposit rate (see below) creates an incentive to work harder. In year 1, hours and GDP rise by 1.56 percent and 1.17 percent,

respectively. There is also a noticeable positive effect on real activity in subsequent years (GDP rises by 0.83 percent and 0.29 percent in years 2 and 4). Investment rises by 6.01 percent during the first year. Aggregate consumption falls initially (but rises after year 2).

In order to smooth her consumption, the banker responds to the government transfer by saving more—thus, bank capital increases. The bank capital ratio rises by 1.10 [1.47] percentage points during the first [second] year. The capital ratio then slowly reverts to its unshocked path. The rise in bank capital leads to a sizable and persistent fall in the lending rate spread, due to a fall in the marginal benefit of excess capital (see equation (3)): −25 basis points (bp) p.a. in year 1. The fall in the loan spread is accompanied by a sizable expansion of loans and deposits. The deposit rate rises noticeably (+34 bp in year 1). The loan rate rises slightly at first (+9 bp in year 1), and then falls below its preshock value (−9 bp in year 4). (The initial loan rate rise is due to the strong increase in employment that raises the marginal product of capital and investment demand; model versions with capital adjustment costs generate a *fall* in the loan rate, on impact.)

The macroeconomic efficacy of state bank aid hinges on its ability to lower the lending spread. Panel B of Table 1 considers a model variant without an operative bank capital requirement ($\phi'' = 0$). In that variant, the state aid measure has a much weaker effect on real activity; output rises by only 0.18 percent in year 1. Bank capital rises, in response to the transfer. However, the loan rate *spread* is unaffected, as the marginal

TABLE 2—DYNAMIC EFFECTS OF RISE IN GOVERNMENT PURCHASES IN RBC MODEL

	GDP	C	I	Loans	Deposits	cr	R^L	R^D	$R^L - R^D$
Panel A. Baseline model									
yr = 1	0.39	−0.17	−2.25	−0.62	−0.65	0.03	0.05	0.06	−0.01
yr = 2	0.12	−0.10	0.79	−0.86	−0.90	0.04	0.03	0.04	−0.01
Panel B. Model variant without *operative bank capital requirement* ($\phi'' = 0$)									
yr = 1	0.37	−0.17	−2.37	−0.65	−0.68	0.03	0.05	0.05	0.00
yr = 2	0.11	−0.10	0.75	−0.91	−0.96	0.05	0.03	0.03	0.00

Note: See Table 1.

benefit of excess bank capital does not change. This explains why loans increase much less than in the baseline model variant, and why interest rate responses too are much more muted (the loan and deposit rates rise by merely 2bp in year 1). Hence, the worker has a much weaker incentive to work more.

B. *Transitory Increase in Government Purchases* (*Table 2*)

We next discuss the effect of a rise in government output purchases in year 1, by 1 percent of annual GDP (spread evenly over four quarters). In the baseline model, the rise in government purchases crowds out consumption and investment in year 1 (see Table 2, panel A). The worker responds to the fall in her after tax income by increasing working hours (+0.57 percent in year 1), and there is a modest increase in output (+0.39 percent). The loan rate and the deposit rate rise slightly. Deposits and loans fall, as the worker saves less to smooth her consumption (given the transitory tax increase), and as investment falls. Bank capital rises slightly, but the loan rate spread is hardly affected. The model variant without an operative capital requirement ($\phi'' = 0$) generates responses to the government purchases shock that are very similar to those predicted by the baseline model (Table 2, panel B). These responses are also similar to those generated by RBC models without banks. Hence, the presence of the bank does not significantly affect the transmission of government purchases shocks, essentially because those shocks do not greatly affect bank capital (in contrast to state bank aid).

IV. A Richer New Keynesian Policy Model

The results above are robust to a range of alternative model settings. In't Veld et al. (2011) build

a bank into a New Keynesian policy model with sticky prices and wages. Their specification of the bank capital requirement is identical to that in the baseline RBC model above. In contrast to the RBC model, the policy model assumes that banks are owned by entrepreneurs. It also features residential investment and mortgage lending to collateral-constrained households. As in other policy models, capital and labor adjustment costs and variable capital utilization rates are assumed in order to improve the empirical fit of the model. Because of these features, the New Keynesian policy model is a good alternative for assessing the robustness of the state bank aid multiplier.

In the policy model, the *bank support* measure raises GDP by 0.97 percent in year 1 (Table 3, panel A). The initial GDP response is thus in the same range as in the baseline RBC structure—however, in the policy model the stimulative effect on GDP is limited to year 1. On impact, the bank capital ratio rises (+0.46 percentage points in year 1), and, hence, the loan rate spread falls (−10 bp in year 1), but the boost to the capital ratio is short-lived (capital ratio in year 2: +0.05 percentage points), which helps to understand why the stimulus to real activity is short-lived too.[3] Interestingly, the GDP increase in year 1 is mainly driven by a strong *rise* in aggregate consumption, +0.99 percent in year 1. Investment increases in year 1 (+1.54 percent), before falling below unshocked values; thus, investment rises much less than in the baseline RBC model. The rise in consumption is due to the presence of collateral-constrained

[3] The weaker, more transient, rise in bank capital (compared to the RBC model) is due to the fact that the bank pays out a larger share of the transfer as dividend; the entrepreneur (bank owner) uses the higher dividend for consumption smoothing and to fund higher year 1 investment.

Table 3—Dynamic Effects of Fiscal Policy in New Keynesian Policy Model

	GDP	C	I	Loans	Deposits	cr	R^L	R^D	$R^L - R^D$
Panel A. Effects of government support for bank									
yr = 1	0.97	0.99	1.54	0.01	−0.47	0.46	−0.05	0.05	−0.10
yr = 2	0.08	0.15	−0.03	0.03	−0.03	0.05	0.13	0.14	−0.01
Panel B. Effects of rise in government purchases									
yr = 1	1.36	0.34	0.08	0.02	−0.18	0.18	0.09	0.13	−0.04
yr = 2	−0.29	−0.18	−0.79	0.02	0.12	−0.09	0.13	0.11	0.02

Note: See Table 1.

households, who have a high propensity to consume out of their increased current income.

In the New Keynesian policy model, the rise in *government purchases* has a strong stimulative effect on GDP in year 1 (+1.36 percent), but output falls thereafter (Table 3, panel B).[4] Note that aggregate consumption rises in year 1, due to the presence of collateral-constrained consumers. We again find that eliminating the bank capital constraint dampens considerably the stimulative effect of the bank support measure, while hardly modifying the effects of the government purchases shock (not shown in table).

V. Conclusion

Government support for the banking system can have a strong positive effect on real activity. State bank aid multipliers are in the same range as conventional fiscal spending multipliers. Bank support has a positive effect on investment, while a rise in government purchases crowds out investment.

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[4] The government purchases multiplier here is at the upper end of the multipliers generated by policy models; see Coenen et al. (2012).