

Allocation and Welfare in General Equilibrium Tax Model with Money for an Open Economy

Keshab Bhattarai¹
University of Hull

June 2009, EEFS Warsaw.
Preliminary, Comments Welcome

¹Business School, University of Hull, HU6 7RX, Hull, UK. email:
K.R.Bhattarai@hull.ac.uk

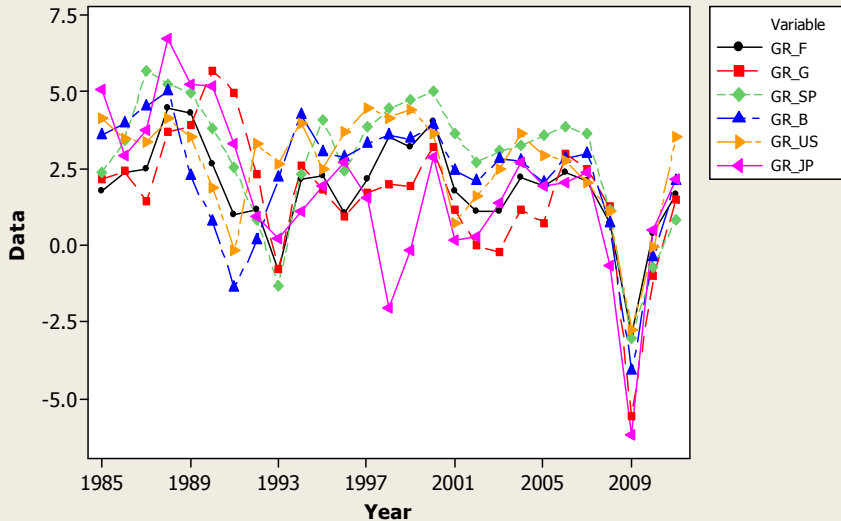
Abstract

Impact of fiscal and monetary policies are assessed in the an open economy two sector multi-household general equilibrium tax model with money. There is alarming gap in the distribution of income among households which none of the stabilisation policies could possibly address. Impacts of fiscal expansions are positive for all categories of households but the gains are much higher for household in the upper income group than for the households in the bottom income group despite claim of the government to help out to those with the least means.. Model results show that demand, output, employment are sensitive to the consumer preference and confidences and sectoral shift in the production technology and impacts vary across households. Simulations result show that monetary policy is less effective in promoting output, employment and other economic policies than the fiscal policy. Relative price based optimal allocation mechanisms and redistribution provide several hints on how the complex mechanist of rellacation and redistribution functions occur in a real economy.

JEL Classification: F41, O11, O33, O41

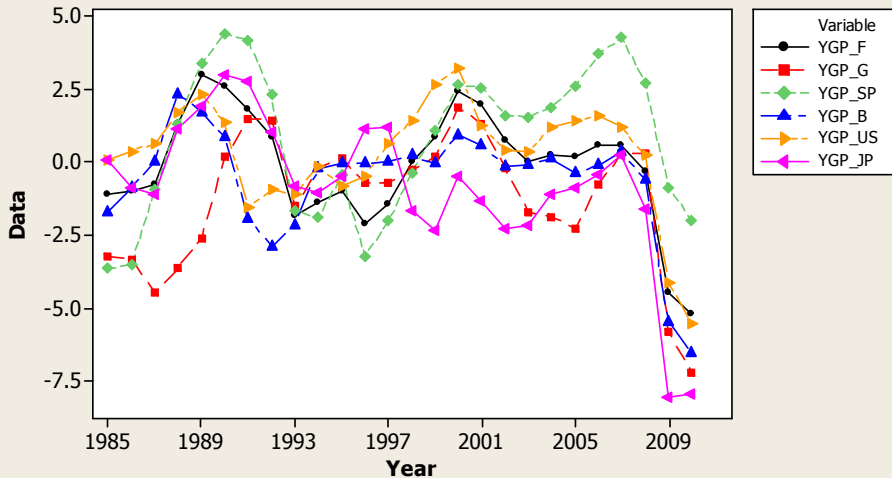
Keywords: Open economy, general equilibrium with money

Growth Rates in France, Germany, Spain, UK, US and Japan



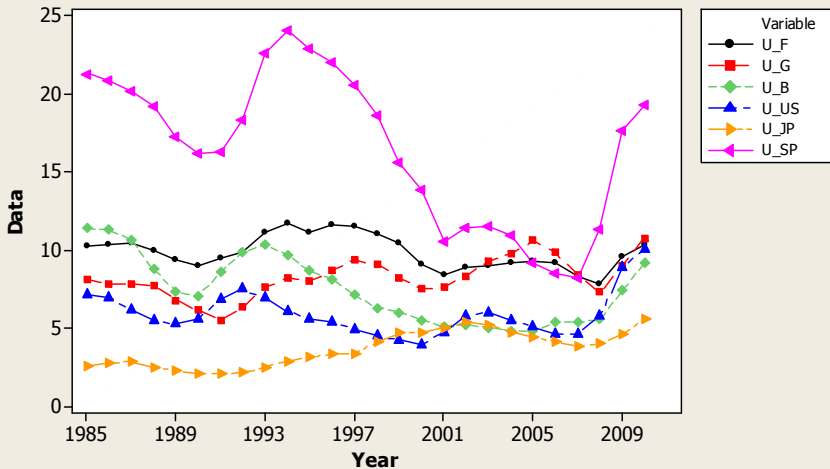
Data Source: www.imf.org

Output Gap in France, Germany, Spain, UK, US and Japan



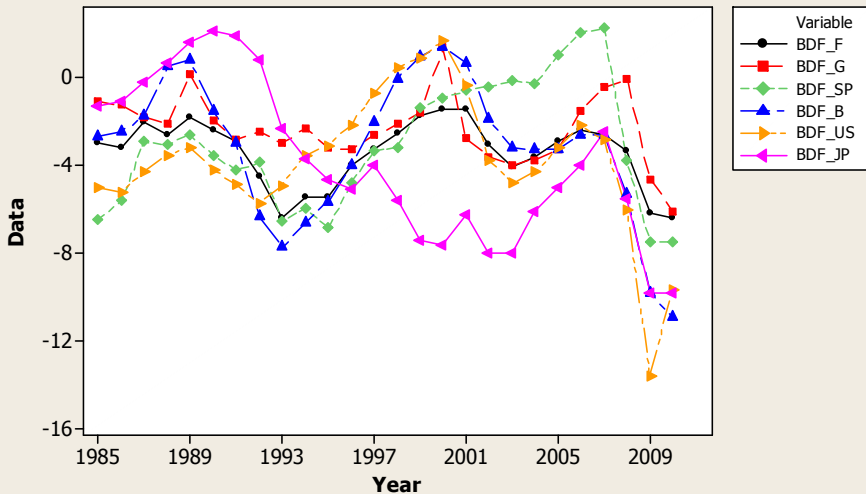
Data Source: www.imf.org
Percent of potential GDP

Unemployment Rates in France, Germany, Spain, UK, US and Japan



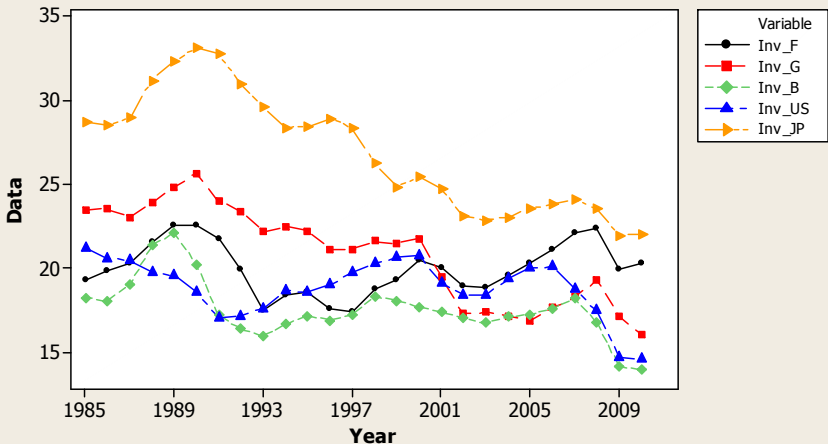
Data Source: www.imf.org

Budget Balance in France, Germany, Spain, UK, US and Japan



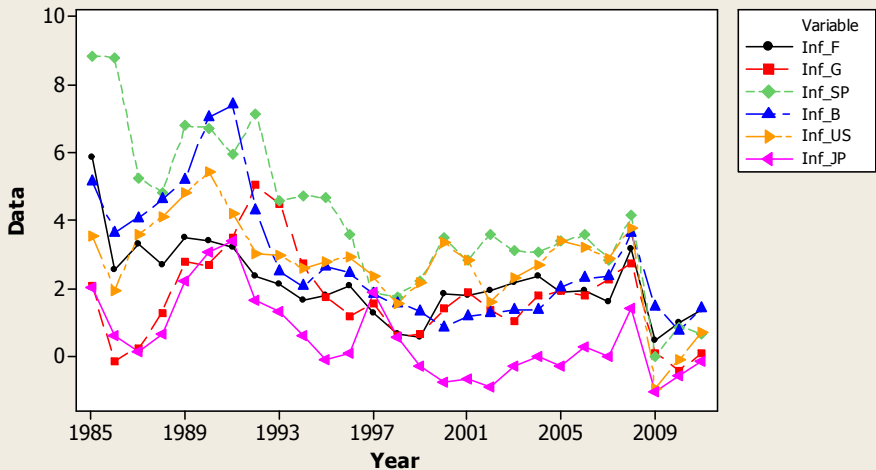
Data Source: www.imf.org

Investment Ratio in France, Germany, Spain, UK, US and Japan



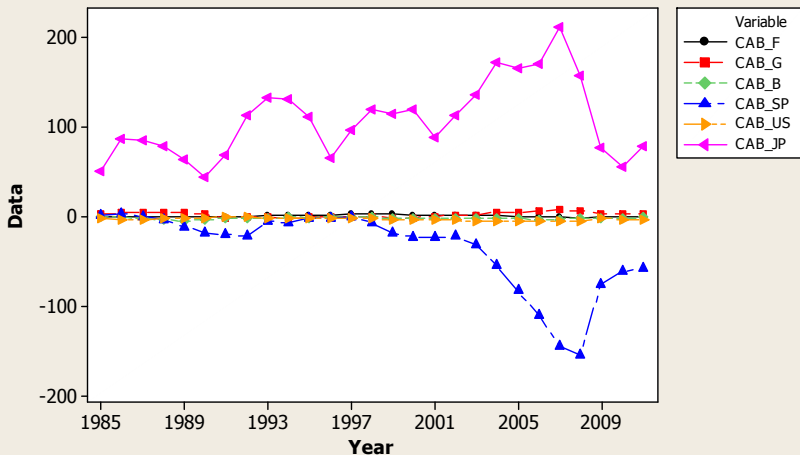
Data Source: www.imf.org
Percent of GDP

Inflation in France, Germany, Spain, UK, US and Japan



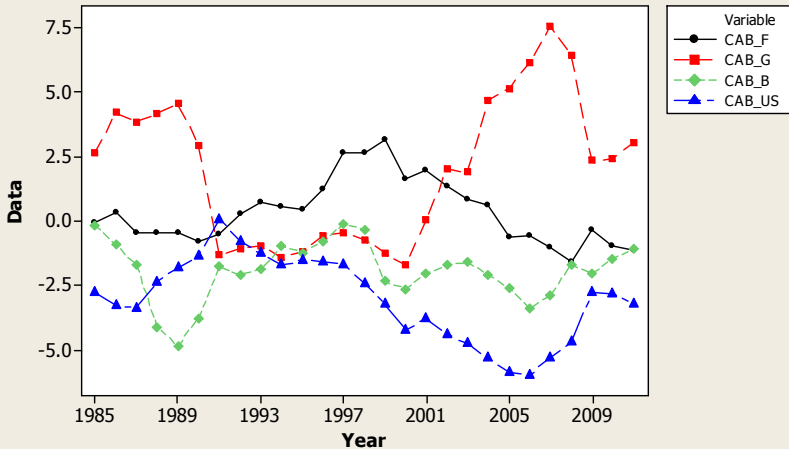
Data Source: www.imf.org
Percent of GDP

Current Account Balance in France, Germany, Spain, UK, US and Japan



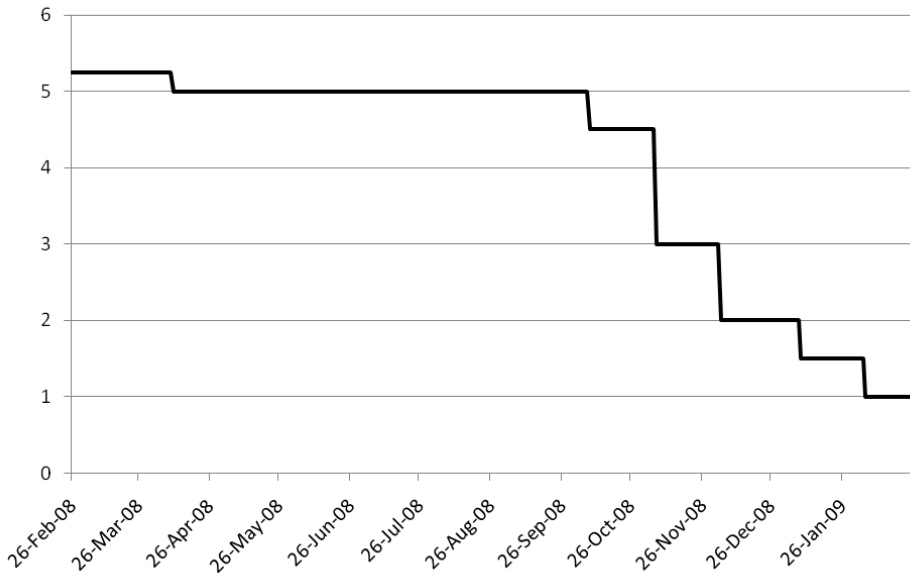
Data Source: www.imf.org

Current Account Balance in France, Germany, Spain, UK, US and Japan

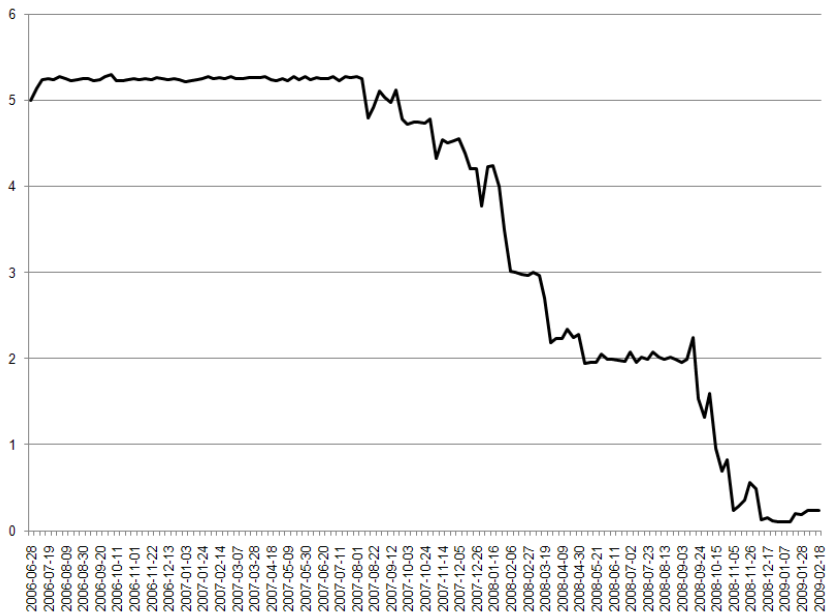


Data Source: www.imf.org

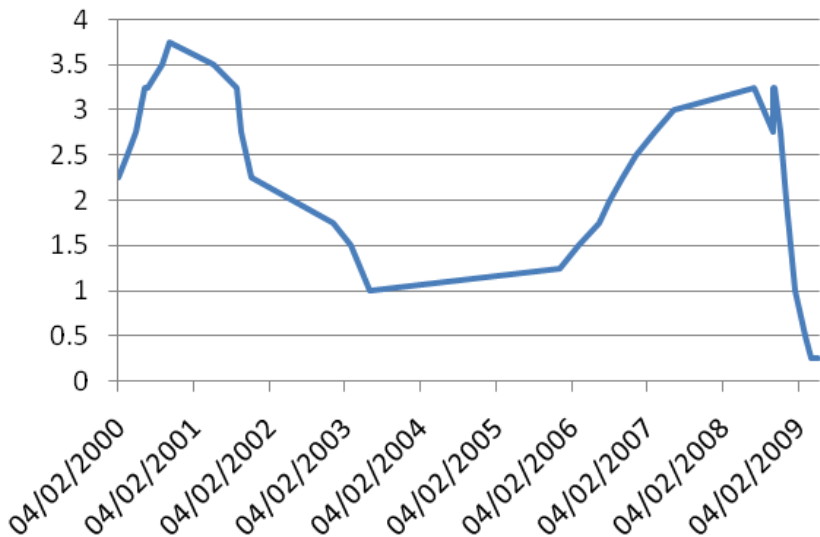
Daily Bank Rate of the Bank Of England



Federal Fund Rate in the US, 2008-2009

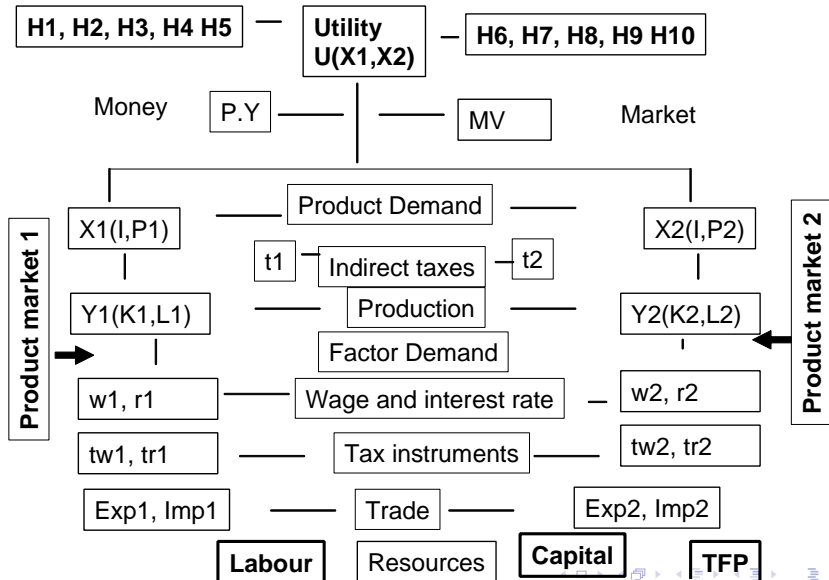


Deposit Facility of ECB



- Governments have attempted to stimulate the aggregate demand by expanding the public expenditure and cutting down the taxes despite risk of accumulation of public debt.
- Central banks have reduced the basic interest rate to a record low since the beginning of central banking (on January 2009 Federal fund rate is zero, BOE bank rate is 0.1 percent, ECB 1..5, BOE .25) in order to expand the liquidity in the system.

Open Economy Two Sector Multi-household General Equilibrium Tax Model with Money



Households

Utility of individual household h given by u^h . It shares η^h of aggregate utility U

$$u^h = \eta^h \cdot U \quad (1)$$

demand for X_1 by household h

$$x_1^h = \eta^h \cdot X_1 \quad (2)$$

demand for X_2 by household h

$$x_2^h = \eta^h \cdot X_2 \quad (3)$$

Total labour supply of type L_1 of household h

$$L_1^h = \theta^h \cdot L_1 \quad (4)$$

Total labour supply of type L_2 of household h

$$L_2^h = \theta^h \cdot L_2 \quad (5)$$

Aggregate of labour demand of type L_1

$$L_1 = \sum_{h=1}^H L_1^h \quad (6)$$

Aggregate of labour demand of type L_2

$$L_2 = \sum_{h=2}^H L_2^h \quad (7)$$

Aggregate of capital demand of type K_1

$$K_1 = \sum_{h=1}^H K_1^h \quad (8)$$

Aggregate of capital demand of type K_2

$$K_2 = \sum_{h=2}^H K_2^h \quad (9)$$

Aggregate income is the total of the household income

$$I = \sum_{h=1}^H I^h \quad (10)$$

$$U = X_1^{\alpha_1} X_2^{1-\alpha_1} \quad (11)$$

Demand for both goods X_1 is derived from the standard optimality conditions as

$$X_1 = \frac{\alpha_1 \cdot I}{P_1 (1 + t_1)} \quad (12)$$

Demand for both goods X_2 is derived from the standard optimality conditions as

$$X_2 = \frac{(1 - \alpha_1) \cdot I}{P_2 (1 + t_2)} \quad (13)$$

Technology of production of good 1 Y_1 is

$$Y_1 = L_1^\beta K_1^{1-\beta} \quad (14)$$

Technology of production of good 1 Y_1 is

Optimal Conditions

Optimal conditions for firm 1 is given by

$$\frac{\beta}{(1-\beta)} \frac{K_1}{L_1} = \frac{w_1(1-tw_1)}{r_1(1-tr_1)} \quad (16)$$

Optimal conditions for firm 2 is given by

$$\frac{\gamma}{(1-\gamma)} \frac{K_2}{L_2} = \frac{w_2(1-tw_2)}{r_2(1-tr_2)} \quad (17)$$

Resource of firm 1 is

$$C_1 = w_1L_1 + r_1K_1 \quad (18)$$

Resource of firm 2 is

$$C_2 = w_2L_2 + r_2K_2 \quad (19)$$

Budget Constraints

Households receive income from labour and capital income and from transfers and net borrowing as:

$$I = w_1 L_1 + r_1 K_1 + w_2 L_2 + r_2 K_2 + TR + B \quad (20)$$

Market clearing conditions in goods market are

$$X_1 = Y_1 - G_1 - (EX_1 - IMP_1) \quad (21)$$

$$X_2 = Y_2 - G_2 - (EX_2 - IMP_2) \quad (22)$$

Labour market clearing implies

$$L_1 + L_2 = \bar{L} \quad (23)$$

Capital market clearing implies

Quantity theory of money implies

$$P.Y = MS.V \quad (26)$$

Initial reserve of the banking system

$$R = C + D0 \quad (27)$$

Currency in circulation

$$C = \phi.R \quad (28)$$

Initial deposit

$$D0 = (1 - \phi) \cdot R \quad (29)$$

Total deposit

$$TD = \frac{D0}{rr} \quad (30)$$

Aggregate money supply in the economy:

$$MS = C + TD \quad (31)$$

Government Sector

Government collects revenue from direct taxes on capital and labour income and indirect tax on commodities as:

$$RV = t_1.P_1.X_1 + t_2.P_2.X_2 + t_{r1}.r_1.K_1 + t_{w1}.w_1.L_1 + t_{r1}.r_2.K_2 + t_{w2}.w_2.L_2 + TR + B \quad (32)$$

Aggregate government expenditure

$$G = G_1 + G_2 \quad (33)$$

Sectoral government expenditure on sector 1 goods

$$G_1 = g_1.RV \quad (34)$$

Sectoral government expenditure on sector 2 goods

$$G_2 = g_2.RV \quad (35)$$

Budget deficit

External Sector

Exports from sector 1

$$EX_1 = e_1 \cdot Y_1 \quad (37)$$

Exports from sector 2

$$EX_2 = e_2 \cdot Y_2 \quad (38)$$

Imports from sector 1

$$IMP_1 = m_1 \cdot Y_1 \quad (39)$$

Imports from sector 2

$$IMP_2 = m_2 \cdot Y_2 \quad (40)$$

Exchange rate

$$ER = \frac{P_1 \cdot EX_1 + P_2 \cdot EX_2}{PM_1 \cdot IMP_1 + PM_2 \cdot IMP_2} \quad (41)$$

Table: Preference and share parameters of households

	h_1	h_2	h_3	h_4	h_5	h_6	h_7	h_8	h_9	h_{10}
α^h	0.44	0.48	0.49	0.41	0.47	0.57	0.47	0.55	0.48	0.47
θ^h	0.02	0.03	0.04	0.05	0.06	0.08	0.11	0.15	0.20	0.25
η^h	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.08	0.09	0.57

Table: Policy and Technology Parameters

t_1	t_2	t_{w1}	t_{w2}	t_{r1}	t_{r2}	e_1	e_2	m_1	m_2	R	$g1$
0.25	0.15	0.40	0.10	0.05	0.3	0.25	0.30	0.15	0.50	100	0.25
α	β	γ	\bar{L}	\bar{K}	C_1	C_2	v	ϕ	rr	TR	$g2$
0.4	0.6	0.5	200	500	1000	800	1	0.03	0.05	0	0.1

Figure: Level of Welfare of the Household in the Lowest Income Decile

	Util_a	Util_b	Util_gm	Util_R	Util_f	Util_m	Util_fm
h1.sc1	0.792	0.726	0.385	0.449	0.556	0.556	0.556
h1.sc2	0.792	0.792	0.556	0.556	0.556	0.556	0.556
h1.sc3	0.784	0.743	0.541	0.556	2.197	0.556	0.540
h1.sc4	0.777	0.695	0.526	0.556	2.197	0.556	0.523
h1.sc5	0.770	0.647	0.512	0.556	2.197	0.556	0.506
h1.sc6	0.762	0.601	0.499	0.556	2.197	0.556	0.489
h1.sc7	0.755	0.556	0.487	0.556	2.197	0.556	0.473
h1.sc8	0.748	0.512	0.476	0.556	2.197	0.556	0.456
h1.sc9	0.740	0.469	0.466	0.556	2.197	0.556	0.439
h1.sc10	0.733	0.426	0.457	0.556	2.197	0.556	0.422

Figure: Level Welfare of the Household in the Highest Income Decile

	Util_a	Util_b	Util_gm	Util_R	Util_f	Util_m	Util_fm
h10.sc1	22.564	20.680	10.964	12.785	15.856	15.856	15.856
h10.sc2	22.564	22.564	15.856	15.856	15.856	15.856	15.856
h10.sc3	22.353	21.163	15.414	15.856	62.606	15.856	15.380
h10.sc4	22.142	19.794	14.996	15.856	62.606	15.856	14.903
h10.sc5	21.932	18.454	14.603	15.856	62.606	15.856	14.426
h10.sc6	21.722	17.142	14.234	15.856	62.606	15.856	13.949
h10.sc7	21.513	15.856	13.891	15.856	62.606	15.856	13.471
h10.sc8	21.304	14.597	13.574	15.856	62.606	15.856	12.993
h10.sc9	21.096	13.362	13.283	15.856	62.606	15.856	12.515
h10.sc10	20.888	12.151	13.020	15.856	62.606	15.856	12.036

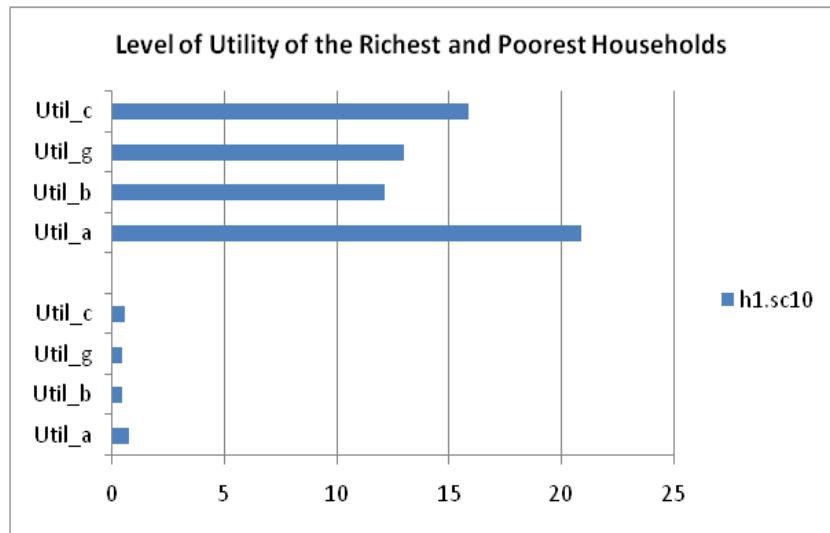


Figure: Baseline Model and Sensitivity of aggregate Preference (Alpha)

	sc1	sc2	sc3	sc4	sc5	sc6	sc7	sc8	sc9	sc10
X1	116.26	116.26	122.02	127.77	133.52	139.26	145.01	150.75	156.49	162.22
X2	190.35	190.35	184.06	177.78	171.49	165.20	158.91	152.62	146.32	140.02
L1	88.89	88.89	92.99	97.06	101.10	105.11	109.09	113.04	116.97	120.86
L2	111.11	111.11	107.01	102.94	98.90	94.89	90.91	86.96	83.03	79.14
K1	173.91	173.91	183.41	192.98	202.64	212.39	222.22	232.14	242.15	252.25
K2	326.09	326.09	316.59	307.02	297.36	287.61	277.78	267.86	257.85	247.75
P1	6.19	6.19	6.20	6.20	6.20	6.20	6.21	6.21	6.21	6.21
P2	5.67	5.67	5.67	5.67	5.67	5.67	5.66	5.66	5.66	5.66
R1	2.30	2.30	2.18	2.07	1.97	1.88	1.80	1.72	1.65	1.59
R2	1.23	1.23	1.26	1.30	1.35	1.39	1.44	1.49	1.55	1.62
W1	6.75	6.75	6.45	6.18	5.94	5.71	5.50	5.31	5.13	4.96
W2	3.60	3.60	3.74	3.89	4.04	4.22	4.40	4.60	4.82	5.06
UTIL	156.28	156.28	154.87	153.73	152.84	152.20	151.80	151.64	151.73	152.05
ALPHA	0.40	0.42	0.44	0.46	0.48	0.50	0.52	0.54	0.56	0.58

Dynamics in Cash in Advance Economy

problems of the household now becomes:

$$\max \sum_{t=0}^{\infty} [\beta^t U(C_t) - V(N_t)] \quad (42)$$

Subject to the technology constraint:

$$Y_t = zN_t \quad (43)$$

Cash in advance constraint

$$P_t C_t + q_t B_{t+1} + P_t s_t X_{t+1} + P_t T_t = M_t + B_t + P_t X_t \quad (44)$$

where $P_t C_t$ is consumption expenditure P_t price of goods, C_t consumption, B_{t+1} is the amount of nominal bonds q_t is the price of nominal bonds, X_{t+1} real bonds s_t prices of real bonds, T_t lump sum tax payment, M_t money.

Cash in Advance Economy

Budget constraint of the consumer:

$$P_t C_t + q_t B_{t+1} + P_t s_t X_{t+1} + P_t T_t + M_{t+1} = M_t + B_t + P_t X_t + P_t z N_t \quad (45)$$

Government's budget constraint:

$$\bar{M}_{t+1} - \bar{M}_t = -P_t T_t \quad (46)$$

Assuming a constant rate of money growth α and $\bar{M}_{t+1} = \alpha \bar{M}_t$

$$\alpha \bar{M}_t = -P_t T_t \quad (47)$$

Cash in Advance Economy

$$p_t C_t + q_t b_{t+1} (1 + \alpha) + p_t s_t X_{t+1} + p_t T_t = m_t + b_t + p_t X_t \quad (48)$$

and

$$p_t C_t + q_t b_{t+1} (1 + \alpha) + p_t s_t X_{t+1} + p_t T_t + m_{t+1} (1 + \alpha) = m_t + b_t + p_t X_t + \quad (49)$$

The representative agent chooses $C_t, N_t, b_{t+1}, X_{t+1}, m_{t+1}$ from $t = 0, 1, 2, \dots$ to ∞ .

Bellman value function for this problem is:

$$v(m_t, b_t, X_t, p_t, q_t, s_t) = \max_{C_t, N_t, b_{t+1}, X_{t+1}, m_{t+1}} \sum_{t=0}^{\infty} [\beta^t U(c_t) - V(N_t)] + \beta v(m_{t+1}, \dots) \quad (50)$$

The Lagrange multiplier of this problem is:

$$\begin{aligned} & \mathcal{L}(C_t, N_t, b_{t+1}, X_{t+1}, m_{t+1}, \lambda_t, \mu_t) & (51) \\ = & \sum_{t=0}^{\infty} [\beta^t U(C_t) - V(N_t)] \\ & + \lambda_t [m_t + b_t + p_t X_t - p_t C_t - q_t b_{t+1} (1 + \alpha) - p_t s_t X_{t+1} - p_t T_t] \\ & + \mu_t \left[\begin{array}{l} m_t + b_t + p_t X_t + p_t z N_t - p_t C_t \\ - q_t b_{t+1} (1 + \alpha) - p_t s_t X_{t+1} - p_t T_t - m_{t+1} (1 + \alpha) \end{array} \right] \end{aligned}$$

First Order Conditions in Cash in Advance Economy

First order conditions for optimisations:

$$C_t : U'(C_t) - (\lambda_t + \mu_t) p_t = 0 \quad (53)$$

$$N_t : V'(N_t) + \mu_t p_t z = 0 \quad (54)$$

$$b_{t+1} : -q_t (1 + \alpha) (\lambda_t + \mu_t) + \beta \frac{\partial v}{\partial b_{t+1}} = 0 \quad (55)$$

$$X_{t+1} : -p_t s_t (\lambda_t + \mu_t) + \beta \frac{\partial v}{\partial X_{t+1}} = 0 \quad (56)$$

$$m_{t+1} : -(1 + \alpha) \mu_t + \beta \frac{\partial v}{\partial m_{t+1}} = 0 \quad (57)$$

Solutions of the Cash in Advance Economy

By envelop theorem:

$$\frac{\partial v}{\partial b_t} = (\lambda_t + \mu_t) \quad (58)$$

$$\frac{\partial v}{\partial X_t} = p_t (\lambda_t + \mu_t) \quad (59)$$

$$\frac{\partial v}{\partial m_t} = (\lambda_t + \mu_t) \quad (60)$$

Combining above conditions:

$$-\frac{q_t (1 + \alpha) U'(C_t)}{p_t} + \beta \frac{U'(C_{t+1})}{p_{t+1}} = 0 \quad (61)$$

$$\begin{aligned} -sU'(C_t) + \beta U'(C_{t+1}) &= 0 \\ -\frac{(1 + \alpha) V'(N_t)}{p_t z} + \beta \frac{U'(C_{t+1})}{p_{t+1}} &= 0 \end{aligned}$$

Solutions of the Cash in Advance Economy

Market clearing conditions

$$m_t = 1, b_t = 0, X_t = 0 \quad (62)$$

Putting these equilibrium conditions in the budget constraint (in cash advance model all money is held for consumption)

$$p_t C_t = 1 + \alpha \quad (63)$$

All output is demanded for consumption

$$C_t = z N_t \quad (64)$$

Putting steady state conditions $C_t = C, N_t = N, p_t = p, q_t = q, s_t = s$, in optimal functions

$$q_t = \frac{\beta}{1 + \alpha} \quad (65)$$

Solutions of the Cash in Advance Economy

$$s = \beta \quad (66)$$

$$(1 + \alpha) V'(N_t) - \beta z U'(zN) = 0 \quad (67)$$

$$p = \frac{1 + \alpha}{C} \quad (68)$$

$$C = zN \quad (69)$$

Lagrange multipliers

$$\begin{aligned} \lambda &= \frac{U'(C)}{p} - \mu = \frac{CU'(C)}{1 + \alpha} - \frac{V'(N)}{pz} = \frac{CU'(C)}{1 + \alpha} - \frac{\beta}{1 + \alpha} \frac{U'(C)}{p} \\ &= \frac{CU'(C)}{1 + \alpha} \left(1 - \frac{\beta}{1 + \alpha} \right) = \frac{CU'(C)}{1 + \alpha} (1 - q) \end{aligned} \quad (70)$$

Equilibrium in Cash in Advance Economy

Nominal interest rate

$$R = \frac{1}{q} - 1 = \frac{1 + \alpha}{\beta} - 1 \quad (71)$$

Real interest rate equals the subjective rate of time preference:

$$r = \frac{1}{s} - 1 = \frac{1}{\beta} - 1 \quad (72)$$

Inflation rate

$$i = \frac{P_{t+1}}{P_t} - 1 = \frac{P_{t+1}\bar{M}_{t+1}}{p_t M_t} - 1 = 1 + \alpha - 1 = \alpha \quad (73)$$

Fisher equation

$$1 + r = \frac{1 + R}{1 + i} = \frac{1 + \alpha}{\beta} \div 1 + \alpha = \frac{1}{\beta} \quad (74)$$

Employment and Welfare in Cash in Advance Economy

Impact of growth rate of money supply on employment is obtained by total differentiation

$$\frac{dN}{d\alpha} = \frac{-V''}{(1 + \alpha) V'' - \beta z^2 U''} < 0 \quad (75)$$

From the equilibrium condition $Y = C = zN$ output, consumption also decline as inflation distorts the intertemporal decisions. Period t labour income is eroded when it is consumed in period $t + 1$.

The optimal rate inflation can be solved from the social planner's problem

$$\max_{\{C_t, N_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} [\beta^t U(C_t) - V(N_t)] \quad (76)$$

subject to $Y_t = C_t = zN_t$.

Implementation of the Cash in Advance Mode

- Transitional dynamics of above models is analytically less tractable.
- A simple version of the CA model is implemented for two different scenarios for finding the transitional dynamics of the model

Table: Parameters of CA Model

Parameters	δ	α	β	g_y	L_0	v	g_m	z	M_0
Scenario 1	0.05	0.5	0.95	0.01	100	1	0.01	(0.1, 0.1)	100
Scenario 2	0.05	0.4	0.99	0.02	100	5	0.02	(0.1, 0.1)	100

- Financial crises occur because of shift in the investor and consumer confidences, change in perceptions and beliefs and technological shocks that hit the system.
- The impact of such changes can be very sudden which affect the velocity of circulation money, technological progress, discount factors or the belief in the underlying growth rate of the economy.
- This impacts on prices, trend of output, prices and other features of the economy.
- Path of model variables implied by the solutions are given in the pdf files in the appendix. Initial financial crises has adverse impact on investment and that lowers the capital formation, output and consumption as shown in the following diagramme.

Implementation of the Money in Utility Function Mode

I

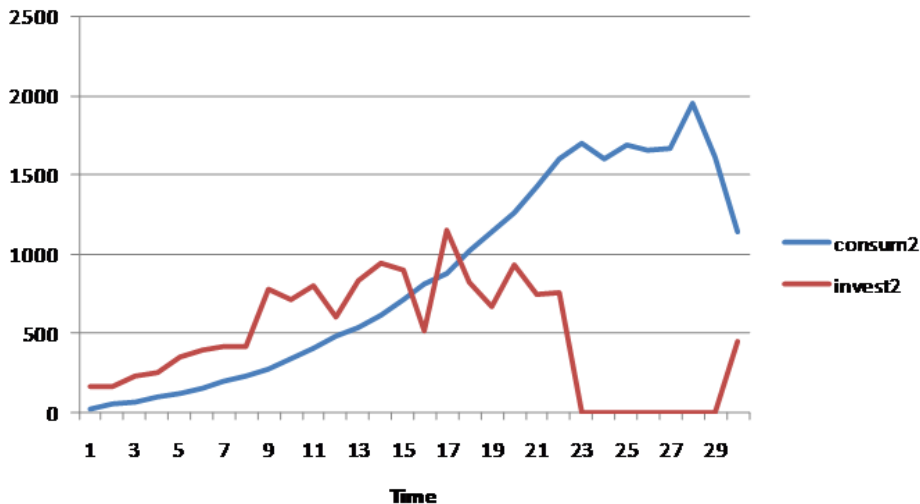
Table: Parameters of MIU Model

Parameters	δ	α	β	g_y	L_0	ν	g_m	z	M_0
Economy 1	0.05	0.5	0.95	0.01	100	1	0.02	(0.1, 0.1)	100
Economy 2	0.05	0.4	0.99	0.02	100	5	0.02	(0.1, 0.1)	100

Detailed time path of variables y_t, k_t, c_t, p_t are shown in series of diagram at the end.

Underlying factors for such fluctuations are the moral hazard and adverse selection between lenders and borrowers or the public or the private sectors or the shocks to the technology or sudden shift in the belief.

Consumption and Investment in Economy 2



- Analysis of results of all economic activities is the welfare of the households from the consumption of goods and services reveals how financial crises impacts their prospects.
- Producers face lower stock of capital and to combine labour and can supply less of those goods and have to pay more for factors.
- Direct and indirect taxes distort choices of households.

The solution of the optimal planner is characterised by

$$zU'(zN^*) - V'(N^*) = 0 \quad (77)$$

where N^* is optimal employment. The optimal growth rate of money supply is given by the Friedman $\alpha = \beta - 1$ where the nominal interest rate is zero, the real interest rate is $r = \frac{1}{\beta} - 1$. Cash in advance constraint does not bind $\alpha = \beta - 1$ because $\lambda = 0$. Rate of return in all assets are equal in equilibrium.

Money in Utility Function

$$\max W = \sum_{t=0}^{\infty} [\beta^t U(c_t, m_t)] \quad (78)$$

Subject to the technology constraint:

$$Y_t = F(K_t, N_t) \quad (79)$$

Under constant returns to scale $y_t = f(k_t)$ where $y_t = \frac{Y_t}{N_t}$ and $k_t = \frac{K_t}{N_t}$.

Cash in advance constraint

$$Y_t + \tau_t N_t + (1 - \delta) K_{t-1} + \frac{M_{t-1}}{P_{t-1}} = C_t + K_t + \frac{M_t}{P_t} \quad (80)$$

Money in Utility Function

In per capita terms

$$\omega_t = f(k_{t-1}) + \tau_t + \left(\frac{1-\delta}{1+n}\right) k_{t-1} + \frac{m_{t-1}}{(1+\pi_t)(1+n)} = c_t + k_t + m_t \quad (81)$$

The dynamic program of this problem is:

$$V(\omega_t) = u(c_t, m_t) + \beta V(\omega_{t+1}) \quad (82)$$

$$V(\omega_t) = \max \left\{ u(c_t, m_t) + \beta V \left[f(\omega_t - c_t - m_t) + \tau_{t+1} + \left(\frac{1-\delta}{1+n}\right) (\omega_t - c_t - m_t) \right] \right\} \quad (83)$$

Money in Utility Function

The Lagrange multiplier of this problem is:

$$\mathcal{L}(c_t, m_t, \lambda_t) = \sum_{t=0}^{\infty} [\beta^t u(c_t, m_t)] + \sum_{t=0}^{\infty} \lambda_t \left[f(\omega_t - c_t - m_t) + \tau_{t+1} + \left(\frac{1-\delta}{1+n} \right) (\omega_t - c_t - m_t) + \frac{r}{(1+\pi_{t+1})} \right]$$

where λ_t is the lagrange multipliers.

First order conditions for optimisations:

$$c_t : u_c(c_t, m_t) - \beta \left[f_k(k_t) + \left(\frac{1-\delta}{1+n} \right) \right] V_\omega(\omega_{t+1}) = 0 \quad (85)$$

Here marginal utility of holding capital $\beta \left[f_k(k_t) + \left(\frac{1-\delta}{1+n} \right) \right] V_\omega(\omega_{t+1})$ should equal the marginal utility of consumption $u_c(c_t, m_t)$.

Optimality in Money in Utility Function Model

Transversality conditions

$$\lim_{t \rightarrow \infty} \beta^t \lambda_t k_t = 0; \lim_{t \rightarrow \infty} \beta^t \lambda_t m_t = 0 \quad (87)$$

By envelop theorem:

$$\lambda_t = V_{\omega}(\omega_t) = u_c(c_t, m_t) \quad (88)$$

This condition can be inserted into the first order condition to get

$$u_m(c_t, m_t) + \frac{\beta u_c(c_{t+1}, m_{t+1})}{(1 + \pi_{t+1})(1 + n)} = u_c(c_t, m_t) \quad (89)$$

Optimality in Money in Utility Function Model

By constant returns to scale assumption

$$r^k k + w = f_k k + (f(k) - f_k k) = f(k)$$

Consider a steady state with $n = 0$. and

$V_\omega(\omega_t) = V_\omega(\omega_{t+1}) = V_\omega(\omega^{ss})$. From the first first order conditions
 $1 - \beta [f_k(k^{ss}) + (1 - \delta)] = 0$

$$f_k(k^{ss}) + (1 - \delta) = \frac{1}{\beta}$$

Assuming a Cobb-Douglas production function $f(k) = k^\alpha$ this condition
converts to $\alpha k^{\alpha-1} + (1 - \delta) = \frac{1}{\beta}$

Solutions of Money in Utility Function Model

$$k^{ss} = \left[\frac{\alpha\beta}{1 + \beta(1 - \delta)} \right]^{\frac{1}{1-\alpha}} \quad (90)$$

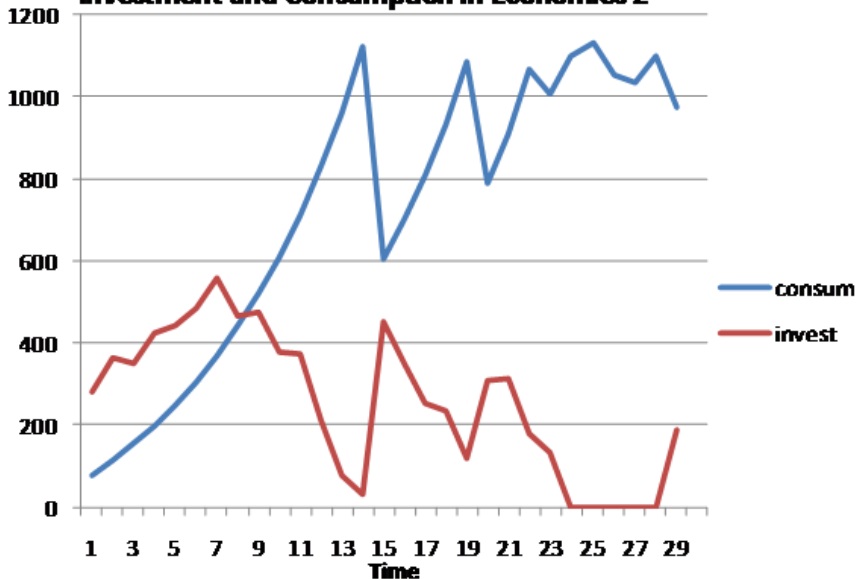
Consumption

$$c^{ss} = f(k^{ss}) - \delta k^{ss} = \left[\frac{\alpha\beta}{1 + \beta(1 - \delta)} \right]^{\frac{\alpha}{1-\alpha}} - \delta \left[\frac{\alpha\beta}{1 + \beta(1 - \delta)} \right]^{\frac{1}{1-\alpha}} \quad (91)$$

Steady state inflation rate equals growth rate of money supply

$$\frac{\Delta m^{ss}}{m^{ss}} = \frac{\theta^{ss} - \pi^{ss}}{(1 + \pi^{ss})} = 0$$

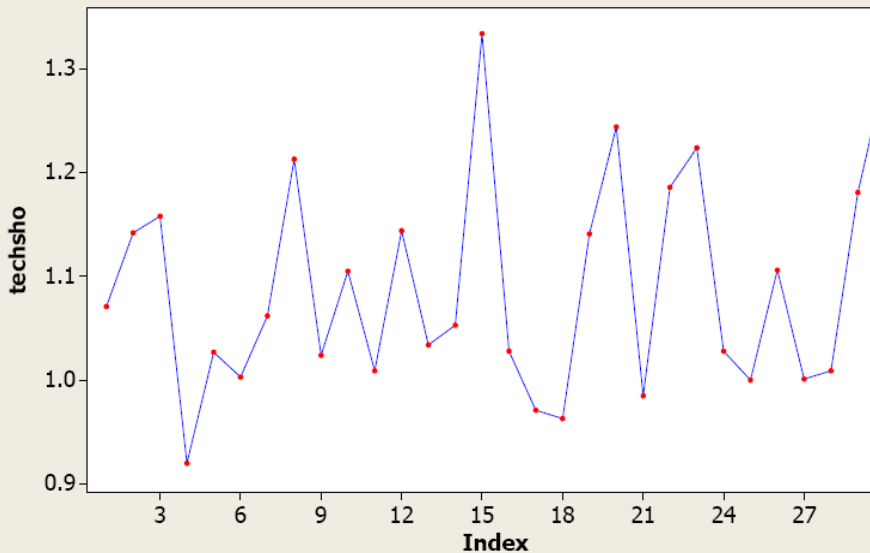
Investment and Consumption in Economies 2



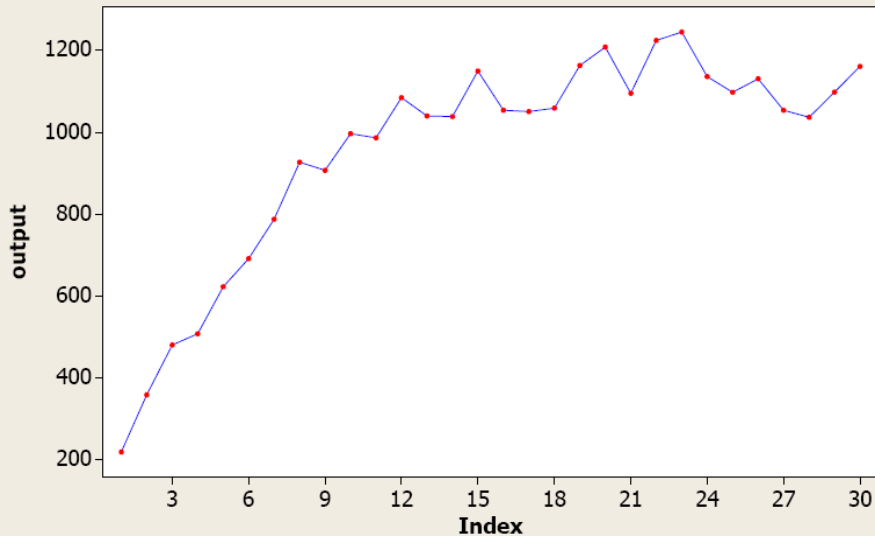
Cash in Advance Model



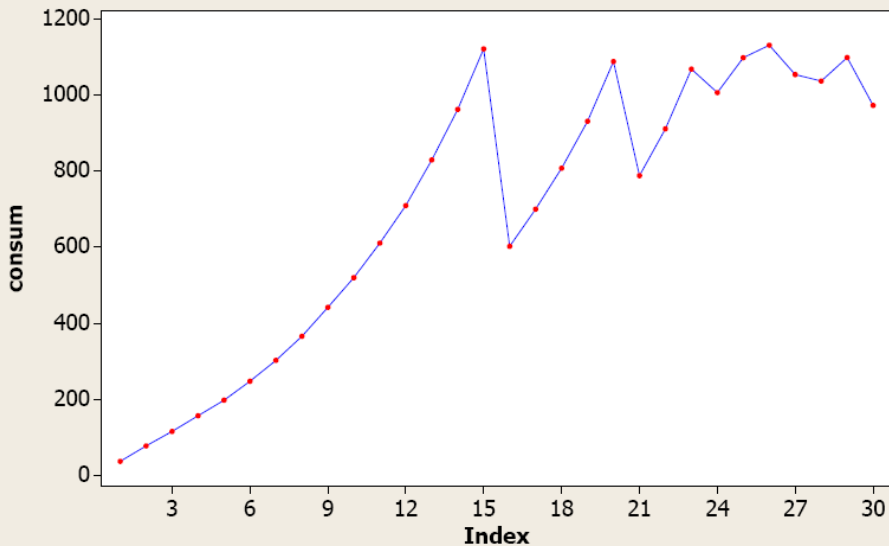
Cash in Advance Model



Money in Utility Function Model



Money in Utility Function Model



Conclusion

- Impact of fiscal and monetary policies are assessed in the an open economy two sector multi-household general equilibrium tax model with money.
- There is alarming gap in the distribution of income among households which none of the stabilisation policies could possibly address. Impacts of fiscal expansions are positive for all categories of households but the gains are much higher for household in the upper income group than for the households in the bottom income group despite claim of the government to help out to those with the least means..
- Model results show that demand, output, employment are sensitive to the consumer preference and confidences and sectoral shift in the production technology and impacts vary across households.
- Simulations result show that monetary policy is less effective in promoting output, employment and other economic policies than the fiscal policy.
- Relative price based optimal allocation mechanisms and redistribution provide several hints on how the complex mechanist of rellacation and redistribution functions occur in a real economy.

-  Altig D E, C.T. Carlstrom and K.L. Lansing (1995) Computable General Equilibrium Models and Monetary Policy Advice, Journal of Money Credit and Banking, vol. 27, no. 4, Nov., pp.1472-1493.
-  Arestis Philip and Panicos Demetriades (1997) Financial Development and Economic Growth: Assessing the Evidence The Economic Journal, Vol. 107, No. 442 :May,, pp. 783-799
-  Bacchetta Philippe (1992) Liberalization of Capital Movements and of the Domestic Financial System Economica, New Series, Vol. 59, No. 236 Nov., pp. 465-474
-  Bank of England (1999) The Transmission Mechanism of Monetary Policy, www.bankofengland.co.uk
-  Bank of England (2001) Financial Stability Review, www.Bankofengland.co.uk.
-  Banerji S and P Basu (2009) Universal Banking and Equity Risk Premium, April; Paper presented in CEP Seminar in Hull Business School.
-  Bolnick Bruce R. (1987) Financial Liberalization with Imperfect Markets:

-  Mayer, Christopher, Karen Pence, and Shane M. Sherlund. (2009). "The Rise in Mortgage Defaults." *Journal of Economic Perspectives*, 23(1): 27–50.
-  Friedman Milton (2005) A Natural Experiment in Monetary Policy Covering Three Episodes of Growth and Decline in the Economy and the Stock Market, *The Journal of Economic Perspectives*, Vol. 19, No. 4 :Autumn,, pp. 145-150
-  GAMS Development Corporation (1999), *GAMS: A User's Guide*, Washington DC 20007, USA.
-  Sinn H.W (2009) Risk Taking, Limited Liability and the Banking Crisis, Ifo Institute, University of Munich
-  King Mervyn (1994) Enrique Sentana and Sushil Wadhvani Volatility and Links between National Stock Markets *Econometrica*, Vol. 62, No. 4 :Jul., pp. 901-933
-  Klein Michael A.(1971) A Theory of the Banking Firm *Journal of Money, Credit and Banking*, Vol. 3, No. 2, Part 1 May, pp. 205-218
-  Krugman Paul (1979) A Model of Balance of Payment Crisis, *Journal of Money, Credit and Banking*, 11, Aug.