

Stock Flow Consistent Models

An Introduction to Theory and Technique

Session 4

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Institute for New Economic Thinking -Young Scholars Initiative
Trento Festival of Economics

Outline

1 Model INSOUT

- Matrices and equations
- 10.7.3 An increase in pure government expenditure
- 10.7.7 An exogenous increase in the rate of inflation
- Adding the Maastricht treaty

2 A Structuralist Perspective: Godin [2012]

- Motivation
- The model
- Results
- Conclusion and the way forward

3 Wrap-up

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Model with active commercial banks

Balance Sheet

	Households	Firms	Government	Central Bank	Banks	Σ
Inventories		$+IN$				$-IN$
HPM	$+H_h$			$-H$ $+A$	$+H_b$ $-A$	0
Checking deposits	$+M1_h$				$-M1$	0
Time deposits	$+M2_h$				$-M2$	0
Bills	$+B_h$		$-B$	$+B_{cb}$	$+B_b$	0
Bonds	$+BL_h \cdot p_{bL}$		$-BL \cdot p_{bL}$			0
Loans		$-L$			$+L$	0
Balance	$-V$	0	$+GD$	0	0	0
Σ	0	0	0	0	0	0

Transaction Flow Matrix

		Households	Firms		Govt.	Central Bank		Banks		Σ
			Current	Capital		Current	Capital	Current	Capital	
Consumption		$-C$	$+C$							0
Government expenditures			$+G$		$-G$					0
Δ in the value of inventories			$+IN$	$-IN$						0
Sales tax			$-T$		$+T$					0
Wages		$+WB$	$-WB$							0
Entrepreneurial profits		$+F_f$	$-F_f$							0
Bank profits		$+F_b$						$-F_b$		0
Central bank profits					$+F_{cb}$	$-F_{cb}$				0
Interest on	loans		$-r_{l-1}.L_{-1}$					$+r_{l-1}.L_{-1}$		0
	deposits	$+r_{m-1}.M2_{-1}$						$-r_{m-1}.M2_{-1}$		0
	bills	$+r_{b-1}.B_{h-1}$			$-r_{b-1}.B_{-1}$	$+r_{b-1}.B_{cb-1}$		$+r_{b-1}.B_{b-1}$		0
	bonds	$+BL_{h-1}$			$-BL_{-1}$					0
Change in the stocks of	loans			$+\Delta L$					$-\Delta L$	0
	cash	$-\Delta H_h$					$+\Delta H$		$-\Delta H_b$	0
	deposits	$-\Delta M2_h$							$+\Delta M2$	0
	bills	$-\Delta B_h$			$+\Delta B$		$-\Delta B_{cb}$		$-\Delta B_b$	0
	bonds	$-\Delta BL_h.p_{bL}$			$+\Delta BL.p_{bL}$					0
Σ		0	0	0	0	0	0	0	0	0

Behavioral equations: Firms

Pricing

$$p = (1 + \tau)(1 + \phi)NHUC \quad (10.10)$$

$$NHUC = (1 - \sigma^T)UC + \sigma^T(1 + r_l)UC_{-1} \quad (10.11)$$

$$UC = \frac{WB}{y} \quad (10.4)$$

$$\sigma^T = \sigma_0 - \sigma_1 r_l \quad (10.7)$$

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Inventories

$$in^T = \sigma^T s^e \quad (10.6)$$

$$in = in_{-1} + y - s \quad (10.14)$$

$$IN = in \cdot UC \quad (10.16)$$

$$L = IN \quad (10.17)$$

Behavioral equations: Households

Haig-Simons' disposable income and consumption

$$yd_r = \frac{YD_r}{p} - \pi \cdot \frac{V_{-1}}{p} \quad (10.26)$$

$$c = \alpha_0 + \alpha_1 \cdot yd_r^e + \alpha_2 \cdot v_{-1} \quad (10.29)$$

$$V^e = V_{-1} + (YD_r^e - C) \quad (10.33)$$

$$V_{nc}^e = V^e - H_{hd} = V^e - \lambda_c \cdot C \quad (10.35)$$

Behavioral equations: Households

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Portfolio equation

$$\begin{pmatrix} M2_d \\ B_h d \\ p_{bL} BL_d \\ M1_d \end{pmatrix} = \begin{pmatrix} +\lambda_{10} & +\lambda_{11} & -\lambda_{12} & -\lambda_{13} & -\lambda_{14} \\ +\lambda_{20} & -\lambda_{21} & +\lambda_{22} & -\lambda_{23} & -\lambda_{24} \\ +\lambda_{30} & -\lambda_{31} & -\lambda_{32} & +\lambda_{33} & -\lambda_{34} \\ +\lambda_{40} & -\lambda_{41} & -\lambda_{42} & -\lambda_{43} & +\lambda_{44} \end{pmatrix} \begin{pmatrix} 1 \\ r_m \\ r_b \\ ERr_{bL} \\ \frac{YD_r^e}{V_{nc}^e} \end{pmatrix} V_{nc}^e$$

Behavioral equations: Public sector and Banks

Government and Central Bank

$$T = S \cdot \frac{\tau}{1 + \tau} \quad (10.48)$$

$$G = p \cdot g \quad (10.49)$$

$$PSBR = G + r_{b,-1} \cdot B_{s,-1} + BL_{s,-1} - (T + F_{cb}) \quad (10.50)$$

$$\Delta B_s = PSBR + (\Delta BL_s) \cdot p_{bL} \quad (10.51)$$

$$B_{cb} = B_s - B_{hh} - B_{bd} \quad (10.57)$$

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Banks

$$BLR_N = \frac{M1_s + M2_s - L_s - H_{bd}}{M1_s + M2_s} \quad (10.67)$$

$$F_b = r_{l,-1} \cdot L_{s,-1} + r_{b,-1} \cdot B_{bd,-1} - r_{m,-1} \cdot M2_{s,-1} - r_{a,-1} \cdot A_{d,-1} \quad (10.77)$$

$$BPM = \frac{F_b + F_{b,-1}}{M1_{s,-1} + M2_{s,-1} + M1_{s,-2} + M2_{s,-2}} \quad (10.82)$$

Behavioral equations: Expectations and Inflation

Expectations

$$x^e = \epsilon \cdot x_{-1} + (1 - \epsilon) x_{-1}^e$$

$$x^e = s_{-1} \cdot (1 + RA)$$

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Inflationary forces

$$\omega^T = \left(\frac{W}{p} \right)^T = \Omega_0 + \Omega_1 \cdot pr + \Omega_2 \cdot \left(\frac{N}{N_{fe}} \right) \quad (10.84)$$

$$W = W_{-1} \left(1 + \Omega_3 \cdot \left(\omega_{-1}^T - \frac{W_{-1}}{p_{-1}} \right) \right) \quad (10.85)$$

Playing with model INSOUT

Two scenarios

- ▶ Increase in public spending from 25 to 30 (g_k)
- ▶ Increase in the target real wage (Ω_0) from -0.32549 to 0

R code: ExINSOUT.R

```
>library(PKSFC)
>insout<-sfc.eviews("gl10insout.prg","insout")
>datainsout<-simulate(insout,tolValue=10e-20)
>init<-datainsout$baseline[66,]
>insout$scenarios<-sfc.addScenario(insout,
list(c("g_k"),c("omega0")), list(c(30),c(0)), c(1960,1960),
c(2010,2010), init)
>datainsout<-simulate(insout,tolValue=10e-20)
```

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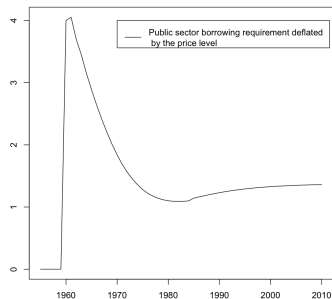
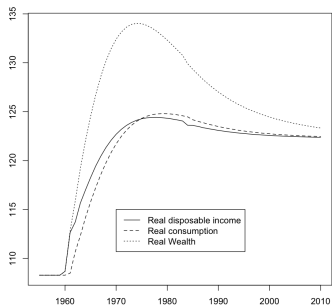
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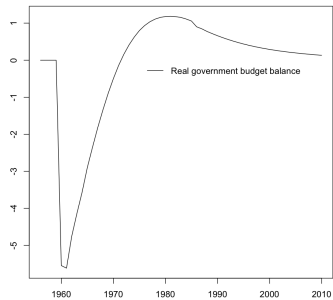
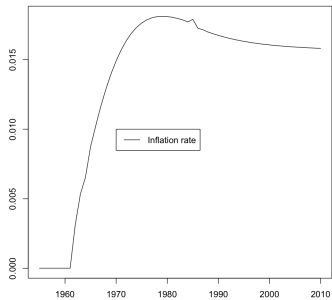
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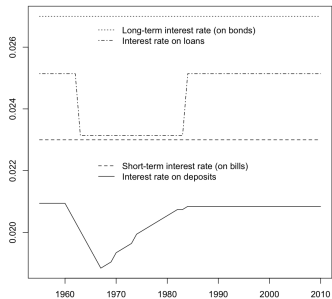
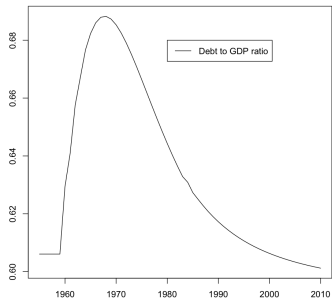
Results scenario 1 I



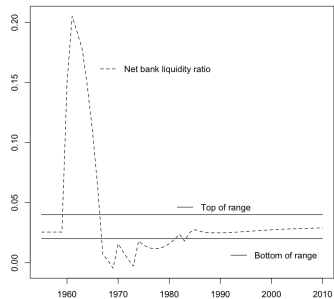
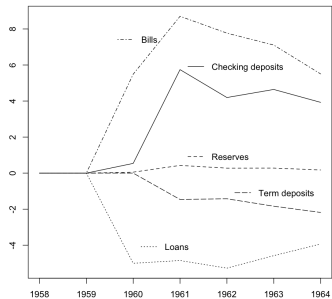
Results scenario 1 II



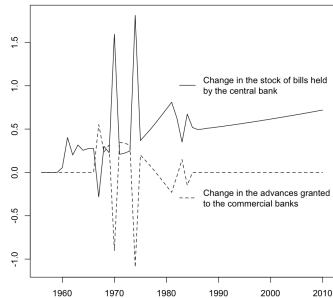
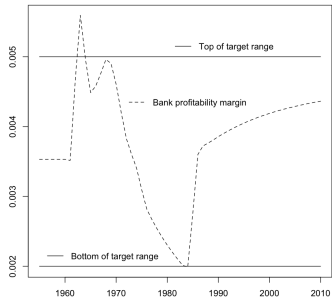
Results scenario 1 III



Results scenario 1 IV



Results scenario 1 V



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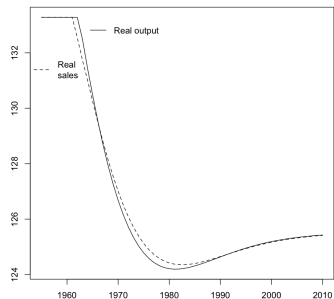
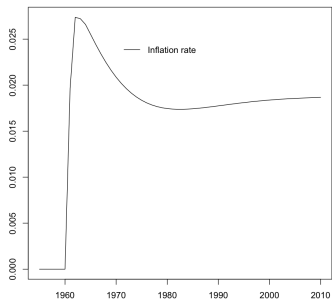
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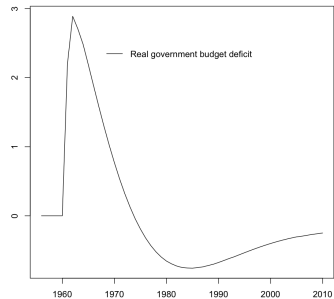
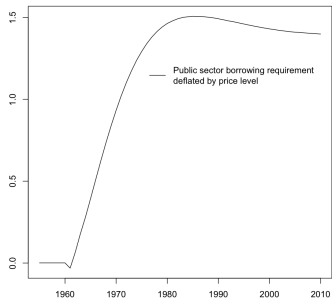
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Results scenario 2 I



Results scenario 2 II



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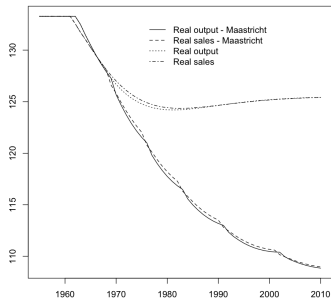
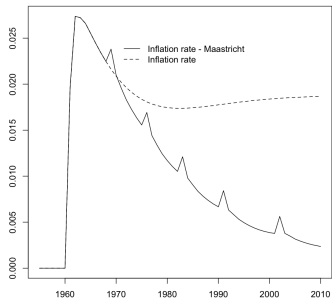
Changing the model

If the deficit is above 0.5%, then change tax rate and government spending so deficit tends to zero

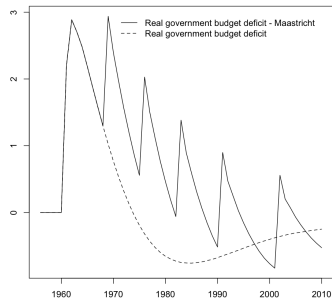
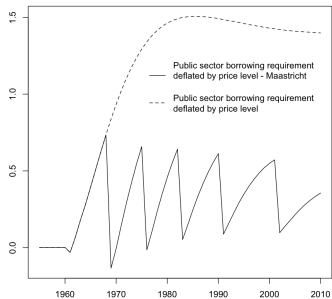
R code

```
>insout2<-sfc.addEqus(insout,list(  
list(var="z8",equ="(psbr(-1)>0.005*y)",desc="Wether there's  
a deficit or not"),  
list(var="g_k",  
equ=g_k(-1)*(1-z8)+z8*(p(-1)*g_k(-1)-z8*psbr(-1)/2)/p"),  
list(var="tau",  
equ="(tau(-1)/(1+tau(-1))+z8*psbr(-1)/(2*s(-1))) /  
(1-tau(-1)/(1+tau(-1))+z8*psbr(-1)/(2*s(-1))))")  
>insout2<-sfc.editEnds(insout2,list(  
list(var="s",init="184.5886"),  
list(var="psbr",init=0)))
```

Results scenario 2 with Maastricht I



Results scenario 2 with Maastricht II



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Motivation

post-Keynesian and Structuralists [Missaglia, 2010]

- ▶ Similitudes between PK and Structuralists theories
- ▶ Similitudes between SFC and CGE methodologies
- ▶ More complex price setting
- ▶ Endogenous labor supply

Political aspects of full employment

While it would be possible to attain full employment via fiscal policies, it would be politically impossible to maintain it, unless for a change in the capitalists institutions. It would not be accepted by "captains of industries" for the sake of their political power. JG would never find any political support, particularly in the United States where trade unions are weaker than in Europe. [Kalecki, 1971, Kriesler and Halevi, 2001/02]

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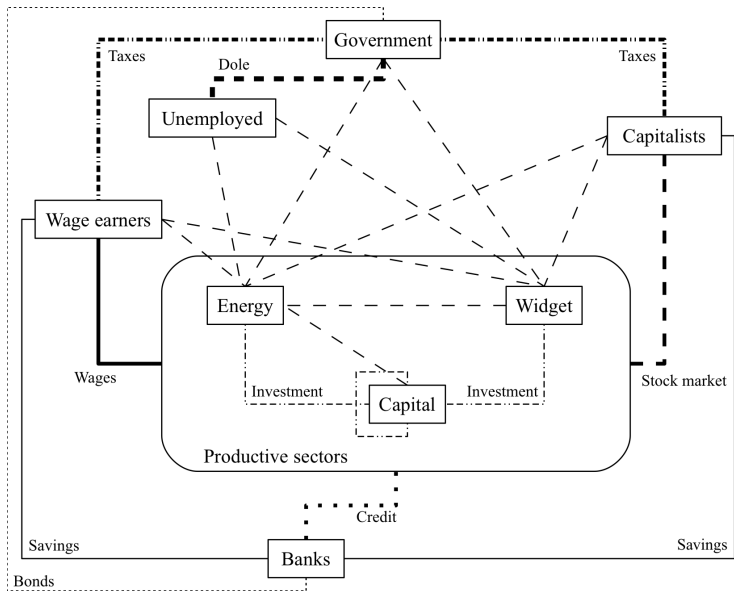
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Flow diagram of the model



Balance Sheet of the model

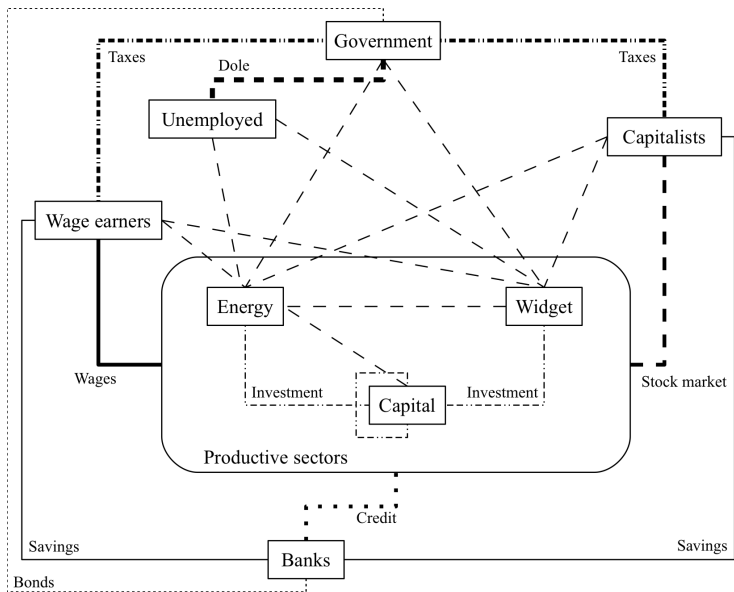
	Unempl.	Workers	Capit.	Cons.	Energy	Capital	Banks	Government	Σ
Deposits		D_w	D_{ca}				$-\sum D_x$		0
Loans				$-L_c$	$-L_e$	$-L_k$	$\sum L_x$		0
Bonds							B_s	$-B_d$	0
Capital				$k_c p_k$	$k_e p_k$	$k_k p_k$			$-pk(\sum k_x)$
Equities			$\sum E_x p_{e,x}$	$-E_c p_{e,c}$	$-E_e p_{e,e}$	$-E_k p_{e,k}$			0
Net Wealth	0	V_w	V_{ca}	V_c	V_e	V_e	0	$-B_d$	$-pk(\sum k_x)$

Transaction Flow Matrix of the model

	Unempl.	Workers	Capitalists	Consumption		Energy		Capital		Banks	Govt	Σ
				Current	Capital	Current	Capital	Current	Capital			
Consumption	$-c_{w,c}p_c$	$-c_{w,c}p_c$	$-c_{ca,c}p_c$	$p_c y_c$							$-C_{g,c}$	0
Energy	$-c_{w,e}p_e$	$-c_{w,e}p_e$	$-c_{ca,e}p_e$	$-c_{e,c}p_c$		$p_e y_e$		$-c_{k,e}p_e$			$-C_{g,e}$	0
Capital					$-I_C$		$-I_E$		$p_k y_k$	$-I_k$		0
Wages		$\sum N_w W_w$		$-N_w W_w$		$-N_w W_w$		$-N_k W_k$				0
Transfers	YD_u										$-YD_w$	0
Taxes		$-T_w$	$-T_{ca}$								T	0
Loans int.				$-i_l L_{e,-1}$		$-i_l L_{e,-1}$		$-i_l L_{k,-1}$		$i_l \sum L_{s,-1}$		0
Deposits int.		$i_d D_{w,-1}$	$i_d D_{ca,-1}$							$-i_d \sum D_{s,-1}$		0
Bonds int.										$i_b B_{s,-1}$	$-i_b B_{s,-1}$	0
Dividends			$F_k + \sum FD_x$	$-FD_c$		$-FD_e$		$-FD_k$		$-F_k$		0
Retained earn.				$-FU_c$	FU_c	$-FU_e$	FU_e	$-FU_k$	FU_k			0
Savings	0	sav_w	sav_{ca}	0	sav_e	0	sav_k	0	sav_b	0	sav_g	0
Capital Gains			$+\sum CG_x$									0
Δ Dep.		$-\Delta D_w$	$-\Delta D_{ca}$							$\sum \Delta D_x$		0
Δ Loans					ΔL_e		ΔL_e		ΔL_k	$-\sum \Delta L_s$		0
Δ Bonds										$-\Delta Bs$	ΔBs	0
Δ Equities			$-\sum \Delta(E_k p_{e,k})$	$\Delta(E_c p_{e,c})$		$\Delta(E_e p_{e,e})$		$\Delta(E_k p_{e,k})$				0
Σ	0	0	0	0	0	0	0	0	0	0	0	0

Table 1: Transaction Flow Matrix

Flow diagram of the model



Households sectors work, pay tax consume and save

Income

- ▶ Unemployed workers: dole
- ▶ Wage earners: wages (taxed) and deposits interests
- ▶ Capitalists: dividend from firms and banks (taxed), and deposits interests

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Consumption and savings

- ▶ Consumption based on real disposable income alla Haig-Simons.
- ▶ Consumption of both energy and widgets (LES)
- ▶ Consumer price index based on prices and preferences
- ▶ All income that is not consumed is saved as deposits or equities (Tobinesque portfolio choice)

Firms produce and invest

Demand, employment and investment

- ▶ Firms produce what is demanded, there are no inventories
- ▶ Employment is determined through technology (productivity and capital labor ratio) and output
- ▶ Investments is based on capacity utilisation
- ▶ Investments are financed through retained earnings, equities and loans (residual)

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Costs and prices

- ▶ Prices are mark-up on unit costs or such that market clears
- ▶ Unit costs depend on wages and energy prices
- ▶ Mark-up such that targeted net of interests return rate on capital
- ▶ Profits divided in between dividends and retained earnings (fixed shares)

Banks and Governments

Banks

- ▶ Revenues: interests from loans and bonds
- ▶ Distribute all revenues as dividends
- ▶ Always grant credit
- ▶ Balance credit and deposits with bonds (or central banks advances)

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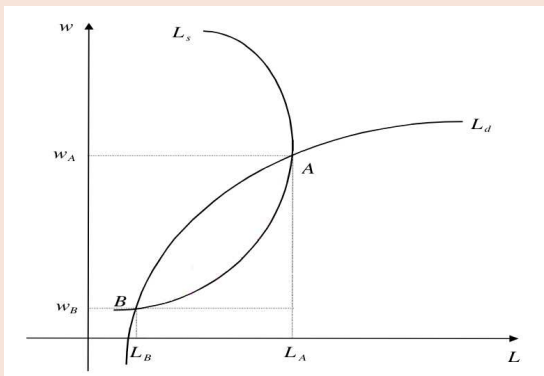
Gouvernement

- ▶ Tax income of wage earners and capitalists
- ▶ Spends on widget and energy, transfers dole to unemployed, and pays interests on bonds
- ▶ Possibility of Golden Rule

Endogenous labor supply I

Seccareccia [2004]

The JG wage would drag private sectors wages and that this would lead the economy to a low-wage full employment equilibrium



Endogenous labor supply II

Wage setting

$$w_x^T = \Omega_{0,x} + \Omega_{1,x} \log(pr_{n,x}) + \Omega_{2,x} \log(1 - u) + \dots \\ \dots + \Omega_{3,x} \left(\frac{W_{m,-1}}{cpi_{w,-1}} - \frac{W_{x,-1}}{cpi_{w,-1}} \right)$$

Labor supply

$$hours = \nu_A + \nu_B \frac{W_m}{cpi_w} \\ part = \mu_A + \mu_B \log(u_{-1}) + \mu_C \frac{W_m}{cpi_w} \\ LF = Pop.part, \quad N = \frac{y}{pr.hours}, \quad u = \frac{N}{LF}$$

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Simulations I

KDS vs PT

Demand shocks: Keynesian Demand Spur (KDS) vs Poverty Targeting (PT), targeted 3% increase in government spending.

- ▶ KDS: increase in government expenditures, no change in "preferences"
- ▶ PT: increase in dole, no structural/social impact

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KDS vs PT

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Scenarios:

- 1 No excess demand
- 2 Excess demand in one or more sector(s)
- 3 Balanced budget
- 4 Endogenous labor supply

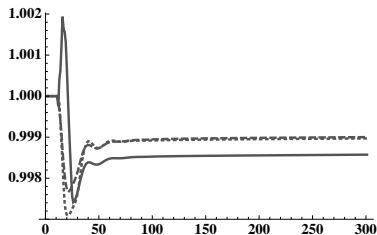
The case of excess demand I

Market clearing prices

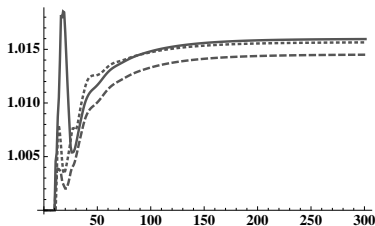
In case of excess demand, price rises so that the market clears.

- ▶ Does not impact government (fixed real expenditure).
- ▶ Constrains other sectors' output
- ▶ Spurs investment via capacity utilization

Prices

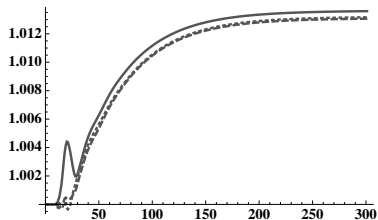


Profits

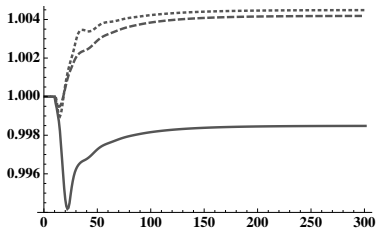


The case of excess demand II

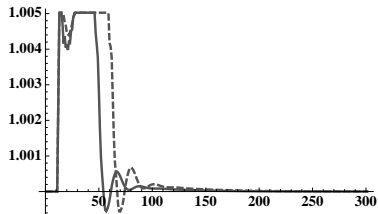
Market Capitalisation



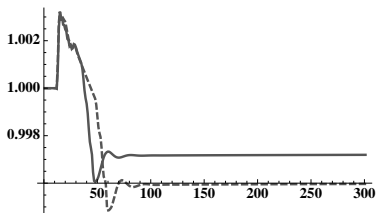
Loans



Capacity utilization



Prices



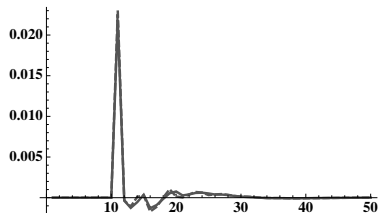
The case of excess demand III

Conclusion

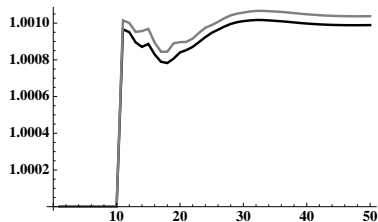
- ▶ KDS has a stronger impact on employment than PT [Not shown]
- ▶ PT decreases more Gini than KDS [Not shown]
- ▶ Possibility of inflation from both policies (PT less longer)
- ▶ Real shock may lead to financial shock

Balanced budget I

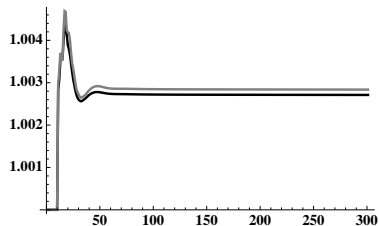
Government deficit



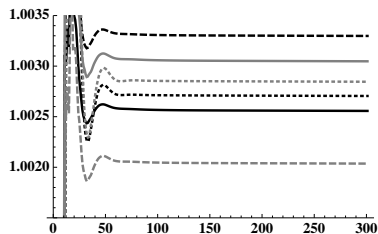
Public debt



Aggregate private employment



Output



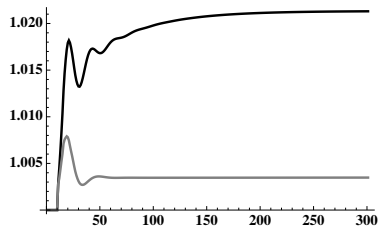
Balanced budget II

Conclusion

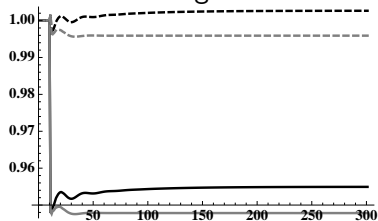
- ▶ Outcome of policies seriously dampened due to balancing policy
- ▶ Different impact on structure of economy due to "preferences"
- ▶ Very little impact on government debt and deficit, with PT redistributive policy

Endogenous labor supply I

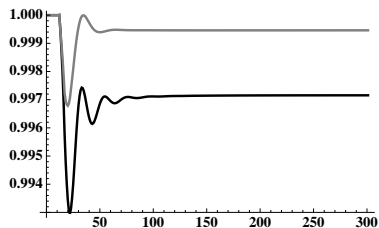
Aggregate private employment



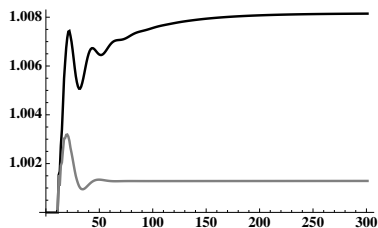
Wages



Average hours worked



Participation rate



Endogenous labor supply II

Conclusion

- ▶ Seccareccia's critique is valid in the case of balanced budget (employment effect lower than average wage)
- ▶ PT has inclusive effects (decrease in worked hours, increase in participation rate)

Simulations II

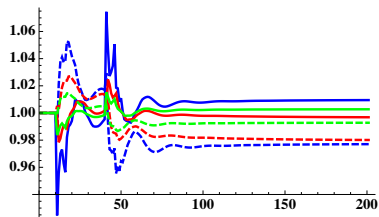
De-leveraging

Desire to decrease leverage by a sector: increase in profit rate for 30 period Scenarios:

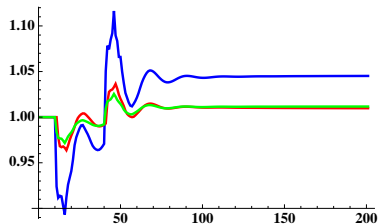
- 1 No excess demand
- 2 Endogenous labor supply
- 3 With or without balanced budget

De-leveraging I

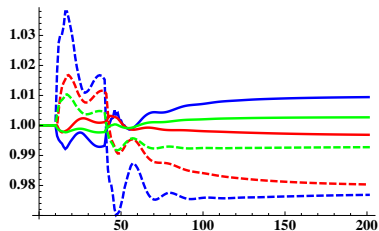
Workers income



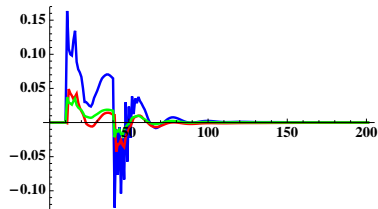
Total Employment



Workers Wealth

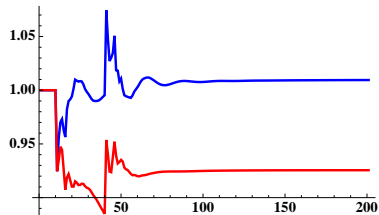


Government Expenditure

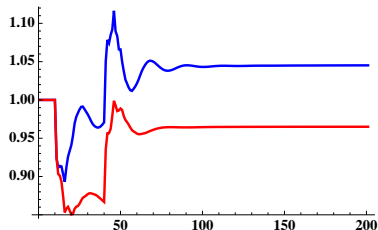


De-leveraging II

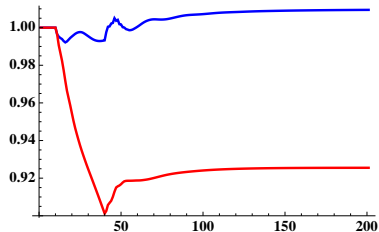
Workers income



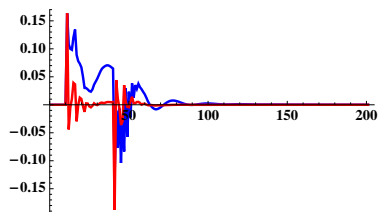
Total Employment



Workers Wealth



Government Expenditures



De-leveraging III

Conclusion

- ▶ Positive wealth effect compensate negative income effect
- ▶ Government expenditure absorb the shock, balanced budget worsen the situation
- ▶ When profit rate return to previous level, deflationary impact in opposed direction

Simulations III

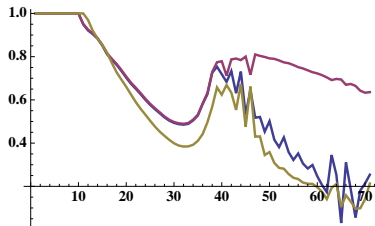
Consumption shock

Workers and Capitalists decrease their propensity to consume out of income by 10% Scenario:

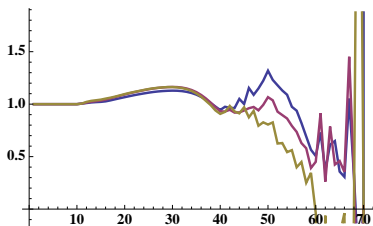
- ➊ Possibility of excess demand
- ➋ Endogenous labor supply
- ➌ With or without balanced budget

Consumption shock I

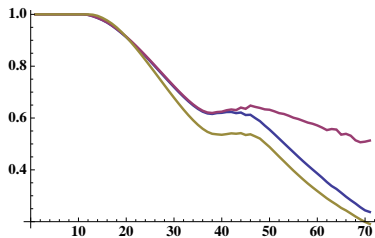
Real Output



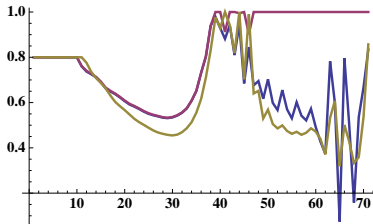
Market Capitalization



Capital

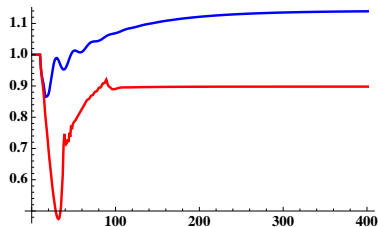


Utilization rate

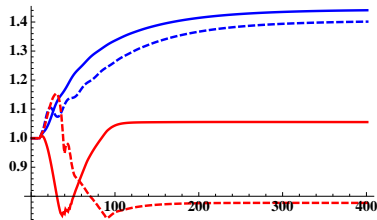


Consumption shock II

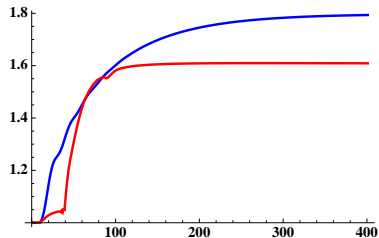
GDP



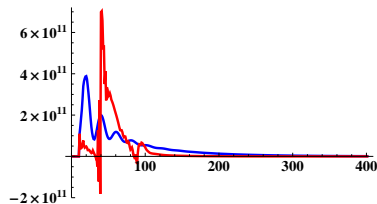
Wealth



Public debt



Public deficit



Outline

1 Model INSOUT

- Matrices and equations
- 10.7.3 An increase in pure government expenditure
- 10.7.7 An exogenous increase in the rate of inflation
- Adding the Maastricht treaty

2 A Structuralist Perspective: Godin [2012]

- Motivation
- The model
- Results
- Conclusion and the way forward

3 Wrap-up

Conclusion and the way forward

Conclusion

- ▶ Direct transfer better at tackling poverty and decreasing inequality
- ▶ KDS better at spurring GDP and increasing private employment
- ▶ Balanced budget policy always worsen the shock
- ▶ Structure of the economy matters and there are feedbacks between financial and real sectors
- ▶ Endogenous labor supply allows a finer analysis

Conclusion and the way forward

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The way forward

- ▶ Add more structuralist features, following Missaglia [2010]
- ▶ Open economy
 - ▶ Trade (im)balances
 - ▶ Austerity and wage containment
- ▶ Growth model

Outline

1 Model INSOUT

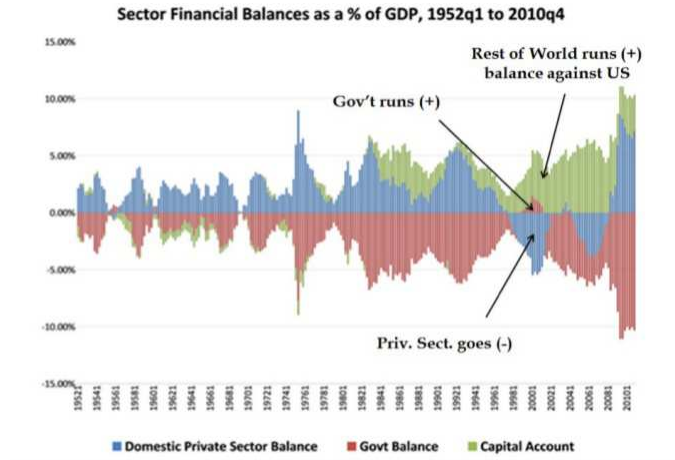
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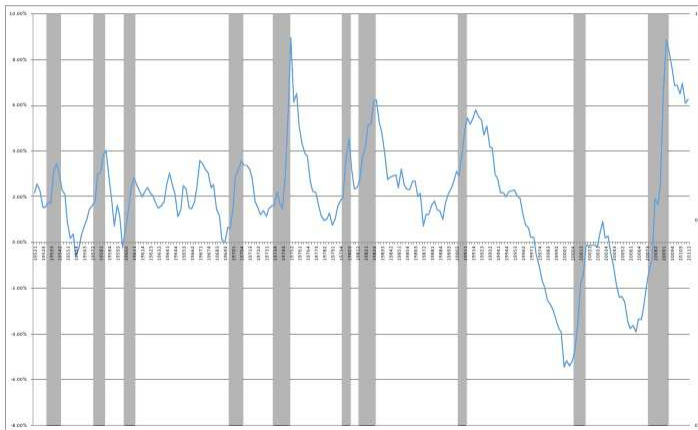
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3 Wrap-up

Courtesy of Stephanie Kelton 2012



Beware Swings in Private Sector Balance



Wrap-up

Policy recommendations

- ▶ The intuitions behind the simple model are not that crazy
- ▶ Crisis of sovereignty
 - ▶ Fiscal
 - ▶ Enforce
 - ▶ Fiscal Competition
 - ▶ Monetary

Wrap-up

Policy recommendations

- ▶ The intuitions behind the simple model are not that crazy
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PK-SFC

- ▶ From a framework to a model
- ▶ The long-run dynamics: a path of short-run periods interconnected with each other via the stocks
- ▶ Stocks allows from short-medium run disequilibria
- ▶ Imbalances leading to unsustainable processes

References I

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- Peter Kriesler and Joseph Halevi. Political aspects of buffer stock employment. Working paper, Center for Applied Economic Research, 2001/02.
- Marco Missaglia. Neoclassical and keynesian macro models: thinking about the "special case". Technical report, University of Pavia, 2010.
- Marco Seccareccia. What type of full employment? a critical evaluation of government as the employer of last resort. *Investigacion Economica*, 43 (247):5–43, 2004.