Real-financial models in Argentina

Distributional and Poverty effects of Capital Outflows

Job Market Paper

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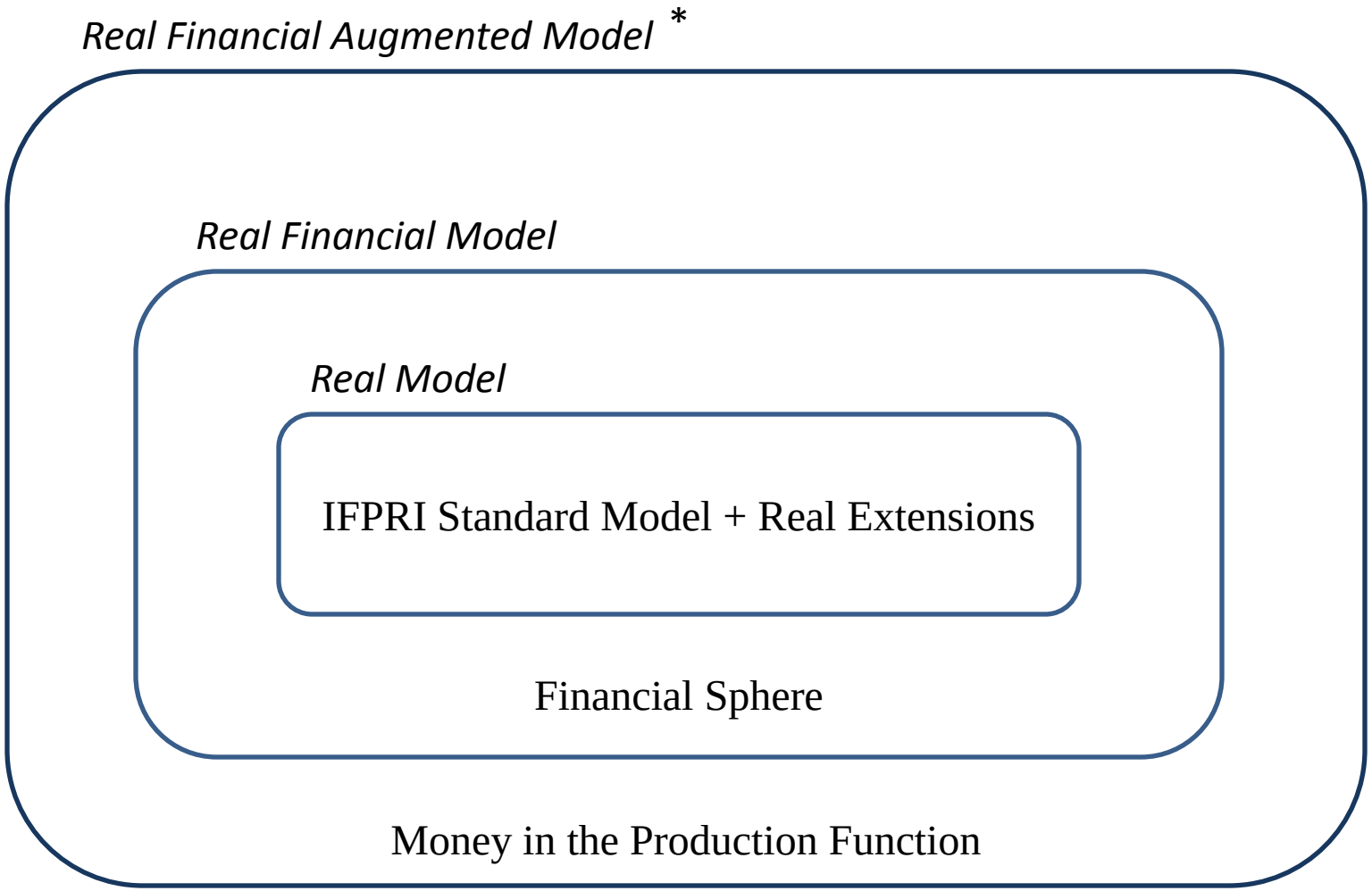
Motivation

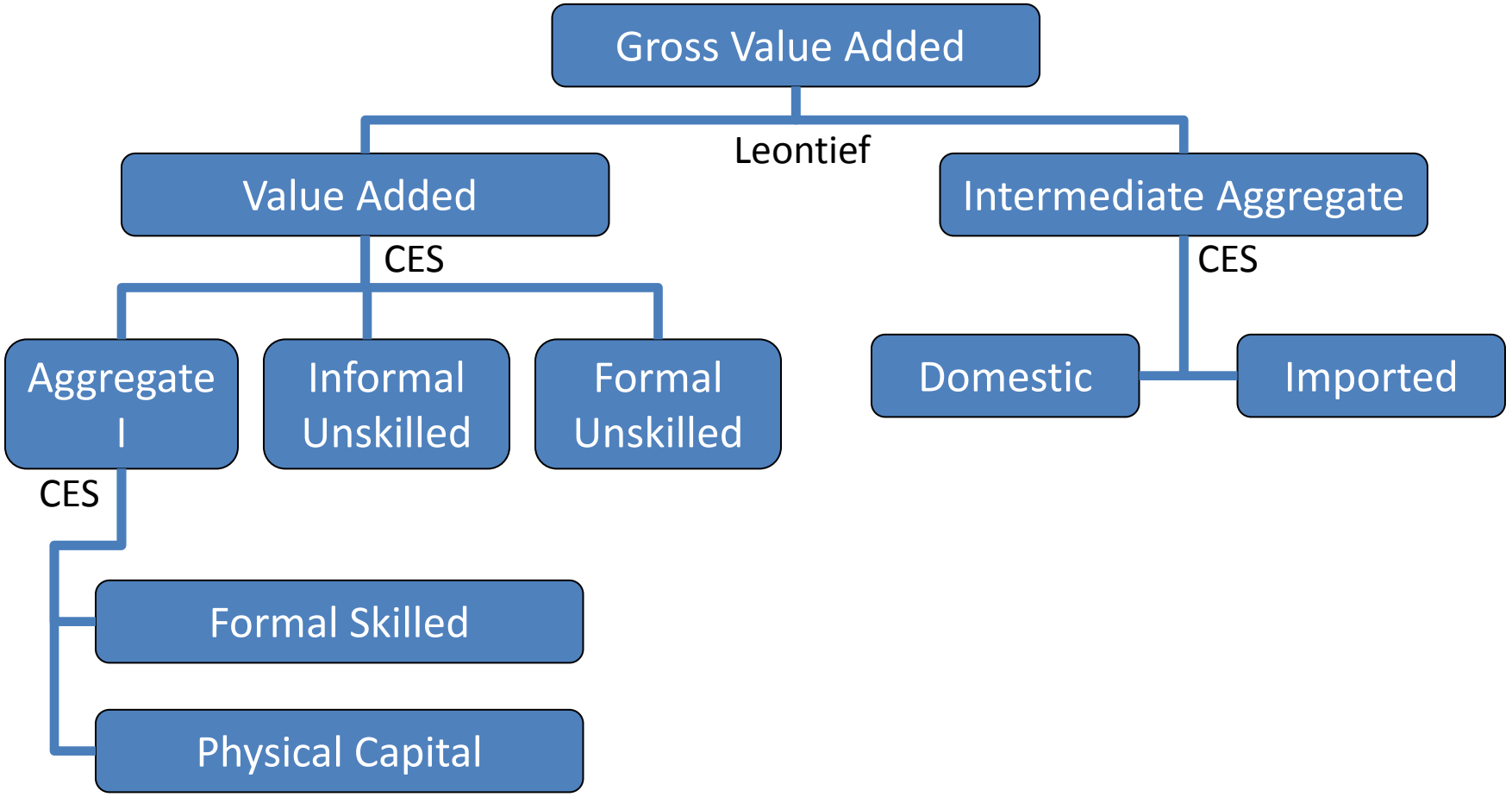
- The explicit inclusion of a financial transmission channel into macro CGEs and a link to a behavioural microsimulation module can improve our insight in explaining macro and distributive effects of events such as capital outflows affecting Argentina in 2001.
- Theoretical support:
  - J. M. Keynes “General theory of employment, interest and money” and Hicks-Hansen IS-LM Model
  - “Money in the production function” as in M. Friedman (1969)
  - F. Bourguignon, A-S. Robilliard and S. Robinson (2004) “Representative vs. real households in the macroeconomic modelling of inequality”

Nested Models



* A “short-run” version of this model will account for a strong degree of wage rigidity.

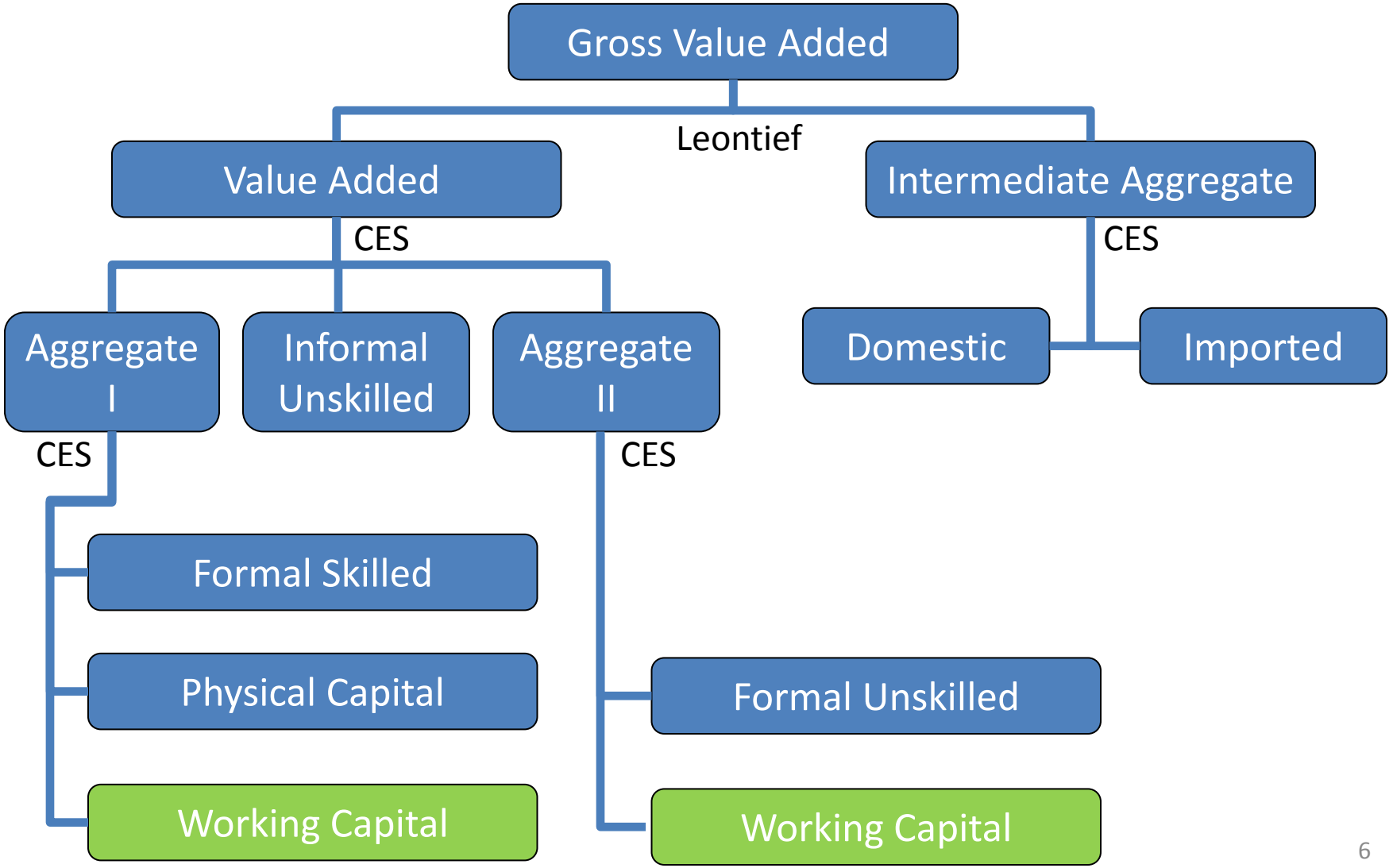
Real Model: Production Function



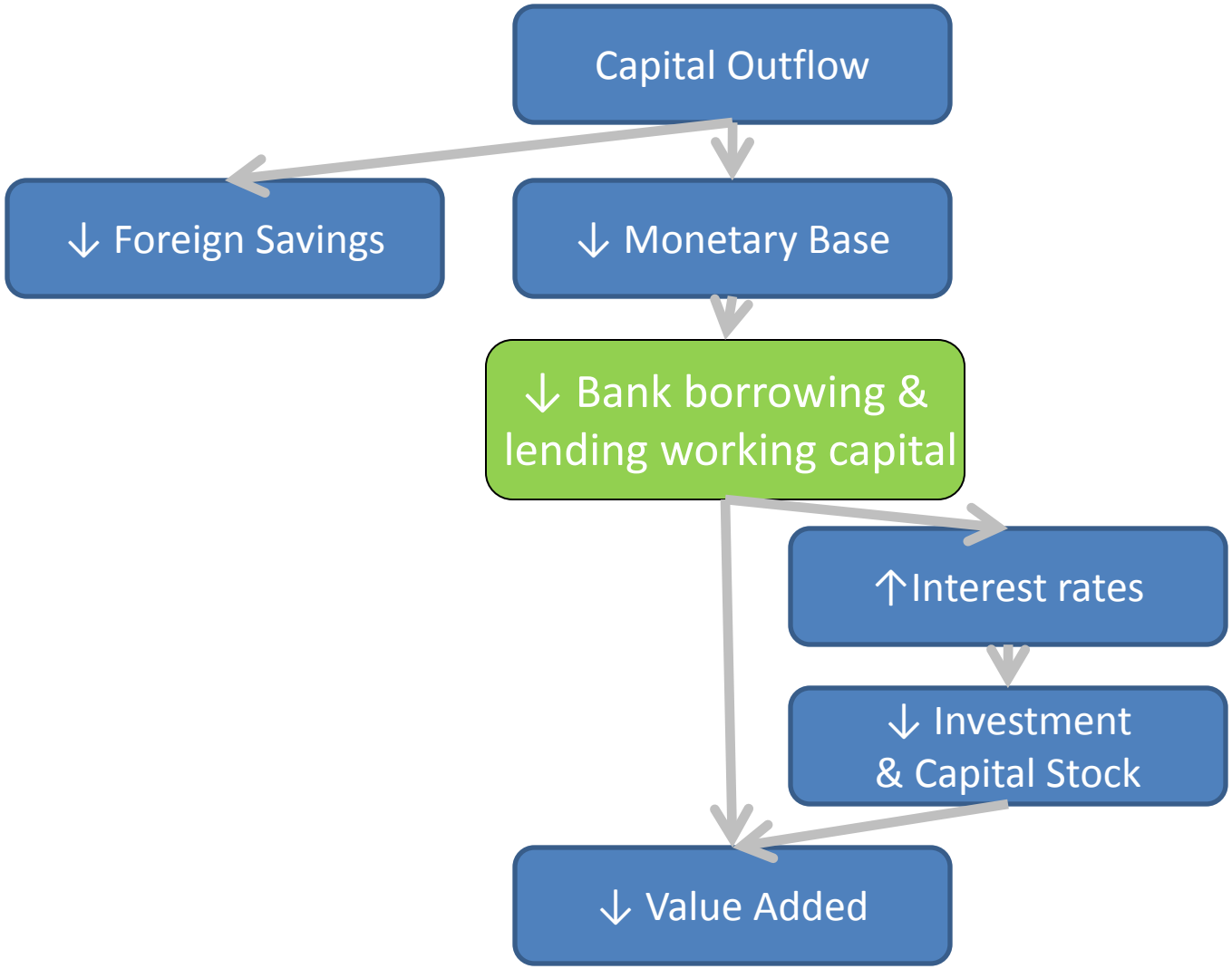
Real-Financial Model
Matrix of Assets & Liabilities

Liability holder \ Asset holder	House-holds	Enter-prises	Govern-ment	Rest Of World	Banks	Central Bank
Households					Loan	
Enterprises	Equity			Equity	Loan	
Government	Bond			Bond	Bond	Bond
Rest of the World	Deposits Abroad				Deposit Abroad	Intern. Reserves
Commercial Banks	Deposit	Deposit		Deposits		Rediscount
Central Bank	Currency				Required Reserves	

Real Financial Augmented Model Production Function



Real-Financial-Augmented Model
Transmission Channels for External Capital Outflow



Simulations

Related to the capital account balance

- ❑ Increase the probability of default on domestic assets by 10 percentage points
- ❑Increase the risk-free world interest rate by 10 percentage points
- ❑Lower non-residents deposits in domestic banks by 10 percent
- ❑Lower non-residents holdings of equity in domestic firms by 10 percent
- ❑Increase non-residents public bond holdings by 10 percent

Related to the trade balance

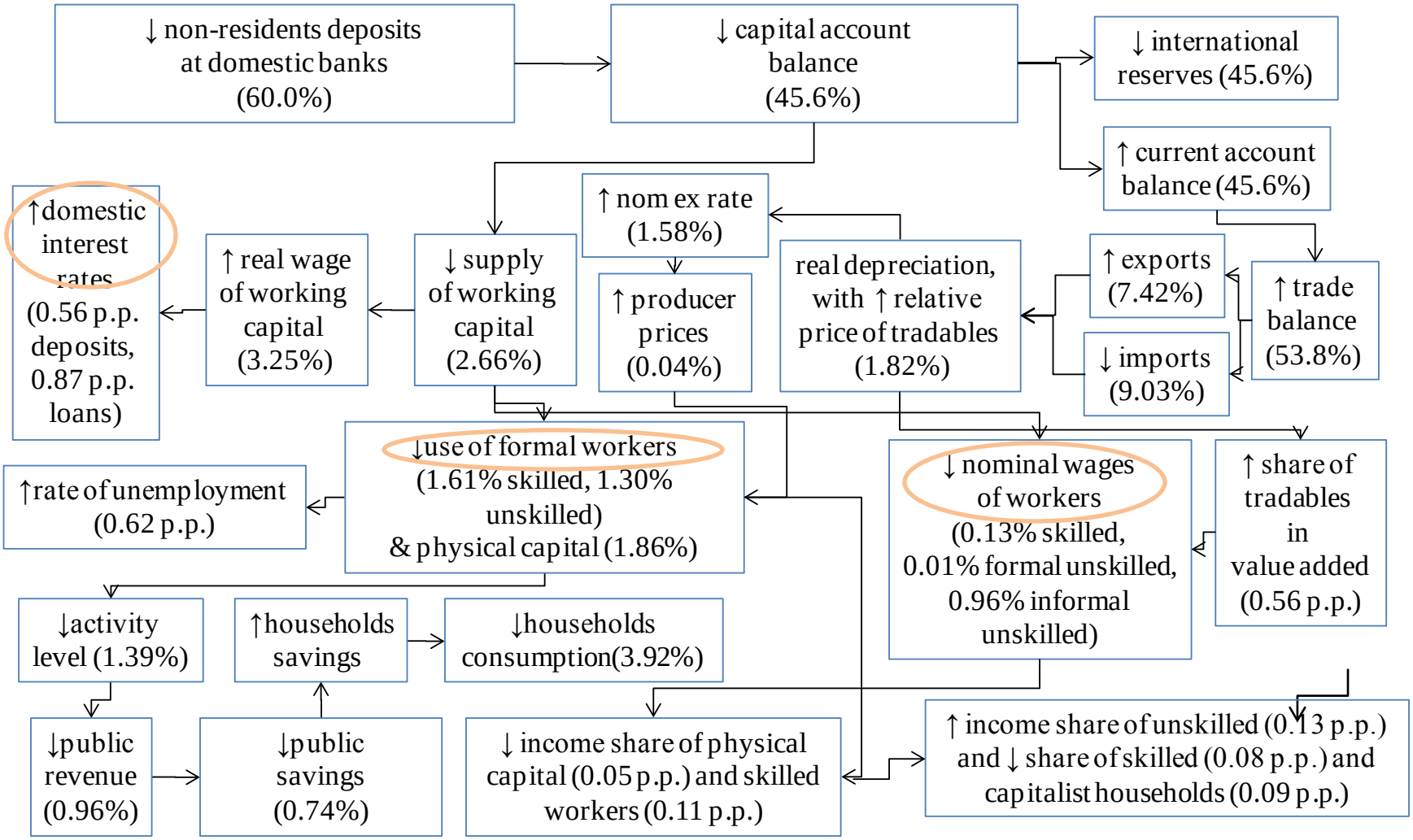
- ❑Lower the import taxes by 10 percent
- ❑Lower the export taxes by 10 percent
- ❑Increase the world prices of exports by 10 percent
- ❑Reduce the world prices of imports by 10 percent
- ❑Devalue the domestic currency by 10 percent

Results

	Perceived prob of default on domestic assets ↑10 p.p.				Risk-free world interest rate ↑10 p.p.				Deposits held by non-residents ↓10%				Equity held by non-residents ↓10%				Bonds held by non-residents ↑10%				Rate of tax on imports ↓10%				Rate of tax on exports ↓10%				Price of exports ↑10%				Price of imports ↓10%				Nominal exchange rate ↑10%			
	R	RF	RFA	RFAS	R	RF	RFA	RFAS	R	RF	RFA	RFAS	R	RF	RFA	RFAS	R	RF	RFA	RFAS	R	RF	RFA	RFAS	R	RF	RFA	RFAS	R	RF	RFA	RFAS	R	RF	RFA	RFAS	R	RF	RFA	RFAS
Balance of Payments[A]																																								
Current Account		++	++	++		++	++	++	++	++	++	++	++	++	++	++	--	--	--	--		++	++	++		+	-	--		--	--	--		--	-	++		--	--	--
Trade Balance		++	++	++	--	--	--	--	++	++	++	++	++	++	++	++	--	--	--	--	-	++	++	++	+	++	++	--	++	--	--	--	--	--	--	++	--	--	--	--
Exports of Goods and NFS		++	++	++	--	--	--	--	++	++	++	++	++	++	++	++	--	--	--	--	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	--	--	--	--
Imports of Goods and NFS		--	--	--	++	++	++	++	--	--	--	--	--	--	--	--	++	++	++	++	++	++	++	-	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
Investment Income		-	-	--	++	++	++	++	+	++	++	--	+	--	--	--	-	-	-	++	+	--	--	--	-	-	--	-	--	++	++	++	+	++	++	--	++	++	++	++
Interests		-	-	--	++	++	++	++		++	++	--		--	--	--		+	+	++		--	--	--		-	--	-		++	++	++		++	++	--	++	++	++	++
Profits and Dividends		+	+	++	--	--	--	--	++	++	++	++	++	++	++	++	--	--	--	--	+	+	+	++	-	-	-	--	--	--	--	--	++	++	++	++	--	--	--	--
Capital Account		--	--	--		--	--	--	--	--	--	--	--	--	--	--	++	++	++	++		--	--	--		-	+	++		++	++	++		++	+	--		++	++	++
Non Financial Private Sector		--	--	--		--	--	--		--	--	--	--	--	--	--		++	++	++		--	--	--		-	+	++		++	++	++		++	+	--		++	++	++
Public Sector		FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX	FX
Commercial Banks		+	+	++		--	--	--	--	--	--	--		++	++	++		--	--	--		+	+	++		+	+	-		--	--	--		--	--	++		--	--	--
Public Deficit		++	++	++	--	--	--	--	+	++	++	++	++	++	++	++	--	--	--	--	++	++	++	++	+	++	++	+	--	--	--	--	--	--	--	++	--	--	--	--
Price of domestic goods		-	-	-	++	++	++	++	--	--	--	--	--	--	--	--	++	++	++	++	-	--	--	--	+	+	+	+	++	++	++	++	--	--	--	--	++	++	++	++
Real GDP		-	-	--	+	+	-	++	-	-	-	--	-	-	-	--	+	+	+	++	+	+	+	--	+	+	+	+	++	++	+	++	++	++	++	--	+	+	+	++
Factor use																																								
Formal Skilled		-	-	--	+	+	-	++	-	-	-	--	-	-	-	--	+	+	+	++	+	+	+	--	+	+	+	+	+	+	+	++	+	+	+	--	+	+	+	++
Formal Unskilled		-	-	--	+	+	-	++	-	-	-	--	-	-	-	--	+	+	+	++	+	+	+	--	+	+	+	+	++	++	++	++	++	++	++	--	+	+	++	++
Physical Capital				--				--				--				--				-				--				-				-				-				-
Working Capital			--	--			--	--			--	--			--	--			++	++			+	-			-	-			--	--			++	--			++	++
Tradables Value Added Shares																																								
Agriculture		+	+	+	--	--	--	--	+	+	+	+	+	+	+	+	-	-	-	--	+	+	+	+	-	-	-	-	+	+	+	-	+	+	+	++	-	--	--	--
Industry		+	+	+	--	-	-	-	+	+	+	+	+	+	+	+	-	-	-	-	+	+	+	-	+	+	+	+	-	-	-	+	-	-	-	-	-	--	--	+
Real Wages																																								
Formal Skilled		-	-	+	+	+	-	--	-	-	-	+	-	-	-	++	+	+	+	--	+	+	+	+	+	+	+	-	++	++	++	--	++	++	++	++	+	+	++	--
Formal Unskilled		-	-	+	+	+	-	--	-	-	-	++	-	-	-	++	+	+	+	--	+	+	+	++	+	+	+	-	++	++	++	--	++	++	++	++	+	+	+	--
Informal Unskilled		+	+	--	--	--	--	+	+	+	+	--	+	+	+	--	--	--	--	++	+	+	+	--	+	+	+	+	++	++	++	++	++	++	++	--	-	--	--	++
Physical Capital		-	-	+	+	+	--	++	-	-	-	+	-	-	-	+	+	+	++	++	+	+	+	+	+	+	+	+	++	++	++	++	++	++	++	++	+	++	++	++
Working Capital			++	+			++	++			++	+			++	-			--	--			-	--			++	+			++	++			--	--			--	--
Factor Income Shares																																								
Formal Skilled		-	-	+	+	+	+	--	-	-	-	+	-	-	-	+	+	+	+	-	-	-	-	+	-	-	-	-	-	-	-	--	-	-	-	+	+	+	+	--
Formal Unskilled		-	-	+	+	+	+	-	-	-	-	+	-	-	-	+	+	+	+	-	-	-	-	+	+	+	+	-	-	-	+	--	-	-	-	+	+	+	+	--
Informal Unskilled		+	+	-	-	-	-	-	+	+	+	-	+	+	+	-	-	-	-	-	+	+	+	-	-	-	-	+	+	+	+	-	+	+	+	-	-	-	-	+
Physical Capital		-	-	-	+	+	-	++	-	-	-	-	-	-	-	-	+	+	+	++	+	+	+	-	+	+	-	+	+	+	-	++	+	+	+	-	-	-	+	++
Working Capital			+	+			+	+			+	+			+	-			-	-			-	-			+	+			+	+			-	-			-	-
Household Income Shares																																								
Skilled		-	-	+	--	--	--	--	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-	+	+	+	--	+	+	+	--	-	-	-	-	+	+	+	--
Unskilled		+	+	+	--	--	--	--	+	-	-	-	+	+	+	+	-	-	-	-	+	-	-	+	-	-	-	-	+	-	-	-	+	+	-	-	-	--	--	--
Capitalist		-	-	-	++	++	++	++	+	+	+	+	+	-	-	-	-	+	+	++	+	+	+	-	-	+	+	++	+	+	+	+	-	++	++	++	++	++	++	++

Only the short-run version of the augmented model allows capital account shocks to have significant effects on the activity level, as observed during the series of financial crisis in Argentina. This model is thus selected to investigate the effect of capital outflows in Argentina.

Transmission channels for a capital outflow: 60% fall in the domestic deposits held by non-residents



Distribution and poverty accounting for households heterogeneity

Behavioural Microsimulations

1. Specify a household income model consistent with the existent CGE model

2. Estimate the household income model

3. Attribute the macro changes at micro level

4. Compute and evaluate distributional outcomes at micro level

1. Specification of household income model

Household income equation: $$YH_h = \sum_{i \in h} (W_i{}^s IW_i{}^s + Y_{0i}) \qquad (1)$$

Employment equation: $$IW_i{}^s = Ind(CV_i{}^s > \overline{CV}^U)$$
$$= Ind\left(\alpha^s + Z_i{}^s \beta^s + u_i{}^s > \overline{CV}^U\right) \qquad (2)$$

Wage equation: $$logW_i{}^s = a^s + X_i{}^s b^s + v_i{}^s \qquad (3)$$

Non-labor income equation: $$Y_{0i} = DIVD_i + FINT_i + \overline{OTHY_i} \qquad (4)$$

- YH_h : nominal income of household h
- IW_i^s : dummy variable identifying labor status (1 for employed, 0 otherwise) in labour segment s of individuals i in household h
- W_i^s : nominal wage of individual i in household h working in labour segment s
- Y_{0i} : non-labour income of individual i in household h

2. Estimation of household income model

$$IW_i^s = Ind(\alpha^s + Z_i{}^s\beta^s + u_i{}^s > \overline{CV}^U) \quad (2) \qquad P(IW_i^s = 1|Z_i{}^s) = \frac{e^{\alpha^s + Z_i{}^s\beta^s}}{1+e^{\alpha^s + Z_i{}^s\beta^s}}$$

Variable	Formal skilled		Formal unskilled	
	Coef	dy/dx[M]	Coef	dy/dx[M]
Male[D]	0.0393	0.0035	0.2333*	0.0581*
	(0.0560)	*(0.0050)*	*(0.0651)*	*(0.0162)*
Married[D]	0.4145*	0.0431*	0.6360*	0.1573*
	(0.0643)	*(0.0071)*	*(0.0586)*	*(0.0142)*
Household Head[D]	0.2747*	0.0270*	0.5901*	0.1462*
	(0.0691)	*(0.0071)*	*(0.0666)*	*(0.0161)*
Completed Education Level[D]	0.9702*	0.0583*	0.7799*	0.1762*
	(0.0705)	*(0.0054)*	*(0.0825)*	*(0.0204)*
Experience	0.0900*	0.0079*	0.0997*	0.0246*
	(0.0072)	*(0.0008)*	*(0.0083)*	*(0.0020)*
Experience squared	-0.0013*	-0.0001*	-0.0014*	-0.0003*
	(0.0001)	*(0.00001)*	*(0.0001)*	*(0.00003)*
Household Size	-0.0613*	-0.0054*	-0.0483*	-0.0119*
	(0.0133)	*(0.0012)*	*(0.0116)*	*(0.0028)*
Region Northwest[D]	0.1752*	0.0144*	0.1277	0.0313
	(0.0830)	*(0.0069)*	*(0.0884)*	*(0.0216)*
Region Northeast[D]	0.3896*	0.0293*	0.0793	0.0195
	(0.1037)	*(0.0077)*	*(0.1052)*	*(0.0258)*
Region Cuyo[D]	0.3618*	0.0275*	0.1742	0.0425
	(0.1060)	*(0.0079)*	*(0.1057)*	*(0.0257)*
Region Pampa[D]	0.0674	0.0057	-0.0770	-0.0190
	(0.0749)	*(0.0065)*	*(0.0800)*	*(0.0198)*
Region Patagonia[D]	0.6654*	0.0449*	0.9434*	0.2071*
	(0.1056)	*(0.0072)*	*(0.1000)*	*(0.0220)*
Constant	0.5730*		-2.5913*	
	(0.0996)		*(0.1637)*	
N	14,574		6,858	
McFadden-R^2	0.0952		0.1252	
Prob > χ^2	0.0000		0.0000	

*: significant at 5% level

[D]: for a discrete change

[M]: marginal and impact effects reported by segment for a married male heading a household in Great Buenos Aires who has not completed education level corresponding to his skill category (primary for unskilled, university for skilled) and has mean experience (25.9 years for unskilled, 17.7 years for skilled).

2. Estimation of household income model

$$logW_i^s = a^s + X_i^s b^s + \lambda(\alpha^s + Z_i^s \beta^s)\rho^s + v_i^s \qquad (3)$$

Variable	Formal skilled	Formal unskilled	Informal unskilled
Male	0.3538*	0.1800*	0.4347*
	(0.0140)	*(0.0241)*	*(0.0164)*
Completed Education Level	0.3692*	0.1027*	0.2563*
	(0.0229)	*(0.0365)*	*(0.0223)*
Experience	0.0209*	0.0033	0.0406*
	(0.0031)	*(0.0045)*	*(0.0021)*
Experience squared	-0.0003*	-0.00001	-0.0005*
	(0.00005)	*(0.00006)*	*(0.00003)*
Married	0.0594*	-0.0386	0.1753*
	(0.0166)	*(0.0251)*	*(0.0175)*
Region Northwest	-0.5441*	-0.2794*	-0.3334*
	(0.0226)	*(0.0273)*	*(0.0273)*
Region Northeast	-0.6392*	-0.3000*	-0.4162*
	(0.0273)	*(0.0324)*	*(0.0308)*
Region Cuyo	-0.5720*	-0.2731*	-0.3440*
	(0.0283)	*(0.0333)*	*(0.0319)*
Region Pampa	-3.3764*	-0.1500*	-0.1115*
	(0.0214)	*(0.0253)*	*(0.0261)*
Region Patagonia	-0.0891*	0.0713	0.2595*
	(0.0277)	*(0.0374)*	*(0.0320)*
Inverse Mills Ratio	2.3143*	0.8279*	
	(0.1990)	*(0.1296)*	
Constant	6.2963*	6.2981*	4.4198*
	(0.0705)	*(0.1614)*	*(0.0420)*
N	10,627	3,386	8,636
R^2	0.3182	0.2240	0.2109
Prob>F	*0.0000*	*0.0000*	*0.0000*

*: significant at 5% level

2. Estimation of household income model

Impute unobservables and criterion value for base option (unemployment)

$$IW_i{}^s = Ind(\alpha^s + Z_i{}^s\beta^s + u_i{}^s > \overline{CV}^U) \quad (2)$$

$u_i{}^s$ values are randomly drawn from the inverse of the logistic pdf assuring consistency with the observed employment status.

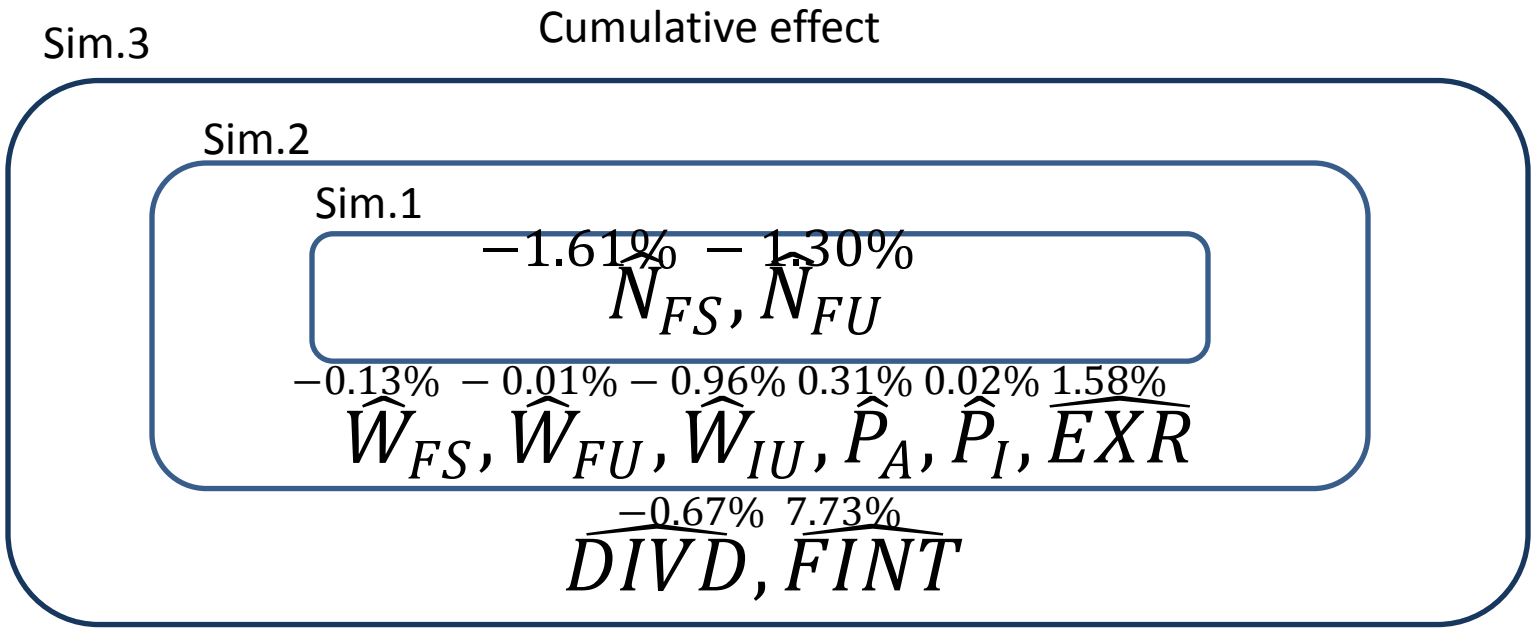
$\overline{CV}^U = E(\alpha^s + Z_i{}^s\beta^s)$ The criterion value associated with unemployment is arbitrarily set; for convenience, at the mean of the index function of the employed alternative

$$logW_i{}^s = a^s + X_i{}^s b^s + \lambda(\alpha^s + Z_i{}^s\beta^s)\rho^s + v_i{}^s \qquad (3)$$

$v_i{}^s$ imputed from regression residual when existent; otherwise randomly from $N(0,G^2 v_i)$

⇨ Every element in the Household Income Model has been determined

3. Communications from the CGE to the microsimulation model



$-1.29\% -0.47\% -0.91\%$

Sim.4 (RHG): $\widehat{YH_S}, \widehat{YH_U}, \widehat{YH_C}$

P_A: price of primary good; P_I: price of industrial good; Y_S: income of skilled RHG; Y_U: income of unskilled RHG; Y_C: income of capitalist RHG

3. Attributing results at micro level

Keeping unaltered the observed and unobserved characteristics of the individuals, the parameters in the household income model need to change to allow employment status and wages to adjust consistently with the CGE macro results.

Following the methodology designed by RBR, the changes in the coefficients are done assuming "neutrality" with respect to individual characteristics:

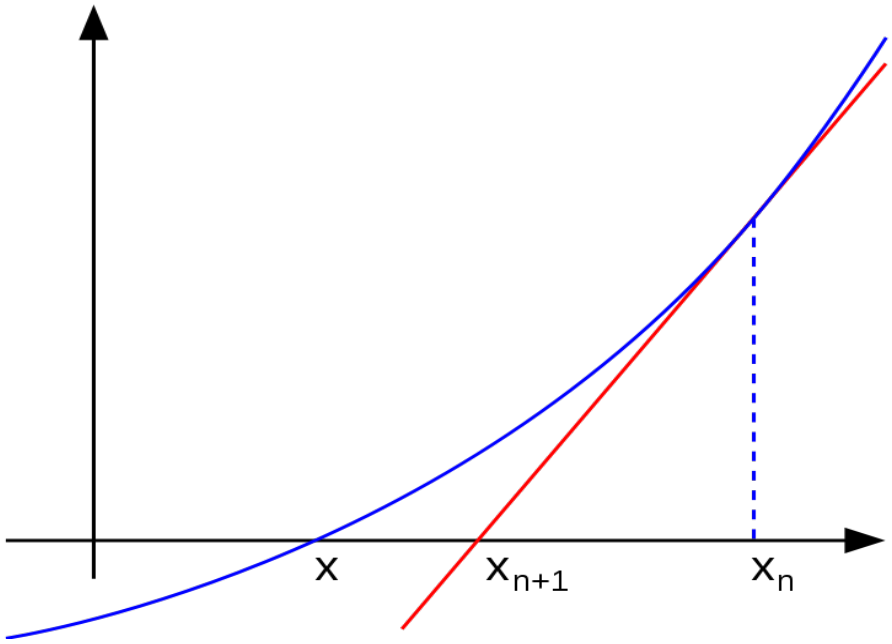
$$P(IW_i^s = 1 | Z_i^s) = \frac{e^{\alpha^s + Z_i^s \beta^s}}{1 + e^{\alpha^s + Z_i^s \beta^s}} \quad (2)$$

$\downarrow \alpha^{FS}, \downarrow \alpha^{FU}$ => fall in probability of being employed for everyone in the labor segment, where the fall depends only on initial probability and not on individual characteristics

$$logW_i = a + X_i b + v_i \quad (3)$$

$\downarrow a_{FS}, \downarrow a_{FU}, \downarrow a_{IU}$ => proportional fall of all wages in the labour segment

3. Newton's technique to change intercepts



$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

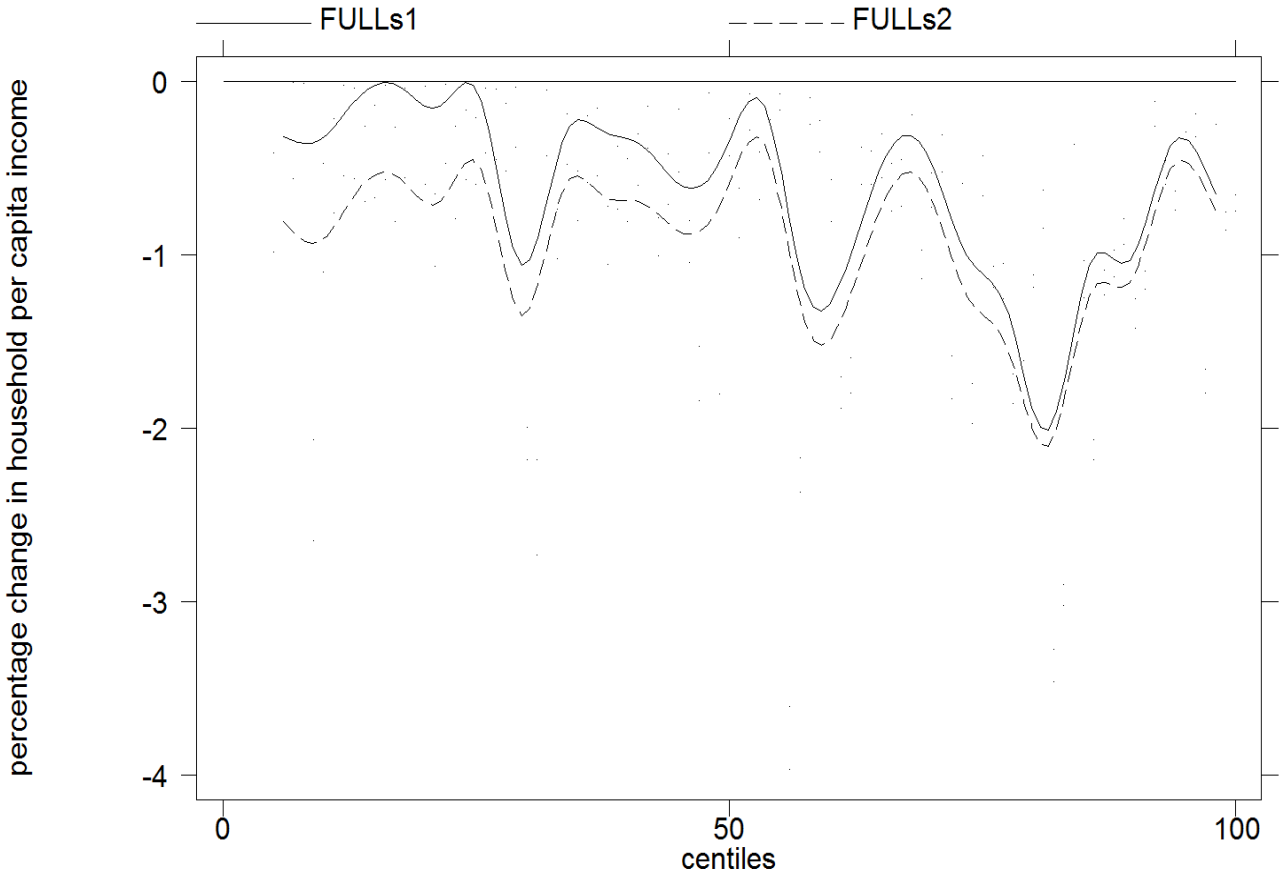
$$J = \begin{bmatrix} \frac{\partial N_{FS}}{\partial a_{FS}} & \frac{\partial N_{FS}}{\partial a_{FS}} & \frac{\partial N_{FS}}{\partial a_{FU}} & \frac{\partial N_{FS}}{\partial a_{FU}} & \frac{\partial N_{FS}}{\partial a_{IU}} \\ \frac{\partial W_{FS}}{\partial a_{FS}} & \frac{\partial W_{FS}}{\partial a_{FS}} & \frac{\partial W_{FS}}{\partial a_{FU}} & \frac{\partial W_{FS}}{\partial a_{FU}} & \frac{\partial W_{FS}}{\partial a_{IU}} \\ \frac{\partial N_{FU}}{\partial a_{FS}} & \frac{\partial N_{FU}}{\partial a_{FS}} & \frac{\partial N_{FU}}{\partial a_{FU}} & \frac{\partial N_{FU}}{\partial a_{FU}} & \frac{\partial N_{FU}}{\partial a_{IU}} \\ \frac{\partial W_{FU}}{\partial a_{FS}} & \frac{\partial W_{FU}}{\partial a_{FS}} & \frac{\partial W_{FU}}{\partial a_{FU}} & \frac{\partial W_{FU}}{\partial a_{FU}} & \frac{\partial W_{FU}}{\partial a_{IU}} \\ \frac{\partial W_{IU}}{\partial a_{FS}} & \frac{\partial W_{IU}}{\partial a_{FS}} & \frac{\partial W_{IU}}{\partial a_{FU}} & \frac{\partial W_{IU}}{\partial a_{FU}} & \frac{\partial W_{IU}}{\partial a_{IU}} \end{bmatrix}$$

4. Per capita income, inequality and poverty by simulation

Indicator	BASE	SIM1	SIM2	SIM3	SIMRHG
Per capita income	328.7	326.0	325.4	327	325.5
Inequality					
Entropy Index (α=2)	69.9	70.4	70.6	71.9	69.6
Gini Index	51.1	51.3	51.3	51.5	51.1
Poverty					
Official Extreme Poverty Line					
Head-Count Index (P_0)	11.8	12.1	12.2	12.2	11.9
Poverty Gap Index (P_1)	7.1	7.4	7.5	7.5	7.2
Poverty Severity Index (P_2)	5.9	6.2	6.2	6.2	5.9
Official Moderated Poverty Line					
Head-Count Index (P_0)	31.0	31.4	31.5	31.5	31.4
Poverty Gap Index (P_1)	15.5	15.8	15.9	15.9	15.6
Poverty Severity Index (P_2)	10.7	11.1	11.1	11.1	10.8
US$ 1 a day Poverty Line					
Head-Count Index (P_0)	7.7	8.3	8.3	8.3	8.0
Poverty Gap Index (P_1)	5.6	6.0	6.0	6.0	5.7
Poverty Severity Index (P_2)	5.0	5.3	5.3	5.3	5.1
US$ 2 a day Poverty Line					
Head-Count Index (P_0)	14.4	15.2	15.3	15.3	15.0
Poverty Gap Index (P_1)	8.4	8.8	8.8	8.8	8.5
Poverty Severity Index (P_2)	6.6	6.9	6.9	6.9	6.6

Official poverty rates are in line with those reported by World Bank-UNLP SEDLAC (Socioeconomic
Data for Latin America and Caribbean): for 2001, 9.4% and 28.0%. CEDLAS estimation of 2.5 DLS a d
Line for 2001 is also in line: 18.7%(P0), 9.1(P1), 6.1(P2)

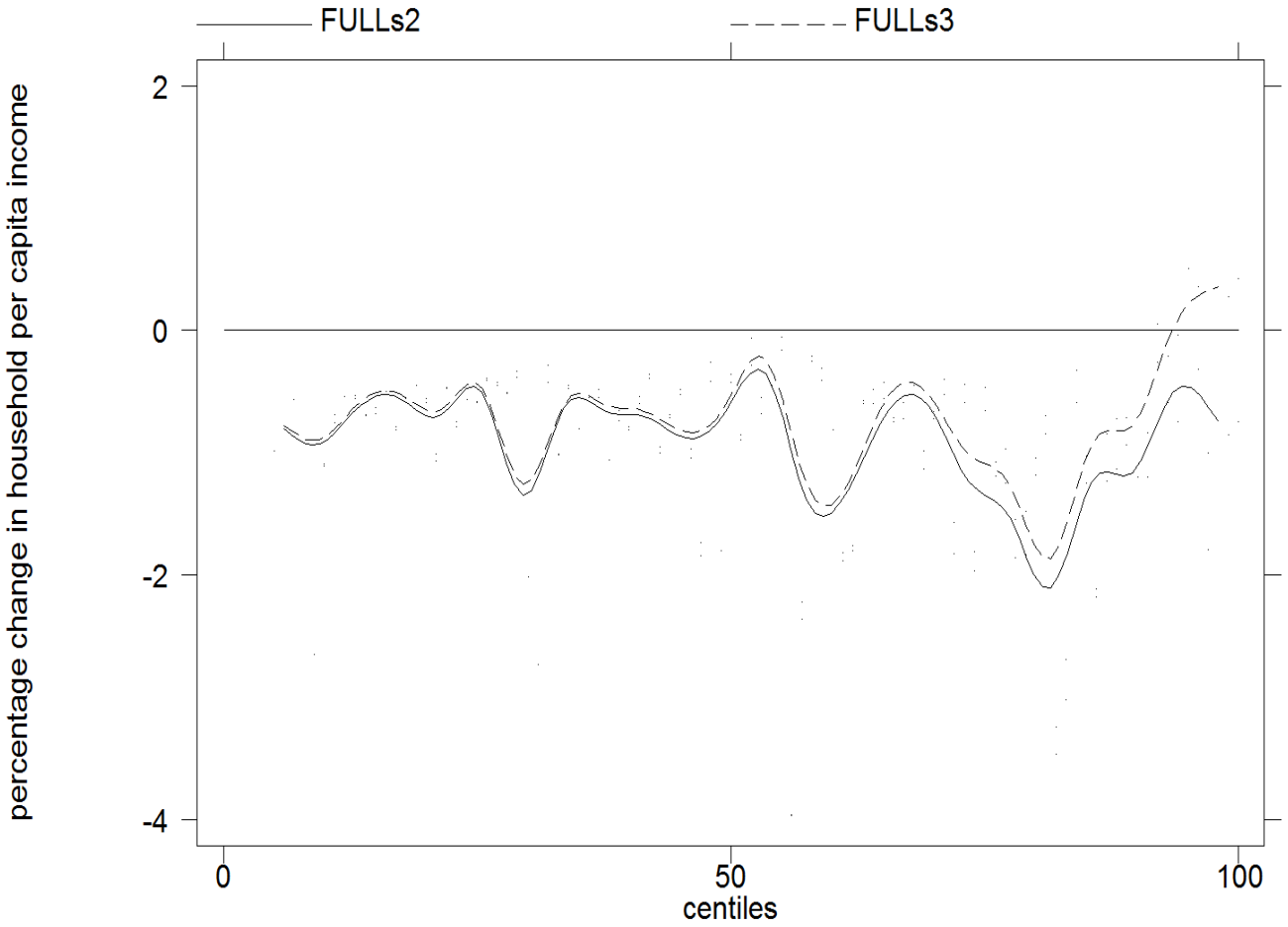
4. Percentage change in household per capita income by percentile
Simulations 1 and 2



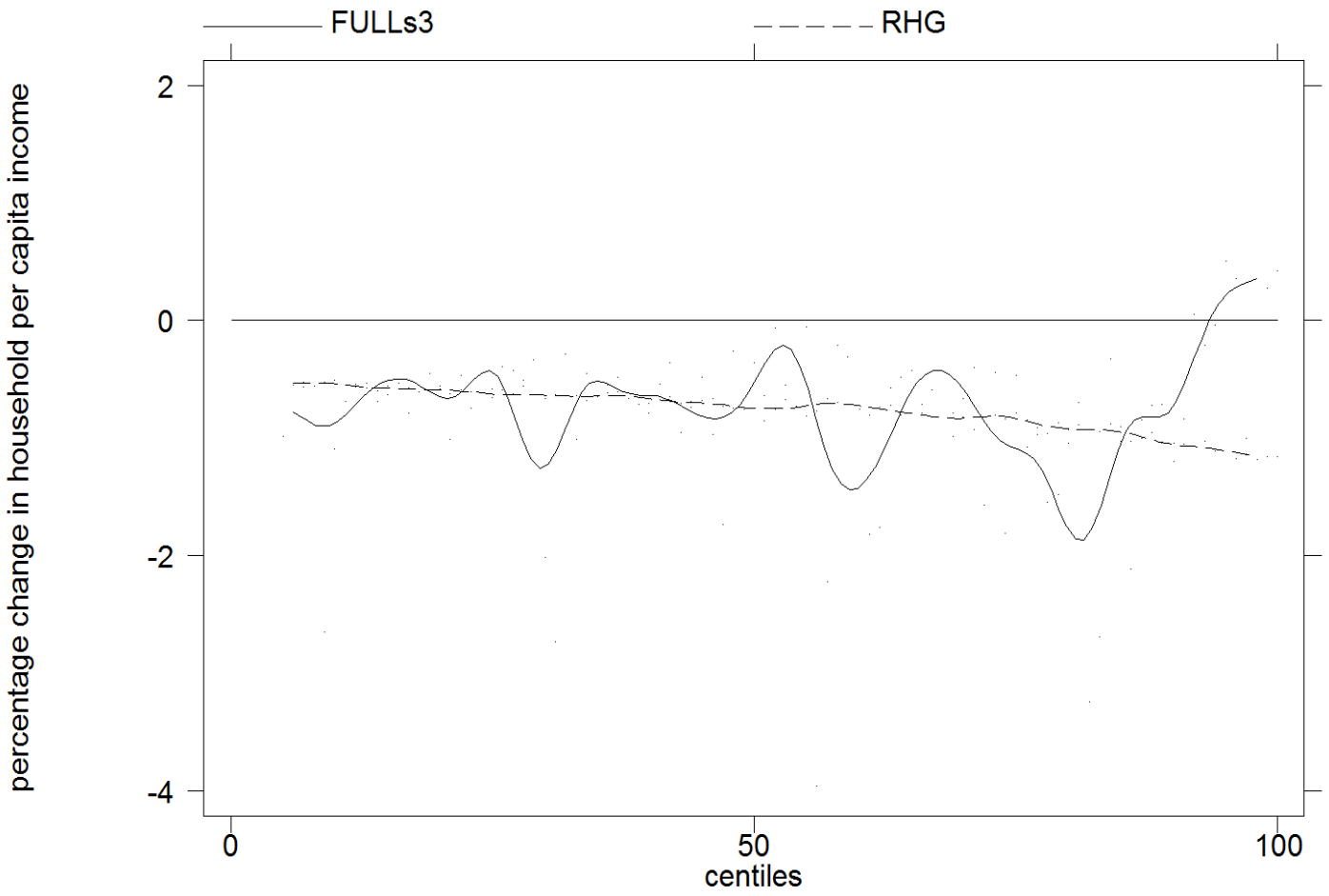
⇒shape dominated by people getting fired

⇒labor income large share of income at the bottom

4. Percentage change in household per capita income by percentile Simulations 2 and 3



4. Percentage change in household per capita income by percentile
Simulations 3 and RHG



Conclusions

•In combination with wage rigidity, the inclusion of working capital does allow financial shocks to hit significantly output and employment in Argentina.

•By itself, the inclusion of the working capital transmission channel in this case is not sufficient to allow financial shocks to hit significantly output and employment. A low starting working capital share in value added (5%) may be explaining this.

•As in RBR, it is found that “the selectivity of labour market rationing is the channel through which economy-wide policies have the most distributional impact”.

•The graphical analysis gives us a clear indication of the power of behavioural microsimulations to capture the heterogeneity of income changes in different parts of the income distribution due to a macro shock, as opposed to arithmetic microsimulations.

Real Model: Macro Balances

Saving-Investment Balance

Gross investment in each sector is a function of the wage of physical capital in the sector and the financial cost of replacing a unit of capital

$$\mathrm{QI}_{a,t} = qi_{0a}\left(\frac{\mathrm{W}_{FK,t}\ \mathrm{WDIST}_{FK,a,t}}{\mathrm{RL}_t \mathrm{PK}_t}\right)^{\varepsilon_I}$$

while household savings adjust to assure financing overall investment

$$\mathrm{SAV}_{h,t} = \mathrm{mps}_h\ \mathrm{MPSADJ}_t\ \ \mathrm{YH}_{h,t}$$

$QI_{a,t}$: Gross investment in activity a at time t
RL(t): Rate of interest on domestic banks loans (fixed at base-year level)
PK(t): Price of capital stock
$MPSADJ_t$:endogenous adjustment factor for households savings

Real Model: Macro Balances

Fiscal Balance

Tax rates and the real fiscal expenditure are exogenous, while the fiscal revenue and the fiscal deficit are endogenous

Foreign Exchange Balance

The nominal exchange rate adjusts to generate an exogenous level of foreign savings

Real Model

Nummeraire: CPI.

Exogenous labour supplies, labour is mobile across sectors, wage curves determine nominal wages in formal labour segments, other wages are fully flex:

$$W_{f,t}\left(UR_{f,t} - nur\right)^{\varepsilon_{wu}} \geq \gamma_f CPI_t$$

There are updating conditions for the sector-specific physical capital stock which, once installed, is immobile across sectors

$$QF_{FK,a,t} = \left(1 - depk\right)QF_{FK,a,t-1} + QI_{a,t-1}$$

Real Financial Model: Assets Returns

On deposits

$$\log \frac{\text{CURRS}_t}{\text{GDPDEFL}_t} = \varepsilon_{my} \log(\text{RGDP}_t) - \varepsilon_{mr} \log(\text{RD}_t) + \text{cdem0}$$

On loans

$$\text{RL}_t = \frac{\text{RD}_t}{1 - \text{rr}_t}(1 + \mu)$$

On Bonds

$$\text{RB}_t = \frac{1}{\text{PBOND}_t}$$

$$\text{BONDS}_t = \sum_b \text{BOND}_{b,t}$$

On Equity

$$\text{RE}_{e,t} = \frac{\text{PROFIT}_{e,t}}{\text{EQT}_{e,t}}$$

Real-Financial Model

Maximizing CES utility function on asset earnings …

$$\underset{\theta_i}{MaxU} = \left[\sum_i \delta_i (r_i \theta_i V)^{-\rho} \right]^{-\frac{1}{\rho}} s.t. \sum_i \theta_i = 1$$

… bank and capitalist households get demanded asset shares:

$$\theta_i = \frac{\delta_i^{\varepsilon} r_i^{\varepsilon - 1}}{\sum_j \delta_j^{\varepsilon} r_j^{\varepsilon - 1}}$$

Real-Financial Model: Asset Earnings

Asset earning = return * domestic-currency value of asset held

e.g.:

$$FINT_{da,R,t} = \overline{RW}_t \, (EXR_t DEPA_{da,t})$$

- Asset Holder
- Liability holder
- World interest rate
- Nominal exchange rate
- Deposits abroad in f currency

The “heterogeneity” problem

The CGE model at stake bases its analysis in representative household groups (RHGs), not allowing to fully account for the observed households heterogeneity neither to evaluate changes in the full income distribution among households.

To overcome these deficits, we can link the CGE model with a microsimulation model (MSM), using a detailed urban-representative household survey*, “Permanent Household Survey” (EPH) of Argentina, October 2001.

*: Urban population = 87.2% of the country’s population.

The microsimulation approach

"Layered" behavioural microsimulations approach developed by Anne-Sophie Robilliard, François Bourguignon and Sherman Robinson (2008), RBR, which captures the way rationing occurs in an imperfect labour market.

The main use of the microsimulation model (MSM) is to select individuals who are fired (or hired), making the selection depend on individuals' characteristics. i.e. **who** is fired when the employment level shrinks

I adapt the RBR model to Argentina and extend it to:

1. Make capital income endogenous
2. Let the CGE model communicate in a cumulative way the simulated effects on:
    1) Employment
    2) Wages and prices
    3) Capital income

Behavioural MS vs. Arithmetic MS which assume that the distribution within (RHG) groups is exogenous and constant.

Stata code used in RBR provided by Anne-Sophie Robilliard.

1. Specification of household income model

CGE (macro) model	Micro model
The labor market is segmented into formal skilled, formal unskilled and informal unskilled components	Individuals supplying labor are assigned into one of these segments
The labor supplies are exogenous and fixed in the short run	They remain in original segment
In the informal segment there is full employment	All individuals informally employed remain as such
In the formal segments there is some unemployment	Individuals supplying labor in the formal segments need to be assigned among employed and unemployed alternatives in each simulation The unskilled unemployed are located into the formal segment

3. Implementing Newton's technique

$$x = (\alpha_{FS}\ a_{FS}\ \alpha_{FU}\ a_{FU}\ a_{IU})$$ intercepts

$$f(x) = (N_{FS,0}, N_{FU,0}W_{FS,0}, W_{FU,0}W_{IU,0})$$

$$f^*(x) = (N^*_{FS}, N^*_{FU}W^*_{FS}, W^*_{FU}W^*_{IU})$$ macro targets

$$N^*_f = N_{f,0}.(1 + \widehat{N}_f)$$

$$W^*_f = W_{f,0}.(1 + \widehat{W}_f),$$

$$J_{5x5} = \begin{bmatrix} \frac{\partial N_{FS}}{\partial a_{FS}} & \frac{\partial N_{FS}}{\partial a_{FS}} & \frac{\partial N_{FS}}{\partial a_{FU}} & \frac{\partial N_{FS}}{\partial a_{FU}} & \frac{\partial N_{FS}}{\partial a_{IU}} \\ \frac{\partial W_{FS}}{\partial a_{FS}} & \frac{\partial W_{FS}}{\partial a_{FS}} & \frac{\partial W_{FS}}{\partial a_{FU}} & \frac{\partial W_{FS}}{\partial a_{FU}} & \frac{\partial W_{FS}}{\partial a_{IU}} \\ \frac{\partial N_{FU}}{\partial a_{FS}} & \frac{\partial N_{FU}}{\partial a_{FS}} & \frac{\partial N_{FU}}{\partial a_{FU}} & \frac{\partial N_{FU}}{\partial a_{FU}} & \frac{\partial N_{FU}}{\partial a_{IU}} \\ \frac{\partial W_{FU}}{\partial a_{FS}} & \frac{\partial W_{FU}}{\partial a_{FS}} & \frac{\partial W_{FU}}{\partial a_{FU}} & \frac{\partial W_{FU}}{\partial a_{FU}} & \frac{\partial W_{FU}}{\partial a_{IU}} \\ \frac{\partial W_{IU}}{\partial a_{FS}} & \frac{\partial W_{IU}}{\partial a_{FS}} & \frac{\partial W_{IU}}{\partial a_{FU}} & \frac{\partial W_{IU}}{\partial a_{FU}} & \frac{\partial W_{IU}}{\partial a_{IU}} \end{bmatrix}.$$

Real Financial Augmented Model
Short-Run Version

Formal labour market: fixed nominal wages (contracts)

Physical capital stock: capacity utilization is flexible (capital vintages)

3. Regression Intercept changes

Intercept	Regression	Simulation 1 (N falls)	Simulations 2 & 3 (N and W falls)
α_{FS}	0.5730	0.5403	0.5403
a_{FS}	6.2963	6.2944	6.2931
α_{FU}	-2.5913	-2.6094	-2.6094
a_{FU}	6.2981	6.3095	6.3052
a_{IU}	4.4198	4.4198	4.4102

4. Implementing Newton's technique

The Newton algorithm is implemented in the following way:

1. The maximum number of iterations for the algorithm $imax$ is set, as well as the tolerance Euclidean distance tol between the final $f(x)$ and the target $f^*(x)$, and a $dump$ scalar which regulates the size of the step given when changing the intercepts in each iteration.
2. $f(x)$ is computed at original x.
3. $f^*(x)$ macro target is assigned.
4. A vector $diff = f(x) - f^*(x)$ is computed, as well as its Euclidean distance to the origin $dist = \sqrt{diff' * diff}$.
5. If $dist$ exceeds tol and $imax$ is not reached:
    a. Compute the Jacobian matrix J and its inverse JI
    b. Compute vector $jdif = dump * JI * diff$
    c. Decrease x by $jdif$
    d. Compute $f(x)$
    e. Calculate $dist$
6. The outcome intercepts x and the Euclidean distance of macro values to target $dist$ are reported, as well as the labor income of each individual.