How can we link CGE models with micro-simulation models?

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Different approaches

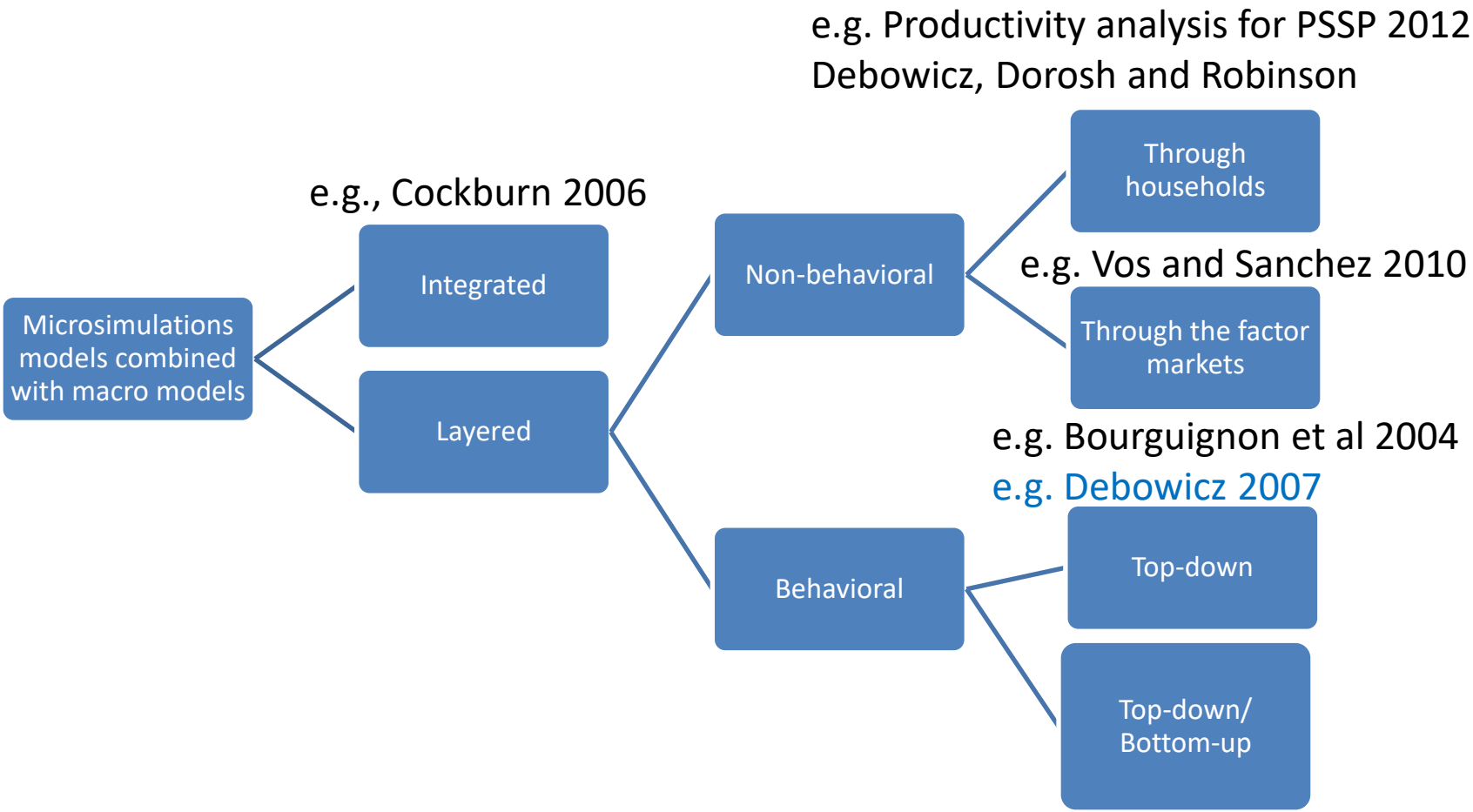


Illustration:
The impact of Oportunidades on human capital and income distribution: a top-down/bottom-up approach

Debowicz and Golan (2014), ‘ The impact of Oportunidades on human capital and income distribution: a top-down/bottom-up approach’, with Jennifer Golan, Journal of Policy Modeling.

Rationale, method and results

- Effects of *Oportunidades* conditional cash transfer program on human capital and labour markets, accounting for its **partial** and **general equilibrium effects**.

- Linking a microeconometric and a general equilibrium model in an iterative bidirectional way.

- Our results suggest that partial equilibrium analysis alone may underestimate the program effects.

- **In terms of future research, the method could be used to look into the general equilibrium effects of an expansion of a social program for which there is an RCT study.**

Oportunidades

Around **14 billion** of Mexican pesos (Mexican Ministry of Finance 2011), or **1.1 billion** US$ per year spent on Oportunidades, reaching **5.8 million** households.

The program aims at developing the human capital of poor households. It provides cash to poor households under the condition that they behave consistently with the accumulation of human capital.

The program has three components: education, nutrition and health. The largest transfer of the program is the educational one.

Beneficiaries are targeted at the micro level. However, given its national scale, it is expected to provoke interesting macro level effects with meaningful interactions with the direct micro-level effects of the programs that will jointly affect income distribution and poverty.

Oportunidades educational transfers

Monthly Scholarship, July to December 2008

Primary education	Boys and Girls
Third grade	$130
Fourth grade	$155
Fifth grade	$195
Sixth grade	$265

Secondary eduction	Boys	Girls
First grade	$385	$405
Second grade	$405	$450
Third grade	$430	$495

Upper secondary/ High school	Boys	Girls
First grade	$645	$740
Second grade	$695	$790
Third grade	$735	$840

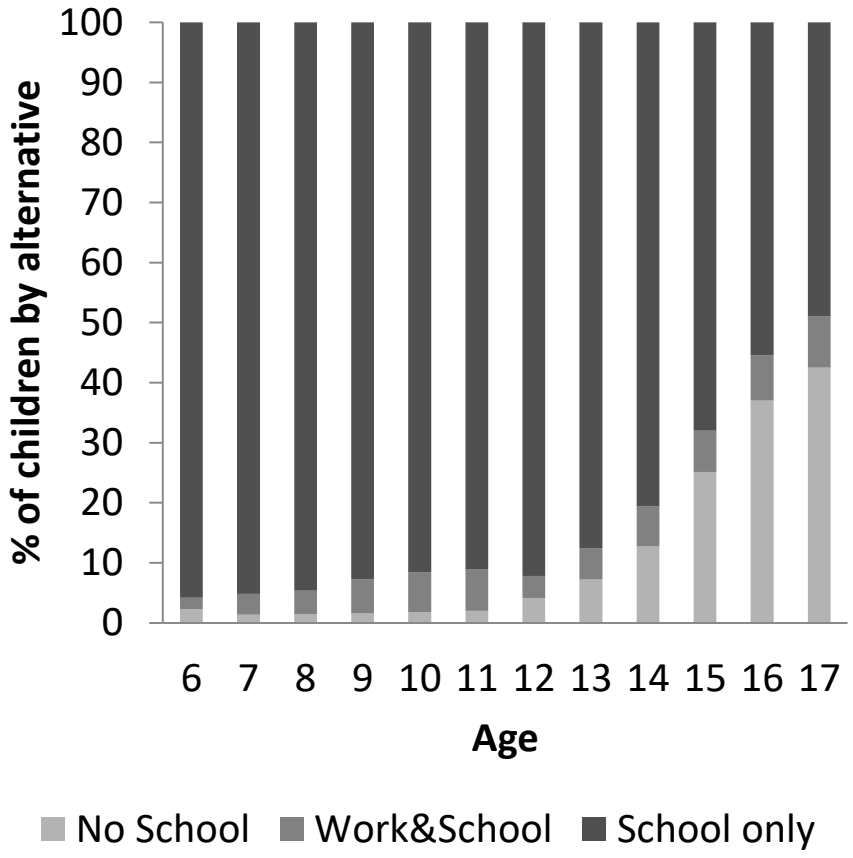
Source: http://www.normateca.gob.mx/Archivos/46_D_1786_.pdf

Observed time allocation of children

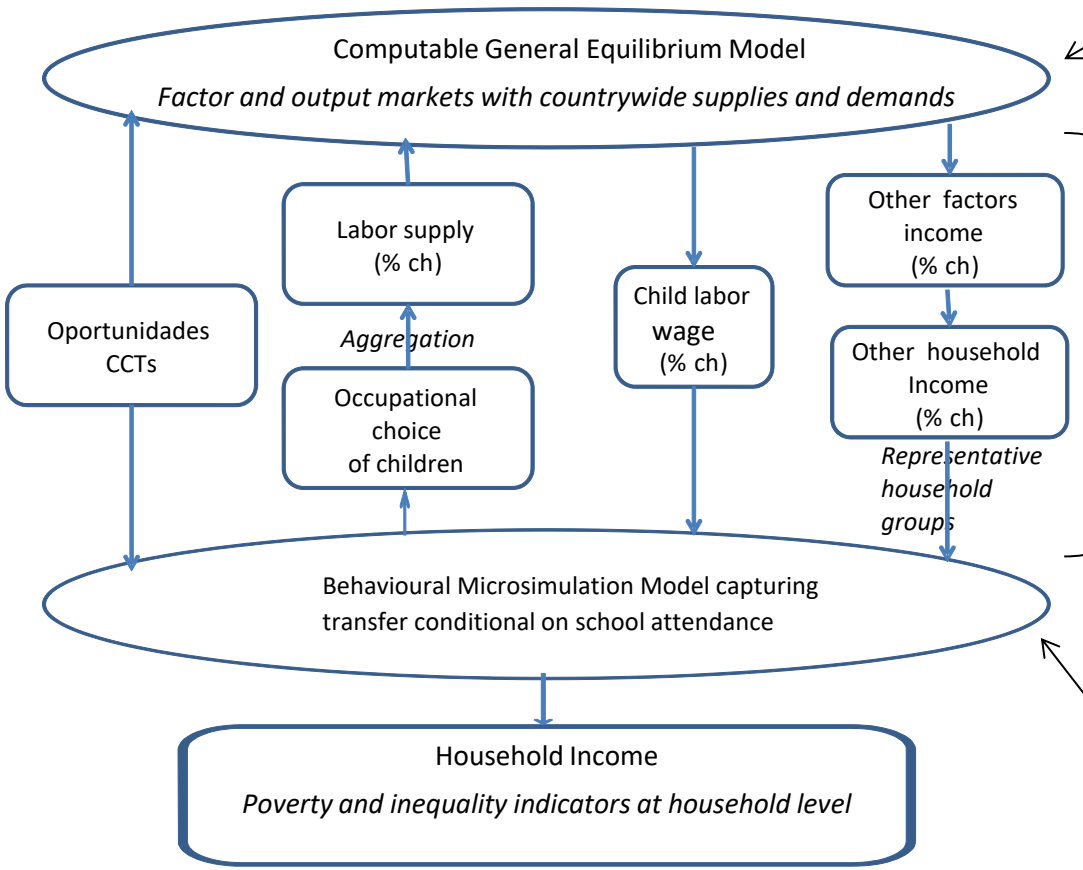
Distribution of children by occupational choice

Choice	Frequency	Percent
Not Studying	3,543	11.68
Work and School	1,702	5.61
School only	25,086	82.71
Total	30,331	100

Authors' calculation based on ENIGH 2008



Our macro-micro approach



What to do?

Behavioral micro-simulation model

Child (i)
- (0) Works
- (1) Works and attends school
- (2) Attends school

Mincer equation for wage

$$\ln w_i = X_i\,\delta + m\;Ind(S_j = 1) + u_i,$$

where X_i obs. chars of child i and hhd, $S_j = 1$ for children who work and attend school

MNL model for time allocation of children based on ARUM (Amemiya and Shimono 1989)

$$U_i(j) = Z_i\gamma_j + (Y_{-i} + CCT_{ij})\alpha_j + w_i\beta_j + v_{ij} \;\; with\; CCT_{i0} = 0\; and\; CCT_{i1} = CCT_{i2} = T,$$

where $U_i(j)$ utility of child i in alt. j, Z_i chars of child and hhd, Y_{-i} non − transfer income of family of child i, CCT_{ij} transfer to child i in alt. j, w_i potential wage of child i, and v_{ij} unobservables affecting time allocation.

Simulations

1) Absence of Oportunidades transfers (conditional and unconditional)

2) **Extension of the conditional transfers to all the moderately poor children according to the existent program rules. Existing transfers remain, but coverage extends with CCT=f(school grade child were to assist, gender) for moderately poor who are not yet beneficiaries.**

3) Lagged human capital effect of the existing transfers

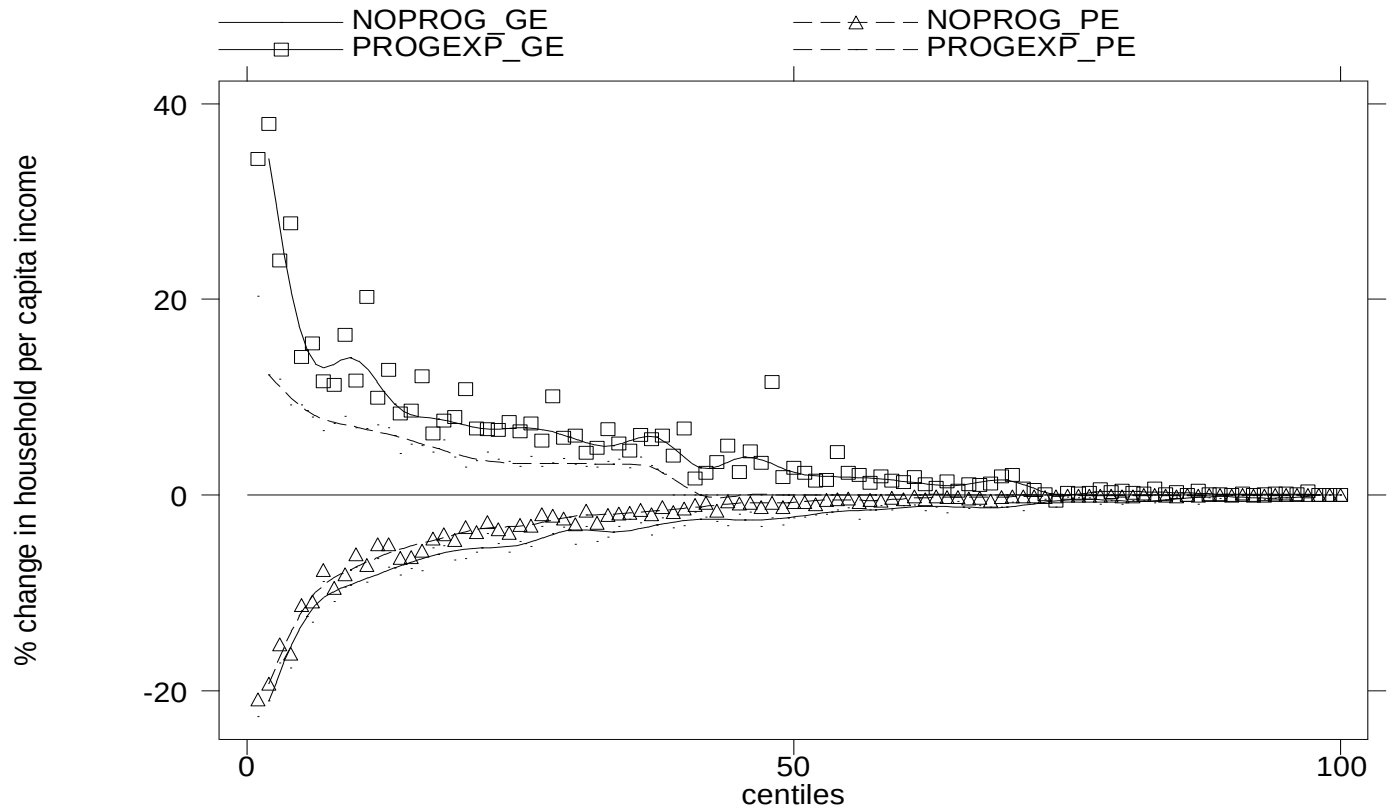
Simulated changes in time allocation

No Program:	Partial Equilibrium			General Equilibrium		
	Base Choice			Base Choice		
Simulated Choice	Not Studying	Work and School	School only	Not Studying	Work and School	School only
Not Studying	100.0	0.3	0.1	100.00	0.0	0.0
Work and School	0.0	99.7	0.0	0.0	99.94	0.0
School only	0.0	0.0	99.9	0.0	0.06	100.00

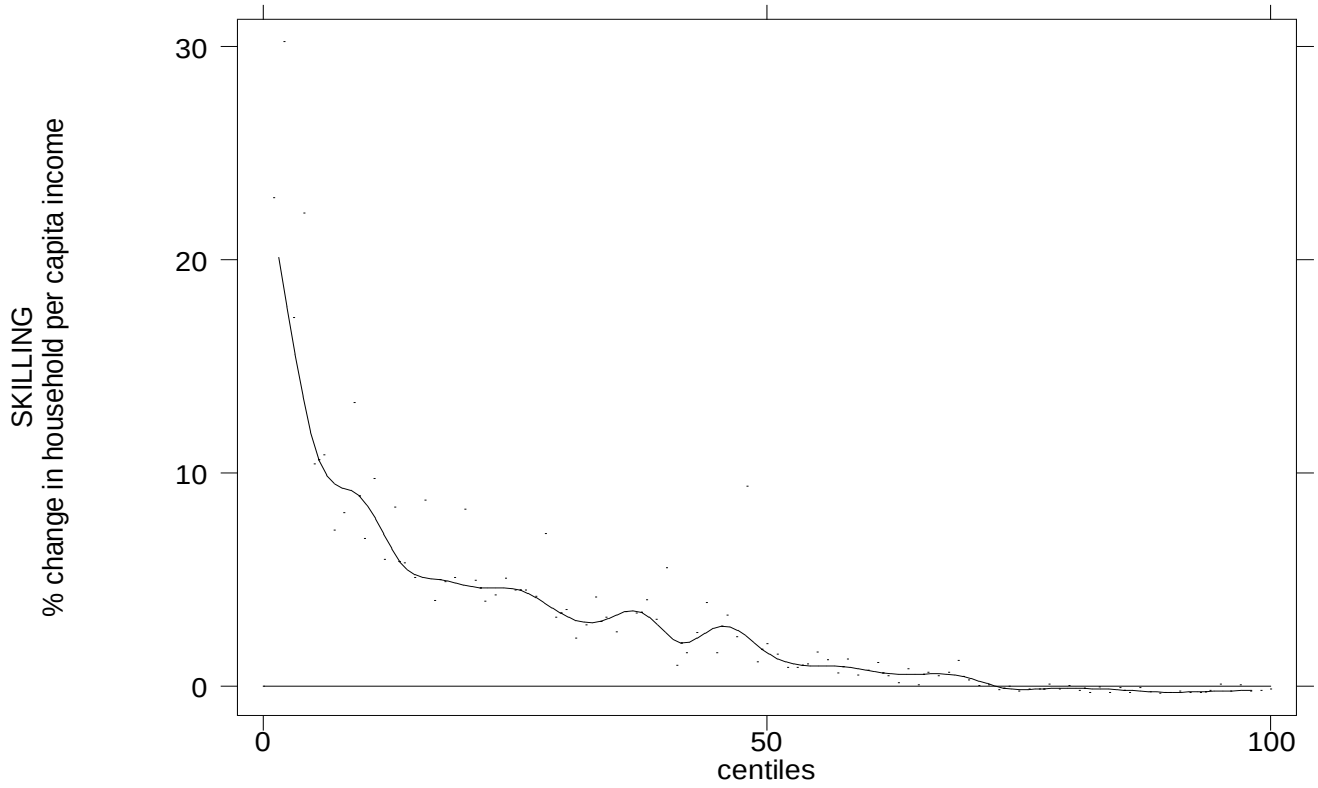
Program Expansion	Partial Equilibrium			General Equilibrium		
	Base Choice			Base Choice		
Simulated Choice	Not Studying	Work and School	School only	Not Studying	Work and School	School only
Not Studying	87.4	0.00	0.00	87.9	0.52	0.05
Work and School	0.8	100.00	0.00	0.5	96.38	0.0
School only	11.8	0.00	100.00	11.6	3.10	99.95

Program Skilling	Partial Equilibrium			General Equilibrium		
	Base Choice			Base Choice		
Simulated Choice	Not Studying	Work and School	School only	Not Studying	Work and School	School only
Not Studying	--	--	--	99.8	0.0	0.0
Work and School	--	--	--	0.0	99.9	100.0
School only	--	--	--	0.2	0.1	0.0

Simulated changes on income distribution: No-program and program-expansion simulations, partial and general equilibrium



Simulated changes on income distribution: Lagged human capital effect general equilibrium



Simulated changes on income distribution and poverty indicators

Simulated poverty and inequality indicators by simulation and type of equilibrium

	Base	No Program		Program Expansion		Program Skilling
FGT(0)		PE	GE	PE	GE	GE
National extreme poverty line	6.7	8.3	8.9	5.7	5.3	5.8
National moderate poverty line	29.2	30.3	31.1	27.4	26.5	27.8
1.25$ a day line	1.7	2.8	3.1	1.2	1.1	1.2
2$ a day line	5.2	6.6	7.0	4.4	4.0	4.4
FGT(1)						
National extreme poverty line	1.9	2.7	2.9	1.5	1.3	1.5
National moderate poverty line	9.9	11.0	11.5	9.0	8.5	9.0
1.25$ a day line	0.4	0.9	1.0	0.3	0.3	0.3
2$ a day line	1.5	2.3	2.5	1.2	1.1	1.2
FGT(2)						
National extreme poverty line	0.8	1.3	1.4	0.6	0.5	0.6
National moderate poverty line	4.8	5.7	6.0	4.2	3.9	4.2
1.25$ a day line	0.2	0.4	0.5	0.1	0.1	0.1
2$ a day line	0.6	1.1	1.3	0.5	0.4	0.5
Gini Coefficient	0.511	0.517	0.521	0.506	0.501	0.504

Conclusions (1 of 2)

- ✓ We combine a micro-simulation model with a general equilibrium model to search for an equilibrium that satisfies both the utility-maximizing decisions regarding the time-allocation of the children in school age and the equilibrium of the country-wide factor and commodity markets.

- ✓ Applying our model to the Oportunidades conditional cash transfers in Mexico, we find that partial equilibrium analysis alone may underestimate the distributional effects of the program.

- ✓ By raising the opportunity cost of work through the provision of transfers conditional on school attendance, and hence reducing child labor supply, Oportunidades increases the wages earned by children at work in a double-digit percentage change magnitude.

- ✓ This indirectly benefits poor households who retain their children at work: in partial equilibrium analysis the program causes a 1.8 percentage-point drop in poverty, accounting also for the general equilibrium effects is estimated to lead to a drop in poverty of up to 2.7 percentage points.

Conclusions (2 of 2)

- ✓ The skilling of the future workforce generated by the lagged human capital acquisition allowed by Oportunidades further increases the incomes of the poor households, decreasing the poverty rate roughly in the order of 1.4 percentage points.

- ✓ The model could be extended to:

- Consider intra-household decision-making mechanisms that affect the determination of the time-allocation choices of children.
- Consider dynamics.

- ✓ **The model could be adapted to consider the general equilibrium effects of extending other social programs for which a study using RCTs is present or planned.**

Illustration:

Micro-simulating the effects of capital outflows on employment, poverty and inequality

in

Debowicz (2016) 'Does the microsimulation approach used in macro–micro modelling matter? An application to the distributional effects of capital outflows during Argentina's Currency Board regime',

Journal of *Economic Modelling*

The macro shock and macro model

Non-residents deposits at domestic banks fall 60.8% in Argentina, from 32.9 billion dollars (December 2000) to 12.9 billion dollars (December 2002).

Real-financial CGE model where money is included in the production function following the tradition of Levhari and Patinkin (1968): liquidity affects the efficiency with which the economy uses its real resources by allowing for greater specialization and exchange.

The behavioural approach

"Layered" behavioural microsimulations approach developed by Anne-Sophie Robilliard, François Bourguignon and Sherman Robinson (2008) (RBR from now on), 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 barred from (or let in) jobs, making the selection depend on individuals' characteristics, i.e. **who** is fired when the employment level shrinks

Simulation: capital outflow suffered by Argentina during the Dec 2000 – Dec 2001 period.

With comparison of Behavioural MS vs. Non-behavioural ones.

Five steps in behavioural MS

1. Specify a household income model consistent with the CGE model
2. Estimate the household income model
3. Simulate capital outflow in the macro CGE model
4. Attribute the macro changes at micro level
5. Compute and evaluate distributional outcomes at micro level

Step 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 supply in each segment is given	The individuals remain in original segment during the microsimulation
There is full employment in the informal segment	All individuals informally employed remain as such
In the formal segments there is some unemployment	The unemployed are allocated into the formal segments of the labour market **Individuals supplying labor in the formal segments need to be assigned among employed and unemployed alternatives in each simulation**

Step 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

Step 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).

Step 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

Step 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^2v_i)

⇨ Every element in the Household Income Model has been determined

Step 3. CGE results of a capital outflow

Non-residents deposits at domestic banks fall 60.8% in Argentina, from 32.9 billion dollars (December 2000) to 12.9 billion dollars (December 2002).

Nummeraire: CPI.

This leads to a contraction of the economy, with the following changes communicated to the microsimulation module:

$$\widehat{N}_{FS} = -1.61\%, \widehat{N}_{FU} = -1.30\%$$

$$\widehat{W}_{FS} = -0.13\%, \widehat{W}_{FU} = -0.01\%, \widehat{W}_{IU} = -0.96\%$$

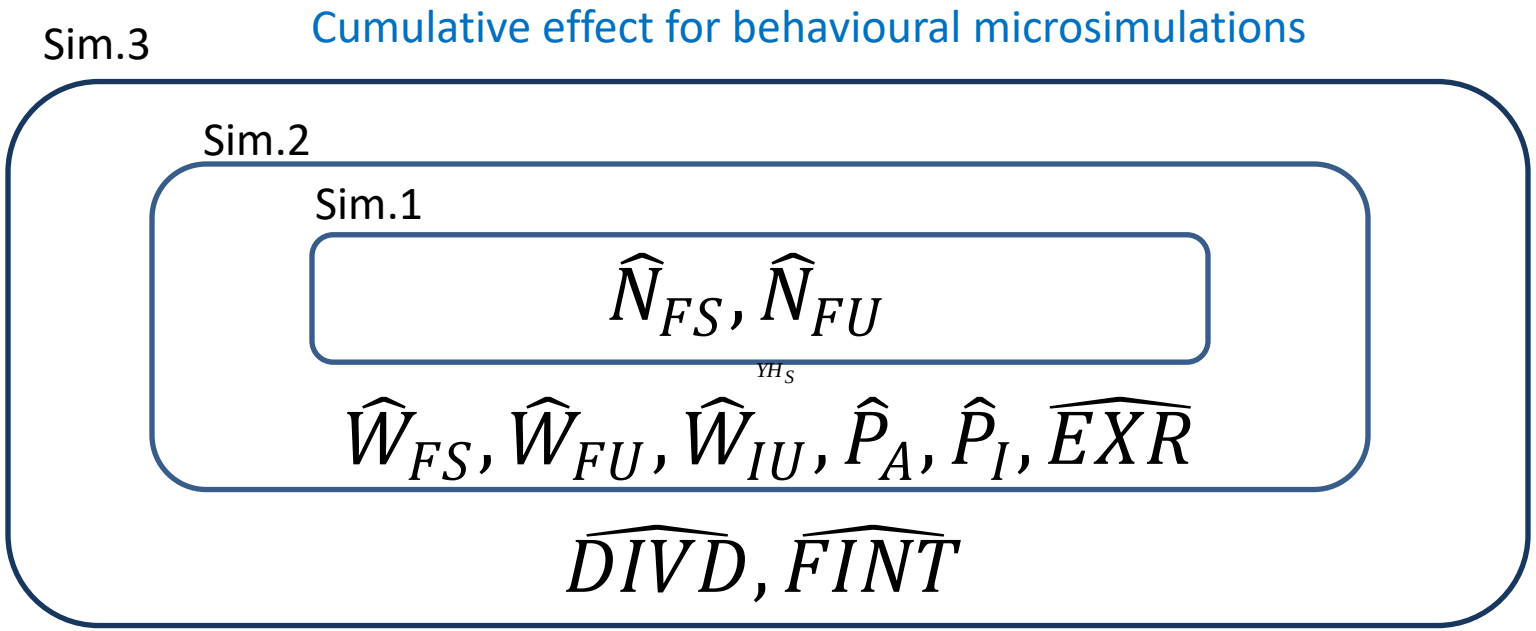
$$\widehat{P}_A = 0.31\%, \widehat{P}_I = 0.02\% \quad EXR = 1.58\%$$

$$\widehat{DIVD} = -0.67\% \qquad \widehat{FINT} = 7.73\%$$

$$\widehat{Y}_S = -1.29\%, \widehat{Y}_U = -0.47\%, \widehat{Y}_C = -0.91\%$$

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

Step 4. Communications from the CGE to the microsimulation model



Sim.H: Non-behavioural microsimulations linked to CGE through the households

$\widehat{YH_S}, \widehat{YH_U}, \widehat{YH_C}$

Sim.F: Non-behavioural microsimulations linked to CGE through the factor markets

In the line of Vos and Sanchez (2010).

Attributing results at micro level

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

Following the methodology designed by RBR, coefficients change assuming "neutrality" with respect to individual characteristics; more precisely, the intercepts change:

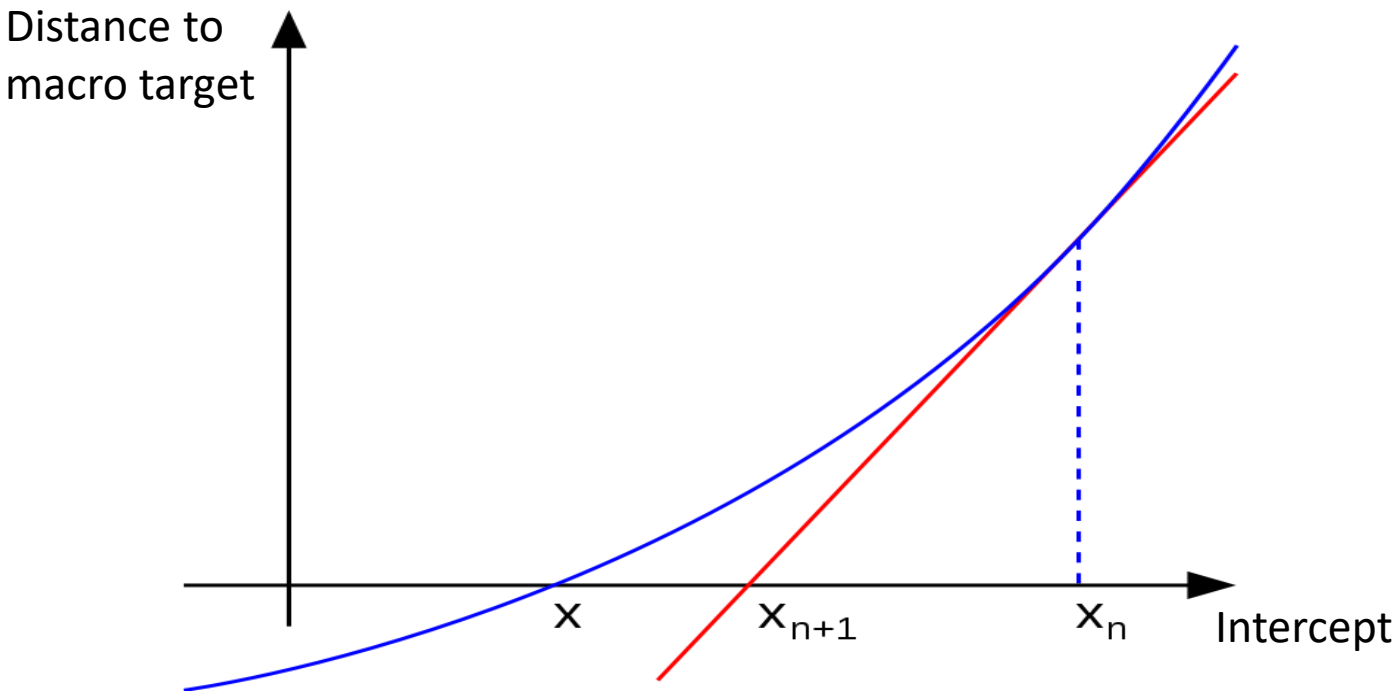
$$P(IW_i^s = 1 | Z_i^s) = \frac{e^{\alpha^s + Z_i^s \beta^s}}{1 + e^{\alpha^s + Z_i^s \beta^s}} \quad (2)$$

$\downarrow \alpha^{FS}, \downarrow \alpha^{FU}$ => 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

Step 4. Newton's technique to change intercepts



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

4. 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

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

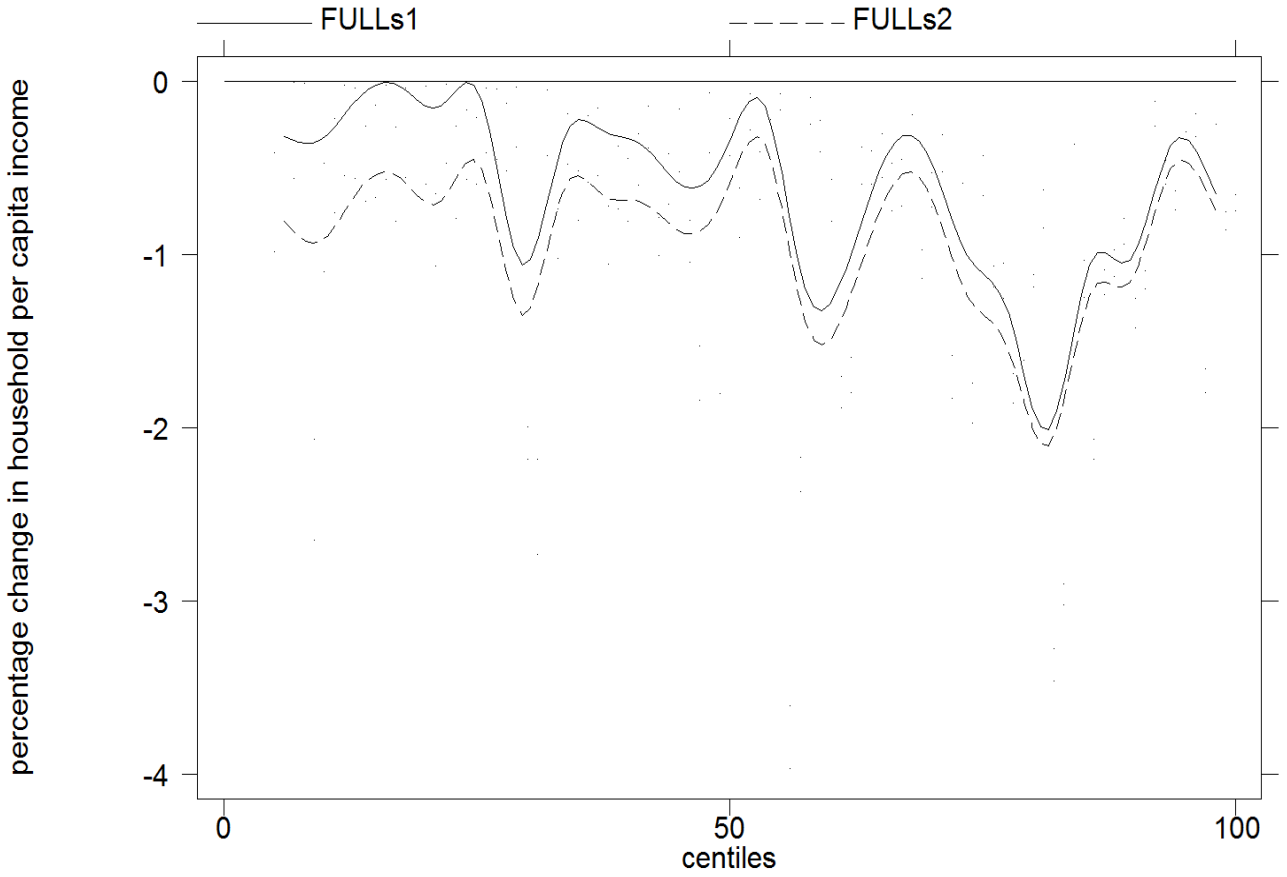
$$W^*_f = W_{f,0}.(1 + \widehat{W}_f),$$

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

4. 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

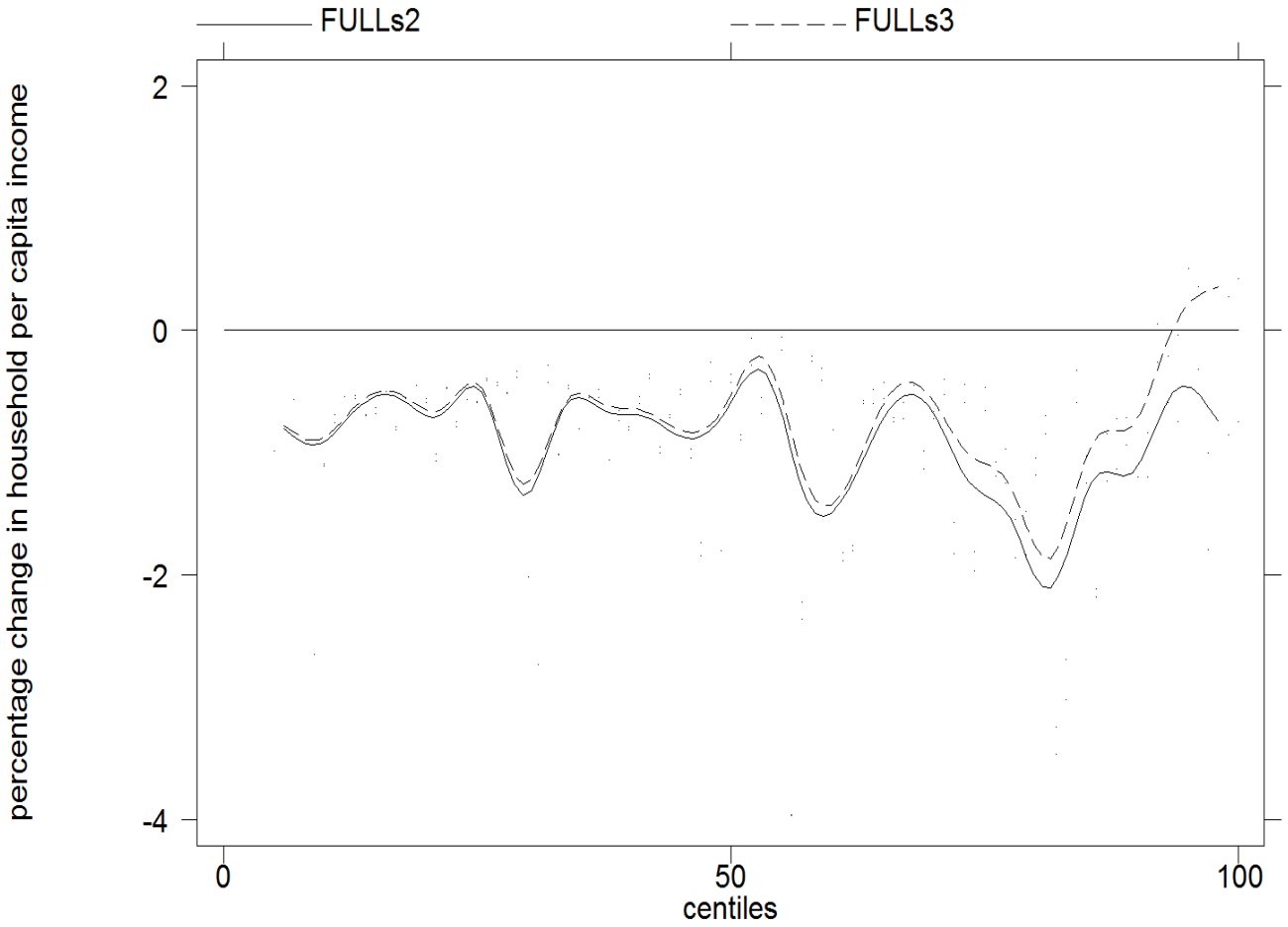
5. Percentage change in household per capita income by percentile
Simulations 1 and 2



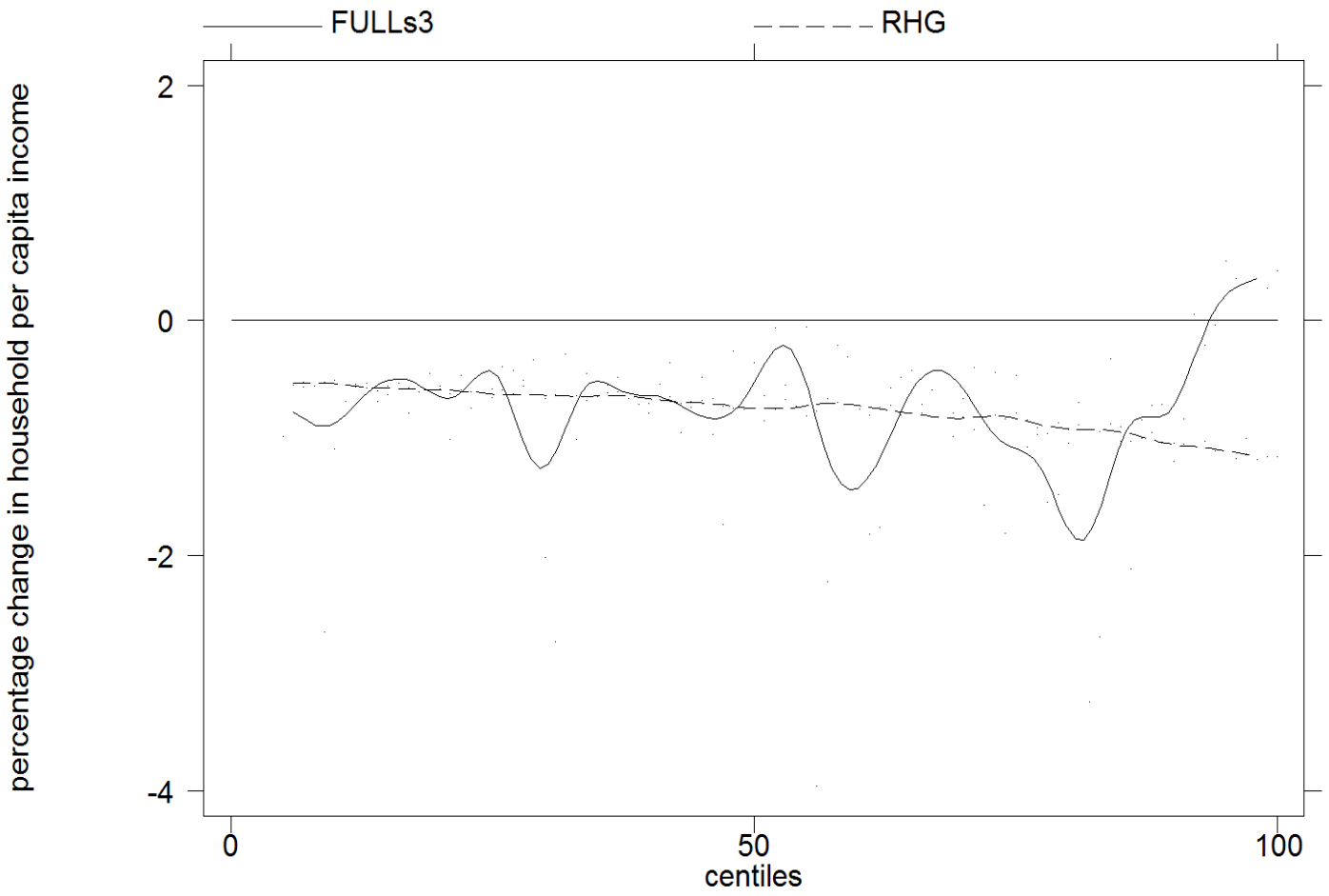
⇒shape dominated by people getting fired

⇒labor income large share of income at the bottom

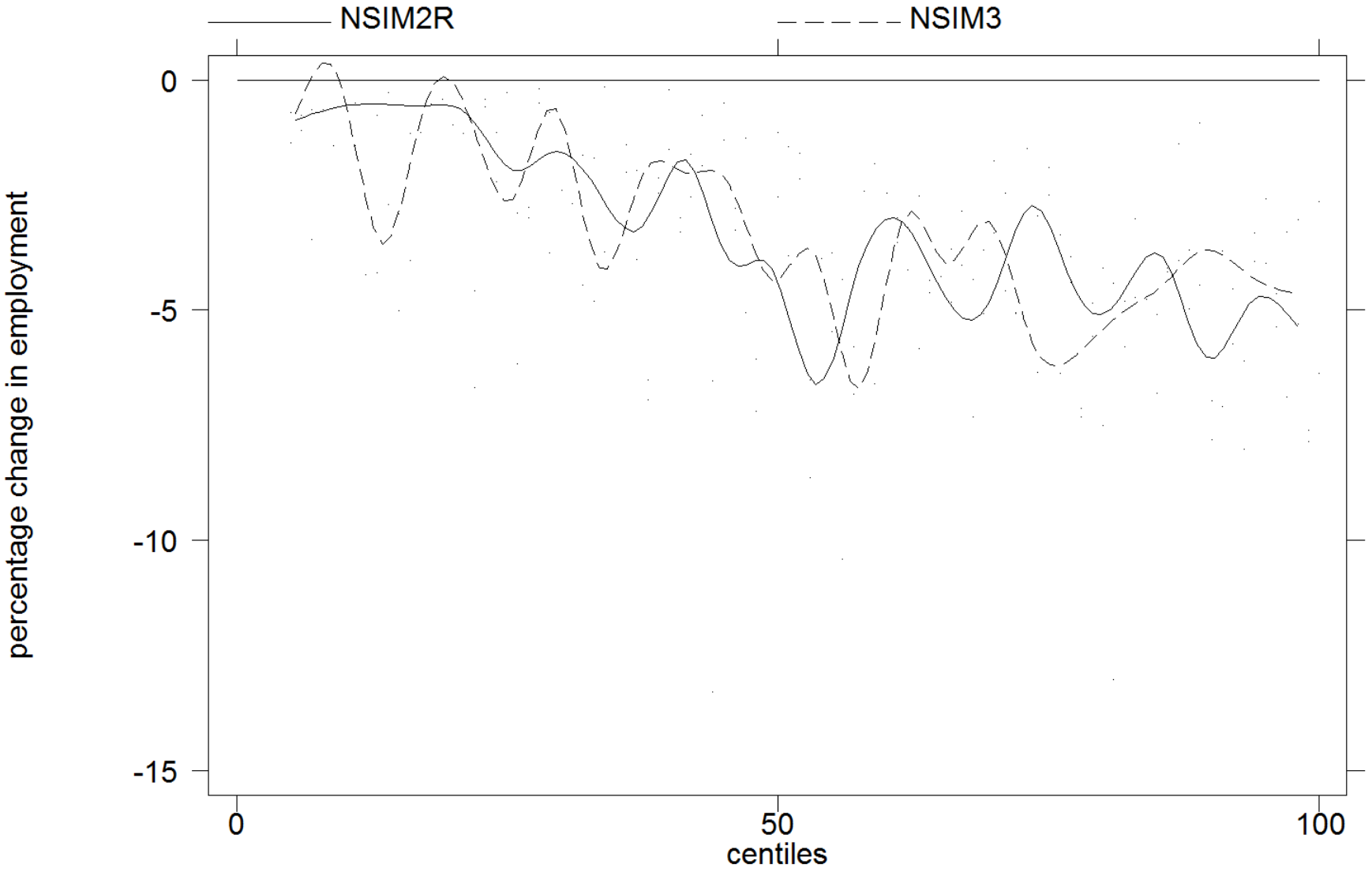
5. Percentage change in household per capita income by percentile Simulations 2 and 3



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



5. Percentage changes in employment by percentile Simulations Behavioural (NSIM3) and 'Non-parametric approach' (via factor market)



5. 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)

Conclusions

•In the behavioural microsimulations, as per capita income falls and inequality increases, the poverty headcounts, the poverty gaps and the poverty severity indexes go up for the different poverty lines. The increase is mainly due to the employment fall, though there are slight increases due to the wage fall, and no change at all due to the capital income changes.

•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”.

•Graph 3 (Behavioural vs. Arithmetic MS) gives 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.

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Backup slides

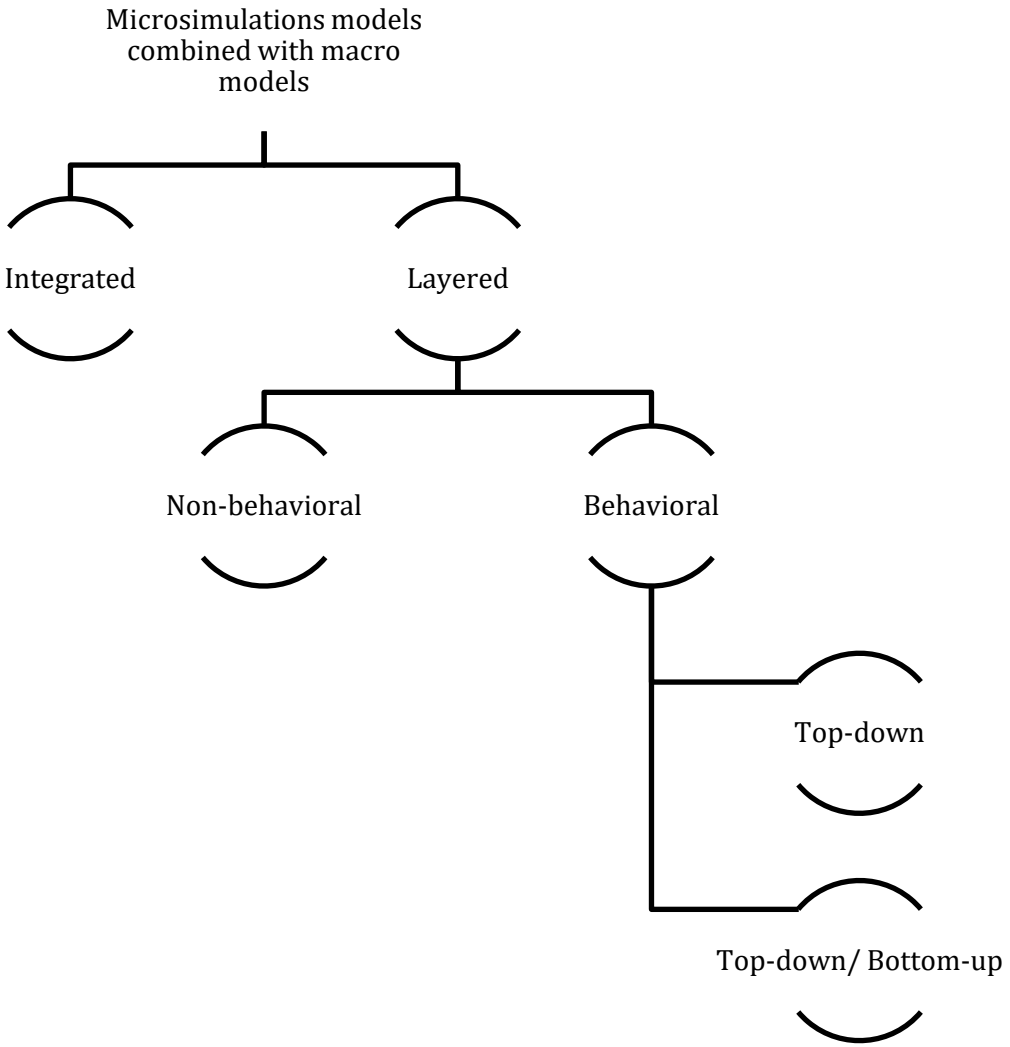
General equilibrium model

Selected equations

$X_i = \Lambda_i \left(\sum_f \alpha_{if} \cdot V_{if}^{-\rho_i} \right)^{-1/\rho_i}$, $where \boldsymbol{X_i}$ output of sector I, $\boldsymbol{V_{if}}$ is use of factor f in sector i

$\sum_i V_{if} = \overline{VS_f}, where\ \boldsymbol{VS_f}$ is child-labor and other factor supply (exogenous in GE model)

Macro-micro approaches



Econometric explanation of child wage

Table 1 Child wage equation

$$\ln w_i = X_i \delta + m\, Ind(S_i = 1) + u_i$$

	(1) Age 6 to 17	(2) Age 12 to 17
Work & School	-0.644***	-0.593***
	(0.060)	(0.058)
Log average federative wage	0.346***	0.438***
	(0.064)	(0.072)
Male	0.214***	0.213***
	(0.048)	(0.053)
Years of schooling	0.009	0.153***
	(0.044)	(0.047)
Years of schooling^2	-0.001	-0.012***
	(0.003)	(0.003)
Age	0.389***	0.366
	(0.090)	(0.334)
Age^2	0.001	-0.001
	(0.003)	(0.011)
Female head	0.135***	0.127**
	(0.052)	(0.056)
Rural	-0.243***	-0.326***
	(0.051)	(0.054)
Noreste	0.219	0.096
	(0.152)	(0.166)
Noroeste	0.306***	0.337***
	(0.100)	(0.108)
Occidente	0.151	0.167
	(0.103)	(0.111)
Oriente	-0.062	0.053
	(0.112)	(0.115)
Centronorte	0.122	0.110
	(0.099)	(0.104)
Centrosur	0.178*	0.206**
	(0.101)	(0.105)
Sureste	-0.023	0.141
	(0.100)	(0.107)
Constant	-5.882***	-5.086**
	(0.528)	(2.484)
Observations	3,021	2,285
R-squared	0.596	0.262

Econometric explanation of children's time allocation

Table 1 Multinomial logit estimates of child labor supply, all children

	(1)	(2)	(3)	(4)	(5)
	Multinomial logit estimates		Marginal effects at the mean of data		
	Work & School	School only	Not studying	Work & School	School only
Y_i	0.019***	0.022***	-0.001***	-0.000	0.001***
	(0.004)	(0.003)	(0.000)	(0.000)	(0.000)
Log mean fed. wage	0.411***	-0.157***	0.008**	0.025***	-0.033***
	(0.089)	(0.054)	(0.003)	(0.003)	(0.005)
Male	0.493***	-0.206***	0.011***	0.031***	-0.042***
	(0.063)	(0.040)	(0.003)	(0.002)	(0.003)
Years of schooling	0.000	-0.093***	0.006***	0.004***	-0.010***
	(0.037)	(0.025)	(0.002)	(0.001)	(0.002)
Years of schooling	0.008**	-0.002	0.000	0.000***	-0.000***
	(0.003)	(0.002)	(0.000)	(0.000)	(0.000)
Rank of child	0.355***	0.396***	-0.025***	-0.001	0.026***
	(0.036)	(0.022)	(0.001)	(0.001)	(0.002)
No child 0<age<6	-0.058	-0.122***	0.008***	0.002	-0.010***
	(0.042)	(0.026)	(0.002)	(0.002)	(0.002)
No child 5<age<13	0.297***	0.289***	-0.018***	0.001	0.017***
	(0.034)	(0.022)	(0.001)	(0.001)	(0.002)
No child 12<age<18	-0.613***	-0.705***	0.044***	0.002	-0.046***
	(0.043)	(0.025)	(0.002)	(0.002)	(0.002)
No people age>17	-0.278***	-0.240***	0.015***	-0.002*	-0.013***
	(0.034)	(0.019)	(0.001)	(0.001)	(0.002)
Rural	-0.412***	-0.211***	0.015***	-0.009***	-0.005
	(0.073)	(0.045)	(0.003)	(0.003)	(0.004)
Educ. Head	0.101***	0.169***	-0.011***	-0.002***	0.013***
	(0.009)	(0.006)	(0.000)	(0.000)	(0.001)
Age Head	0.006*	0.019***	-0.001***	-0.001***	0.002***
	(0.003)	(0.002)	(0.000)	(0.000)	(0.000)
Noreste	-0.160	-0.289**	0.020**	0.005	-0.025**
	(0.205)	(0.115)	(0.009)	(0.009)	(0.012)
Noroeste	0.618***	0.076	-0.007	0.029***	-0.023***
	(0.135)	(0.082)	(0.005)	(0.007)	(0.009)
Occidente	0.371***	-0.153*	0.008	0.027***	-0.035***
	(0.144)	(0.087)	(0.006)	(0.008)	(0.010)
Oriente	0.253	0.171*	-0.010**	0.004	0.006
	(0.154)	(0.090)	(0.005)	(0.006)	(0.008)
Centronorte	0.112	-0.068	0.004	0.008	-0.012
	(0.138)	(0.080)	(0.005)	(0.006)	(0.008)
Centrosur	0.042	0.153*	-0.009*	-0.004	0.013*
	(0.140)	(0.080)	(0.005)	(0.005)	(0.007)
Sureste	0.631***	0.108	-0.008*	0.029***	-0.020**
	(0.136)	(0.081)	(0.005)	(0.008)	(0.009)

Conceptual and Numerical SAM capturing Oportunidades in Mexico

	Activities	Commodities	Factors	Households	Government	Saving-Investment	Changes in stocks	Rest of world	Oportunidades	Other p transf
Activities		Domestic supply								
Commodities				Private final consumption	Public final consumption	Fixed investment	Change in stocks	Exports		
Factors	Value added at factor cost									
Households			Households factor income					Foreign remittances	Oportunidades	Other p transf
Government	Activity taxes	Tariffs		Direct taxes						
Saving-Investment				Private saving	Public saving			Foreign saving		
Changes in stocks						Change in stocks				
Rest of world		Imports	Net factor income of non-residents		Public transfers to non-residents					
Oportunidades					Oportunidades					
Other public transfers					Other public transfers					

	Activities	Commodities	Factors	Households	Government	Saving-Investment	Changes in stocks	Rest of world	Oportunidades	Other transfe
Activities		12,165								
Commodities				7,856	1,307	2,696	612	3,417		
Factors	10,964									
Households			10,867					281	14	1,(
Government	1,201	35		813						
Saving-Investment				3,494	-368			182		
Changes in stocks						612				
Rest of world		3,689	97		94					
Oportunidades					14					
Other transfers					1,002					
Total	12,165	15,889	10,964	12,164	2,049	3,309	612	3,880	14	1,(

Actors in Mexican CGE model

Activity Sectors (14)

Agriculture, Livestock, Forestry, Fishing and Haunting; Mining; Electricity, water and gas provision by tube to final consumer; Construction; Manufacturing; Trade; Transport, mail and stocking; Information in massive media; Financial and insurance services; Professional, scientific and technical services; Education; Health and social assistance; Public services; Other services.

Production Factors (15)

Labor (13): Male skilled informal; Male unskilled informal; Male semi-skilled informal; Male skilled formal; Male unskilled formal; Male semi-skilled formal; Female skilled informal; Female unskilled informal; Female semi-skilled informal; Female skilled formal; Female unskilled formal; Female semi-skilled formal; Child labour

Others (2): Capital, Land.

Representative Household groups (16)

Non-oport non-poor urban male; Non-oport non-poor urban female; Oport non-poor urban male; Oport non-poor urban female; Oport poor urban male; Oport poor urban female; Oport poor rural male; Oport poor rural female; Oport non-poor rural male; Oport non-poor rural female; Non-oport poor urban male; Non-oport poor urban female; Non-oport poor rural male; Non-oport poor rural female; Non-oport non-poor rural male; Non-oport non-poor rural female.

Other Accounts (10)

Government; Income tax; Imports tax; Activity tax; Oportunidades; Rest of transfers from government to households; Change in stock; Saving-Investment; Rest of the World.

Evaluation of CCTs following BFL

A Summary of the Microsimulation Literature on Conditional Cash Transfers following Bourguignon, Ferreira and Leite

Study	Country	Sample	Year (data)	Program Name	Scenarios	Impact
Bourguignon, Ferreira and Leite (2002)	Brazil	Children aged 10-15 and children aged 10-15 living in poor households	1999	Bolsa Escola	1. Bolsa Escola transfer, 2. doubling Bolsa Escolar transfers, 3. age-contingent transfer, 4. means-test raised, 5. combination of 2 and 4, 6. combination of 3 and 4, 7. no conditionality.	Simulation 1: 2.1 percentage point reduction in children out of school, 1.1 percentage point increase in fraction of children working and going to school, 1.8 percentage point increase in children attending school. Effect more pronounced for the poor: initially 9.1 percent working decreases in simulation to 4.7 percent, 23.7 percent working and studying increases to 24.7 percent and 67.3 percent increases to 70.6 percent attending school only. Doubling the transfer reduces fraction of children out of school by an additional percentage point, age-contingency of transfer does not alter to a great extent the results, amount seems more relevant than means-test. In terms of poverty, program in Simulation1 would reduce poverty by 1 percentage point and inequality by 0.5 percentage points, Simulation2 would reduce headcount by 1.3 percentage points.
Azevedo and Robles (2010)	Mexico	Children aged 12-18, 12-15, 16-18	1996	Oportunidades in 2005	1. Oportunidades design in 2005, 2. Increase UCT by 26 percent, 3. suspension of transfer to students in third to fifth grade of primary school and proportional increase in transfer to the rest maintaining UCT component, 4. suspension of transfer to grade three and five of primary school plus triplicating existing transfers, maintaining UCT, 5. triplication of the CCT plus UCT as in 2, 6. quadruples transfer to secondary and high school students, maintain UCT, 7. transfer design based on opportunity costs as measured by average reported wage in 2005, 8. Reduction of 2005 transfer design by one half.	Simulation 1: 2005 CCT design increases school attendance by 1.18 percentage points for 12-15 year olds, by 1.17 for 16-18 year olds to study only and 0.34 percent work and study and 1.17 for 12-18 year olds to study only and 0.14 percent of work and study. The effect is more pronounced for the poor. Modifying the 2005 design for poor children according to the different scenarios yields in Simulation 2. does not alter occupational choices, Simulation 3 increases the fraction of students attending school only from 44.04 to 44.66, the fraction of students working and going to school from 10 to 10.8. Simulation 4 and 5 increase the fraction of children going to school only to 48.2 and 50.4 and the fraction of children going to school and working 10.91 and 11.25. Simulation 6 reduces the fraction of children not attending school by 4.71 percentage points, Simulation 7 by 0.56 percentage points and Simulation 8 increases the school dropouts by 2.58 percentage points. The program reduces poverty by 2 percentage points nationally and by 4 percentage points in rural areas. Also, inequality is reduced with the Gini dropping from 0.527 to 0.512.
Amarante, Arim, de Melo and Vigorito (2008)	Ururguay	Boys and girls aged 14 -17	2006	Asignaciones familiars	1. New asignaciones familiares regime, 2. Change in the transfer amount for children aged 0-12 and 13-17, 3. Equal transfer amount to all children aged below 18, 4. Simulation of transfer design on adult labor supply (assuming first children's labor supply is decided upon and then adults)	Simulation 1: increase in school attendance by about 2.5 percentage points. 14 % of children that are out of school in baseline return to educational system and 20% who initially work and study, study only in simulation. This effect does not vary much by the different simulation scenarios. The authors find a reduction in poverty by 1 percentage point and 2 percentage points for households with children. Also, the authors find the program to reduce inequality. The transfer is only reduces spouses labor supply and is simulated to reduce hours of work for eligible households.

Statistics by Occupational choice

Table 1 Summary statistics by Occupational Choice

	Not Studying	Work and School	School only
Wage (yearly)	7275	6189	0
Total hh income (yearly)	109709	133661	140243
Rural	0.40	0.26	0.28
Age	15.11	12.49	10.98
Male	0.53	0.65	0.50
Years of schooling	6.74	6.01	4.68
No child 0<age<6	0.57	0.50	0.52
No child 5<age<13	1.06	1.33	1.48
No child 12<age<18	1.68	1.14	0.94
No people age>17	2.94	2.56	2.63
Education head	4.77	6.92	7.59
Education spouse of head	3.50	5.37	5.96
Age head	45.93	43.34	43.61
Age spouse of head	32.51	30.38	32.10
Female headed household	0.24	0.26	0.21
Rank	2.04	2.02	2.12
Hrs. worked	19.54	16.13	0.00
N	3,543	1,702	25,086

Authors' calculation based on ENIGH 2008

Elasticities in CGE model

	Factor substitution	Armington	CET
Agriculture, livestock, forestry, fishing, hunting	0.6	4	4
Mining	0.6	3	3
Electricity, water and gas provision	0.6	3	3
Construction	0.6	3	3
Manufacturing	0.6	3	3
Trade	0.6	3	3
Transport, mail and storage	0.6	3	3
Media	0.6	2	2
Financial and insurance services	0.6	2	2
Profesional, scientific and technical services	0.6	2	2
Education	0.6	2	2
Health and social assistance	0.6	2	2
Other private services	0.6	2	2
Public services	0.6	2	2

Source: IFPRI model for Mexico – Rebecca Lee Harris and David Coady (2000)

Frisch and expenditures elasticities in LES consumption demand

	Non-oport non-poor urban male hhd	Non-oport non-poor urban female hhd	Oport non-poor urban male hhd	Oport non-poor urban female hhd	Oport poor urban male hhd	Oport poor urban female hhd	Oport poor rural male hhd	Oport poor rural female hhd	Oport non-poor rural male hhd	Oport non-poor rural female hhd	Non-oport poor urban male hhd	Non-oport poor urban female hhd	Non-oport poor rural male hhd	Non-oport poor rural female hhd	Non-oport non-poor rural male hhd	Non-oport non-poor rural female hhd
Frisch parameter	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Agriculture, livestock, forestry, fishing, hunting	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Mining	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Electricity, water and gas provision	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Construction	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Manufacturing	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Trade	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Transport, mail and storage	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Media	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Financial and insurance services	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Profesional, scientific and technical services	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Education	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Health and social assistance	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Other private services	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Public services	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Source: IFPRI model for Mexico – Rebecca Lee Harris and David Coady (2000)