First-Order Effects of Liberalization on Real Wages: Chile

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Motivation

- This work is an attempt to develop an *ex-post* evaluation methodology to help understand the interaction between trade liberalization and development (poverty, wages, welfare, etc).

- This work starts with the case of Chile due to its high degree of trade liberalization (>90%) and available datasets.

- We aim to compare the results across countries and to inform complementary policies that can target specific groups of the population who are vulnerable or can most gain from liberalization.

Methodology

- We follow the methodology developed by Porto (2006)
- Starting from the income-expenditure equilibrium condition of household *h:*

$$e^h(p_i, p_k, u^h) = x_0^h + \sum_m w_m^h + G^h + \phi^h$$

- The household impact is defined as:

$$\frac{dx_o^h}{e^h} = \underbrace{\left[s_i^h \frac{\partial \ln(p_i)}{\partial \ln(\tau_i)} \mathrm{dln}(\tau_i) \right]}_{Direct\ Price\ Effect} + \underbrace{\left[\sum_{k \in K} s_k^h \frac{\partial \ln(p_k)}{\partial \ln(p_i)} \frac{\partial \ln(p_i)}{\partial \ln(\tau_i)} \mathrm{dln}(\tau_i) \right]}_{Indirect\ Price\ Effect} - \underbrace{\left[\sum_{m \in h} (\theta_m^h \varepsilon_{wmpi}) \frac{\partial \ln(p_i)}{\partial \ln(\tau_i)} \mathrm{dln}(\tau_i) \right]}_{Indirect\ Wage\ Effect}$$

$$1 \qquad\qquad\qquad 2 \qquad\qquad\qquad 3$$

- Aggregating over product i gives the effect of a change in border prices (tau) on the household.

Data sources

- Monthly data for 456 products of the CPI basket 1999-2008 (Santiago Metro).
- Tariffs at the 5-digit level of the HS.
- Household Expenditure Survey, 1997 and 2007.
- The employment survey of Chilean households (Encuesta Suplementaria de Ingresos ESI).

Estimation Strategy

- <u>Direct Effect</u> – *Mallick and Marques (2008)*
  - Standard *pass-through* model, using tradable good prices, tariffs, and controls.
- <u>Indirect Effect</u> - *Nicita (2009) and Porto (2006)*
  - Estimate the correlation between tradable and non-tradable product prices, matched using eight categories.
- <u>Indirect effect on household income</u> - *Nicita (2009) and Porto (2006)*
  - Estimate the *pass-through* of changes in domestic prices to wages, according to skill level, and the classic controls.

Estimation Strategy

- We depart from Porto (2006) by estimating the *pass-through* coefficient for each of the 8 product categories

  ◦ Porto assumes complete *pass-through*, which is more likely in a larger, more open and competitive economy.

Estimation Strategy

- As in Porto (2006), wages are unknown linear function of prices of tradable, and exogenous factors.

$$\ln\left(w^m\right) = \sum_i \ln\left(p_{i,t}^m\right)\left(\mathbf{e^{m'}}\beta_i\right) + \mathbf{e^{m'}}\mathbf{d} + \mathbf{z^{m'}}\gamma + \varepsilon^m$$

Pass-through estimates

ESTIMATED EFFECT OF DIRECT PASS-THROUGH OF TARIFF CHANGES ON DOMESTIC PRICES

Product category	Generalized least square panel data	
	Coefficients	Standard errors
Food	0.140*	(0.020)
Housing	0.093**	(0.038)
Equipment	0.114*	(0.022)
Clothing	0.330*	(0.024)
Transportation	0.134*	(0.046)
Education	0.119*	(0.024)
Health care	-0.243*	(0.024)
Other	0.883*	(0.082)
Diff lnFX	0.735*	(0.017)
Observations	5 762	
Number of subgroups	230	

Source: Prepared by the authors on the basis of econometric estimates.
Note: Standard errors in parentheses.
** significant at 5%.
* significant at 1%.

Pass-through from tradable to non-tradable products

RESULTS OF THE ESTIMATION: EFFECT OF INDIRECT TRADABLES PRICE PASS-THROUGH ON NON-TRADABLES PRICES (COCHRANE-ORCUTT METHODOLOGY)

Tradables \\ Non-tradables	Food	Housing	Equipment	Clothing	Transportation	Health care	Education	Others
Food	0.256*	-0.014	0.080+	0.046	0.012	0.043	0.062**	0.092**
	(0.034)	(0.096)	(0.048)	(0.061)	(0.061)	(0.029)	(0.025)	(0.041)
Housing	0.134*	0.162**	0.072	0.119+	0.207*	0.060**	0.047	0.124*
	(0.049)	(0.065)	(0.044)	(0.070)	(0.069)	(0.027)	(0.038)	(0.042)
Equipment	0.623*	1.428*	0.214	0.255	-0.378	0.139	0.684*	0.629+
	(0.194)	(0.469)	(0.320)	(0.377)	(0.611)	(0.240)	(0.208)	(0.366)
Clothing	0.163	-0.014	-0.029	0.306+	-0.037	-0.091	-0.241	-0.049
	(0.103)	(0.201)	(0.123)	(0.180)	(0.244)	(0.115)	(0.149)	(0.156)
Transportation	-0.061	-0.239**	-0.013	-0.063	0.070	-0.021	-0.135*	-0.101+
	(0.057)	(0.093)	(0.056)	(0.066)	(0.076)	(0.029)	(0.039)	(0.056)
Health care	-0.060	-0.132+	0.010	-0.149**	0.025	-0.027	0.001	-0.032
	(0.041)	(0.067)	(0.042)	(0.072)	(0.108)	(0.027)	(0.042)	(0.043)
Education	0.233+	0.198	-0.025	-0.149	0.571+	0.052	-0.267	0.063
	(0.138)	(0.318)	(0.174)	(0.209)	(0.318)	(0.156)	(0.172)	(0.196)
Others	0.038**	-0.028	0.023	0.040	0.059	0.018	0.075*	0.031
	(0.019)	(0.056)	(0.018)	(0.041)	(0.039)	(0.023)	(0.018)	(0.019)
Number of observations	120	120	120	120	120	120	120	120
R^2	0.995	0.847	0.965	0.979	0.982	0.972	0.997	0.987
Durbin-Watson statistic	1.76	1.96	1.99	2.08	1.86	1.67	2.04	1.84
Durbin-Watson statistic 0	0.90	1.04	1.22	1.05	1.11	0.92	1.48	0.98

Source: Prepared by the authors on the basis of econometric estimates.
Note: Standard errors in parentheses.
+ Significant at 10%; ** significant at 5%; * significant at 1%.

Wage-price elasticities

RESULTS OF THE ESTIMATION: EFFECT OF CHANGES IN DOMESTIC PRICES ON THE GROWTH OF WAGES

	Low skill (0-6)	Medium skill (>6<12)	High skill (> 12)
Foods	-0.159	-0.037	**-0.578**
	(0.75)	(0.37)	**(3.85)****
Housing	0.110	0.022	-0.072
	(0.44)	(0.12)	(0.32)
Equipment	**-3.578**	**-5.236**	-2.881
	(2.09)*	**(4.40)****	(2.01)*
Clothing	**2.681**	**2.827**	**2.609**
	(5.91)**	**(7.00)****	**(6.14)****
Transportation	0.443	0.188	0.166
	(1.37)	(0.81)	(0.60)
Health care	**1.438**	1.457	1.111
	(4.98)**	(6.32)**	(4.22)**
Education	0.522	2.368	0.493
	(0.24)	(1.38)	(0.26)
Other	1.519	1.234	2.113
	(2.80)**	(3.33)**	(4.77)**
_cons	116.340		
	(5.33)**		
R^2	0.45		
N	290,053		

Source: Prepared by the authors on the basis of econometric estimates.
Note: Standard errors in parentheses. Estimation includes controls for gender, age, marital status, year, occupation and industry.
** Significant at 10%.
* significant at 5%.

Mapping the estimated coefficients to household data

$$\frac{dx_o^h}{e^h} = \underbrace{\left[s_i^h \frac{\partial \ln(p_i)}{\partial \ln(\tau_i)} \mathrm{dln}(\tau_i) \right]}_{Direct\ Price\ Effect} + \underbrace{\left[\sum_{k \in K} s_k^h \frac{\partial \ln(p_k)}{\partial \ln(p_i)} \frac{\partial \ln(p_i)}{\partial \ln(\tau_i)} \mathrm{dln}(\tau_i) \right]}_{Indirect\ Price\ Effect} - \underbrace{\left[\sum_{m \in h} \left(\theta_m^h \varepsilon_{wmpi} \right) \frac{\partial \ln(p_i)}{\partial \ln(\tau_i)} \mathrm{dln}(\tau_i) \right]}_{Indirect\ Wage\ Effect}$$

We calculated the household effect of changes in tariffs according to the three effects above.

We compare our results with the full pass-through assumption in Porto (2006).

The tariff changes between 1999 and 2006 was small. We expect small effects in the case of Chile.

CHILE: EVOLUTION OF TARIFFS, 1999-2006
(Percentage points and multiples)

Product groups	Tariffs calculated (Percentages)		
	1999	2006	Change 1999-2006
Food	10.0	3.3	-6.7
Housing	10.0	0.4	-9.6
Equipment	10.0	2.1	-7.8
Clothing	10.0	4.6	-5.4
Transport	10.0	2.8	-7.3
Health care	10.0	1.2	-8.8
Education	9.4	1.4	-8.0
Others	10.0	0.4	-9.6
Total	**10.0**	**1.9**	**-8.0**

Source: Authors calculations, based on TRAINS database (from WITS)

Expenditure patterns differ significantly across household income levels. We expect this to have a significant effect on the results

STRUCTURE OF FAMILY EXPENDITURE BY QUINTILES AND CATEGORIES, 1997 AND 2007
(Percentages of the total)

Quintile Type of good	1997					2007				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
Food	49.5	42.6	35.8	28.3	12.7	43.4	37.6	33.0	27.3	15.2
Housing	3.7	6.1	7.9	9.6	5.9	2.0	4.0	6.0	6.1	5.1
Equipment	17.2	16.2	16.2	16.2	8.7	22.2	18.8	16.0	14.1	11.1
Clothing	4.7	6.6	8.0	9.9	10.5	6.1	6.9	7.0	8.1	9.1
Transport	2.9	4.3	4.9	6.2	5.7	3.0	4.0	5.0	6.1	7.1
Health care	14.5	14.0	14.3	13.7	33.9	12.1	12.9	14.0	16.2	27.3
Education	2.5	3.4	4.7	5.6	5.0	3.0	4.0	4.0	4.0	4.0
Other	5.1	6.6	8.3	10.6	17.6	8.1	11.9	15.0	18.2	21.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors calculations, based on 1997 and 2007 family expenditure surveys

The direct effect on domestic prices dominates the results, while wage effects are half as large. Price effect are larger in lower incomes, while wage effects are more important in the middle class

CHILE (GREATER SANTIAGO): EQUIVALENT VARIATION AFTER THE TARIFF CHANGE BETWEEN 1999 AND 2006

(Millions of pesos a month and percentages)

Quintile	Total household income (2007) *(millions of pesos)* (A)	Direct effect *(percentage)* (B)	Indirect effect *(percentage)* (C)	Wage effect *(percentage *-1)* (G)	Change in tariffs *(percentage points)* (D)
Q1	87 883	-0.218	-0.002	-0.067	-7.5
Q2	143 865	-0.192	-0.002	-0.080	-7.6
Q3	185 316	-0.180	-0.002	-0.128	-7.8
Q4	267 718	-0.164	-0.002	-0.100	-7.9
Q5	676 233	-0.141	-0.003	-0.028	-8.1
Total	**1 361 014**	**-0.178**	**-0.002**	**-0.081**	**-8.0**

Source: Authors calculation.

The total price effect (direct+indirect) has a pro-poor bias

DISTRIBUTION OF BENEFITS AMONG HOUSEHOLDS BY QUINTILE

Legend: Q1, Q2, Q3, Q4, Q5
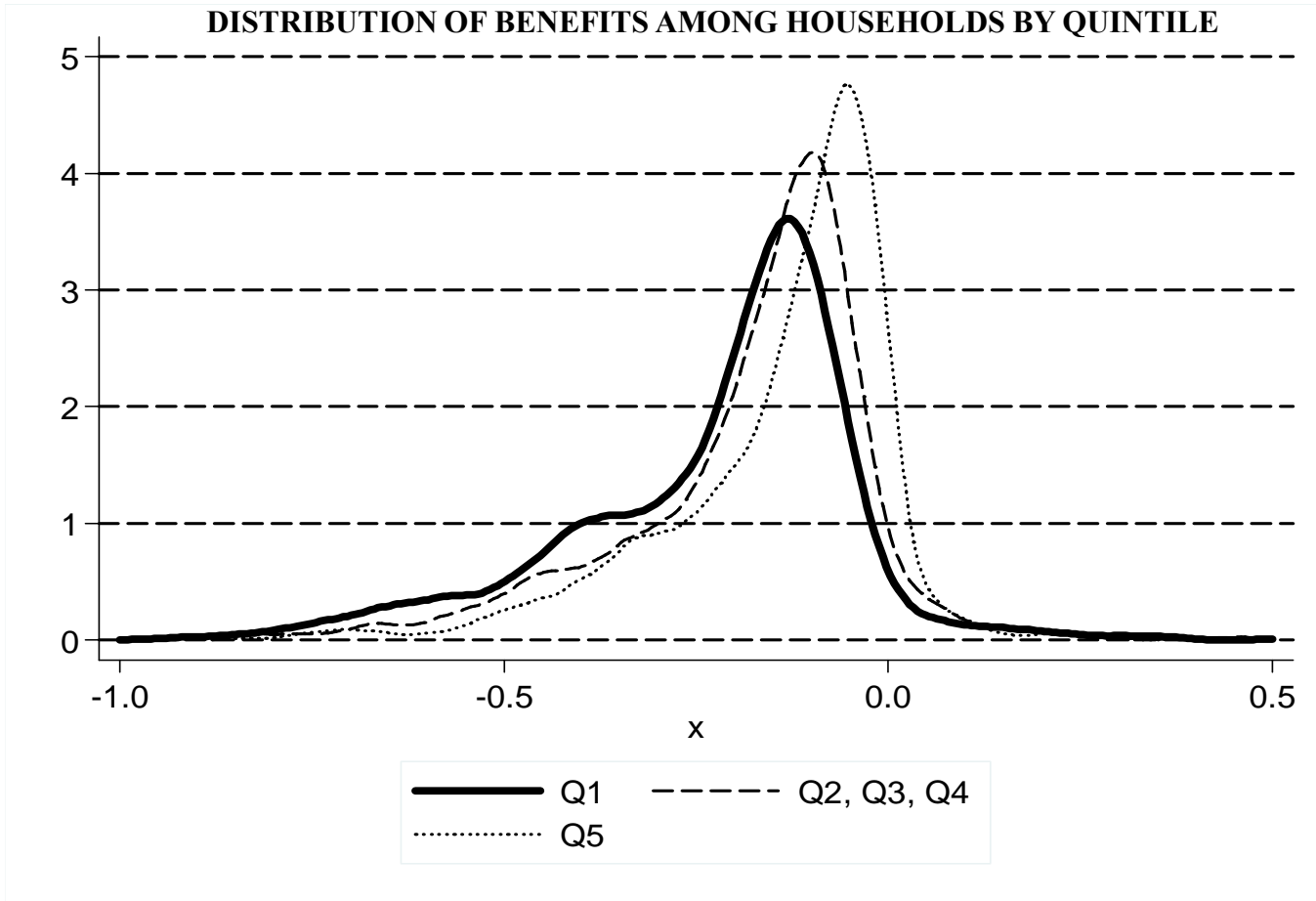
The wage effect benefits almost exclusively the medium education workers

CHILE (GREATER SANTIAGO): WAGE INCOME EFFECT ACCORDING TO EDUCATION LEVEL BY DECILE
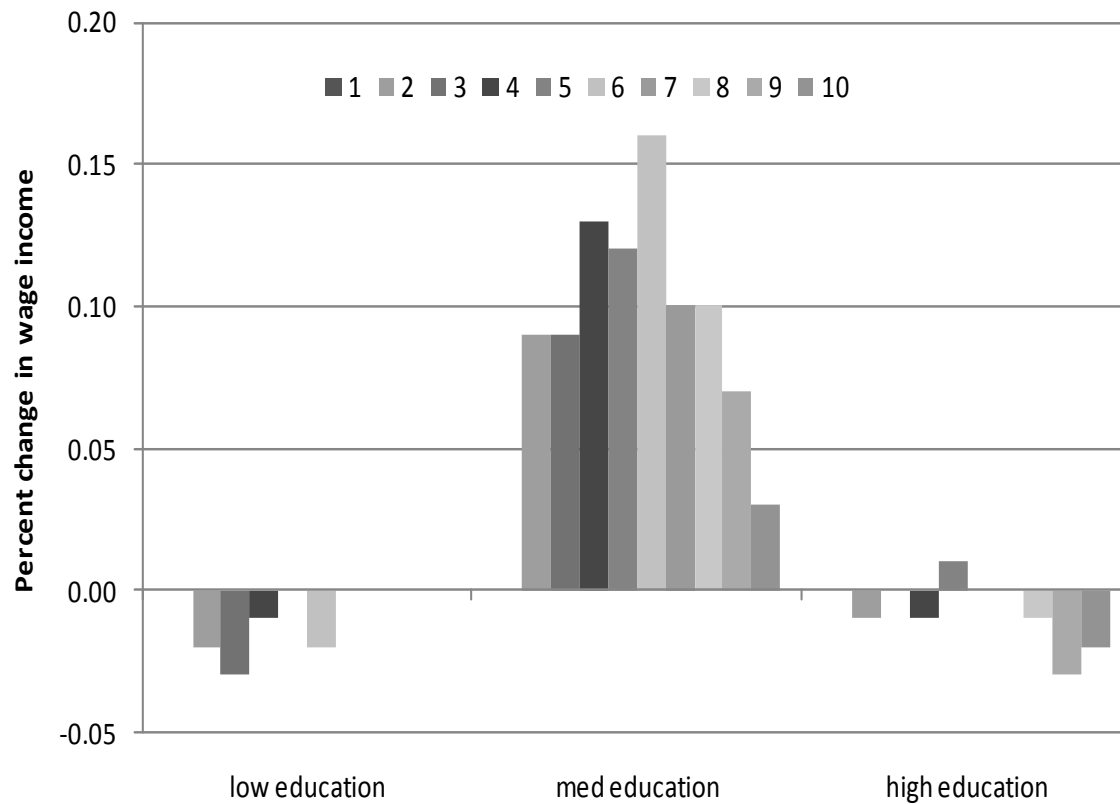
Source: Authors calculation.

Policy scenarios

- **Scenario 1: Uniform transfer of benefit:** It is assumed that benefits are redistributed uniformly among all individuals. Income exceeding the average is withdrawn from quintiles four and five and reallocated to the first three quintiles so that all individuals in the population receive the same amount.

- **Scenario 2: Robin Hood-style transfers:** The benefits of the higher-income quintiles are redistributed to the lower-income quintiles. A benefit equivalent to 5,000 pesos per individual per year was calculated for each inhabitant belonging to the first three quintiles. This amount is withdrawn from the benefit mass of the fourth and fifth quintiles.

- **Scenario 3: Liberalization favouring the poor alone:** It is assumed that tariff changes between 1999 and 2006 only occurred in the food and clothing groups, with the 1999 tariff level being retained for the remaining groups.

- **Scenario 4: Further liberalization favouring the poor:** There are assumed to have been further-reaching tariff changes favouring the consumption basket of the most vulnerable households, i.e., tariffs both on food, drinks and tobacco and on textile and clothing products are cut to zero.

- **Scenario 5: Full price pass-through:** This scenario simulates a rise in pass-through coefficients from the levels calculated in the econometric estimates presented in the study to 1, following the lead of Porto (2006), who assumes full pass-through of tariff cuts to domestic prices.

- **Scenario 6: Full price pass-through and Robin Hood-style transfers:** This scenario simulates the rise in pass-through coefficients on the assumption of full pass-through of tariff cuts to prices plus simultaneous application of direct transfers from higher-income households to lower-income ones.

Social and alternative trade policies have a clear impact on the welfare of households in Chile. A combination of these would have significant effects

CHILE (GREATER SANTIAGO): EQUIVALENT VARIATION AFTER THE TARIFF CHANGE BETWEEN 1999 AND 2006, OBSERVED CHANGES AND DIFFERENT SCENARIOS
(Percentages of total income)

Quintile	Observed changes	Social policy of direct transfers with income redistribution		Alternative trade policy changes		With rise in pass-through coefficient and income redistribution	
		Scenario 1 Uniform transfer of the benefit	Scenario 2 Robin Hood-style transfers	Scenario 3 Pro-poor	Scenario 4 Further liberalization favouring poor	Scenario 5 Pass-through = 1	Full pass-through and Robin Hood-style transfers
Q1	0.22	0.60	0.70	0.28	0.26	1.90	6.12
Q2	0.23	0.37	0.52	0.28	0.26	1.75	4.33
Q3	0.30	0.34	0.52	0.35	0.32	1.70	3.70
Q4	0.27	0.24	0.11	0.30	0.29	1.56	0.11
Q5	0.13	0.05	0.01	0.17	0.15	1.08	0.01
Total	**0.20**	**0.20**	**0.20**	**0.26**	**0.24**	**1.38**	**1.38**

Main conclusions

- Trade liberalization has been pro-poor in the Santiago de Chile Metro area. While the effect is small, the distribution is biased towards the lower quintiles of the population.

- These results depend on the pass-through coefficients as well as the consumption basket of the Chilean households.

- The wage gains are concentrated in the medium skilled workers

- The analysis casts light on different policy options, such as competition policies to improve the pass-through, targeted liberalization, and transfer policies.