

GROWTH IN BRAZIL

## Trade and Productivity

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*UC San Diego*

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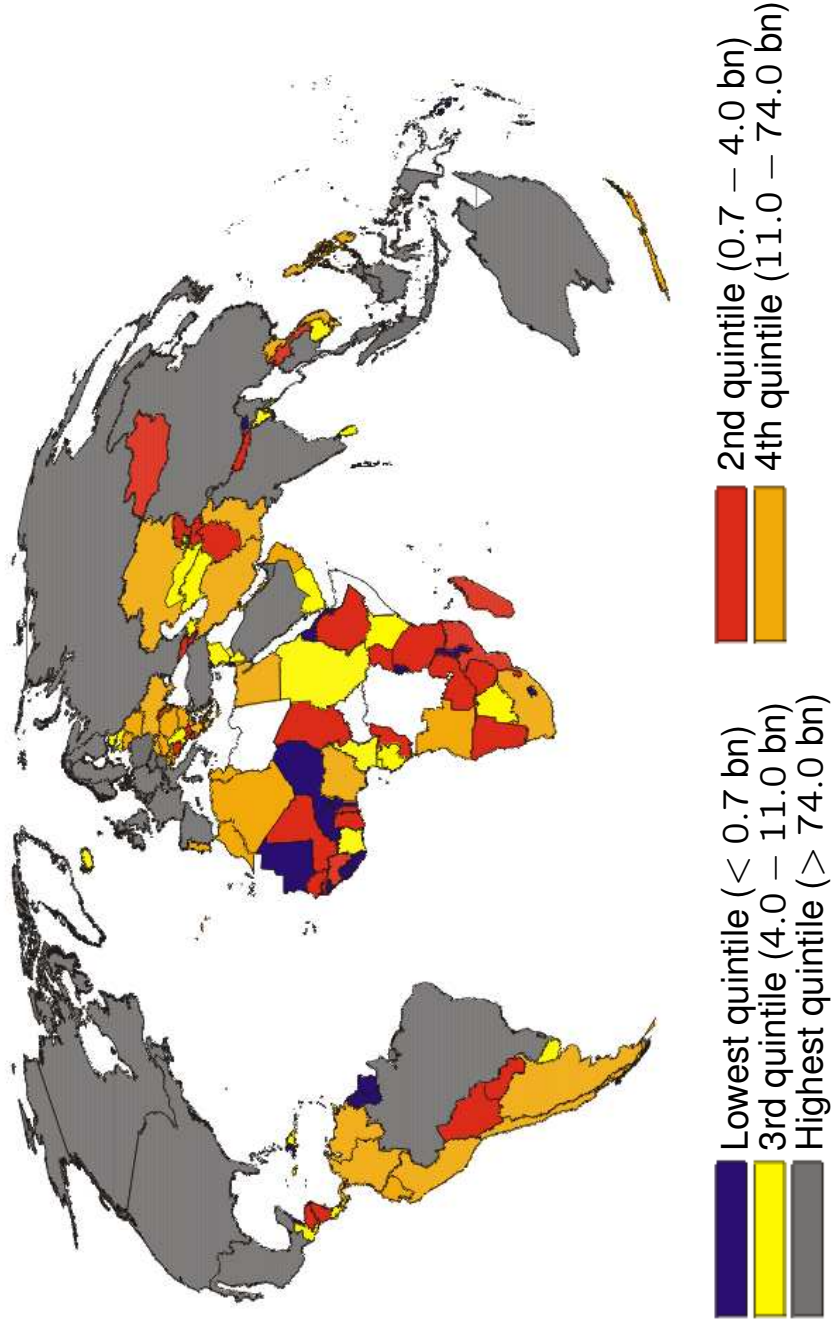
## Trade and Productivity

- There is noticeable **trade-induced efficiency change** in Brazil
- ... but it came at the **cost of shock therapy**.
- Now is the time to **lock-in the gains** from trade
- ... and there are **bottlenecks to break through**.

## Brazil and Global Trade

- Brazil ranks among the world's top 25 exporters since 2000
- Brazil is nevertheless a relatively closed economy per-capita
- Brazil's export goods increasingly include advanced manufactures
- Trade reform in the 1990s did not result in de-industrialization

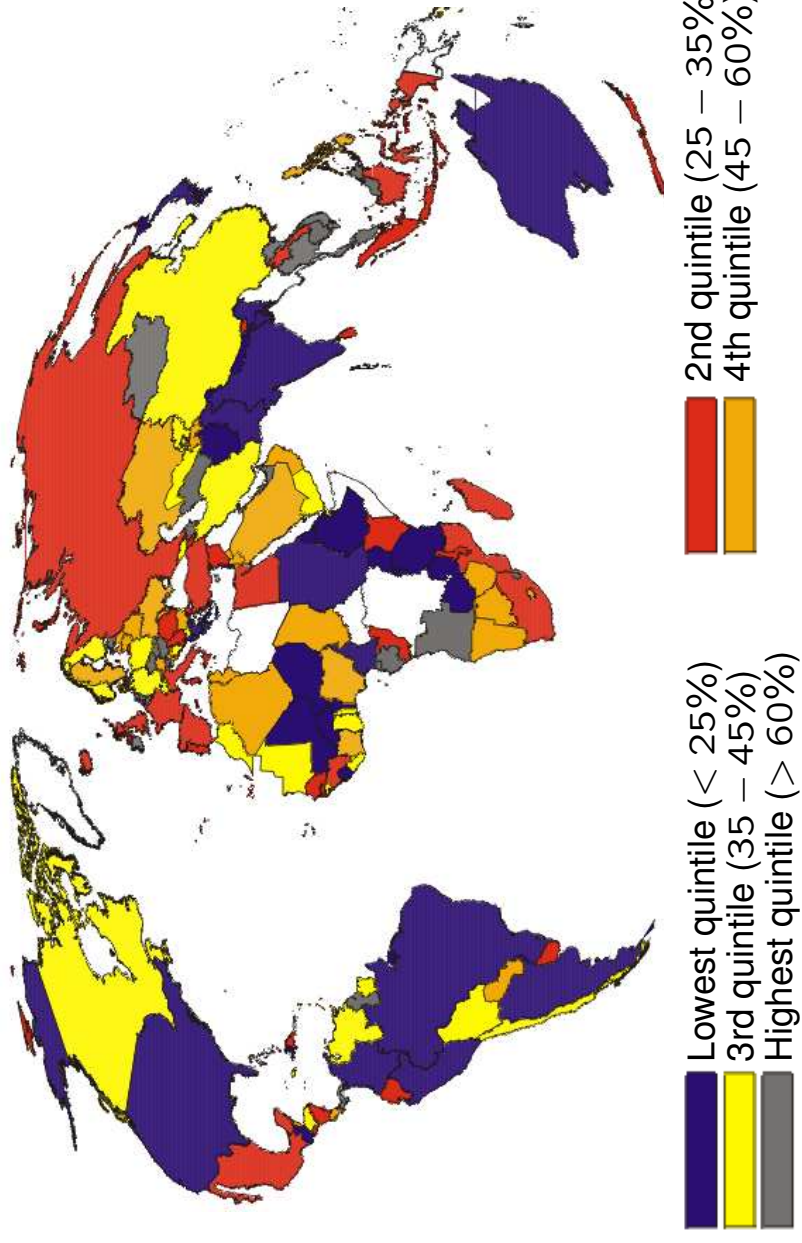
### Total Exports by Five Country Groups



Source: World Development Indicators 2005. Total exports by quintile (US\$ Billion).

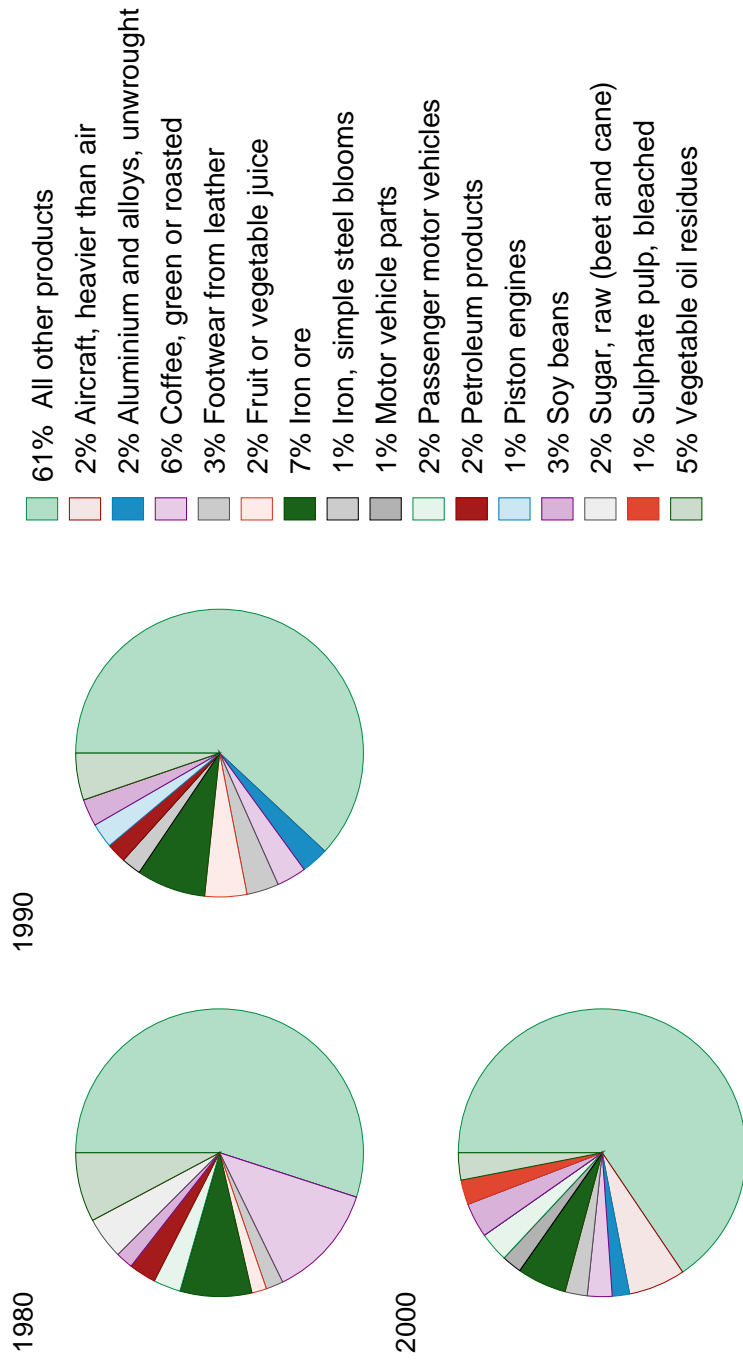
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## Exports per GDP by Five Country Groups



Source: World Development Indicators 2005. Total exports per GDP by quintile (percent). © D. Molina

## Leading Ten Export Products, 1980, 1990 and 2000

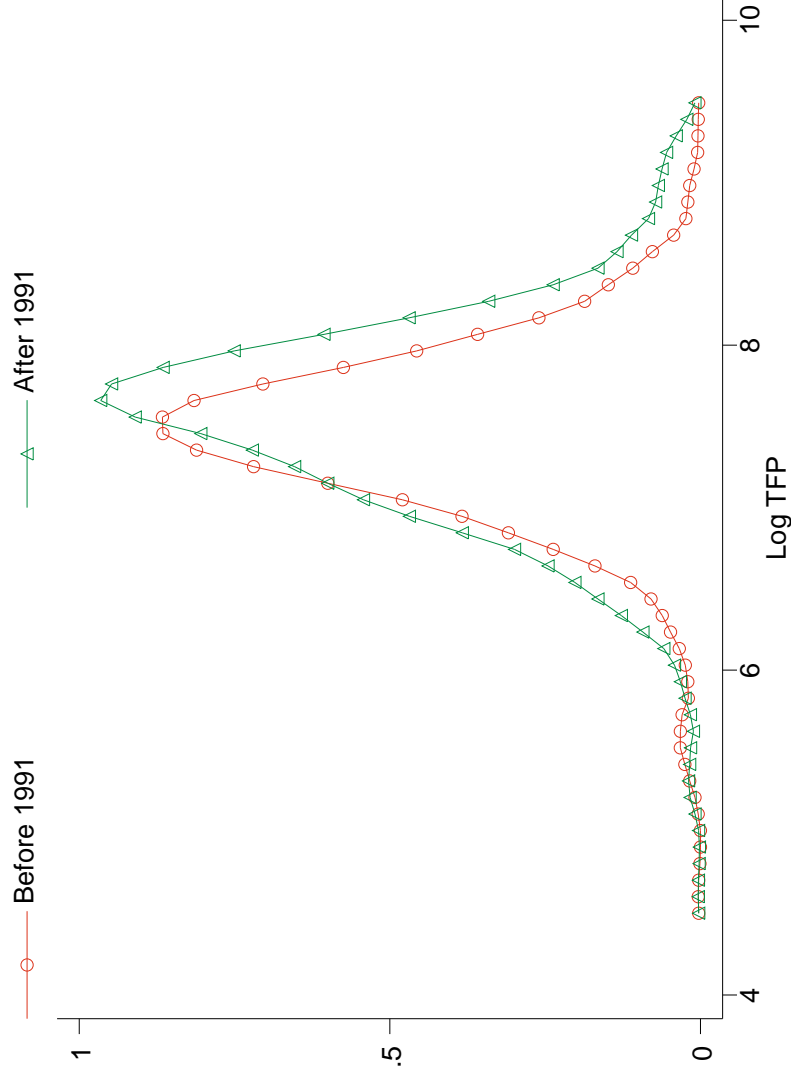


Source: Source: ECLAC, Statistical Yearbook, 2002

## Trade-induced Efficiency Change

- Brazil's 1990 trade liberalization raised manufacturing productivity
- *Foreign Input Push* has small effect on productivity
- *Competitive Push* leads firms to improve efficiency markedly
- *Competitive Elimination* induces shutdown of inefficient firms

## Moving Ahead: Productivity Distribution in the Car Parts Industry

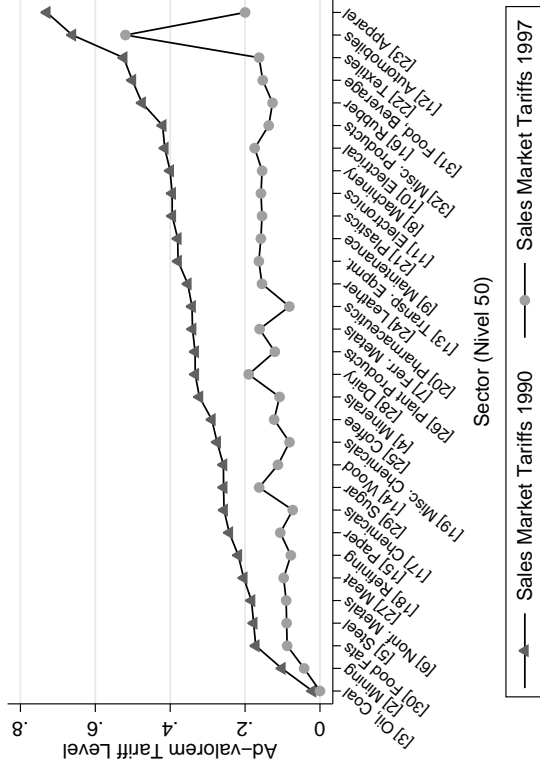


Source: Muendler (CESifo WP 1148, 2004); Pesquisa Industrial Anual, 1986-98.  
Note: Productivity is Log TFP from production function estimation.

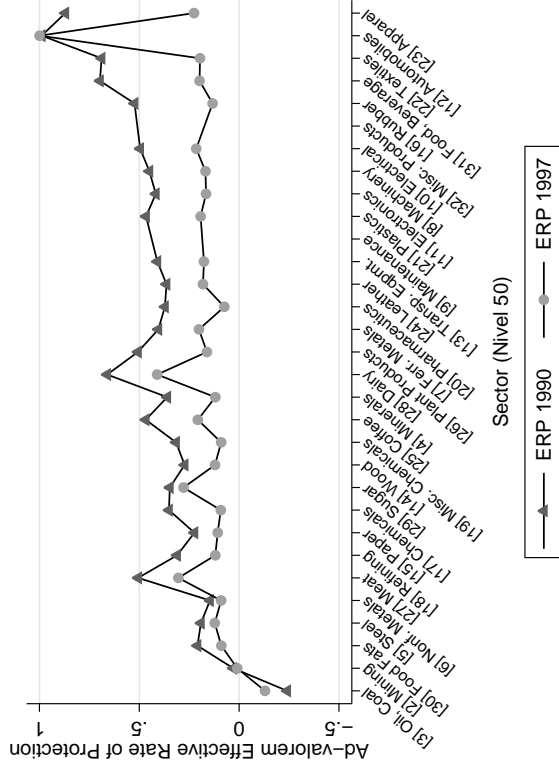


## Tariffs and Effective Rates of Protection

Product market tariffs

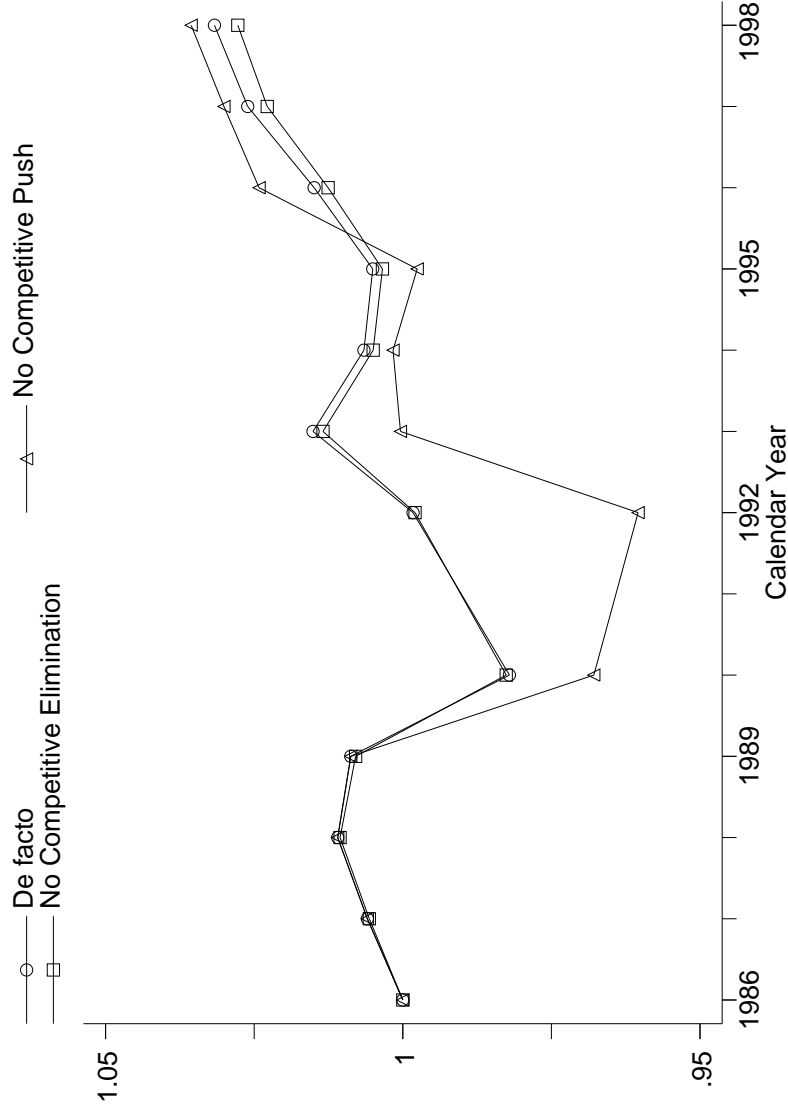


Effective rates of protection



Source: Product tariffs from Kume, Piani & Souza (2000) and input-output matrices (IBGE).  
 Note: Sectors at *Nível 50* ranked by 1990 product tariff.

## Simulation: Productivity in the Absence of Trade Reform

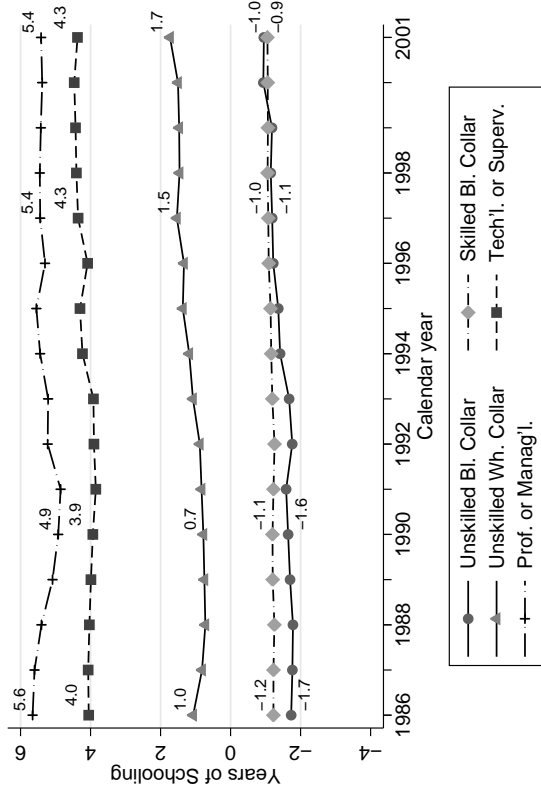


Source: Muendler (CESifo WP 1148, 2004); *Pesquisa Industrial Anual*, 1986-98.

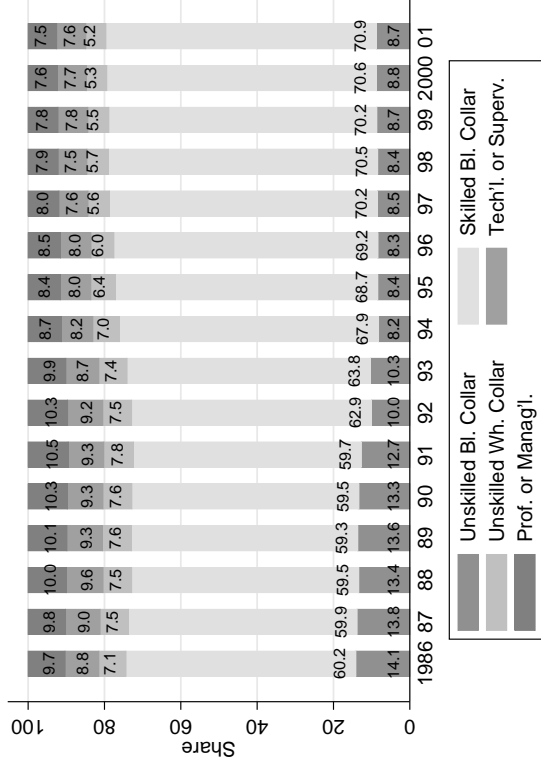
Note: Predicted productivity (Log TFP) from variation in tariffs and import penetration.

## Workforce Changeover

Schooling intensity of occupations



Occupational workforce composition



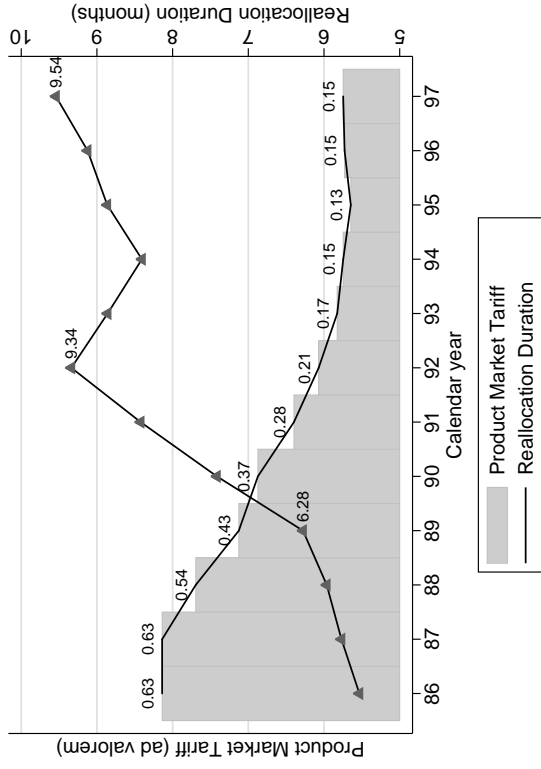
Source: Muendler (NBER WP 12980, 2007); RAIS 1986-2001 (1% random sample).  
 Note: Male workers nationwide, 25 to 64 years old, with employment on December 31st. Traded-goods sectors are agriculture, mining and manufacturing (subsectors *IBGE* 1-13 and 25). Left panel shows difference between schooling intensity of occupations and annual mean schooling level; mean years of schooling weighted by worker numbers within occupations. In right panel, occupation shares based on worker numbers.

## The Cost of Shock Therapy

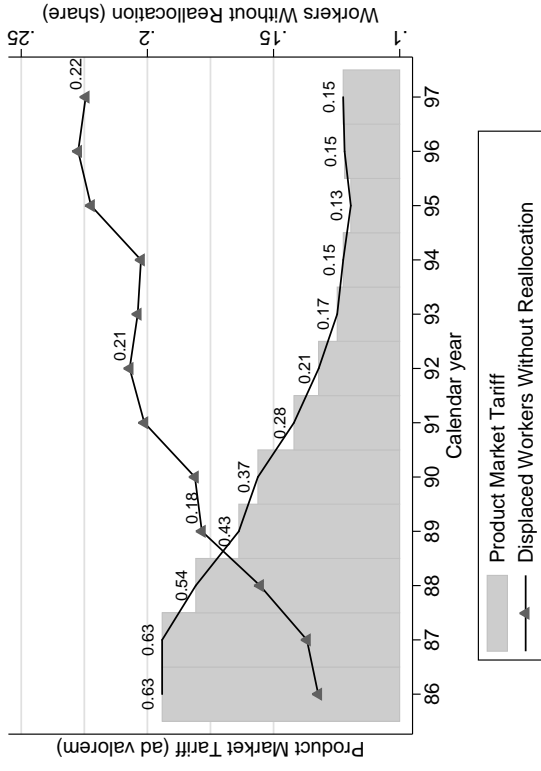
- Layoffs from protected industries, as trade theory welcomes
- ... but neither comparative-advantage industries nor exporters absorb displaced workers for years
- Growth in Brazil throughout the 1990s remains modest
- Lacking labor reallocation may be cause of sluggish performance

## Tariffs, Reallocation Durations and Failures over Four Years

Reallocation durations



Reallocation failures



Source: Menezes-Filho & Muendler (CESifo WP 1936, 2007); RAIS 1986-99 (1% random sample).  
 Note: Male workers nationwide, 25 to 64 years old, displaced from a formal-sector job; rehired or not into a formal-sector job within 48 months. Product tariffs from Kume et al. (2000), employment weighted at *Nível 50* sector level.

## Labor Market Performance and Economic Outcomes

	1986	1990	1992	1994	1998
FAILED REALLOCATIONS WITHIN A YEAR					
Mean failure rate (share of displaced)	.248	.323	.410	.369	.459
young workers	.235	.303	.354	.326	.366
college-educated workers	.258	.315	.350	.337	.387
Change over 1990		.000	<b>.086</b>	<b>.046</b>	<b>.136</b>
Idle labor (foregone share of GDP)		.000	<b>.014</b>	<b>.006</b>	<b>.024</b>
DURATIONS OF SUCCESSFUL REALLOCATIONS WITHIN A YEAR					
Mean duration (in months)	2.776	3.808	4.206	4.108	4.220
young workers	2.226	3.135	3.460	3.262	3.367
college-educated workers	1.691	2.429	2.423	2.250	2.282
Change over 1990 (one twelfth)		.000	<b>.033</b>	<b>.025</b>	<b>.034</b>
Idle labor (foregone share of GDP)		.000	<b>.005</b>	<b>.003</b>	<b>.006</b>

Source: Menezes-Filho & Muendler (CESifo WP 1936, 2007); RAIS 1986-99 (1% random sample).

Note: Male workers nationwide, 25 to 64 years old, displaced from a formal-sector job; not rehired into a formal-sector job within 12 months (*upper panel*) or rehired into a formal-sector job within 12 months (*lower panel*). PME 1986-1999, share of idle workers (unemployed or withdrawn from labor force), and Banco Central do Brasil, GDP.

## Locking-in the Gains from Trade

- The benefits from trade: Lower commodity prices and more varieties
- Labor-market rigidity hampers job creation
- Infrastructure deficiencies restrict trade growth
- Educational shortfall and limited exporter entry: A coincidence?

## Household Income and Expenditure Inequality

	No Price Correction		Price Correction for Reforms	
	1987-8	2002-3 % chg.	1987-8	2002-3 % chg.
<i>Real per-capita household net income</i>				
Median	2,912	2,821	1,773	3,711
Bottom 20%	1,145	1,152	462	1,548
Top 20%	15,379	20,325	14,500	26,219
<i>Real household expenditure inequality</i>				
Gini coefficient	.533	<b>.542</b>	.533	<b>.398</b>

Source: Carvalho & Chamon (IMF WP/06/275 2006).

Note: Values in 1996 R\$. Based on collective expenditure notebooks from household sample with at least one expenditure recorded. The bottom and top 20 percent refer to quintiles of expenditure per survey year in sample.



## Relative Manufacturing Wages in Brazil, France and the U.S.

	Brazil 1990 (1)	Brazil 1997 (2)	France 1992 (3)	U.S. 1990 (4)
<b>Education</b>				
College Degree	2.516	<b>2.412</b>	1.376	1.693
Some College	1.793	<b>1.758</b>	1.057	1.073
Primary School (or less)	.859	.888	.920	.885
<b>Occupation</b>				
Professional or Managerial	2.355	2.488	2.139	1.432
Technical or Supervisory	1.821	1.882	1.493	1.228
Other White Collar	1.299	1.283	1.184	.962
Skill-intensive Blue Collar	1.270	1.252	1.168	1.087

*Source:* Menezes-Filho, Muendler & Ramey (REStatistics 2008) for Brazil; *RAIS* São Paulo state manufacturing 1990 and 1997 (prime age workers in their highest-paying job); Abowd, Kramarz, Margolis & Troske (JJIE 2001) for France 1992 and the U.S. 1990.

*Note:* Male workers only. Wage levels relative to comparison-group wage levels from plant-FE component estimates. Education estimates relative to worker with some or complete high school education, controlling for occupation. Occupation estimates relative to non-skill-intensive blue collar occupations, controlling for education.

**Exporter Shares in Brazil, France and the U.S.**

SIC industry	Brazil 2000 (1)	France 1986 (2)	U.S. 1987 (3)
[20, 21] Food and tobacco products	.8	5.5	13.1
[31] Leather and leather products	3.2	26.3	17.0
[34] Fabricated metal products	1.3	16.8	15.2
[37] Transportation equipment	2.5	32.9	23.5
<b>Manufacturing (ex. petroleum refining)</b>	<b>1.5</b>	<b>17.4</b>	<b>14.6</b>

Source: Arkolakis & Muendler (unpublished 2007) for Brazil; RAIS and SECEX 2000 manufacturing firms. Eaton, Kortum & Kramarz (AER 2004) for France 1986 and the U.S. 1987.

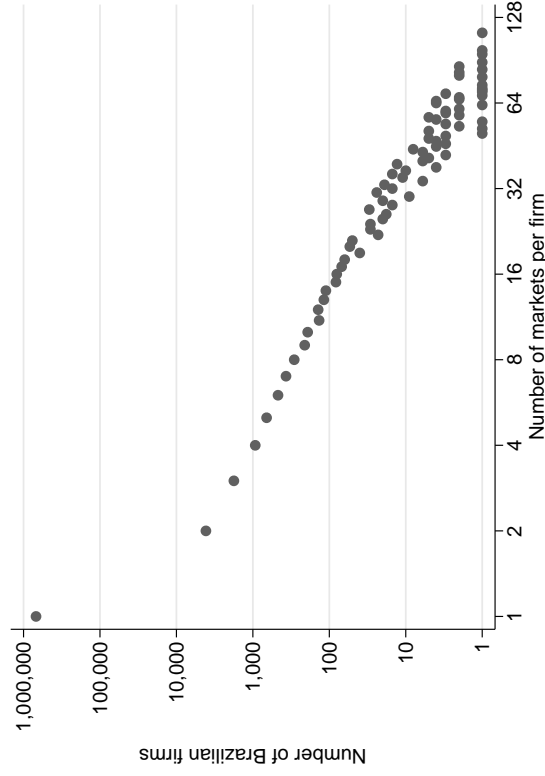
Note: Percentages of manufacturing firms that export. Manufacturing total excludes petroleum refining.

## Unlocking Bottlenecks for Trade and Gains

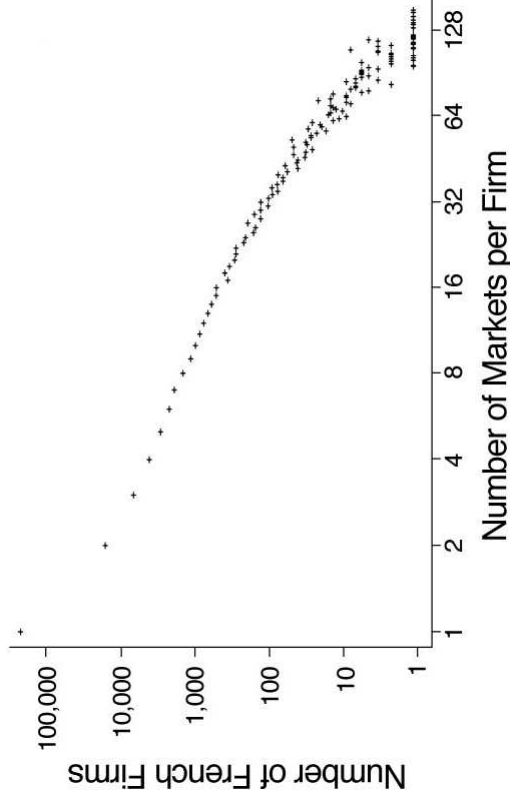
- Exposure to foreign markets keeps pushing firms to frontier
- Compared to industrialized countries, potential to unlock exporters
- Comparative-advantage goods now include advanced manufactures
- Compared to Latin American countries, trade dynamic to unfold

## Export-market Presence: Unlocking Brazil's Exporters

Brazil 2000



France 1986



Source: Arkolakis & Muendler (unpublished 2007) for Brazil; RAIS and SECEX 2000 manufacturing firms. Eaton, Kortum & Kramarz (AER 2004) for France 1986.

Note: Left graph under assumption that every Brazilian manufacturer has sales in domestic Brazilian market. The elasticity of the number of Brazilian firms with respect to the number of markets is  $-2.48$  (standard error  $.065$ ), and the elasticity of the French number of firms with respect to the number of markets is roughly  $-2.5$ .

## Product-level Comparative Advantage

Product rank in	1980	1990	2000
<i>Brazil</i>			
Mate	1st (68.4)	1st (58.9)	1st (54.4)
Waxes of animal or vegetable origin	6th (29.1)	3rd (45.2)	2nd (42.3)
Iron ore agglomerates	.	7th (30.85)	3rd (36.3)
Sisal, agave fibres, raw or processed	3rd (37.3)	2nd (54.3)	4th (35.2)
Iron ore and concentrates, not agglom.	.	8th (28.9)	5th (34.6)
Aircraft, unladen weight from 2t to 15t	.	.	9th (24.9)
<i>Mexico</i>			
Other rail locomotives	.	.	1st (10.3)
Counting devices non-electrical	.	.	2nd (10.3)
Radio receivers for motor-vehicles	.	4th (12.3)	3rd (9.1)
Television receivers, color	.	.	4th (7.7)
Beer made from malt	.	.	5th (7.3)
Tomatoes, fresh or chilled	.	1st (16.4)	.
Sesame seeds	1st (73.9)	.	.

Source: WTF-NBER bilateral trade data. SITC 4-digit products by year (up to top ten).

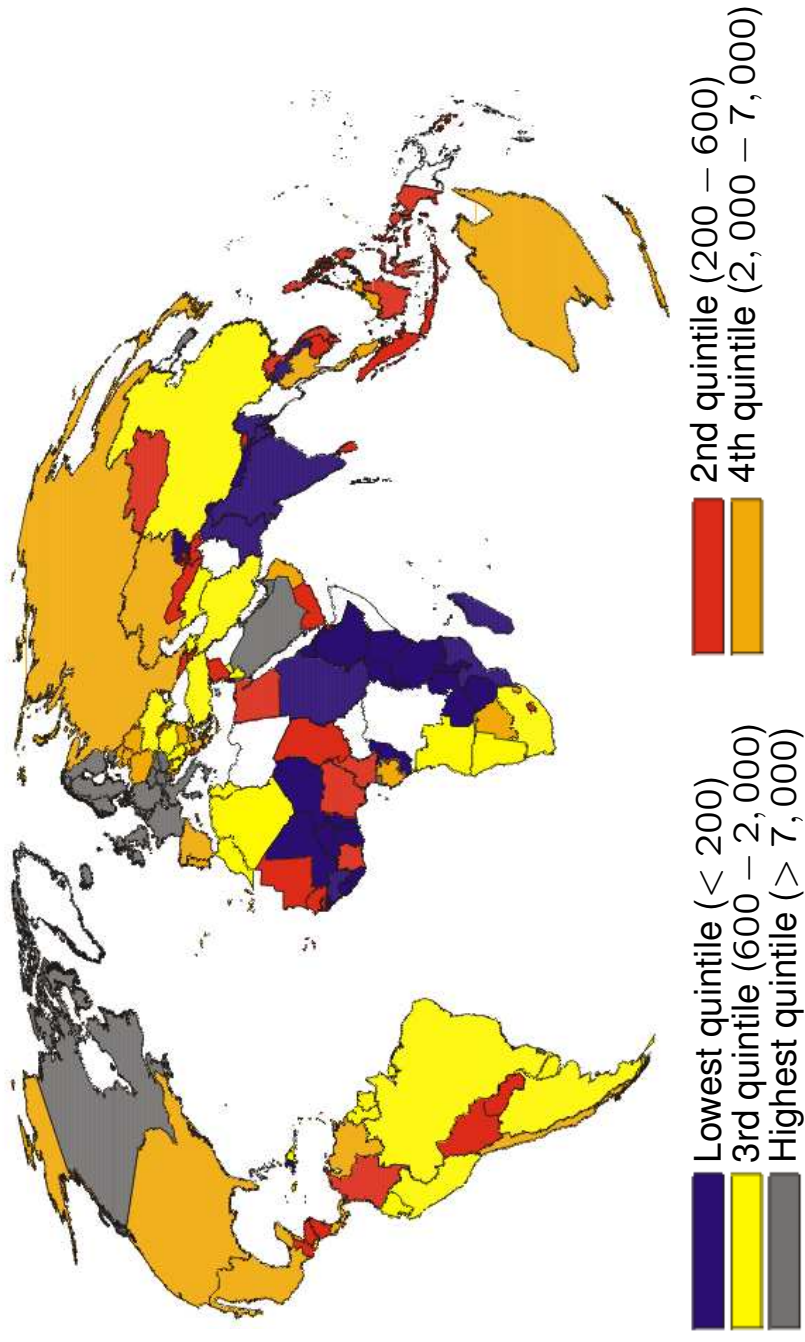
Note: Comparative advantage of product  $i$  in year  $t$ :  $[X_{i,t}^c / \sum_k X_{k,t}^c] / [X_{i,t}^{\text{world}} / \sum_k X_{k,t}^{\text{world}}]$ .

## Trade, Productivity and Prosperity

- The costs of large-scale trade reform lie in the past
- Bottlenecks to unlocking exporters include infrastructure and, arguably, education
- The potential benefits include a continuous push to the frontier,
- . . . consumption variety and productive innovation

## *Backup Slides*

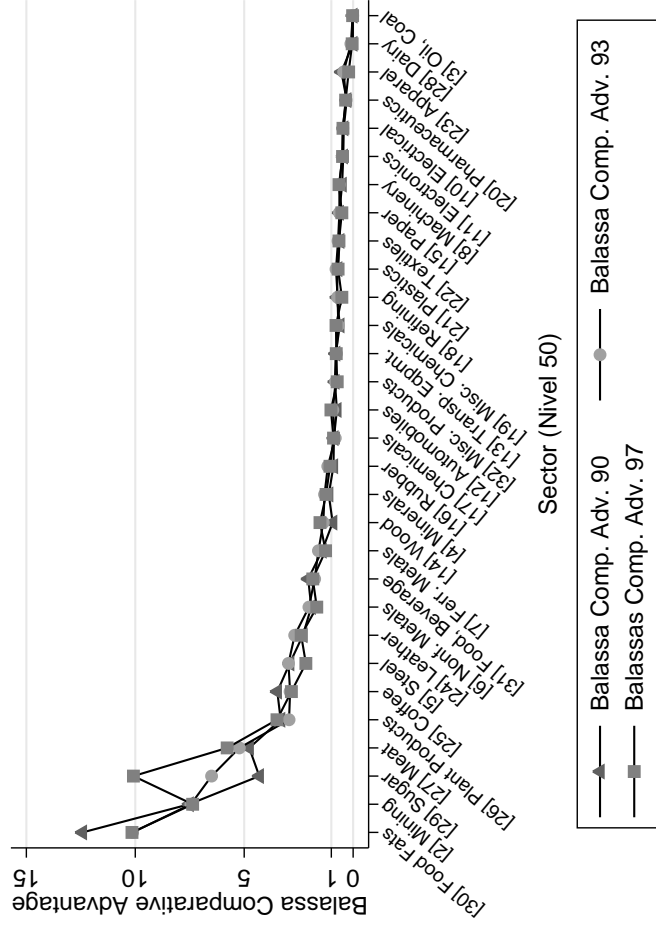
## Exports per Capita by Five Country Groups



Source: World Development Indicators 2005. Exports per capita by quintile (US\$). © D. Molina



## Sector-level Comparative Advantage



Source: Menezes-Filho & Muendler (CESifo WP 1936, 2007); UN Comtrade 1986-98.  
 Note: Sectors at *Nível 50* ranked by Balassa comparative advantage FE. Estimates of Balassa comparative advantage fixed effects (FE) from sector-fixed effects regression on output tariffs, input tariffs and year indicators.

## Productivity Change and Market Shares, Olley & Pakes (1996)

	TFP and Output shares				Labor Prod. and Employment shares			
	Cross section		Ann. chg. <sup>a</sup>		Cross section		Ann. chg.	
	wgtd. (1)	unwgted. (2)	cov. (3)	raw cov. <sup>a</sup> (4)	wgtd. (5)	unwgted. (6)	cov. (7)	raw cov. <sup>a</sup> (8)
1986	1.018	.924	<b>.095</b>		1.011	1.019	<b>-.008</b>	
1990	1.000	.899	<b>.101</b>	<b>.065</b>	1.000	.997	<b>.003</b>	<b>-.029</b>
1994	1.013	.918	<b>.096</b>	<b>.067</b>	1.023	1.019	<b>.005</b>	<b>-.043</b>
1998	1.035	.910	<b>.125</b>	<b>.047</b>	1.073	1.043	<b>.030</b>	<b>-.039</b>

<sup>a</sup>Four-year average of the raw covariance between annual share changes and outcome changes.

Source: Menezes-Filho & Muendler (CESifo WP 1936, 2007); PIA firms 1986-98 (1991 missing).

Note: Log total factor productivity based on Olley & Pakes (1996) estimation (at *Nível/50*), inferring labor productivity at changing capital stocks. Cross-sectional productivity decomposition as in Olley & Pakes (1996):  $y_t = \bar{y}_t + \sum_i \bar{\Delta}\theta_{it}\bar{\Delta}y_{it}$ , where  $y_t$  is weighted and  $\bar{y}_t$  is unweighted mean log productivity and  $\bar{\Delta}$  denotes deviations from cross-section means (rebased to unity in 1990). Annual productivity change correlation  $\sum_{i \in C} \Delta\theta_{i,t}\Delta y_{i,t}$  (raw covariance) from Haltiwanger (1997) decomposition, where  $\Delta$  denotes annual change (not rebased).

## Year-over-Year Trade Sector Transitions and Failures, 1986-2001

From: (in %)	Traded: Comp. adv. quintile <sup>a</sup>					Nontraded (6)	Failure (7)	Total (8)
	1st (1)	2nd (2)	3rd (3)	4th (4)	5th (5)			
Traded: <i>BADV</i> <sup>a</sup>								
1st quintile	<b>14.6</b>	7.4	3.1	6.2	2.8	<b>35.3</b>	<b>30.7</b>	100.0
2nd quintile	6.5	<b>14.2</b>	3.3	4.6	3.3	<b>35.7</b>	<b>32.5</b>	100.0
3rd quintile	3.2	3.6	<b>14.2</b>	7.1	2.8	<b>34.5</b>	<b>34.5</b>	100.0
4th quintile	2.1	2.1	2.7	<b>26.3</b>	5.5	<b>28.3</b>	<b>33.2</b>	100.0
5th quintile	1.9	2.7	1.7	11.2	<b>19.5</b>	<b>32.5</b>	<b>30.4</b>	100.0
Nontraded	1.3	1.5	1.3	3.3	1.8	57.9	32.9	100.0
<i>Failure</i>	3.0	3.1	3.4	11.3	5.0	74.1	.0	100.0
<i>Total</i>	2.6	2.7	2.7	8.4	4.0	60.6	19.1	100.0

<sup>a</sup>Balassa (1965) comparative advantage, transition year quintile (5th: strongest advantage).

Source: Menezes-Filho & Muendler (CESifo WP 1936, 2007); *RAIS* 1986-2001 (1% random sample).

Note: Male workers nationwide, 25 to 64 years old. UN Comtrade 1986 for Balassa comparative advantage; defined at two-digit sector level (Subsector *IBGE*). Transition frequencies are job accessions in Brazil within one year after separation, based on last employment of year (highest paying job if many). Failed accessions are separations followed by no formal-sector accessions anywhere in Brazil within a year, excluding workers with prior retirement or death, or age 65 or above on earlier job.

## Labor Market Rigidity Comparison to Trade Partners

	Rigidity and Difficulty Indices				
	Hiring difficulty (1)	Hours rigidity (2)	Firing difficulty (3)	Employment rigidity (4)	Firing costs* (5)
Brazil	67.0	80.0	70.0	72.0	165.0
Trade partners					
<i>weighted by trade volume<sup>†</sup></i>					
1990	23.1	48.0	27.3	32.7	48.4
1997	20.0	45.0	25.2	30.1	43.9
<i>weighted by source-country imports</i>					
1990	40.1	50.6	37.2	42.7	44.0
1997	37.4	47.7	32.2	39.2	43.3
<i>weighted by destination-country exports</i>					
1990	23.6	46.5	28.4	32.8	48.5
1997	21.5	47.0	27.2	31.9	43.6

Source: World Bank labor market rigidity measures (courtesy of Marc Melitz).

Note: Measures weighted by *WTF* (NBER) bilateral trade data for 1990 and 1997. A higher index indicates a more rigid labor market.