

LOCAL IMPACTS OF GLOBAL MARKETS

Labor Reallocation in Response to Trade Reform

Marc-Andreas Muendler

UC San Diego

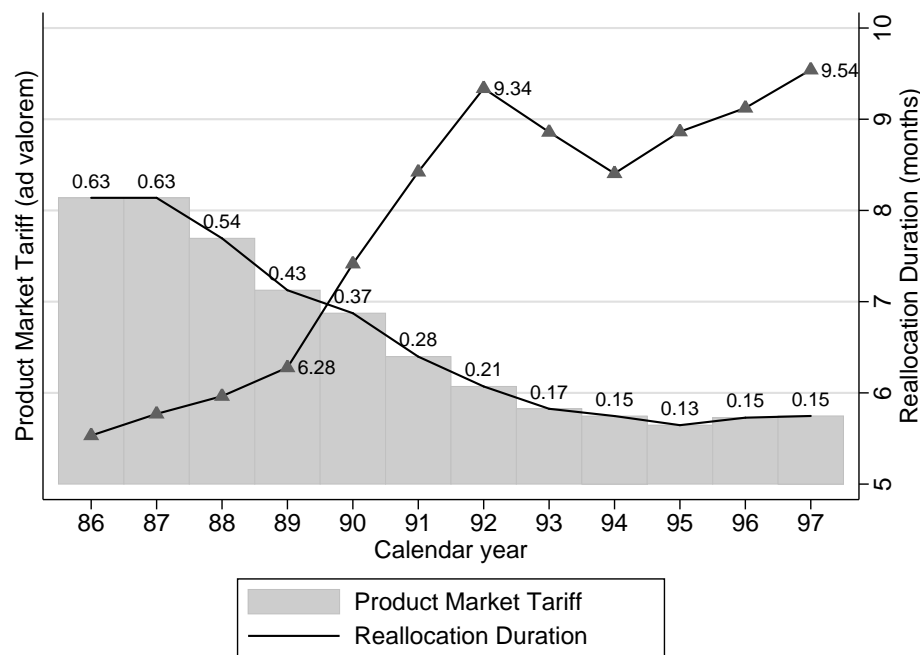
joint with Naércio Menezes, U and IBMEC São Paulo

IPES: November 9, 2007

Empirical Objective and Findings

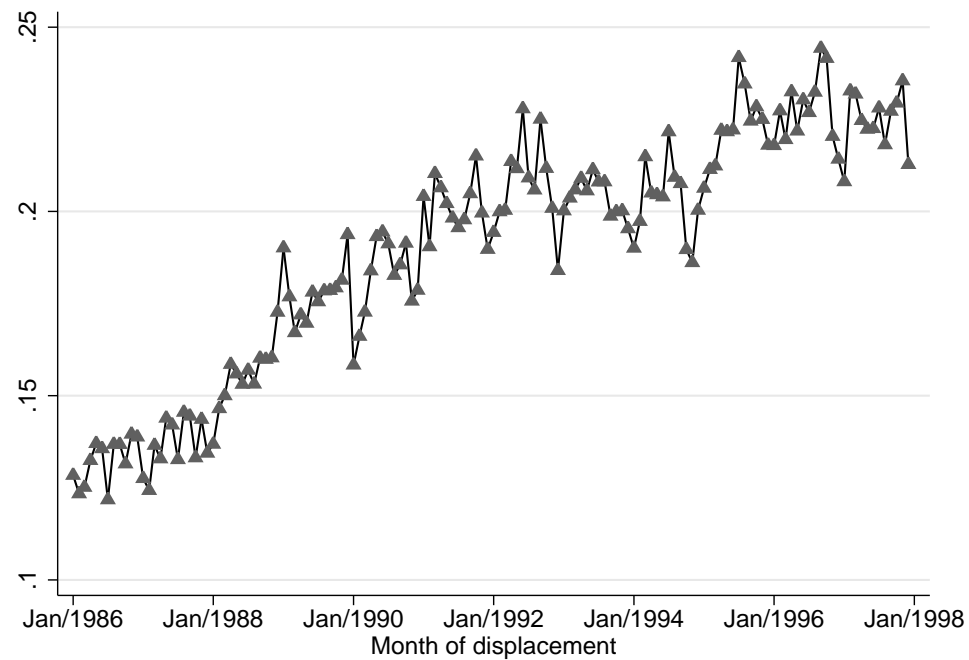
- Assess labor reallocation after Brazil's large-scale trade reform
- Linked employer-employee data permit tracking of individuals between identified establishments over 1986-2001 period
- Shifts in product-market shares to more advanced firms and exporters are commonly interpreted as evidence for successful resource reallocation
- But labor is flowing away from export sectors and exporters because labor productivity increases faster than production so that output shifts to more productive firms but labor does not

Tariffs and Reallocation Durations



Sources: RAIS 1986-2001 (1% random sample), male workers nationwide, 25 to 64 years old, displaced from a formal-sector job; rehired into a formal-sector job within 48 months. Product tariffs from Kume et al. (2000), employment weighted at *Nível 50* sector level.

Displaced Workers without Formal-sector Reallocation within 48 Months



Source: RAIS 1986-2001 (1% random sample), male workers nationwide, 25 to 64 years old, displaced from a formal-sector job and not rehired into a formal-sector job within 48 months.

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

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

^aFour-year average of the raw covariance between annual share changes and outcome changes.

Source: PIA firms 1986-98 (1991 missing); 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 Δ denotes annual change (not rebased).

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Related Literature

- Haltiwanger, Kugler, Kugler, Micco & Pagés (2004): Sector study for six Latin American countries; tariff reductions and exchange rate appreciations increase churning, reduce employment (also Revenga 1992, 1997)
- Goldberg & Pavcnik (2003): Industry-level two-step approach; tariff declines not associated with informality in Brazil
- Saint Paul (1997), Davidson, Martin and & Matusz (1999), Cunat & Melitz (2006): Countries with flexible factor markets tend to export products from industries with high factor turnover

Trade Reform and Comparative Advantage

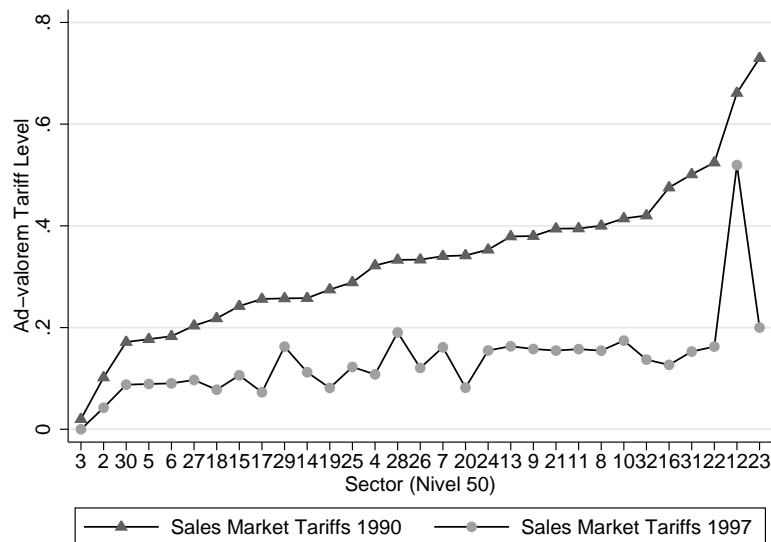
- Trade Liberalization on imports side.
Political motivation:
 - Reduce pricing power of oligopolies to combat inflation
 - Induce efficiency through foreign competition
- Balassa comparative advantage of sector i in year t

$$BADV_{i,t} \equiv \frac{X_{i,t}^{\text{Brazil}} / \sum_k X_{k,t}^{\text{Brazil}}}{X_{i,t}^{\text{World}} / \sum_k X_{k,t}^{\text{World}}}$$

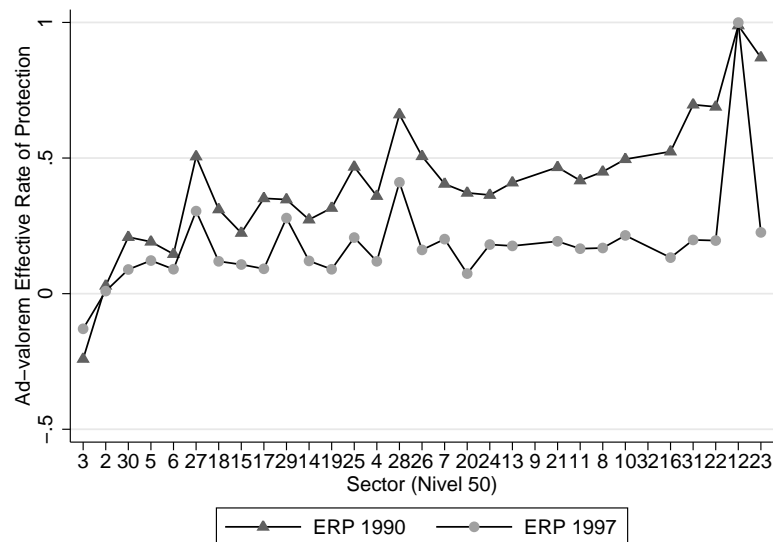
where $X_{i,t}$ are exports (UN Comtrade 1990-97) .

Tariffs and Effective Rates of Protection

Product market tariffs

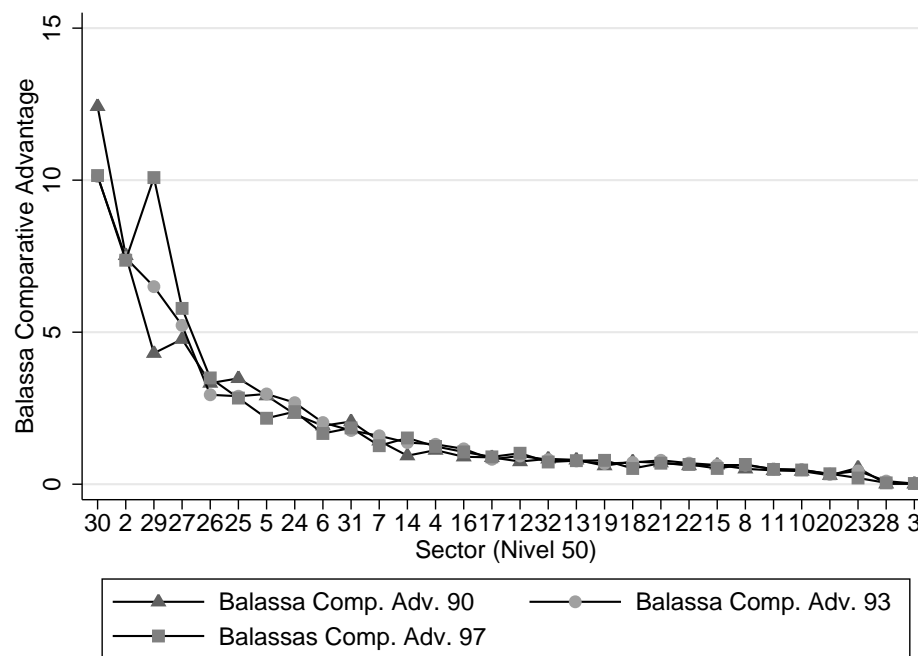


Effective rates of protection



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

Revealed Comparative Advantage



Sources: UN Comtrade 1986-98. Sectors at *Nivel 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.

Data Sources

- **Worker data:** *RAIS (Relação Anual de Informações Sociais)* with 555 million records of formally employed workers in any sector at 5.5 million plants, 1986-2001
Samples: Prime-age male workers with proper worker ID (*PIS*) nationwide (1% sample) or in metropolitan areas (5% sample)
- **Firm data:** Export data 1990-2001 from *SECEX (Secretaria de Comércio Exterior)*. Firm survey data 1986-98 from *PIA (Pesquisa Industrial Anual)*, sample of all but smallest manufacturing firms.
- **Complementary household data:** Survey *PME (Pesquisa Mensal de Emprego)* for informal employment

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

From:	To: (in %)	Traded: Comp. adv. quintile ^a					Nontraded (6)	Failure (7)	Total (8)
		1st (1)	2nd (2)	3rd (3)	4th (4)	5th (5)			
Traded: <i>BADV</i> ^a									
1st quintile		14.6	7.4	3.1	6.2	2.8	35.3	30.7	100.0
2nd quintile		6.5	14.2	3.3	4.6	3.3	35.7	32.5	100.0
3rd quintile		3.2	3.6	14.2	7.1	2.8	34.5	34.5	100.0
4th quintile		2.1	2.1	2.7	26.3	5.5	28.3	33.2	100.0
5th quintile		1.9	2.7	1.7	11.2	19.5	32.5	30.4	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

^aBalassa (1965) comparative advantage, transition year quintile (5th: strongest advantage).

Source: RAIS 1986-2001 (1% random sample), 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.

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Empirical Models

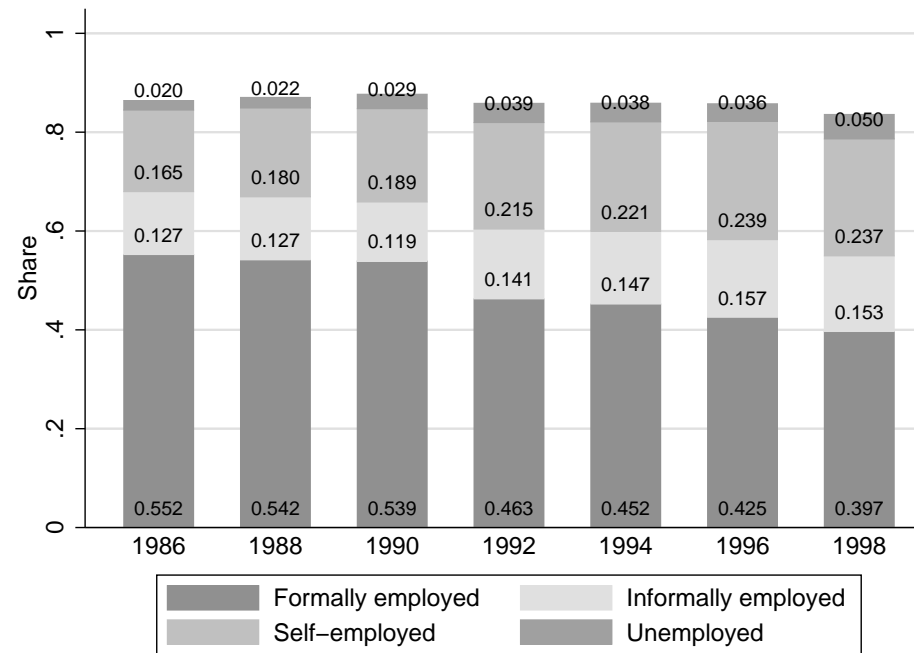
- *Conditional logit model for worker panels* (FE cLogit)

$$\begin{aligned} Pr(\sigma_{i,t} | \mathbf{x}_{i,t}, \mathbf{y}_{J(i),t}, \mathbf{z}_{S(J(i)),t}) &= \\ &= \frac{\exp\{\alpha_i + \mathbf{z}_{S(J(i)),t}\beta_z + \mathbf{y}_{J(i),t}\beta_y + \mathbf{x}_{i,t}\beta_x\}}{1 + \exp\{\alpha_i + \mathbf{z}_{S(J(i)),t}\beta_z + \mathbf{y}_{J(i),t}\beta_y + \mathbf{x}_{i,t}\beta_x\}} \end{aligned}$$

- *Multinomial logit model for work status and sector transitions* (MNL)

$$Pr(\sigma_{i,t+1} | \sigma_{i,t} = \sigma; \mathbf{x}, \mathbf{z}) = \frac{\exp\{\mathbf{z}_{S(i),t}\beta_z^\sigma + \mathbf{x}_{i,t}\beta_x^\sigma\}}{\sum_{s \in \mathbf{S}} \exp\{\mathbf{z}_{S(i),t}\beta_z^s + \mathbf{x}_{i,t}\beta_x^s\}}$$

Work Status in Metropolitan Areas



Source: PME 1986-98, male workers, 25 years or older and employed in metropolitan area. Remaining share: Withdrawn from labor force.

Work Status Transitions

- Higher foreign import penetration and reduced product market tariffs significantly raise the odds of a worker's transition into informal work status
- Similarly, higher foreign import penetration and reduced product market tariffs significantly lower the odds of a move back from informal to formal
- Prior employment history is a significant predictor of subsequent performance (in the absence of worker fixed effects)

Work Status Transitions from Formal Employment, 1986-99

Covariate (in t)	(in $t+1$)	From formal work status in t to:			
		Informal (1)	Self empl. (2)	Unempl. (3)	Withdrawn (4)
Product Market Tariff		-1.431 (.156) ^{***}	-.828 (.169) ^{***}	.223 (.192)	.490 (.189) ^{***}
Intm. Input Tariff		.298 (.398)	.913 (.436) ^{**}	-1.130 (.489) ^{**}	-.045 (.495)
Formal worker (4 months or more)		-1.767 (.030) ^{***}	-1.428 (.036) ^{***}	-.597 (.055) ^{***}	-1.097 (.045) ^{***}

Source: *PME* 1986-99, male workers in metropolitan area, 25 years or older, with formal employment in initial period (annual transitions between 4th and 8th interview). Reference category: continuation in formal work status. Controlling for year and city effects. Robust standard errors in parentheses: * significance at ten, ** five, *** one percent.

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Work Status Transitions from Informal Employment, 1986-99

Covariate (in t)	(in $t+1$)	From informal work status in t to:			
		Formal (1)	Self empl. (2)	Unempl. (3)	Withdrawn (4)
Product Market Tariff		1.437 (.255) ^{***}	.735 (.319) ^{**}	2.141 (.614) ^{***}	.948 (.429) ^{**}
Intm. Input Tariff		-.699 (.680)	1.259 (.816)	-.385 (1.606)	.120 (1.124)
Informal worker (4 months or more)		-1.323 (.037) ^{***}	-1.591 (.048) ^{***}	-1.457 (.106) ^{***}	-1.112 (.063) ^{***}

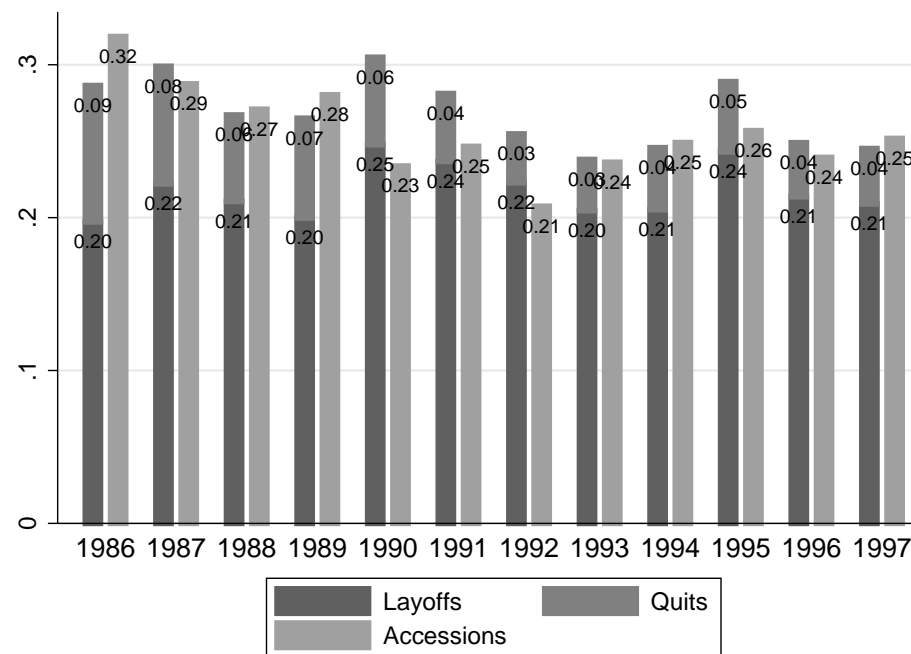
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Separations and Accessions in Manufacturing



Source: RAIS 1990-97 (1% random sample), male workers nationwide, 25 to 64 years old, with employment in subsector *IBGE* manufacturing (highest paying job if many). Separation and accession rates exclude transfers, deaths, and retirements and are relative to totals of first and last observed employments in a given year.

Separations and Accessions

- Foreign competition significantly raises separation rates at formal-sector manufacturing firms
- Sectors with revealed comparative advantage and exporters exhibit significantly higher separation and significantly lower accession rates
- There is a significant monotonic increase in worker separations from manufacturing over time, and a significant (almost) monotonic drop in worker accessions

Separations (Conditional Logit Estimates), 1990-98

	Specification				
	(1)	(2)	(3)	(4)	(5)
Balassa Comp. Adv.	.080 (.021) ^{***}			.169 (.024) ^{***}	-.094 (.049) [*]
Exporter Status		.289 (.028) ^{***}		.283 (.028) ^{***}	.284 (.028) ^{***}
Product Market Tariff			-.104 (.416)	-.705 (.426) [*]	-2.361 (.476) ^{***}
Intm. Input Tariff			1.601 (.633) ^{**}	2.880 (.678) ^{***}	5.149 (.748) ^{***}
Import Penetration				1.257 (.388) ^{***}	3.227 (.638) ^{***}
Sector effects					yes
Obs.	145,408	145,408	145,408	145,408	145,408
Pseudo R^2	.148	.149	.148	.150	.151

Source: RAIS 1990-98 (1% random sample), male workers nationwide, 25 to 64 years old, with manufacturing job. Separations exclude transfers, deaths, and retirements. Reference observations are employments with no reported separation in a given year. Sector information at subsector *IBGE* level. Controlling for year effects, sector, plant and worker covariates. Robust standard errors in parentheses: * significance at ten, ** five, *** one percent.

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Accessions (Conditional Logit Estimates), 1990-98

	Specification				
	(1)	(2)	(3)	(4)	(5)
Balassa Comp. Adv.	.041 (.017)**			-.016 (.020)	-.067 (.048)
Exporter Status		-.449 (.027)***		-.439 (.027)***	-.438 (.027)***
Product Market Tariff			1.306 (.379)***	1.246 (.393)***	1.822 (.498)***
Intm. Input Tariff			-3.258 (.540)***	-3.073 (.598)***	-2.954 (.750)***
Import Penetration				.198 (.355)	1.764 (.665)***
Sector effects					yes
Obs.	112,974	112,974	112,974	112,974	112,974
Pseudo R^2	.036	.040	.037	.041	.042

Source: RAIS 1990-98 (1% random sample), male workers nationwide, 25 to 64 years old, with manufacturing job. Accessions exclude transfers. Reference observations are employments with no reported accession in a given year. Sector information at subsector *IBGE* level. Controlling for year effects, sector, plant and worker covariates. Robust standard errors in parentheses: * significance at ten, ** five, *** one percent.

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Empirical Concerns

- Firms choose exporting status simultaneously with employment
IV: Imports from other countries into Brazil's export destinations
(seven world regions, weighted with 1990 sector export volumes)
- The government's tariff reductions are targeted at low-efficiency sectors; and sector characteristics correlate with labor turnover
IV: Components of the sectoral real exchange rate
(PPI in US and EU by sector, USD exch. rate)
- Linear worker-FE IV regressions

Linear Fixed-Effects and Instrumental-Variable Estimates, 1990-98

	Separations			Accessions		
	Cdl. Logit	OLS-FE		Cdl. Logit	OLS-FE	
		IV			IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Comp. Adv.	.168 (.024) ^{***}	.017 (.002) ^{***}	.023 (.003) ^{***}	-.016 (.020)	.002 (.002)	-.002 (.003)
Exp. Status	.283 (.028) ^{***}	.038 (.003) ^{***}	.516 (.096) ^{***}	-.439 (.027) ^{***}	-.050 (.003) ^{***}	-.498 (.090) ^{***}
Prod. Mkt. Trf.	-.710 (.426) [*]	-.100 (.035) ^{***}	-.033 (.081)	1.248 (.393) ^{***}	.124 (.032) ^{***}	.114 (.073)
Import Penetr.	1.247 (.388) ^{***}	.051 (.034)	.003 (.077)	.203 (.355)	.089 (.031) ^{***}	.266 (.071) ^{***}
Obs.	145,418	293,369	293,369	112,971	293,137	293,137

Source: RAIS 1990-98 (1% random sample), male workers nationwide, 25 to 64 years old, with manufacturing job. Further regressors (not reported): Year indicators, sector, plant and worker covariates. Robust standard errors in parentheses: * significance at ten, ** five, *** one percent.

Alternative Samples and Robustness Checks

- Accession and separation coefficients are remarkably stable across education groups
- Privatization does not affect findings, controlling for the share of privatized establishments at the sector level
- Indicators of job-level outsourcing (*terceirização*) do not overturn findings
- Sector-fixed effects rule out level effects of prior labor-market reforms

Accessions (Conditional Logit Estimates), 1990-98

	Cdl. Logit baseline	Primary school	High school	College educ.	Privatiz. control	Outsrc. job ind.
	(1)	(2)	(3)	(4)	(5)	(6)
Balassa Cmp. Adv.	-.016 (.020)	-.120 (.209)	-.006 (.023)	-.141 (.118)	-.024 (.022)	-.015 (.021)
Exporter Status	-.439 (.027)***	-.477 (.216)**	-.420 (.031)***	-.776 (.140)***	-.439 (.027)***	-.437 (.027)***
Import Penetration	.198 (.355)	-9.315 (3.845)**	.084 (.423)	-.720 (1.948)	.128 (.363)	.181 (.358)
<i>addl. regressor(s)</i>					1.140 (1.166)	-.098 (.033)***
Obs.	112,974	2,752	86,468	4,786	112,974	110,985
Pseudo R^2	.041	.223	.043	.088	.041	.040

Source: RAIS 1990-98 (1% random sample), male workers nationwide, 25 to 64 years old, with manufacturing job. Accessions exclude transfers. Reference observations are employments with no reported accession in a given year. Sector information at subsector *IBGE* level. Further regressors (not reported): Year indicators, sector, plant and worker covariates. Robust standard errors in parentheses: * significance at ten, ** five, *** one percent.

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	(1)	(2)	(3)	(4)	(5)	(6)
Balassa Cmp. Adv.	.169 (.024)***	.498 (.267)*	.145 (.028)***	.216 (.150)	.170 (.026)***	.169 (.024)***
Exporter Status	.283 (.028)***	.379 (.243)	.296 (.033)***	.297 (.143)**	.283 (.028)***	.283 (.029)***
Import Penetration	1.257 (.388)***	8.588 (3.668)**	.678 (.477)	.886 (1.995)	1.264 (.392)***	1.269 (.391)***
<i>addl. regressor(s)</i>					-.142 (1.227)	-.018 (.037)
Obs.	145,408	2,897	110,831	7,498	145,408	143,536
Pseudo R^2	.150	.391	.161	.245	.150	.151

Source: RAIS 1990-98 (1% random sample), male workers nationwide, 25 to 64 years old, with manufacturing job. Separations exclude transfers, deaths, and retirements. Reference observations are employments with no reported separation in a given year. Sector information at subsector *IBGE* level. Further regressors (not reported): Year indicators, sector, plant and worker covariates. Robust standard errors in parentheses: * significance at ten, ** five, *** one percent.

Trade Exposure and Predicted Labor Market Outcomes

	1990	1992	1994	1998
<i>Trade Exposure</i>				
Import Penetration	.041	.056	.060	.103
Product Market Tariff	.358	.202	.142	.167
Intm. Input Tariff	.278	.152	.107	.129
<i>Change in Separation rates predicted by</i>				
change in Import Penetration since 1990		.016	.020	.064
changes in Tariffs since 1990		.067	.092	.081
<i>Change in Accession rates predicted by</i>				
change in Import Penetration since 1990		-.008	-.012	-.040
changes in Tariffs since 1990		.018	.023	.019

Source: RAIS 1990-98, male workers nationwide, 25 to 64 years old, with manufacturing job. Sector information at subsector IBGE level. Predicted changes in separation and accession rates based on marginal effects implied by estimates, excluding year effects ($\hat{P}(1 - \hat{P})$ is .170 for separations and .174 for accessions).

Concluding Remarks

- Matched employer-employee data seem to be uniquely suited for an analysis of labor reallocation following trade reform.
- There are significant and important worker-fixed effects in Brazil's labor turnover
- Foreign competition depresses accession at formal-sector manufacturing firms, raises separation rates, and raises the odds of informality
- Brazil's tradable goods sectors do not seem to expand activities with a comparative advantage by reallocating factors of production in the short to medium term; neither do exporters

Backup Slides

Reform and Growth

- Despite vigorous pro-competitive and trade reforms, growth in Latin America throughout the 1990s remained relatively slow
- Lacking resource reallocation following pro-competitive reform may be a cause of sluggish performance
- Brazil's trade reform triggers worker displacements particularly from protected industries, as trade theory predicts and welcomes
- But neither comparative-advantage industries nor exporters absorb trade-displaced workers for years

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	.086	.046	.136
Idle labor (foregone share of GDP)		.000	.014	.006	.024
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	.033	.025	.034
Idle labor (foregone share of GDP)		.000	.005	.003	.006

Sources: RAIS 1986-1999 (1% random sample), 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.

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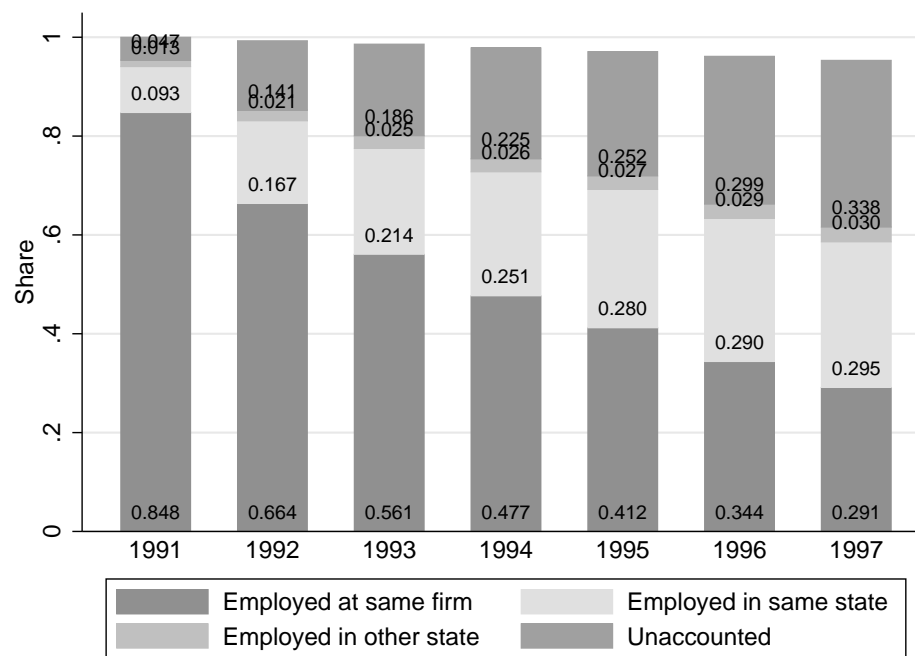
Formal-sector Reallocation Time Spans 1990-97

	Mean 1990-07		1990		1997	
	nation	metro	nation	metro	nation	metro
	(1)	(2)	(3)	(4)	(5)	(6)
within						
same month	.146	.597	.163	.615	.138	.576
1 year	.627	.353	.663	.351	.614	.361
1 to 2 years	.134	.031	.101	.021	.135	.037
2 to 3 years	.058	.012	.045	.008	.065	.015
3 to 4 years	.035	.007	.027	.005	.048	.011
<i>Total (thsd)^a</i>	29,660	21,878	4,195	3,113	3,682	2,630

^aTotal reallocation (thousand workers), scaled to population equivalent.

Source: RAIS 1990-2001. Male workers nationwide (1% random sample) or in metropolitan areas only (5% random sample), 25 to 64 years old (in highest paying job if many), displaced from a formal-sector job between 1990 and 1997 and rehired into a formal-sector job within 48 months (regression samples with subsector *IBGE* and *CNAE* sector information).

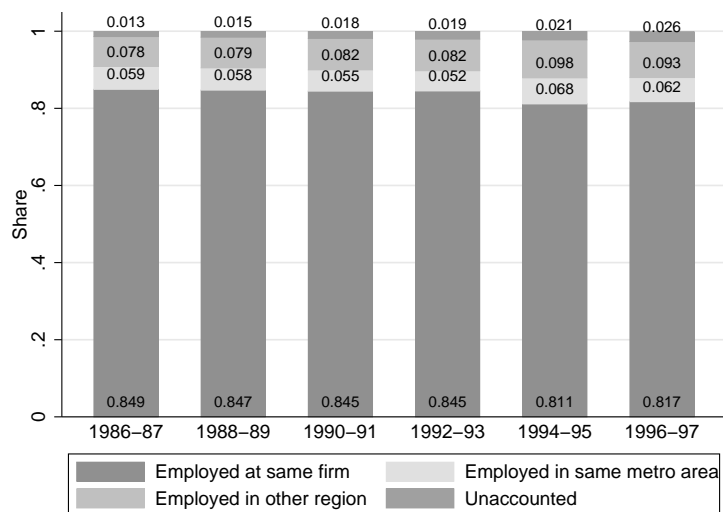
Labor Market Experience of 1990 Workers



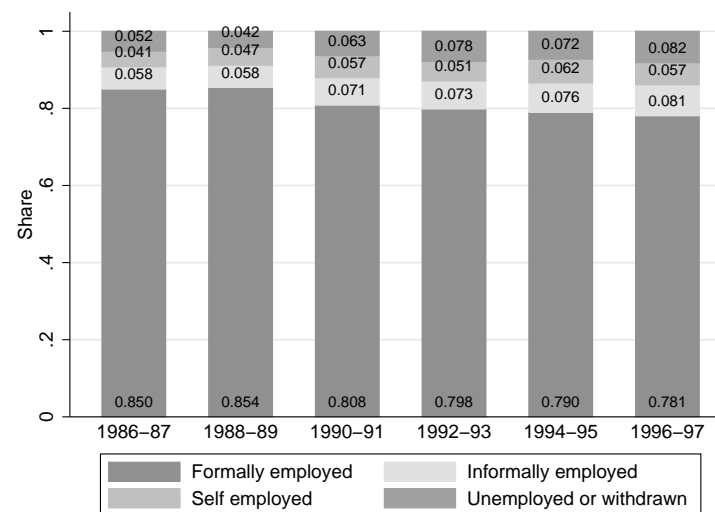
Source: RAIS 1990-97 (1% random sample), male workers, 25 years or older and employed on Dec 31, 1990. Frequencies based on last employment of year (highest paying job if many); continuations at same firm include regional transfers. Frequencies exclude workers with prior retirement or death, or age 65 or above on earlier job.

Annual labor market and work status transitions, 1986-97

From formal *RAIS* job to being



From formal *PME* job to being



Sources: *RAIS* 1986-2001 (1% random sample), male workers nationwide, 25 to 64 years old, displaced from a formal-sector job and rehired into a formal-sector job within 48 months. Product tariffs from Kume, Piani & Souza (2000), employment weighted at *Nível 50* sector level.

Revealed Comparative Advantage and Tariff Correlations

$BADV_{i,t}$	Sector FE		OLS	
	1986-98 (1)	1990-98 (2)	1986-98 (3)	1990-98 (4)
Product Market Tariff	.052 (.059)	.234 (.076)***	.485 (.125)***	.504 (.140)***
Sectoral Intermediate Input Tariff	-.015 (.059)	-.085 (.124)	-.603 (.156)***	-1.343 (.231)***
Constant	.978 (.037)***	.975 (.034)***	1.048 (.056)***	1.070 (.036)***
Observations	387	267	387	267
R^2 (within for FE regressions)	.005	.055	.042	.116
p -value: Joint test nonzero year indic.	1.000	.809	1.000	.875

Source: Revealed comparative advantage and *ad-valorem* tariff measures based on economy-wide input-output matrices and national accounting data from Ramos and Zonenschain (2000), and on nominal product tariff data from Kume et al. (2000). Controlling for year effects (only joint χ^2 test statistic reported). Robust standard errors in parentheses: * significance at ten, ** five, *** one percent. .