Supplemental File:

Trade Liberalization and Wage inequality: Evidence from Chile

In this supplemental file, we double-check the robustness of our findings in the main text. For this purpose, we repeat the estimation strategy presented in Section 5 by employing the two-stage estimation strategy.

Estimation strategy

In the two-stage estimation strategy, we regress the log of worker *i*'s wages (*w*) on the worker's skill categories, which consist of a dummy for semiskilled workers (*semiskilled*) and for skilled workers (*skilled*), a vector of the worker's other individual characteristics ***X***, and a vector of industry effects indicating the worker's industry affiliation ***I*** in the first stage. Thus, we estimate the following wage equation separately for each year:

(S-1)

$$\ln(w_{ijt}) = \mathbf{X}'_{it}\boldsymbol{\beta}_1 + \beta_2 semiskilled_{it} + \beta_3 skilled_{it} + \mathbf{I}'_{jt}\mathbf{wp}_{jt} + \varepsilon_{ijt}.$$

The vector of coefficients on the industry effects (***wp***) capture the industry wage premiums. The variables included in vector ***X*** are the same as in equation (1) of Section 3.1. Following Attanasio, Goldberg, and Pavcnik (2004), Dutta (2007), Goldberg and Pavcnik (2005), Kovak (2013), Kumar and Mishra (2008), Paz (2014), and Pavcnik et al. (2004), we express

industry wage premiums as deviations from the employment-share-weighted average industry wage premiums, rather than the deviations from a particular base category. Thus, we can interpret the normalized industry wage premiums as the proportional difference in wages for a worker in a given industry relative to the average worker in all industries with the same observable characteristics (Attanasio, Goldberg, and Pavcnik 2004; Goldberg and Pavcnik 2005, Kumar and Mishra 2008; Pavcnik et al. 2004). We calculate the exact standard errors for the normalized wage premiums using the Haisken-Denew and Schmidt's (1997) two-step restricted least squares procedure. The annex of Murakami (2013) provides the detailed procedures for the calculation.

In the second stage, we pool the estimated industry wage premiums over time and regress them on the effective tariff rates on final goods (*output tariff*), those on intermediate inputs (*input tariff*), a vector of other industry characteristics $\boldsymbol{Z}$ lagged by one year, which consist of the share of foreign owned capital (*FDI*) and the ratio of expenditure on licenses and foreign technical assistance (*foreign technology*), a vector of industry effects $\boldsymbol{I}$, and a vector of year effects $\boldsymbol{Y}$:

(S-2)

$$wp_{jt} = \gamma_1 \ln(output\,tariff_{jt}) + \gamma_2 \ln(input\,tariff_{jt}) + \mathbf{Z}'_{jt-1}\boldsymbol{\gamma}_3 + I_j + Y_t + \varepsilon_{ijt}.$$

Following Attanasio, Goldberg, and Pavcnik (2004), Dutta (2007), Goldberg and Pavcnik (2005), Kovak (2013), Kumar and Mishra (2008), Paz (2014), and Pavcnik et al. (2004), we estimate equation S-2 using weighted least squares (WLS), with the inverse of the standard error of the wage premium from the first-stage as the weight. This procedure puts more weight on industries with a smaller standard error. To address potential heteroscedasticity and serial correlation in the error term in equation S-2, we estimate robust standard errors clustered at the three-digit industry level. As discussed in Section 5.3, we also estimate equation S-2 including industry-level total factor productivity (TFP). Further, to address the potential endogeneity of effective tariffs, we estimate equation S-2 using the most-favored-nation (MFN) tariff rate in each year interacted with initial applied tariff levels as the instrumental variable.

To analyze the impacts of trade liberalization on industry skill premiums, we estimate a modified version of equation S-1 in the first-stage, where we allow industry wage premiums to differ for workers with different skills:

(S-3)

$$\ln(w_{ijt}) = \mathbf{X}'_{it}\boldsymbol{\beta}_1 + \beta_2 semiskilled_{it} + \beta_3 skilled_{it} + \mathbf{I}'_{jt}\mathbf{wp}_{jt} + semiskilled_{it} * \mathbf{I}'_{jt}\mathbf{semiswp}_{jt} + skilled_{it} * \mathbf{I}'_{jt}\mathbf{swp}_{jt} + \varepsilon_{ijt} \quad .$$

The vector of coefficients ***semiswp*** and ***swp*** capture the industry wage premiums for semiskilled workers and skilled workers, respectively. As in the case of industry wage premiums, we estimate the coefficients and standard errors using the Haisken-Denew and Schmidt's (1997) two-step restricted least squares procedure. In the second stage, we pool the industry skill premiums (***swp***) over time and regress them on the same variables as in equation S-2.

Estimation results

Tables S-1 and S-3 present the first-stage estimation results; that is, the estimation results of industry wage premiums and industry skill premiums, respectively. Additionally, Tables S-2 and S-4 report their year-to-year correlations. We find that both the industry wage premiums and industry skill premiums vary widely across industries in each year. Further, their structures changed substantially between 2000 and 2003, as evidenced by the low correlation coefficients between those years (0.093 and 0.063, respectively). By contrast, the structure is much more stable after 2003. Considering that the reductions in effective tariff rates are concentrated in the period from 2000 to 2003, the reductions are likely to be associated with the changing structure of industry wage premiums and industry skill premiums.

Table S-5 reports the second-stage estimation results for industry wage premiums. We find that the coefficient of output tariffs is negative and significant, and is unaffected by the inclusion of FDI, foreign technology, and TFP. The absolute value of the coefficient of the two-stage least squares (2SLS) is larger than that of the OLS, as expected. By contrast, the coefficients of FDI, foreign technology, and TFP are insignificant.

Table S-6 reports the second-stage estimation results for industry skill premiums. The coefficient of output tariffs is negative and significant, and is unaffected by the inclusion of FDI, foreign technology, and TFP. Interestingly, the Durbin-Wu-Hausman test does not reject the exogeneity of output tariffs, unlike in one-stage estimation strategy. However, the result is plausible because the political characteristics that correlate with trade protection (e.g., powerful unions) are likely to be associated with the wages of unskilled workers only.

Therefore, we find the robust effects of output tariffs on industry wage premiums and industry skill premiums, thereby confirming the robustness of our findings in the main text.

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Table S-1. First-stage estimation results: industry wage premiums, 2000-2009

ISIC (Rev.2)	Industry	2000		2003		2006		2009	
311	Food manufacturing	-0.128	***	-0.120	***	-0.127	***	-0.064	***
		(0.016)		(0.016)		(0.014)		(0.014)	
312	Food manufacturing	-0.058		-0.112	**	0.063		-0.062	
		(0.038)		(0.047)		(0.049)		(0.044)	
313	Beverage industries	-0.032		0.007		0.046		0.039	
		(0.032)		(0.032)		(0.033)		(0.032)	
314	Tobacco manufactures	0.433	***	0.878	***	0.974	***	0.321	
		(0.160)		(0.149)		(0.192)		(0.326)	
321	Manufacture of textiles	0.060		-0.056		-0.093	**	0.041	
		(0.041)		(0.049)		(0.040)		(0.059)	
322	Manufacture of wearing apparel, except footwear	-0.041		-0.005		-0.091	*	-0.220	***
		(0.054)		(0.058)		(0.054)		(0.047)	
323	Manufacture of leather and products of leather, leather substitutes and fur, except footwear and wearing apparel	0.002		-0.207		0.177	**	-0.392	*
		(0.106)		(0.147)		(0.083)		(0.238)	
324	Manufacture of footwear, except vulcanized or moulded rubber or plastic footwear	-0.136	**	-0.123	**	-0.025		0.096	
		(0.059)		(0.051)		(0.066)		(0.066)	
331	Manufacture of wood and wood and cork products, except furniture	-0.096	***	-0.123	***	-0.101	***	-0.101	***
		(0.034)		(0.030)		(0.027)		(0.031)	
332	Manufacture of furniture and fixtures, except primarily of metal	-0.042		-0.140	***	-0.046		-0.067	*
		(0.037)		(0.032)		(0.030)		(0.035)	
341	Manufacture of paper and paper products	0.136	***	0.033		0.044		0.036	
		(0.044)		(0.044)		(0.036)		(0.037)	
342	Printing, publishing and allied industries	-0.094	**	0.214	***	0.182	***	0.089	***
		(0.037)		(0.029)		(0.029)		(0.033)	
351	Manufacture of industrial chemicals	0.004		0.085		0.176	***	0.253	***
		(0.072)		(0.056)		(0.054)		(0.074)	
352	Manufacture of other chemical products	0.323	***	0.325	***	0.174	***	0.041	
		(0.035)		(0.034)		(0.038)		(0.043)	
353	Petroleum refineries	0.141		0.554	***	0.225	**	1.125	***
		(0.093)		(0.115)		(0.106)		(0.125)	

Continued

ISIC (Rev.2)	Industry	2000		2003		2006		2009	
354	Manufacture of miscellaneous products of petroleum and coal	-0.430	*	0.342	**	0.582	***	0.592	***
		(0.258)		(0.150)		(0.139)		(0.147)	
355	Manufacture of rubber products	0.244	***	-0.026		-0.042		-0.011	
		(0.079)		(0.069)		(0.030)		(0.086)	
356	Manufacture of plastic products not elsewhere classified	-0.049		-0.059		-0.260	***	0.082	*
		(0.046)		(0.041)		(0.040)		(0.045)	
361	Manufacture of pottery, china and earthenware	-0.065		-0.040		-0.179		-0.045	
		(0.114)		(0.144)		(0.139)		(0.170)	
362	Manufacture of glass and glass products	-0.065		0.015		-0.002		-0.206	***
		(0.068)		(0.073)		(0.077)		(0.072)	
369	Manufacture of other non-metallic mineral products	0.035		-0.001		0.183	***	-0.080	
		(0.052)		(0.047)		(0.050)		(0.050)	
371	Iron and steel basic industries	0.071		0.081	*	0.005		0.017	
		(0.053)		(0.049)		(0.034)		(0.036)	
372	Non-ferrous metal basic industries	0.016		0.448	***	0.129	**	-0.048	
		(0.090)		(0.118)		(0.057)		(0.076)	
381	Manufacture of fabricated metal products, except machinery and equipment	0.015		0.000		0.110	***	0.028	
		(0.024)		(0.019)		(0.027)		(0.020)	
382	Manufacture of machinery except electrical	0.283	***	0.176	***	0.045		0.130	***
		(0.046)		(0.042)		(0.032)		(0.033)	
383	Manufacture of electrical machinery apparatus, appliances and supplies	-0.112	**	0.130	**	0.186	***	-0.023	
		(0.056)		(0.053)		(0.035)		(0.061)	
384	Manufacture of transport equipment	-0.029		-0.024		0.019		0.148	***
		(0.053)		(0.049)		(0.048)		(0.050)	
385	Manufacture of professional and scientific, and measuring and controlling equipment not elsewhere classified, and of photographic and optical goods	0.293		0.229	*	0.119		0.049	
		(0.247)		(0.119)		(0.099)		(0.251)	
390	Other Manufacturing Industries	1.102	***	-0.237	**	0.047		0.139	**
		(0.083)		(0.093)		(0.086)		(0.067)	
	Standard deviation of industry wage premiums	0.263		0.245		0.233		0.269	

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Numbers in parentheses are standard errors. Industry wage premiums and their standard errors are calculated using the Haisken-Denew and Schmidt's (1997) procedure.

Table S-2. Year-to-year correlation matrix for industry wage premiums

	2000	2003	2006	2009
2000	1.000			
2003	0.093	1.000		
2006	0.129	0.769	1.000	
2009	0.084	0.591	0.436	1.000

Note: The calculation is based on the industry wage premiums presented in Table S-1.

Table S-3. First-stage estimation results: industry skill premiums, 2000-2009

ISIC (Rev.2)	Industry	2000		2003		2006		2009	
311	Food manufacturing	-0.203	***	0.000		-0.079		-0.033	
		(0.068)		(0.063)		(0.049)		(0.054)	
312	Food manufacturing	-0.018		-0.157		0.168		0.271	*
		(0.124)		(0.180)		(0.144)		(0.161)	
313	Beverage industries	-0.122		0.362	***	0.535	***	0.376	***
		(0.094)		(0.088)		(0.102)		(0.097)	
314	Tobacco manufactures	0.318		1.558	***	1.950		0.873	
		(0.586)		(0.446)		(1.471)		(0.875)	
321	Manufacture of textiles	0.746	***	-0.386	**	-0.196		-0.067	
		(0.140)		(0.158)		(0.144)		(0.216)	
322	Manufacture of wearing apparel, except footwear	0.048		0.326		-0.416	**	-0.471	***
		(0.163)		(0.240)		(0.212)		(0.123)	
323	Manufacture of leather and products of leather, leather substitutes and fur, except footwear and wearing apparel	-0.006		0.117		-0.420			
		(0.317)		(0.721)		(0.503)			
324	Manufacture of footwear, except vulcanized or moulded rubber or plastic footwear	-0.159		-0.247		-0.431			
		(0.234)		(0.202)		(0.475)			
331	Manufacture of wood and wood and cork products, except furniture	0.104		-0.156		0.006		0.017	
		(0.117)		(0.100)		(0.100)		(0.128)	
332	Manufacture of furniture and fixtures, except primarily of metal	-0.546	***	-0.439	***	-0.194	*	-0.325	*
		(0.166)		(0.114)		(0.101)		(0.187)	
341	Manufacture of paper and paper products	-0.009		-0.012		0.229	**	0.444	***
		(0.159)		(0.164)		(0.105)		(0.141)	
342	Printing, publishing and allied industries	-0.047		0.297	***	0.002		-0.150	
		(0.129)		(0.113)		(0.107)		(0.109)	
351	Manufacture of industrial chemicals	-0.351		0.477	**	0.157		0.463	
		(0.268)		(0.195)		(0.175)		(0.432)	
352	Manufacture of other chemical products	-0.005		0.262	***	-0.339	***	-0.231	
		(0.129)		(0.095)		(0.116)		(0.168)	

Continued

ISIC (Rev.2)	Industry	2000		2003		2006		2009	
353	Petroleum refineries	0.344		-0.436		0.333		1.067	**
		(0.753)		(0.714)		(0.215)		(0.454)	
354	Manufacture of miscellaneous products of petroleum and coal								
355	Manufacture of rubber products	0.180		0.548	***	-0.362	***	0.008	
		(0.263)		(0.198)		(0.106)		(0.349)	
356	Manufacture of plastic products not elsewhere classified	0.086		-0.205		-0.402	***	0.892	***
		(0.133)		(0.147)		(0.118)		(0.159)	
361	Manufacture of pottery, china and earthenware	-0.739	***	-0.748		-0.501		-0.288	
		(0.265)		(0.508)		(0.396)		(0.430)	
362	Manufacture of glass and glass products	0.216		0.131		-0.589		-0.022	
		(0.583)		(0.192)		(0.384)		(0.358)	
369	Manufacture of other non-metallic mineral products	0.058		0.031		1.396	***	0.418	***
		(0.151)		(0.145)		(0.149)		(0.126)	
371	Iron and steel basic industries	0.059		-0.073		-0.038		-0.233	*
		(0.171)		(0.174)		(0.103)		(0.129)	
372	Non-ferrous metal basic industries	0.643	**	0.326		-0.228		0.013	
		(0.251)		(0.346)		(0.201)		(0.499)	
381	Manufacture of fabricated metal products, except machinery and equipment	-0.310	***	-0.524	***	0.075		-0.192	***
		(0.080)		(0.065)		(0.086)		(0.073)	
382	Manufacture of machinery except electrical	-0.059		0.060		-0.071		0.001	
		(0.148)		(0.169)		(0.123)		(0.130)	
383	Manufacture of electrical machinery apparatus, appliances and supplies	-0.090		0.372	**	-0.027		0.035	
		(0.179)		(0.166)		(0.111)		(0.310)	
384	Manufacture of transport equipment	-0.701	***	0.085		0.187		-0.104	
		(0.186)		(0.143)		(0.163)		(0.187)	
385	Manufacture of professional and scientific, and measuring and controlling equipment not elsewhere classified, and of photographic and optical goods	0.472		0.247		0.066			
		(0.661)		(0.780)		(0.453)			
390	Other Manufacturing Industries	1.811	***	-0.391		0.600		-0.329	
		0.365		0.316		0.561		0.280	
Standard deviation of industry skill premiums		0.485		0.443		0.546		0.407	

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Numbers in parentheses are standard errors. Industry skill premiums and their standard errors are calculated using the Haisken-Denew and Schmidt's (1997) procedure. The missing values indicate that high-skilled workers employed in a given industry do not exist in the sample.

Table S-4. Year-to-year correlation matrix for industry skill premiums

	2000	2003	2006	2009
2000	1.000			
2003	0.063	1.000		
2006	0.221	0.446	1.000	
2009	0.051	0.284	0.499	1.000

Note: The calculation is based on the industry skill premiums presented in Table S-3.

Table S-5. Second-stage estimation results: the impacts of trade liberalization on industry wage premiums

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Technique	OLS	OLS	OLS	OLS	OLS	OLS	2SLS	2SLS
Log output tariff	-0.158**	-0.159**	-0.163**	-0.159**	-0.159**	-0.164**	-0.629***	-0.633***
	(0.063)	(0.059)	(0.063)	(0.063)	(0.061)	(0.066)	(0.213)	(0.197)
Log input tariff		0.007	0.014		-0.002	0.002		
		(0.074)	(0.087)		(0.073)	(0.089)		
FDI			0.035			0.043		0.131
			(0.173)			(0.174)		(0.155)
Foreign technology			5.462			5.762		6.839
			(6.977)			(6.870)		(6.841)
TFP				0.029	0.029	0.028	0.024	0.022
				(0.020)	(0.020)	(0.020)	(0.026)	(0.023)
Constant	-0.432***	-0.415	-0.420	-0.498***	-0.504*	-0.518	-1.689***	-1.732***
	(0.151)	(0.269)	(0.344)	(0.144)	(0.261)	(0.339)	(0.507)	(0.491)
Industry effects	yes	yes	yes	yes	yes	yes	yes	yes
Year effects	yes	yes	yes	yes	yes	yes	yes	yes
Kleibergen–Paap rK F statistic							11.043	9.75
Stock–Yogo reference values 10%								
maximal IV size							16.38	16.38
Durbin-Wu-Hausman test							3.14*	3.03*
							[0.087]	[0.093]
Observations	116	116	116	115	115	115	115	115
R-squared	0.275	0.275	0.282	0.282	0.282	0.290	0.311	0.318

Note: ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. Numbers in parentheses represent robust-standard errors clustered at the three-digit industry level. Numbers in brackets represent *p*-values. 2SLS indicates that the two-stage least squares estimation is used.

Table S-6. Second-stage estimation results: the impacts of trade liberalization on industry skill premiums

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Technique	OLS	OLS	OLS	OLS	OLS	OLS	2SLS	2SLS
Log output tariff	-0.314**	-0.337***	-0.335**	-0.316***	-0.330***	-0.330***	-0.764	-0.846*
	(0.116)	(0.120)	(0.127)	(0.100)	(0.102)	(0.109)	(0.472)	(0.508)
Log input tariff		0.098	0.052		0.062	0.011		
		(0.238)	(0.253)		(0.210)	(0.222)		
FDI			0.243			0.275		0.386
			(0.257)			(0.267)		(0.293)
Foreign technology			-17.376			-17.075		-17.498
			(15.592)			(16.240)		(17.614)
TFP				0.159***	0.159***	0.159***	0.152***	0.151***
				(0.052)	(0.052)	(0.051)	(0.048)	(0.049)
Constant	-0.732**	-0.503	-0.668	-1.088***	-0.941	-1.133*	-2.224*	-2.498*
	(0.300)	(0.667)	(0.717)	(0.316)	(0.616)	(0.657)	(1.212)	(1.331)
Industry effects	yes	yes	yes	yes	yes	yes	yes	yes
Year effects	yes	yes	yes	yes	yes	yes	yes	yes
Kleibergen–Paap rK F statistic							10.971	9.684
Stock–Yogo reference values 10%								
maximal IV size							16.38	16.38
Durbin-Wu-Hausman test							0.64	0.76
							[0.430]	[0.390]
Observations	110	110	110	109	109	109	109	109
R-squared	0.153	0.155	0.169	0.212	0.212	0.227	0.217	0.234

Note: ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. Numbers in parentheses represent robust-standard errors clustered at the three-digit industry level. Numbers in brackets represent *p*-values. 2SLS indicates that the two-stage least squares estimation is used.