Supplemental material to "Effects of upstream positions in global value chains on skilled labor wage share in Chile: Evidence from plant-level panel data"

Appendix A: Appendix tables

Table A1. Correspondence between the classifications of the Chilean input-output (I-O) tables for 1986 and 1996 and ISIC Revisions 2 and 3.

Code	Industry name	I-O1996	I-O1986	ISIC Rev2
11	Meat	11	13	3111
12	Seafood	12	16	3114
13	Canned fruits and vegetables	13	15	3113
14	Oils and fats	14	17	3115
15	Dairy Products	15	14	3112
16	Grain mill products	16	18	3116
17	Animal feed	17	21	3122
18	Bread, noodles, and pasta	18	18	3117
19	Sugar and starch	19	19	3118/ 3121
20	Other food products	20	20	3119
21	Liquors and spirits	21	23	3131
22	Wines	22	23	3132
23	Beer	23	22	3133
24	Non-alcoholic beverages	24	22	3134
25	Snuff products	25	24	314
26	Textiles	26	25	321
27	Clothing	27	26	322
28	Leather and leather products	28	27	323
29	Footwear	29	28	324
30	Wood and wood products	30	29	331
31	Paper and paper products	31	31	341
32	Printing and publishing	32	32	342
33	Fuel and other petroleum products	33	35	353/354
34	Basic Chemicals	34	33	351
35	Other chemicals	35	34	352
36	Rubber Products	36	36	355
37	Plastic Products	37	37	356
38	Glass and glass products	38	39	362
39	Non-metallic mineral products	39	38/40	361/369
40	Basic iron and steel	40	41	371
41	Basic products of nonferrous metals	41	41	372
42	Metal products	42	42	381
43	Non-electrical machinery and equipment	43	43	382
44	Machinery and electrical equipment	44	44/46	383/385
45	Transportation equipment	45	45	384
46	Furniture	46	30	332
47	Other manufactured products	47	47	390

Source: Author's own elaboration based on Venegas Morales (1994, p. 87) and Annex 1 of the Central Bank of Chile (2001, p. 207).

Note: The code corresponds to the classification of I-O table for 1996. The industry names are based on the country to sector table in the UNCTAD-Eora Global Value Chain Database. The correspondence between the classification of I-O table for 1986 and the ISIC Revision 2 was based on Venegas Morales (1994, p. 87), while the correspondence between the classifications of the I-O tables for 1986 and 1996 was based on the Central Bank of Chile (2001, p. 207).

Table A2. Average global value chain position index from 1996 to 2006 for each industry.

Code	Industry name	Observations	Mean
11	Meat	1228	-0.0010
12	Seafood	1389	-0.0127
13	Canned fruits and vegetables	915	-0.0044
14	Oils and fats	321	-0.0005
15	Dairy Products	596	-0.0006
16	Grain mill products	956	-0.0002
17	Animal feed	253	0.0001
18	Bread, noodles, and pasta	7051	-0.0001
19	Sugar and starch	520	0.0001
20	Other food products	258	-0.0045
21	Liquors and Spirits	164	0.0000
22	Wines	687	-0.0039
23	Beer	61	0.0000
24	Non-alcoholic beverages	352	0.0003
25	Snuff products	25	0.0013
26	Textiles	3040	-0.0010
27	Clothing	2383	-0.0007
28	Leather and leather products	430	0.0000
29	Footwear	1142	-0.0001
30	Wood and wood products	3243	-0.0041
31	Paper and paper products	1059	-0.0046
32	Printing and publishing	2542	0.0003
33	Fuel and other petroleum products	204	0.0167
34	Basic Chemicals	769	-0.0073
35	Other chemicals	1917	-0.0004
36	Rubber Products	582	0.0003
37	Plastic Products	2623	-0.0005
38	Glass and glass products	303	-0.0003
39	Non-metallic mineral products	1763	0.0002
40	Basic iron and steel	556	0.0014
41	Basic products of nonferrous metals	602	-0.0119
42	Metal products	4643	0.0005
43	Non-electrical machinery and equipment	2454	-0.0014
44	Machinery and electrical equipment	1154	-0.0013
45	Transportation equipment	1141	-0.0015
46	Furniture	1284	-0.0005
47	Other manufactured products	666	-0.0012
	Total	49276	-0.0013

Source: Author's own calculations based on UNCTAD-Eora Global Value Chain Database

Table A3. Average global value chain participation index from 1996 to 2006 for each industry.

Code	Industry name	Observations	Mean
11	Meat	1228	0.0016
12	Seafood	1389	0.0157
13	Canned fruits and vegetables	915	0.0061
14	Oils and fats	321	0.0007
15	Dairy Products	596	0.0009
16	Grain mill products	956	0.0004
17	Animal feed	253	0.0004
18	Bread, noodles, and pasta	7051	0.0004
19	Sugar and starch	520	0.0001
20	Other food products	258	0.0059
21	Liquors and Spirits	164	0.0001
22	Wines	687	0.0056
23	Beer	61	0.0002
24	Non-alcoholic beverages	352	0.0004
25	Snuff products	25	0.0013
26	Textiles	3040	0.0023
27	Clothing	2383	0.0014
28	Leather and leather products	430	0.0003
29	Footwear	1142	0.0004
30	Wood and wood products	3243	0.0127
31	Paper and paper products	1059	0.0183
32	Printing and publishing	2542	0.0020
33	Fuel and other petroleum products	204	0.0183
34	Basic Chemicals	769	0.0348
35	Other chemicals	1917	0.0044
36	Rubber Products	582	0.0014
37	Plastic Products	2623	0.0021
38	Glass and glass products	303	0.0008
39	Non-metallic mineral products	1763	0.0006
40	Basic iron and steel	556	0.0033
41	Basic products of nonferrous metals	602	0.0158
42	Metal products	4643	0.0032
43	Non-electrical machinery and equipment	2454	0.0054
44	Machinery and electrical equipment	1154	0.0018
45	Transportation equipment	1141	0.0054
46	Furniture	1284	0.0007
47	Other manufactured products	666	0.0015
	Total	49276	0.0043

Source: Author's own calculations based on UNCTAD-Eora Global Value Chain Database

Table A4. Average share of skilled workers to total wage bill from 1996 to 2006 for each industry.

Code	Industry name	Observations	Mean
11	Meat	1228	0.5014
12	Seafood	1389	0.3713
13	Canned fruits and vegetables	915	0.4310
14	Oils and fats	321	0.5301
15	Dairy Products	596	0.4950
16	Grain mill products	956	0.4991
17	Animal feed	253	0.4974
18	Bread, noodles, and pasta	7051	0.4657
19	Sugar and starch	520	0.5271
20	Other food products	258	0.4494
21	Liquors and Spirits	164	0.4313
22	Wines	687	0.5876
23	Beer	61	0.7137
24	Non-alcoholic beverages	352	0.6569
25	Snuff products	25	0.7376
26	Textiles	3040	0.4593
27	Clothing	2383	0.4861
28	Leather and leather products	430	0.4894
29	Footwear	1142	0.4304
30	Wood and wood products	3243	0.3585
31	Paper and paper products	1059	0.5352
32	Printing and publishing	2542	0.6528
33	Fuel and other petroleum products	204	0.6524
34	Basic Chemicals	769	0.6482
35	Other chemicals	1917	0.6402
36	Rubber Products	582	0.5164
37	Plastic Products	2623	0.4619
38	Glass and glass products	303	0.4727
39	Non-metallic mineral products	1763	0.5013
40	Basic iron and steel	556	0.5281
41	Basic products of nonferrous metals	602	0.6539
42	Metal products	4643	0.5020
43	Non-electrical machinery and equipment	2454	0.6123
44	Machinery and electrical equipment	1154	0.5469
45	Transportation equipment	1141	0.5354
46	Furniture	1284	0.4505
47	Other manufactured products	666	0.5412
	Total	49276	0.5029

Source: Author's own calculations based on the data sources presented in Section 3.

Table A5. Estimation results of Equation (5) using correlated random effects (CRE) Tobit model.

	Dependent variable: Share of skilled workers to total wage			
	(1)	(2)	(3)	(4)
ln*k*	-0.0069***	-0.0069***	-0.0069***	-0.0069***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
ln*y*	-0.0114***	-0.0115***	-0.0114***	-0.0114***
	(0.0028)	(0.0028)	(0.0028)	(0.0028)
GVCposition	-12.0438***	-11.7843***	-12.2418***	-12.4613***
	(3.8483)	(3.8635)	(3.8726)	(3.8574)
GVCparticipation	-20.4647***	-20.5715***	-20.5381***	-20.7438***
	(3.4596)	(3.4673)	(3.4665)	(3.4674)
GVCposition×L. Export		-2.8238		
		(3.7820)		
GVCparticipation×L. Export		-1.0289		
		(2.4058)		
GVCposition×L. Import			2.0024	
			(4.1532)	
GVCparticipation×L. Import			0.2621	
			(1.6325)	
GVCposition×L. License				120.7169*
				(67.9952)
GVCparticipation×L. License				25.8752
				(31.7170)
Tariff	-0.8461***	-0.8467***	-0.8464***	-0.8463***
	(0.1437)	(0.1437)	(0.1437)	(0.1437)
L. Export	-0.0007	-0.0058	-0.0006	-0.0007
	(0.0147)	(0.0222)	(0.0147)	(0.0147)
L. Import	0.0039	0.0039	0.0047	0.0042
	(0.0102)	(0.0102)	(0.0119)	(0.0102)
L. License	-0.2970***	-0.2967***	-0.2962***	-0.3219*
	(0.1126)	(0.1126)	(0.1127)	(0.1696)
L. Foreign	0.0119	0.0119	0.0119	0.0121
	(0.0115)	(0.0115)	(0.0115)	(0.0115)
L. TFP	0.0041	0.0041	0.0041	0.0041
	(0.0033)	(0.0033)	(0.0033)	(0.0033)
Years	-0.0047	-0.0047	-0.0047	-0.0047
	(0.0037)	(0.0037)	(0.0037)	(0.0037)
Region-year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Average scale factor	0.9018	0.9018	0.9018	0.9018
Number of uncensored observations	39,473	39,473	39,473	39,473
Number of left-censored observations	2,658	2,658	2,658	2,658
Number of right-censored observations	7,145	7,145	7,145	7,145
Number of observations	49,276	49,276	49,276	49,276

Note: The coefficients are the marginal effects of the CRE Tobit estimation. ∗∗∗, ∗∗, and ∗ indicate significance at 1%, 5%, and 10% levels, respectively. Numbers in parentheses represent standard errors. L. indicates a one-year lagged variable. The plant-level time averages of all explanatory variables including region-year fixed effects and industry fixed effects are included.

Appendix B: Detailed definition of the variables used in the estimation of production function

Using the full panel dataset with 8,900 plants and 60,730 plant-year observations, we estimated the production function separately for each industry classified according to the Chilean input-output (I-O) table for 1996. As industries of codes 21, 23, and 25 in this classification do not have enough observations (189, 76, and 29, respectively), we aggregated codes 21 and 23 into code 22, and code 25 into code 20 in the production function estimation. Following Gandhi et al. (2020), we used the intermediate inputs (sum of the material inputs, energy, and services) as flexible inputs to proxy for unobserved productivity shocks. Table B1 reports the estimation results of each industry. Among the explanatory variables employed (log of labor, real capital stock, and real intermediate inputs), the log of real capital stock was described in Section 3. The dependent variable, the log of the real gross output was also described in Section 3. The details of the labor and intermediate inputs are described below.

Labor

Labor input is measured as the sum of the annual average number of skilled and unskilled workers. We described the definition of skilled and unskilled workers in Section 3.

Intermediate inputs

We defined intermediate inputs as the sum of material inputs, energy, and services (in thousands of pesos), and material inputs as the sum of domestic and imported material inputs. Following Murakami (2025), we calculated the industry-level prices of domestic material inputs p_{jt}^{D} as follows:

$$p_{jt}^{D} = \sum_{k} w_{jk}^{D} \, p_{kt}^{DO}, \tag{B-1}$$

where p_{kt}^{DO} is the domestic wholesale price index (originally, *índice de precios al por mayor*) [June 1992 = 1] of industry *k,*[1] and w_{jk}^{D} is the share of domestic inputs

[1] We sourced the data from INE (https://www.ine.gob.cl/estadisticas/economia/indices-de-precio-e-inflacion/indice-de-precios-al-por-mayor, accessed on June 23, 2023). The

purchased from industry k in the total domestic inputs of industry j.[2] The domestic input share was based on the domestic input coefficient matrix of the Chilean I-O table for 1996.[3]

Similarly, following Murakami (2025), we calculated the industry-level prices of imported material inputs as follows:

$$p_{jt}^{M} = (\sum_k w_{jk}^{M} p_{kt}^{MO}) * (1 + \tau_{jt}), \quad \text{(B-2)}$$

where p_{kt}^{MO} is the wholesale price index of imported products [June 1992 = 1] of industry k,[4] w_{jk}^{M} is the share of imported inputs purchased from industry k in the total imported inputs of industry j,[5] and τ_{jt} is input tariff rate of industry j. We calculated input tariff rate of industry j by

$$\tau_{jt} = \sum_k w_{jk}^{M} \tau_{kt}^{O}, \quad \text{(B-3)}$$

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classification of the wholesale price index corresponds to the classification of the Chilean I-O table for 1996. As the wholesale price index is available at a more disaggregated level, we constructed the wholesale price index of 47 tradable sectors of the total 73 sectors in the I-O table for 1996 using the cost share of disaggregated products among each industry as the weight.

[2] As the wholesale price index is available only for 47 tradable sectors, we limited the total domestic and imported inputs to these tradable sectors.

[3] We sourced the data from the Central Bank of Chile (https://si3.bcentral.cl/estadisticas/Principal1/Excel/CCNN/cdr/excel.html, accessed on June 21, 2023).

[4] We sourced the data from INE (https://www.ine.gob.cl/estadisticas/economia/indices-de-precio-e-inflacion/indice-de-precios-al-por-mayor, accessed on June 23, 2023).

[5] The imported input share was based on the imported input coefficient matrix of the Chilean I-O table for 1996, sourced from the Central Bank of Chile (https://si3.bcentral.cl/estadisticas/Principal1/Excel/CCNN/cdr/excel.html, accessed on June 21, 2023).

where τ_{kt}^{O} is the output tariff rate of industry k, measured by the applied tariff rates on final goods explained in Section 3.

Following Murakami (2025), the energy inputs were defined as the sum of the real net purchased value of electricity and combustibles. The deflator is the implicit price deflator of electricity, gas, and water sectors [1992 = 1].[6] Following Murakami (2025), service inputs were defined as the sum of the real expenditures on advertising and promotion, commission payments, communications, insurance, legal and technical consulting, licenses and foreign technical assistance, maintenance and repair payments, rental and leasing payments, transportation and storage, and other services. As explained in Section 3, payments to subcontracted workers (this category first appeared in the category of service expenditures in 1998) were also included in service inputs. The deflators for the service inputs were the implicit price deflators of the service sectors.[7]

[6] We sourced the data from the Statistical Yearbook of ECLAC (http://interwp.cepal.org/anuario_estadistico/anuario_2015/en/index.asp, accessed on February 8, 2018).

[7] We sourced the data from the Statistical Yearbook of ECLAC (http://interwp.cepal.org/anuario_estadistico/anuario_2015/en/index.asp, accessed on February 8, 2018).

Table B1. Estimation results of the production function based on Levinsohn and Petrin (2003).

	Dependent variable: log of gross output				
Code	11	12	13	14	15
Log of labor	0.1353***	0.1194***	0.1041***	0.1916***	0.1496***
	(0.0200)	(0.0175)	(0.0198)	(0.0694)	(0.0391)
Log of capital	0.1514***	0.0951***	0.0913**	-0.1549	0.0581
	(0.0482)	(0.0364)	(0.0462)	(0.1490)	(0.0452)
Log of intermediate inputs	0.6749***	0.7988***	0.8004***	0.7776***	0.8111***
	(0.0407)	(0.0338)	(0.0517)	(0.0860)	(0.0569)
Observations	1,495	1,775	1,149	406	750
	Dependent variable: log of gross output				
Code	16	17	18	19	20/25
Log of labor	0.0706**	-0.0537	0.2116***	0.1647*	0.2092***
	(0.0322)	(0.0419)	(0.0117)	(0.0870)	(0.0654)
Log of capital	0.0882**	0.0886*	0.0742***	0.0761	0.0828
	(0.0404)	(0.0505)	(0.0137)	(0.0651)	(0.0807)
Log of intermediate inputs	0.7644***	0.8877***	0.7134***	0.6836***	0.7570***
	(0.0650)	(0.0700)	(0.0167)	(0.0979)	(0.1317)
Observations	1,099	313	8,492	639	355
	Dependent variable: log of gross output				
Code	21/22/23	24	26	27	28
Log of labor	0.0515	0.0635	0.1977***	0.1780***	0.3420***
	(0.0443)	(0.1632)	(0.0195)	(0.0168)	(0.0458)
Log of capital	0.1708**	-0.0814	0.0492	0.0707**	-0.0130
	(0.0673)	(0.0871)	(0.0357)	(0.0319)	(0.0537)
Log of intermediate inputs	0.8087***	0.6707***	0.6541***	0.6764***	0.7692***
	(0.0663)	(0.0822)	(0.0363)	(0.0275)	(0.0594)
Observations	1,150	410	3,693	3,053	526
	Dependent variable: log of gross output				
Code	29	30	31	32	33
Log of labor	0.1781***	0.0858***	0.1659***	0.2198***	-0.0212
	(0.0266)	(0.0199)	(0.0353)	(0.0218)	(0.0587)
Log of capital	0.0527	0.0967***	0.0745	0.1203***	-0.0485
	(0.0336)	(0.0259)	(0.0582)	(0.0343)	(0.0766)
Log of intermediate inputs	0.7176***	0.7915***	0.6732***	0.6984***	0.9872***
	(0.0356)	(0.0286)	(0.0632)	(0.0389)	(0.0767)
Observations	1,400	4,085	1,267	3,135	251
	Dependent variable: log of gross output				
Code	34	35	36	37	38
Log of labor	0.1153*	0.0141	0.2163***	0.1358***	0.1683***
	(0.0660)	(0.0355)	(0.0354)	(0.0178)	(0.0599)
Log of capital	0.2090***	0.1298**	0.0332	0.0999***	0.1967**
	(0.0705)	(0.0574)	(0.0326)	(0.0328)	(0.0911)
Log of intermediate inputs	0.5910***	0.6945***	0.7146***	0.7106***	0.6233***
	(0.1075)	(0.0759)	(0.0536)	(0.0270)	(0.1162)
Observations	924	2,319	722	3,241	360
	Dependent variable: log of gross output				
Code	39	40	41	42	43
Log of labor	0.0143	0.0891	0.0636	0.2202***	0.2508***
	(0.0222)	(0.0604)	(0.0633)	(0.0112)	(0.0198)

Log of capital	0.0403	0.0436	0.2126*	0.0905***	0.0696**
	(0.0509)	(0.1237)	(0.1120)	(0.0238)	(0.0290)
Log of intermediate inputs	0.8212***	0.6590***	0.5105***	0.7277***	0.6098***
	(0.0302)	(0.1068)	(0.0895)	(0.0204)	(0.0261)
Observations	2,194	666	722	5,752	3,079
	Dependent variable: log of gross output				
Code	44	45	46	47	
Log of labor	0.1786***	0.1918***	0.1887***	0.2959***	
	(0.0383)	(0.0278)	(0.0209)	(0.0408)	
Log of capital	0.1639***	0.1082***	0.0679**	0.0918**	
	(0.0490)	(0.0395)	(0.0313)	(0.0450)	
Log of intermediate inputs	0.6470***	0.7243***	0.7642***	0.5952***	
	(0.0400)	(0.0358)	(0.0300)	(0.0519)	
Observations	1,394	1,421	1,662	831	

Note: The industry name of each code is presented in Table A1. The estimations were performed using the Stata command *prodest*. ∗∗∗, ∗∗, and ∗ indicate significance at 1%, 5%, and 10% levels, respectively. Numbers in parentheses represent bootstrapped standard errors (500 replications).

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