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**Effects of Upstream Positions in Global
Value Chains on Skilled Labor Wage Share
in Chile: Evidence from Plant-level
Panel Data**

Yoshimichi MURAKAMI

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Research Institute for Economics and Business Administration

Kobe University

2-1 Rokkodai, Nada, Kobe 657-8501 JAPAN

1 **Effects of upstream positions in global value chains on skilled labor**
2 **wage share in Chile: Evidence from plant-level panel data**

3 Yoshimichi Murakami^{a*}

4 ^a *Research Institute for Economics and Business Administration (RIEB), Kobe*
5 *University, Kobe, Japan*

6 Professor, Research Institute for Economics and Business Administration (RIEB), Kobe
7 University, 2-1, Rokkodai, Nada-ku, Kobe 657-8501, Japan. ORCID: 0000-0001-8385-
8 2871 Email: y-murakami@rieb.kobe-u.ac.jp

9 *corresponding author

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13 **Data availability statement**

14 The data that support the findings of this study are available upon request.

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17 **Conflict of interest disclosure**

18 There are no potential conflicts of interest to declare.

19

1 **Effects of upstream positions in global value chains on skilled labor**

2 **wage share in Chile: Evidence from plant-level panel data**

3 Although upstream positions in GVCs are expected to expand unskilled-intensive
4 activities and reduce wage inequality in developing countries, empirical studies
5 based on cross-country analysis have largely failed to provide evidence
6 supporting the theoretical prediction. Employing exogenous industry-level
7 variations and combining industry-level GVC indicators with plant-level detailed
8 panel data, this study empirically analyzes whether upstream positions in GVCs
9 are negatively associated with skilled labor wage share in Chile from 1995 to
10 2006. The results revealed that upstream positions in GVC were negatively
11 associated with skilled labor wage share, indicating that upstream activities are
12 related to unskilled- intensive tasks, as expected. Although the upstream positions
13 were positively associated with skilled labor wage share in highly technological-
14 intensive plants, the number of such plants was very limited. The findings were
15 robust to the exclusion of affiliates with changing their industry affiliations and
16 control for the persistent effect of the dependent variable and endogeneity of
17 plant-level variables. Additionally, we found that the negative effects of the
18 upstream positions in GVCs are primarily derived from plants operating in
19 industries that were initially located in downstream position and shifted towards
20 upstream position.

21 Keywords: Global value chains; Upstream positions; Wage inequality; Chile

22 Subject classification codes: D24; F14; F16; F66; J31

23 **1. Introduction**

24 Along with increased international fragmentation of production processes, an abundant
25 body of research has focused on the effects of global value chains (GVCs) position and
26 participation on wage inequality. The positions in GVCs are usually assessed by the
27 relative upstreamness, which is defined as the relative importance of a country-
28 industry's supply of intermediates used by other countries' exports (i.e., forward GVC

1 participation) to the use of imported intermediates for its own exports (i.e., backward
2 GVC participation; Koopman et al., 2010).

3 Upstream activities in developing countries tend to be dominated by low-value
4 added and less-skilled activities such as supply of primary inputs or basic
5 manufacturing materials (Ndubuisi & Owusu, 2021), whereas imported intermediate
6 goods from developed countries tend to complement skilled labor (Carpa & Martínez-
7 Zarzoso, 2022; Yasar & Rejesus, 2020). Thus, we expect that upstream positions in
8 GVCs are negatively associated with the relative demand for skilled workers and their
9 wage share, thereby decreasing wage inequality in developing countries. Notably,
10 Marjit et al. (2026) theoretically showed that forward GVC participation narrow wage
11 gap between skilled and unskilled workers in absence of urban informal sector, whereas
12 backward GVC participation widen it.¹ This is because the former leads to a contraction
13 of skill-intensive final goods-producing sector using imported intermediate goods and
14 an expansion of exportable intermediate goods-producing sector that intensively use
15 unskilled workers, whereas the latter has opposite effects on the two sectors. Therefore,
16 an increase in the relative importance of forward GVC participation is expected to
17 promote the expansion of unskilled-intensive activities existing at various production

¹ In their model, they examined the effects of the forward and backward GVC participation through an exogenous increase in the price of exportable intermediate goods and an exogenous decrease in the price of imported intermediate goods, respectively. In the case of incorporating informal sector, their model predicted that although the backward GVC participation widen wage gap, the effects of the forward GVC participation are ambiguous. The result was derived from that a part of unskilled workers displaced from informal sector is absorbed by low-wage agriculture sector.

1 stages across industries, in which developing countries possess comparative advantage,
2 thereby reducing wage inequality between skilled and unskilled workers.

3 However, empirical findings based on cross-country analysis are quite
4 inconclusive. Owusu (2025) found that both forward and backward GVC participation
5 has positive effects on labor productivity growth in developing countries with larger
6 effects of forward participation for the period 1995–2015, indicating that forward GVC
7 participation is associated with improved resource allocation and higher wages.
8 However, he did not provide direct evidence on the impacts of forward GVC
9 participation on wage inequality between skilled and unskilled workers. Carpa and
10 Martínez-Zarzoso (2022) found that although backward GVC participation expectedly
11 increased income inequality in developing countries for the period 1995–2016, forward
12 GVC participation had no significant effects. Other studies provide more direct
13 contradictory evidence; for example, Coveri et al. (2024) found that upstream positions
14 in GVCs were associated with higher income inequality in middle- and low-income
15 economies for the 2003–2015 period. Similarly, Cai et al. (2023) found that upstream
16 positions in GVCs were associated with higher wage gap between skilled and unskilled
17 workers in developing countries for the 1995–2009 period.² Therefore, we conclude that
18 empirical studies based on cross-country analysis have largely failed to provide
19 empirical evidence supporting the theoretical prediction of Marjit et al. (2026) in
20 developing or emerging countries.

21 This study aims to examine the effects of upstream positions in GVCs on skilled
22 labor wage share using plant-level panel data in Chile. In addition to filling the literature

² They additionally showed that upstream GVC positions decreased income inequality through increasing labor income share.

1 gap on developing countries, this study contributes to the literature by providing
2 empirical evidence based on micro data, specifically plant-level panel data. Given that
3 participation in GVCs is essentially a firm-level phenomenon, studies using plant- or
4 firm-level panel data on wage inequality between skilled and unskilled worker are
5 essential. In this respect, important studies are Chen (2017) and Wang et al. (2021),
6 both of which found that upstream positions in GVCs are associated with higher wage
7 gap between skilled and unskilled workers in China using firm-level panel data.
8 However, given that their firm-level data only provided wages by skill for the year
9 2004, they used the 25th quantile of the province-level average wage as the proxy for
10 unskilled wages for their panel-data analysis. This lack of direct measure on the
11 dependent variable likely reduced the reliability of their estimation results. Furthermore,
12 they utilized a measure developed by Antràs et al. (2012) on upstream positions in
13 GVCs based on the distance of an industry in a country to final demand, which, as
14 pointed out by Cai et al. (2023), only represents whether the country's industry is closer
15 to upstream or downstream and does not necessarily reflect its economic position in
16 GVCs. To avoid these shortcomings, the measure proposed by Koopman et al. (2010)
17 was deemed more appropriate for this study.

18 Chile is an interesting case for analyzing the impacts of GVC positions and
19 wage inequality. Chile is well-integrated and has upstream positions in GVCs compared
20 to other emerging economies such as Mexico (Montalbano et al., 2018; OECD, 2015).
21 Notably, Chile moved further upstream positions in GVCs as a country and in the
22 manufacturing sector from 1995 to 2017. This took place mainly from 1995 to 2006
23 (Figure 1) when strong demand from emerging economies, particularly China, further
24 strengthened the role of suppliers of primary products (Rosales & Kuwayama, 2012).
25 Moreover, although Chile has a similarly high level of income inequality as other Latin

1 American countries, it experienced a significant decline in wage inequality from 1996 to
2 2017 (Blundell et al., 2024). Therefore, the association between GVC participation and
3 wage inequality in this period, particularly from 1995 to 2006, is interesting topic for
4 research.

5 Several studies have analyzed the determinants of the share of skilled labor
6 wages in Chile using plant-level panel data. Pavcnik (2003) found that the use of
7 imported materials, foreign technical assistance, and patented technology was not
8 significantly associated with the share of skilled wages after controlling for plant-level
9 fixed effects for the period 1979–1986. Álvarez and López (2009) found that the real
10 depreciation of Chilean currency was associated with an increase in the share of skilled
11 wages through increasing export intensity of exporters for the period 1990–1999.
12 Similarly, Namini and López (2013) found that tariff rates levied on Chilean exports
13 were negatively associated with relative wage of skilled workers for the period 1990–
14 1999. However, the impacts of GVC position and participation are beyond scope of
15 these studies.

16 By employing exogenous industry-level variations in which plants operate, this
17 study aims to analyze whether upstream position and participation in GVCs are
18 negatively associated with skilled labor wage share in Chile. To this end, we combined
19 industry-level panel data, including the position and participation in GVCs sourced
20 from the UNCTAD-Eora Global Value Chain Database, with plant-level panel data
21 from the National Annual Manufacturing Survey (*Encuesta Nacional Industrial Anual*,
22 ENIA) for the period from 1995 to 2006. To the best of our knowledge, this study is the
23 first to analyze the effects of upstream positions in GVCs on skilled labor wage share in
24 Chile using detailed plant-level panel data.

1 The remainder of this paper is organized as follows. Section 2 presents the
 2 empirical model. Section 3 explains the data sources and definitions of the variables
 3 used in the empirical analysis and presents the descriptive statistics. Section 4 presents
 4 the estimation results and performs several robustness checks. The final section
 5 concludes the paper.

6 [Insert Figure 1 here]

7 **2. Empirical model**

8 Following Álvarez and López (2009), Pavcnik (2003), and Yasar and Rejesus (2020),
 9 we estimated the share of skilled labor wage to the total wage bill using a translog cost
 10 function with two-variable inputs (i.e., skilled and unskilled workers) and one quasi-
 11 fixed factor (i.e., capital stock).

12 Thus, we denote the variable cost function of a plant i operating in industry j at
 13 time t by $C_{ijt}(\mathbf{w}_{ijt}, k_{ijt}, y_{ijt}, \Omega_{jt})$, where \mathbf{w}_{ijt} is a vector of variable input prices, that is,
 14 the wages of two types of workers $n \in \{s, u\}$ (s and u index skilled and unskilled
 15 workers, respectively), k_{ijt} is the capital stock, y_{ijt} is the gross output, and
 16 Ω_{jt} represents time-variant industry characteristics such as GVC position and
 17 participation.

18 The second-order Taylor series approximation of the variable cost function in
 19 logarithmic form except for Ω_{jt} yields

$$\begin{aligned}
 20 \quad \ln C_{ijt} &= \alpha_0 + \sum_{n \in N} \beta_n \ln w_{ijt}^n + \alpha_k \ln k_{ijt} + \alpha_y \ln y_{ijt} + \alpha_\Omega \Omega_{jt} + \\
 21 \quad &\frac{1}{2} \sum_{n \in N} \sum_{m \in N} \beta_{nm} \ln w_{ijt}^n \ln w_{ijt}^m + \frac{1}{2} \alpha_{kk} (\ln k_{ijt})^2 + \frac{1}{2} \alpha_{yy} (\ln y_{ijt})^2 + \frac{1}{2} \alpha_{\Omega\Omega} (\Omega_{jt})^2 + \\
 22 \quad &\sum_{n \in N} \rho_{nk} \ln w_{ijt}^n \ln k_{ijt} + \sum_{n \in N} \rho_{ny} \ln w_{ijt}^n \ln y_{ijt} + \sum_{n \in N} \rho_{n\Omega} \ln w_{ijt}^n \Omega_{jt} + \\
 23 \quad &\alpha_{ky} \ln k_{ijt} \ln y_{ijt} + \alpha_{k\Omega} \ln k_{ijt} \Omega_{jt} + \alpha_{y\Omega} \ln y_{ijt} \Omega_{jt} .
 \end{aligned} \tag{1}$$

1 The symmetry implies $\beta_{nm} = \beta_{mn}$. Differentiating Equation (1) with respect to the
 2 skilled labor wage $\ln w_{ijt}^s$ yields

$$3 \quad \frac{\partial \ln C_{ijt}}{\partial \ln w_{ijt}^s} = \beta_s + \sum_{n \in N} \beta_{sn} \ln w_{ijt}^n + \rho_{sk} \ln k_{ijt} + \rho_{sy} \ln y_{ijt} + \rho_{s\Omega} \Omega_{jt} = \beta_s + \beta_{ss} \ln w_{ijt}^s +$$

$$4 \quad \beta_{su} \ln w_{ijt}^u + \rho_{sk} \ln k_{ijt} + \rho_{sy} \ln y_{ijt} + \rho_{s\Omega} \Omega_{jt} . \quad (2)$$

5 Assuming a competitive input market and applying the Shephard's lemma, $Share_{ijt}$,
 6 the cost share of skilled workers to the total variable costs, becomes

$$7 \quad Share_{ijt} = \frac{w_{ijt}^s L_{ijt}^s}{\sum_{n \in N} w_{ijt}^n L_{ijt}^n} = \frac{w_{ijt}^s \partial C_{ijt}}{C_{ijt} \partial w_{ijt}^s} = \frac{\partial \ln C_{ijt}}{\partial \ln w_{ijt}^s} ,$$

$$8 \quad (3)$$

9 where L_{ijt}^n is the labor inputs of type $n \in \{s, u\}$.

10 As well-behaved cost function must be homogeneous of degree one in input prices, we
 11 imposed the restrictions of $\beta_{ss} + \beta_{su} = 0$. Therefore, combining Equations (2) and (3),
 12 we obtain the cost share of skilled workers as

$$13 \quad Share_{ijt} = \beta_s + \beta_{ss} \ln \left(\frac{w_{ijt}^s}{w_{ijt}^u} \right) + \rho_{sk} \ln k_{ijt} + \rho_{sy} \ln y_{ijt} + \rho_{s\Omega} \Omega_{jt} . \quad (4)$$

14 As this relative wage is apparently endogenous, following Fontagné et al. (2023)
 15 and Taylor and Driffield (2005), we assumed that the variable can be captured by plant-
 16 level fixed effects, industry-level fixed effects, and time-varying regional fixed effects.
 17 Replacing Ω_{jt} with the vector of GVC indicators \mathbf{GVC}_{jt} ; introducing regional dimension
 18 l ; and adding a vector of other time-varying one-year lagged plant characteristics \mathbf{Z}_{ijt-1} ,
 19 time-varying regional fixed effects λ_{lt} , time-invariant industry fixed effects μ_j , time-
 20 invariant plant fixed effects θ_i , and the error term ε_{ijlt} , we obtain the following
 21 empirical specification:

$$22 \quad Share_{ijlt} = \alpha + \rho_{sk} \ln k_{ijlt} + \rho_{sy} \ln y_{ijlt} + \mathbf{GVC}'_{jt} \boldsymbol{\rho} + \mathbf{Z}'_{ijlt} \boldsymbol{\gamma} + \lambda_{lt} + \mu_j + \theta_i + \varepsilon_{ijlt} . (5)$$

1 Note that we included the time-varying regional fixed effects rather than region
2 and year fixed effects separately to control for time-varying region-level socioeconomic
3 characteristics, including the relative supply of skilled workers. Additionally, as 1,429
4 out of 7,567 plants in our used sample experienced changes in their industry affiliation
5 at least one-time, we included the industry fixed effects in addition to the plant fixed
6 effects.

7 **3. Data sources, variable definitions, and descriptive statistics**

8 **3-1. Data sources**

9 We used plant-level unbalanced panel data from 1995 to 2006 from the ENIA.³ The
10 survey has been conducted by the National Institute of Statistics (*Instituto Nacional de*
11 *Estadísticas*, INE) of Chile and covers all manufacturing plants with at least 10
12 employees and provides detailed plant-level detailed information on sales, employment,
13 wages, input material and service expenditures, and fixed assets.

14 The available plant-level panel data spanned the period 1995 to 2007. As the
15 identifier of each plant has been randomly assigned in each year since 2008, the ENIA
16 survey has lost panel data continuity since 2008 (INE, 2021). Additionally, as the ENIA
17 survey 2007 reported the industrial classification only in international standard
18 industrial classification (ISIC) Revision 3, the classification cannot be matched with the
19 classification of the GVC position index in the same manner as that of 2006 and earlier.
20 Consequently, we used plant-level panel data for 1995–2006.

³ We sourced the data from INE (<https://www.ine.gob.cl/estadisticas/economia/industria-manufacturera/estructura-de-la-industria>, accessed on July 9, 2023).

1 We calculated the industry-level GVC indicators using data from the UNCTAD-
2 Eora Global Value Chain Database.⁴ As the database preserves each country’s national
3 input-output (I-O) table in its native classification scheme (Casella et al., 2019), the
4 industry classification of the GVC indicators corresponds to the Chilean I-O table for
5 1996. Thus, following Murakami (2025), based on two correspondence tables of Central
6 Bank of Chile (2001) and Venegas Morales (1994), we converted the ISIC Revision 2
7 into the 1996 I-O table classification, which includes 37 manufacturing sectors (see
8 Table A1 in the Supplemental material). We applied this 1996 I-O table classification to
9 industry-level applied tariff rates and industry fixed effects.

10 **3-2. Variable definitions**

11 *Share of skilled workers to total wage bill: $Share_{ijlt}$*

12 The wages were defined as the sum of annual real wages and bonus (in thousands of
13 pesos, deflated by the national consumer price index [CPI], June 1992 = 1⁵). Skilled
14 workers consist of managers, specialized production workers, administrative workers,
15 and commissioned workers, whereas unskilled workers consist of workers who are
16 directly or indirectly involved in the production process and service workers.⁶ Note that

⁴ We sourced the data from the UNCTAD-Eora Global Value Chain Database
(<https://worldmrio.com/unctadgvc/>, accessed on January 17, 2022).

⁵ We sourced the data from the Central Bank of Chile (http://www.bcentral.cl/estadisticas-economicas/series-indicadores/index_p.htm, accessed on January 1, 2015).

⁶ The categories of skilled and unskilled workers correspond to “*empleados*” and “*obreros*” defined in the 1995–1999 survey. Although the two categories were disaggregated after 1999, we aggregated the subdivided categories into the original two categories.

1 we did not include owners in the category of skilled workers because the survey did not
2 report their wages before 2000. Following the categorization of the survey
3 questionnaire, skilled and unskilled workers were limited to those who have direct
4 contractual relationships with the plants or firms. Payments to subcontracted workers
5 without direct contractual relationships were included in service expenditures.

6 *Capital stock: k_{ijlt}*

7 The capital stock was defined as the product of total real capital stock (in thousands of
8 pesos) and capital price. Real capital stock was constructed for each of three types of
9 capital (buildings, machinery and equipment, and vehicles) using the perpetual
10 inventory method as follows:

$$11 \quad k_{ijlt} = (1 - \delta)k_{ijlt-1} + I_{ijlt}, \quad (6)$$

12 where k_{ijlt} is real capital stock (in thousands of pesos), δ is the depreciation rate, and
13 I_{ijlt} is real net investment (in thousands of pesos). We assigned the real value of fixed
14 assets in the entry year as the initial capital stock for each capital.⁷ Following Fernandes
15 and Paunov (2012), we assumed that the depreciation rates of 3.0%, 7.0%, and 11.9%
16 for buildings, machinery and equipment, and vehicles, respectively. Following
17 Murakami (2025), we used an implicit price deflator for the construction sector [June

⁷ For plants that disappeared in one year and reappeared a year or more later, we assigned the real value of fixed assets in the re-entry year as the real capital stock in that year and calculate the real capital stock for subsequent years using Equation (6).

1 1992 = 1] for buildings⁸ and the wholesale price indexes of the given type of capital
2 [June 1992 = 1] for machinery and equipment and vehicles, respectively.⁹ Furthermore,
3 following Murakami (2025), we winsorized the top 1% of the distribution of the
4 calculated real capital stock of each capital and replace the negative values of the real
5 capital stock with zero.

6 As for the capital price p_{ijlt}^K , following the formula of the user cost of capital
7 (Hall & Jorgenson, 1967), we defined it as follows:

$$8 \quad p_{ijlt}^k = p_{ijlt}^l (r_t + \delta_{ijlt}), \quad (7)$$

9 where p_{ijlt}^l and δ_{ijlt} are the plant-specific investment goods price deflator and
10 depreciation rate respectively, both of which were defined as the averages of the above-
11 defined deflators and depreciation rates for each type of capital, weighted by the real
12 capital stock of each capital; and r_t is the real interest rate defined as the lending interest
13 rate¹⁰ minus annual change of the CPI.

⁸ We sourced the data from CEPALSTAT of the Economic Commission for Latin America and the Caribbean (ECLAC; <https://statistics.cepal.org/portal/cepalstat/index.html?lang=es>, accessed on August 21, 2023).

⁹ 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).

¹⁰ We sourced the data from International Monetary Fund (IMF; <https://data.imf.org/>, accessed on August 27, 2023).

1 *Gross output: y_{ijt}*

2 The gross output is total real revenue adjusted for inventory change. We used an
3 industry output price deflator.¹¹

4 *GVC indicators: $GVCposition_{jt}$, $GVCparticipation_{jt}$*

5 Following Amendolagine et al. (2019) and Koopman et al. (2010), we defined the index
6 to measure the upstream positions in GVCs as follows:

7
$$GVCposition_{jt} = \ln(1 + DVX_{jt}) - \ln(1 + FVA_{jt}), \quad (8)$$

8 where $DVX_{jt} = \frac{\sum_{vf} VA_{ft}^{vj}}{GrossExports_t}$ is the sum of intermediate inputs supplied by the industry j

9 of Chile that are used as intermediate inputs by industry v of Chile's export partner
10 country f to produce the country's own exports to other countries, divided by

11 $GrossExports_t$, Chile's total exports; and $FVA_{jt} = \frac{\sum_{hg} VA_{gt}^{jh}}{GrossExports_t}$ is the sum of

12 intermediate inputs supplied by sector h of source country g that are used by industry j
13 of Chile for producing exports, divided by $GrossExports_t$.¹²

¹¹ We sourced the data from INE (<https://www.ine.gob.cl/estadisticas/economia/industria-manufacturera/estructura-de-la-industria>, accessed on June 9, 2023). Given that the output price deflator [1992 = 1] for this variable was available at the four-digit level of ISIC Revision 3, we used it in this study.

¹² Following Figure 2 of Casella et al. (2019: 123), we calculated DVX_{jt} in Equation (8) from the row sum excluding Chile of industry j in the "sector to country" table of the UNCTAD-Eora Global Value Chain Database, whereas we calculated FVA_{jt} from the column sum excluding Chile of industry j in the "country to sector" table of the database.

1 As it is possible that industries with identical GVC position index have different
2 degrees of participation in GVCs, following Amendolagine et al. (2019) and Koopman
3 et al. (2010), we also defined the following GVC participation index:

$$4 \text{ GVCparticipation}_{jt} = DVX_{jt} + FVA_{jt}. \quad (9)$$

5 Finally, we included industry-level applied tariff rates as an additional industry-
6 level control because Chile enacted regional trade agreements (RTAs) with its major
7 trading partners in the early 2000s, which also could affect plant-level skilled labor
8 wage share.¹³ Murakami (2021) indeed found that a reduction in applied tariffs leads to
9 an increase in industry-level skill premiums.

10 *Other plant characteristics:* Z_{ijlt-1}

11 In line with previous studies analyzing the determinants of plant-level skilled labor
12 wage share (e.g., Álvarez & López, 2009; Pavcnik, 2003; Yasar and Rejesus, 2020), we
13 included the following variables to control for time-variant plant-level characteristics:
14 share of export sales to total sales (*Export*), share of imported material inputs to the total
15 material inputs (*Import*), ratio of expenditures on licenses and foreign technical
16 assistance to total sales (*License*), share of foreign-owned capital to total capital
17 (*Foreign*), years of operation since the entry (*Years*),¹⁴ and total factor productivity

¹³ Following Murakami (2025), we sourced the data on applied tariff rates from Annex 4 of Becerra (2006, pp. 21–26) for the period for the period 2000–2005, while sourcing the data from the World Integrated Trade Solution (WITS; <https://wits.worldbank.org/>, accessed on July 18, 2023) for the period 1995–1999 and 2006.

¹⁴ Following Murakami (2025), we defined the entry as the first year in which a plant appears in the dataset. As we do not have data prior 1995, we set the year of entry for all plants started their operation prior to 1995 at 1995.

1 (TFP).¹⁵ Following Álvarez and López (2009), we used one-year lagged values of the
2 plant-level control variables except for the years of operation because these control
3 variables are likely to be simultaneously determined with the dependent variable.
4 Additionally, as the effects of GVC position and participation are likely to be
5 heterogeneous with different export, import, and technological intensity, we included
6 the interaction terms between the two GVC indexes and these three variables (*Export*,
7 *Import*, and *License*).

8 **3-3. Descriptive statistics**

9 The original panel dataset contains 10,674 distinct plants and 65,182 plant-year
10 observations for the period 1995–2006. For minimum data-cleaning, we excluded plants
11 with zero and negative values for real gross output and zero values for real capital stock,
12 total employment, labor cost, and material inputs. Additionally, we excluded plants that
13 appeared only for one year after applying the data-cleaning procedures. As a result, we
14 obtained the full panel dataset with 8,900 distinct plants and 60,730 plant-year
15 observations. As we used plant-level variables lagged by one year, we excluded
16 observations in entry and re-entry years. Additionally, we excluded plants that appeared
17 only for one year except for entry or re-entry year. Consequently, we obtained 7,567
18 distinct plants and 49,276 plant-year observations for our main estimation. Tables 1 and
19 2 present the descriptive statistics and correlation matrix of the variables used.

20 [Insert Tables 1 and 2 here]

¹⁵ We estimated Levinsohn–Petrin TFP (Levinsohn & Petrin, 2003). Appendix B in the Supplemental material provides the details of the estimation and Table B1 reports the estimation results of each industry.

1 (5) to control for the plant-level time-invariant unobserved heterogeneity.¹⁶ We then
2 estimated the pooled Tobit model with time averages using robust standard errors
3 clustered by plant, allowing serial correlation within each plant.

4 Alternatively, considering the time-invariant unobserved heterogeneity as
5 random effects, we can estimate Equation (5) using correlated random effects (CRE)
6 Tobit mode (Wooldridge, 2010; 2019), allowing the correlation between the random
7 effects and explanatory variables.¹⁷ However, the consistency of CRE Tobit model
8 requires the assumption that the time-varying error term ε_{ijlt} is serially independent
9 (Wooldridge, 2010). Given this strong assumption, we used the pooled Tobit model
10 with time averages as our main estimation. We also reported the estimation results using
11 the CRE Tobit model in Table A-5 in the Supplemental material, which are remarkably
12 similar to the baseline results of Table 3.

13 Note that the coefficients of Tobit models cannot be directly interpreted as the
14 magnitudes of the effects of the explanatory variables. Thus, following Wooldridge
15 (2010), we examined the marginal effects of the explanatory variables on the
16 conditional mean, as shown in Tables 3–5 and 7–8.¹⁸ While it is recommended that the

¹⁶ As for linear models, Mundlak (1978) showed that fixed effects model is equivalent to the pooled ordinary least squares (OLS) model with time averages of all explanatory variables in addition to the original explanatory variables.

¹⁷ In this case, the unobserved effect consists of time averages of all explanatory variables and random effects.

¹⁸ We calculated the marginal effects of the q -th explanatory variable of the vector \mathbf{Z} in Equation (5) as follows (note that \mathbf{Z} denotes the vector of all explanatory variables in the equation): $\frac{\partial E(\text{share}|\mathbf{Z})}{\partial z_q} = \Phi\left(\frac{\mathbf{Z}'\boldsymbol{\gamma}}{\sigma}\right)\gamma_q$, where Φ is the cumulative density function of the

1 number of time periods observed after year t are included when using unbalanced panel
2 data (Wooldridge, 2019), we already controlled for this variable by the years of
3 operation since the entry.¹⁹

4 Table 3 shows the baseline estimation results of Equation (5). The results show
5 that the GVC position index was negative and highly significant. The coefficient
6 reported in column 1 of Table 3 indicates that an increase in the index's two standard
7 deviations (0.0061; see Table 1) leads to a 0.0763 decrease in the share of skilled
8 workers' wages. Thus, the upstream positions in GVC are negatively associated with
9 skilled labor wage share, indicating that upstream activities in GVCs are related to
10 unskilled intensive tasks in Chile and supporting the theoretical prediction by Marjit et
11 al. (2026). We also found that the GVC participation index was negative and highly
12 significant.

13 Among plant-level characteristics, the licenses and foreign technical assistance
14 ratio was unexpectedly negative and significant. However, the interaction term between
15 the GVC position index and the license ratio was positive and significant. The marginal
16 coefficients of column (4) of Table 3 show that the GVC position index is positively
17 associated with skilled labor wage share in plants with more than threshold level of the

standard normal distribution, and σ is the standard deviation of the error term. Thus, the
estimated scale factor for given Z is $\Phi(\frac{Z'\hat{\gamma}}{\sigma})$.

¹⁹ As explained in footnote 14, the number of time periods observed after year t is equal to the
maximum number of years of operation since the entry minus of the number of years of
operation in year t .

1 license ratio (0.0972).²⁰ Note that the threshold level was substantially higher than the
2 average of the variable (0.0012; see Table 1); only 85 plant-year observations exceeded
3 this threshold level.²¹ In other words, upstream positions in GVCs are positively
4 associated with skilled labor wage share only in very limited number of highly
5 technological-intensive plants. As the interaction terms with other two variables (*Export*
6 and *Import*) were insignificant, we did not show the results in subsequent Tables 4–8.
7 Additionally, we found that the applied tariff rates were negative and highly significant,
8 which corresponds to the finding of Murakami (2021).

9 To reveal the mechanism underlying the negative effect of the GVC position
10 index, following Carpa and Martínez-Zarzoso (2022) and Ndubuisi and Owusu (2021),
11 we decomposed the index into their original two components of the backward GVC
12 participation (*DVX*) and forward GVC participation (*FVA*). In this estimation, we
13 checked whether the two-component variables yield the expected signs of the former
14 with negative and later with positive respectively, aligned with the theoretical prediction
15 by Marjit et al. (2026). Table 4 reports the estimation results. *DVX* was expectedly
16 negative and significant; although *FVA* was also negative, the coefficient of *DVX* was
17 expectedly larger than that of *FVA* in absolute values. Therefore, we conclude that the
18 forward GVC participation is the main mechanism underlying the negative effect of the
19 GVC position index: the supply of intermediate goods used by other countries' exports,

²⁰ The threshold level of skilled labor wage share was calculated by $13.0267/134.0543 = 0.0972$.

²¹ Approximately half of these plants' industrial affiliation is basic chemicals (code 34) or other chemicals (code 35).

1 time-variant shocks would affect both such changes and their skill intensity. To rule out
2 this possibility, we excluded 1429 distinct plants that changed their industry affiliations
3 at least one-time during the analysis period. Consequently, the number of plant-year
4 observations decreased from 49,276 to 38,856.

5 Table 5 reports the estimation results excluding plants with changing their
6 industry affiliations. We found that the negative effects of upstream positions in GVCs
7 and forward GVC participation on the skilled labor wage share were robust to the
8 exclusion of plants with changing their industry affiliations.

9 [Insert Table 5 here]

10 4-2-2. Two-step difference Generalized Method of Moments (GMM) estimation

11 It is possible that the skilled labor wage share has persistent effect, and the variable is
12 affected by past dependent variable. Moreover, although we address the endogeneity of
13 plant-level variables by using their lagged values, the exogeneity of lagged variables
14 relies on the absence of serial autocorrelations in time-variant unobservable variables
15 (Bellemare et al., 2017). Therefore, to account for the possible autocorrelation of the
16 dependent variable and endogeneity of plant-level variables, we used Arellano and
17 Bond's (1991) two-step difference GMM estimation.²³

18 In this estimation, we used the first difference of Equation (5) adding
19 $Share_{ijlt-1}$. Furthermore, the first difference of the lagged dependent variable and
20 lagged endogenous variables (*Export*, *Import*, *License*, *Foreign*, and *TFP*) are

²³ Although the difference GMM estimation also uses lags as the instruments, Bellemare et al.
(2017) showed that the bias is mitigated compared to the use of lagged explanatory
variables.

1 instrumented by all valid lags, under the assumption of the absence of second-order
2 serial correlation in the first-differenced error term. As we used all valid lags as the
3 instruments, we excluded plants that changed their industry affiliations at least one time
4 to avoid potential endogeneity of the lagged instruments. Additionally, given the need
5 for two-year lagged values for this estimation, observations one year after the entry and
6 re-entry were additionally excluded. Consequently, the number of observations was
7 reduced from 38,856 to 32,215.

8 Table 6 reports the estimation results.²⁴ The lagged dependent variable was
9 expectedly positive and significant. However, despite the inclusion of the lagged
10 dependent variable, the upstream position in GVCs and forward GVC participation
11 were still negative and significant, while their interaction terms with the license ratio
12 were positive and significant. Therefore, we conclude that our baseline estimation
13 results were robust to controlling for the persistent effect of the dependent variable and
14 endogeneity of plant-level variables.²⁵

15 [Insert Table 6 here]

16 ***4-3. Heterogeneity in initial GVC positions***

17 Finally, to further reveal the mechanism underlying the negative effects of the GVC

²⁴ Unfortunately, the null hypothesis of the Hansen test was rejected owing to large number of GMM-style instruments (330 for columns [1] and [3] and 440 for columns [2] and [4]).

²⁵ Similar to the baseline estimation results, the marginal coefficients of column (2) of Table 6 show that only 53 plant-year observations had an increase in the license ratio above the threshold level of the license ratio (0.0641) in which an increase in the GVC position index is associated with increasing skilled labor wage share.

1 activities and reduce wage inequality in developing countries (Marjit et al., 2026),
2 empirical studies based on cross-country analysis have largely failed to provide
3 evidence supporting the theoretical prediction. Employing exogenous industry-level
4 variations in which plants operate and combining industry-level GVC indicators with
5 plant-level detailed panel data, this study analyzed whether upstream positions in GVCs
6 are negatively associated with skilled labor wage share in Chile from 1995 to 2006.

7 We found that upstream positions in GVC were negatively associated with
8 skilled labor wage share, indicating that upstream activities are related to unskilled-
9 intensive tasks, as expected. Although the upstream positions were positively associated
10 with skilled labor wage share in highly technological-intensive plants mainly operation
11 in chemical industries, the number of such plants was very limited. We confirmed that
12 the findings were robust to the exclusion of affiliates with changing their industry
13 affiliations and control for the persistent effect of the dependent variable and
14 endogeneity of plant-level variables. Additionally, we found that the negative effects of
15 the upstream positions in GVCs are primarily derived from plants operating in
16 industries that were initially located in downstream position and shifted towards
17 upstream position. Therefore, we conclude that the exogenous increase in upstreamness
18 in GVCs derived from the commodity boom contributed to narrowing wage inequality
19 observed in this period in Chile. The findings support Álvarez et al. (2021), who found
20 that higher metal-mining product prices had positive effects on employment and wages
21 of unskilled workers in Chile using municipal-level data.

22 This study contributed to the literature by providing new empirical evidence on
23 the effects of upstream positions in GVCs on skilled labor wage share using plant-level
24 panel data. However, one limitation should be noted: this study constructed the GVC
25 indexes at industry-level. In the used panel dataset, we identified whether a plant

1 imported intermediate goods and exported its products; however, we did not identify
2 whether the exported products were intermediate goods or final goods nor whether the
3 exported intermediate goods were fully absorbed in importing countries or re-exported
4 to third markets. To construct such measures of plant-level GVC participation, plant-
5 level data on import and export transactions are needed (Antràs, 2020). Empirical
6 analysis based on the measures of firm- or plant-level GVC participation is at an infant
7 stage (Antràs, 2020) and is beyond the scope of this study. However, given that
8 participation in GVCs is essentially a firm-level phenomenon, it is an important subject
9 for future research.

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Tables

Table 1. Descriptive statistics of variables.

Variable	Observations	Mean	Standard deviation	Min	Max
Share	49,276	0.5029	0.3201	0.0000	1.0000
$\ln k$	49,276	11.4385	2.3301	0.3373	17.5427
$\ln y$	49,276	12.9055	1.7727	1.3846	20.9982
GVCposition	49,276	-0.0013	0.0030	-0.0146	0.0209
GVCparticipation	49,276	0.0043	0.0060	0.0001	0.0368
Tariff	49,276	0.0668	0.0367	0.0000	0.1123
L. Export	49,276	0.0661	0.2007	0.0000	1.0000
L. Import	49,276	0.0710	0.1822	0.0000	1.0000
L. License	49,276	0.0012	0.0174	0.0000	1.0000
L. Foreign	49,276	0.0454	0.1960	0.0000	1.0000
L. TFP	49,276	2.4545	0.8955	-9.7461	8.6637
Years	49,276	5.6762	2.9326	2.0000	12.0000

Source: Author's own calculations based on the data sources presented in Section 3. L. indicates a one-year lagged variable.

Table 2. Correlation matrix of variables.

	Share	ln <i>k</i>	ln <i>y</i>	GVC position	GVC participation	Tariff	L. Export	L. Import	L. License	L. Foreign	L. TFP	Years
Share	1.0000											
ln <i>k</i>	0.0906	1.0000										
ln <i>y</i>	0.1135	0.8022	1.0000									
GVCposition	0.0574	-0.2057	-0.2146	1.0000								
GVCparticipation	0.0069	0.2318	0.2649	-0.6481	1.0000							
Tariff	-0.1376	-0.0226	-0.0467	0.0272	-0.1214	1.0000						
L. Export	0.0044	0.3487	0.3701	-0.4231	0.2852	-0.024	1.0000					
L. Import	0.0694	0.2776	0.3007	0.042	0.011	0.0253	0.0507	1.0000				
L. License	0.0036	0.0388	0.0355	0.0004	0.0139	-0.012	0.0088	0.0279	1.0000			
L. Foreign	0.0990	0.2346	0.2695	-0.0786	0.1477	-0.024	0.1825	0.1753	0.0447	1.0000		
L. TFP	0.1193	0.1014	0.2198	0.0168	0.0246	-0.0192	-0.0556	0.1553	-0.0148	0.0716	1.0000	
Years	0.0453	0.0915	0.064	0.0168	0.0137	-0.655	0.0044	0.0205	0.0139	0.0038	0.0183	1.0000

Source: Author's own calculations based on the data sources presented in Section 3. L. indicates a one-year lagged variable.

Table 3. Baseline estimation results of Equation (5).

	Dependent variable: Share of skilled workers to total wage			
	(1)	(2)	(3)	(4)
<i>lnk</i>	-0.0072* (0.0040)	-0.0071* (0.0040)	-0.0072* (0.0040)	-0.0072* (0.0040)
<i>lny</i>	-0.0113** (0.0049)	-0.0113** (0.0049)	-0.0113** (0.0049)	-0.0112** (0.0049)
GVCposition	-12.5739*** (4.7561)	-12.2841** (4.7836)	-12.6851*** (4.7669)	-13.0267*** (4.7568)
GVCparticipation	-21.1170*** (4.3179)	-21.1967*** (4.3233)	-21.1165*** (4.3139)	-21.4351*** (4.3105)
GVCposition×L. Export		-3.0287 (3.9247)		
GVCparticipation×L. Export		-1.2642 (2.3628)		
GVCposition×L. Import			1.9742 (3.3326)	
GVCparticipation×L. Import			0.4125 (1.4506)	
GVCposition×L. License				134.0543*** (48.1142)
GVCparticipation×L. License				27.6917 (23.7724)
Tariff	-0.8357*** (0.1816)	-0.8358*** (0.1816)	-0.8353*** (0.1816)	-0.8360*** (0.1816)
L. Export	-0.0016 (0.0166)	-0.0054 (0.0268)	-0.0016 (0.0166)	-0.0018 (0.0166)
L. Import	0.0045 (0.0114)	0.0045 (0.0114)	0.0045 (0.0133)	0.0048 (0.0114)
L. License	-0.3120*** (0.1131)	-0.3119*** (0.1135)	-0.3110*** (0.1131)	-0.3324* (0.1771)
L. Foreign	0.0137 (0.0124)	0.0137 (0.0124)	0.0138 (0.0124)	0.0139 (0.0124)
L. TFP	0.0042 (0.0039)	0.0042 (0.0039)	0.0042 (0.0039)	0.0042 (0.0039)
Years	-0.0053 (0.0068)	-0.0053 (0.0068)	-0.0053 (0.0068)	-0.0053 (0.0068)
Region-year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Average scale factor	0.9113	0.9113	0.9113	0.9113
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 Tobit estimation presented in footnote 18. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. Numbers in parentheses represent robust standard errors clustered by plant. 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.

Table 4. Estimation results of Equation (5) decomposing the global value chain (GVC) position index.

	Dependent variable: Share of skilled workers to total wage	
	(1)	(2)
<i>lnk</i>	-0.0072* (0.0040)	-0.0072* (0.0040)
<i>lny</i>	-0.0113** (0.0049)	-0.0112** (0.0049)
DVX	-33.5507*** (7.8652)	-34.3190*** (7.8571)
FVA	-8.7023** (4.4255)	-8.5708* (4.4275)
DVX×L. License		160.7084** (63.6255)
FVA×L. License		-105.0042*** (40.5632)
Tariff	-0.8352*** (0.1816)	-0.8355*** (0.1816)
L. Export	-0.0016 (0.0166)	-0.0018 (0.0166)
L. Import	0.0045 (0.0114)	0.0048 (0.0114)
L. License	-0.3120*** (0.1131)	-0.3336* (0.1773)
L. Foreign	0.0138 (0.0124)	0.0139 (0.0124)
L. TFP	0.0042 (0.0039)	0.0042 (0.0039)
Years	-0.0053 (0.0068)	-0.0053 (0.0068)
Region-year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Average scale factor	0.9113	0.9113
Number of uncensored observations	39,473	39,473
Number of left-censored observations	2,658	2,658
Number of right-censored observations	7,145	7,145
Number of observations	49,276	49,276

Note: The coefficients are the marginal effects of the Tobit estimation presented in footnote 18. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. Numbers in parentheses represent robust standard errors clustered by plant. 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.

Table 5. Estimation results of Equation (5) excluding plants with changing their industry affiliations.

	Dependent variable: Share of skilled workers to total wage			
	(1)	(2)	(3)	(4)
<i>lnk</i>	-0.0079*	-0.0080*	-0.0079*	-0.0080*
	(0.0046)	(0.0046)	(0.0046)	(0.0046)
<i>lny</i>	-0.0093	-0.0093	-0.0093	-0.0093
	(0.0060)	(0.0060)	(0.0060)	(0.0060)
GVCposition	-16.5908***	-16.7219***		
	(6.0577)	(6.0616)		
GVCparticipation	-25.8711***	-25.9634***		
	(5.6378)	(5.6393)		
GVCposition×L. License		98.4668		
		(77.8910)		
GVCparticipation×L. License		17.0167		
		(39.8001)		
DVX			-42.2989***	-42.5203***
			(10.3615)	(10.3668)
FVA			-9.4812*	-9.4429*
			(5.3020)	(5.3040)
DVX×L. License				115.1097
				(112.3353)
FVA×L. License				-80.7254
				(50.3486)
Tariff	-0.8239***	-0.8228***	-0.8234***	-0.8223***
	(0.2018)	(0.2018)	(0.2018)	(0.2018)
L. Export	-0.0212	-0.0210	-0.0212	-0.0210
	(0.0188)	(0.0188)	(0.0188)	(0.0188)
L. Import	0.0092	0.0094	0.0092	0.0094
	(0.0134)	(0.0134)	(0.0134)	(0.0134)
L. License	-0.2591**	-0.2674	-0.2591**	-0.2683
	(0.1020)	(0.2229)	(0.1020)	(0.2234)
L. Foreign	0.0110	0.0112	0.0110	0.0112
	(0.0144)	(0.0144)	(0.0144)	(0.0144)
L. TFP	-0.0012	-0.0012	-0.0012	-0.0012
	(0.0065)	(0.0065)	(0.0065)	(0.0065)
Years	-0.0066	-0.0066	-0.0066	-0.0066
	(0.0080)	(0.0080)	(0.0080)	(0.0080)
Region-year fixed effects	Yes	Yes	Yes	Yes
Average scale factor	0.9073	0.9073	0.9073	0.9073
Number of uncensored observations	30,950	30,950	30,950	30,950
Number of left-censored observations	2,217	2,217	2,217	2,217
Number of right-censored observations	5,689	5,689	5,689	5,689
Number of observations	38,856	38,856	38,856	38,856

Note: The coefficients are the marginal effects of the Tobit estimation presented in footnote 18. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. Numbers in parentheses represent robust standard errors clustered by plant. L. indicates a one-year lagged variable. The plant-level time averages of all explanatory variables including region-year fixed are included.

Table 6. Estimation results of Equation (5) using two-step difference Generalized

Method of Moments (GMM) estimation.

	Dependent variable: Share of skilled workers to total wage			
	(1)	(2)	(3)	(4)
L. Share	0.4372*** (0.0188)	0.4376*** (0.0180)	0.4372*** (0.0188)	0.4376*** (0.0180)
ln <i>k</i>	0.0024 (0.0049)	0.0017 (0.0050)	0.0024 (0.0049)	0.0017 (0.0050)
ln <i>y</i>	-0.0114** (0.0055)	-0.0102* (0.0056)	-0.0114** (0.0055)	-0.0103* (0.0056)
GVCposition	-11.8153** (5.0214)	-11.4004** (5.1234)		
GVCparticipation	-9.5075** (4.5049)	-10.2333** (4.5316)		
GVCposition×L. License		177.8242** (74.7678)		
GVCparticipation×L. License		61.4553** (30.3537)		
DVX			-21.3665*** (8.2878)	-21.5969** (8.4621)
FVA			2.2000 (4.5719)	1.0560 (4.5375)
DVX×L. License				238.3797** (98.6471)
FVA×L. License				-115.1168** (56.0621)
Tariff	-0.5438*** (0.1989)	-0.3308* (0.1983)	-0.5441*** (0.1989)	-0.3305* (0.1982)
L. Export	0.0701* (0.0388)	0.0797** (0.0370)	0.0700* (0.0388)	0.0796** (0.0370)
L. Import	0.0389** (0.0153)	0.0392** (0.0159)	0.0389** (0.0153)	0.0392** (0.0159)
L. License	-0.0784 (0.0745)	-0.2266 (0.1432)	-0.0784 (0.0745)	-0.2276 (0.1432)
L. Foreign	0.0434** (0.0221)	0.0358 (0.0228)	0.0433* (0.0221)	0.0357 (0.0228)
L. TFP	0.0413*** (0.0146)	0.0517*** (0.0142)	0.0413*** (0.0146)	0.0516*** (0.0142)
Region-year fixed effects	Yes	Yes	Yes	Yes
Number of observations	32,215	32,215	32,215	32,215
AR (2) <i>p</i> -value	0.0180	0.0170	0.0180	0.0170
Hansen <i>p</i> -value	0.0000	0.0000	0.0000	0.0000

Note: ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. Numbers in parentheses represent robust standard errors. L. indicates a one-year lagged variable. AR (2) shows the Arellano-Bond test for the second-order serial correlation in the first-differenced error term.

Table 7. Estimation results of Equation (5) for plants operating in initially upstream and downstream industries.

	Dependent variable: Share of skilled workers to total wage			
	Initially upstream		Initially downstream	
	(1)	(2)	(3)	(4)
<i>lnk</i>	-0.0233** (0.0094)	-0.0233** (0.0094)	-0.0038 (0.0044)	-0.0038 (0.0044)
<i>lny</i>	0.0032 (0.0146)	0.0032 (0.0147)	-0.0138*** (0.0051)	-0.0138*** (0.0051)
GVCposition	-6.2130 (14.7113)	-6.5766 (14.7360)	-30.4929*** (7.3994)	-30.7529*** (7.4026)
GVCparticipation	9.6232 (14.7495)	9.3616 (14.7378)	-40.4513*** (6.5936)	-40.5988*** (6.5948)
GVCposition×L. License		41.0480 (40.0319)		153.3540** (68.5263)
GVCparticipation×L. License		44.4008* (24.5906)		19.1945 (33.6982)
Tariff	-0.8798* (0.4564)	-0.8776* (0.4565)	-1.1947*** (0.2096)	-1.1935*** (0.2096)
L. Export	-0.1603*** (0.0610)	-0.1601*** (0.0610)	0.0119 (0.0174)	0.0117 (0.0173)
L. Import	0.0012 (0.0329)	0.0034 (0.0330)	0.0047 (0.0121)	0.0049 (0.0121)
L. License	-0.1406 (0.5227)	-0.3423 (0.6132)	-0.3132*** (0.1129)	-0.2737 (0.1992)
L. Foreign	0.0406 (0.0368)	0.0404 (0.0368)	0.0091 (0.0129)	0.0095 (0.0129)
L. TFP	0.0105 (0.0096)	0.0104 (0.0096)	0.0035 (0.0043)	0.0034 (0.0043)
Years	-0.0133 (0.0198)	-0.0134 (0.0198)	-0.0049 (0.0072)	-0.0049 (0.0072)
Region-year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Average scale factor	0.9400	0.9400	0.9063	0.9064
Number of uncensored observations	5,766	5,769	33,707	33,707
Number of left-censored observations	251	251	2,407	2,407
Number of right-censored observations	1,411	1,411	5,734	5,734
Number of observations	7,428	7,428	41,848	41,848

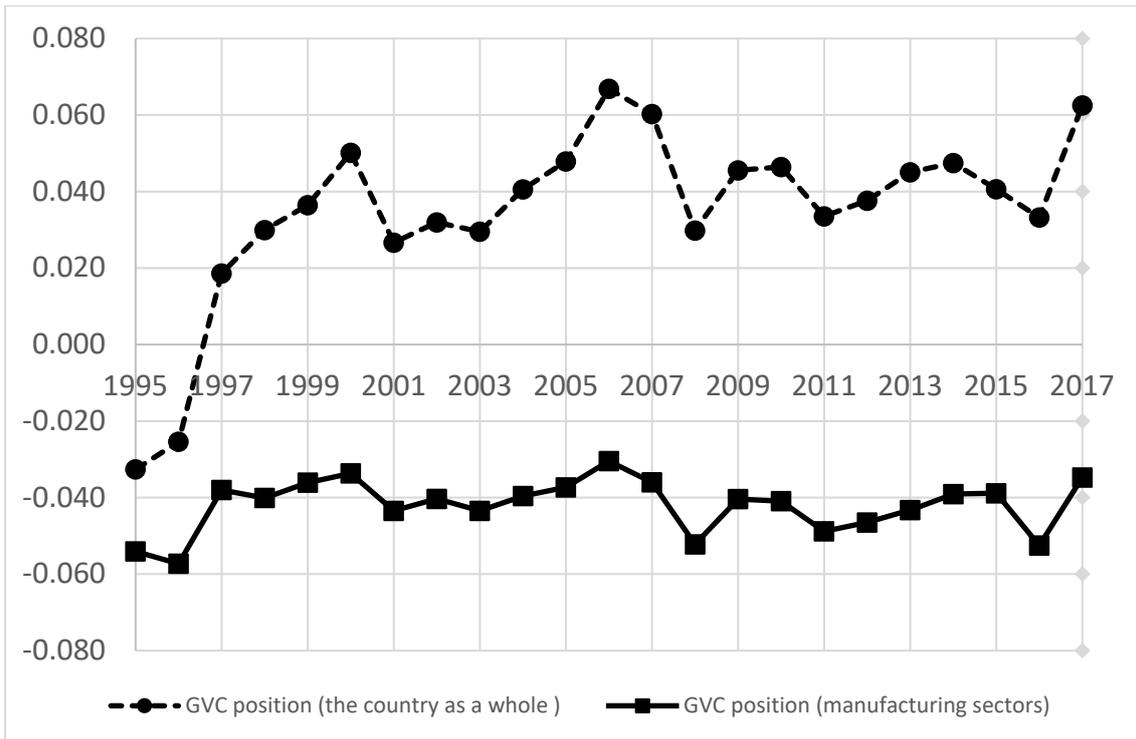
Note: The coefficients are the marginal effects of the Tobit estimation presented in footnote 18. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. Numbers in parentheses represent robust standard errors clustered by plant. L. indicates a one-year lagged variable. The plant-level time averages of all explanatory variables including region-year fixed effects and industry fixed effects are included.

Table 8. Estimation results of Equation (5) for plants whose global value chain (GVC) position index decreased and plants whose GVC position index increased.

	Dependent variable: Share of skilled workers to total wage			
	Decrease		Increase	
	(1)	(2)	(3)	(4)
<i>lnk</i>	0.0001 (0.0081)	0.0001 (0.0081)	-0.0093** (0.0046)	-0.0093** (0.0046)
<i>lny</i>	-0.0139* (0.0077)	-0.0139* (0.0077)	-0.0106* (0.0060)	-0.0105* (0.0060)
GVCposition	-3.8934 (8.9869)	-4.7696 (9.0971)	-20.1729*** (6.0188)	-20.2360*** (6.0207)
GVCparticipation	-10.0052 (9.2748)	-10.7740 (9.3136)	-25.1166*** (5.2474)	-25.1436*** (5.2552)
GVCposition×L. License		72.5390 (61.3582)		117.6486 (87.4449)
GVCparticipation×L. License		42.2851* (22.4541)		-11.1107 (52.6092)
Tariff	-0.9834*** (0.3532)	-0.9869*** (0.3535)	-0.6495*** (0.2122)	-0.6488*** (0.2122)
L. Export	-0.0108 (0.0326)	-0.0111 (0.0328)	-0.0074 (0.0194)	-0.0073 (0.0194)
L. Import	-0.0307 (0.0234)	-0.0294 (0.0234)	0.0115 (0.0130)	0.0117 (0.0130)
L. License	-0.9636* (0.5298)	-1.1366* (0.6433)	-0.2451** (0.1084)	-0.1250 (0.2722)
L. Foreign	-0.0036 (0.0214)	-0.0039 (0.0214)	0.0214 (0.0149)	0.0218 (0.0148)
L. TFP	0.0019 (0.0071)	0.0019 (0.0071)	0.0057 (0.0048)	0.0056 (0.0048)
Years	0.0150 (0.0164)	0.0149 (0.0164)	-0.0096 (0.0075)	-0.0096 (0.0075)
Region-year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Average scale factor	0.9141	0.9141	0.9106	0.9106
Number of uncensored observations	9,735	9,735	29,738	29,738
Number of left-censored observations	573	573	2,085	2,085
Number of right-censored observations	1,600	1,600	5,545	5,545
Number of observations	11,908	11,908	37,368	37,368

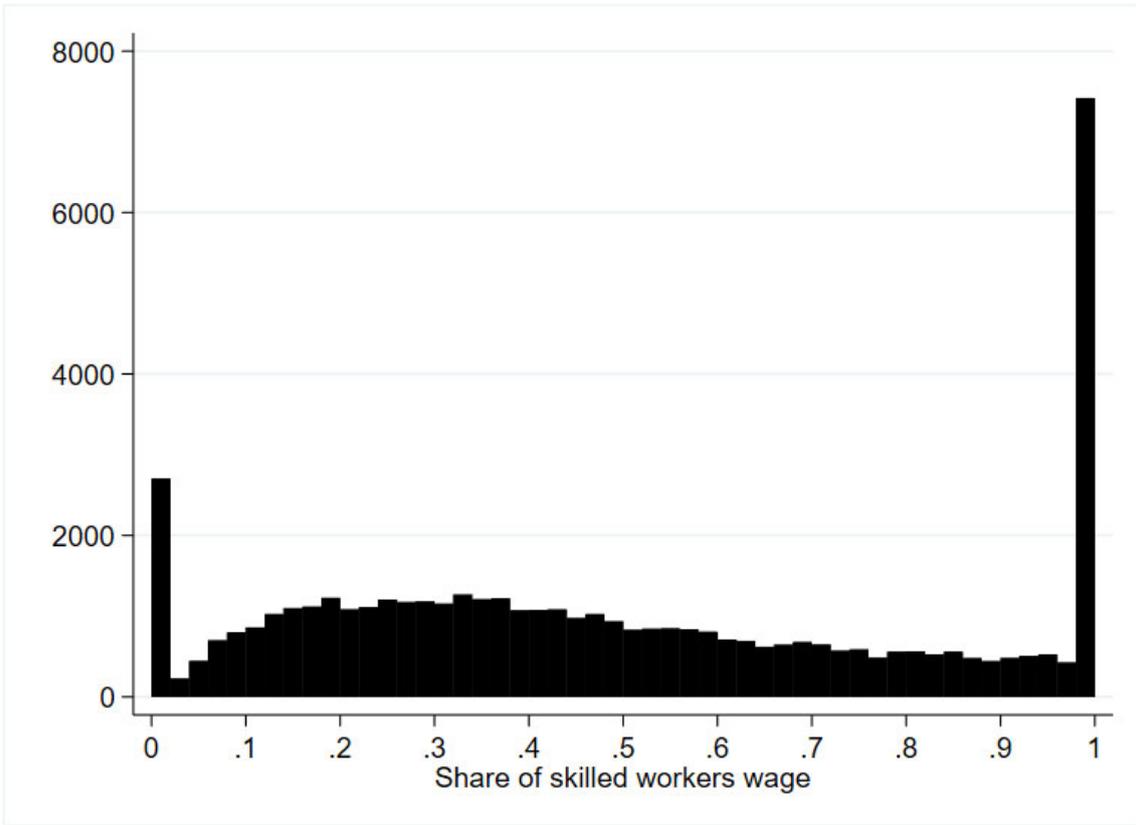
Note: The coefficients are the marginal effects of the Tobit estimation presented in footnote 18. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. Numbers in parentheses represent robust standard errors clustered by plant. L. indicates a one-year lagged variable. The plant-level time averages of all explanatory variables including region-year fixed effects and industry fixed effects are included.

Figure



Source: Author's own calculations based on the data from UNCTAD-Eora Global Value Chain Database. Note: "The country as a whole" includes 73 sectors of the classification of the Chilean I-O table for 1996, while "Manufacturing sectors" includes sectors from 11 to 47 (see Table A1) of the classification. The GVC position index is defined by Equation (8).

Figure 1. Evolution of global value chain (GVC) position in Chile from 1995 to 2017.



Source: Author's own calculations based on the data from the National Annual Manufacturing Survey.

Figure 2. Distribution of the share of skilled workers to total wage bill.