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Dimensions of surplus value in construction: contributions to labor Economics from the real estate sector

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ABSTRACT

This manuscript investigates the real estate sector in Santiago, Chile, examining how the distribution of value in residential construction projects reflects and reinforces labour market inequalities. Utilizing the Marx Ratio, the study measures the surplus value extracted from workers, providing a quantitative framework to explore the dynamics of value extraction and its effects on workers across twenty-eight projects. By analysing these patterns, the research offers insights into broader economic and social disparities within urban economic frameworks. The findings contribute to understanding the complex interactions between capital and labour and suggest pathways towards more equitable distribution mechanisms. Additionally, the study highlights how real estate investment and labour practices perpetuate or could potentially alleviate urban inequalities.

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Introduction

The construction industry plays a pivotal role in driving economic development in the Global South, serving as a catalyst for infrastructure growth, job creation, and urbanization. Its impact extends beyond physical structures, fostering social mobility and enabling the provision of essential services, thereby laying the foundation for sustainable development. Literature emphasizes its importance in delivering the UN Sustainable Development Goals (SDGs), with significant impacts on 10 key SDGs, including sustainable cities, climate action, and infrastructure (Fei et al., 2021; Ofori, 2023). The industry contributes to wealth generation in low-to-middle-income countries, though its relationship with economic growth is complex. As developing countries reach an advanced stage of economic development, construction output tends to decrease relatively but not absolutely (Lopes & Banaitienè, 2024). Recent global events, such as the COVID-19 pandemic, have underscored the importance of future-proofing the industry through improved health and safety measures and virtual working environments (Ogunnusi et al., 2021). This study aims to create a useful, simple, and replicable tool to enhance negotiation capabilities between workers and capitalists, focusing on the actual value generated by labor in relation to wages. These reflections are therefore framed within an empirical perspective of Marx's labor theory of value, utilizing what is known as the Marx Ratio,

with Chile's construction industry – specifically in its primary city, Santiago – as a case study.

Marx's concept of surplus value, a fundamental element of his critique of capitalism, underscores the disparity between the value produced by labour and the wages workers receive (Marx, 1994, 2000). This surplus value, or excess value, is appropriated by capitalists, thereby reinforcing their economic power and perpetuating systemic exploitation within capitalist structures (Althusser et al., 2015). While some critics contend that surplus value represents not just expropriated wealth but also a necessary return on investment essential for sustaining business operations and compensating workers, Marx anticipated that the rate of surplus value would increase over time, driven by rising labour productivity (Moseley, 1985; Onuoha & Gwunireama, 2022). This dynamic, according to Marx, intensifies the exploitation inherent in capitalist systems and is intimately connected to his labour theory of value and the distinction between productive and unproductive labour (Dussel in Musto, 2008).

Lacan, extending Marx's analysis through a psychoanalytic lens, interpreted surplus value as symptomatic of capitalism's inherent contradictions, which are manifested in the subjective experiences of desire and lack (Vighi, 2016).

Empirical investigations into the manifestation of surplus value within capitalist economies have utilized diverse methodologies and datasets. For instance, studies have explored the relationship between surplus value and capital distribution across industries (Johnson, 2021), as well as the connection between the rate of surplus value and capital composition in international trade (Martínez & Baeza, 2023). Additionally, the impact of work time regulations on surplus value has been examined within European contexts (Philp & Wheatley, 2013), while long-term trends in the rate of surplus value have been assessed for the U.S. economy (Moseley, 1986) and Greece (Maniatis, 2005), generally corroborating Marx's predictions. Furthermore, neoclassical approaches have also been employed to measure labour's surplus value, offering alternative perspectives on the relationship between value and price rates of profit (Flaschel et al., 2013; James, 2016). Lastly, Marx's distinctions between absolute and relative surplus-value have been related to factors such as labour duration, intensity, and productivity (Mavroudeas & Ioannides, 2011), which are particularly relevant when analysing the construction industry's labour dynamics.

In the Marxist critique of the political economy of real estate development, the relationship between capital, labour, and capitalists is central (Lefebvre, 1972a, 1972b). Marx and Engels establish the fundamental concept of the capitalist system, where the bourgeoisie (the capitalists) owns the means of production, and the proletariat (the labour) sells its labor power. This relationship exemplifies exploitation, as capitalists not only extract surplus value by minimizing labor costs but also by controlling the spatial output of labor, which is often limited in quality to maximize profits (Elden, 2004; Lefebvre, 1991; Merrifield, 2002). In doing so, workers experience alienation, becoming disconnected from the buildings they construct (Francese, 2013; Kipfer, 2002; Winkler, 2020), as they are not intended for the workers' use or benefit but rather serve as commodified assets, reinforcing class divisions and reducing the worker's creative agency in the built environment (Elden, 2004; Lefebvre, 1991; Merrifield, 2002). Thus, real estate capital is able to contribute to a hegemonic condition (Francese, 2013; Kipfer, 2002; Winkler, 2020) constituted in the cultural landscape of cities. The built environment

becomes a visual representation of capitalist priorities, where the skyline reflects economic power and exclusivity (Sudjic, 2006). This urban landscape prioritizes individual ownership and profit-driven construction over collective or inclusive spaces, reinforcing the alienation of workers who contribute to, but are excluded from, these structures. In the case of Chile, the institutional design of the nation causes the market to predominate absolutely in city production, with a merely subsidiary state in favour of the commercial (Dattwyler et al., 2022; Hidalgo Dattwyler et al., 2016; Inzulza-Contardo & Gatica-Araya, 2019). Indeed, the scenario is created in which without the active participation of private real estate developers, new housing would not exist. Although various studies have examined the relationship between workers and corporate profits, empirical contributions on this relationship within the construction industry are virtually non-existent, and in the case of Chile, they are entirely absent. Filling this gap in the literature is crucial, as Chile is currently facing a housing access crisis, with both the state and private companies urgently seeking to drastically increase annual housing production. In this rush, little attention has been given to the role of construction workers and how they might benefit from this process, considering the potential for this boom to improve their well-being. In order to address this concern, this study provides an empirical application of the Marx ratio indicator.

The Marx Ratio is defined as a contemporary metric inspired by Marx's theory of surplus value, designed to estimate the surplus value captured by capitalists. Calculated as the difference between company profits and worker compensation costs, it attempts to reveal how much value, produced by workers, is appropriated by owners rather than returned to labor. This mirrors Marx's rate of surplus value, which measures the ratio of surplus value (generated through productive economic activities) to the wages of workers, highlighting the degree of exploitation by showing the proportion of value extracted relative to labor compensation. The Marx Ratio offers a modernized approach to understanding capital-labor dynamics, especially in industries like real estate, where the alignment of investment returns with labor costs can be pronounced.

By quantifying surplus value at a firm or project level, it allows analysts to see how much labor value is converted into profit, enhancing the understanding of structural inequalities in profit distribution. For Marxist analysis, both the Marx Ratio and the traditional rate of surplus value provide insights into the conditions of worker exploitation and capital accumulation, emphasizing the persistent disparity between labor's contribution to production and the rewards workers receive. This metric, though simplified, strengthens the empirical base for examining capitalism's inherent inequalities. In May 2018, New York Times columnist Neil Irwin introduced an empirical approach to the 'Marx Ratio' (Irwin, 2018). On his version, the ratio was calculated using a dataset on average worker income in U.S. companies (made available due to the Dodd-Frank financial reform), representing the difference between company profits and worker compensation costs, thus indicating the surplus value accrued by capitalists. It aims to apply Marx's theory to highlight the inherent tension between labour and capital. Irwin acknowledges the limitations of his study, including the exclusion of costs related to company maintenance, asset acquisition, non-labour production expenses, and capital depreciation. Additionally, it doesn't account for payments to creditors. These factors restrict the ratio's applicability for large-scale company assessments but may enable more nuanced analysis when

comprehensive cost, expense, and compensation data is available. The Marx ratio might be particularly suitable for evaluating specific ventures or investments rather than entire corporations. David Ruccio notes that Irwin's model closely mirrors Marx's rate of exploitation, with adjustments for data availability (Ruccio, 2018). Although distinct, both models contribute to the discourse on the relationship between companies and their workers, and between capital and labour value. Matt Bruenig suggests that this approach could be especially valuable for analysing real estate companies, as their investment and return structures align well with Irwin's methodology (Bruenig, 2018).

The research aims to empirically examine the gap between the value produced by construction workers and their wages by operationalising Marx's concept of surplus value. The core objective is to apply the 'Marx ratio', a metric quantifying the surplus value appropriated by companies, to real estate projects in Santiago, Chile. This application seeks to reveal the extent to which companies profit from their workers' labour and to assess the implications for workers' well-being and the development of equitable policies. The findings of this microeconomic analysis could inform discussions on fiscal policies and regulatory frameworks designed to address inequality and ensure a fairer distribution of benefits within the construction industry and the broader housing market. The availability of detailed data for each project allows for more precise estimates of surplus value using Irwin's approach, which is typically applied at a national level. The results of this microeconomic analysis tend to generate an effective profit rate for real estate projects, which can be useful for setting fiscal tariff rates aimed at providing funds for strategies to reduce inequality. The practical use of this application of the Marx Ratio can be especially valuable for local governments seeking to review the regulatory frameworks of real estate and construction projects, by understanding the relationship between profit rates and the labour costs of producing new housing units.

Methodology

This study is of a deductive nature, as it starts from the theoretical premise of the algebraic proposal developed by Neil Irwin and, through empirical application, seeks to test its results by applying this theory to a set of case studies. This lends an exploratory approach to the research with an emphasis on the quantitative aspects of a random sample. The aim is to determine how much surplus value is produced by workers on a real estate project in Greater Santiago, identifying the Marx Ratio and the monthly monetary value of this surplus value.

This is an exercise based on empirical data obtained from various sources. Using information provided by real estate companies to the Chilean Environmental Assessment Service, the location of housing projects is compiled, along with declared investment amounts, construction permits, incorporation of investment or real estate companies, project development time, number of workers per stage, project size in square meters, and location. Real estate projects developed between 2015 and 2020, approved by the environmental authority and also aimed at selling homes, have been included. Housing projects developed for social purposes by SERVIU have been excluded from the analysis, as these projects are not marketed. Specifically, a total sample of 239 projects to review has been defined.

Data selection focused exclusively on verticalized housing projects to maintain a consistent typology across cases, facilitating more accurate comparisons of productive activities and surplus value extraction. Cases lacking geographical coordinates were excluded, as these would require field verification to ensure the physical existence of the building, which was deemed impractical for this study. On the projects analysed, the initial sample consisted of 40 projects, but by the time we reached 28, sample saturation had already been achieved. The selected cases in relation to the total number of available cases are distributed in Greater Santiago as shown in Figure 1.

From these 28 cases, their specific economic-spatial characteristics are recorded and lifted for quantitative analysis. To begin, each case is indexed to the value of the land paid by the company, data obtained from the Santiago Real Estate Registry. This is used to

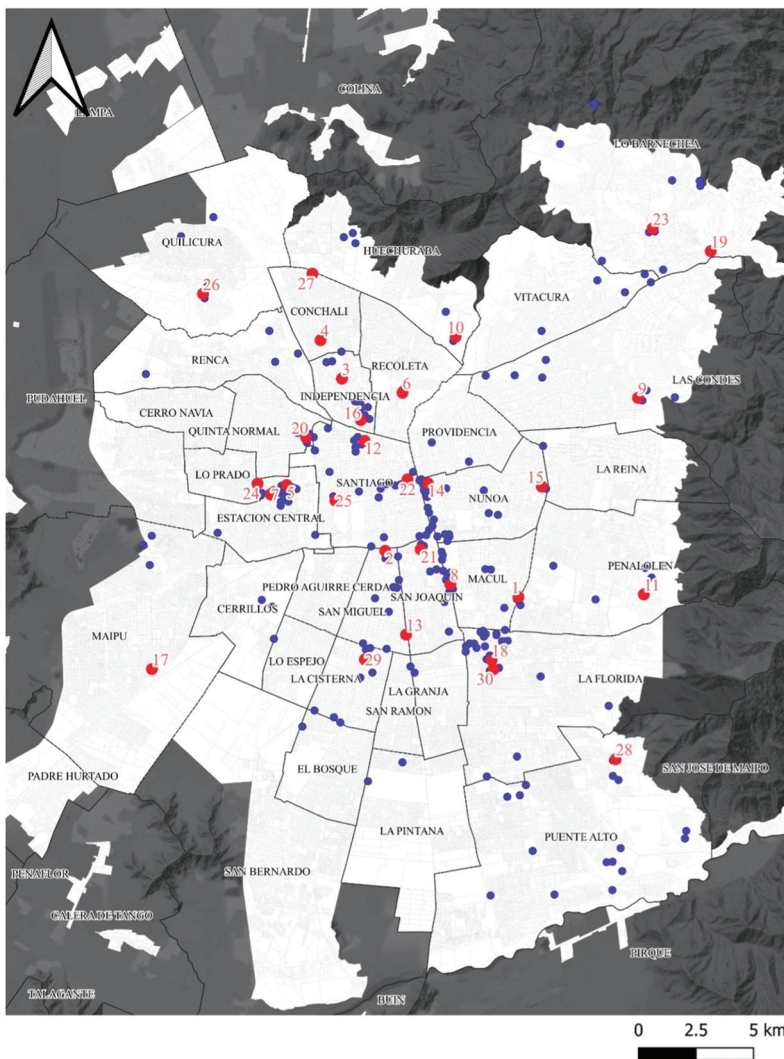


Figure 1. Total available cases in the sample (blue) versus cases chosen for the study (red). Source: authors.

configure the initial investment of the projects that includes: capital investment for the execution of the projects declared to the Environmental Assessment Service and the price paid by the company to acquire the land on which the housing project is built. As a detail, the land value may be included in some of the declarations made by the companies to the Environmental Assessment Service, but it is assumed as a different investment to generate a more conservative estimation of the analysis. All selected cases are from the Metropolitan Area of Santiago, which hosts 40% of Chile's population, 60% of the GDP. Chile has high levels of centralization and concentration of real estate investment, and Santiago holds 45% of the national GDP in Housing and Real Estate Services, according to data from the Central Bank of Chile. Additionally, data from the National Statistics Institute indicate that the Metropolitan Area of Santiago alone accounts for 65% of all constructions over five stories in the country between 2010 and 2020. Furthermore, the Metropolitan Region of Santiago has advantage on data access for its usual requirement of environmental assessment permits for most verticalized developments. This regulatory framework ensures access to comprehensive data, including investment levels, workforce size, and project specifics, which are essential for calculating the Marx Ratio accurately. Furthermore, all data provided by companies is submitted under oath, enhancing its reliability and ensuring that it meets high standards of accuracy. However, even within this regulatory framework data can have issues which need amendment. Table 1 presents descriptive statistics for the 28 indexed housing projects analyzed in the study, covering a range of economic and physical variables.

Table 1 presents descriptive statistics for the 28 indexed housing projects analyzed in the study, covering a range of economic and physical variables. The housing price per square meter (UF/m²) ranges from 31.18 to 110.66 UF, with an average of 66.11 UF/m². Land price shows a substantial spread, from 10,189 UF to 1,137,150 UF, with a mean of 233,336.14 UF, reflecting the variability in land values across Santiago. In terms of investment, values range widely from 161,235.86 UF to 4,350,863.13 UF, with an average investment of 952,998.09 UF per project. The projects involve an average of 180.75 workers over a work period ranging from 18 to 120 months, with an average duration of 46.29 months. Constructed area varies significantly, with a mean of 53,578.51 m², including both above-ground and underground spaces. For expected income from

Table 1. Descriptive statistics.

Variables	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Housing Price (UF/m ²)	28	31.18	110.66	1851.18	66.11	16.41
Land Price (UF)	28	10189.00	1137150.00	6533412.02	233336.14	281969.65
Land Price (UF/m ²)	28	0.13	54.03	542.23	19.37	16.21
Expected Income of Apartments Sales	28	142467.00	7744927.87	60193424.48	2149765.16	1635842.24
Investment (UF)	28	161235.86	4350863.13	26683946.45	952998.09	852824.69
Workers	28	43.00	490.00	5061.00	180.75	78.90
Months of Work	28	18.00	120.00	1296.00	46.29	28.16
Investment per m ² Constructed	28	5.45	52.26	516.86	18.46	10.94
Constructed m ²	28	19629.00	133153.00	1500198.17	53578.51	33790.48
Above Ground m ²	28	16092.00	130694.00	1086870.84	40254.48	26652.04
Underground m ²	28	0.00	46607.00	268130.21	9930.75	10141.08
m ² of Apartments for Sale	28	13490.00	69991.20	893280.36	31902.87	17184.11
Land Area	28	1131.00	781398.00	1441089.60	51467.49	147909.72
Housing Units	28	210.00	1501.00	15744.00	562.29	305.85
Parking Spaces	28	113.00	1650.00	12906.00	478.00	365.72
Sales	28	142467.00	7744927.87	60193424.48	2149765.16	1635842.24

apartment sales, the range extends from 142,467 UF to 7,744,927.87 UF, with an average income of 2,149,765.16 UF. Other metrics, such as housing units (average 562.29 units), parking spaces (average 478 spaces), and land area (average 51,467.49 m²), show the scale and intensity of each project. These statistics highlight the variability and scope of real estate projects in Santiago's metropolitan area. A baseline net return of 10% has been applied. This may seem high for real estate projects, but in fact, for Chile, it is considered the minimum. The literature has documented this high income expectation, showing that in the case of verticalized projects in Santiago, Vergara-Perucich and Aguirre-Núñez (Vergara-Perucich & Aguirre-Núñez, 2019; Vergara-Perucich & Aguirre, 2019) studied 16 verticalization projects and identified that the lowest-performing project by IRR yielded a return of 19%, while the average was 88%, with an average Net Present Value of \$7,139,245. In this sense, the 10% measure indicated here is considered conservative. In any case, since it is a unifying measure and not specific to each project, it is used as a variable that lends credibility to the idea of investing with the expectation of earning a return. In other words, the Marx Ratio calculated here does include profits for the capitalist, and based on those hypothetical profits, the calculation of how much surplus value is extracted from labor is also applied.

Given the precise details of location, it facilitates the process of estimating the sale values of the projects in the market based on the specific price of the housing units. These data are contrasted with transactions near the locations of the projects, based on information contained in the databases of the inciti.com platform. In any case, the sale value of the housing units has been considered, not that of parking spaces, storage rooms, offices, and commercial premises. Another criterion applied to filter the cases was to discard projects that some companies use for rental housing, since the objectives change, and this would also require a different method of analysis. Following the recommendations for applying the Marx Ratio, it is preferable to work with specific business typologies that improve the results. Having this information, some assumptions are added to calculate the Marx Ratio for each evaluated project:

The average number of workers is taken as a reference to know how many people dedicated hours of their life to performing profitable work for others. This figure is declared to the Environmental Assessment Service by the companies themselves.

It is assumed that the total sale time of each project is a maximum of 24 months from the start of construction, based on data from the Chilean Chamber of Construction, which estimates the average time for the complete sale of projects in Greater Santiago at 24 months.

The calculation of the Marx Ratio is obtained from the following algebraic operation:

$$MR = S/I$$

Where MR is Marx Ratio, S is the net income from selling the project in relation to the number of workers of the project, and the total investment (I) is distributed equally among the workers involved in the project building implementation. Finally, a synthesis mapping is developed to locate where there is the highest extraction of surplus value from workers to capitalists in each project studied. In this analysis, 10% of the project's net income is awarded to the investor. That is, the surplus value analysed contemplates a profit for the capitalist of 10% and on that basis, it is calculated how much each worker could give away with their work.

Results

The analysis of the Marx Ratio across these 28 projects reveals significant insights into the capitalist dynamics underpinning Santiago's real estate market. Although limited in sample size, the calculated average Marx Ratio of 2.02 suggests a substantial degree of surplus value extraction from labor, aligning with the theoretical expectation of high-profit margins within Chile's real estate sector. This ratio indicates that, on average, the value appropriated by capitalists from each worker far exceeds their compensation, reinforcing the conditions of labor exploitation theorized in Marxist political economy. The persistent profitability demonstrated by each project underscores the structural nature of this surplus extraction, which appears unaffected by the socioeconomic profile of the project's location – a finding that suggests a pervasive pattern of profit maximization within the real estate industry, regardless of local economic conditions.

Although this result is based on 28 cases, it is important to mention a relevant factor which is the high residential segregation among communes in Greater Santiago (Encinas et al., 2019; Link et al., 2015), where there are communes for high, medium, and low-income households, a very marked situation that is not so evident in the results of this study (Encinas et al., 2021; J. F. Vergara-Perucich, 2021). To illustrate this similarity, projects located in high-income communes like Las Condes or Ñuñoa share a similar Marx Ratio to low-income communes like Estación Central, Recoleta, or Independencia (see Table 2 and Figure 2). In other words, the process of extracting surplus value from labour in these projects does not directly depend on the socioeconomic level of the commune, but on other factors.

Table 2. Summary of the Marx Ratio results for 28 recent real estate projects in Greater Santiago.

District	Marx Ratio	Surplus value from workers (USD)	Monthly surplus value from workers (USD)
Macul	3,48	157.808,3 USD	6.665,2 USD
San Miguel	3,31	172.768,7 USD	4.864,7 USD
Independencia	2,6	236.695,9 USD	7.997,7 USD
Conchalí	2,55	194.035,5 USD	5.176,0 USD
Estación Central	2,55	148.912,0 USD	5.590,6 USD
Recoleta	2,48	431.800,7 USD	12.873,5 USD
Estación Central	2,43	92.379,9 USD	3.901,8 USD
Macul	2,36	304.434,7 USD	4.060,4 USD
Las Condes	2,27	643.040,0 USD	5.431,9 USD
Huechuraba	2,22	183.918,5 USD	1.553,6 USD
Peñalolén	2,16	243.335,4 USD	5.138,7 USD
Santiago	2,13	152.237,4 USD	5.935,3 USD
San Miguel	2,11	175.537,1 USD	9.885,3 USD
Ñuñoa	2,02	193.174,4 USD	7.252,4 USD
Ñuñoa	1,95	171.022,8 USD	5.977,9 USD
Independencia	1,9	58.875,5 USD	2.387,2 USD
Maipú	1,87	358.276,7 USD	4.323,5 USD
La Florida	1,84	168.618,7 USD	4.498,0 USD
Vitacura	1,74	831.142,3 USD	11.701,4 USD
Quinta Normal	1,63	301.962,7 USD	6.376,8 USD
San Joaquín	1,62	102.819,6 USD	2.895,1 USD
Santiago	1,54	123.160,3 USD	4.458,7 USD
Lo Barnechea	1,44	323.006,5 USD	6.548,4 USD
Estación Central	1,42	149.518,7 USD	1.918,5 USD
Santiago	1,32	31.655,9 USD	1.146,0 USD
Quilicura	1,32	373.214,3 USD	5.404,5 USD
Conchalí	1,28	70.956,8 USD	2.179,6 USD
Puente Alto	1,03	5.391,5 USD	133,3 USD

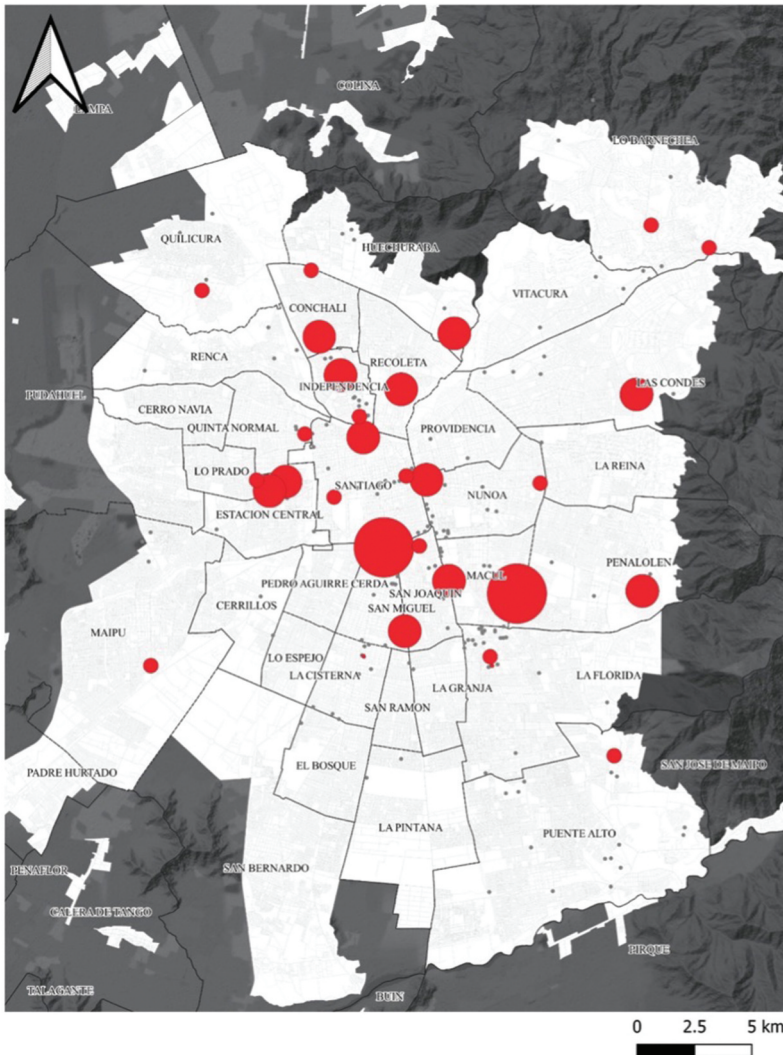


Figure 2. Map of the intensity of the Marx Ratio of the selected projects.

Regarding the specific factors of each project that best help to explain where there is a greater extraction of surplus value from workers, the amount of investment for each project appears to be predominant. That is, the greater the amount of investment, the greater the surplus value for the capitalists of each project. The lowest Marx Ratio obtained was 1.03 in the commune of Puente Alto, a commune of large middle-income households located on the southern edge of Greater Santiago, where most real estate projects are houses and not high-rise apartments. On the other hand, the highest Marx Ratio was obtained in the commune of Macul, another middle-income commune, although unlike Puente Alto, Macul is dominated by high-rise construction and is more central than Puente Alto. Undoubtedly, the highest Marx Ratio is observed in communes with aggressive verticalization processes (Rojas

Symmes, 2017; Schlack & Vicuña, 2011; Vergara, 2017; Vergara-Perucich, 2021; Vicuña, 2013).

Furthermore, when examining the surplus value extracted per worker, we find that it averages approximately USD 208,560 over the course of each project. This amount, which exceeds the average price of a housing unit in Santiago, illustrates a striking contradiction: workers generate enough surplus value to theoretically afford a residence in the buildings they construct, yet the economic structures governing wages and housing accessibility prevent this possibility. This paradox reflects a broader inequity within Santiago's urban development, where housing affordability remains out of reach for those who directly contribute to its production.

The correlation between high Marx Ratios and more intensive verticalization in certain communes, such as Macul and San Miguel, highlights a particular mechanism of surplus extraction in urban development. Verticalization accelerates the capital turnover rate by maximizing the use of urban land, which is especially valuable in dense metropolitan areas. By concentrating investment in high-rise constructions, developers can capture surplus value more effectively, benefiting from economies of scale and greater market demand. This process aligns with theories suggesting that urban densification serves capital accumulation more than addressing housing needs, as it enables higher returns on investment at the expense of affordable and equitable urban spaces.

The findings show the utility of the Marx Ratio in quantifying labor exploitation within the construction industry. These results suggest that similar surplus extraction patterns could be present across other real estate markets with comparable economic structures. The implications of this research underscore the need for regulatory frameworks that could mitigate such exploitative practices, possibly through fiscal policies aimed at redistributing surplus value or improving labor conditions within the construction sector. Addressing these systemic inequalities is crucial, especially in a context where housing demand continues to escalate and affordability becomes increasingly challenging for working-class populations.

Discussion

The findings of this study align with and expand upon the Marxist critiques of labor and value production explored in the literature, particularly within the context of the real estate sector and urbanization. Marx's labor theory of value and the concept of surplus value highlight how capitalists accrue economic benefits by appropriating the excess value produced by workers (Marx, 1994, 2000), a process well-documented in various empirical settings (Johnson, 2021; Moseley, 1986). In this study, the calculated Marx Ratio of 2.02, reflecting substantial surplus value extraction in Santiago's real estate industry, provides strong evidence for the presence of this exploitation dynamic within Chile's construction sector. This finding echoes the theoretical arguments of Althusser et al. (2015) regarding the reinforcing nature of surplus value in capitalist structures, underscoring how capital-labor relationships in real estate are structurally oriented towards maximizing capitalist gains at the expense of labor.

These results resonate with Lefebvre's (1991) critique of the urban political economy, which posits that the capitalist production of space, including real estate development, primarily serves to sustain hegemonic power relations. Lefebvre's work, extended by

scholars such as Kipfer (2002) and Winkler (2020), suggests that real estate capital shapes urban landscapes in ways that reflect and reinforce class distinctions. The empirical data from Santiago, revealing that projects in both high- and low-income communes exhibit similar levels of surplus extraction, affirms Lefebvre's argument that the capitalist logic of profit maximization overrides socioeconomic variations in space, resulting in a homogenized exploitation across urban areas. This finding is particularly relevant in the context of Santiago's intense verticalization processes in communes like Macul and San Miguel, where high Marx Ratios correlate with significant capital turnover (López-Morales et al., 2019; Rojas Symmes, 2017). By concentrating investments in high-density construction, developers can maximize surplus extraction, a pattern that supports Graham's (2016) argument that verticalized urban spaces are strategic sites for accelerated capital accumulation.

However, the findings challenge certain assumptions within the existing literature regarding the direct link between urban socioeconomic conditions and levels of surplus extraction. While Link et al. (2015) and Encinas et al. (2019) underscore the marked socioeconomic segregation within Santiago, this study shows that surplus value extraction is relatively unaffected by these divides, as evidenced by similar Marx Ratios across diverse communes. This suggests that, within the capitalist dynamics of real estate, spatial differentiation plays a less critical role in surplus extraction than factors such as investment scale and construction type. Consequently, while socioeconomic segregation may shape access to urban space, it does not necessarily alter the mechanisms of exploitation inherent to labor-capital relations within the real estate market. This finding invites a reconsideration of how urban socioeconomic divides impact labor exploitation, calling for a more nuanced understanding of capitalist dynamics in urban studies.

Additionally, this study affirms Lacan's (Vighi, 2016) psychoanalytic interpretation of surplus value, which suggests that capitalism generates both economic and subjective forms of alienation. The significant surplus value extracted per worker in Santiago's construction sector highlights a paradox: although construction workers generate enough value to afford housing within the very buildings they construct, systemic structures of wage suppression and speculative real estate pricing prevent them from accessing this housing. This alienation from the products of their labor, discussed by Elden (2004) and Lefebvre (1991), is further reinforced by Santiago's urban landscape, where housing primarily serves as a commodified asset rather than a public good. Thus, the Marx Ratio does not only quantify exploitation; it also illustrates how capitalist urban development exacerbates worker disconnection from their labor's outcomes.

The findings also lend empirical support to recent studies that emphasize the significance of surplus value as an indicator of worker exploitation across industries (Martínez & Baeza, 2023; Philp & Wheatley, 2013). Bruenig (2018) argues that the Marx Ratio is particularly useful for analyzing industries like real estate, where high investment returns align with labor-intensive work. The high Marx Ratios observed in Santiago's construction projects reinforce this perspective, indicating that the real estate sector provides fertile ground for surplus value extraction. These results suggest that, with appropriate methodological adaptations, the Marx Ratio could serve as a comparative tool for measuring surplus value across sectors and informing labor policies. The insights generated could be instrumental for unions in bargaining efforts, as they provide a clear, quantifiable representation of exploitation levels that

can be used to advocate for fairer compensation and benefits (Althusser et al., 2015; Ruccio, 2018).

The Marx Ratio offers a potent framework to quantify surplus value extraction, making it particularly suitable for examining labor exploitation within various industries, and construction is an illustrative example. By calculating the ratio of net income generated per worker to their wages, the Marx Ratio encapsulates the degree of value appropriated by capitalists, revealing the hidden dimensions of capitalist profit-making. In the context of Santiago's real estate market, this study illustrates how the Marx Ratio provides a clear metric for visualizing the significant discrepancy between the value generated by construction workers and their wages – a discrepancy that aligns with Marx's theory of surplus value. Here, the Marx Ratio enables a precise calculation of surplus value, offering quantitative evidence of the gap between labor's contribution and its compensation.

This measure's utility extends beyond academic analysis; it has practical implications for labor organizations and unions aiming to secure fair wages and benefits. By adopting the Marx Ratio as a benchmarking tool, unions can use surplus value calculations to negotiate stronger collective bargaining agreements. For instance, a union representing construction workers in Santiago could leverage the finding that an average surplus value of US\$208,560 is extracted per worker per project. Such figures starkly reveal the extent to which workers' labor generates value for developers, providing empirical leverage to advocate for wage increases and improved working conditions. Armed with Marx Ratio calculations, unions can make a case that the wealth generated by their members warrants a proportionate redistribution in the form of wages, benefits, or even profit-sharing schemes.

The broader applicability of the Marx Ratio also facilitates comparisons across sectors. When unions from different industries adopt this measure, it allows for the comparison of surplus value extraction in construction, manufacturing, services, and beyond. Such cross-industry analyses highlight differences in exploitation levels, which can, in turn, strengthen collective advocacy for systemic changes in labor compensation. In industries with especially high Marx Ratios, the metric can serve as a signal for policymakers and regulatory bodies to scrutinize labor practices and implement corrective policies aimed at reducing exploitative profit margins. For example, if data reveal that the Marx Ratio in construction is significantly higher than in other sectors, this might suggest that labor policies should prioritize wage improvements or enhanced protections within the construction industry.

Moreover, the Marx Ratio sheds light on the broader economic implications of surplus value extraction and provides insights into systemic urban inequalities. The construction industry, particularly in centralized urban markets like Santiago, capitalizes on high population density and investment inflows, concentrating economic value within a few corporations. The finding that surplus value extraction occurs at similar levels in both high- and low-income communes suggests that the industry's exploitative practices are pervasive and not limited to areas with significant economic disparity. This underscores the structural nature of exploitation within real estate, a sector where investment intensification, driven by urbanization and verticalization, enables the extraction of significant surplus value.

For workers, understanding the Marx Ratio in relation to their labor reveals the hidden costs of urban growth and the commodification of housing. While verticalized projects maximize space utilization and developer profits, they reinforce an economic model where housing becomes a speculative asset rather than a public good. In Santiago, this manifests in the extraction of surplus value that far exceeds the cost of acquiring a housing unit, revealing a contradiction between workers' role in constructing the city and their inability to afford its housing. By contextualizing the Marx Ratio within this urban framework, the study illuminates how capitalist dynamics in the real estate sector contribute to broader social inequities and deepen the housing affordability crisis.

On a policy level, the Marx Ratio offers a valuable empirical basis for regulatory reforms. Policymakers could use this metric to justify measures such as progressive taxation on real estate profits, minimum wage increases, or mandatory reinvestment into worker welfare funds. The metric could also guide zoning laws and real estate policies that aim to mitigate the concentration of surplus value among developers and redistribute economic gains more equitably. Implementing a Marx Ratio threshold, for example, might require companies exceeding a certain level of surplus extraction to provide additional compensation to their workforce or contribute to local housing funds. This approach would leverage the Marx Ratio as both a diagnostic tool and a regulatory benchmark for promoting economic justice.

Finally, the Marx Ratio embodies a modern approach to Marxist theory, translating abstract concepts of surplus value into concrete, actionable metrics. It allows researchers, workers, and policymakers alike to understand and address exploitation within specific economic sectors. The findings from Santiago's construction industry exemplify how this metric can be applied to reveal hidden economic dynamics and inspire collective action. Unions, for instance, can use Marx Ratio findings to strengthen solidarity across sectors, demanding fairer wages and better working conditions through evidence-based claims of disproportionate surplus extraction. In this way, the Marx Ratio serves not only as a lens for academic critique but also as a practical tool for mobilizing labor movements and guiding public policy.

Conclusion

The study reveals a stark reality in the Chilean construction industry: the extraction of substantial surplus value from workers. The average Marx Ratio of 2.02 across the 28 analysed projects indicates that the net income generated per worker significantly exceeds the investment made per worker. This finding underscores a considerable power imbalance between capital and labour, where the profits accrued by real estate developers far outweigh the compensation received by the workers who contribute their labour to these projects. The fact that the surplus value extracted from each worker, on average, is enough to purchase a house within the very building they constructed further highlights the inequity inherent in this system.

The research challenges the notion that surplus value extraction is solely a function of the socioeconomic context of the project location. The study found that the Marx Ratio did not vary significantly between projects in high-income and low-income communes, suggesting that other factors, such as the scale of investment and the type of construction, play a more decisive role in determining the extent of surplus value extraction. The

analysis points towards a concerning trend where projects with higher investment levels and those characterized by aggressive verticalization processes tend to exhibit higher Marx Ratios, implying a greater degree of labour exploitation.

The implications of these findings are profound. The study underscores the urgent need to address the systemic inequalities within the Chilean construction industry and the broader housing market. The current model, characterized by a dominant role of private real estate developers and a subsidiary state, appears to perpetuate a system where workers are disproportionately contributing to the wealth accumulation of capitalists. The research calls for a critical re-evaluation of existing policies and regulatory frameworks to ensure a more equitable distribution of benefits within the industry. The empirical evidence presented in the study could inform discussions on fiscal policies, such as progressive taxation on real estate profits, and regulatory measures aimed at strengthening workers' bargaining power and improving their working conditions.

The study's contribution to the field is multifaceted. It provides a novel microeconomic perspective on the dynamics of surplus value extraction in the construction industry, moving beyond macroeconomic analyses and offering insights into the specific mechanisms through which labour is exploited in real estate projects. The application of the Marx Ratio at a micro-level, enabled by the availability of detailed project-level data, enhances the precision and granularity of the analysis. Furthermore, the research highlights the potential of the Marx Ratio as a tool for informing policy development, particularly in the context of local governments seeking to review regulatory frameworks and address inequality in the housing market.

The study underscores the Marx Ratio's utility as a modern tool for quantifying surplus value extraction in the real estate sector, offering a powerful lens through which to examine labor exploitation. The calculated average Marx Ratio of 2.02 across Santiago's real estate projects reflects a profound imbalance between the value generated by workers and their compensation, reinforcing longstanding Marxist critiques of capitalist labor dynamics. This finding illustrates the structural nature of surplus value extraction within the construction industry, a pattern that is particularly stark in the context of Santiago's verticalized real estate market. The consistency of the Marx Ratio across both high- and low-income communes also highlights that profit maximization remains a primary driver across varying socioeconomic contexts, suggesting that the scale of investment and project type play more decisive roles in surplus extraction than location.

The policy implications of these findings are substantial. The Marx Ratio could serve as an empirical benchmark for labor unions and advocacy groups seeking fairer wages and benefits in industries marked by high surplus extraction, such as real estate. Additionally, the study suggests that local governments in Santiago and other urban centers might consider policies to limit excessive profit margins on real estate projects or to require that a portion of these profits be redirected towards labor welfare or affordable housing initiatives. Implementing a regulatory framework that includes fiscal measures, such as a progressive tax on real estate profits, could help curb the pervasive exploitation observed in this study and promote a fairer distribution of the economic value generated within the industry.

This study also points to the broader applicability of the Marx Ratio as a comparative tool across sectors. By adapting this metric, other industries could reveal hidden

dimensions of surplus value extraction, allowing for a cross-sectoral analysis of labor exploitation and strengthening bargaining positions for labor organizations. The Marx Ratio thus offers a pathway for a more equitable and transparent economic structure, where labor's contributions are more accurately recognized and rewarded.

Future research is needed to validate the findings across different contexts, especially in industries with similar labor structures. Moreover, examining the potential for the Marx Ratio to inform fiscal and regulatory policy presents an important avenue for addressing urban inequality in Santiago and beyond. By shedding light on these dynamics, this study contributes to ongoing discussions about economic justice and sustainable urban development, calling for a more just and inclusive approach to labor valuation in real estate.

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