When Competition and Labor Market Policy Collide: The Case of the Minimum Wage

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November 1, 2024

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Abstract

Policymakers and competition authorities are concerned about the negative effects that labor market power has on workers and the efficient functioning of the labor market. The minimum wage has the potential to curb firms' power, raising employment and wages (Robinson 1933). However, how does using the minimum wage to mitigate firms' labor market power impact social welfare, when these firms produce imperfect substitutes and have product market power as well? Do the interests of consumers and workers align or conflict? We answer these questions in the context of sector-specific minimum wages. In our framework, raising the minimum wage affects labor and product market equilibrium. First, it may either increase, reduce or have no effect at all on the marginal cost of a given firm, depending on its level relative to the marginal revenue product of labor. Second, the minimum wage influences the strategic pricing decisions of competing firms in the product market, even when the own-cost effect is null. We extend a model of supply and demand in an oligopolistic industry with rich consumer preferences and endogenous marginal costs, to incorporate firms' production, employment and wages. We estimate the model using a unique dataset from the beer industry in Uruguay, where firms of different sizes producing imperfect substitutes compete. We find that the minimum wage that minimizes employers' power and enhances labor market efficiency also reduces consumer surplus and competition in the product market. The presence of firms with labor and product market power poses a challenge for policymakers aiming to curb employers' power without causing unintended harm.

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1 Introduction

Reducing firms' labor market power is a priority for policymakers and competition authorities. The minimum wage is a tool they can use to achieve this goal, capable of reaching a large number of workers while being straightforward to implement. It is well known that when firms have labor market power, the minimum wage has the potential to raise both wages and employment, thereby increasing efficiency and welfare (Robinson 1933, Manning 2021, Luduvice et al. 2024). In practice, firms produce imperfect substitutes, exhibit different levels of product market power, and often display differences in labor productivity. How does employing the minimum wage to mitigate labor market power affect firms' profits and the welfare of consumers and workers in this case? Do the interests of consumers and workers align or conflict?

In this paper, we evaluate how the minimum wage affects social welfare in a specific industry, where firms with varying degrees of product and labor market power compete. We focus on two dimensions that shape the ultimate impact of the policy. First, a higher minimum wage can raise marginal costs in some firms (Friedman 1962) and lower them in others (Robinson 1933), depending on its level relative to the marginal revenue product of labor. Second, firms' strategic responses to these cost changes alter equilibrium prices in the product market (Weyl et al. 2013), even when the own-cost effect is null. Combined, these factors make the overall effect of a higher minimum wage on social welfare uncertain.

We find that the minimum wage that increases labor market efficiency and maximizes social welfare also reduces consumer surplus in the industry we study. In the presence of firms with different labor productivity, the minimum wage that improves labor market efficiency and lowers costs in one firm may be too high for another. For consumers, the net effect on welfare depends then on how these firms adjust product prices in equilibrium. When the pass-through of cost savings to prices is limited due to product market power, price increases in fringe firms due to higher labor costs may dominate, reducing consumer welfare. In cases of imperfect product substitution, as in this study, welfare losses can be amplified. Addressing labor market power with the minimum wage can result in lower consumer welfare and higher product market concentration, even when enhancing labor market efficiency and social welfare. The existence of firms with power in labor and product markets poses a significant challenge for policymakers aiming to raise wages without causing negative unintended consequences for consumers and competition in the product market.

In order to illustrate how the minimum wage can impact market structure and affect workers, as well as consumer welfare, this paper considers the Uruguayan beer industry. Our setting is ideal, since it is characterized by three distinctive features that highlight the main trade-

offs we study. First, there exist an industry-specific minimum wage, and it is high.[1] As of 2015, the minimum wage was approximately 3.7x the National minimum wage and 2.5x the private sector average wage for workers without a college degree. Second, the industry is highly concentrated. The largest firm holds an aggregate market share of 90% and offers both domestic and imported products.[2] Third, domestic craft brewers have entered the market and expanded the set of available varieties in recent years. Importantly, craft brewers are more labor-intensive than non-craft ones. Despite having a low market share (3%), craft firms account for more than 15% of employment in the industry.

We use a static, partial equilibrium framework, to examine the role that consumer preferences and productivity differentials between firms play in mediating minimum wage effects. We extend a demand and supply model of oligopolistic competition in the product market, to relate firms' endogenous marginal costs with production, employment and wages. Domestic production requires hiring workers, and labor demand depends on the level of production, which we assume equal to sales, unobserved productivity and relative input prices. In the model, multi-product firms set prices to maximize profits, and post wages consistent with those prices, in order to hire workers in the labor market. Then, consumers and workers make discrete choices over products and jobs, respectively.

The minimum wage affects firms' hiring decisions and marginal costs. When the minimum wage doesn't bind, the marginal cost of hiring an additional worker is increasing in the stock of workers, consistent with an upward-sloping labor supply curve and a non-discriminatory wage policy (Manning 2003) that gives infra-marginal workers positive rents. In this case, output is inefficiently low and equilibrium wages are below the marginal revenue product of labor due to labor market power. Alternatively, when the minimum wage binds and operates mitigating labor market power, the marginal cost of hiring decreases and firms are able to add additional workers without having to raise wages. This constitutes the pro-efficiency effect of the minimum wage (Robinson 1933), and it's exhausted when labor supply, labor demand and the minimum wage intersect. Finally, when the minimum wage is high enough, it leads to standard rationing (Friedman 1962), and firms hire where the minimum wage intersects the labor demand.

Simultaneously, the minimum wage affects equilibrium prices in the product market. When the minimum wage reduces marginal costs in a firm, the firm may respond reducing prices, leading competitors that offer close substitutes to reduce prices as well, even when their own

[1] As in approximately 20% of countries (International Labour Organization, 2021), in Uruguay firms categorized within the same sector of economic activity have to comply with a uniform industry-specific minimum wage. In the case of Uruguay, this applies irrespective of firm size or location.

[2] Market share based on overall beer consumption in the country for 2022. It reached 98% in 2003, after the horizontal merger of the two largest firms of the time was not challenged by the Government. See Section (2) for more details.

costs remain unaffected. Competition in the product market can intensify as a result of a more efficient functioning of the labor market. In contrast to the case of perfect competition, under imperfect competition consumers also benefit from the pro-efficiency effects of the minimum wage. Crucially, how strong this mechanism is relies on whether firms pass cost efficiencies through to prices, in the availability (or absence) of close substitutes, and on differences in labor productivity between competing firms.

We estimate consumer demand and products' marginal costs following Berry et al. 1995. Demand side moments are built using a random coefficients nested logit model (Brenkers et al. 2006), and supply side moments assume that firms set products' prices separately in each market to maximize profits. We augment the estimation by adding "second" choice aggregate diversion moments following Conlon et al. 2024, exploiting a natural experiment that removed certain products from some consumers' choice set. This allows us to estimate rich consumer preference heterogeneity, despite using only aggregate shares, working with a single market per period, and without data on the choices of individual consumers.[3]

In our framework, both prices and the labor component of marginal costs are endogenous. We instrument prices using cost data at the product level and products' characteristics. In the case of labor costs, we follow the literature on production function estimation (Ackerberg et al. 2015) and instrument with data on fixed and flexible inputs in previous periods. Finally, we calibrate the firm-level labor supply using previous research on set ups similar to ours (Card et al. 2018, Kroft et al. 2021, Amodio et al. 2021, Casacuberta et al. 2023) and the National Minimum Wage. In Appendix (8), we provide robustness checks that show how our main results hold under a broad range of plausible parameterizations.

We perform two sets of counterfactual to study the welfare consequences of alternative labor market policies for consumers, workers and firms. In the first counterfactual, we search for the industry minimum wage that maximizes social welfare. In the second, motivated by the low degree of substitution between craft and non-craft products, and associated differences in firms' size and productivity, we simulate alternative product and labor market equilibrium under distinct minimum wages for craft and non-craft firms. In both cases, we use as baseline the counterfactual equilibrium without minimum wage. To compare counterfactual scenarios, we compute social welfare as the sum of consumer surplus, workers' rents and firms profits, and assume it coincides with private welfare (Conlon and Rao 2020).

In the first counterfactual, we find that the industry minimum wage that maximizes social welfare is US$ 1,000 per month.[4] This minimum wage level is compatible with an average

[3]The benefit is that we avoid multiplicity of equilibrium (Bulow et al. 1985).
[4]As a reference, a US$ 50 change in the gross monthly wage is equivalent to US$ 26 cents per hour for a full-time worker.

wage 18% higher than the average under the no minimum wage scenario, and 94% higher than the National minimum wage. The minimum wage that maximizes social welfare creates winners and losers in the industry we study. Because the efficiency gains of mitigating labor market power in the largest firm are only partially passed to prices due to product market power, consumers would be better off under a lower minimum wage (US$ 550).

The main driver of the negative welfare effect for consumers is a reduction of 14% in the production and sales of craft products in the high minimum wage equilibrium. Craft firms are more labor-intensive, less productive and face a more elastic residual demand curve, so higher labor costs are passed through one-to-one to prices, and result in more than proportional reductions in sales. The difference in labor productivity between craft firms and the largest (non-craft) firm is such that the minimum wage that delivers the highest efficiency gains in the later is too high for the former. Lower sales in craft firms also imply reduced employment within these firms. However, at the industry level, total wage increases more than compensate employment losses and result in higher rents for workers. Because craft and non-craft products are poor substitutes, sales and jobs lost in craft firms are not compensated by meaningful changes of opposite sign in non-craft firms. The best uniform minimum wage in terms of social welfare balances between consumers and small craft firms on one side, and workers and the largest firm on the other. Addressing labor market power with the minimum wage raises product market concentration and equilibrium markups in this industry. This result is robust to alternative beer demand specifications and degrees of firms' labor market power.

Given that a uniform minimum wage tends to work well for the non-craft segment but leads to both lower employment in craft firms and higher prices for their products, we next consider the impact of distinct minimum wage categories for craft and non-craft firms. In this case, the minimum wage combination that maximizes social welfare is US$ 550 for craft firms and US$ 1,000 for non-craft firms. Notably, this policy increases consumer surplus and employment relative to the best uniform minimum wage, though with a smaller increase in effective wages for incumbent workers in craft firms. The low non-craft to craft diversion ratio implies that the lower equilibrium prices of craft products do not impose a significant competitive pressure on other firms in the product market. The availability of more affordable craft products likewise does not prompt the largest firm to pass a higher share of cost savings to consumers. Overall, social welfare is higher with separate minimum wage categories primarily because it boosts consumer surplus, employment and profits at craft firms, with negligible negative effects on profits and employment effects at non-craft firms.

We contribute to two strands of the literature. First, we contribute to the literature that studies the interactions between labor and product markets in specific industries (Kroft et al. 2021, Montag et al. 2022), considering the possibility that certain firms may have price-setting

power in both the input (labor) and output (product) markets (Kroft et al. 2021, Avignon et al. 2022, Rubens 2023). We do not consider entry and exit (Montag et al. 2022), but we incorporate a model of the labor market as in Kroft et al. 2021, with the novelty that we study how minimum wages affect both labor and product market equilibrium. Additionally, we use a richer specification of consumer preferences than Kroft et al. 2021. This allows us to analyze the trade-offs that the minimum wage entail for consumers when firms with different labor productivity produce imperfect substitutes. To our knowledge, we are the first to incorporate a measure of consumer welfare based on observed choices in the study of minimum wage consequences. The idea that minimum wages can affect competition in the product market has been studied before (Williamson 1968, Salop et al. 1983). In our model, this policy is not merely a distortion negatively affecting consumers through higher costs and prices. Instead, the existence of labor market power gives the minimum wage the ability to reduce prices through cost efficiency and enhanced competition. In practice, this channel is not sufficiently strong in the industry we study, consumer welfare would be higher if the policymaker accepted a certain degree of labor market power.

Second, our work is related to the literature that investigates the consequences of general (Card and Krueger 1993, Aaronson et al. 2018, MaCurdy 2015, Dube 2019, Harasztosi et al. 2019, Berger et al. 2022, Luduvice et al. 2024)[5] and industry-specific (Haucap et al. 2001, Braun 2011, Martins 2021, Hijzen et al. 2020, Card and Cardoso 2022, Bello et al. 2022, Hermo 2023, Casacuberta et al. 2023) minimum wages. In particular, our work contributes to a recent strand that studies the effects of minimum wage changes beyond employment and prices (Harasztosi et al. 2019, Berger et al. 2022, Dustmann et al. 2022, Luduvice et al. 2024). Relative to these papers, our framework enables us to focus on the role that product market power plays in mediating minimum wage effects on total welfare. In this case, we contribute by including into the analysis consumer welfare and not just workers' rents and firms' profits. Additionally, our modeling strategy retains the possibility of studying multiple outcomes simultaneously as in general equilibrium models (Braun 2011, Berger et al. 2022, Bello et al. 2022), but using more realistic consumer preferences. In this context, we show how the degree of product differentiation can be a relevant channel affecting the reallocation of workers from smaller/lower productivity to larger/higher productivity firms documented in previous studies (Harasztosi et al. 2019, Dustmann et al. 2022). Finally, the modeling approach we use can rationalize previous findings about the effects of industry-specific labor cost changes. There is evidence that following a change in labor costs, some firms might not only face higher production cost but also produce more (Dodini et al. 2023). This can occur naturally in our model as the equilibrium outcome of simultaneous cost increases and positive residual demand shocks.

[5]See Neumark et al. 2022 for a recent survey.

The paper proceeds as follows. First, we provide institutional details of the industry and of the labor market institutions in place. Second, we describe the data and display the most relevant descriptive information that rationalizes our modeling decision. Third, we present the model we employ in detail, describe the estimation procedure and show the main results. Finally, we study counterfactual scenarios, discuss our results and then conclude.

2 Institutional Environment

In Uruguay, minimum wages apply by sector of economic activity, similar to over 20% of countries.[6] Sectoral minimum wages for multiple occupations are established in Collective Bargaining Agreements (CBA) between representative unions and employers associations every 2-3 years.[7]. A National Minimum Wage is in place as well, and serves as a significant reference point in the labor market. Approximately 18% of workers earned less than 1.5 times the National Minimum Wage in 2018.[8]

We study the sector that covers firms producing and selling beer and non-alcoholic beverages (water, juice and soft-drinks).[9] In particular, we define the beer industry as a subgroup of this sector that contains firms whose primary activity is to produce or to import beer. Craft and non-craft domestic producers are included in this sector and in the beer industry.

For the purpose of this paper, the minimum wage of the sector (and the industry) is the lowest among the four occupation-specific minimum wages governing the wages of manufacturing workers.[10] As of 2019, the minimum wage we consider was approximately 3.7x higher than the National Minimum Wage and 2.5x the average wage in the private sector for workers without a college degree.[11] According to Ramirez et al. 2022, this is among the highest sector-specific minimum wages across all sectors in the country.

The beer industry is highly concentrated, with a single firm accounting for 90% of sales.[12] The largest firm of the industry is the consequence of two unchallenged horizontal mergers that occurred between 1998 and 2003 between the three national firms of the time.[13] The industry went from an oligopoly with three firms of similar scale to a monopoly over a five-

[6] International Labor Organization, 2021.
[7] An occupation broadly refers to a set of tasks and responsibilities within a job. Other dimensions such as region, firm size or trade exposure are not taken into account.
[8] PIT-CNT, 2018
[9] Group 1, Sub-Group 9, Table 1, Tray 1 according to the classification of the Ministry of Labor and Social Security.
[10] This sector also defines minimum wages for two auxiliary processes (sales and administrative), but we do not consider them as part of the production process.
[11] This will be proven useful in the estimation process.
[12] See summary statistics in Table (1)
[13] Melgar et al. 2004

year period. Along this paper, we will refer to this firm as the largest firm, the largest domestic producer or the largest (and only) non-craft domestic producer.

The largest firm participates in the bargaining of minimum wages for the sector, but does not control the employer's side; other firms participate as well. In contrast, craft brewers are part of the sector but do not participate in negotiations. Still, they must comply with minimum wage regulations. The Government extends agreements to non-participating firms within sectors once they are signed. The extension does not have formal requirements on firms' representation or an analysis of the consequences that the extension may have on non-represented firms.

3 Data

We leverage multiple data sources to connect labor and product markets. We use these sources to build a dataset containing prices and quantities of inputs and final products of firms participating in the Uruguayan beer industry.

3.1 Data Sources

We use sales data provided by a Uruguayan firm that tracks multiple retail stores to estimate consumer preferences.[14] The data contains monthly observations at the store-brand-size-flavor level between April 2015 and October 2022. The name of the store is anonymous. We complement sales data with production statistics. For craft brewers, we use publicly available data from the brewers' association and proprietary information provided by some of these firms.[15] For non-craft domestic brewers (the largest firm in the industry), we use publicly available data from the Tax Authority about beer volumes associated with excise tax payments by origin (domestic vs imported) and subtract from the total domestic, the output series calculated for craft firms.[16] There are no other non-craft domestic producers in the country. Different from the case of sales, our production data aggregates by groups of firms (craft and non-craft). However, considering that craft brewers entered the market during the same period and that their scale of operations is similar, this aggregation preserves the heterogeneity between craft and industrial production that is relevant for this study.

We exploit three data sources with information on wages, employment and firms' capital stocks. First, we use anonymized matched employer-employee data provided by the Ministry of Labor and Social Security for the period 2015 to 2022, covering formal workers in the

[14] *IdRetail*
[15] AMAU for *Asociacion de Microcervecerias Artesanales del Uruguay.*
[16] We check implied figures with other statistics for consistency.

private sector. The data contains monthly records on workers' basic demographics, employment status, earnings and sector-job classification for wage floor purposes. For the case of manufacturing firms, using the number of employees and the ISIC code, we classify them in two groups based on their size.[17] According to our discussions with craft brewers, the group of small firms contains the relevant employment information we need to associate sales in the product market with employment and wages in the labor market. The second source we use is the Annual Survey of Economic Activity (ASEA) conducted by the INE.[18] This survey contains balance sheet data -revenues, expenditures, assets, debt, capital- and employment information -number of employees by job category and sector of activity, labor costs- for large firms. Finally, to construct a series of the capital stock, we use data from the ASEA, balance sheets and financial statements published by the National Internal Audit Office, as well as customs records of imported capital goods.[19]

We complement previous data sources with information on quantities and prices of materials and other relevant prices (exchange rates, gas). For materials (hops, bottles and cans), we use customs' records at the firm level. We leverage the fact that except for malt and certain bottles, all other inputs are imported. In the case of malt, we use the export price as a measure of the opportunity cost of the input.

3.2 Descriptive Information

3.2.1 Beer Sales

We define a product j as a serving size q_j of a combination of brand and flavor (Lager, Ale), similar to Fan et al. 2020. For example, *"Heineken Lager"* is one product in our data. We define a market m as the consolidated group of large supermarkets in the Capital Montevideo and its Metropolitan area in a given period t. The advantage of using supermarkets is that they provide consumers with access to a wide variety of beer products. We assume that market size $\mathcal{M}_m$ is proportional to the largest sales volume observed in our data over the period we study (4.0x), in line with Miller et al. 2017. A product must be available in at least 35 markets to be included in our sample. Sales data contains information on units and revenues, so we calculate monthly prices as the ratio of the two. We standardize product size and express units in servings of 12oz/355mL. Unlike in the US, over 90% of sales in Uruguay are single units rather than packs, so we focus exclusively on those. We exclude non-alcoholic or low alcohol products.[20] Finally, except for certain imported brands during short periods of time, in our sample products match one to one with firms.

[17] International Standard Industrial Classification
[18] Uruguayan National Institute of Statistics
[19] See Appendix (8) for details.
[20] Alcohol by Volume $\leq 1\%$.

We display sales summary statistics in Table (1), which highlights the level of market concentration, the entry of domestic craft brewers, and the increase in the consumption of craft and imported brands over time. The largest firm of the industry is responsible for roughly 9 out of 10 servings sold in the beer market, and offers both domestic and imported products.[21] The majority of sales consist on four non-craft brands that this firm produces domestically. To manufacture these brands, the firm needs to hire workers in the labor market.[22] Imported products are both offered by the largest firm and by six non-craft importers that jointly account for 8% of sales.

Table 1: Beer Market Summary Statistics

		Quantity			Price			Revenues		
		(# Servings, M)			(US$/Serving)			(US$ M)		
Characteristic		2016	2019	2021	2016	2019	2021	2016	2019	2021
Craft	Non-Craft	14.1	16.2	15.3	1.17	1.27	1.30	20.8	22.0	17.3
	Craft	0.1	0.3	0.4	2.53	2.60	2.53	0.4	0.8	0.5
Style	Lager	13.4	14.3	13.1	1.17	1.24	1.28	19.6	19.0	14.4
	Ale	0.9	2.2	2.6	1.47	1.62	1.55	1.6	3.7	3.3
Origin	Domestic	9.9	10.6	9.0	1.050	1.14	1.18	13.0	12.9	9.1
	Imported	4.4	5.9	6.7	1.49	1.56	1.50	8.2	9.9	8.7
Firm	Largest	13.0	15.0	13.9	1.15	1.25	1.28	18.9	20.2	15.5
	Other	1.2	1.5	1.7	1.51	1.65	1.64	2.4	2.6	2.3
Total		14.3	16.5	15.7	1.19	1.29	1.32	21.2	22.8	17.8
HHI		8,357	8,324	8,076				7,924	7,877	7,624

Note: Supermarkets' sales in the Capital and its Metropolitan Area. Real Uruguayan Pesos converted to US$.

Craft sales in the data consider the sum of the five largest craft breweries in the country. These firms represent over 80% of craft production, and it is on them that we focus in this study. A brewer is considered craft when it receives a certification issued by the craft brewers association, and therefore, a product is characterized as craft when it is produced by a craft brewer.[23] Craft brewers usually advertise their craft condition in the front label of their products, in order to make this characteristic salient for consumers.

While increasing over time, craft beer represents a minor share in this market (1.9%) and is more expensive than non-craft products (94.5% on average in 2021).[24] The increase in the

[21] See the Institutional Section (2) for details.

[22] Three of the four brands have a longstanding tradition in the Uruguayan beer market, they were introduced in 1890, 1947 and 1956.

[23] The label certifies that the brewer *"is an independent Uruguayan craft brewery, which is neither part of nor affiliated in any way with a multinational corporation"* Different from the US, the craft certificate does not include a cap on market share. Nevertheless, it does include a revision of production standards and it is more restrictive regarding multinational ownership participation (0% in Uruguay vs up to 25% in the US).

consumption of craft products has been part of a broader trend, as the raise in the consumption of new flavors (Ales) and imported brands shows. Seasonality plays an important role in demand, though seasonal patterns differ between beer types. Craft consumption raises in the colder months, while the consumption of non-craft products raise during the summer.

3.2.2 Productivity, Employment and Wages

Industrial (non-craft) producers offer products at lower prices than craft brewers. Among the reasons that can explain this, is the gap that exist in labor productivity. In 2021, the average labor productivity of manufacturing workers in the largest firm (measured as production per worker during a year), was roughly 5 times higher than in craft breweries. The capital-labor ratio is higher in the largest producer too, and this may contribute to explain (partially) the difference in labor productivity. However, craft brewers have invested in physical capital to automatize processes that workers used to do, leading them to reduce the gap in capital per worker during the period we study.[25]

Table 2: Production Summary Statistics

	Productivity		Capital		Wages		Labor Cost	
	(Q/L)		(K/L)		$(\frac{\bar{w}}{\underline{w}})$		$(\frac{wL}{Q})$	
	2016	2021	2016	2021	2016	2021	2016	2021
Non-Craft	276	220	247.1	156.7	2.8	2.6	7.4	8.7
Craft	23	45	52.4	107.2	0.5	0.6	21.7	14.1

Note: Manufacturing statistics for domestic producers. Craft firms consider the five firms contained in sales summary statistics. Labor productivity in liters per worker-year. Capital per worker in constant US$ 000's of 2019, considers manufacturing capital only. The ratio of average to minimum wages considers total labor cost of workers involved in the manufacturing process. Ratio calculated using raw data, does not adjust for reported hours. Average labor cost expressed in constant US$ cents per serving.

The largest firm is not only more productive but pay higher wages. Even though the industry minimum wage is high compared to other industries in the country (Ramirez et al. 2022), the largest firm pay average wages above that threshold. This may be related to the fact that in this industry there are multiple manufacturing occupations and to other benefits like tenure within the firm, for example. Still, the minimum wage binds for new workers. According to our data, new workers earn gross entry wages that are 1.0-1.3 times the minimum wage. Craft brewers report gross wages below the minimum, but in most cases associated with part time workers. These firms seem to comply with the industry minimum wage as well, once we adjust for the number of hours of work they report.

[24] According to (Fan et al. 2020) and (Hidalgo 2023), the price gap was ≈55% for California and 69% for the US, respectively. Similarly, craft products accounted for ≈10% of beer consumption in California (Fan et al. 2020) and 13% in the US (Hidalgo 2023).

[25] Considers only the capital stock used for manufacturing beer.

Labor costs are quantitatively more important for craft brewers. The average manufacturing labor cost per serving is 1.5-3.0 times higher in craft than in non-craft domestic firms during the period we study. Despite paying lower average wages, the fact that craft firms are more labor-intensive dominates. This explains how, even when they represent approximately 2% of national beer consumption (3% of production), they account for 15% of manufacturing jobs in the industry. For the same reason, a uniform minimum wage can increase the costs of craft firms relatively more than those of non-craft firms.

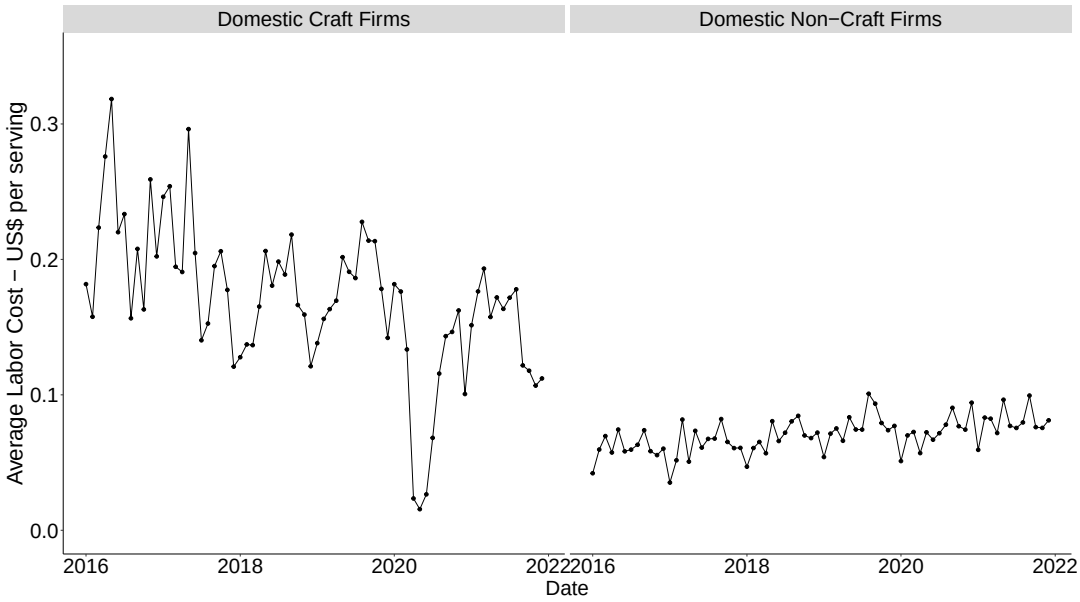
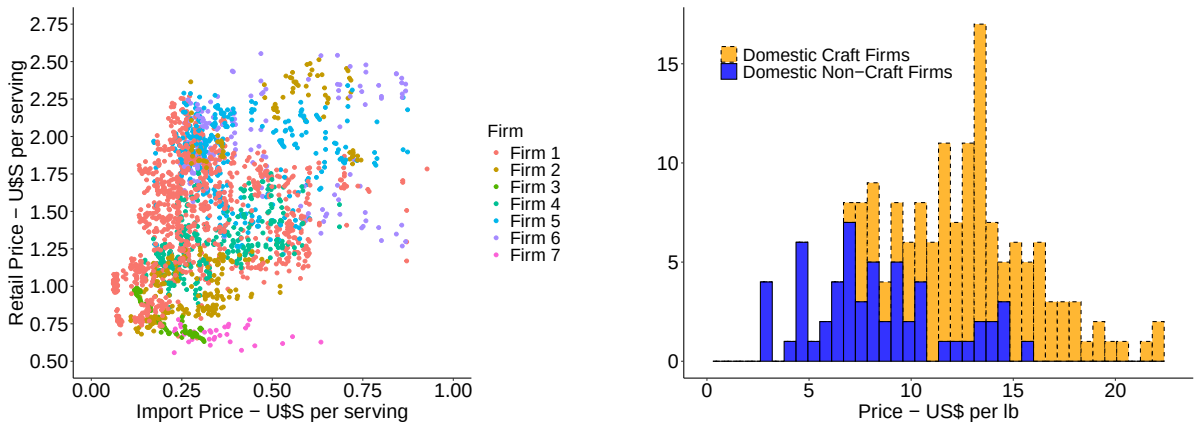


Figure 1: Average Labor Cost - US$ per serving

3.2.3 Imported Products and Materials

We use customs data to calculate import prices per serving for imported products. In most cases, we are able to match custom records to products in the output market using firm name, country of origin and products' descriptions. For those that we can't, we assign them the average import price from that country and firm to all products within the same group. Figure (2) depicts the relationship between the import price and the retail price in our sample. Additionally, we use inputs' import prices at the firm level to estimate cost functions. In Figure (8.1a) we display hops prices, one of the main materials that firms use. Cost differences between domestic producers are also the result of paying different prices for the materials they use.

In what follows, we outline the model we use to represent the most salient characteristics of the industry. Firms, differing in labor productivity and scale, produce imperfect substitutes, charge different prices, and incur varying labor costs, yet adhere to the same industry minimum wage.



(a) Import and Retail Price

(b) Hops Import Price

Figure 2: Input prices

4 Model

We use a partial equilibrium, static framework, where firms in an oligopolistic industry sell differentiated products and compete by setting prices (Berry et al. 1995). Firms that produce locally hire workers in the labor market to manufacture the products they sell to consumers in the product market. Alternatively, firms that sell imported products do not require hiring manufacturing workers. Manufacturing is the only process that affects variable costs and needs labor in our framework. A policymaker sets the minimum wage at the beginning of each period, then firms take it as given when making pricing and hiring decisions. For simplicity, we assume that consumers and workers belong to separate households.

4.1 Consumers

Consumers -indexed by i- make discrete choices among available products $\mathcal{J}_{mt}$ and a no-purchase outside option -indexed by 0- in retail market m at time t[26]. Consumers choose the product j that maximizes indirect utility, which is represented by a linear index that considers prices p_{jmt}, exogenous attributes x^d_{jmt}, unobserved quality ξ_{jmt} and idiosyncratic preferences ε_{ijmt}.

$$u_{ijmt} = \gamma_{imt}\mathrm{x}^d_{jmt} + \alpha_{imt}p_{jmt} + \xi_{jmt} + \varepsilon_{ijmt} \tag{1}$$

Preferences for products in certain categories h might be correlated (Cardell 1997), so we include a one-level nest specification with $\varepsilon_{ijmt} = \bar{\varepsilon}_{ih(j)mt} + (1-\rho)\bar{\varepsilon}_{ijmt}$ distributed Generalized Extreme Value. We consider parametric distributions of taste parameters (γ_i, α_i) that account for consumers' income y_{imt} and unobserved preference heterogeneity. We interact both types

[26] A retail market m identifies a geographical location.

of heterogeneity with product characteristics, indexed by k. We specify the model to estimate flexible substitution patterns and inform the extent of competition between firms. In our setting, this is a relevant channel for understanding the welfare effects of the minimum wage. The full specification for $(\gamma_{imt}, \alpha_{imt})$ is:

$$\alpha_{imt} = -\exp(\alpha_0 + \sigma_\alpha \nu_{i\alpha} + \kappa_\alpha y_{imt}) \tag{2}$$

$$\gamma_{imt} = \sum_k (\gamma_{0,k} + \gamma_{y,k} y_{imt} + \sigma_k \nu_{ik}) \tag{3}$$

To answer our question we need plausible estimates of how marginal cost changes are passed-through to prices. In principle, the pass-through rate of a particular product depends on the own price elasticity and on the curvature of residual demand. However, in multinomial or mixed logit models with constant price sensitivity, the curvature of demand is imposed rather than estimated and the pass-through rate is incomplete. The specification of α_i overcomes this limitation (Miravete et al. 2023) by allowing ex-ante for a broad range of estimable demand curvatures. We normalize the utility of the outside option $u_{i0mt} = 0$ and draw unobserved taste for product characteristics ν_{ik} from the standard normal distribution. For a given month, market shares are given by integrating over the distribution of consumers who vary in income, unobserved tastes for characteristics, and idiosyncratic error terms,

$$s_{jmt} = \int \frac{\exp\left(\alpha_{imt} p_{jmt} + \gamma_{imt} \mathrm{x}_{jmt} + \xi_{jmt}\right)}{1 + \sum_{k \in \mathcal{J}_{mt}} \exp\left(\alpha_{imt} p_{kmt} + \gamma_{imt} \mathrm{x}_{kmt} + \xi_{kmt}\right)} dF(i) \tag{4}$$

When estimating the model, we match "second" choice aggregate diversion moments that exploit a natural experiment that removed a group of products from the choice set of certain consumers. We follow the procedure developed by (Conlon, forthcoming). In this case, we calculate "second" choice shares conditional on a given first choice, by integrating consumers' choice probabilities when the group of products is removed, weighted by consumers' probability of making that first choice (Conlon and Mortimer 2021). When the group of products $\mathcal{J}_{rem}$ is removed in mt, the diversion ratio to product k is:

$$D_{\mathcal{J}_{rem} \to k,mt} = \frac{s_{kmt \setminus \mathcal{J}_{rem}} - s_{kmt}}{\sum_{j \in \mathcal{J}_{rem}} s_{jmt}} = \frac{1}{\sum_{j \in \mathcal{J}_{rem}} s_{jmt}} \int \frac{s_{ikmt}\left(\sum_{j \in \mathcal{J}_{rem}} s_{ijmt}\right)}{1 - \sum_{j \in \mathcal{J}_{rem}} s_{ijmt}} dF(i) \tag{5}$$

The choice probability of an individual consumer (s_{ijmt}) is calculated according to the term inside the integral in (4), and the term $s_{kmt \setminus \mathcal{J}_{rem}}$ represents the market share of product k after the removal.

4.2 Workers

Workers -indexed by n- make discrete choices over firms in the labor market at time t, considering posted wages w_{gt}, amenities z_{gt} and idiosyncratic unobserved preferences ψ_{ngt} (Kroft et al. 2021, Berger et al. 2022). We assume that there is a unified labor market, so only the time dimension matters.[27] Firms do not observe workers' preferences and can not wage-discriminate, so every worker in g earns the same wage. However, workers' next best alternatives differ, so infra-marginal workers receive positive rents in equilibrium.[28] Workers' choices maximize an indirect utility function:

$$u_{ngt} = \ln w_{gt} + \ln z_{gt} + \theta\psi_{ngt} \tag{6}$$

In this framework, workers view firms (jobs) as imperfect substitutes and firms have to compete to attract them. The degree of imperfect substitution is measured by the variance parameter θ that controls the relationship between jobs' vertical and horizontal differentiation. When there is pure vertical differentiation ($\theta = 0$), the best job is the one that offers the highest $u_{.gt}(w_{gt}, z_{gt})$. In this case, all workers want to work for the firm that offers that job only. Alternatively, when there is pure horizontal differentiation ($\theta \to \infty$) each worker wants to work at the firm where ψ_{ngt} is the highest, irrespective of wages or amenities. In our model, an imperfect labor market implies that both types of differentiation coexist ($0 < \theta << \infty$). To calculate the probability of accepting a job in a particular firm, we assume that ψ_{ngt} follows a Gumbel distribution and that all workers are employed. We use the probability and the labor market size ($\bar{L}_t$) to calculate the inverse labor supply curve that firm g faces. The function relates the wage it offers (w_{gt}) with the number of workers it attracts (L_{gt}) and information about amenities and general labor market conditions (U_{gt}).

$$w_{gt} = U_{gt} L_{gt}^{\theta} \tag{7}$$

In the model, the labor supply elasticity is constant and common to all firms ($\eta_w^L = 1/\theta$), and so is the markdown in the no-minimum wage scenario ($1 + \eta^{-1} = 1 + \theta$).[29] Notice how pure vertical differentiation implies an infinitely elastic labor supply, a competitive labor market and no markdown; while pure horizontal implies an inelastic labor supply, a captive labor market and an infinite markdown.

[27] This assumption is based on the fact that we do not observe workers' locations in our payroll data. However, apart from two cases, all factories are situated in the region that includes the Capital (Montevideo) and its Metropolitan Area

[28] They depend on individual unobserved $\psi_{ng't}$

[29] A constant markdown might still imply different employment and output distortions with respect to the no-markdown equilibrium. The slope of labor demand may -as it is the case in our empirical application- differ between firms.

Alternatively, the term U_{gt} is firm-specific and captures the effect of amenities (z_{gt}) and labor market conditions (Ξ_t).

$$U_{gt} = z_{gt}^{-1}\Xi_t \quad \text{with} \quad \Xi_t = \left(\frac{\sum_{k\in G}(w_{kt}z_{kt})^{1/\theta}}{\bar{L}_t}\right)^{\theta}$$

We assume that when a firm posts a wage, it does not internalize its influence on posted wages in other firms: firms are strategically small in the labor market.[30] This is consistent with our empirical application, where the minimum wage is industry-specific, but the relevant labor market might be broader once we consider workers' mobility. Workers are not constrained to work in the beer industry only.[31]

4.3 Firms

In our model, firms may participate in multiple retail markets -indexed by m- at time t. Nonetheless, production is centralized and firms produce at a single factory: g identifies firms, production facilities and jobs. Their portfolio may include imported and domestic products $\mathcal{J}_g = \mathcal{J}_g^I \cup \mathcal{J}_g^D$. We assume imported products have constant marginal costs, but for domestic products are endogenous and vary based on how much the firm produces at time t. In this case, costs result from a cost function $\mathcal{C}_{gt}^D(\cdot)$ that depends on the level of production Y_{gt}^D required to serve all markets, which we assume equal to sales $Y_{gt}^D = Q_{gt}^D$. To characterize products' marginal costs and solve the pricing problem of the firm, we describe first how firms produce and the cost function of domestic products. The marginal cost of these products is what connects product and labor markets in our model.[32]

4.3.1 Production

The scale of a firm's operation depends on the total production of domestic products at t. The firm uses workers L_{gt}, capital K_{gt} and materials M_{gt}, according to a production function:

$$Y_{gt}^D = H_g(A_{gt}, L_{gt}, K_{gt}, M_{gt}; \beta_g) \tag{8}$$

Technology and productivity are summarized by the vector of parameters β_g and an unobserved component A_{gt}. We further assume that workers and capital are homogeneous and interchangeable in the production of different products within the firm. These assumptions represent the beer industry appropriately according to market participants, and are in line

[30] Formally, this implies that $\frac{\partial \Xi_t}{\partial w_{kt}} = 0$.

[31] Firms in the beer industry are a subset of the total number of firms in the labor market G

[32] For the same reason, imported products do not require any labor in our framework. Consistently, in our empirical application we separate production workers from the rest, which we consider part of the fixed cost of the firm.

with previous studies for the US and Canada (Grieco et al. 2018, De Loecker et al. 2022). The aggregate production function is consistent with fixed labor and capital proportions that add up to one, once all products in all markets served at t are considered: $a^D_{jmt} = \frac{L_{jmt}}{L_{gt}} = \frac{K_{jmt}}{K_{gt}}$ (DeLoecker et al. 2021). This aggregate specification allows us to study hiring decisions at the firm level.

Following De Loecker et al. 2022, we parameterize the production function using Leontief technology with fixed proportions between materials and value added. This captures the fact that, for example, hops and malt cannot be replaced for capital or workers. Materials $M_{k,gt}$ may include hops, bottles and malt, and vary according to a composite technology term $\beta^k_{M,g}$. Value added is Cobb-Douglas with Hicks-neutral productivity A_{gt} and constant capital and labor elasticities with respect to output $\{\beta_K, \beta_L\}$. The aggregate production function is:[33]

$$\sum_{m\in\mathcal{M}}\sum_{j\in\mathcal{J}^D_{gmt}} y^D_{jmt} = Y^D_{gt} = A_{gt}L^{\beta_L}_{gt}K^{\beta_K}_{gt}\sum_{m\in\mathcal{M}}\sum_{j\in\mathcal{J}^D_{gmt}}\left(a^D_{jmt}\right)^{\beta_L+\beta_K} + \sum_k \beta^k_{M,g}M_{k,gt} \tag{9}$$

4.3.2 Marginal Cost

We use the production function to characterize the cost function behind the marginal costs of domestic products.[34] In this case, marginal costs result from the cost function that solves the short-run cost-minimization problem of the firm. For this problem, we treat labor and materials as variable inputs, and capital as fixed (Ackerberg et al. 2015). We assume that marginal costs are endogenous $c_{jmt}(Q^D_{gt})$ because labor costs are a function of sales through employment and production, according to the production function (9).[35] The variable cost of production of national products in a given month is:

$$\mathcal{C}^D_{gt}(Q^D_{gt}) = w_{gt}\big(L_{gt}\big)L_{gt} + \sum_k \beta^k_{M,g}M_{k,gt} \tag{10}$$

Considering that employment is an explicit function of sales $L_{gt}(Q^D_{gt})$ through equation (9), the wage policy w_{gt} is the only element needed to specify how labor and product markets are related through $c_{jmt}(\cdot)$.

We consider three cases. First, when the minimum wage $\underline{w}_t$ binds on the labor demand, the firm faces an excess of labor supply and pays workers the minimum wage applicable in period t. Second, when the minimum wage doesn't bind, the firm faces the labor supply curve

[33] We define $\mathcal{M}$ as the set of retail markets (locations) served by the firm and assume it remains constant during the period we study.

[34] For simplicity, we present the model assuming that β_L and β_K are common across firms, that returns to scale are constant ($\beta_L + \beta_K = 1$), and that there are no other product or firm-specific cost components. We relax some of these assumptions in the empirical section.

[35] For imported products, marginal costs are constant and do not require special consideration.

of equation (7). In this case, the firm hires workers where marginal cost equals marginal revenue, and pays employed workers on the labor supply. Here, firm-level production is inefficiently low and the wage is below the marginal revenue product of labor. Finally, when the minimum wage binds on the labor supply, the firm pays employed workers the minimum wage, but different from the first case, it has an excess of labor demand. However, raising wages is not optimal either, given that marginal cost is higher than marginal revenue due to the no-discrimination wage policy. The policymaker can remove the constraint by increasing $\underline{w}_t$, raising effective wages, employment and firm profit at the same time. The marginal cost of domestic products for cases one and two, respectively, is[36]:

$$\frac{\partial \mathcal{C}^D(Q^D_{gt})}{\partial q_{jmt}} = \frac{1}{\beta_L}\frac{\underline{w}_t L_{gt}}{Q^D_{gt}} + \sum_k \frac{p^M_{k,gt}}{\beta^k_{M,g}} \tag{11}$$

$$\frac{\partial \mathcal{C}^D(Q^D_{gt})}{\partial q_{jmt}} = \frac{(1+\theta)}{\beta_L}\underbrace{\frac{w_{gt} L_{gt}}{Q^D_{gt}}}_{lc_{gt}(\cdot)} + \sum_k \frac{p^M_{k,gt}}{\beta^k_{M,g}} \tag{12}$$

Notice that the marginal cost of q_{jmt} contains a labor cost element lc_{gt} that is common to all national products in all markets served at t.[37] The wage policy and the minimum wage affect the cost of domestic products and equilibrium in the product market through this term. When the minimum wage does not bind (12), the term $(1+\theta)$ represents the equilibrium markdown $(1+1/\eta^L_w)$, which is decreasing in the elasticity of labor supply.

Moreover, in the model higher capital K_{gt} and higher productivity A_{gt} firms have lower marginal costs (higher Q_{gt}/L_{gt}). In our empirical application, the labor productivity of non-craft firms is approximately ten times larger than in craft ones, so a uniform minimum wage may have different implications in marginal cost levels. Finally, marginal costs might differ also because firms pay -as we observe in the data- different prices for materials $p^M_{k,gt}$ or use different technology $\beta^k_{M,g}$.[38]

Marginal costs might contain other elements unrelated with the production process as well.[39] In order to parameterize marginal costs, we isolate the endogenous labor cost lc_{gt}, arrange

[36]The difference with case three is related to the shadow cost it introduces to reflect the hiring constraint and prevent firms from hiring additional workers. In this case, the marginal cost has a discontinuity and the equilibrium markdown is in the range $(0,\ 1+1/\eta^L_w)$. We handle this case in the empirical section.

[37]The result uses the fact that Q_{gt} is the sum of q_{jmt} across products j in $\mathcal{J}^D_{gmt}$ and across markets m in $\mathcal{M}$, so $\frac{\partial Q_{gt}}{\partial q_{jmt}} = 1$

[38]In the case of prices differences, they may originate in quality -craft brewers may use better quality hops- or bulk buying. For this reason, we do not use the price of hops when instrumenting for endogenous prices in the demand model.

[39]Different from other countries like the US, firms in the beer industry can be vertically integrated and distribute and sale their own products. As a result, marginal cost may contain distribution and retail related costs.

the full set of exogenous attributes in $\mathrm{x}_{jmt}^{s,ex}$, and include an unobserved cost shock ω_{jmt}:

$$mc_{jmt}(Q_{gt}) = \lambda_j^{lc} lc_{gt}(Q_{gt}) + \lambda_j^{ex} \mathrm{x}_{jmt}^{s,ex} + \omega_{jmt} \tag{13}$$

The vector of coefficients $\{\lambda_j^{lc}, \lambda_j^{ex}\}$ is allowed to vary by product, to acknowledge the difference between domestic and imported products in our framework.[40] According to our specification of the production process, the coefficient λ_j^{lc} has a structural interpretation: it depends on the elasticity of output with respect to labor (β_L), and potentially, on the elasticity of labor supply ($\eta = \theta^{-1}$), depending on whether the minimum wage has an active or passive role in the equilibrium under consideration.[41] Additionally, the vector $\mathrm{x}_{jmt}^{s,ex}$ may contain both product specific (the price of materials for domestic products or the import price for imported products) and common attributes (gas prices or taxes).

4.3.3 Firm problem

We use previous results on products' marginal cost to solve the pricing problem of the firm. We assume that firms play a static, full information, simultaneous move pricing game each period t. Firms know the distribution of shocks for consumers (ε) and workers (ψ) but not their realizations.

The timing of events is as follows. First, firms choose prices p_{jmt} to maximize profits in each product market, and make simultaneous wage offers w_{gt} in the labor market, consistent with those prices.[42] Consistency implies that, for any candidate vector of equilibrium prices $\mathbf{p}_t$, firms need to hire workers to produce enough output in order to serve the associated demand for domestic products $Q_{gt}^D(p_t)$ at those prices. Afterwards, consumers and workers observe their preference shocks and decide. Payoffs—utilities, wages, and profits—are realized.

We work under the assumption that observed prices and wages constitute a Nash equilibrium in the pricing and wage posting game, and that marginal costs in (13), sales, production and employment are consistent with it. The first order condition of a firm's problem in market m at time t is:

$$q_{jmt}(p_{mt}) + \sum_{k \in \mathcal{J}_{gmt}} \Big(p_{jmt} - mc_{jmt}(\cdot)\Big) \frac{\partial q_{jmt}(p_{mt})}{\partial p_{kmt}} = 0 \tag{14}$$

The assumption regarding the price setting behavior of firms implies that the first order conditions are standard, and that we can estimate consumer demand using only a subset

[40] In fact, $\lambda_j^{lc} = 0$ for imported products.
[41] This notation can accommodate the case of firm-specific production technology $\beta_{L,g}$.
[42] For firms offering imported products only, this is the traditional pricing game except for the fact that the minimum wage affects them through competition in the product market.

of the markets firms serve each period.[43] We use these first order conditions and previous modeling assumptions to estimate jointly consumer demand and marginal costs in the next section.

5 Estimation and Main Results

5.1 Specification details and Instruments

We estimate consumer demand in a single retail market m per period t. The retail market is the group of large supermarkets in the Capital and its Metropolitan area, which accounts for 79% of national sales in this type of store.[44] For the purpose of this paper, defining more granular markets and including smaller regions would introduce the problem of multiple equilibrium in the counterfactual analysis (Bulow et al. 1985), with little additional gain in terms of identifying consumer heterogeneity.[45] As a result, we omit the subscript m in what follows, except where necessary.

We include unobserved preference heterogeneity for the inside good (σ_0), the price sensitivity (σ_α), and craft characteristic (σ_C). We further consider a nesting parameter (ρ) to account for correlated preferences for lager products, in line with observed consumer behavior in the removal experiment. In the baseline specification, we don not consider income heterogeneity due to lack of meaningful time variation.

To account for price endogeneity, we use a vector of demand side instruments (z^d_{jt}) that include product attributes (x^d_{jt}) and a set of excluded instruments. We decompose unobserved quality (ξ_{jt}) into product and time fixed effects, and an unobserved deviation term ($\xi_{jt} = \xi_j + \xi_t + \Delta\xi_{jt}$), in line with Hausman et al. 1994. Product fixed effects (ξ_j) absorb consumer mean valuation ($\gamma_{0,k}$) for attributes that are constant over time. Nevertheless, we use product characteristics (brand, beer style, and dummies for craft, domestic, alcohol content and bitterness) to create price instruments.[46]

The set of excluded instruments contain prices in previous periods ($p_{j,t-1}$), contemporaneous prices in smaller regions (m') not included in the analysis ($p_{j,m't}$) and exogenous input prices interacted with product characteristics. For imported products, we use their import prices, and for domestic products we use firm-level prices of inputs uncorrelated with unobserved quality (bottles and malt).[47] Excluded instruments also contain interactions between beer

[43] Formally, $\frac{\partial q_{km't}(p_{m't})}{\partial p_{jmt}} = 0 \;\; \forall m \in \{\mathcal{M} \setminus m\} \;\; \& \;\; \forall k \in \mathcal{J}_g$

[44] The market definition (region $\times$ time) is in line with the one used by (Miller et al. 2017), for example.

[45] In Appendix (8) we display the results of using a similar model using a more granular market definition and show that the main summary statistics do not differ greatly.

[46] For Alcohol by Volume (ABV) and International Bitterness Units (IBU), we classify products based on whether they are below or above the median in our sample

style and time, to account for the fact that Lager (Ale) products are consumed more intensively in the warm (cold) season. Joint with the traditional within-group share instrument, this instrument also contributes to identify ρ in our model.

In our supply specification, the labor cost of national products (13) is an explicit function of quantity and prices. In this case, we address endogeneity concerns following the literature on production function estimation (Olley et al. 1996, Ackerberg et al. 2015), and use as excluded instruments fixed inputs in current period (K_{gt}), and flexible and fixed inputs in previous periods ($K_{g,t-1}, lc_{g,t-1}$).[48] We estimate the first-stage by least-squares using these instruments and work with predicted values $\hat{lc}_{gt}$ during the estimation routine.[49] Additionally, we consider exogenous product attributes ($x_{jt}^{s,ex}$) that vary according to the origin of the product. For domestic products, we include the import price of hops and bottles and the export price of malt, while for imported products we use the import price of the final product.[50] We decompose cost shocks into product, month and year fixed effects, and an unobserved deviation term ($\omega_{jt} = \omega_j + \omega_{mo} + \omega_{yr} + \Delta\omega_{jt}$).[51]

Finally, we include "second" choice aggregate diversion moments, that consider the removal of a subset of products from the choice set of certain consumers between June 2020 and November 2021.[52] The removal resembles a real experiment, where certain products are excluded from a selling point for a period of time. In this case, the experimenter is unable to observe the decision of individual consumers, but only shares before and after the removal takes place. We match the diversion ratios calculated with the model for markets in the first quarter of 2020, with the ones observed after June 2020 for the outside good (no-purchase option) and relevant inside products, following Conlon et al. 2024. This approach allows us to uncover rich consumer preference heterogeneity, despite estimating demand with aggregate market shares, a single market per period, and no data on individual consumers.

5.2 Estimation

We estimate the model with GMM, following the procedure outlined by Berry et al. 1995, and incorporate the "second" choice aggregate diversion moments according to the procedure

[47] We use CIF prices. CIF (Cost, Insurance, and Freight) is the import price reported to customs, including the cost of goods, insurance, and transport cost to the destination country.

[48] We build a series of observed labor cost using data on gross wages, employment, workers categories and production. Due to our inability to identify craft firms by name in our employment data, our measure of labor cost aggregates across them. See (ref Data)

[49] See first-stage.

[50] In months without transactions, we use data on previous months. The export price is FOB (Free On Board), in the custom of origin.

[51] We don't consider market fixed effects (ω_t) because, jointly with ω_j, they would absorb most of the variation contained in $\hat{lc}_{gt}$

[52] See details in Appendix (8).

developed by Conlon et al. 2024.

Moments are built using a two step procedure that incorporates demand (z^d_{jt}) and supply (z^s_{jt}) instruments. The goal is to search for the combination of parameters of the model that match predicted and observed market shares. First, we use a candidate solution for the parameters that drive consumer heterogeneity and compute mean utility (δ_{jt}), in order to match shares and infer the vector of unobserved quality (ξ_{jt}). Then, we compute marginal cost (mc_{jt}) and cost shocks (ω_{jt}) using the model and the first order conditions of the firm. Second, we estimate the fixed effects and build demand and supply moment conditions, by interacting structural error terms with their corresponding instruments:

$$g^d(\Theta) \equiv \mathbb{E}[\Delta\xi_{jt}(\Theta)z^d_{jt}] \tag{15}$$

$$g^s(\Theta) \equiv \mathbb{E}[\Delta\omega_{jt}(\Theta)z^s_{jt}] \tag{16}$$

The vector Θ contains the full list of parameters included in the model. "Second" choice aggregate diversion moments $g^{sc}(\Theta)$ are included at this stage and match observed "second" choices with the ones calculated using the model (5). When calculating $g^{sc}(\Theta)$, we weight consumers according to the ratio between sales in treated selling points and total sales, in the period before the removal took place. If the model is correctly specified, moment conditions $\{g^d(\Theta), g^s(\Theta), g^{sc}(\Theta)\}$ are equal to zero when evaluated at the true value of the parameters Θ_0. We estimate the model by minimizing the following objective function, where W is a weighting matrix and $g(\Theta)$ is a vector that stacks the moment conditions described before:

$$\min_{\Theta} \; q(\Theta) = g(\Theta)' W g(\Theta) \tag{17}$$

We estimate demand and supply using PyBLP (Conlon and Gortmaker 2020). We employ the two step GMM procedure with a derivative based optimization algorithm, approximate the market share using individuals' nodes and weights according to the Gauss-Hermite product rule, and use an error tolerance of 10^{-10} for the contraction mapping.

5.3 Estimates

Table (3) reports the estimates of the parameters associated with consumer preference heterogeneity, mean price sensitivity[53] and marginal costs, and main summary statistics.

5.3.1 Demand

We estimate relevant unobserved heterogeneity in the price sensitivity (σ_α) and a significant distaste for prices (α_0). Notice that, while the negative sign is imposed, the magnitude of

[53]To be precise, the price sensitivity of the consumer with $\nu_{i,\alpha} = 0$

Table 3: Demand and Supply Estimates

Variable	Parameter	RCNL-1	RCNL-2	Logit
Demand				
Price	$\exp(\alpha_0)$	-2.20 (0.37)	-2.38 (0.18)	-3.31 (0.08)
RC - Price	σ_α	0.95 (0.18)	1.04 (0.16)	
RC - Inside Good	σ_0	2.24 (0.46)	2.71 (0.45)	
RC - Craft	σ_C	0.94 (0.16)	0.87 (0.15)	
Nest - Lager	ρ	0.66 (0.03)	0.63 (0.03)	
Supply				
Labor Cost - Dom ($\mathcal{J}^D$)	λ^{lc}	3.81 (0.22)	3.83 (0.23)	4.7 (0.42)
Hops - Dom ($\mathcal{J}^D$)	λ_H	0.009 (0.001)	0.01 (0.001)	0.015 (0.002)
Imp. Price - Imp ($\mathcal{J}^I$)	λ_I	1.36 (0.04)	1.47 (0.12)	3.0 (0.092)
Summary Statistics				
Median Own-Price Elasticity		-3.49	-3.55	-2.34
Median Market Price Elasticity		-0.11	-0.08	-0.12
Median Outside Good Diversion		12.4%	16.5%	89.8%
Fixed Effects				
Product - Demand	ξ_j	Y	Y	Y
Market - Demand	ξ_t	Y	Y	Y
Product - Supply	ω_j	Y	N	N
Month, Year - Supply	$\omega_{m(t)}$	Y	Y	Y

Note: Standard errors are displayed in parentheses. We use monthly data between April 2015 and June 2022, and only consider products that were available in at least 50 markets. N: 3,722 observations, 87 markets and 54 products. The price sensitivity of the mean consumer ($\exp(\alpha_0)$) is evaluated at $\nu_{i,\alpha} = 0$.

the coefficient is not. Furthermore, unobserved heterogeneity in the preference for the inside good is sizeable. This is the result of observed consumer behavior in the removal experiment. Despite excluding products that accounted for 92% of sales, most consumers remained in the market: observed diversion to the outside good was only 38%.[54] Consumers exhibit unobserved preference heterogeneity for craft products and correlated taste for Lager products, as indicated by the estimates of the associated random coefficient and nest parameters. In contrast, they do not show significant heterogeneity for Ale or Imported attributes. Overall, we are able to estimate rich consumer preferences for the product's characteristics that are important for this study.

The estimates of price elasticity are similar to the ones found in previous studies of the beer market, though in our framework consumers seem to be less price sensitive. The median estimate of the own-price elasticity is similar to Romeo 2016, Hidalgo 2023 and slightly below Miller et al. 2017, Fan et al. 2020; while the median diversion to the outside good is in line with Miller et al. 2017.[55] We estimate a market-level price elasticity of -0.11, lower

[54]The plain-vanilla logit model predicts a 95% diversion rate in this case.
[55]Median own-price elasticity of -4.74 in Miller et al. 2017 preferred specification, and between -5.8 and -10.1

in absolute terms than previous studies, but below one as in Miller et al. 2017. Regarding product categories, we find that craft products have a higher median own-price elasticity than non-craft (-4.2 vs -3.1), in line with the findings of Hidalgo 2023, Fan et al. 2020 for the US.[56]

5.3.2 Supply

We use our supply side estimates to recover the elasticity of output with respect to labor ($\hat{\beta}_L$). According to our specification of the production process and the assumption on firms' short-run cost-minimizing behavior, the coefficient on labor cost $\hat{\lambda}^{en}$ has a structural interpretation.[57] However, without additional information regarding whether the equilibrium we observe is consistent with the marginal costs of Equation (11) or (12), in principle, we are not able to distinguish between the two possible cases $\{\frac{1+\theta}{\beta_L};\ \frac{1}{\beta_L}\}$. To overcome this limitation, we assume that, for the number of workers we observe in the data, the current minimum wage is higher than the marginal cost of hiring and binds on firms' labor demand (11).[58] This assumption is also supported by the high level of the industry's minimum wage compared to those in other industries (Ramirez et al. 2022).

In this context, we interpret $\hat{\lambda}^{en}$ as containing information only about the output-labor elasticity ($\hat{\beta}_L = 0.33$). The implied coefficient, once the value added tax has been accounted for, is similar to De Loecker et al. 2022, who estimated the same production function for the US using cost data only. The coefficients on materials are significant and have the expected sign as well. The magnitude of the coefficient on hops imply a unitary cost for craft products of 25 cents per serving, which aligns with the average cost of 20 cents per serving as reported by craft brewers. The coefficient on imported products is consistent too, as more expensive products are sold to consumers at higher prices.

5.3.3 Marginal Costs, Markups and Diversion Ratios

The marginal cost of national products is higher for craft products compared to non-craft (industrial) products. In our preferred specification (RCNL-1), the marginal cost ratio of craft relative to non-craft products was 5.6 during 2020/21, on average[59]. From our model, we can explain part of the difference through heterogeneous labor costs and input prices. First,

in Fan et al. 2020

[56](Hidalgo 2023) estimate a median own-price elasticity of -3.4 for flagship products and -8.6 for craft ones. Alternatively, (Fan et al. 2020) estimate a median of -6.3 for non-craft and -9.7 for craft.

[57]See Equation (13).

[58]Observed wages would need to compensate for very low levels of amenities, and this is not a plausible explanation according to market participants. In fact, according to the owner of one of these firms, they *"receive hundreds of application each time they post a wage offer at the current minimum wage level* $\underline{w}$*"*.

[59]This is above the 4.8 estimated by (Hidalgo 2023) for the US in 2016. However, different from their context, in Uruguay the price differences are larger (≈95% versus 55-70% in US).

craft products are more expensive to produce because the labor cost element of marginal costs is 55% higher. Second, craft firms pay for hops twice what non-craft firms pay. These production components explain approximately 25% of the total gap in marginal cost between these two types of products (US$1.53 per serving). Arguably, there might be other factors associated with distribution or retail activities that explain the remaining part, and are contained in supply structural cost shocks in our model. Market prices do not reflect fully these cost differences and equilibrium markups ($\mu_u = \frac{p}{mc}$) in craft products are lower than in non-craft. During 2020/21, the average markup in craft products was ($\mu_u^C = 1.3$) and in non-craft ($\mu_u^{NC} = 3.1$), in line with the estimates Hidalgo 2023 for craft (1.2) and flagship (3.5) products.

The median non-craft to craft diversion ratio is 5%, lower than the 25-35% range than Hidalgo 2023 finds for the US. Diversion ratios inform the extent of direct competition in the product market (2023 U.S. Merger Guidelines). In our study, this is relevant because it reveals how much price changes in the products of one firm, affect residual demand and production in competing firms. Estimated diversion ratios points towards a low level of competition between craft and non-craft products. In the Uruguayan market, craft products do not seem to be an important competitive threat to traditional industrial brewers. Our findings are consistent with those of Fan et al. 2020, who estimated that consumers of craft products tend to exhibit strong loyalty to this category.

Summarizing, results show sizable marginal cost differences between craft and non-craft products, weak direct competition as implied by low non-craft to craft diversion ratios, and higher elasticity on the segment of residual demand where craft firms operate. These facts are central to understand the results of the counterfactual analysis we conduct next.

6 Alternative Labor Market Policies

We perform two sets of counterfactual analyses to study the welfare consequences of alternative labor market policies for consumers, workers and firms. In the first counterfactual, we search for the industry minimum wage that maximizes social welfare, and discuss the role that the positive correlation between labor and product market power plays in our results. In the second, motivated by the low degree of substitution between craft and non-craft products that we estimate, and differences in firms' size and productivity, we simulate alternative product and labor market equilibrium under distinct industry minimum wages for craft and non-craft firms. In what follows, we first describe briefly the basic implementation details and characterize the measure of welfare we use, and then present the results of our counterfactual analysis.[60]

[60]See Appendix (8) for implementation details.

6.1 Implementation details

6.1.1 Labor supply and wages

We calibrate the inverse labor supply curve that firms would face in the absence of the industry-specific minimum wage.[61] In the case of the labor supply elasticity, we follow recent evidence for Uruguay (Casacuberta et al. 2023) and assume that small craft (large non-craft) firms face a more elastic (more inelastic) labor supply curve and have less (more) labor market power.[62] For amenities ($U_{gt'}$), the calibration allows small craft firms to attract a certain number of workers when offering the National minimum wage.[63] [64] Notably, the core results of our study do not depend on the particular details of this calibration.[65]

We make three assumptions regarding how the level of the minimum wage translates into effective wages. First, we relate changes in the minimum wage to changes in effective wages using an elasticity of one, in line with the findings of Casacuberta et al. 2023 and Hermo 2023 for Uruguay and Argentina, respectively.[66] Second, based on the descriptive evidence, for craft firms we assume that when the industry minimum wage binds, it coincides with effective wages. Third, for non-craft firms we assume that the ratio between the minimum and the average wage that we observe in the data remains constant.[67] Despite the existence of four occupation-specific minimum wages related to manufacturing activities, the ratio between categories remained constant in the period we study. The minimum indexes the entire wage structure in these firms.

6.1.2 Social Welfare

We calculate social welfare as the un-weighted sum of consumer surplus, workers' rents and producer surplus (firms' profits).[68] In our framework, all measures are a function of the

[61] We describe the inverse labor supply curve in Equation (7).
[62] Formally, the inverse of the elasticity in craft firms is lower than in non-craft ($\theta_C \leq \theta_{NC} \iff \eta_C \geq \eta_{NC}$). Studies for other developing (Amodio et al. 2021) and developed (Yeh et al. 2022) countries find a similar relationship between firm size, markdowns and the labor supply elasticity.
[63] This term contains information about firm level amenities and the general situation of the labor market. Because we assume firms to be strategically small relative to the labor market, we describe it only referring to its amenities component.
[64] Approximately 18% of employed workers earn a wage in the range 1.0-1.5x the National minimum wage. For workers with less than 12 years of formal education, this is a relevant benchmark.
[65] In the baseline specification, we use ($\theta_C = 0.1$) for craft and ($\theta_{NC} = 0.25$) for non-craft firms, consistent with wages that would be marked down 9% and 20%, respectively, absent the industry minimum wage. In the case of amenities we use ($U_C = 440$) and ($U_{NC} = 276$), consistent with the largest non-craft firm offering 20% better amenities than craft. We show results using alternative parameterizations in Appendix (8).
[66] In Uruguay, internal studies conducted in the Ministry of Labor and Social Security find the same elasticity.
[67] Even though the minimum wage binds for new (entry) workers, in practice the average wage is above this level. This is the consequence of the existence of more than one production occupation, and of other benefits or payments related with, for example, tenure within firms.
[68] We abstract from fixed cost considerations.

minimum wage ($\underline{w}$) through equilibrium prices ($\mathbf{p}_t$) at time t. We refer to the minimum wage that maximizes this measure as the optimal minimum wage $\underline{w}^*$.

$$SW_t(\underline{w}) \quad = \quad CS_t(\mathbf{p}_t(\underline{w})) + WR_t(\mathbf{p}_t(\underline{w})) + PS_t(\mathbf{p}_t(\underline{w})) \tag{18}$$

We calculate consumer surplus using the log-sum formula (McFadden 1981), integrating over the estimated distribution of consumers' marginal utility of income (α_i). We assume that consumers in the beer market do not experience any income effect from price variations, so consumer surplus and the compensating variation coincide. The measure we use is:[69]

$$CS_t = \int \frac{1}{\alpha_{it}} \log \left[1 + \sum_{j \in \mathcal{J}_t} \exp\left(\alpha_{it} p_{jt} + \gamma_{it} \mathrm{x}_{jt} + \xi_{jt}\right)\right] dF(i) \tag{19}$$

We define workers' rents in line with Kroft et al. 2021, who follow Robinson 1933 and Rosen 1986: the rent of a given worker is the excess payment that she receives over what would be required to change her job choice. In practice, all workers have the same weight and total rents in a given firm are the difference between the equilibrium wage bill of the firm and the area below the inverse labor supply curve (7). In each period t, we measure rents in every firm g and then aggregate at the industry level according to:

$$WR_t = \sum_g \left(w_{gt} L^*_{gt} - \int_0^{L^*_{gt}} w^s_{gt}(L) dL \right) = \sum_g \left(w_{gt} L^*_{gt} - \frac{U_{gt}(L^*_{gt})^{1+\theta}}{1+\theta} \right) \tag{20}$$

Finally, we assume that social and private welfare coincide (Conlon and Rao 2020). As a result, social welfare can be expressed equivalently as the total area below the demand curve, net of total variable (non-labor) costs and the value of workers' next best alternatives.[70]

6.1.3 Simulation procedure

We simulate labor and product market equilibrium for every minimum wage ($\underline{w}$) set by the policymaker. From our description of the problem of the firm in Section (4.3.3), in equilibrium the prices that firms set in the product market and the wages they post in the labor market are consistent with each other. Consistency implies that the there is no profitable deviation in any market: the vector of market prices is an equilibrium in the product market given a vector of marginal costs, and the vector of wages associated with those marginal costs is an equilibrium in the labor market. At the vector of posted wages, firms are able to hire the

[69] We normalize the constant of integration to 0. Its value is not relevant when calculating welfare changes.
[70] We assume that firms' profits include Government revenues from value added and excise taxes. Notice that while we can infer revenues associated with the value added tax, we can not do the same for the excise tax. We assume that the excise tax is part of a product's marginal cost through $\hat{\omega}_{jt}$, and that it remains constant in our counterfactual analysis.

workers they need to produce and satisfy the demand they receive from consumers at the vector of equilibrium prices.

We use the estimated model and the calibrated labor supply curve to search for the equilibrium vector of prices (p_t) that would arise in each case, and then recover wages, employment, production and sales.[71] We operationalize the search using the concept of consistency defined above. We employ a fixed point iteration over product and labor markets' equilibrium with a tolerance of 10^{-9} for the maximum difference between shares in successive rounds. We simulate equilibrium for all markets in the period 2019-2021, using a grid of gross minimum wages in the range [525; 1,500] in intervals of US$ 25.[72]

Finally, to isolate inefficiencies related to labor and product market power from input misallocation, in our counterfactual we allow firms to adjust their capital-labor ratio before engaging in short-run price competition. We do this because changes in the minimum wage affect relative input prices and firms' optimal capital-labor ratios.[73]

6.2 Optimal Uniform Minimum Wage

The first labor market policy that we study is allowing the policymaker to establish the minimum wage that maximizes social welfare. We find that the gross minimum wage that maximizes social welfare is US$ 1,000 per month, compatible with an industry average wage 18.0% higher than the average under the no minimum wage scenario, and 93.7% higher than the National minimum wage.[74] We display the change in social welfare relative to baseline at each minimum wage level in Figure (3) and summarize the welfare gains that the optimal level ($\underline{w}^*$) achieves for consumers, workers and firms in Table (4). We use as baseline an equilibrium where the industry minimum wage coincides with the National minimum wage.[75]

The optimal minimum wage results in both winners and losers. Compared to the baseline, workers and the largest firm are better off under $\underline{w}^*$, while consumers and craft brewers are worse off. On one hand, the minimum wage is high for craft brewers, increasing marginal costs and prices, and reducing employment, production and sales. On the other hand, the optimal minimum wage mitigates labor market power in the largest firm and improves efficiency. This boosts effective wages, employment and profits at this firm, as well as in the industry due to its dominant size. For consumers, the welfare loss associated with the first effect outweighs

[71] Conservatively, we assume that remaining retail markets m' are not affected, so we focus on the market where we estimated the demand model only.
[72] Equivalent to 13 cents in the gross hourly wage of a full time worker.
[73] We explain the procedure in detail in Appendix (8) and discuss the consequences of this assumption in the Counterfactual Section (6.2).
[74] Relative to the current equilibrium, the observed minimum wage is 72.2% above the optimal.
[75] Since the National minimum wage is not binding in any equilibrium, the baseline scenario is equivalent to a situation without an effective minimum wage.

the gains from the second, leading to a reduction in consumer surplus (US$ 0.16 Million).

Consumers receive a modest share of the efficiency gains that mitigating labor market power in the dominant firm delivers. While the optimal minimum wage reduces marginal costs 5.5%, equilibrium prices of domestic products fall by a smaller amount (0.6%). Figure (??) displays changes in equilibrium marginal costs and prices of domestic products by firm relative to the baseline. Furthermore, once the equilibrium response in the prices imported products is accounted for, the aggregate price reduction is even lower (0.3%). The degree of product market power of this firm is large, so marginal cost savings in domestic products are pass-through to prices at a rate of 12%, on average. Operating over the inelastic part of the demand curve weakens the incentives of this firm to reduce prices and increase sales after a cost's reduction. The minimum wage that maximizes consumer surplus (US$ 550) is lower than the optimal minimum wage.[76] The main driver of the difference in consumer surplus between the two minimum wage levels is the reduction in the consumption of craft products. For minimum wages above US$ 550, and except in a neighborhood of $\underline{w}^*$, consumer surplus decreases monotonically. Consumers would be better off if the policymaker where to accept certain degree of labor market power in this industry.[77]

Table 4: Simulation Results - Uniform Minimum Wage

Optimal Minimum Wage $\underline{w}^*$ by Objective - (Variation vs Baseline No-MW Equilibrium)				
Welfare (US$ Million)	**Δ Cons. Surp.**	**Δ W. Rents**	**Δ Profits**	**Δ Soc. Welfare**
Social Welfare - MW: US$ 1,000	-0.16	1.52	0.49	1.85
Consumer Surplus - MW: US$ 550	0.00	0.03	-0.00	0.03
Equilibrium (Δ %)	$\Delta\bar{p}$	ΔQ_t	$\Delta\bar{w}$	ΔL_t
Social Welfare - MW: US$ 1,000	-0.3%	0.1%	18.0%	4.0%
Consumer Surplus - MW: US$ 550	-0.0%	0.0%	-0.0%	0.1%

Note: Welfare effects for markets in 2019/2021.

In craft firms, the optimal minimum wage binds on the labor demand and reduces sales (-14.2%), due to higher marginal costs (5.6%) and associated equilibrium prices (5.1%). Craft firms are more labor-intensive, less productive and face a more elastic residual demand curve, so higher labor costs are passed through one-to-one to prices, and result in more than proportional reductions in sales. According to our demand estimates[78] consumers have a taste for craft products, so the reduction in consumption entails a meaningful welfare loss. Therefore, when the price reduction in non-craft firms and the reduction of craft consumption are combined, consumers are worst off under the optimal minimum wage than under the no

[76] This level is 7% above the National MW.

[77] Importantly, our assumption on the specific degree of labor market power (θ_{NC}) changes the size of the gap between the two minimum wage levels, but not the underlying low pass-through rate that drives it.

[78] See Table (3)

minimum wage equilibrium. The minimum wage that mitigates labor market power and improves efficiency, reduces the welfare of consumers and craft firms' profits.

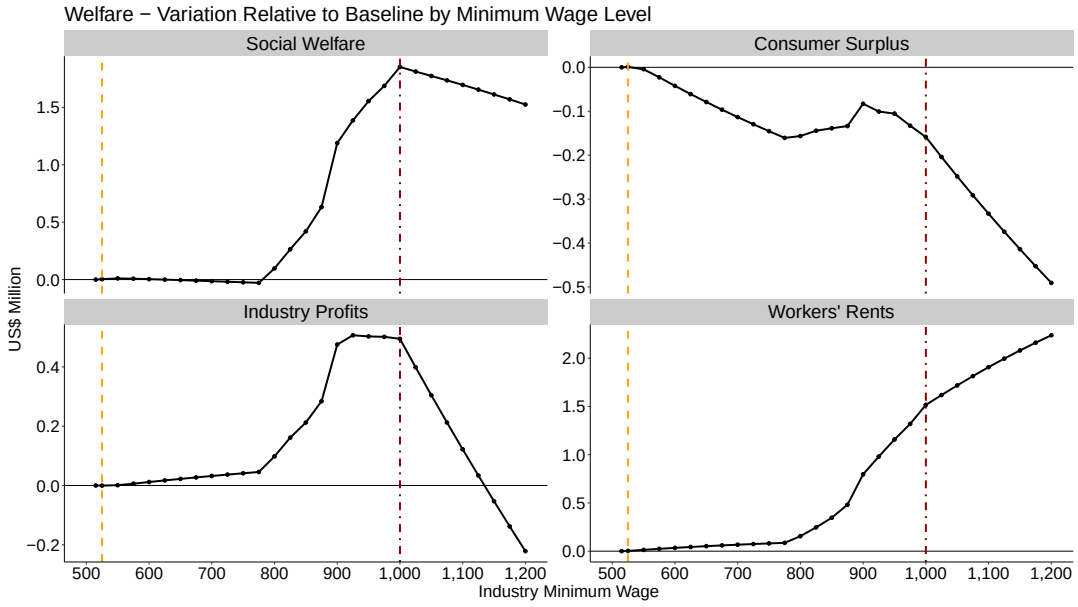
In contrast, the optimal minimum wage leads to improved outcomes for both workers and the largest firm. In the case of workers, despite lower employment at craft firms, average wages (18.0%), aggregate employment (4.0%) and total workers' rents in the industry are higher. The optimal minimum wage increases efficiency in the sense of Robinson 1933, and raises employment and effective wages simultaneously. Industry profits raise because the increase in the profits of the largest firm dominates the reduction in craft firms' (-10.9%). For the former, the low equilibrium pass-through rate implies that the price-cost margin increases. Still, the increase in profits at the largest firm is modest (2.6%). The reason is that labor market power represents a minor distortion relative to product market power in this industry, so addressing this inefficiency does not entail large aggregate welfare gains, except for workers. Then, even under the optimal minimum wage, efficiency gains do not translate into sizeable reductions in products' prices. In fact, equilibrium markups and product market concentration raise (marginally) under the optimal minimum wage.

Jobs lost at craft firms under the optimal minimum wage are compensated by an increase in equilibrium employment at the largest firm. The reason is that mitigating monopsony reduces the marginal cost of labor, and incentivizes firms to hire additional workers. Lower own-hiring costs affect equilibrium employment through two channels in our framework. First, lower labor costs reduce marginal costs and prices, expanding sales, production and employment. This effect, that materializes in an increase in the manufacturing of domestic non-craft products explains approximately 18% of the increase. The second channel is a consequence of the assumption of no input misallocation. We assumed that firms adjust their capital-labor ratio when input prices change before engaging in price competition. This implies that a lower (higher) equilibrium wage makes labor relative less (more) expensive and decreases (increases) the equilibrium capital-labor ratio. The remaining share of the employment gain in the largest firm is due to the effect of the minimum wage on input combination, an not to lower products' prices and higher sales.

The reallocation of workers from craft (small/less productive) to non-craft (large/more productive) firms driven by consumer substitution, plays a minor role in this industry. Recent work shows that following a minimum wage increase, workers reallocate from small/less productive firms to larger/higher productivity firms (Harasztosi et al. 2019, Dustmann et al. 2022)[79]. While possible in our model, sales lost in craft firms are not compensated by meaningful changes of opposite sign in non-craft firms, due to the low estimated craft to non-craft diversion ratio. Approximately 9 out 10 consumers that stop purchasing craft beer following

[79] Dodini et al. 2023 find similar results for plausibly exogenous labor cost increases.

Figure 3: Welfare - Change relative to Baseline at each Minimum Wage - US$ Million



a price increase choose to leave the market, instead of purchasing non-craft options.[80] The shift in the residual demand of non-craft products when the prices of craft ones increase is not large. This is consistent with consumers' taste for craft, and rationalizes the reduction in consumer surplus we described before under the optimal minimum wage.

Our results imply that technology and consumer preferences are both potentially relevant in understanding the reallocation process that has been documented after a minimum wage increase. Crucially, a lower elasticity of substitution between capital and labor that the one implicit in Cobb-Douglas technology, may make jobs lost at craft firms irrecoverable. This complements the work of Berger et al. 2022 for the US. In a model that assumes perfect competition in the product market, the authors find that the largest efficiency gain of using the minimum wage to curb labor market power would come from workers reallocation to more productive firms. Our work shows how product market power and consumer preferences over imperfect substitutes may ameliorate the pace of the reallocation process, and ultimately, reduce the efficiency gain of such policy.

Alternative Correlation between Product and Labor Market Power The positive correlation between labor and product market power is the main driver behind the conflict between the interests of consumers and workers in our framework. In this industry, the minimum wage that addresses labor market power leads to limited price savings for consumers, while also raising the price of craft products. To study how our results depend on this cor-

[80]For minimum wages in the range US$ 550 - US$775, the market shrinks at the pace of the sale reduction in craft brewers.

relation, we simulate a situation where product market power diminishes while labor market power remains constant. This would resemble firms producing in separate plants with local labor market power, while competing in the product market at a higher (national) level.

The simulation consist on changing the ownership of certain products currently in the portfolio of the largest firm, and establishing an oligopoly with three large national producers instead, but retaining the degree of labor market power and productivity that we estimate for the largest firm.[81] A key aspect that explains the degree of product market power of the largest firm is that it offers products with high diversion ratios with each other. Therefore, by changing the ownership of some of these products, we make competition in the product market more intense.

We find that the optimal minimum wage ($\underline{w}^*_{sim}$) is US$ 975 and that now the interests of consumers and workers are better aligned.[82] The minimum wage that maximizes consumer surplus is US$ 850 in this case. The gap between the minimum wages that maximize social welfare and consumer surplus decreased from US$ 450 to US$ 75 relative to the estimated for the observed product market structure. Consumers now benefit from the efficiency gains that mitigating labor market power delivers due to higher product market competition. When firms experience the cost efficiency that the optimal minimum wage entails, they have the incentive to pass it through to prices in order to increase sales and market share. The equilibrium pass-through rate of national non-craft products in this simulated oligopoly is 56%, on average. Fixing labor market inefficiency produces a larger positive welfare effect for consumers because the markups of national non-craft products are lower (1.9-2.0) relative to the estimated ones in observed equilibrium (3.1). Therefore, eliminating the markdown distortion is relatively more important. Notice that the optimal minimum wage in this simulation is still high for craft brewers, but different from before, the pro-efficiency effects that the minimum wage delivers lower the prices of national non-craft products to a larger extent. Under a more competitive product market, the minimum wage that mitigates labor market power in large firms raises the welfare of consumers and workers simultaneously.

[81] In practice, we simulate a product market with 2, 3, 4, and 5 large firms. Part of the exercise consist on restoring in steps the brand ownership before 1998 when the first horizontal merger took place and the market went from an oligopoly with 3 firms to a duopoly with just 2. The second merger occurred in 2003 and established a monopoly in production and sales. We describe here the oligopoly with 3 national producers and one large importer. The full exercise is described in Appendix (8).

[82] The optimal minimum wage is lower for two reasons. First, the labor demand of the new firms shift inward as a result of the change in product ownership. The beer market expand due to more competition, but firms produce individually less. Second, since divested firms have the labor productivity and face the labor supply curve of the largest firm, the marginal costs' curves coincide. Combined, firms produce at a smaller scale and the pro-efficiency effects of the minimum wage materialize at lower wage levels.

6.3 Minimum Wages for Craft and Non-Craft Firms

Considering that the optimal uniform minimum wage leads to lower consumer surplus and to both lower employment of craft firms, as well as higher prices for their products, we next consider the impact of distinct minimum wages for craft and non-craft firms.[83] Notably, this labor market policy was approved by the Ministry of Labor and Social Security during the course of this project and will take effect in 2025. In this context, our counterfactual provides a first measure of the potential welfare gains that would be achieved under an optimal implementation for the group of firms that are currently in the industry.

From our previous results, we know that craft and non-craft products are considered poor substitutes from consumers' point of view, and that the labor productivity in craft firms is lower than the productivity in non-craft firms. This results in lower consumer surplus when the minimum wage is established to mitigate labor market power. In this context, our solution consist on allowing the policymaker to establish the optimal combination of minimum wages for craft and non-craft firms that maximizes social welfare. In Table (5) we display the welfare variation relative to baseline, and compare it with the two optimal levels we discussed previously.

Table 5: Simulation Results - Optimal Minimum Wage

Optimal Minimum Wage $\underline{w}^*$ by Objective - (Variation vs Baseline No-MW Equilibrium)				
Uniform Minimum Wage				
Welfare (US$ Million)	**Δ Cons. Surp.**	**Δ W. Rents**	**Δ Profits**	**Δ Soc. Welfare**
Social Welfare - MW: 1,000	-0.16	1.53	0.49	1.87
Consumer Surplus - MW: 550	0.00	0.03	-0.00	0.03
Equilibrium (Δ %)	$\Delta\bar{p}$	ΔQ_t	$\Delta\bar{w}$	ΔL_t
Social Welfare - MW: US$ 1,000	-0.3%	0.1%	18.0%	4.0%
Consumer Surplus - MW: US$ 550	-0.0%	0.0%	-0.0%	0.1%
Minimum Wages for Craft and Non-Craft firms				
Welfare (US$ Million)	**Δ Cons. Surp.**	**Δ W. Rents**	**Δ Profits**	**Δ Soc. Welfare**
Social Welfare - MWs: {550, 1,000}	0.12	1.42	0.5	2.04
Equilibrium (Δ %)	$\Delta\bar{p}$	ΔQ_t	$\Delta\bar{w}$	ΔL_t
Social Welfare - MWs: {550, 1,000}	-0.5%	0.3%	12.3%	9.6%

Note: Welfare effects for markets 2019-2021.

We find that the combination of minimum wages that maximizes social welfare is US$ 550 and US$ 1,000, for craft and non-craft firms, respectively. This policy increases consumer

[83] Furthermore, introducing a structural remedy in the product market to deal with a merger that occurred more than twenty years ago seems unlikely.

surplus by US$ 0.12 M and employment by 9.6% relative to baseline. When compared to the optimal uniform minimum wage equilibrium, consumer surplus improves even further (+US$ 0.28 M). Consumer benefit from lower prices in craft products (-4.8%) and marginal additional price reductions in domestic non-craft (-0.2%) and imported products (-0.1%) relative to the uniform optimal case. The low non-craft to craft diversion ratio prevents lower craft prices from imposing significant competitive pressure on other firms in the industry.

Worker welfare increases less than under the uniform minimum wage. The employment gain in craft firms is insufficient to compensate for the more moderate wage increase. Overall, social welfare is higher with distinct minimum wage categories primarily because it raises consumer surplus, employment and profits at craft firms, with negligible negative impacts on profits and employment at non-craft firms. This policy framework provides policymakers with an additional degree of freedom in setting minimum wages. Therefore, when used to account for structural differences in labor productivity and consumer preferences between craft and non craft products, it can enhance social welfare.

7 Conclusion

Policymakers and competition authorities are concerned about the negative effects that labor market power has on workers and the efficient functioning of the labor market. In this paper, we investigate the trade-offs they face when using the minimum wage as a tool to curb firms' power. Using a model of simultaneous product and labor markets' equilibrium, we find that using the minimum wage to mitigate labor market power reduces consumer welfare. This occurs due to a positive correlation between labor and product market power, and the existence of firms with varying levels of labor productivity. We highlight the role that product market power plays in the distribution of the efficiency gains that the minimum wage generates in the labor market. Finally, in contexts where sector-specific minimum wages apply, grouping firms with different levels of labor productivity that produce imperfect substitutes under a common sector may lead to unnecessary welfare losses.

We make a series of relevant assumptions that influence our results. First, by studying only the intensive margin (no entry-exit) without involuntary unemployment, we may underestimate the negative welfare effects of the optimal minimum wage on consumers and on workers due to possible job losses. Incorporating these dimensions could be a direction for future research. Second, the conduct assumptions in the product market might underestimate the share that consumers receive from mitigating labor market power in the largest firm, or overestimate the extent to which the prices of craft products vary when sold through retailers. Third, the utilization of a production technology with constant elasticity of substitution between capital and labor may affect the employment variation we estimate and ultimately

workers' rents. Considering a more flexible technology could improve the ability of this study to evaluate similar situations in other contexts.

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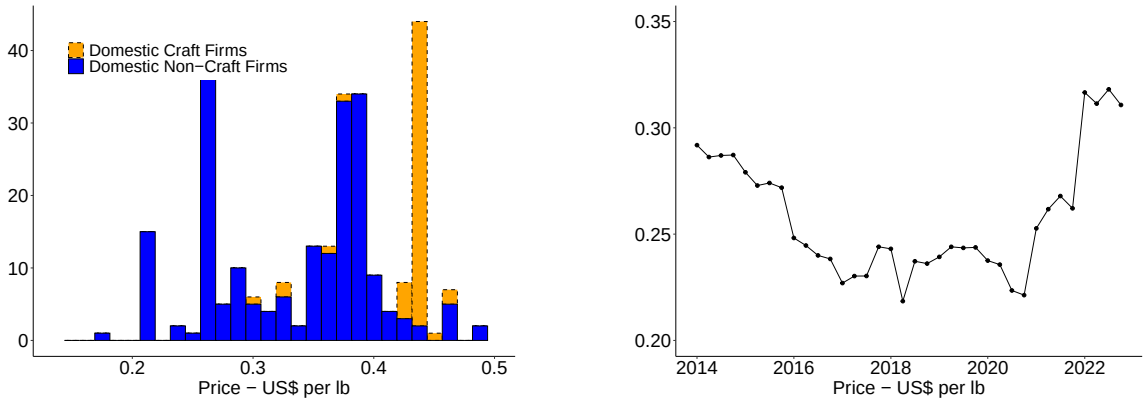
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8 Appendix

8.1 Data

8.1.1 Inputs

For imported products, we use customs data to retrieve information on products' import prices and quantities at the product level. We remove imports in bulk and calculate import prices per serving for those products where we can identify the number of units and volume. We assume products take 30 days to arrive from the border to the store and consider the import price as the main product cost for the upstream firm. When a price is missing during a month, we use the last available one. In most cases, we are able to match custom records to products in the output market using firm name, country of origin and products' descriptions. For those that we can't, we assign them the average import price from that country and firm to all products within the same group. Figure (8.1) contains the price of bottles at the firm level and average malt prices during the period we study.



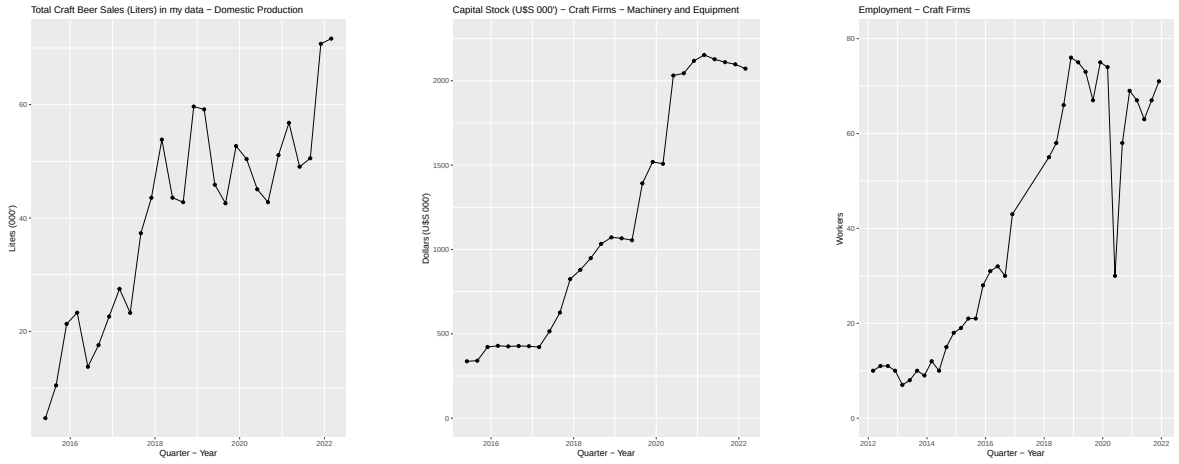
(a) Bottles Import Price

(b) Malt Price

Figure 8.1: Input prices

8.1.2 Craft Firms

We do not have balance sheet information for craft firms. Therefore, in order to overcome this limitation and construct a series of the capital stock, we exploit the fact that all capital goods that affect firms' production capacity such as automatic bottling machines, steel tanks and beer barrels, have to be imported from abroad. We build a capital stock index at the firm level that uses import prices and augments them conservatively for a factor of 1.2 to account for transport and installation costs. Then, over time we consider a depreciation rate of 5% per year. Figure (??) we display the evolution of sales, the stock of capital and employed workers for craft firms.



(a) Retail Sales (q) (b) Capital stock (c) Workers

Figure 8.2: Craft brewers

8.2 Estimation Results

8.2.1 Labor Costs - First Stage

We instrument labor costs ($lc_{\bar{g},t}$) at time t following the literature on production function estimation (Olley et al. 1996, Ackerberg et al. 2015). We aggregate domestic producers by firm type $\bar{g}$, depending on whether they produce craft or non-craft products. We assume that labor is a flexible input, so firms can adjust its quantity based on current period shocks. We use labor costs in the previous period ($lc_{\bar{g},t-1}$) and capital in the current period ($k_{\bar{g},t}$). We include time and group fixed effects. The model of the first stage is:

$$lc_{\bar{g},t} = \kappa_{lc} lc_{\bar{g},t-1} + \kappa_{\bar{g}} k_{\bar{g},t} + \sigma_t + \tau_{\bar{g}} + \nu_{\bar{g}t} \tag{8.1}$$

Estimation results using ordinary least-squares are displayed in the following table: Results

Table 8.1: First Stage - Dep. Var. $lc_{\bar{g},t}$

	I	II	III	IV
$\hat{\kappa}_{lc}$	0.95***	0.59***	0.65***	0.47***
	(0.02)	(0.064)	(0.06)	(0.07)
$\hat{\kappa}_{\bar{g}}$	0.002	-0.014***	-0.012***	-0.0063***
	(0.0018)	(0.0032)	(0.003)	(0.0012)
FE				
Year	N	Y	Y	Y
Month	N	N	Y	Y
Firm	N	N	N	Y
Num.Obs.	164	164	164	164
R2	0.94	0.94	0.95	0.96

* p < 0.1, ** p < 0.05, *** p < 0.01

display the expected signs, with labor costs (capital) positively (negatively) correlated with labor costs. We use the predicted values of $\hat{lc}_{\bar{g},t}$ under model IV in the estimation of demand and marginal costs.

8.2.2 Demand Estimates - Alternative Market Definition

We estimate demand using a more granular market definition, exploiting regional and retail chain variations in sales. These extra dimensions of heterogeneity allow us to introduce cross-section income variation using the Household Survey conducted by the National Institute of Statistics. In this case, data is aggregated at the quarter level and a product is defined as a brand only. The estimates of this demand model are displayed in Table (??). Importantly, the medians of market and own-product elasticities are similar to the estimates we obtain using a more aggregated model.

Variable	Parameter	Logit	RCL-1	RCL-2	RCNL-1
Price	α	-1.38 (0.09)	-4.75 (1.44)	-5.08 (1.54)	-2.85 (0.75)
RC	σ_0		1.49 (0.16)		
Nest	ρ_0				0.41 (0.09)
Demographic Interactions					
Income × Price	κ_α		1.46 (0.44)	1.51 (0.49)	0.86 (0.23)
Income × Constant	κ_0			1.46 (0.21)	0.54 (0.23)
Fixed Effects		(P,R,T,C)	(P,R,T,C)	(P,R,T,C)	(P,R,T,C)
Median Own Price El.		-2.39	-3.41	-3.38	-3.44
Median Market Price El.		-0.29	-0.44	-0.44	-0.34
Median Outside Div.		74.8%	51.2%	46.1%	38.1%

Models estimated by GMM, standard errors are shown in parentheses. Data was aggregated at the quarter level. Products should be available in at least 100 markets and more than 1 retail chain between 2015Q2 and 2022Q1. Prices per serving (355mL-12oz) are expressed in US$; Income per HH member is expressed in real UYU and converted to US$ 000'. Fixed Effects: (P) Product, (R) Region, (T) time and (C) Chain for P = 34, R = 6, T = 28 and C = 8. 15,930 observations of 721 markets.

8.3 Additional Results

8.3.1 Uniform Minimum Wage

The welfare consequences of a uniform minimum wage were described in Section (6). In Figure (8.3) we show results for average prices (wages) and total sales (employment) in the product (labor) market. Table (8.2) contains counterfactual results by firm type and product origin.

Figure 8.3: Labor and Product Market Equilibrium relative to Baseline

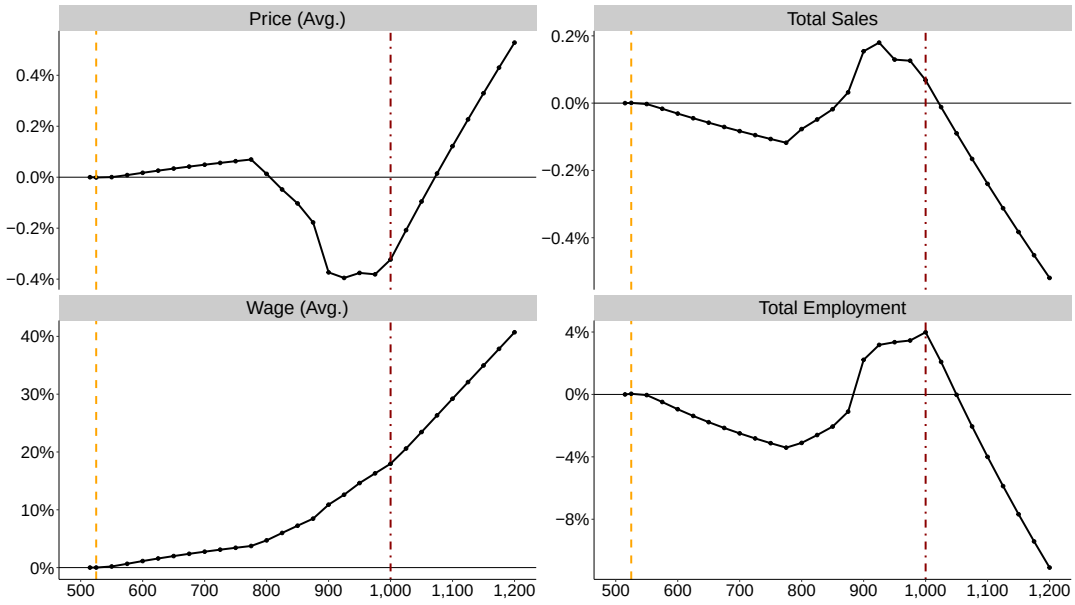
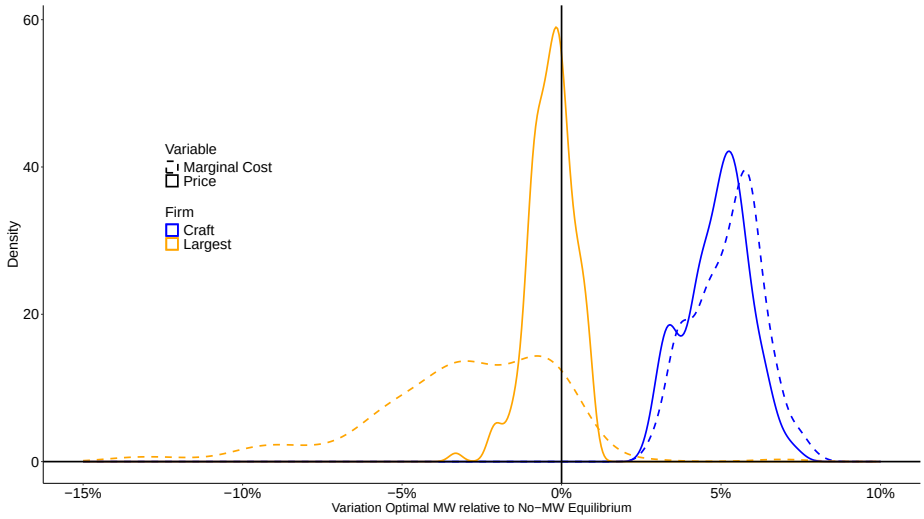


Table 8.2: Simulation Results by Firm - Optimal Uniform Minimum Wage

Optimal Minimum Wage by Objective										
	Prices		**Sales**		**Wages**		**Employment**		**WR**	π
	$\Delta\%^{\dagger}$	US$ ‡	$\Delta\%^{\dagger}$	$s_{g(j),ins}$	$\Delta\%^{\dagger}$	US$ ‡	$\Delta\%^{\dagger}$	# L	US$ M	US$ M
Social Welfare - MW: US$ 1,000										
Craft Firms	5.1	2.56	-14.3	1.2	94.2	1,000	-43.7	9	0.2	0.46
Largest Firm	-0.6	1.18	0.5	87.8	11.4	2,059	10.8	121	6.1	47.6
Domestic Products	*-0.5*	*1.06*	*1.8*	*61.9*	-	-	-	-	-	*33.1*
Imported Products	*1.5*	*1.62*	*-3.0*	*21.7*	-	-	-	-	-	*14.5*
Importers	0.3	1.21	-0.1	15.1	-	-	-	-	-	*2.9*
Consumer Surplus - MW: US$ 550										
Craft Firms	-1.5	2.43	4.6	1.4	10.8	550	6.8	16	0.03	0.51
Largest Firm	-0.0	1.19	0.0	87.5	0.0	1,848	0.00	109	4.7	47.0
Domestic Products	*-0.1*	*1.07*	*0.03*	*60.7*	-	-	-	-	-	*32.3*
Imported Products	*0.0*	*1.59*	*0.0*	*22.6*	-	-	-	-	-	*14.8*
Importers	0.0	1.20	-0.0	15.3	-	-	-	-	-	*2.9*

Note: Welfare for markets we study in 2019/2021. † Variations ($\Delta\%$) relative to a baseline scenario with National Minimum Wage. ‡ Average price per serving, gross monthly wage. Inside share $s_{g(j),ins}$. Employment considers only the jobs needed to produce and serve the markets we study.

Figure 8.4: Price and Marginal Cost Variation - Domestic Products, Optimal MW vs No-MW



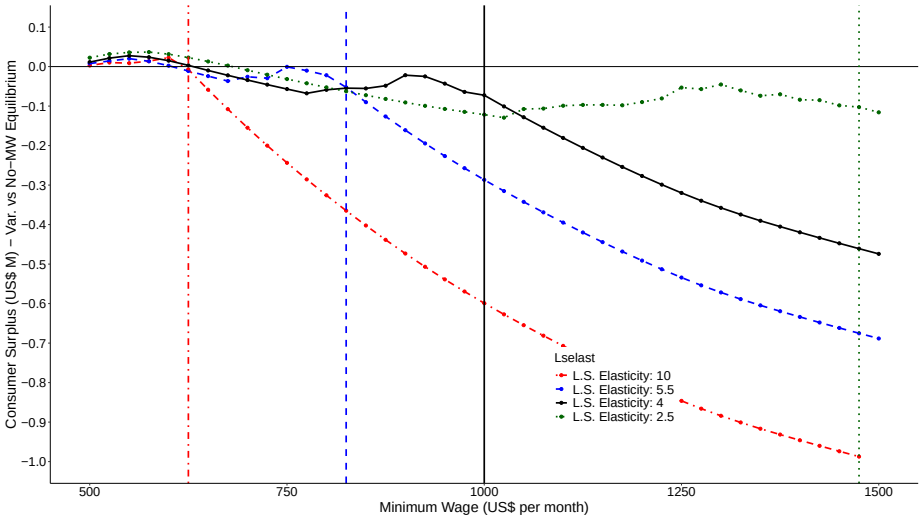
Note: kernel density estimates, marginal cost and price variation of domestic products by product and market, under optimal minimum wage relative to baseline equilibrium.

8.3.2 Uniform MW - Alternative Labor Supply Elasticity

The baseline specification assumes that, absent the minimum wage, the largest firm has more labor market than craft brewers. In this sense, we assumed $\theta_{NC} = 0.25$ and $\theta_C = 0.1$, consistent with labor supply elasticities of $\eta_{NC} = 4$ and $\eta_C = 10$. We tested the sensibility of our results to alternative parameterizations of the labor supply elasticity, in this case using common values for craft and non-craft domestic firms.

In Figure (8.5) we display consumer surplus variations relative to the equilibrium without minimum wage. Vertical lines represent the minimum wages that maximize social welfare in each case. Notice that, while consumer surplus is maximized in a range of US$ 550-600, social welfare is maximized at minimum wages that increase with the degree of labor market power. Again, efficiency gains in the largest firm are realized at higher minimum wages and that improves welfare for this firm and workers. Consumers do not receive a large share of these gains, so jointly with craft brewers, they would be better off under lower minimum wages.

Figure 8.5: Consumer Surplus - Variation relative to No-MW Equilibrium



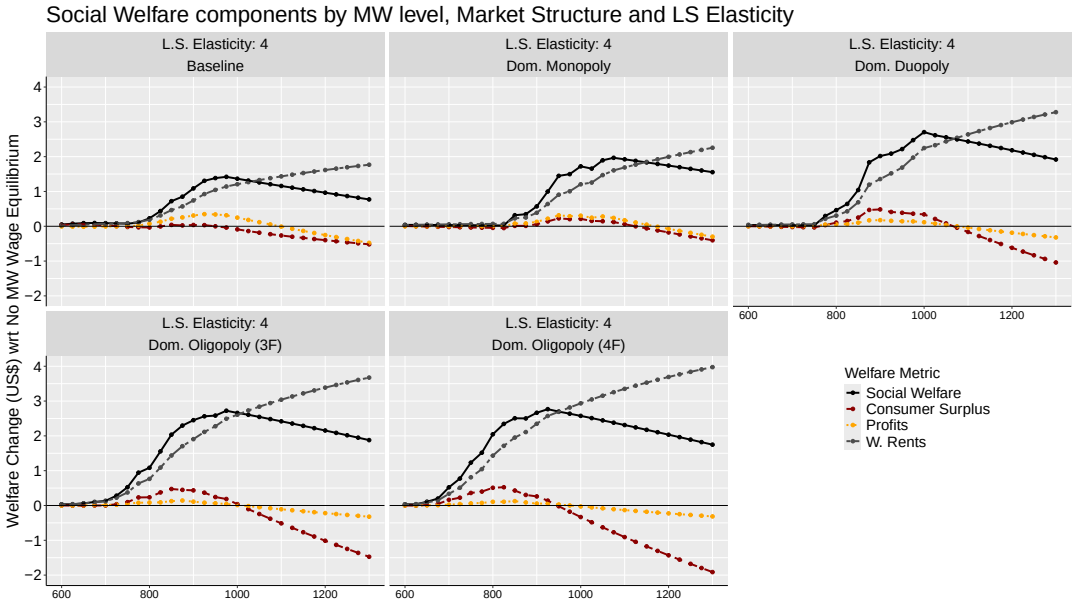
8.3.3 Uniform MW - Alternative Labor and Product Market Correlation

Table (??) contains the simulated changes in ownership, where we divest the property of the main products offered by the largest firm. In each case, we assign all imported products to a different firm and keep it constant in alternative simulations. The case we discuss in the counterfactual section is Domestic Oligopoly (A) with 3 large domestic firms. Results for other ownership scenarios are displayed in Figure (8.6), in all cases under the a common labor supply elasticity $\eta = \theta^{-1} = 4$.

Table 8.3: Simulated Ownership of Divested Products

# Domestic Firms →		# 1		# 2	# 3	# 4
Brand	Mkt. Share (Inside)	Baseline	Domestic Monopoly	Domestic Duopoly	Domestic Oligopoly (A)	Domestic Oligopoly (B)
HHI:		*7,521*	*4,316*	*2,552*	*2,152*	*1,761*
Brand 1	22.4%	1	1	1	1	1
Brand 2	15.6%	1	1	2	2	2
Brand 3	12.6%	1	1	2	2	3
Brand 4	8.9%	1	1	1	3	4
Domestic	59.5%					
Brand 5	11.6%	1	2	3	4	5
Brand 6	5.2%	1	2	3	4	5
Brand 7	4.8%	1	2	3	4	5
Brand 8	3.3%	1	2	3	4	5
Brand 9	1.1%	1	2	3	4	5
Rest	1.0%	1	2	3	4	5
Imported	27.0%					
Total	86.5%					

Figure 8.6: Welfare (US$ M) - Variation relative to No-MW Equilibrium



8.4 Second Choice Diversion Moments

We match aggregate second choice diversion moments using an unexpected removal of all products offered by the largest firm ($\mathcal{J}_{large}$) in a particular retailer between June 2020 and November 2021.

In Figure (8.7) we display the evolution of sales over time in retail chains affected and unaffected by the removal. In the case of affected chains (right panel), a large share of consumers previously choosing products of the largest firm, switched to products of competitors that had a minor share before. The diversion to the outside good we estimate is a consequence of the consequence that most consumers remained in the market. Figure (8.8) shows consumer substitution patterns in the affected retail chain. Even though only non-craft products were removed, the consumption of craft products was unaffected. In the case of lager, most consumers continued kept buying lager after the event.

We follow the procedure developed by Conlon et al. 2024, exploiting the model assumption that consumers make mutually exclusive and exhaustive discrete choices. When product j is removed from the choice set, consumers previously choosing j (treated), can either select one of the remaining products $\mathcal{J} \setminus \{j\}$ or the outside good q_0. The procedure consist on selecting valid controls to compute raw diversion ratios, based on the fact that the level of sales of alternative products can neither decrease nor increase more than the volume of sales of the removed product j. Finally, we use a Bayesian procedure to obtain a posterior distribution of the diversion ratio to each alternative. The posterior restricts diversion ratios to be in the unit simplex and to sum one. In this case, the removal included more than one product ($\mathcal{J}_{rem} = \mathcal{J}_{large}$), but the estimation procedure is the same. For estimation purposes, we match model based diversion calculated using Equation (5) with the mean of the posterior distribution.

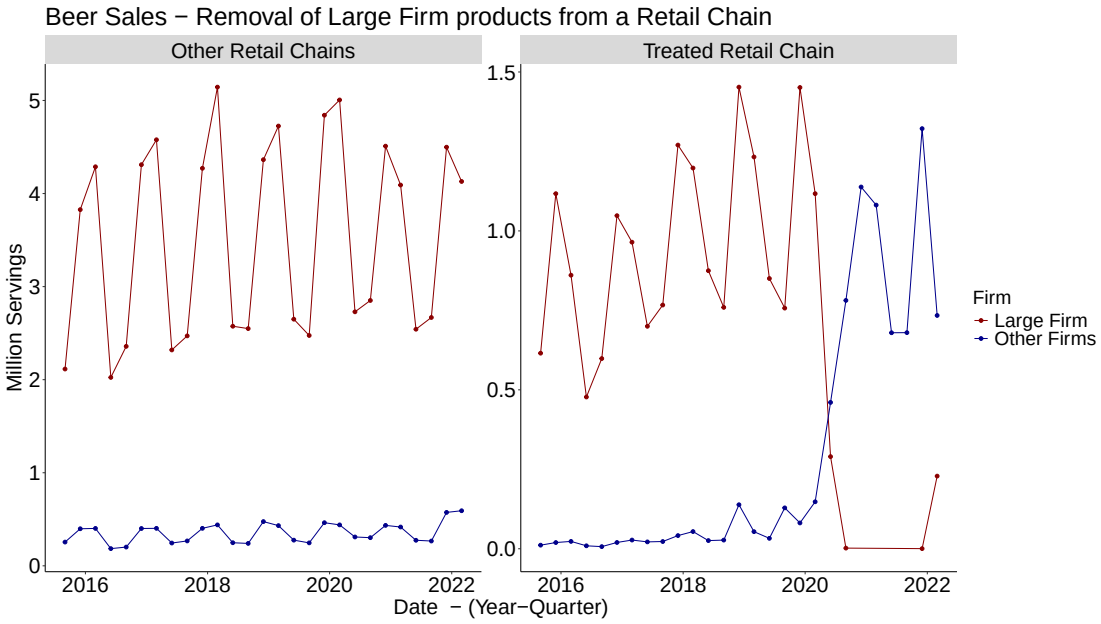


Figure 8.7: Total Sales by Retail Chain

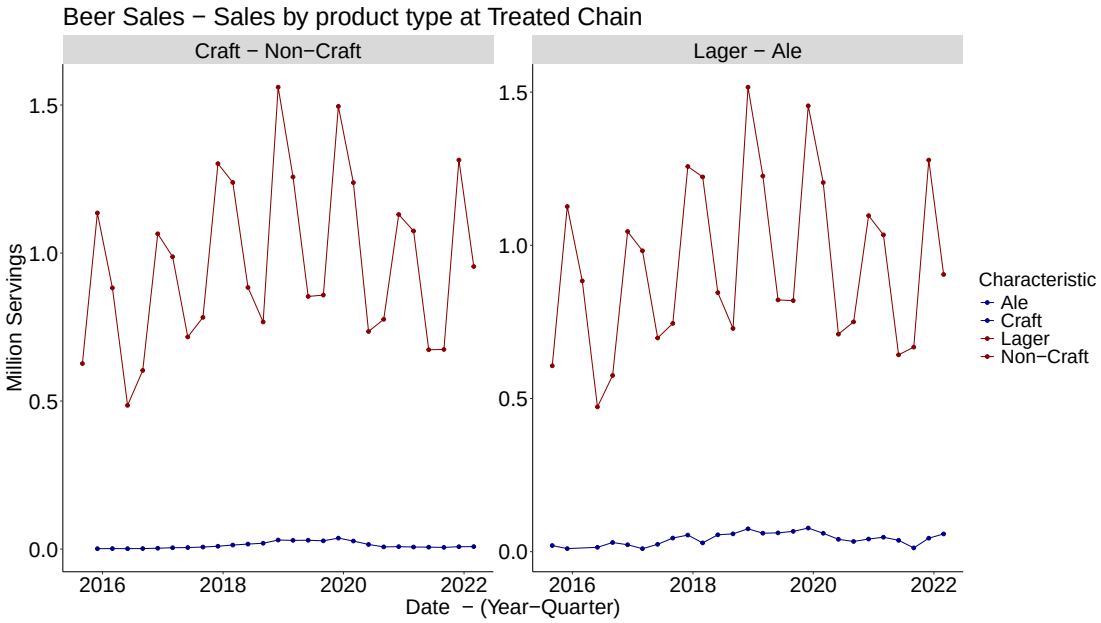


Figure 8.8: Sales by Characteristic, Treated Retail Chain

In practice, we match diversion ratios for the outside good and for a subset of relevant products spanning multiple characteristics. Table (8.4) contains the mean of the posterior distribution of calculated diversion ratios.

Table 8.4: Diversion Ratio - Posterior Distribution - Mean

Product	Div. Ratio	Lager	Imported	Craft
Inside Good	0.38			
Product 1	0.20	✓	✓	
Product 2	0.18	✓	✓	
Product 3	0.09	✓	✓	
Product 4	0.05	✓	✓	
Product 5	0.006	✓	✓	
Product 6	0.005	✓	✓	
Product 7	0.004	✓	✓	
Product 8	0.002	✓	✓	
Product 9	0.002	✓		✓
Product 10	0.001			✓

8.5 Counterfactual - Implementation details

8.5.1 Simulation procedure

We simulate labor and product market equilibrium for every minimum wage ($\underline{w}$) set by the policymaker. From our description of the problem of the firm (4.3.3), in equilibrium the prices that firms set in the product market and the wages they post in the labor market are consistent with each other. Consistency implies that the there is no profitable deviation in any market: the vector of market prices is an equilibrium in the product market given a vector of marginal costs, and the vector of wages associated with those marginal costs is an equilibrium in the labor market. At the vector of posted wages, firms are able to hire the workers they need to produce and satisfy the demand they receive from consumers at the vector of equilibrium prices. We use the estimated model and the calibrated labor supply curve to search for the equilibrium vector of prices (p_t) that would arise in each case, and then recover wages, employment, production and sales. Conservatively, we assume that remaining retail markets m' are not affected, so we focus on the market where we estimated the demand model only.

The core of our counterfactual analysis consist on changing minimum wage levels, and this affects (in most cases) relative input prices. Therefore, to isolate the inefficiencies we study (labor and product market power) from input misallocation, in our counterfactual we allow firms to adjust their capital-labor ratio before engaging in short-run price competition when wages change. We proceed as follows: First, we assume that the capital-labor ratio in the equilibrium we observe is the optimal (short and long run marginal cost coincide), and that the technology firms use has constant returns to scale ($\hat{\beta}_K = 1 - \hat{\beta}_L$). Using these assumptions and information on the capital stock, we recover firm-specific implicit capital prices $r_{gm(t)}$. Then, similar to the case of other inputs (bottles, hops), we assume that firms can buy and sell all the capital they want at that price when the equilibrium wage change.

We operationalize the simulation with a fixed point iteration over product and labor markets' equilibrium. When the minimum wage binds on firms' labor demand, the marginal cost is constant and the simulation is standard. When the MW doesn't bind, the marginal cost is

increasing in production due to the upward sloping labor supply curve[84], and the fixed point solves for the intersection of marginal revenue and marginal cost. Finally, when the minimum wage binds on the labor supply, we solve for the shadow value of the hiring constraint (ref Appendix) that makes the level of employment and production consistent with marginal revenue and sales[85]. To search for an equilibrium, we use a fixed point iteration with a tolerance of 10^{-9} for the maximum difference between shares in successive iterations, using the concept of consistency defined above. We simulate equilibrium for all markets we study in the period 2019-2021, using a grid of gross minimum wages in the range [525, 1,500] in intervals of US$ 25[86].

[84]This holds even under the assumption of constant returns to scale
[85]See (4.3.2)
[86]Equivalent to 13 cents in the gross hourly wage of a full time worker.