The Value of Insurance Coverage for Over-the-Counter Drugs: Evidence from Contraceptives*

Jorge Florez
Central Bank of Colombia

Santiago Ortiz-Ortiz
Toulouse School of Economics

Paul Rodríguez-Lesmes
Universidad del Rosario

Natalia Serna
Stanford University

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Abstract

After gaining over-the-counter (OTC) status, many drugs continue to be supplied by health insurers. This paper measures the value of insurance coverage for these drugs in the market for hormonal contraceptives in Colombia. We develop and estimate a structural model of demand and supply, leveraging a price ceiling policy and a survey of reproductive-age women to identify our parameters. Moving to an OTC-only market would raise contraceptive demand by 41% and lower retail prices by 4.6%. Hassle costs in the insurance segment are the main barrier to contraceptive use and are higher for lower-quality health insurers. Therefore, insurance coverage as currently delivered is of limited value, but policies that reduce hassle costs would substantially benefit women.

Keywords: Over-the-counter drugs, Health insurance, Contraception.

JEL codes: I18, I12, L10.

*Florez: jhflorez@gmail.com; Ortiz-Ortiz: santiago.ortiz@tse-fr.eu; Rodríguez-Lesmes: paul.rodriguez@urosario.edu.co; Serna: nserna@stanford.edu. Natalia Serna acknowledges funding from the Stanford Rosenkranz Prize. We are deeply grateful to IQVIA Colombia and the Colombian Ministry of Health for providing the data for this research. We thank Juan Pablo Atal, Martha Bailey, Natalie Bau, Zach Brown, Mike Dickstein, Martin Hackmann, Chenyuan Liu, Carolina Tojal-Ramos, and Wesley Yin for their feedback. We also thank participants to the 2025 IO Fest, 2025 IIOC, 2025 RIDGE IO, 2026 Paris IO Day, 2026 Swiss Health Economics conference, 2026 Rotterdam Health Economics conference, and seminar participants at UCLA CCPR and the Central Bank of Colombia. The findings of this paper do not represent the views of any institution involved. All errors are our own.

1 Introduction

Over the counter (OTC) drug approvals are made in part to prevent unnecessary visits to the healthcare system for medications that are safe to consume without medical supervision (Brass, 2001). However, even after gaining OTC status, many drugs continue to be supplied by health insurers. For example, in Colombia, our empirical setting, 2,668 of the 16,755 drugs with OTC status were also dispensed through the insurance system in 2018, generating 18.7 million insurance claims.[1] Routing OTC-eligible drugs through insurers thus works against one of the purposes of OTC approval, and may leave consumers worse off if it limits their ability to manage everyday health needs or to treat health conditions that would otherwise go unaddressed (Leonard-Segal and Simone, 2025). This paper asks what is the value to consumers of insurance coverage for therapeutic classes approved for OTC sale.

Theoretically, the welfare effects of coexisting OTC and insurance segments are ambiguous. On one hand, this form of segmentation can increase consumer welfare by expanding product variety. Indeed, regulators often approve an active ingredient for OTC sale only at lower dosages than those available with prescription, so the two segments can carry distinct products (U.S. Food and Drug Administration, 2013). On the other hand, segmentation can lower welfare by allowing pharmaceutical manufacturers to price discriminate or by forcing consumers to face non-pecuniary costs of navigating each segment (Dickstein et al., 2024; Karle et al., 2020). Empirically, this question is timely since several countries are expanding OTC access to pharmaceuticals in order to address under-treatment of conditions for which broader access could save or improve lives, such as hyperlipidemia which requires cholesterol-lowering drugs, birth control which requires contraceptives, or drug overdoses which require opioid antagonists (U.S. Food and Drug Administration, 2024, 2023).[2]

[1] Counts refer to unique *Códigos Únicos de Medicamento* (CUMs), the presentation-level identifier issued by INVIMA, the Colombian drug regulator, whose active ingredients and pharmaceutical form appear on INVIMA's list of OTC-eligible formulations.

[2] For example, in December 2024, the U.S. Food and Drug Administration (FDA) finalized the Additional Conditions for Nonprescription Use (ACNU) rule, creating a pathway for drugs that previously required medical supervision to be approved for OTC sale (U.S. Food and Drug Administration, 2024). Under this rule, a progestin-only oral contraceptive became available OTC for the first time, even as the Affordable Care

Our focus is on the market for hormonal contraceptives in Colombia, where 70% of sales are made OTC and the remaining 30% through insurance. This type of market segmentation is widespread in the context of birth control—56 countries offer contraceptives through both channels (Grindlay et al., 2013)—and its consequences welfare-relevant—the inability to access contraception can negatively impact women's health and socioeconomic position (Bailey, 2020; Bailey and Lindo, 2017).

Women who buy OTC in Colombia pay full retail prices but can choose among nearly 150 brand-dosage combinations (products). Women who obtain contraceptives through insurance pay nothing out of pocket but are limited to the 60 products covered by the national health insurance formulary. Covered contraceptives are dispensed through insurer-owned facilities rather than at any pharmacy, so women also face hassle costs when sourcing them through insurance.[3]

Beyond the costs of navigating each segment, the choice of a hormonal contraceptive is characterized by information frictions about product quality and side effects (Carter et al., 2012). Side effects vary across women and can only be learned through experimentation, which carries the risk of unintended pregnancy (Ali et al., 2012), therefore ex-ante product choice is typically made under imperfect information.

Quantifying the value of insurance coverage for OTC-approved contraceptives requires evaluating counterfactual policies in which products are supplied only OTC or only through insurance. To do so, we develop and estimate a structural model of the contraceptive market. On the demand side, women seeking to avoid pregnancy choose among available hormonal contraceptives and an outside option to maximize their indirect utility in a random coefficients logit framework. Utility depends on the retail price for OTC purchases, a segment-level disutility of claiming through insurance that captures hassle costs, and beliefs about product quality. We assume women are Bayesian agents who update these beliefs upon observing a quality signal. Although women pay nothing out of pocket through insurance, we also allow insurance-segment demand to depend on

Act already mandated comprehensive insurance coverage of contraceptives (FDA, 2024).

[3]Transaction costs, time costs of scheduling doctor appointments, and travel costs to insurer-owned dispensing facilities are examples of hassle costs women face when claiming contraceptives through insurance. Moreover, wait times at these insurer dispensing facilities are relatively long (see El Colombiano, Dec. 21, 2023).

wholesale prices, since insurers have an incentive to steer women toward cheaper products, and the wholesale price coefficient captures this behavior in reduced form. On the supply side, manufacturers sell through both segments and set segment-specific prices, competing Nash-Bertrand in the OTC segment and making take-it-or-leave-it offers to a representative insurer in the insurance segment.

We combine two data sources covering the years 2018 and 2019. For the OTC segment, we use product-level data from IQVIA Colombia reporting monthly retail prices and sales. For the insurance segment, we use individual-level enrollment and health claims data covering nearly half of the Colombian population. To identify price responses and information frictions in our demand model, we leverage a 2019 policy in which the Colombian government imposed wholesale price ceilings on 29 products. First, using event study designs, we show that the policy reduced both wholesale prices through insurance and retail prices OTC, raising demand for targeted products relative to untargeted ones in each segment. Therefore, the policy serves as an instrument for both wholesale and retail prices.

Second, beyond prices, the policy may have also acted as an information signal about quality by disproportionately targeting products with milder androgenic side effects. The demand increase in the insurance segment partly evidences this, since women pay nothing out of pocket both before and after the policy yet demand for targeted products increases. However, the demand response could also reflect insurers steering women toward the products that became cheaper. To provide direct evidence of information frictions, we surveyed 310 reproductive-age women in Bogotá between June and August 2026. The survey confirms that information frictions are relevant even for basic product attributes: 87.6% of respondents recognize at least one brand, but 24.7% cannot correctly identify the route of administration of any brand. Product knowledge is higher among women with any healthcare spending than among those without. The claims data corroborate this pattern: better-informed women (which we define as those with above-median pre-policy healthcare spending based on the survey) exhibit 40% higher demand for targeted, higher-quality products than less-informed women, and this gap halves after the policy, consistent with the policy updating the beliefs of less-informed women. Pre-policy health-

care spending thus proxies for information status, and the post-policy change in demand for targeted products among less-informed women identifies the weight they place on quality signals in our demand model.

We also find direct evidence of hassle costs in the insurance segment that motivate our modeling approach. Among surveyed women who obtain contraceptives through insurance, 82.4% report that obtaining the product takes more than one hour, compared with 20.1% of OTC purchasers. Because the hassle cost does not vary across products, we model it as an insurance segment-level disutility (as in Marshall, 2015).

Implementing our full estimation, we find that women place 63% weight on their prior beliefs about product quality and the remaining 37% on quality signals, implying that most women remain poorly informed even after the policy shock. The median own-price elasticity in the OTC segment equals −2.14, which is consistent with estimates from the randomized controlled trial in Bailey et al. (2025) for uninsured women in the U.S. Price sensitivity is higher among women who are younger, lower income, and more likely to have claimed contraceptives through insurance.

Women also face substantial hassle costs in the insurance segment and, as expected, these costs are negatively correlated with measures of insurer quality. For instance, they are higher for women enrolled with insurers with narrower provider networks and with more patient complaints related to medication dispensing. Women are willing to pay $4.3 on average to avoid these hassle costs, but retail prices in the observed market exceed that threshold preventing switches to the OTC segment. On the supply side, we find that the average markup equals 50% of the retail price in the OTC segment and 19% of the wholesale price in the insurance segment.

Demand estimates suggest that part of the value of the insurance segment is to serve women who are more price-sensitive. But more generally that value must be assessed relative to the alternative market structure in which products are supplied only OTC. We therefore use our estimates to simulate this counterfactual under two assumptions about information, one where we hold information status fixed and one where we assume full information.

We find that moving to an OTC-only market raises demand by 41% relative to baseline,

or roughly 673 thousand additional women using contraceptives each month, with the largest gains for conventional pills. This response is driven primarily by the removal of the hassle costs, since holding these costs fixed would generate negligible effects on total demand. Equilibrium prices fall 2.2% when we hold information frictions fixed but 4.6% when we assume full information, suggesting women's beliefs about quality are biased upward, which allows manufacturers of lower-quality products to sustain higher prices. Although in percentage terms the price changes are small, they would generate a 16.1 billion COP pesos reduction in out-of-pocket spending per year. Consumer surplus increases $7.1 per woman-year and the gains are larger for women who are lower-income, uninformed, and aged 15–19. An insurance-only market produces broadly symmetric results in the opposite direction.

While our results suggest that there is little value of offering contraceptives through insurance, the policy implication is not to eliminate these products from the insurance formulary but to make it easier for women to navigate the insurance segment by lowering hassle costs. One way to do this would be to require insurers to offer a broad network of pharmacies, so that women can fill their prescriptions at any pharmacy rather than at insurer-dispensing facilities. Using our model estimates to simulate such a policy by reducing hassle costs by 50% (roughly the dollar-equivalent of a minimum taxi fare in Colombia or $2.7), we find that contraceptive demand would increase 24%, with women reallocating toward longer-acting methods. However, this policy is more expensive for the government than pooling the market, since in addition to financing the reduction in hassle costs, wholesale prices increase 5.2%. A 50% reduction in hassle costs generates the same impact on demand as a 30% retail subsidy, but the two policies differ widely in which women benefit the most. Reducing hassle costs raises consumer welfare the most for women who are lower-income and uninformed.

Our paper makes several contributions to the literature. First, it adds to a growing literature on market segmentation. Previous studies have examined markets characterized by adverse selection (Shahidinejad et al., 2025), such as health insurance, and found that eliminating segmentation results in lower premiums (Fleitas et al., 2019; Dickstein et al., 2024). We contribute by showing that the effects of pooling are similar in markets without

adverse selection but where segments differ in prices and hassle costs.

A second line of literature has documented the importance of information frictions in shaping product demand (Crawford and Shum, 2005; Hendricks and Sorensen, 2009; Dickstein et al., 2018; Brown et al., 2023; Dickstein et al., 2023; Brown and Jeon, 2024; Gupta and Cao, 2025). Within pharmaceutical markets, information frictions have been proposed as an explanation for why consumers buy branded drugs over generics (Handel and Schwartzstein, 2018; Bronnenberg et al., 2015). Within health insurance, the focus has been on how these frictions lead to suboptimal plan choices (Abaluck and Gruber, 2011; Handel and Kolstad, 2015) and higher premiums (Ho et al., 2017). We contribute to this literature by jointly modeling demand and supply (as in Atal et al., 2024), considering how information frictions interact with market segmentation in equilibrium. Our results suggest that providing information about contraceptive quality can reduce manufacturers' ability to price discriminate and exert market power in the segmented market.

Third, several papers consider the impact of hassle costs on product demand, from refillables in consumer packaged goods and price-matching guarantees (Marshall, 2015; Hviid and Shaffer, 1999) to ordeals in public program participation (Domurat et al., 2021; Homonoff and Somerville, 2021; Brot-Goldberg et al., 2023; Shepard and Wagner, 2023) and education (Dynarski et al., 2021). We extend the notion of hassle costs to pharmaceutical markets, showing that when drugs achieve OTC status there is little rationale for continuing to offer them through insurance, which imposes the hassle of interacting with the heath system when it is safe to consume the medication without supervision.

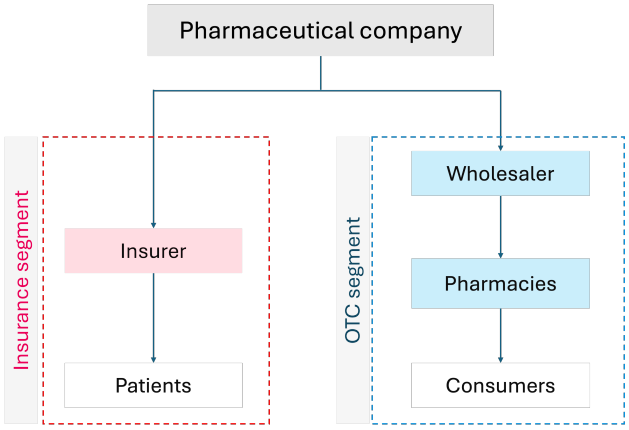
Finally, a rich literature in health economics has studied demand-side barriers to contraceptive use, including financial constraints (Willage, 2020; Bailey, 2012; Pace et al., 2016; Snyder et al., 2018; Bailey et al., 2023; Dupas et al., 2024), cultural and social barriers (Miller et al., 2023; Bau et al., 2024), and supply-side restrictions (Kelly et al., 2020; Rossin-Slater et al., 2026). We extend this literature by showing that contraceptive access depends not only on the barriers women face, but also on market structure and manufacturers' pricing incentives. Combining evidence from OTC and insurance markets, we show how segmentation between these channels affects women's access to contraception and which policies help address the consequences of segmentation.

2 Setting

2.1 Institutional Background

Our setting is the Colombian hormonal contraceptive market, where products are sold through both OTC and insurance segments. The OTC segment accounts for roughly 70% of contraceptive sales by volume, and the insurance segment makes up the remaining 30% (Appendix Figure 1). Contraceptives in Colombia are known as "branded generics," meaning that products are off-patent, yet are sold under distinct brand names rather than under their chemical designation. Segmentation between OTC and insurance therefore does not reflect a distinction between branded and generic drugs.

FIGURE 1: Pharmaceutical Supply Chain in Colombia



Insurance segment. In the insurance segment, health insurers negotiate wholesale prices with pharmaceutical manufacturers or distributors for contraceptives covered by the national health insurance plan (see Figure 1). The set of contraceptives covered by the health plan is determined by the government on the basis of clinical effectiveness, and is therefore exogenous to individual insurers. Approximately 60 brand-dosage combinations (hereafter, "products") are covered by the health plan, including first- and second-generation oral contraceptives, implants, intrauterine devices (IUDs), and injections.

First- and second-generation oral contraceptives contain older progestin formulations associated with higher rates of side effects such as weight gain, acne, and irregular bleeding, whereas third- and fourth-generation formulations use newer progestins with milder

androgenic side effects (Sitruk-Ware, 2006). Notably, third- and fourth-generation oral contraceptives are not covered by the national health insurance plan. When women obtain a covered contraceptive, insurers pay the negotiated wholesale price to the manufacturer or distributor, but women face zero out-of-pocket costs.

Health insurance coverage in Colombia is nearly universal: roughly 93% of Colombians are enrolled (DANE, 2019), so selection into insurance is limited. All insurers are required by law to cover the same set of contraceptives, so women face the same formulary regardless of which insurer they belong to. The decision of which insurer to enroll with is therefore orthogonal to contraceptive demand, and the relevant selection margin is whether women choose to obtain contraceptives OTC or through their insurer.

Accessing contraceptives through insurance requires a doctor's prescription, which takes time and effort to obtain. Doctors recommend contraceptives based on the woman's health status and family planning needs, which supports treating women as the primary decision-makers.

OTC segment. In the OTC segment, pharmaceutical manufacturers negotiate wholesale prices with distributors, who then supply pharmacies. Pharmacies set the retail prices faced by consumers, though strong competition among pharmacies suggests that pricing power rests primarily with manufacturers rather than retailers.[4] Women purchasing OTC have access to the full set of government-approved contraceptives (including those offered through insurance), nearly 150 products.

Some OTC products have historically been considerably expensive. For example, before 2019, the most expensive fourth-generation oral pill had a retail price equivalent to 15% of the monthly minimum wage. Although a doctor's prescription is technically required for pharmacy purchases, enforcement is minimal, making it a *de facto* OTC market.[5] Women purchasing OTC therefore face high prices but few hassle costs, while women sourcing them from insurance face zero out-of-pocket prices but substantial hassle costs.

[4]See for example https://www.bloomberglinea.com/latinoamerica/colombia/el-auge-de-los-genericos-la-estrategia-de-ahorro-que-transforma-el-mercado-farmaceutico/?reader_id=READER_ID&url=SOURCE_URL&_=RANDOM/

[5]An audit study in Bogotá found that only 1% of pharmacy staff requested a prescription when selling contraceptive pills (Andia et al., 2022).

Based on the structure of the market, women must select a market segment and a product within that segment. This choice is inherently complex. It requires trading off prices and hassle costs for segment choice and then learning about contraceptive quality through experimentation for product choice, but experimentation is costly because switching products can result in unintended pregnancy. Hence, women often face information frictions about quality when choosing their contraceptive.

2.2 Price Ceiling Policy

To facilitate contraceptive choice and reduce out-of-pocket costs for women purchasing OTC, the Colombian government imposed wholesale price ceilings on 29 contraceptives in January 2019. Half of the targeted products were third- and fourth-generation oral contraceptives—commonly marketed as higher quality—whose prices prior to the policy were nearly three times higher than in countries such as Canada and Norway (Ministerio de Salud y Protección Social, 2019). The regulation was subsequently expanded in July 2019 and May 2020 to cover 13 additional products, bringing the total number of regulated contraceptives to 42.[6]

The contraceptive price ceilings were implemented under a broader pharmaceutical price regulation framework introduced in 2013, which targeted products based on two criteria. First, products had to belong to highly concentrated markets—with either fewer than three competitors or a Herfindahl-Hirschman Index exceeding 2,500—and have the highest market share in their market.[7] Second, their retail prices had to exceed an international reference price, defined as the 25th percentile of average prices for the same active ingredient across a set of comparator countries.[8]

[6]Additional details on regulated products are provided in Circulares 07/2018, 09/2019, and 10/2020 from the Ministry of Health available at MinSalud, 2025.

[7]Markets were defined as the fifth level of the World Health Organization's Anatomical Therapeutic Chemical (ATC) classification (ATC5).

[8]Reference countries include Argentina, Brazil, Chile, Ecuador, Mexico, Panama, Peru, Uruguay, Spain, the United States, the United Kingdom, Australia, Canada, France, Norway, Germany, and Portugal.

3 Data

We use three datasets for our analysis. The first is IQVIA Colombia, which reports monthly retail prices, quantities, national drug codes (NDCs), brand names, manufacturers, and routes of administration for all contraceptives (3-digit ATC G03) sold OTC between 2018 and 2019, covering approximately 90% of Colombian pharmacies. The retail pharmacy market consists of large pharmacy chains with stores in multiple cities, which account for 30% of units sold in the data, and small independent drugstores, which account for the remaining 70%. While pharmacy chains report retail prices directly, independent pharmacies report only wholesale prices. Hence, to approximate retail prices for these observations, we apply a 15% markup following IQVIA's guidance.

The second dataset are the quarterly adverse event reports from the FDA's Adverse Event Reporting System (FAERS). We use these reports—which cover unintended pregnancies, venous thromboembolism, weight gain, acne, bleeding, device expulsion, and other outcomes—to construct a measure of contraceptive quality at the level of active ingredient, route of administration, and quarter. For active ingredients approved in Colombia but not in the U.S., we supplement the FAERS data with Colombia's National Drug and Safety Agency (INVIMA) adverse event reports. Our quality measure is the Proportional Reporting Ratio (PRR) typically used in pharmacovigilance (Evans et al., 2001). The PRR compares the share of a drug's adverse event reports attributable to a given reaction relative to the share across all other drugs. Appendix 1 provides details on the construction of this measure.

The third dataset are individual-level enrollment and health claims records from the Colombian Ministry of Health and Social Protection (known as *Base Única de Afiliados* and *Base de Suficiencia*, respectively). These data cover all outpatient, inpatient, and prescription claims made by nearly 25 million enrollees in Colombia's contributory health insurance system between 2018 and 2019. For each claim, we observe the contraceptive prescribed, and the woman's insurer, age, and municipality of residence.

We define a product as a brand–dosage combination and aggregate the IQVIA data to the product level. We similarly aggregate individual-level health claims to the product

TABLE 1: Summary Statistics by Market Segment

Variable	Contraceptive type	Pre 2019-01		Post 2019-01	
		mean	sd	mean	sd
Panel A. Over-the-counter					
Targeted					
Retail prices	Conventional pill	11.44	(7.84)	4.53	(3.56)
	Other	3.66	(1.63)	3.25	(1.53)
Sales volumes	Conventional pill	13.34	(18.97)	18.39	(23.42)
	Other	24.52	(20.05)	35.20	(24.25)
Untargeted					
Retail prices	Conventional pill	5.33	(5.83)	4.52	(4.77)
	Injection	4.47	(2.54)	4.94	(2.59)
	Other	2.77	(1.64)	2.79	(1.64)
Sales volumes	Conventional pill	7.26	(21.90)	8.19	(24.82)
	Injection	44.98	(32.16)	47.49	(41.45)
	Other	21.22	(33.75)	19.24	(33.97)
Total sales volume		1450.50	(87.67)	1654.09	(84.78)
Panel B. Insurance					
Targeted					
Wholesale prices	Conventional pill	3.47	(0.93)	2.30	(0.24)
	Other	1.49	(1.17)	1.66	(0.75)
Sales volumes	Conventional pill	1.91	(3.02)	3.11	(4.17)
	Other	1.74	(2.52)	1.72	(2.21)
Untargeted					
Wholesale prices	Conventional pill	0.74	(1.12)	0.75	(1.25)
	Injection	0.81	(0.27)	0.81	(0.28)
	Other	0.67	(0.13)	0.65	(0.02)
Sales volumes	Conventional pill	2.89	(5.97)	2.92	(5.94)
	Injection	20.11	(20.16)	16.62	(22.91)
	Other	20.79	(41.01)	23.13	(42.38)
Total sales volume		289.54	(31.85)	260.06	(62.11)

Note: Table shows the mean and standard deviation in parentheses of prices and sales volumes by contraceptive type, regulation status, and policy period from January 2018 to December 2019. *Targeted* products correspond to those products regulated in January 2019 or July 2019. Products regulated in 2020 are classified as *Untargeted* because they were not regulated during the sample period. Panel A shows summary statistics for the OTC segment and Panel B for the insurance segment. In the insurance segment, we exclude data for implants that were introduced for the first time after January 2019. Average prices are weighted by sales volumes. Prices are measured in 2018 USD, and sales volumes are in 1,000 units.

level, restricting attention to claims made by women of reproductive age (15–45). To ensure comparability across contraceptive presentations, we standardize prices and quantities to a single menstrual cycle. For example, for an NDC corresponding to three blisters of 21 pills, we divide the price by three and multiply the quantity by three. Appendix 1 provides additional details on data cleaning.

Table 1 reports summary statistics for the OTC and insurance segments before and after the first regulatory wave in January 2019. An observation in this table is a product-month. Prior to the regulation, targeted products in the OTC segment had substantially higher prices than untargeted products. For example, the average price of a targeted conventional pill ($11.44) was more than twice that of an untargeted one ($5.33). After the policy, prices of targeted products declined to levels comparable to those of untargeted products, and their sales volumes increased. The policy also generated spillover effects, as prices of untargeted products within the same contraceptive type as targeted ones declined after the regulation. Overall, total sales volume in the OTC segment increased 14%. In the insurance segment, wholesale prices for targeted contraceptives also declined after the policy, although the effects were smaller in magnitude. For example, the average wholesale price of a conventional pill declined from $3.47 to $2.30. Spillover effects are not apparent in this segment.

4 Reduced-Form Evidence

This section presents reduced-form evidence related to two key elements of our demand model. First, we examine the effects of the price ceiling policy on prices and quantities, documenting the product-level policy-induced variation that we exploit to identify consumers' price sensitivity. Second, we provide evidence of information frictions and the non-pecuniary costs women face when obtaining contraceptives through insurance, motivating their inclusion in the utility specification.

4.1 Effects of the Price Ceiling on Prices and Quantities

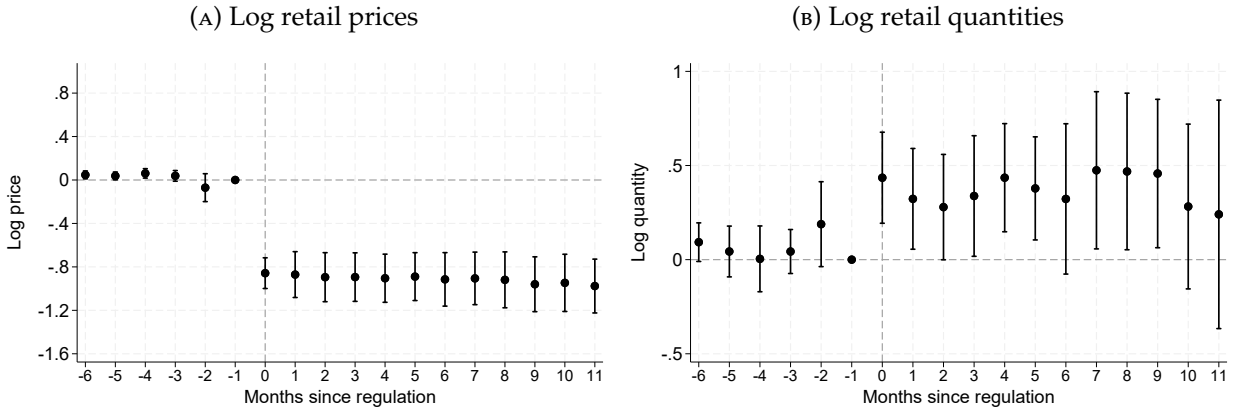
We begin by examining the timing and magnitude of the policy's effects on prices and quantities. Because the policy impacts prices at the product level, it provides the variation we need to identify price sensitivity in the demand model. We estimate event studies separately in the OTC and insurance segments, comparing products targeted by the price

ceiling against untargeted products:

$$y_{jt} = \beta_\tau + \delta_j + \gamma_t + \varepsilon_{jt},$$

where y_{jt} is an outcome for product j in month t, τ is the number of months since the regulation wave in January 2019 (normalizing untargeted products to -1), and δ_j and γ_t are product and month fixed effects, respectively. We use a two-way fixed effects estimator and cluster standard errors at the product and manufacturer level.

FIGURE 2: Effects of the Price Ceiling Policy in the OTC Segment



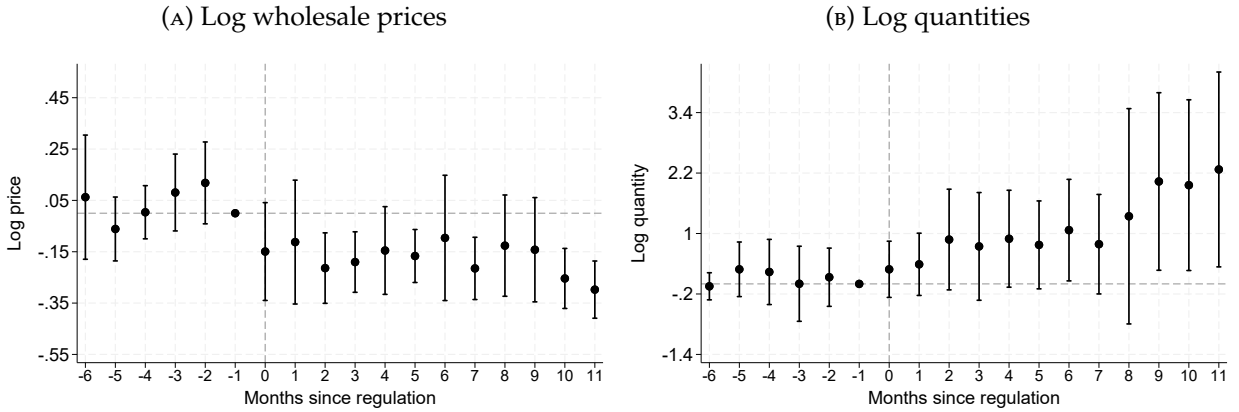
Note: Figure presents event study coefficients and 95% confidence intervals estimated using a TWFE estimator. Panel A shows the effect of the price ceiling policy on log retail prices, and Panel B reports the analogous estimates for log unit sales in the OTC segment. An observation is a product-month.

Identification of treatment effects relies on two assumptions: that outcomes for targeted products would have evolved in parallel to untargeted ones absent the regulation (indirectly testable with pre-period estimates), and that the control group is unaffected by the regulation. Because the regulation generated small spillovers onto untargeted products of the same contraceptive type (Table 1), we expect estimates to be slightly conservative.

Figure 2, Panel A presents our estimates for β_τ using as outcome the log of retail prices. Pre-policy coefficients are close to zero and precisely estimated, indicating no differential trends before the regulation. In the month the price ceiling went into effect, retail prices of targeted products fell by roughly 0.9 log points relative to untargeted products, a decline of about 60%, and this effect persisted throughout the post-period. This pattern suggests that retailers passed through the reductions in wholesale prices induced by the ceiling almost

immediately. Panel B uses as outcome the log retail quantities. Pre-period coefficients are again near zero. After the policy, quantities of targeted products rose by roughly 0.3 to 0.45 log points or 35% to 56% relative to untargeted products. Together, the two panels show that the price ceiling was binding and provides rich variation to identify price sensitivity in the OTC segment.

FIGURE 3: Effects of the Price Ceiling Policy in the Insurance Segment



Note: Figure presents event study coefficients and 95% confidence intervals estimated using a TWFE estimator. Panel A shows the effect of the price ceiling policy on log wholesale prices, and Panel B reports the analogous estimates for log unit sales in the insurance segment. An observation is a product-month.

We next estimate the same event study on claims data from the insurance segment. Figure 3 shows that wholesale prices of targeted products fell by 28% (Panel A) and that demand for these products more than doubled after the regulation, particularly toward the end of 2019 (Panel B). The demand response in the insurance segment cannot reflect an out-of-pocket price effect, since women pay nothing for covered contraceptives both before and after the policy. Two mechanisms could instead explain this increase. First, women may have interpreted the policy as a signal of product quality and updated their beliefs toward targeted products. Second, insurers may have responded to lower wholesale prices by making targeted products easier to obtain, whether through dispensing practices, stock availability, or prescribing guidance.

Appendix Table 5 provides evidence for the second mechanism. We regress product-level insurance-segment market shares on wholesale prices controlling for quality and find a significant negative coefficient on wholesale price even though women never face these prices directly. We therefore allow wholesale prices to enter insurance-segment demand

in the model, with its coefficient capturing insurer behavior in reduced form.

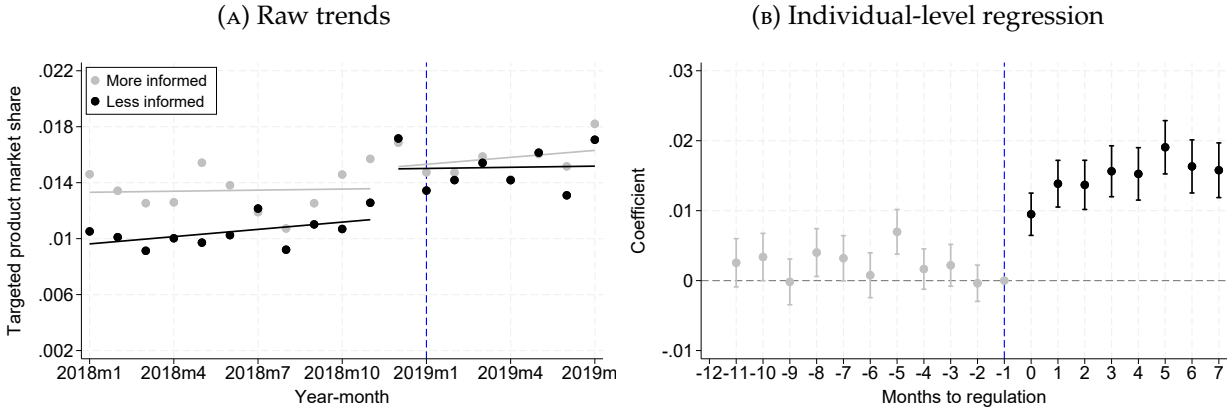
4.2 Survey and Market Evidence on Non-Price Frictions

Information frictions. To understand the forces beyond prices that determine demand through each market segment, we surveyed 310 reproductive-age women in Bogotá from June to August 2026. We were interested in measuring women's awareness of product attributes given that information frictions are a well-known feature of pharmaceutical markets (Crawford and Shum, 2005), and in identifying the main barriers women perceive from sourcing their contraceptives OTC or through insurance.[9] An extract of survey questions and a description of respondents is provided in Appendix 2. 77% of respondents were 18–25 years old, 73% had more than a high school education, and 54% reported currently using contraceptives. On educational attainment and current contraceptive use, survey respondents closely matched contributory-system respondents in the 2015 Demographic and Health Survey (DHS), but reported much lower rates of injection use (Appendix Table 2).

Respondents were presented with seven commonly marketed contraceptive brands spanning oral pills, injections, and implants. For each brand, we first asked whether they recognized its name and then asked them to identify objectively verifiable characteristics, including route of administration. Appendix Table 3 shows that brand awareness is substantially more common than product knowledge. Although 87.6% of respondents recognize at least one brand, 24.7% cannot correctly identify the route of administration of any recognized brand. Familiarity with a brand name therefore does not imply knowledge of readily observable product characteristics nor complex unobservable ones like quality, supporting the existence of information frictions (rather than limited consideration set awareness). Knowledge of product attributes also differs by past healthcare expenditure: 21% of those with any health spending in the past month cannot correctly identify a route compared to 46% of their counterparts.

[9]We note that our survey is externally valid: 61.1% obtained their most recent contraceptive from a pharmacy, whereas 13.5% obtained it from an insurer dispensing facility; this figures are comparable with those obtained from administrative records such as the Medication Price Information System (SISMED) from the Ministry of Health and Social Protection.

FIGURE 4: Targeted Product Market Shares Among Informed and Uninformed Women



Note: Panel A presents the trend of average targeted product market share among more- and less-informed women in Colombia's contributory health insurance system. More-informed women are those with above-median pre-policy annual healthcare spending (excluding prescriptions); less-informed women are their counterparts. Panel B presents coefficients and 95% confidence intervals of an event study comparing the likelihood of consuming targeted products between less-informed (treated) and more-informed (control) women. The regression includes a treated dummy and month fixed effects; standard errors are clustered at the woman level. The dashed blue line represents the month when the price ceiling regulation went into effect.

The market data corroborate the survey. Figure 4 compares contraceptive use in the claims data between women with above- and below-median annual healthcare spending (excluding prescriptions), whom we classify as more- and less-informed women, respectively, based on the survey findings. Panel A plots the average market share of products targeted by the price ceilings, which are considered of higher quality, in each group. More-informed women exhibit higher baseline use of targeted products, and less-informed women show a stronger post-policy increase, so the gap between the two groups narrows after the regulation. Panel B formalizes these differences with an event study using individual-level data, comparing the likelihood of claiming a targeted contraceptive between less-informed (treated) and more-informed (control) women. Less-informed women become 1.5 percentage points more likely to claim targeted products after the policy, a 23% increase relative to the baseline treated mean. Appendix Figure 2 shows that effects survive even in a balanced panel of women including individual fixed effects. These patterns suggest that women interpreted the policy as a signal of product quality: most targeted products are marketed as having milder side effects, so a regulation singling them out conveyed information that less-informed women did not previously hold. Consistent with this interpretation, Appendix Figure 3 shows a sharp increase in Google

searches for the active ingredients targeted by the policy around January 2019.

Hassle costs. Information frictions are an important determinant of contraceptive demand. However, because they affect women across both market segments to varying degrees, they cannot alone explain why most sales occur OTC. Another factor that can help explain the dominance of OTC purchases is the hassle associated with obtaining contraceptives through insurance. Purchasing a contraceptive OTC generally requires only a visit to a retail pharmacy, whereas obtaining it through insurance may involve a combination of appointments, prior authorizations, and travel to an insurer dispensing facility. These additional costs may discourage women from claiming contraceptives through insurance even when doing so would be financially advantageous.[10] The survey provides direct evidence of this. Appendix Table 4 shows that 77.6% of respondents have a pharmacy within ten minutes, compared with only 5.4% for an insurer dispensing facility. Conversely, 65.2% report traveling more than thirty minutes to an insurer facility, compared with 5.5% to a pharmacy.

Because hassle costs are a feature of the insurance segment rather than of any particular product, they shift demand for all covered products equally. In the model we therefore capture hassle costs with an insurance-segment indicator.

5 Model

The reduced-form analyses yield three main takeaways: (i) contraceptive demand in the OTC segment responds strongly to retail prices, while insurance claims increased substantially following the policy-induced reduction in wholesale prices, (ii) women face information frictions about quality and update beliefs based on quality signals related to the price ceiling regulation, and (iii) women face hassle costs when accessing contraceptives through insurance. In this section, we develop a model of the Colombian market for hormonal contraceptives that incorporates these takeaways.

[10] In Colombia, long wait times and administrative burdens in medication dispensing are among the most common complaints filed against health insurers (See El Colombiano, Dec. 21, 2023).

5.1 Demand

Contraceptives are supplied through two segments, indexed by $h = \{ins, otc\}$, where ins denotes insurance and otc denotes over-the-counter. The set of products available to consumers varies across segments, with products indexed by $j = 1, \ldots, J_{ht}$. Assume that, conditional on the set of products available in month t through market segment h, women have common prior beliefs about contraceptive j's quality given by:

$$q_j | J_{ht} \sim \text{Beta}(\mu, \omega),$$

where mean quality is $E[q_j | J_{ht}] = \mu/(\mu + \omega)$.[11] We allow prior beliefs to be segment-specific to capture the possibility that women believe products in any particular segment are of higher quality. Women receive a signal every month, denoted r_{jt}, about whether contraceptive j is regulated. The product-specific signal depends on the quality of the drug,[12] with

$$r_{jt} \sim \text{Bernoulli}(q_j).$$

Suppose that woman i can be either informed ($v = I$) or uninformed ($v = U$) about product quality. Conditional on the signal and the set of available products, women form Bayesian posterior beliefs about the quality of contraceptive j. For informed women, $v = I$, posterior beliefs coincide with true product quality, $E_{It}[q_j | J_{ht}, r_{jt}] = q_j$. For uninformed women, $v = U$, given the distributional assumptions, the mean of the posterior distribution is

$$E_{Ut}[q_j | J_{ht}, r_{jt}] = \sigma E[q_j | J_{ht}] + (1 - \sigma) r_{jt},$$

where $\sigma = (\mu + \omega)/(\mu + \omega + 1)$.

We model contraceptive choice among women who wish to avoid pregnancy using a random coefficients logit model. The indirect utility of woman i from choosing contra-

[11] Our choice of beta-distributed priors follows the data patterns reported in Appendix Figure 4.

[12] This assumption is supported by descriptive evidence in Appendix Table 6 showing that higher-quality products are more likely to be regulated.

ceptive j in month t is

$$u_{ijt} = (\alpha_i + \tau_{\text{ins}(j)}) \log(p_{jt}^h) + \eta_{\text{ins}(j)} + \gamma E_{v(i)t}[q_j | J_{ht}, r_{jt}] + \rho_i \mathbb{1}\{j \in \text{IUD}\} + \xi_{jt} + \varepsilon_{ijt},$$

where

$$\alpha_i = \alpha_0 + \mathbf{D}_i' \boldsymbol{\alpha}_d$$
$$\rho_i = \rho_0 + \rho_1 \cdot \text{age}_i,$$

$\mathbf{D}_i = (\text{age}_i, \text{low income}_i, \text{INS history}_i)'$, "low income" is an indicator that equals one if the woman makes less than a 2018 monthly minimum wage and "INS history" is the probability that the woman obtains contraceptives from the insurance segment, which we predict based on her age from the DHS.

The variable $p_{jt}^h = \{p_{jt}, w_{jt}\}$ denotes the price associated with obtaining product j through each segment: the retail price p_{jt} when the product is purchased OTC and the wholesale price w_{jt} when the product is obtained through insurance.[13] The coefficient α_i thus captures price sensitivity in the OTC segment and the coefficient $\alpha_i + \tau_{\text{ins}(j)}$ the price sensitivity in the insurance segment, with $\tau_{\text{ins}(j)}$ denoting insurer responses to wholesale prices in reduced-form. $E_{v(i)t}[q_j | J_{ht}, r_{jt}]$ is the woman's posterior belief about product j's quality and its associated coefficient γ represents women's preferences for quality. $\eta_{\text{ins}(j)}$ is an insurance segment indicator variable capturing the hassle cost, and $\mathbb{1}\{j \in \text{IUD}\}$ is an indicator for IUDs, with ρ_i representing preferences for this long-acting method.

The term ξ_{jt} is the unobserved product characteristic. We decompose this term as $\xi_{jt} = \xi_j + \xi_t + \Delta\xi_{jt}$; the first component captures preferences for time-invariant contraceptive j's characteristics, the second captures time shocks, and the third is a structural demand error. We normalize the utility of not buying contraceptives to zero, so that $u_{i0t} = \varepsilon_{i0t}$, and assume that ε follows a Type I Extreme Value distribution.

[13] Although IUDs in Colombia can be purchased over the counter, women still need to see a healthcare provider to have the device inserted. Hence, we allow both the price and the hassle cost to affect the choice of IUDs offered OTC.

Define the mean utility and the woman-specific component of utility, respectively, as:

$$\delta_{jt} = (\alpha_0 + \tau_{\text{ins}(j)}) \log(p_{jt}^h) + \eta_{\text{ins}(j)} + \rho_0 \mathbb{1}\{j \in \text{IUD}\} + \xi_j + \xi_t + \Delta\xi_{jt} \tag{1}$$

$$\mu_{ijt} = (\mathbf{D}_i' \boldsymbol{\alpha}_d) \cdot \log(p_{jt}^h) + \gamma E_{v(i)t}[q_j | J_{ht}, r_{jt}] + \rho_1 \mathbb{1}\{j \in \text{IUD}\} \cdot \text{age}_i.$$

Then, the model's predicted market share of contraceptive j is:

$$\hat{s}_{jt} = \int s_{ijt} dP(v, \mathbf{D}), \tag{2}$$

where s_{ijt} is the probability that woman i chooses contraceptive j, which is given by:

$$s_{ijt} = \frac{\exp(\delta_{jt} + \mu_{ijt})}{1 + \sum_{k=1}^{J_t} \exp(\delta_{kt} + \mu_{ikt})}.$$

where $J_t = J_{\text{otc},t} + J_{\text{ins},t}$.

5.1.1 Identification

Our model includes two types of parameters, one associated with the mean utility and the other with the woman-level component of utility: $\boldsymbol{\Phi} = (\boldsymbol{\Phi}^l, \boldsymbol{\Phi}^{nl})' = \left((\alpha_0, \tau, \rho_0), (\boldsymbol{\alpha}_d', \rho_1, \gamma, \sigma)\right)'$.

A. Linear parameters, $\boldsymbol{\Phi}^l$. To identify the linear parameters, we first fix $\boldsymbol{\Phi}^{nl}$ and recover the mean utility term δ_{jt} by iterating on a contraction mapping between model-predicted market shares in equation (2) and observed market shares (Berry et al., 1995). Then, we estimate equation (1) and address price endogeneity using the predicted percentage change in prices for targeted products after the regulation and an indicator for targeted products after the regulation as instruments for the effective price of product j and its interaction with the insurance segment indicator (as in Panel A of Figure 2).

B. Non-linear parameters, $\boldsymbol{\Phi}^{nl}$. We discuss identification of the nonlinear parameters beginning with beliefs and preferences for quality and then turning to demographic interactions.

B.1. Beliefs and preference for quality. A key identification challenge in our model with information frictions is to separately identify preferences for quality, captured by γ, from imperfect information about quality, captured by σ, since their effects on women's choices are observationally equivalent. To do so, we exploit the individual-level insurance data to construct two micro-moments that target the difference-in-differences estimator from Figure 4.[14] Intuitively, the average market share of targeted products among informed women (those with higher healthcare spending) before the price ceiling policy identifies the preference for quality, while the difference in targeted product market share among uninformed women (those with lower healthcare spending) after the policy identifies the relative weight women place on information signals. The respective micro-moments are:

$$\text{For } \gamma: \qquad g^{\text{qual}}(\mathbf{\Phi}) = \frac{1}{T}\sum_{t=1}^{T} \widehat{m}_t^{\text{qual}}(\mathbf{\Phi}) - \overline{m}^{\text{qual}} = 0.$$

$$\text{For } \sigma: \qquad g^{\text{reg}}(\mathbf{\Phi}) = \left(\frac{1}{T_{\text{post}}}\sum_{t\in\text{post}} \widehat{m}_t^{\text{reg}}(\mathbf{\Phi}) - \frac{1}{T_{\text{pre}}}\sum_{t\in\text{pre}} \widehat{m}_t^{\text{reg}}(\mathbf{\Phi})\right) - \left(\overline{m}_{\text{post}}^{\text{reg}} - \overline{m}_{\text{pre}}^{\text{reg}}\right) = 0,$$

with:

$$\widehat{m}_t^{\text{qual}}(\mathbf{\Phi}) = \frac{\frac{1}{R}\sum_{i,j} \mathbb{1}\{j \in \text{reg}\} \cdot \mathbb{1}\{v_i = I\} \cdot \hat{s}_{ijt}(\mathbf{\Phi})}{\frac{1}{R}\sum_{i,j} \mathbb{1}\{v_i = I\} \cdot \hat{s}_{ijt}(\mathbf{\Phi})}, \quad \text{and}$$

$$\widehat{m}_t^{\text{reg}}(\mathbf{\Phi}) = \frac{\frac{1}{R}\sum_{i,j} \mathbb{1}\{j \in \text{reg}\} \cdot \mathbb{1}\{v_i = U\} \cdot \hat{s}_{ijt}(\mathbf{\Phi})}{\frac{1}{R}\sum_{i,j} \mathbb{1}\{v_i = U\} \cdot \hat{s}_{ijt}(\mathbf{\Phi})},$$

where $\mathbb{1}\{j \in \text{reg}\}$ is an indicator for whether product j is targeted by the price ceiling

[14] This indirect inference approach follows Fu and Gregory (2019) who match regression discontinuity estimates.

policy; R denotes the number of women sampled for estimation, set to 1000; and T denotes the number of months. The empirical targets $\overline{m}^{\text{qual}}$, $\overline{m}^{\text{reg}}_{\text{post}}$ and $\overline{m}^{\text{reg}}_{\text{pre}}$ are computed from the claims data.

B.2. Demographic interactions. To identify the parameters capturing individual heterogeneity in preferences, we use another set of micro-moments capturing the consumption patterns by age and route of administration:

$$g^{A,C}(\boldsymbol{\Phi}) = \frac{1}{T}\sum_{t=1}^{T} \widehat{m}_t^{A,C}(\boldsymbol{\Phi}) - \overline{m}^{A,C} = 0, \qquad g^{D,w}(\boldsymbol{\Phi}) = \frac{1}{T}\sum_{t=1}^{T} \widehat{m}_t^{D,w}(\Phi) - \overline{m}^{D,w} = 0,$$

with

$$\widehat{m}_t^{A,C}(\boldsymbol{\Phi}) = \frac{\frac{1}{R}\sum_{i,j} \text{age}_i \cdot C_j \cdot \hat{s}_{ijt}(\boldsymbol{\Phi})}{\frac{1}{R}\sum_{ij} C_j \cdot \hat{s}_{ijt}(\boldsymbol{\Phi})}, \quad \text{and} \quad \widehat{m}_t^{D,w}(\boldsymbol{\Phi}) = \frac{\frac{1}{R}\sum_{i,j\in N_{\text{ins}}} \log(w_{jt}) \cdot D_i \cdot \hat{s}_{ijt}(\boldsymbol{\Phi})}{\frac{1}{R}\sum_{i,j\in N_{\text{ins}}} D_i \cdot \hat{s}_{ijt}(\boldsymbol{\Phi})},$$

where $C_j \in \{\text{pills}, \text{injections}, \text{IUDs}\}$, $\mathbf{D}_i = (D_{i1}, D_{i2}, D_{i3})'$ with $D_{i1} = \mathbb{1}\{\text{age}_i > 35\}$, $D_{i2} = \text{low income}_i$, $D_{i3} = \mathbb{1}\{\text{INS history}_i \geq 0.44\}$, N_{ins} is the number of product-month observations in the insurance segment, and the targets $\overline{m}^{A,C}$ and $\overline{m}^{D,w}$ are computed from the health claims data.

Finally, we combine the exogenous variables from the mean utility equation (1), $\mathbf{Z}_d$, with an additional differentiation instrument in the spirit of Gandhi and Houde (2020), defined as the distance between a product's predicted price and those of its competitors,[15] to form the moment condition:

$$\mathbf{g}^{\text{agg}}(\boldsymbol{\Phi}) = \frac{1}{N}\mathbf{Z}_d'\boldsymbol{\Delta\xi}(\boldsymbol{\Phi}) = \mathbf{0},$$

where N is the total number of product-month observations and $\boldsymbol{\Delta\xi}(\boldsymbol{\Phi})$ is the vector of

[15]The predicted price comes from a regression of log prices on the grams of estrogen and progestin, product age, and fixed effects for ATC code, route of administration, segment, manufacturer, and import status.

structural error terms. These moments help identify $\mathbf{\Phi}^{nl}$ through δ_{jt}.

5.1.2 Estimation Approach

We use a generalized method of moments (GMM) estimator that combines standard demand-side instruments with micro-moments derived from the price ceiling policy and our individual-level health claims data. Collecting all the moment conditions presented above in the vector $\mathbf{g}(\mathbf{\Phi})$, our GMM estimator solves the following objective function:

$$\widehat{\mathbf{\Phi}} = \arg\min_{\mathbf{\Phi}} \ \mathbf{g}(\mathbf{\Phi})' \mathbf{W}_d^{-1} \mathbf{g}(\mathbf{\Phi}).$$

The weighting matrix $\mathbf{W}_d$ is block-diagonal, with each block equal to the empirical variance of the corresponding micro-moment and a block equal to $\mathbf{Z}_d' \mathbf{Z}_d$ for the aggregate moment conditions. Because the two types of moments are computed from samples of different sizes, we rescale the aggregate moment conditions to prevent one block from dominating the objective function (Conlon and Gortmaker, 2020).

5.2 Supply

We model manufacturers in the OTC segment as setting retail prices, as if they were vertically integrated with pharmacies. Although prices at different stages of the supply chain may be negotiated, particularly between manufacturers, wholesalers, and large pharmacy chains, the downstream market is highly competitive and includes a large number of small retail pharmacies. This limits the scope for independent downstream markups and makes manufacturer control of the final retail price a reasonable approximation.[16]

In the insurance segment, manufacturers and/or wholesalers supply contraceptives to health insurers at negotiated prices. The OTC segment is manufacturers' largest and most profitable segment, while insurers are legally required to ensure the continuous supply of covered medications to their enrollees. These asymmetries strengthen manufacturers'

[16]The OTC contraceptive supply chain involves price negotiations between manufacturers and wholesalers and between wholesalers and some large retail pharmacy chains (see Figure 1). The IQVIA data, however, report retail prices but do not contain the upstream transaction prices generated by these negotiations. We therefore model pricing at the manufacturer level and abstract from explicit vertical bargaining.

bargaining position. We therefore simplify negotiations by assuming that manufacturers contract directly with insurers, have all the bargaining power, and make take-it-or-leave-it (TIOLI) offers specifying a per-unit wholesale price. We further assume that there is a single representative insurer, reflecting Colombia's health insurance system, where all insurers are required to provide the same nationally defined health benefits plan, including prescription drug coverage. The representative insurer accepts an offer if it satisfies its participation constraint, receiving zero surplus otherwise.[17]

Manufacturer f chooses retail prices in the OTC segment and wholesale prices in the insurance segment to maximize total profits given by:

$$\Pi_{ft}(\mathbf{p}) = \sum_{j \in J_{otc,ft}} (p_{jt} - mc_{jt}) \cdot s_{jt}(\mathbf{p}) M_t + \sum_{k \in J_{ins,ft}} (w_{kt} - mc_{kt}) \cdot s_{kt}(\mathbf{p}) M_t,$$

where $J_{h,ft}$ is the set of products manufactured by firm f in month t and segment h, $\mathbf{p}$ is the vector of prices of the $J_t = J_{ins,t} + J_{otc,t}$ products available in the market, mc_{jt} is the marginal cost of product j in month t, s_{jt} is product j's market share, and M_t is the potential market size. We calibrate M_t using contraceptive prevalence estimates from the DHS, which the World Bank uses to estimate that 83% of reproductive-age women in Colombia use contraception (World Bank, 2025). Hence, excluding women who are sterilized, the outside option of not using hormonal contraceptives has a market share of roughly 40%.[18]

In the OTC segment, contraceptive manufacturers compete in retail prices in a Nash–Bertrand fashion. In the insurance segment, manufacturers choose wholesale prices to maximize profits subject to the insurer's surplus being nonnegative. Following Gowrisankaran et al. (2015), we write the insurer's surplus function as

$$U_t(J_{ins,t}; \varphi) = M_t \underbrace{\int -\alpha_i^{-1} \mathcal{I}_{ins,it} dP_{l(i)}(v, \mathbf{D})}_{\bar{\mathcal{I}}_t} - \varphi_t M_t \sum_{k \in J_{ins,t}} w_{kt} s_{kt}(\mathbf{p}),$$

[17] There are no incentive compatibility constraints for the insurer because the set of products covered by the national health insurance plan is exogenously determined by the government.

[18] In our estimation, the market share of the outside option varies between 35% and 45% across months.

where $\mathcal{I}_{\text{ins},it}$ is the individual-specific inclusive value from the logit demand, given by

$$\mathcal{I}_{ins,it} = \log\Big(\sum_{j \in J_{ins,t}} \exp(\delta_{jt} + \mu_{ijt})\Big).$$

The term $\bar{\mathcal{I}}_t$ denotes the inclusive value in dollars aggregated across consumers. We convert the inclusive value into dollars by dividing by the absolute value of the price coefficient, and scale it by market size, M_t. The parameter $\varphi_t > 0$ captures the weight the insurer places on total contraceptive expenditures relative to women's expected utility. The insurer offers the bundle $J_{ins,t}$ to its enrollees whenever its surplus is nonnegative. We treat this product bundle as exogenous because it is determined by the government.

The manufacturer problem is given by:

$$\max_{p_{jt}, w_{kt}, \lambda} \mathcal{L} = \sum_{j \in J_{otc,ft}} (p_{jt} - mc_{jt}) s_{jt}(\mathbf{p}) M_t + \sum_{k \in J_{ins,ft}} (w_{kt} - mc_{kt}) s_{kt}(\mathbf{p}) M_t + \lambda U(J_{ins,t}; \varphi), \quad (3)$$

where λ captures the marginal value of insurer profits to the manufacturer. Assuming that a pure-strategy Nash equilibrium in prices exists, profit maximization involves a set of first-order conditions (FOCs) that after stacking and writing in matrix notation yields:

$$\mathbf{0} = \begin{bmatrix} \mathbf{s}_{\text{otc}} \\ \mathbf{s}_{\text{ins}} \end{bmatrix} + \begin{bmatrix} \mathbf{\Lambda}_{p,\text{otc}} & \mathbf{\Lambda}_{p,\text{ins}} \\ \mathbf{\Lambda}_{w,\text{otc}} & \mathbf{\Lambda}_{w,\text{ins}} \end{bmatrix} \begin{bmatrix} \mathbf{p} - \mathbf{mc}_{\text{otc}} \\ \mathbf{w} - \mathbf{mc}_{\text{ins}} \end{bmatrix} + \lambda \left(\begin{bmatrix} \mathbf{0} \\ \nabla_w \bar{\mathcal{I}} \end{bmatrix} - \varphi \begin{bmatrix} \nabla_p C \\ \nabla_w C \end{bmatrix} \right).$$

Here, $\mathbf{\Lambda}$ is the matrix of demand derivatives with respect to prices multiplied by the ownership matrix, $\nabla_w \bar{\mathcal{I}}$ is the vector of derivatives of the inclusive value with respect to wholesale prices, and $\nabla_w C$ and $\nabla_p C$ are the vectors of derivatives of the insurer's total contraceptive costs with respect to wholesale and retail prices, respectively. The manufacturer's optimization problem in equation (3) applies to the months before the price ceiling policy. After the policy, the derivatives of OTC contraceptive demand for targeted products with respect to prices are zero, since the price ceiling is binding.

The FOC of the manufacturer's problem yields an expression for the implied marginal

cost of each product:

$$\mathbf{mc} = \mathbf{p} + \mathbf{\Lambda}^{-1}\mathbf{s} + \lambda\mathbf{\Lambda}^{-1}\nabla\mathbf{U}.$$

We decompose the marginal cost as $\mathbf{mc} = \mathbf{X}\boldsymbol{\beta}^s + \boldsymbol{\omega}$, where $\mathbf{X}$ are observed product characteristics including the product's number of cycles, true observed quality, age, and whether it is imported; $\boldsymbol{\beta}^s$ are supply-side parameters to be estimated; and $\boldsymbol{\omega}$ is the supply-side structural error capturing unobserved cost shifters. Substituting, we obtain the estimating equation:

$$\mathbf{X}\boldsymbol{\beta}^s + \boldsymbol{\omega} = \mathbf{p} + \mathbf{\Lambda}^{-1}\mathbf{s} + \lambda\mathbf{\Lambda}^{-1}\nabla\mathbf{U}. \tag{4}$$

Additional considerations. In principle, market segmentation could reflect the selection of manufacturers or products into each segment, or differences in the women each segment serves. We take the first as given and focus on the second, that is, on how women's demand responds to the resulting market structure. This modelling choice is supported by two facts. First, manufacturers' participation in each segment does not change over our sample period. Second, the composition of products within each segment is likewise stable – there are no new OTC approvals nor changes to the insurance formulary over the sample period.

Identification and Estimation Approach. We estimate the supply parameters $\boldsymbol{\theta} = (\lambda, \boldsymbol{\beta}^s, \varphi_t)'$ using GMM, taking demand estimates as given (as in Miller and Weinberg, 2017) and restricting estimation to the pre-policy period from January to December 2018.

The parameter φ_t is identified directly from the insurer's participation constraint. In equilibrium this participation constraint must be binding; otherwise the manufacturer could charge higher prices to the insurer, increasing its profits while still satisfying the participation constraint. Imposing this binding condition yields a closed-form expression for φ_t:

$$\varphi_t = \frac{\bar{\mathcal{I}}_t}{\sum_{k \in J_{ins,t}} w_{kt} s_{kt}(\mathbf{p})}.$$

The linear parameters $\boldsymbol{\beta}^s$ are identified from equation (4) under the assumption that the product characteristics in $\mathbf{X}$ are exogenous to unobserved cost shifters.

Finally, the estimation of the Lagrange multiplier λ requires an instrumental variable

approach. The vector of surplus derivatives is potentially endogenous because it reflects the manufacturer's optimal response to cost conditions that are observed by the manufacturer but unobserved to the econometrician. To address this, we instrument the insurer's surplus with two sets of instruments. The first are Gandhi and Houde (2020)-style differentiation instruments, constructed as the euclidean distance in grams of estrogen and progestin between own and rival products per month. The second is the aggregate observed market share of rival manufacturers in the OTC segment. Both instruments satisfy the exclusion restriction for distinct reasons. The hormonal composition of a contraceptive is set by pharmacological requirements and is therefore orthogonal to a manufacturer's idiosyncratic cost shocks. Rival manufacturers' OTC demand shifts the focal manufacturer's outside option in its TIOLI offer to the insurer without directly affecting the focal product's own marginal cost. To ensure that the Kuhn-Tucker condition $\lambda \geq 0$ is satisfied, we reparametrize $\lambda = \exp(\tilde{\lambda})$ and estimate $\tilde{\lambda}$ directly. Since $\tilde{\lambda}$ in principle can take very negative values, a significance test on λ will inform whether the model rejects pure Bertrand pricing in the insurance segment.

We implement these instruments in our GMM procedure by constructing the moment condition:

$$\mathbf{g}^{\text{supply}}(\boldsymbol{\theta}) = \frac{1}{N_{\text{pre}}} \mathbf{Z}_s' \boldsymbol{\omega}(\boldsymbol{\theta}) = \mathbf{0},$$

where the matrix $\mathbf{Z}_s$ includes the exogenous product characteristics $\mathbf{x}_{jt}$ and our instruments, and N_{pre} is the number of product-month observations in the pre-policy period. The GMM estimator is given by:

$$\hat{\boldsymbol{\theta}} = \arg\min_{\boldsymbol{\theta}} \ \mathbf{g}(\boldsymbol{\theta})' \mathbf{W}_s^{-1} \mathbf{g}(\boldsymbol{\theta}),$$

where $\mathbf{W}_s = \mathbf{Z}_s' \mathbf{Z}_s$. Appendix 4 provides the estimation details.

6 Results

Table 2 reports our estimation results. Women experience negative marginal utility from both retail prices and wholesale prices, but the disutility from wholesale prices in the

TABLE 2: Model Estimation Results

Variable	coef	se (·) | sd [·]
Panel A. Demand parameters		
Log price	-1.877***	(0.258)
Log price × Age	0.35***	(0.034)
Log price × Low income	-0.373***	(0.005)
Log price × INS history	-0.216***	(0.032)
Log price × INS dummy	-2.431***	(0.076)
INS dummy (Hassle coefficient)	-4.050***	(0.037)
IUD dummy × Age	7.691***	(0.272)
Quality preference (γ)	1.309***	(0.321)
Weight on prior (σ)	0.627***	(0.098)
Panel B. Supply parameters (pre-period)		
Number of cycles	-0.041	(0.046)
Imported product	-0.180	(0.293)
Product age	0.027	(0.026)
Shadow price of insurance (λ)	0.012***	(0.001)
Weight on insurer costs (φ)	0.538	[0.021]
Panel C. Model metrics		
Median own-price elasticity (OTC)	-2.143	[0.455]
Median own-price elasticity (INS)	-4.570	[0.050]
Demand Fixed Effects		
ATC, Route, Nest, Quarter (separate)	Yes	
Observations (product-months)	1728	
Supply Fixed Effects		
ATC, Route, Nest, Lab, Quarter (separate)	Yes	
Observations (product-months)	864	

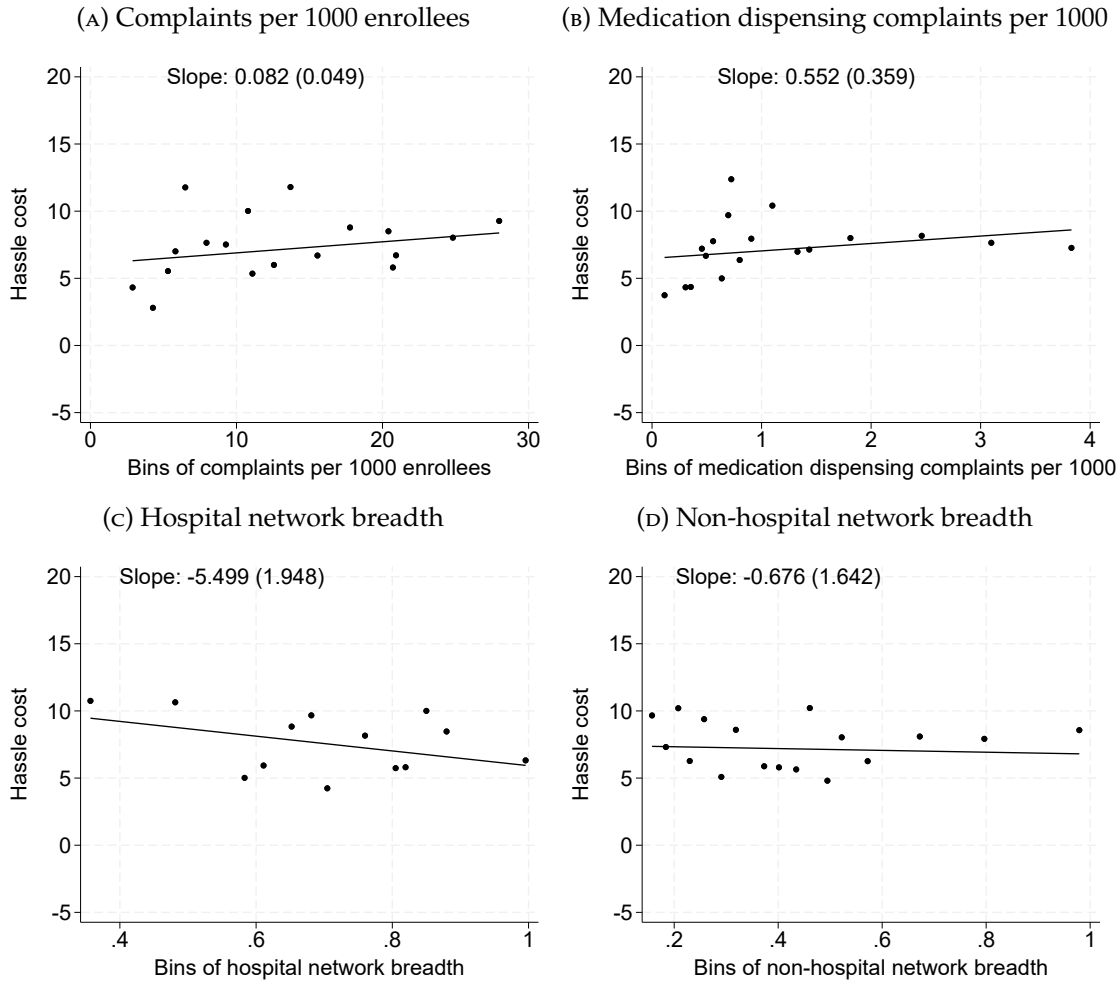
Note: Table presents the demand and supply model estimates. In the demand model we use as instruments for the log effective price and its interaction with the insurance segment dummy the predicted percentage change in prices for targeted products after the regulation and an indicator for targeted products after the regulation. We recover the weight insurer's place on contraceptive costs by setting the participation constraint to zero. The instruments for the shadow price of insurance are the average distance between the focal product and its competitor's grams of estrogen and progestin and the demand for other manufacturers in the OTC segment excluding the focal manufacturer. Age is divided by 100 in estimation. The regression for the mean utility includes ATC, route, and quarter fixed effects. The regression for the marginal cost includes ATC, route, segment, manufacturer, and quarter fixed effects. The demand model is estimated on data from January 2018 to December 2019. The supply model is estimated on data from January to December 2018. Standard errors are reported in parenthesis and standard deviations in brackets.

insurance segment is substantially larger, suggesting prices and insurer behavior deter contraceptive take-up. Price sensitivity is higher among women who are younger, lower income, and more likely to have claimed contraceptives through insurance. The greater price sensitivity of women with a history of insurance claims is what allows the manufacturer to price discriminate across segments. The median own-price elasticity is -2.14 in the OTC segment and -4.57 in the insurance segment. In particular, the insurance-segment

elasticity reflects insurer behavior to wholesale prices.

Women have strong preferences for higher-quality contraceptives, but they face information frictions about quality: they place 63% weight on their prior beliefs about product quality and 37% on quality signals, indicating that most women remain poorly informed about contraceptive quality even after a policy shock.

FIGURE 5: Correlates of Insurance Hassle Cost



Note: Figure presents binned scatter plots of the hassle cost (the highest OTC price that makes the woman indifferent between buying over the counter or claiming through her insurer) and characteristics of the insurer the woman is enrolled with. Panel A uses patient complaints per 1,000 enrollees. Panel B uses patient complaints related to medication dispensing per 1,000 enrollees. Panel C uses the insurer's fraction of covered hospitals. Panel D uses the insurer's fraction of covered non-hospital providers.

Hassle costs in the insurance segment are also substantial. The coefficient on the insurance segment indicator is more than twice as large in magnitude as the coefficient on the log of the effective price. To better interpret this coefficient, we calculate the highest

OTC price at which a woman is indifferent between buying product j over the counter and claiming it through her insurer with hassle. Let $\tilde{w}_j = \ln w_j$ and $\tilde{p}_j = \ln p_j$. The price- and segment-related components of the indirect utility in the observed scenario and the OTC scenario are:

$$V_{ij}^{\text{obs}} = (\alpha_i + \tau)\,\tilde{w}_j + \eta \quad \text{and} \quad V_{ij}^{\text{cf}} = \alpha_i \tilde{p}_j.$$

Equating these two utilities and solving for the retail price yields

$$p_{ij}^{*} = \exp\left[\left(1 + \frac{\tau}{\alpha_i}\right)\tilde{w}_j + \frac{\eta}{\alpha_i}\right].$$

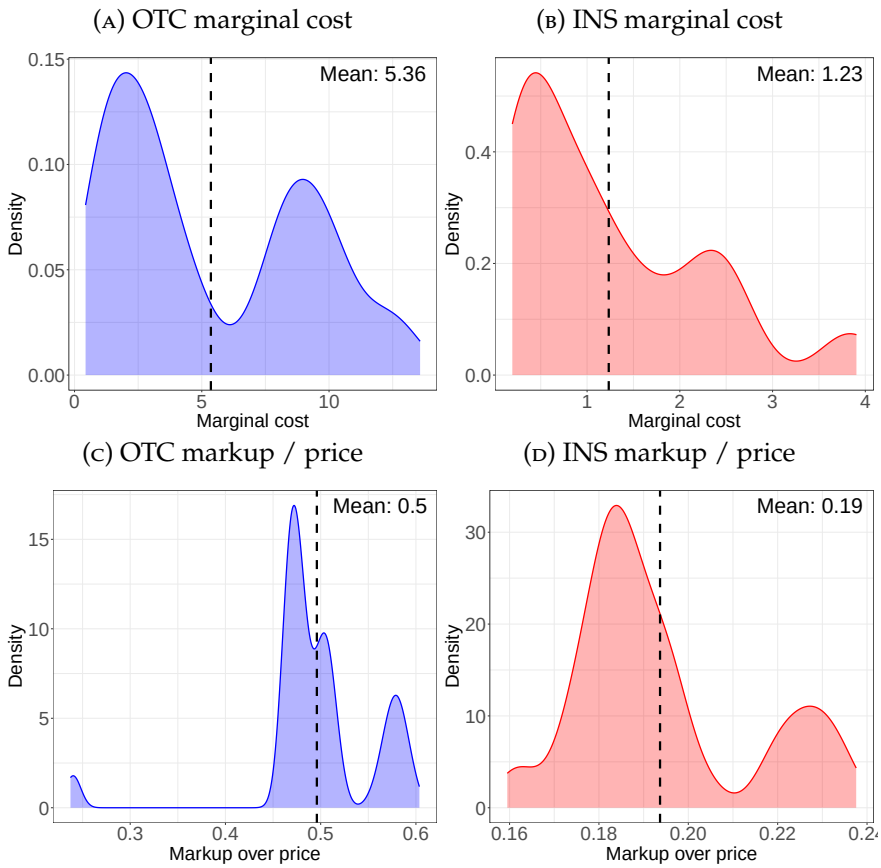
Figure 5 relates the implied hassle costs to insurer characteristics. The interquartile range of the hassle cost goes from \$1.4 to \$8.5 per woman-month and, as expected, this cost is higher for women enrolled with lower-quality insurers. Hassle costs increase with the number of patient complaints per enrollee (Panel A) and with complaints specifically about medication dispensing, such as delays or denials (Panel B), and decrease with the breadth of the insurer's hospital and non-hospital networks (Panels C and D).

Moving to the supply side, the second panel of Table 2 reports our estimates. Marginal costs are lower for imported products than for domestically produced ones, in line with multinational companies being more efficient than local producers. Products covering more menstrual cycles have lower marginal costs per cycle, while products introduced earlier in the market have higher marginal costs than their counterparts. These parameters are imprecise but informative about the cost structure of contraceptive manufacturers. Using a binding insurer's participation constraint to recover φ implies that insurers place a weight of 54% on total contraceptive costs and the remaining 46% on women's surplus.[19] The estimated Lagrange multiplier λ is statistically significant, allowing us to reject pure Bertrand pricing in the insurance segment. Appendix Table 7 shows that our model closely matches the empirical micro-moments from the claims data.

Model metrics. Appendix Table 8 reports average own- and cross-price elasticities in the OTC segment during the pre-policy period by route of administration. Own-price

[19] We recover the explicit weight on contraceptive costs by solving for ψ from $\varphi = \frac{\psi}{1-\psi}$.

FIGURE 6: Distribution of Marginal Costs and Markups



Note: Figure presents the distribution of marginal costs and markups separately by market segment. The supply model estimation uses data from January to December 2018. The dashed line represents the mean of the distribution.

elasticities exceed one in absolute value across all routes and fall within the ballpark of those derived from experimental variation in out-of-pocket contraceptive prices in the U.S. (Bailey et al., 2025). Demand for conventional pills is more elastic than for injections, and IUD users are more likely to switch to injections than to conventional pills when prices rise. Appendix Table 9 reports wholesale price elasticities for the insurance segment, which are much larger in magnitude than price elasticities in the OTC segment. Substitution patterns in the insurance segment show that IUD users are more likely to switch to implants than injections.

Figure 6 presents the implied distributions of marginal costs and markups across both segments. Marginal costs are largely bimodal in both segments because of the costs of the two most common active ingredients, levonorgestrel and medroxyprogesterone. All

estimated marginal costs are positive. The (unweighted) average marginal cost is $5.36 in the OTC segment, reflecting the higher quality of some products offered exclusively there, and $1.23 in the insurance segment.

Retail markups also have a bimodal distribution with the average equal to 50%. In the insurance segment, estimated wholesale markups are on average 19%. These two estimates imply that if the manufacturer sold insurance-exclusive products OTC, it would earn a markup of nearly 4 times the marginal cost of production.[20]

7 Insurance Coverage of OTC Contraceptives

Counterfactual setup. We now use our model estimates to evaluate the equilibrium effects of offering contraceptives only OTC, and report results holding information status fixed and assuming full information. We report results of the insurance-only counterfactual in Appendix 6.2.

In the OTC-only counterfactual, we set the insurance segment indicator to zero in the demand function, hence hassle costs have no impact on demand (except for IUDs), which puts upward pressure on equilibrium prices. On the supply side, manufacturers price all products according to Nash-Bertrand competition. Two opposing forces shape equilibrium prices in this counterfactual. Removing the insurer's participation constraint allows manufacturers to solve an unconstrained pricing problem, which tends to raise prices. At the same time, manufacturers must offer all insurance-segment products through the OTC segment, intensifying competition across products and putting a downward pressure on prices. The net effect is therefore ambiguous a priori.

We additionally remove information frictions by assuming all women are fully informed. The equilibrium price effects of better information depend on the direction of the quality bias. If women systematically underestimate the quality of higher-priced products, then removing information frictions shifts demand toward these products, putting upward pressure on their prices. Conversely, if information frictions disproportionately

[20]This estimate is computed as the difference between the average OTC retail price and the average marginal cost in the insurance segment, divided by the average marginal cost in the insurance segment.

affect lower-quality products, removing frictions would shift demand away from these products, putting downward pressure on their prices. The net effect therefore depends on the distribution of quality misperceptions across products, which we recover from the structural estimates.

Equilibrium. Our estimates describe the observed equilibrium, which raises the question of how far the counterfactuals extrapolate from it. Although we do not prove the existence or uniqueness of the counterfactual price equilibrium, we numerically verify that the system of first-order conditions converges to the same fixed point from a range of starting values, as is standard in the literature.

Results. We simulate all counterfactuals in the period between January and June 2018 before the announcement of the price ceiling policy. To ensure comparability across scenarios, we report counterfactual price results separately for products that are offered OTC at baseline and for products that are offered through insurance at baseline. By reporting results in this way we avoid comparisons of retail and wholesale prices.

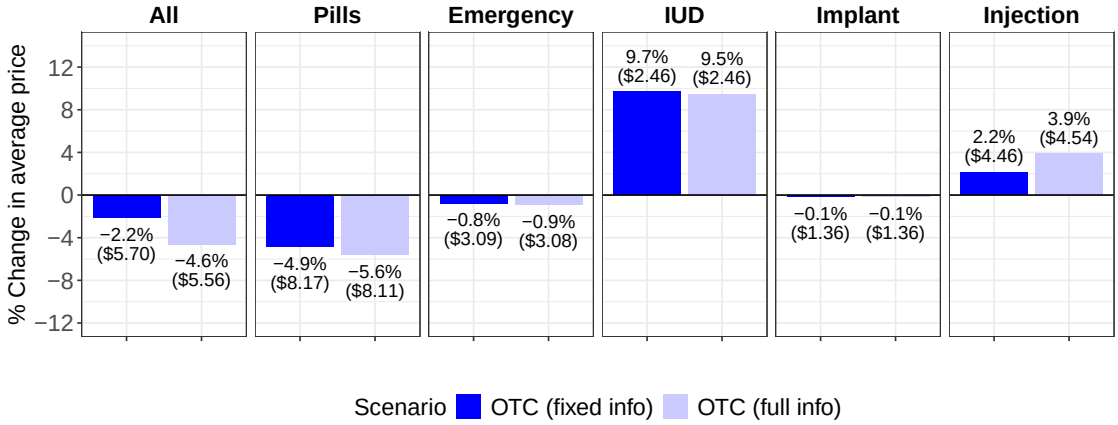
7.1 OTC-only Market

Figure 7 presents the percentage change in retail price and the price level (in parenthesis) for baseline OTC products. We find that moving to an OTC-only market holding information fixed slightly lowers the (demand-weighted) average price by 2.2%, from \$5.83 to \$5.70. The impact of greater product competition therefore slightly offsets that of a lower price elasticity in this counterfactual. Effects differ markedly by route of administration. The price of oral contraceptives falls by 4.9% (from \$8.59 to \$8.17) while that of IUDs and injections increases by 9.7% (from \$2.24 to \$2.46) and 2.2% (from \$4.37 to \$4.46), respectively. Hence, the overall price reduction is driven by oral contraceptives.

Incorporating full information generates larger reductions in average equilibrium prices equal to 4.6%. Both the price reduction for oral contraceptives and the price increase for injections are much larger when information frictions are removed, at 5.6% and 3.9%, respectively. These results suggest that manufacturers exploit information frictions

to sustain higher markups and that women's prior beliefs about quality tend to be biased upward for pills but downwards for injections. Appendix Figure 5 shows counterfactual price trends, confirming that the average effects reported in Figure 7 are not driven by seasonal variation in contraceptive demand.

FIGURE 7: Retail Price Changes in Baseline OTC Segment



Note: Figure shows the percentage change in price relative to the observed scenario in the OTC-only counterfactual holding information fixed (in dark blue) and assuming full information (in light blue), both overall and by route of administration. Numbers in parenthesis present the price level. Figure conditions on products offered OTC at baseline.

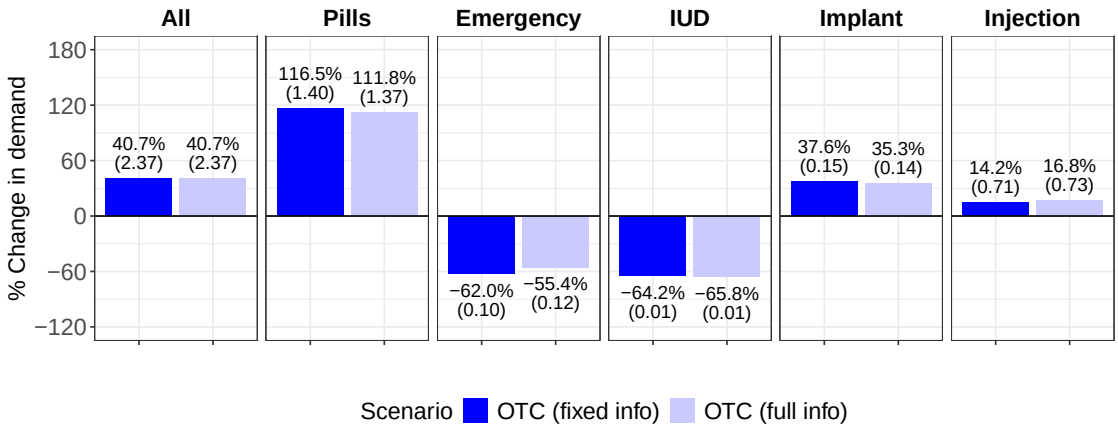
Although the overall price reductions seem relatively modest in percentage terms, they are economically meaningful at the market level. Holding demand fixed, the price decrease under the scenario with full information would reduce annual out-of-pocket spending on contraceptives by 16.1 billion COP pesos ($5.46 million).[21] Hence, the coexistence of OTC and insurance segments allows manufacturers to price-discriminate and charge higher retail prices for products offered OTC at baseline.

Figure 8 reports the percentage change in demand relative to the observed scenario and the demand level (in parenthesis) measured in millions of women per month. Moving to an OTC-only market holding information fixed raises total demand by 41% (from 1.68 to 2.37 million women per month). This demand increase is driven by a more than doubling of demand for conventional pills. Demand for emergency pills falls 62%, suggesting these products partly serve women who would otherwise obtain contraceptives through

[21] We calculate this figure by multiplying the price change in dollars by the COP/USD exchange rate and by total annual demand in the observed scenario.

insurance and who switch to conventional methods once those become available over the counter. Likewise, demand for IUDs falls 64%, albeit from a small baseline (0.039 million women per month). Despite the fact that prices for injections increase, their demand also rises 14% because some women substitute away from IUDs and emergency contraceptives. Assuming full information yields similar effects on contraceptive demand. Appendix Tables 10 reports diversion ratios to the outside option consistent with the results reported in Figure 8. For completeness, Appendix 6.2 presents the counterfactual scenario in which all products are pooled in the insurance segment, where we find largely symmetric results.

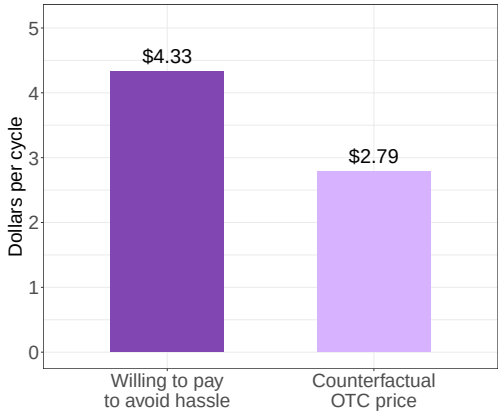
FIGURE 8: Counterfactual Demand Changes in OTC-only Market



Note: Figure shows the percentage change in demand relative to the observed scenario in the OTC-only counterfactual holding information fixed (in dark blue) and assuming full information (in light blue), both overall and by route of administration. Numbers in parenthesis present the demand level.

The price and demand results indicate that there is little value of covering contraceptives through insurance. The coexistence of OTC and insurance segments not only allows manufacturers to charge higher prices relative to a pooled OTC market, but it also dampens demand. Although prices play a role in this demand increase, most of the effect is explained by the elimination of hassle costs. Appendix Figure 6 shows this by comparing our OTC-only results holding information fixed with a version in which the insurance-segment disutility remains attached to products formerly supplied through insurance, even though they are now sold OTC. With hassle costs held fixed, the change in total demand is negligible, so their removal is the primary driver of the main result.

FIGURE 9: Willingness to Pay to Avoid Hassle Costs



Note: Figure presents the average reservation retail price that women would be willing to pay to avoid the hassle of claiming through insurance (in dark purple) and the equilibrium price in the OTC-only counterfactual for products offered through insurance at baseline (in light purple).

To further analyze the role of hassle costs, we repeat the exercise of Section 6 assuming hassle costs are zero. There, we computed the OTC price at which a woman is indifferent between buying a product over the counter and claiming it through insurance, taking the segment-level disutility of the insurance segment as given. Here we ask what is the highest OTC price a woman would pay to avoid that disutility altogether. This reservation price is

$$p_{ij}^{*} = \exp\left[\left(1 + \frac{\tau}{\alpha_i}\right)\tilde{w}_j\right],$$

and comparing it with the price she faces in the OTC-only counterfactual tells us whether she gains more from escaping the frictions of the insurance segment than she loses from paying the retail price.

Figure 9 compares the average reservation retail price against the equilibrium retail price in the OTC-only counterfactual for products purchased through insurance at baseline. Women are willing to pay up to $4.33 at retail to avoid the hassle of the insurance segment, whereas the counterfactual OTC price of baseline insurance product is $2.79, so they are better off switching to the OTC market. This willingness to pay is lower than the pre-regulation average price of a conventional pill in the OTC segment ($11), which explains why a fraction of sales still occurs through insurance in the observed market.

7.2 Reducing the Burden of Hassle Costs

Our results have several implications for policy. The fact that hassle costs are an important constraint on access through insurance does not imply that governments should remove contraceptives from the national insurance formulary; it implies that they should make the insurance system easier to use. Policies that reduce hassle costs would raise the value of the insurance segment, especially for the more price-sensitive women who sort into it. One such policy would be to require insurers to have broad pharmacy networks, allowing women to fill contraceptives at any pharmacy rather than only at insurer-owned dispensing facilities.

We use our model to evaluate this proposed policy. Requiring insurers to offer broad pharmacy networks would be equivalent to reducing the magnitude of the coefficient on the insurance-segment indicator in our demand model. We choose the magnitude of the reduction so that in dollar terms its median equals roughly the minimum fare of a taxi ride (7,500 COP or $2.7)—the cost of a trip to an insurer dispensing facility that the policy would eliminate. In practice, this is a 50% reduction in the hassle cost.

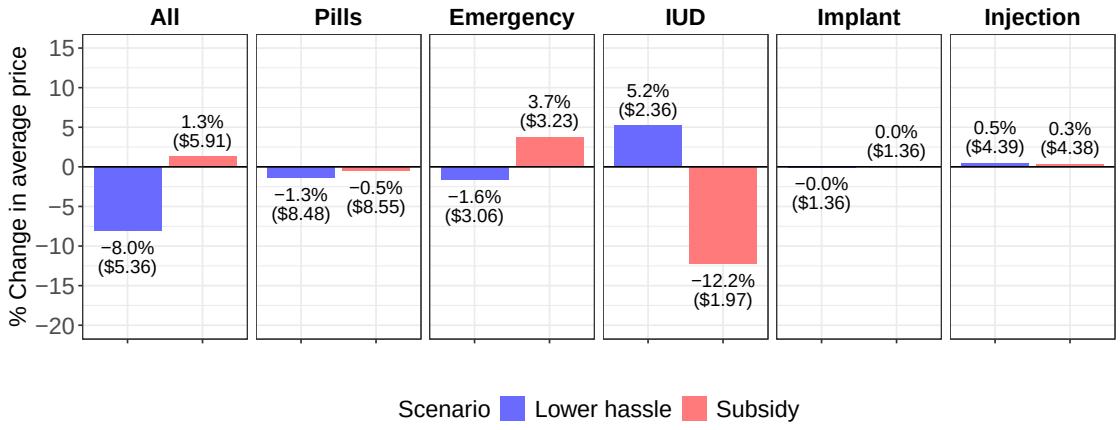
Blue bars in Figure 10 report the counterfactual price changes for baseline OTC products (Panel A) and baseline insurance products (Panel B). Because the policy makes the insurance segment more attractive, part of OTC demand reallocates toward insurance, and manufacturers respond by lowering average retail prices by 8.0%. The same reallocation raises demand in the insurance segment and weakens the insurer's bargaining position, increasing average wholesale prices by 5.2%. The policy is therefore more costly for the government than pooling the two segments: note that in addition to financing the reduction in hassle costs, the government would face higher insurer spending on contraceptives, which rises by 2.4 billion COP pesos ($808 thousand) from the wholesale price increase alone, holding insurance-segment demand at observed levels.

Blue bars in Figure 11 report the percentage change in demand. We find that a 50% reduction in hassle costs would increase contraceptive demand by 23.6%, which is substantial but still below the effect of pooling the segments. The demand increase is driven by a higher take-up of longer-acting methods. For instance, demand for IUDs

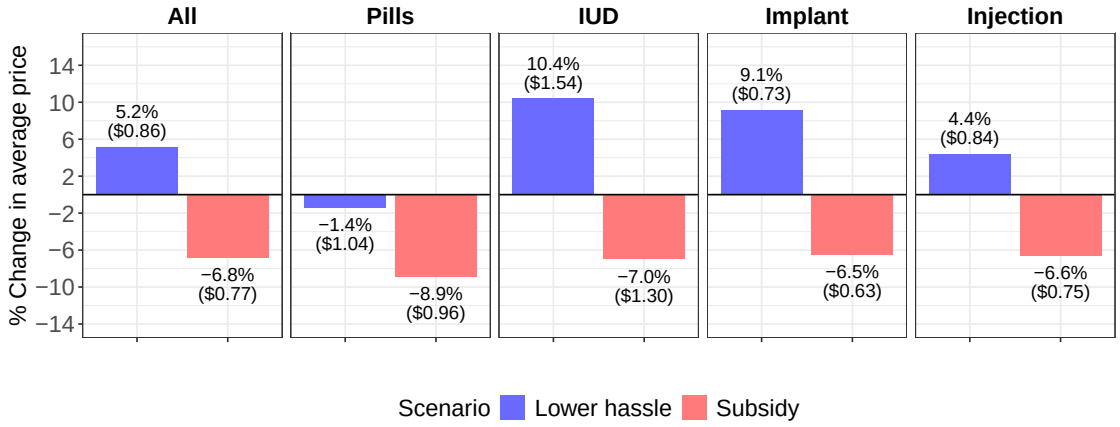
and implants increase 323% and 220% respectively albeit from a small baseline. Injection demand also rises 23% as women substitute away from emergency contraception.

FIGURE 10: Price Changes After Insurance Hassle Reduction and Retail Subsidy

(A) Baseline OTC segment



(B) Baseline INS segment



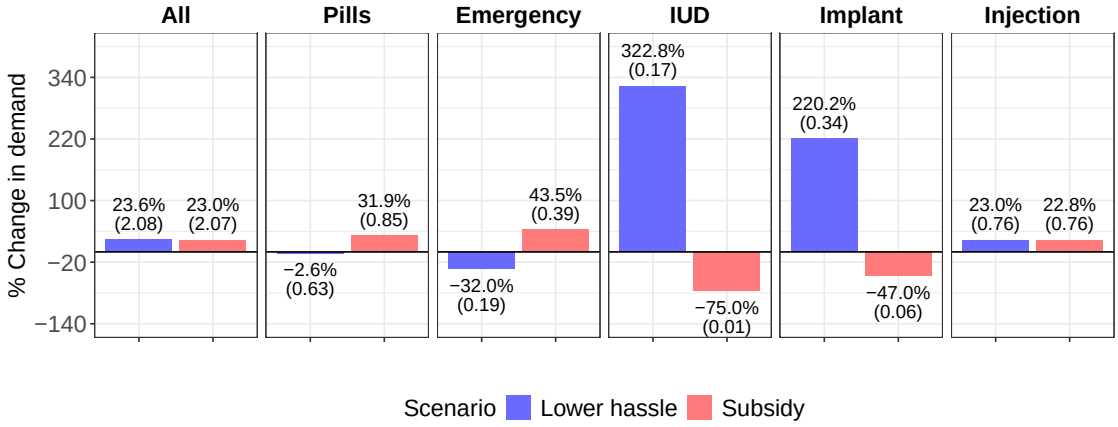
Note: Figure shows the percentage change in price relative to the observed scenario in the counterfactual where we reduce hassle costs by 50% (in blue) and the counterfactual where we give a 30% retail subsidy (in red), both overall and by route of administration. Numbers in parenthesis present the price level. Panel A conditions on products offered OTC at baseline. Panel B conditions on products offered through insurance at baseline.

We next ask what price subsidy in the OTC segment would deliver the same demand gain as the reduction in hassle costs. This exercise isolates the price benefit of insurance coverage (i.e., women face zero out-of-pocket costs) from its friction (i.e., the hassle cost). A subsidy of 30% matches the 23% demand increase of the previous counterfactual.

Red bars in Figure 10 report the percentage change in retail prices (Panel A) and wholesale prices (Panel B) relative to the observed scenario. Because the subsidy makes

retail demand less price elastic with respect to the producer price, manufacturers capture part of it and the average retail price increases 1.3%. This effect is heterogeneous across routes: the price of emergency contraceptives increases 3.7% but that of IUDs falls by 12.2%. Because some women switch away from the insurance segment, wholesale prices decrease 6.8% on average and the reduction is common across routes.

FIGURE 11: Demand Changes After Insurance Hassle Reduction and Retail Subsidy



Note: Figure shows the percentage change in price relative to the observed scenario in the counterfacfual where we reduce the hassle cost by 50% (in blue) and the counterfactual where we give a 30% retial subsidy (in red), both overall and by route of administration. Numbers in parenthesis present the demand level in women-months.

The composition of the demand response differs from the hassle cost counterfactual as seen in the red bars of Figure 11. Reducing hassle costs reallocated demand toward longer-acting methods, which require a visit to the doctor regardless of the segment through which women obtain them. The OTC subsidy instead reallocates demand toward pills and injections, the shorter-acting methods most prevalent in the retail market. Demand for IUDs, for which women must see a doctor, falls by 75% as the insurance segment becomes relatively less attractive.

7.3 Distributional Consequences

To examine the distributional welfare consequences of our counterfactuals, Table 3 reports the change in consumer surplus relative to the observed scenario in dollars per woman-year. Consumer surplus is the inclusive value from the logit demand system, divided by

TABLE 3: Dollar Change in Consumer Surplus

Group	OTC (fixed info) (1)	OTC (full info) (2)	Hassle reduction (3)	Retail subsidy (4)
All women	7.06	7.07	3.53	5.30
Low income	6.94	6.95	3.84	5.23
High income	7.40	7.39	2.64	5.51
Informed	6.95	6.98	3.35	5.40
Uninformed	7.14	7.13	3.66	5.23
Age 15–19	6.94	6.96	3.79	5.25
Age 20–35	7.08	7.09	3.47	5.32
Age 36+	7.04	7.04	3.58	5.25

Note: Table presents the change in women's surplus per capita measured in dollars per year between the OTC-only, hassle reduction, and retail subsidy counterfactuals and the observed scenario. All counterfactual simulations use information from January to June 2018.

the effective price coefficient α_i to convert to dollar terms. Under full information, the OTC-only counterfactual raises average consumer surplus by \$7.1. The gains are shared by all women but are largest (in percentage terms) for those who are lower-income, less informed, or aged 15–19, so the counterfactual narrows welfare differences across women. The pattern is similar when we reduce hassle costs. Low-income women gain \$1.20 more than their high-income counterparts, and less-informed women gain \$0.31 more than informed ones, so hassle costs fall disproportionately on these groups. A retail subsidy has the opposite distributional effects, raising consumer surplus most for higher-income, informed women aged 20–35.

8 Conclusion

This paper asks what insurance coverage is worth for drugs that are also approved for over-the-counter (OTC) sale, using the market for hormonal contraceptives in Colombia. Women there can buy contraceptives OTC at retail prices from any pharmacy, or obtain them through their health insurer at zero out-of-pocket cost but with a restricted formulary and substantial hassle costs. We first use a 2019 wholesale price ceiling and a survey of reproductive-age women to document the determinants of demand: women are price-sensitive, they face information frictions about product quality, and claiming through insurance imposes hassle costs.

We then develop and estimate a structural model of demand and supply that incorporates these frictions, and use it to simulate a market in which contraceptives are supplied only OTC. The coexistence of OTC and insurance segments lowers contraceptive take-up relative to a pooled OTC market, both because it lets manufacturers price discriminate across segments and because it imposes the hassle cost of navigating the insurance segment on the women who use it. Moving to an OTC-only market raises demand by 41% and average consumer surplus by $7.1 per woman–year, with the largest gains for low-income, less-informed, and younger women.

The value of insurance coverage for an OTC-eligible drug therefore depends on how costly it is to navigate the health system. Our results do not argue for removing contraceptives from the national health insurance formulary but for making coverage easier to use, for instance by letting women fill claims at any retail pharmacy. We find, for example, that a 50% reduction in hassle costs that could be achieved with such a policy would also raise demand by 24%. These findings have direct implications for expanding access to other drug classes subject to the same form of market segmentation or to ones where OTC approval is being considered, such as cholesterol-lowering drugs and opioid antagonists.

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Online Appendix

Manuscript Title: The Value of Insurance Coverage for Over-the-Counter Drugs: Evidence from Contraceptives

Author Names: Jorge Florez, Santiago Ortiz-Ortiz, Paul Rodriguez-Lesmes, Natalia Serna

Appendix 1 Details on Data Construction

1.1 IQVIA and INVIMA data

The IQVIA dataset reports monthly prices and quantities of contraceptives purchased OTC in Colombia between 2009 and 2023. We have information on all medications categorized under ATC codes G03A, G03C, and G03F.

An observation in the raw dataset is a combination of the national drug code (NDC), month, and pharmacy type. Pharmacy type indicates whether the report originates from a chain or stand-alone pharmacy. A pharmacy is classified as chained if it operates more than five establishments under the same corporate name. Independent pharmacies account for around 70% of OTC contraceptive sales in Colombia. The NDC uniquely identifies a drug and its commercial presentation. For example, a single oral contraceptive brand might have two presentations: one with a single blister containing 21 pills and another with two blisters or 42 pills.

Our data cleaning procedure proceeds as follows:

- *Sample selection from INVIMA.* We begin with the universe of products registered in INVIMA. We exclude NDCs corresponding to hormone replacement therapy (post-menopause) and treatments for amenorrhea. The resulting sample focuses on contraceptive methods, including conventional oral contraceptives, emergency pills, injections, implants, intrauterine devices (IUDs), and patches. The INVIMA dataset contains 1,285 NDCs corresponding to 324 products, where a product is defined as a commercial brand.

- *Imputation of NDCs in IQVIA data.* Due to inconsistencies in pack codes across datasets, we impute INVIMA NDC identifiers to IQVIA pack codes. This process

yields 227 matched NDCs out of 246 pack codes (corresponding to 190 products, including hormone replacement therapy). Unmatched observations account for less than 1.5% of total sales.

- *Merging INVIMA and IQVIA data.* We merge the INVIMA and IQVIA datasets using the matched identifiers, resulting in 183 NDCs corresponding to 162 products after excluding hormone replacement therapy.

- *Price normalization.* We deflate nominal prices using the Colombian Consumer Price Index (base: December 2018 = 100) and convert them to U.S. dollars using the 2018 average exchange rate (2,952 COP/USD).

- *Retail price adjustment.* As prices reported for independent pharmacies correspond to wholesale prices, we apply a 15% retail markup following IQVIA guidelines.

- *Standardization of units.* To ensure comparability across products with different packaging and dosage forms, we standardize prices and quantities to a single menstrual cycle.

- *Aggregation.* We aggregate the data to the product–month level.

After cleaning outliers, the final dataset comprises 156 unique products observed monthly from January 2009 to December 2023, yielding 16,551 observations in an unbalanced panel.

1.2 Enrollment and Health Claims Data

1.2.1 Product-level data

To construct the product-month panel for the insurance segment for the months between January 2018 and December 2019 we use individual-level health claims records. Below is the list of cleaning steps we use to construct this data:

Sample restrictions. We restrict the sample as follows:

- We retain only claims made by women of reproductive age (15–45).
- We restrict attention to outpatient prescription claims for hormonal contraceptives, identified using ATC codes and medication names from INVIMA.
- We drop claims with zero wholesale price.
- We determine the number of presentations per refill as the median number of months between refills per woman. For median refills over 3 months, we constrain to 3 months.
- We define a product as a brand-dosage combination. We standardize quantities and prices to a single menstrual cycle to ensure comparability across presentations. For products dispensed in multi-cycle presentations, we divide the price by the number of cycles and multiply the quantity accordingly.

Price cleaning. Wholesale prices in the health claims reflect negotiated contracts between insurers and providers and vary across insurers, providers, and contract types in ways unrelated to the underlying price of the contraceptive. Contract types include fee-for-service, capitation, and fee-for-package. We proceed in two steps to clean these prices:

1. We residualize observed log wholesale prices per claim on contract type–product, insurer–provider–product, and insurer–provider–month fixed effects to remove contract-driven price variation.
2. We define the "cleaned price" as the exponential of the residual of the previous regression, plus the constant, plus the fee-for-service dummy per product.
3. We winsorize the cleaned price at the 2nd and 98th percentiles to remove outliers, and define the final price as the median of the winsorized residual at the product-month level.

Market share construction. We aggregate cleaned claims to the product-month level, computing total cycles dispensed and the final price for each product-month cell.

1.2.2 Individual-level data

For descriptive analyses where we use the individual level data we follow the cleaning steps below.

Sample restrictions. We apply the following restrictions sequentially:

- We retain only women of reproductive age (15–45).
- To deal with the fact that there may be multiple prescriptions for contraceptives in the same day, we prioritize those with greater effectiveness or clinical recommendation following the table below, which was produced by ChatGPT.

Appendix Table 1: Suggested Ranking of Hormonal Contraceptives (High to Low Priority)

Rank	ATC Code	Reasoning
1	G03AD01	Implant – long-acting, high effectiveness
2	G03AC03	Depo-Provera – 3-month injectable
3	G03AC06	2-month injectable
4	G03AA14	Drospirenone progestin-only pill – newer, more selective
5	G03AA07	Desogestrel progestin-only pill – modern, widely used mini-pill
6	G03AA17	Nomegestrol progestin-only pill – selective, less common
7	G03AA12	Lynestrenol progestin-only pill – older generation
8	G03FA11	Combined oral contraceptive with Desogestrel – third-generation progestin
9	G03FA01	Combined oral contraceptive with Levonorgestrel – second-generation progestin

- We expand the annual enrollment data to a monthly panel, generating one observation per woman per month. We then merge in contraceptive claims, other health claims (outpatient, inpatient, and prescription), and income data from 2017 payroll records.
- Because contraceptives differ in their duration of protection, we carry forward contraceptive claims to fill months without a new prescription:
  - For three-month injections, we carry forward the claim for up to two additional months.
  - For monthly products (pills and one-month injections), we carry forward the claim for one additional month.

1.3 Construction of the Contraceptive Quality Measure

We construct a measure of contraceptive quality at the level of active ingredient, route of administration, and quarter using adverse event reports from the FDA Adverse Event Reporting System (FAERS) from 2014 to 2019. We describe the construction procedure below.

Data assembly. We download quarterly FAERS files covering patient demographics, drug, outcome, reaction, therapy, indication, and report source tables for each quarter from 2014Q1 to 2019Q4. We retain only cases in which the reported indication includes contraception-related terms (e.g., contraception, birth control, oral contraceptive, emergency contraception). For each case, we retain drugs listed as the primary or secondary suspect (`role_cod` $\in \{PS, SS\}$) and merge in the associated reaction and outcome records.

Severity classification. We classify adverse events into two categories:

- *High-severity events*: outcomes recorded in the FAERS outcomes table, including death, hospitalization, disability, and life-threatening events.
- *Low-severity events*: reactions recorded in the FAERS reactions table, including side effects such as weight gain, acne, mood changes, and irregular bleeding.

We collapse these counts to the active ingredient-route-year-quarter level, after standardizing drug names to active ingredients using a hand-coded crosswalk that maps brand names and generic names to their active ingredients and routes of administration.

Quality measure. We construct a quality measure based on the Proportional Reporting Ratio (PRR), a standard pharmacovigilance statistic that compares the reporting rate of adverse events for a given drug to the reporting rate across all other drugs in the same period. For active ingredient k in quarter q, the PRR is defined as:

$$\text{PRR}kq = \frac{(a_{kq} + 0.5)/(a_{kq} + b_{kq} + 0.5)}{(c_{kq} + 0.5)/(c_{kq} + d_{kq} + 0.5)}$$

where a_{kq} is the number of high-severity adverse event reports for active ingredient k in quarter q, b_{kq} is the number of low-severity reports for the same ingredient, $c_{kq} = A_q - a_{kq}$ is the number of high-severity reports for all other active ingredients in the same quarter, and $d_{kq} = B_q - b_{kq}$ is the analogous count for low-severity reports. The 0.5 correction is applied to avoid division by zero for active ingredients with sparse reports. We then define true quality as:

$$\text{Quality}_{kq} = \frac{1}{1 + \text{PRR}_{kq}}$$

so that higher values correspond to lower relative adverse event rates and therefore higher quality. We collapse to the active ingredient-route-quarter level by taking the mean quality across cases, and carry forward values for quarters with missing observations using the most recent available value.

Imputation hierarchy. We construct the quality measure at four levels of aggregation, used hierarchically to impute missing values:

- *Level 1*: active ingredient combination and route of administration (e.g., Levonorgestrel + Ethinylestradiol, oral).
- *Level 2*: progestin component only and route of administration (e.g., Levonorgestrel, oral).
- *Level 3*: active ingredient combination only, pooled across routes.
- *Level 4*: progestin component only, pooled across routes.

For active ingredients approved in Colombia but not reported in FAERS, we supplement with adverse event reports from INVIMA, Colombia's national drug safety agency, using the same PRR methodology (*Level 5*).

Appendix 2 Survey

2.1 Survey Design

The following items are selected and translated from the Spanish-language survey instrument. Several of these questions are shown conditionally, based on responses to earlier questions in the survey; conditional logic is noted in italics where applicable.

Q4. How old are you? *(Shown only if respondent's sex assigned at birth is female.) (Choose one answer.)*

- Under 15
- 15–17
- 18–20
- 21–25
- 26–30
- 31–35
- 36–40
- 41–49
- 50 or more

Q7. Do you have children? *(Choose one answer.)*

- Yes
- No

Q8. Do you currently have a partner? *(Choose one answer.)*

- Yes, married
- Yes, in a common-law union (living together)
- Yes, has a partner but does not live together
- Does not currently have a partner

Q9. What is your current educational level? *(Choose one answer.)*

- Primary school
- Secondary school
- High school diploma
- Technical/vocational
- University (undergraduate)

- Graduate/postgraduate

Note: Indicate the highest level of education completed.

Q12. What is the socioeconomic stratum (*estrato*) on the electricity bill for the place where you currently live? (If your residence has no assigned stratum or is in a heritage/protected zone, indicate the one that most closely resembles it.) *(Choose one answer.)*

- Urban area, Stratum 1 or undefined
- Urban area, Stratum 2
- Urban area, Stratum 3
- Urban area, Stratum 4
- Urban area, Stratum 5
- Urban area, Stratum 6
- Rural area

Q13. Do you currently receive your own income (from work, business, pension, assistance, or any other source)? *(Choose one answer.)*

- Yes
- No

Q15. Approximately, what is your average monthly personal income? (Include salary, self-employment income, pension, rental income, assistance, or any other source. If your income varies, think of an average month.) *(Shown only if the respondent answered "Yes" to Question 13.) (Choose one answer.)*

- $100 – $500,000
- $500,001 – $1,000,000
- $1,000,001 – $1,500,000
- $1,500,001 – $2,500,000
- $2,500,001 – $4,000,000
- $4,000,001 – $7,000,000
- $7,000,001 – $10,000,000
- More than $10,000,000
- Don't know

Q17. Are you enrolled in a health social security entity (EPS, subsidized EPS)? *(Choose one answer.)*

- Yes, as a contributing member (*cotizante*)
- Yes, as a primary beneficiary

- Yes, but doesn't know whether as a contributing member or as a primary beneficiary
- Not enrolled
- Don't know

Q18. On average, how many times do you visit the doctor per year? *(Choose one answer.)*

- 0 times
- 1 time
- 2–3 times
- 4–6 times
- 7–10 times
- More than 10 times

Q19. How much do you pay or have deducted monthly to be covered by a health social security entity? *(Choose one answer.)*

- $0
- $100 – $50,000
- $50,001 – $100,000
- $100,001 – $200,000
- $200,001 – $400,000
- More than $400,000

Note: Take into account EPS, supplementary plans, prepaid health plans, policies, etc.

Q20. Approximately how much did you spend on healthcare services last month (excluding insurance premiums)? *(Choose one answer.)*

- $0
- $100 – $30,000
- $30,001 – $80,000
- $80,001 – $150,000
- $150,001 – $300,000
- $300,001 – $600,000
- More than $600,000
- Don't know

Question 21 asks respondents which of seven contraceptive brands/methods they recognize (Cyclofem, Depo Provera, Jadelle, Microgynon, Gynorelle, Yasminiq, Veroniq). For each brand a respondent indicates recognizing, the survey platform (LimeSurvey) repeats an identical five-item product-knowledge block (route of administration, prescription requirement, insurance coverage, ease of access, and awareness of comments), incrementing the underlying question numbers by nine each time. The Cyclofem instance of this block (Questions 22–26) is reproduced below.

Q22. For this product (Cyclofem), please indicate the route of administration that you know or believe to be correct: *(Choose one answer.)*

- Daily oral pill
- Weekly patch
- Monthly injection
- Quarterly injection (every 3 months)
- Subdermal implant
- Hormonal IUD
- Copper IUD
- Vaginal ring
- Female or male condom
- Emergency contraceptive pill
- Other (please specify)

Q23. Is a medical prescription required? *(Choose one answer.)*

- Yes
- No
- Don't know

Q24. Is it provided free of charge by your EPS or health insurer? *(Choose one answer.)*

- Yes
- No
- Don't know
- I do not have health insurance

Q25. How easy is it to obtain this product at each of the following places? *(Please select the appropriate answer for each row.)*

Scale: 1. Not obtainable / 2. Requires waiting days / 3. Requires waiting hours / 4. Immediately

	1	2	3	4	Don't know
EPS or health insurer					
Neighborhood pharmacy/drugstore					
Internet or social media					

Q26. Have you heard positive or negative comments about this product? *(Choose one answer.)*

- Only negative
- Mostly negative
- Generally neutral
- Mostly positive
- Only positive
- I have not heard any comments

e.g., positive: it might have health benefits

2.2 Description of Respondents

Appendix Table 2: Comparison between Survey and DHS Respondents

	Survey	DHS 2015
Panel A. Age group		
18 – 25	77.04	35.21
26 – 35	12.06	37.98
36 – 49	10.89	26.81
Panel B. Educational attainment		
No education	—	0.26
Primary	0.34	4.43
Secondary	27.03	29.37
Higher	72.64	65.94
Panel C. Current contraceptive use		
Yes	54.39	53.90
No	45.61	46.1
Panel D. Contraceptive Method Conditional on Using Hormonal Contraceptives		
Pills	40.00	25.97
Injections	6.00	38.96
LARC	51.00	34.89
Other	3.00	0.18

Notes: Entries are percentages of respondents within each column. The *DHS* column includes respondents from DHS 2015 aged 18 to 49 years who reported being in the contributory health insurance system. Panel D reports the distribution of contraceptive methods conditional on using a hormonal contraceptive.

2.3 Survey Evidence

Appendix Table 3: Survey Evidence of Contraceptive Knowledge

Panel A. Number of contraceptive routes correctly identified

	Obs.	Mean	Std. Dev.	Mean as % of max score (%)
All sample (contributors)	89	1.07	0.79	15.25
High expenditure	76	1.12	0.78	15.98
Low expenditure	13	0.77	0.83	10.99

Panel B. Awareness and route knowledge

	Obs.	Recognizing at least one brand (%)	Correctly identifying at least one route (%)	Correctly identifying no routes (%)
All sample (contributors)	89	87.64	75.28	24.72
High expenditure	76	88.16	78.95	21.05
Low expenditure	13	84.62	53.85	46.15

Notes: The table reports awareness of contraceptive brands and knowledge of their routes of administration for women responsible for financing their health insurance enrollment. Participants were asked about seven contraceptives; consequently, the count variable ranges from zero to seven. A route was classified as correct only when the participant both recognized the contraceptive brand and correctly identified its route of administration. Responses in which the brand was recognized but the route was incorrect or not provided were coded as zero and therefore did not increase the count. In Panel A, *Mean as % of maximum score* is calculated as the mean number of correctly identified routes divided by seven and multiplied by 100. Panel B reports the percentage recognizing at least one brand, correctly identifying at least one route, and correctly identifying no routes. *High expenditure* denotes women who have any spending in the last month on healthcare. *Low expenditure* denotes their counterparts.

Appendix Table 4: Survey Evidence of Hassle Costs

Panel A. Time required to obtain contraceptives

	Time required to obtain contraceptives	
	Insurance	OTC
Less than one hour	17.65	79.87
More than one hour	82.35	20.13
Observations	34	154

Panel B. Travel time to the nearest location

	Travel time to the nearest location	
	Insurer delivery point	Retail pharmacy
Less than 10 minutes	5.41	77.60
Between 10 and 30 minutes	29.39	16.88
More than 30 minutes	65.20	5.52
Observations	296	308

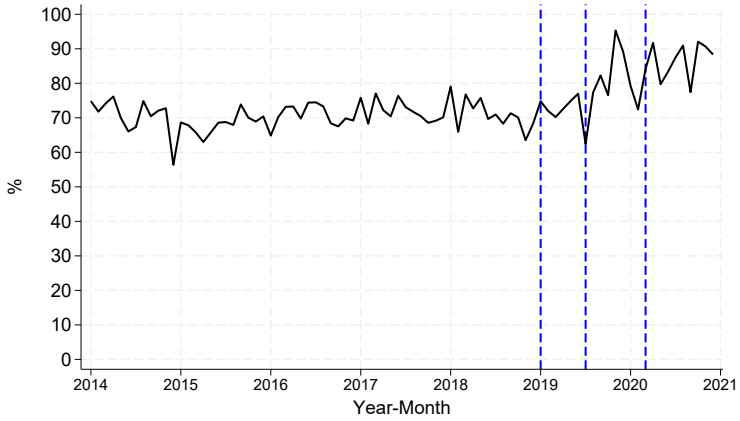
Panel C. Location where the most recent contraceptive was obtained

	Share (%)	Observations
Retail pharmacy or drugstore	61.35	154
Insurer dispensing facility	13.55	34
Other source	25.10	63
Applicable responses	100.00	251

Notes: Entries are percentages of respondents within each column. Panel A reports the time required to obtain the most recent contraceptive, including visits to the pharmacy, waiting in line, or scheduling an appointment with the appropriate physician. The Insurance column includes respondents whose most recent method was obtained at an insurer dispensing facility; the OTC column includes respondents whose most recent method was obtained at a retail pharmacy or drugstore. Panel B reports travel time from the respondent's home or workplace to the nearest insurer delivery point or retail pharmacy. Missing and *Does not know* responses are excluded separately for each location. Panel C reports the location where the respondent obtained her most recent contraceptive among women for whom the question was applicable. OTC denotes over-the-counter.

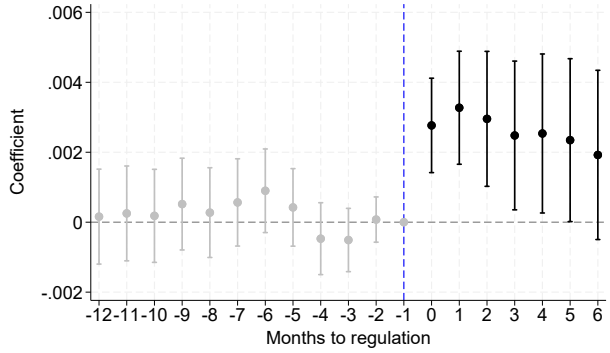
Appendix 3 Additional Descriptive Evidence

Appendix Figure 1: Share of Total Volume Through the OTC Segment



Note: Figure shows the share of the total volume of contraceptives distributed through the over-the-counter segment. The first blue line marks January 2019,when the first contraceptive price cap regulation (*Circular 07/2018*) came into effect. The second and third lines correspond to July 2019 (*Circular 09/2019*) and March 2020 (*Circular 10/2020*), marking the implementation of two additional contraceptive price cap regulations. Data comes from the Medication and Medical Device Price Information System (SISMED).

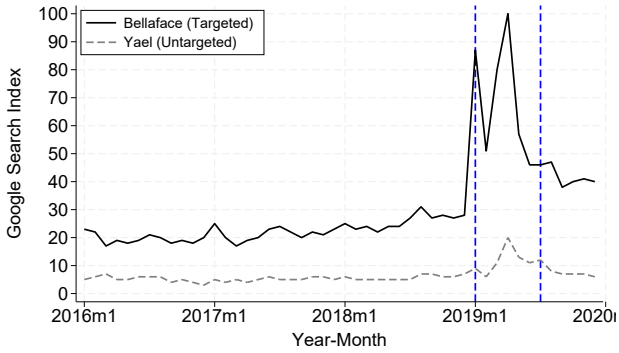
Appendix Figure 2: Comparison of Targeted Product Demand Among Informed and Uninformed Women



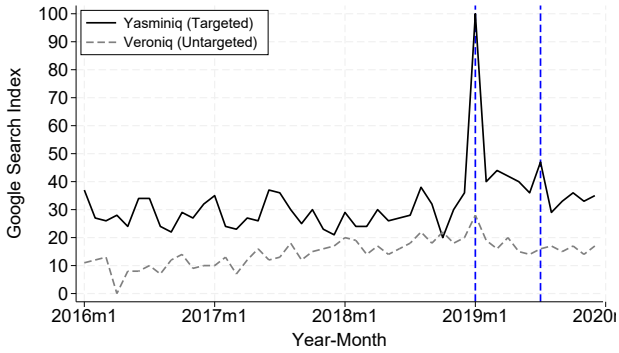
Note: Figure presents coefficients and 95% confidence intervals of an event study using as outcome an indicator for consuming targeted products. The treatment group are less-informed women or those with below-median pre-policy annual health spending (excluding prescriptions), the control group are their counterparts. The regression includes woman and month fixed effects; standard errors are clustered at the woman level. The dashed blue line represents the month when the price ceiling regulation went into effect.

Appendix Figure 3: Google Search Trends on a Subset of Contraceptives

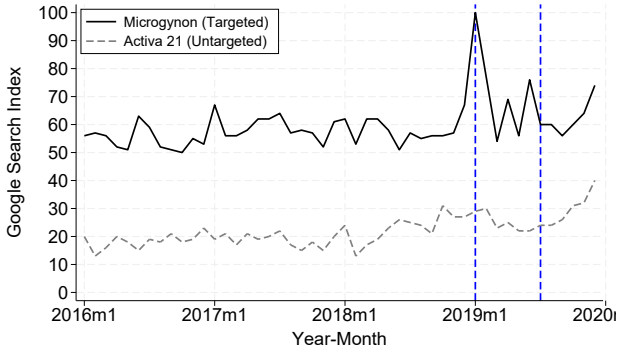
(a) Dienogest + Ethinylestradiol



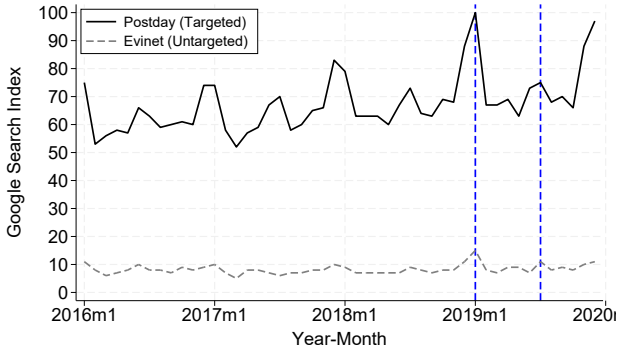
(b) Drospirenone + Ethinylestradiol



(c) Levonorgestrel + Ethinylestradiol



(d) Levonorgestrel (emergency)



Note: Figure presents the monthly Google Search Index for each pair of contraceptives by active ingredient from 2016-01 to 2019-12. The blue dashed lines correspond to the months when the contraceptive price ceilings were enacted. The light gray, long-dashed line represents untargeted contraceptives, while the solid black line represents targeted products.

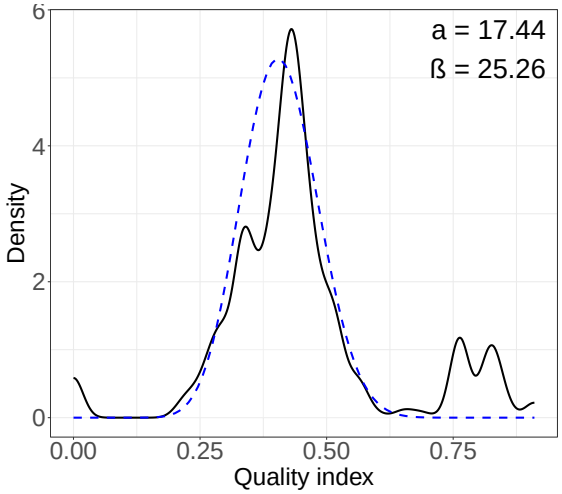
Appendix Table 5: Correlation between Wholesale Prices and Demand in INS Segment

	Market share	
	(1)	(2)
Log wholesale price	—	-0.004***
		(0.0009)
Quality index	0.013	0.003
	(0.017)	(0.016)
Route FE	Yes	Yes
Month FE	Yes	Yes
Observations	437	437
R^2	0.689	0.715

Note: Table presents OLS regressions of product market shares in the insurance segment on our measure of quality and the log of wholesale prices. Specifications include route of administration and month fixed effects. Market shares are constructed relative to the size of the potential market. Standard errors in parenthesis clustered at the product level.

3.1 Support for Model Assumptions

Appendix Figure 4: True Quality Distribution



Note: Figure presents the distribution of true quality in black and an estimated beta distribution in blue. The estimated parameters of the beta distribution are reported in the text box.

Appendix Table 6: Correlation between Regulation Status and Quality

Variable	$\mathbb{1}\{\text{Regulated}\}$	
	(1)	(2)
Quality index	0.437***	0.433***
	(0.072)	(0.065)
Log price (OTC)		0.132***
		(0.008)
Fixed-effects		
Route	Yes	Yes
Month	Yes	Yes
Observations	1,728	1,728
R^2	0.218	0.297

Note: Table presents OLS regressions of an indicator for whether the product is ever regulated on its quality measure in column (1) and additionally on its log effective price in column (2). Both specifications include route of administration and month fixed effects. Robust standard errors in parenthesis.

Appendix 4 Estimation Details

Data preparation. We append the product-month level data from IQVIA and from the insurance segment. Then, we restrict the estimation sample to the pre- and post-policy period from January 2018 to December 2019. We drop all months of products whose maximum inside market share over the sample period falls below 0.1% to avoid numerical instability in the contraction mapping and keep 87% of observations that constitute a balanced panel of products. Potential market size is set to 117% of observed monthly quantity in the reference period (December 2018), implying an outside option share of approximately 35%–45%.

Demand estimation. We estimate the nonlinear parameters $\Phi^{nl} = (\boldsymbol{\alpha}_d', \rho_1, \gamma, \sigma)$ by minimizing the GMM objective using the BOBYQA algorithm implemented in the `nloptr` package in R (Johnson, 2008). We impose the constraints $\gamma \geq 0$ and $\sigma \in [0, 1]$.

To guard against local minima, we estimate the model from 10 starting values, drawn uniformly from [0, 0.5] for α_1, [-0.4, 0] for α_2, [-0.4, 0] for α_3, [0, 10] for ρ_1, [0, 2] for γ, and [0, 0.5] for σ. We use the following convergence tolerances (`ftol_rel` $= 1^{-6}$, `xtol_rel`

= `xtol_abs` = 1^{-3}, and maximum 100 iterations). We select the solution with the lowest GMM objective.

The contraction mapping tolerance is set to 1^{-12} throughout. Conditional on the nonlinear parameter estimates, we recover the linear parameters $\Phi^l = (\alpha_0, \tau, \rho_0)$ via 2SLS as described in equation (1). Estimation is parallelized across 10 cores.

Supply estimation. We estimate the supply-side nonlinear parameter $\tilde{\lambda}$ where $\lambda = \exp(\tilde{\lambda})$ to ensure $\lambda > 0$, by minimizing the supply-side GMM objective using BOBYQA, taking demand estimates as given. We initialize the algorithm at $\tilde{\lambda} = 0.1$ and use convergence tolerances of `ftol_rel` = 5^{-3}, `ftol_abs` = `xtol_rel` = `xtol_abs` = 1^{-3} with a maximum of 5,000 iterations.

Conditional on $\hat{\lambda}$, we recover the linear supply parameters β^s via OLS on equation (4), and recover φ_t directly from the insurer's binding participation constraint.

Standard errors. We compute standard errors jointly for the demand and supply parameters using the sandwich GMM variance estimator, accounting for the two-step nature of the estimator. The standard error routine takes the estimated nonlinear demand and supply parameters as inputs and computes the full parameter covariance matrix in a single pass.

Appendix 5 Additional Model Results

Appendix Table 7: Measures of Model Fit

Moment	Observed	Predicted
$g^{\text{age,pills}}$	0.281	0.277
$g^{\text{age,inject}}$	0.271	0.276
$g^{\text{age,IUD}}$	0.369	0.317
g^{reg}	0.036	0.041
g^{qual}	0.078	0.082
g^{old}	-0.306	-0.305
g^{young}	-0.350	-0.359
g^{poor}	-0.327	-0.376
g^{rich}	-0.358	-0.243
$g^{\text{ins history}}$	-0.347	-0.357
$g^{\text{no ins history}}$	-0.340	-0.344

Note: Table presents empirical moment from the health claims data and the model-predicted moment.

Appendix Table 8: Price Elasticity Matrix by Route of Administration in OTC Segment

Route	Conventional Pills	Emergency Pills	Implant	Injection	IUD
Conventional Pills	-2.143	0.034	0.001	0.040	0.031
Emergency Pills	0.013	-2.117	0.002	0.039	0.029
Implant	0.012	0.034	-2.157	0.038	0.028
Injection	0.013	0.034	0.002	-2.124	0.029
IUD	0.013	0.034	0.001	0.039	-4.556

Note: Table presents the price elasticity matrix across routes of administration in the OTC segment during the pre-policy period. To obtain route-level elasticities from the product-level matrix, we aggregate by taking simple averages of own- and cross-price elasticities across all products within each route.

Appendix Table 9: Price Elasticity Matrix by Route of Administration in INS Segment

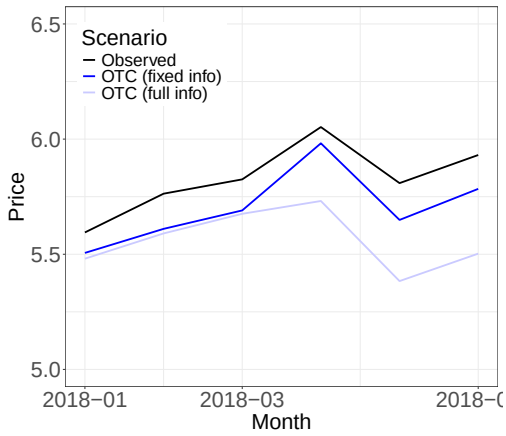
Route	Conventional Pills	Implant	Injection	IUD
Conventional Pills	-4.582	0.162	0.047	0.008
Implant	0.009	-4.422	0.048	0.008
Injection	0.009	0.166	-4.535	0.008
IUD	0.009	0.156	0.045	-4.560

Note: Table presents the price elasticity matrix across routes of administration in the INS segment during the pre-policy period. To obtain route-level elasticities from the product-level matrix, we aggregate by taking simple averages of own- and cross-price elasticities across all products within each route.

Appendix 6 Additional Counterfactual Results

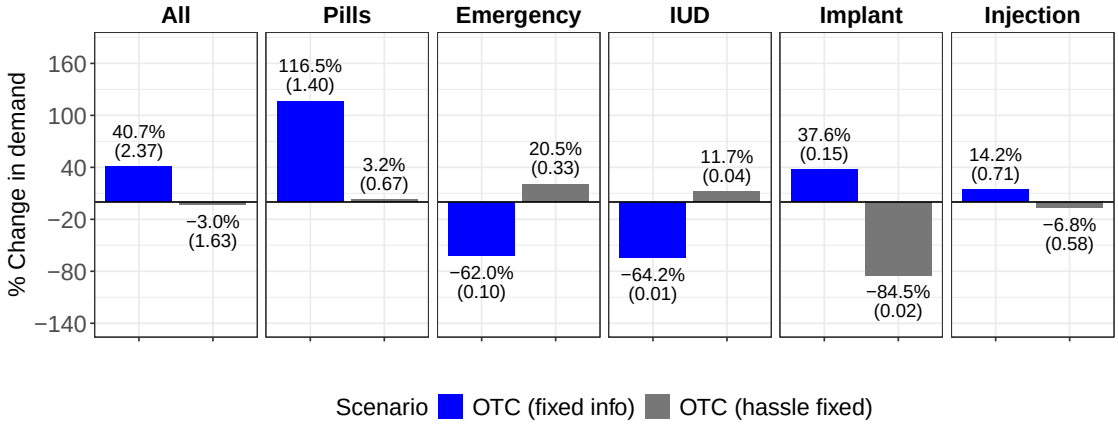
6.1 OTC-only Market

Appendix Figure 5: Counterfactual Price Trends



Note: Figure presents counterfactual and observed demand-weighted average per month during 2018, conditional on products offered OTC at baseline for the OTC-only counterfactual. The figure presents price trends under three scenarios: the observed scenario and the counterfactual holding information fixed (DS) and assuming full information (DSI).

Appendix Figure 6: Counterfactual Demand Changes in OTC-only Market Holding Hassle Fixed



Note: Figure shows the percentage change in demand relative to the observed scenario in the OTC-only counterfactual holding information fixed (in blue) and holding hassle costs fixed (in gray), both overall and by route of administration. Numbers in parenthesis present the demand level.

Appendix Table 10: Diversion to Outside Option from Baseline OTC Products

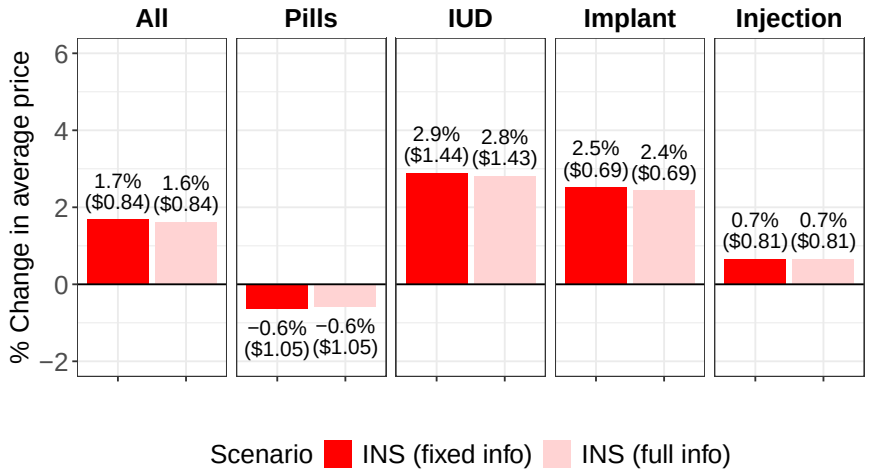
Route	Observed (1)	DS (2)	DSI (3)
All types	0.391	0.156	0.156
Conventional Pill	0.392	0.157	0.156
Emergency Pill	0.389	0.156	0.156
IUD	0.399	0.158	0.158
Implant	0.379	0.150	0.150
Injection	0.390	0.156	0.156

Note: Table presents the demand-weighted diversion to the outside option conditional on products offered OTC at baseline. The diversion ratio is calculated as $\bar{D}_{0,t} = \sum_{j \in \mathcal{J}_{\text{OTC}}} \frac{s_{jt}}{\sum_{k \in \mathcal{J}_{\text{OTC}}} s_{kt}} \cdot \frac{\sum_i s_{i0t}}{\sum_i (1 - s_{ijt})}$. We report several scenarios: the observed scenario (column 1); the OTC-only counterfactual holding information status fixed (column 2); and the OTC-only counterfactual assuming full information (column 3). All counterfactual simulations use information from January to June 2018.

6.2 Insurance-only Market

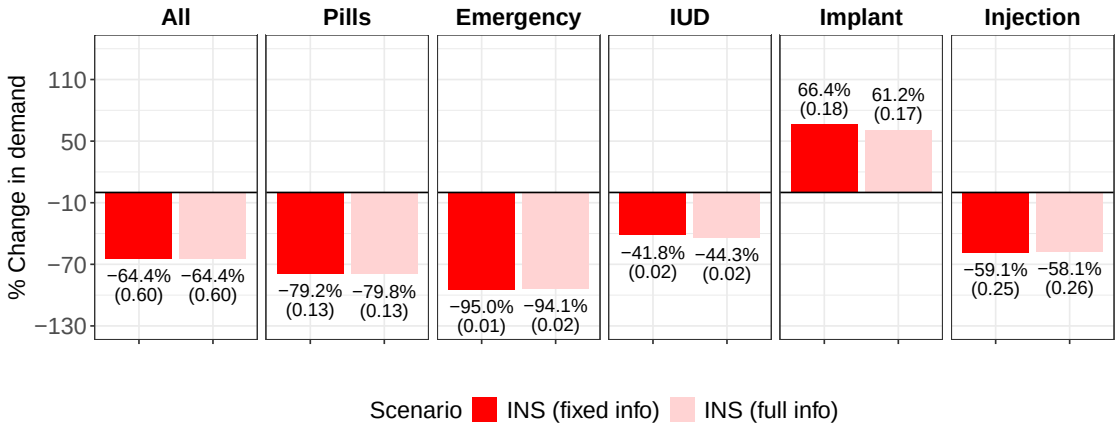
In this Appendix we present the results of pooling all products in the insurance segment. Figure 7 plots the percentage change in wholesale prices between the observed market and the insurance-only counterfactual, for products that were offered through insurance at baseline. Dark red bars hold information fixed, while light red bars assume full information. Figure 8 presents the percentage change in contraceptive demand relative to the observed scenario.

Appendix Figure 7: Wholesale Price Changes in Baseline INS Segment



Note: Figure shows the percentage change in wholesale price relative to the observed scenario in the insurance-only counterfactual holding information fixed (in dark red) and assuming full information (in light red), both overall and by route of administration. Numbers in parenthesis present the price level. Figure conditions on products offered through insurance at baseline.

Appendix Figure 8: Counterfactual Demand Changes in INS-only Market



Note: Figure presents the percentage change in demand for contraceptives relative to the observed scenario in the OTC-only counterfactual (Panel A) and the INS-only counterfactual (Panel B). Dark colors represent the scenario holding information status fixed. Light colors represent the scenario with full information. Counterfactual simulation use data from January to June 2018.