Gains from Trade in Gun Policy: A Compensation-Based Benchmark*

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Abstract

Policies restricting gun sales face substantial political opposition and constitutional constraints. We ask how costly it would be to induce potential handgun buyers to choose less lethal alternatives. Pairing stated-choice experiments with a behavioral model of firearm choice, we estimate the payments required to induce substitution away from handguns toward long guns or no gun purchase. We then compare these payments with the resulting mortality benefits. We identify substantial gains from trade: many prospective handgun buyers require little compensation to switch, and targeted compensation can avert homicides at a social cost below conventional estimates of the value of a statistical life. The extent to which these gains can be realized through compensation, however, depends on the state's information about which consumers would change their choices and at what price. Without this information, uniform subsidies pay consumers who would choose an alternative anyway and overcompensate those willing to switch for less.

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1 Introduction

Handguns account for approximately 90 percent of firearm homicides in the United States where firearm type is identified, despite representing only about 44 percent of the privately owned firearm stock (Berrigan et al. 2022; Harrell et al. 2024). Relative to their prevalence, handguns are involved in approximately 11 times as many homicides as long guns. Yet efforts to restrict their purchase face intense political opposition. A longstanding insight in political economy is that resistance to reform need not reflect the aggregate economic gains and losses from changing the status quo (Olson 1965; Fernandez and Rodrik 1991). In the context of firearms, the intensity of political opposition does not directly reveal how much prospective handgun buyers value purchasing a handgun rather than an alternative, or how these private valuations compare with the potential mortality benefits of substitution.

Consider compensating a prospective handgun buyer to choose a long gun or forgo a firearm purchase altogether. The minimum payment the buyer would accept measures the private cost of changing their choice. Moshary et al. (2025) document substantial consumer surplus from firearm purchases. This does not necessarily imply, however, that consumers place similarly high value on purchasing a handgun rather than an alternative. Personal and household protection is a primary motivation for firearm ownership, and long guns or other alternatives can serve some of the same purposes. Substitution may therefore preserve much of the private value of firearm ownership while reducing the associated mortality risks. If the expected mortality benefits of substitution exceed its private costs, there is, in principle, scope to reduce firearm mortality while fully compensating buyers for changing their choices.

Our objective is to quantify the magnitude of these potential gains from trade. We first establish a benchmark under perfect information about consumers' valuations, asking how much substitution could occur while fully compensating buyers for their private losses. We then use a uniform subsidy to illustrate how imperfect information can increase the cost of realizing these gains through voluntary exchange. Compensation-based approaches are not unfamiliar in firearm markets, as illustrated by gun buyback programs. Our analysis

does not evaluate such programs or resolve the practical challenges of implementation, including verification, arbitrage, and repeated purchases. Instead, it highlights how consumer valuations and information about those valuations shape the economic scope for voluntary substitution.

To quantify these potential gains, we combine a stated-choice experiment with a structural model of firearm demand to estimate the distribution of prospective handgun buyers' willingness to accept (WTA) to choose a long gun or forgo a gun purchase altogether. We focus on prospective buyers from households without existing firearms, for whom substitution changes whether the household enters handgun ownership. We then combine the estimated substitution responses with existing evidence on the relationship between firearm ownership and homicide to quantify the expected mortality benefits. A central uncertainty is the extent to which substitution from handguns to long guns reduces mortality risk. We therefore consider alternative assumptions about the mortality risks associated with long-gun ownership and examine how these assumptions affect the potential gains from trade.

Our estimates reveal substantial heterogeneity in the private costs of substitution. The median prospective handgun buyer requires approximately $815 to choose an alternative, while the mean exceeds $2,000. While some buyers place considerable value on purchasing a handgun, many can be induced to substitute at relatively low private cost. Comparing these costs with the expected mortality benefits, we find substantial potential gains from trade. Under this perfect-information benchmark, the welfare-maximizing scale of compensation induces 27–48 percent of prospective handgun buyers to switch, depending on assumptions about the mortality consequences of long-gun ownership, and averts an estimated 60–220 homicides annually. Even after accounting for the excess burden of financing compensation, the social cost per homicide averted is approximately $5.5–5.9 million, below the $13 million value of a statistical life used in our analysis. These findings suggest that substantial reductions in handgun purchases could generate positive net surplus even when every buyer induced to switch is fully compensated for their private loss.

To illustrate how imperfect information can limit the gains realized through voluntary exchange, we consider a simple mechanism in which all consumers who choose an alternative to a handgun receive the same payment. Relative to the perfect-information compensation scheme, uniform subsidies are more expensive for two reasons: consumers who switch may receive more than they require, and consumers who would have chosen a subsidized alternative anyway receive payments without changing their behavior. These costs are substantial. For a given number of switchers, uniform subsidies require five to six times as much government expenditure as perfectly targeted compensation. At the welfare-maximizing uniform subsidy, 64–78 percent of program expenditure goes to consumers whose behavior is unchanged. Although these payments are transfers rather than direct resource costs, financing them imposes additional social costs. Consequently, the welfare gains from uniform compensation are 45–65 percent lower relative to the perfect-information benchmark.

A tax on handguns could also induce substitution without requiring information about individual valuations. Unlike compensation, however, taxation imposes private losses on consumers induced to switch, as well as on those who continue purchasing handguns. The two instruments therefore differ in who bears the costs of substitution.[1]

Building on the demand model estimated in Moshary et al. (2025), we recover the joint distribution of prospective handgun buyers' willingness to accept compensation for switching away from handguns and the alternatives they would choose. Unlike conventional demand measures such as cross-price elasticities or diversion ratios, these estimates characterize the private costs of changing individual purchasing decisions and the resulting substitution patterns. Much of the earlier economics literature on firearms has focused on the relationship between gun ownership and violence (Duggan 2001; Cook and Ludwig 2006). By combining our estimates of private substitution costs with evidence on the mortality consequences of firearm ownership from this literature, we quantify the potential gains from trade from re-

[1]For comparison, Appendix E computes a welfare-maximizing handgun tax of $605–$1,098, which induces 42–58 percent of prospective handgun buyers to switch and averts an estimated 91–269 homicides annually, assuming tax revenue offsets other distortionary taxes. Taxes of this magnitude could also face constitutional scrutiny.

ducing handgun purchases, even when buyers are fully compensated for their private losses. We further illustrate how imperfect information about consumer valuations can increase the costs of realizing these gains through voluntary exchange. Our analysis complements recent work evaluating firearm taxes and restrictions on retail access (Armona and Rosenberg 2024; Rosenberg 2026) by establishing benchmarks for the potential welfare gains from reducing handgun purchases, rather than evaluating a particular policy proposal.

2 Data: Stated Choice Experiment

Our analysis uses data from a stated-choice experiment designed to elicit preferences over firearms. Stated-choice experiments of this kind are a standard tool for measuring multi-dimensional preferences in economics, marketing, and political science (Hainmueller et al. 2014). Rather than estimating the average effects of individual attributes, we use the choice data to estimate a structural model of firearm demand that allows us to evaluate counterfactual substitution across firearm categories. This section describes the experimental design and the features of the data most relevant to our analysis. Complete details of the experiment are provided in Moshary et al. (2025).

2.1 Experimental Design

Sample. The experiment was fielded online in March and April 2022 to 22,522 U.S. adults in partnership with The Harris Poll. Survey participants were drawn from the general population available to The Harris Poll. Among respondents, 4,018 report owning a gun, interest in buying a gun in the next 12 months, and/or interest in purchasing a gun more generally. This set comprises the estimation sample; the remaining respondents completed only the panel's demographic questions and the screening questions.[2]

[2]The data collection was reviewed and approved as minimal-risk research by the University of Chicago Social and Behavioral Sciences Institutional Review Board (protocol IRB20-1351). Participants were adult members of The Harris Poll's online panel who consented to participate after reading an online information sheet; all purchase scenarios were hypothetical, and no participant was offered or sold a firearm. The research

Choice Tasks. Each respondent completed seven choice tasks. In each task, respondents were presented with three firearm alternatives and asked, in a forced-choice hypothetical purchase scenario, to select their most preferred option. Respondents were then asked whether they would actually buy their most preferred alternative at the quoted price. The first choice elicits trade-offs among firearm alternatives, while the follow-up purchase question allows us to observe the extensive margin. Appendix A reproduces the instructions and task screens as shown to respondents.

Attributes. In each choice task, respondents were shown pictures of each alternative firearm, alongside information on price, brand, caliber, capacity, and action type. We estimate part-worths for category (Pistol, Revolver, Rifle, Shotgun), brand (e.g., Smith & Wesson, Glock, Remington), and price.

Randomization. For each task, prices were varied independently of other attributes, allowing identification of price sensitivity. The composition of choice sets—the three gun models available in each task—was also randomized, providing variation used to identify consideration set formation.

2.2 Consideration Sets

A key feature of the experimental design is that it elicits both choices and *consideration sets*. Before the choice tasks, respondents report which types of firearms they would consider among pistols, revolvers, shotguns, and/or rifles. The alternatives in each task were then drawn primarily from these stated categories but tasks occasionally included options outside the reported consideration set. We therefore observe directly whether a respondent considers handguns, long guns, or both, while also observing choices involving firearms outside the respondent's stated consideration set. The latter variation is important for estimating pref-

team received only de-identified responses, which are publicly available in the replication archive of Moshary et al. (2025).

erences over non-considered categories, and ultimately, the compensation required to induce substitution toward them.

2.3 Sample Characteristics

Table 1 reports summary statistics for the respondents. The sample is roughly balanced by gender and somewhat older than the general population, consistent with the demographics of gun ownership in the United States. Approximately two-thirds of respondents currently own firearms.

Table 1: Sample Characteristics

	Mean
Male	0.48
Age	48.8
Household income <$50k	0.42
Household income $50k–$100k	0.37
Household income >$100k	0.21
College educated	0.31
Currently owns a gun	0.64
No gun in household	0.18

The distinction between respondents from gun-owning households and those from gun-naïve households is central to our analysis. For households that already own a handgun, an additional purchase changes the stock of firearms but not the extensive margin of gun ownership. For a gun-naïve household, in contrast, a purchase moves the household from no handgun to handgun ownership. The literature linking gun ownership to homicide identifies causal effects at this extensive margin (Duggan 2001; Cook and Ludwig 2006).

We define gun-naïve households as those in which the respondent reports no current gun ownership. Approximately 17.7% of prospective buyers in our sample come from gun-naïve households. To translate our individual-level demand estimates into household ownership shares, we must determine the population share of gun-naïve households in the market. Gallup surveys indicate that the share of U.S. households owning a firearm has remained

relatively stable at approximately 44%. In steady state, entry by gun-naïve households must therefore be offset by divestiture among incumbent gun-owning households. Because our survey samples both existing gun owners and gun-naïve prospective buyers, mapping the composition of our sample into population shares requires an assumption about the timing of this divestiture. We assume that exiting households divest their firearms before the survey, so that the survey frame consists of incumbent households that remain gun owners and gun-naïve households currently in the market. Combining the composition of this sample with the 44% population firearm ownership rate implies that 7.9% of households are gun-naïve and in the market, of whom 92.3% purchase a firearm under the status quo, yielding 7.3% of households as new gun-owning entrants.[3]

2.4 Design Features and Limitations

Stated choice experiments offer several advantages for our analysis. The randomized variation in prices and choice sets allows us to estimate substitution patterns that would be difficult to recover from transaction data. The two-stage design—selecting a preferred alternative, then deciding whether to purchase—provides information on both intensive and extensive margins of demand. Eliciting consideration sets directly provides information on the search process. These features are particularly useful in the firearms market, where transaction data are limited.

The main limitation of stated choice data is that choices are hypothetical. Respondents may not fully account for budgets, storage, or other real-world constraints. We address this concern in two ways. First, the experimental design presents realistic scenarios with

[3]Let E denote the population share of gun-naïve households in the market and S the share of incumbent households that remain gun owners. Gun-naïve households constitute 17.7% of our estimation sample, implying $E/(S+E) = 0.177$. The demand model predicts that $p = 0.923$ of these households purchase a firearm, while steady state requires $S + pE = 0.44$. Solving yields $E = 0.079$, $pE = 0.073$, and $S = 0.367$. Taken literally, this calibration implies substantial turnover in household gun ownership. We instead view this as likely evidence that incumbent gun owners are underrepresented in our survey relative to gun-naïve prospective buyers, and treat the calculation as an internally consistent normalization rather than a serious estimate of household turnover. Importantly, the choice of E scales aggregate program costs and averted deaths proportionally and therefore does not affect optimal subsidies, cost per averted death, or our cost-benefit conclusions.

plausible prices. Second, Moshary et al. (2025) validates stated preferences against revealed-preference data where available. More broadly, evidence on hypothetical bias suggests that it primarily affects absolute willingness-to-pay rather than marginal rates of substitution between attributes (Carlsson and Martinsson 2001). Our counterfactuals rely primarily on relative trade-offs—in particular, the compensation required to induce substitution from handguns to long guns or no purchase.

3 Model: Demand Estimation with Consideration Data

This section presents the structural model of firearm demand developed in Moshary et al. (2025). In addition to respondents' choices, our data include their stated consideration sets. We incorporate this information using a search-cost framework in which consumers choose which firearm categories to consider before choosing among available products in those categories. Modeling consideration is important for our counterfactual analysis because inducing a consumer to substitute away from a handgun may require not only changing their choice among considered products, but also inducing them to consider a different firearm category.

3.1 Model Setup

Products and Categories. The market consists of J products organized into K categories. In our application, the four categories are pistol, revolver, rifle, and shotgun. Products correspond to specific firearm profiles defined by brand, price, and feature combinations. The outside option is always available and requires no search cost. Let $\mathcal{K} = \{1, \ldots, K\}$ denote the set of categories and $\mathcal{J}_k$ denote the set of products in category k.

Consumer Problem. Consumer i makes decisions in two stages. First, the consumer observes their search cost κ_i and chooses a consideration set $\mathcal{C}_i \subseteq \mathcal{K}$, paying κ_i for each

category they include. The consumer then observes the utilities of all products in the considered categories and chooses the utility-maximizing option from $\mathcal{C}_i \cup \{0\}$, where 0 denotes the outside option.

3.2 Utility Specification

Product Utility. Consumer i's utility from purchasing product j in category k is:

$$u_{ij} = \alpha_{ik} + x_j'\beta_i + \gamma_i p_j + \varepsilon_{ij} \tag{1}$$

where α_{ik} is consumer i's preference for category k, x_j is a vector of product attributes (brand dummies, features), β_i is consumer i's vector of preferences for those characteristics, p_j is the price of product j, $\gamma_i < 0$ is consumer i's price sensitivity, and ε_{ij} is an idiosyncratic taste shock distributed Type I Extreme Value. We allow preferences to vary across consumers. Individual preference parameters $(\alpha_i, \beta_i, \gamma_i, \kappa_i)$ are drawn from a joint population distribution:

$$(\alpha_i, \beta_i, \gamma_i, \kappa_i) \sim F(\cdot|\theta) \tag{2}$$

where θ parametrizes its mean and the variance–covariance matrix.

Outside Option. The outside option has utility:

$$u_{i0} = \varepsilon_{i0} \tag{3}$$

where ε_{i0} is also distributed Type I Extreme Value. The outside option is normalized to have zero mean utility.

Category-Level Expected Utility. Before searching a category, consumer i does not observe the product-level shocks $\{\varepsilon_{ij}\}_{j \in \mathcal{J}_k}$. The expected purchase utility from category k,

conditional on consideration, is:

$$V_{ik} = \mathbb{E}\left[\max_{j \in \mathcal{J}_k} u_{ij}\right] \tag{4}$$

Under the Type I Extreme Value assumption, expected maximum utility is equal to the inclusive value plus Euler's constant. Because this additive constant is common across consideration sets and therefore does not affect the consumer's decision, we normalize it to zero and write:

$$V_{ik} = \log\left(\sum_{j \in \mathcal{J}_k} \exp\left(\alpha_{ik} + x_j'\beta_i + \gamma_i p_j\right)\right). \tag{5}$$

3.3 Consideration Set Formation

Optimal Consideration. Consumer i chooses the consideration set that maximizes expected utility net of search costs:

$$\max_{\mathcal{C} \subseteq \mathcal{K}} \left\{\mathbb{E}\left[\max_{j \in \bigcup_{k \in \mathcal{C}} \mathcal{J}_k \cup \{0\}} u_{ij}\right] - |\mathcal{C}| \cdot \kappa_i\right\}. \tag{6}$$

Adding a category expands the set of products available to the consumer but requires paying an additional search cost κ_i. The consumer therefore considers a category when the expected utility gain from expanding the choice set is sufficient to justify this cost.

Solving the Consideration Problem. Using the inclusive values defined above, the optimal consideration set is:

$$\mathcal{C}_i^* = \arg\max_{\mathcal{C} \subseteq \mathcal{K}} \left\{\log\left(1 + \sum_{k \in \mathcal{C}} \exp(V_{ik})\right) - |\mathcal{C}| \cdot \kappa_i\right\}. \tag{7}$$

The term 1 reflects the normalized utility of the outside option. Because there are only four firearm categories, we solve the consideration problem by enumerating all 2^4 possible consideration sets.

Intuition. Consumers with stronger preferences for a category are more likely to consider it, while consumers with lower search costs consider more categories. Search costs are not themselves a primary object of interest in our analysis. Rather, modeling consideration allows us to better recover consumers' underlying preferences, including preferences for categories they do not currently consider.

3.4 Choice Probabilities

Let $\delta_{ij} = \alpha_{ik} + x_j'\beta_i + \gamma_i p_j$ denote the deterministic component of utility. Given consideration set $\mathcal{C}_i$, the probability that consumer i chooses product j in category $k \in \mathcal{C}_i$ is:

$$P(j|\mathcal{C}_i) = \frac{\exp(\delta_{ij})}{\exp(\delta_{i0}) + \sum_{k' \in \mathcal{C}_i} \sum_{j' \in \mathcal{J}_{k'}} \exp(\delta_{ij'})}. \tag{8}$$

This is the standard multinomial logit choice probability conditional on the consumer's consideration set.

3.5 Identification

Price Sensitivity (γ_i). Price sensitivity is identified by the randomized variation in prices across choice tasks. Holding other attributes fixed, we observe how choice probabilities change with price. The coefficient γ_i measures the marginal utility of money and allows us to translate utility differences into dollar-denominated willingness-to-accept.

Attribute Preferences (β_i). Preferences over product attributes (brand, features) are identified by randomized variation in the attributes present in each choice set. For example, comparing choices across tasks that differ solely in the brand of one product reveals the preference for that brand.

Category Preferences (α_{ik}). Category preferences are identified by choices among products within and across categories, holding other attributes fixed. The relative frequency

of choosing handguns vs. long guns (conditional on both being in the consideration set) identifies the category preference parameters.

Search Cost (κ_i). The search cost is identified by variation in consideration sets, *holding fixed the inclusive values of categories.* Conditional on preferences, consumers with the same inclusive values but different consideration sets must differ in their search costs: consumers who consider more categories have lower search costs.

3.6 Estimation

We estimate the model using hierarchical Bayesian methods implemented in the `bayesm` package (Rossi et al. 2005). The estimation uses a custom Markov Chain Monte Carlo (MCMC) with a Metropolis-in-Gibbs sampler to allow for search cost estimation, following the approach in Moshary et al. (2025).[4]

The hierarchical structure treats individual-level preference parameters $(\alpha_i, \beta_i, \gamma_i, \kappa_i)$ as draws from a population distribution characterized by hyperparameters θ. The Gibbs sampler alternates between: (1) drawing individual-level parameters conditional on the hyperparameters and data, using a Metropolis-Hastings step to account for the nonlinear consideration set model; and (2) drawing hyperparameters conditional on the individual-level parameters. We use the posterior draws to construct the distribution of willingness-to-accept used in the counterfactual analysis. For additional estimation details, see Appendix B.

[4]We used generative AI tools in preparing this article. Claude (Anthropic; models Claude Opus 4.5, Opus 4.6, Sonnet 4.6, Opus 4.7, Opus 4.8, Fable 5, and Opus 5.5), accessed through the commercially available Claude Code interface between January and October 2026, was used to write and debug code implementing the model, counterfactual simulations, figures, and tables as specified by the authors; to search the code and manuscript for errors and propose corrections; and to revise prose, check grammar and spelling, and format the manuscript. OpenAI's Codex (GPT-5.1) was also used to debug code in a single session in July 2026. ChatGPT (OpenAI) and Gemini (Google), using the most recent publicly available model of each between July and October 2026 and accessed through their public web interfaces, were used to refine prose, improve the clarity and sequencing of the exposition, and check for errors. The authors designed the research, specified every model and analysis, reviewed all AI-generated code, output, and text, and take full responsibility for the article's content. All code is included in the replication materials.

3.7 Estimation Results Summary

Table 2 summarizes the estimated parameters for the full sample and for the gun-naïve subsample that is the focus of our counterfactual analysis.

Table 2: Estimated Model Parameters

	Full Sample			Gun-Naïve Subsample		
Parameter	Mean	Median	[5th, 95th]	Mean	Median	[5th, 95th]
Price (per $100)	−0.34	−0.16	[−1.25, −0.02]	−0.38	−0.19	[−1.41, −0.02]
Handgun intercept	0.56	0.59	[−3.55, 4.66]	0.61	0.59	[−3.40, 4.65]
Long gun intercept	0.05	0.09	[−3.64, 3.72]	−0.05	−0.09	[−3.67, 3.69]
Search cost ($)	420	126	[9, 1,659]	395	110	[8, 1,575]

Notes: Posterior distribution summaries across all respondent-draw combinations; brackets report the 5th and 95th percentiles. Category intercepts are simple averages across subcategories (4 for handguns, 10 for long guns). Search cost is converted to dollars using each draw's price coefficient. Gun-naïve households exhibit slightly higher price sensitivity and a stronger preference for handguns relative to long guns.

Three features of the estimates are particularly relevant for our counterfactual analysis. First, consumers are price-sensitive, with a median price coefficient of −0.16 per $100. This price sensitivity allows us to express the compensation required to induce substitution in dollar terms. Second, there is substantial heterogeneity in preferences for handguns relative to long guns. Third, search costs are meaningful, with a median of roughly $126. Thus, for some consumers who do not currently consider rifles or shotguns, inducing substitution requires overcoming a substantial cost of considering an alternative category.

4 Model Results: Status Quo

4.1 Simulation Procedure

We simulate status quo choices from the estimated model. For each respondent i and posterior draw, we compute the optimal consideration set $\mathcal{C}_i^*$, draw product-level utility shocks ε_{ij}, and record the utility-maximizing choice. We repeat this process for multiple posterior

draws to integrate over parameter uncertainty. Repeating this procedure across posterior draws yields predicted market shares that integrate over both preference heterogeneity and parameter uncertainty.

4.2 Market Shares

Panel A of Table 3 reports predicted market shares for the full sample of prospective gun buyers and also for the sample of gun naïve buyers separately. In the full sample, handguns account for 58.2% of predicted choices, with pistols accounting for the largest share. Long guns account for 34.8%, while 7% choose the outside option and do not purchase a firearm.

Table 3: Status Quo Predictions: Market Shares, Consideration Sets, and Household Ownership

	Full Sample	Gun-Naive
Panel A: Predicted individual market shares		
Handguns	**58.2%**	**63.6%**
Pistol	38.3%	43.0%
Revolver	19.9%	20.6%
Long Guns	**34.8%**	**28.7%**
Semi-auto rifle/shotgun	12.2%	10.0%
Other rifle	10.1%	7.4%
Other shotgun	12.6%	11.4%
Outside Option	**7.0%**	**7.7%**
Panel B: Gun categories considered, gun-naïve handgun buyers		
Handguns only		42.3%
Handguns + long guns		57.7%
Panel C: Status quo household gun ownership		
Handgun household	39.3%	
Long-gun-only household	4.7%	
No gun	56.0%	

Notes: Panel A reports simulated individual-level market shares from the estimated model. Panel B conditions on gun-naïve respondents whose predicted choice is a handgun; the outside option (no purchase) is always available and requires no search cost. Panel C reports shares of all U.S. households, combining the model's gun-naïve predictions with incumbent-owner shares calibrated from Gallup (2020) and English (2022); the implied any-gun share is 44.0%.

Gun-naïve buyers are more likely to choose handguns than buyers in the full sample

(63.6% vs. 58.2%). Correspondingly, long guns account for a smaller share of their predicted choices (28.7% compared with 34.8%). The outside-option shares are similar across the two groups (7.7% and 7.0%, respectively).

4.3 Consideration Sets

Panel B of Table 3 reports the distribution of consideration sets among gun-naïve buyers whose predicted status quo choice is a handgun. Among these buyers, 57.7% already consider both long guns and handguns. For these consumers, inducing substitution to a long gun requires compensating them for choosing a less-preferred product, but does not require expanding their consideration set. The remaining 42.3% consider only handguns. For these consumers, a subsidy must also induce them to consider long guns, although this need not increase total search costs if they substitute long guns for handguns in their consideration set.

This distinction has important implications for willingness-to-accept. For consumers who already consider long guns, WTA reflects the utility difference between the handgun and long gun, scaled by price sensitivity. For many consumers who do not consider long guns, the subsidy must also induce search.

4.4 Translation to Household-Level Ownership

Status Quo Household Ownership. To apply causal estimates of firearm ownership on mortality, we convert our individual-level market share estimates (Panel A of Table 3) into predicted household firearm ownership. We construct status quo household ownership shares by gun type as follows. The steady-state calibration in Section 2 implies that 7.9% of households are gun-naïve and in the market; we treat the remaining 36.7% of gun-owning households as incumbent gun owners whose ownership predates the current period. We allocate incumbent households between handgun owners and long-gun-only owners using ownership ratios from the 2021 National Firearms Survey (English 2022), yielding baseline

shares of approximately 30.4% handgun households and 6.3% long-gun-only households. We then add the gun-naive households' predicted choices from our demand model to obtain the status quo ownership shares reported in Panel C of Table 3.

In our policy counterfactuals, we connect simulated changes in individual purchases to changes in ownership shares as follows. Let s_{HG}^{gn} denote the share of gun-naïve households choosing handguns. A policy that reduces this share by Δs changes household-level handgun ownership by:

$$\Delta(\text{HG households}) = f_{gn} \cdot \Delta s \tag{9}$$

where $f_{gn} = 0.079$ is the fraction of households that are gun-naïve and in the market. For example, reducing the handgun share among gun-naïve households from 63.6% to 50% implies a 1.07 pp reduction of the household-level handgun ownership share.

4.5 Summary and implications for counterfactuals

The estimated model implies that 63.6% of gun-naïve households would choose handguns in the status quo, quantifying the margin targeted by our counterfactual policies. The estimates also reveal substantial heterogeneity in consideration sets. Some handgun buyers already consider long guns, so inducing substitution requires only compensating them for choosing a less-preferred product. For others, compensation must also induce them to consider the long gun category.

The next section uses the predicted market shares and substitution patterns to evaluate the cost and mortality effects of compensation-based policies.

5 Counterfactual Analysis

This section evaluates compensation-based policies that reduce handgun purchases. We first define willingness to accept for substitution away from handguns. We then present a mortality model that translates changes in gun ownership into averted firearm homicides.

We use these components to compare two policy scenarios: perfect targeting and uniform subsidies.

5.1 Willingness to Accept

Willingness to accept (WTA) is the minimum payment required to induce a household that would choose a handgun in the status quo to instead choose a less lethal alternative, either a long gun or the outside option. Our main analysis takes a post-consideration perspective: consumers have already formed their consideration sets when the subsidy is introduced, but may expand those sets in response to the subsidy before deciding whether—and what—to purchase. This perspective reflects the consumers in our sample, who are already in the market for a firearm and have therefore likely considered some alternatives before the policy is introduced. In the appendix, we also estimate counterfactuals from a pre-consideration perspective, in which consumers learn about the subsidy before forming their consideration sets. We view this case as potentially more relevant for the long-run effects of a permanent policy.

First, consider substitution to a long gun. Let $U_i^{HG}(\mathcal{C}_i)$ denote consumer i's utility from their preferred handgun among the options in their consideration set $\mathcal{C}_i$. When $\mathcal{C}_i$ contains a long gun, let $U_i^{LG}(\mathcal{C}_i)$ denote their utility from the preferred long gun in $\mathcal{C}_i$. A subsidy s for choosing an alternative to a handgun raises the utility of each long-gun option by $-\gamma_i s$, where $\gamma_i < 0$ is price sensitivity.

For consumers whose status quo consideration set $\mathcal{C}_i$ contains a long gun, one route to substitution is simply to make the preferred long gun already considered more attractive than the preferred handgun. The minimum payment required along this route is the monetized utility gap:

$$\frac{U_i^{HG}(\mathcal{C}_i) - U_i^{LG}(\mathcal{C}_i)}{-\gamma_i}. \tag{10}$$

The subsidy may also make it worthwhile to search one or more additional long-gun categories

by raising their inclusive values. Because the subsidy is paid for the outside option as well, it also raises the value of the consumer's existing choice set; the consumer's search decision weighs both effects. For consumers who do not initially consider any long guns, only this search-expansion route to substitution to a long gun is available. Numerically, we find the smallest subsidy at which the consumer chooses a long gun rather than a handgun, accounting for any expansion of the consideration set induced by the subsidy. We define this minimum subsidy as WTA_i^{LG}.

The outside option encompasses both non-purchase and alternatives to firearms not explicitly modeled in the conjoint (e.g., a Taser). Because the outside option is always in the consumer's consideration set, no additional search is required. Let U_i^{out} denote its utility. The minimum subsidy to induce a switch to the outside option is:

$$\text{WTA}_i^{out} = \frac{U_i^{HG}(\mathcal{C}_i) - U_i^{out}}{-\gamma_i}. \tag{11}$$

The consumer's overall WTA to switch away from a handgun purchase is the minimum of the two:

$$\text{WTA}_i = \min\left\{\text{WTA}_i^{LG}, \text{WTA}_i^{out}\right\}. \tag{12}$$

The consumer switches to whichever alternative requires the smaller subsidy. Let $d_i \in \{\text{LG}, \text{out}\}$ denote the switch destination:

$$d_i = \begin{cases} \text{LG} & \text{if } \text{WTA}_i^{LG} < \text{WTA}_i^{out} \\ \text{out} & \text{otherwise.} \end{cases} \tag{13}$$

Our estimates imply that, among status quo handgun buyers, 78.2% have a long gun as their minimum-WTA alternative and 21.8% have the outside option.

5.2 WTA Distribution

Figure 1 plots the distribution of WTA among gun-naïve handgun buyers. The distribution is highly right-skewed: the median consumer requires $815 to switch, while the mean requires $2,118 due to a long right tail (the 25th and 75th percentiles are $295 and $2,121, and the 95th percentile is $8,055). This skewness implies that many consumers can be induced to switch away from handguns at modest cost, but reaching the most committed handgun buyers is expensive.

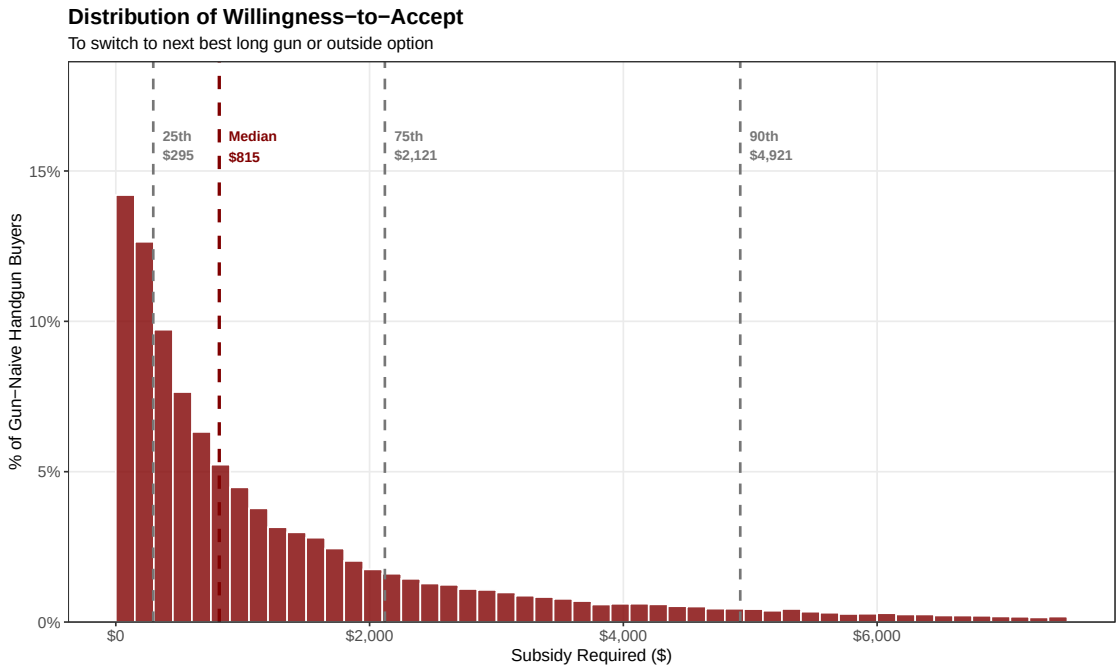


Figure 1: Distribution of Willingness to Accept Among Gun-Naïve Handgun Buyers

Alt text: Histogram of the subsidy required to switch to the next-best long gun or outside option, in dollars, on the horizontal axis against the percent of gun-naïve handgun buyers on the vertical axis. The distribution peaks near zero at about 15 percent and declines steadily into a long right tail beyond $6,000. Dashed vertical lines mark the 25th percentile at $295, the median at $815, the 75th percentile at $2,121, and the 95th percentile at $4,921.

5.3 From Ownership to Homicides: The Mortality Model

To translate changes in gun ownership into averted homicides, we model homicides as a function of gun ownership with constant elasticity:

$$H = H_0 \cdot \left(\frac{G}{G_0}\right)^{\varepsilon} \tag{14}$$

where H denotes homicides, G the share of households owning a firearm, subscript 0 denotes status quo values, and ε is the elasticity of homicides with respect to gun ownership. This specification implies that a 1% increase in gun ownership leads to an ε% increase in homicides.

We calibrate the elasticity at $\varepsilon = 0.2$. Prior work, including Duggan (2001) and Cook and Ludwig (2006), places the extensive-margin elasticity in the range of 0.1 to 0.3.[5] Our counterfactual likewise focuses on the extensive margin, making these estimates appropriate for our setting.

Our analysis focuses on homicides as a measure of harm. Gun ownership may generate additional externalities—including non-fatal injuries and psychological trauma—that are serious and consequential but not captured in our model. These outcomes are important in their own right and could be incorporated into a similar framework with appropriate data.

A natural concern is whether policies targeting legal first-time buyers can meaningfully affect homicide rates, given the association between gun violence and criminal activity. However, many homicides occur between people who know one another, including intimate partners, family members, friends, and acquaintances (Bureau of Justice Statistics 2022). Thus, reductions in homicide need not operate through changes in access to firearms through criminal markets. Changes in the weapons available within households can also affect the lethality of domestic disputes and other interpersonal conflicts that escalate to violence. This "instrumentality" effect, whereby weapon lethality shapes the probability of death conditional on a

[5] Duggan (2001) proxies for gun prevalence using magazine subscriptions, capturing changes in ownership driven by legal acquisition rather than criminal markets. Cook and Ludwig (2006) proxies for gun ownership with the fraction of suicides using a firearm.

violent incident, is well documented in the public health literature (Braga and Cook 2018). Legal first-time buyers are precisely the population for whom this household weapon-choice margin matters.

Because handguns account for the majority of homicides, consistent with their ease of concealment and use in close-quarters confrontations, we specify separate elasticities by firearm type, applying the same constant-elasticity form to each category: $H_{HG} = H_{HG,0}\,(G_{HG}/G_{HG,0})^{\varepsilon_{HG}}$ for handgun homicides and $H_{LG} = H_{LG,0}\,(G_{LG}/G_{LG,0})^{\varepsilon_{LG}}$ for long gun homicides, where G_{HG} and G_{LG} denote handgun and long-gun-only household shares.

Two Scenarios. We consider two scenarios for the relative effects of handgun and long gun ownership on homicide. The optimistic scenario ($\varepsilon_{HG} = 0.22$, $\varepsilon_{LG} = 0$) reflects the view that handguns are disproportionately associated with homicide risk, while long guns contribute relatively little (and under this assumption, any contribution of long-guns is non-incremental). The pessimistic scenario ($\varepsilon_{HG} = \varepsilon_{LG} = 0.2$) instead assumes that long guns present an equal proportional effect as handguns. It is worth noting that this still implies that long guns present a much smaller absolute effect because the baseline homicide rate per long gun is lower than the corresponding rate for handguns.[6]

Both scenarios interpret the disparity between handgun and long gun homicide rates as reflecting a *treatment* effect of weapon type: a given individual switching from a handgun to a long gun causes a decreased risk of homicide. This interpretation is consistent with the physical differences between handguns and long guns and with evidence that many homicides arise from escalated interpersonal conflicts, where weapon type can determine whether an incident becomes fatal (Cook and Ludwig 2000).[7]

[6]The value 0.22 preserves the calibrated aggregate response when the entire effect is attributed to handguns. For a proportional change in gun ownership, the aggregate elasticity is the homicide-share-weighted average of the category elasticities, $\varepsilon = \frac{H_{HG,0}}{H_0}\varepsilon_{HG} + \frac{H_{LG,0}}{H_0}\varepsilon_{LG}$. Setting $\varepsilon_{LG} = 0$ and solving gives $\varepsilon_{HG} = 0.2 \times 17{,}609/16{,}024 = 0.22$. The pessimistic scenario, $\varepsilon_{HG} = \varepsilon_{LG} = 0.2$, reproduces the aggregate elasticity directly.

[7]Further evidence that most firearms are not purchased with criminal intent is that the median time from retail sale to recovery at a crime scene is approximately nine years (Bureau of Alcohol, Tobacco, Firearms, and Explosives).

If differences in homicide rates instead reflect selection into weapon type, this calibration would overstate the mortality benefits of substitution. In the extreme, if long guns were equally or more lethal for the relevant marginal buyers, substitution could yield little reduction in homicides or even increase them. This distinction also clarifies the role of different margins: if long guns are less lethal than handguns, both substitution to long guns and movement to the outside option reduce homicides, whereas if lethality differences are small, the extensive margin drives the results.

A more difficult concern is selection on characteristics we do not observe. The accuracy of our mortality-benefit calculation depends on whether the handgun buyers induced to switch have similar homicide risk to other handgun buyers. We do not observe the joint distribution of WTA and violence risk, so we cannot determine the magnitude or direction of this selection from our data. One reason selection could matter is that consumers contemplating a handgun purchase for an imminent criminal purpose may be both less willing to substitute and less likely to participate in a survey such as ours, which would tend to make marginal switchers lower risk than other handgun buyers. At the same time, homicide risk need not reflect criminal intent at the time of purchase: firearms recovered in connection with crimes are often recovered years after their initial retail sale. Appendix F examines the more limited question of how selection of switchers on observable characteristics affects the estimates.

Averted Homicides Calculation. A policy that changes the household handgun ownership share from $G_{HG,0}$ to G'_{HG} and long-gun-only ownership share from $G_{LG,0}$ to G'_{LG} averts:

$$\text{Averted homicides} = \left[H_{HG,0} - H_{HG,0} \cdot \left(\frac{G'_{HG}}{G_{HG,0}}\right)^{\varepsilon_{HG}}\right] - \left[H_{LG,0} \cdot \left(\frac{G'_{LG}}{G_{LG,0}}\right)^{\varepsilon_{LG}} - H_{LG,0}\right]. \tag{15}$$

The first bracket captures deaths averted through a reduction in handgun ownership; the second captures additional deaths from increased long-gun ownership (if $\varepsilon_{LG} > 0$).

A Note on the Mechanism. Our counterfactual assumes that gun-naïve households have approximately unit demand over the horizon relevant for the policy: a household induced to substitute from a handgun to a long gun does not subsequently purchase the handgun it was paid to forgo. In our survey, gun-naïve households overwhelmingly cite personal safety as the concern motivating their purchase. Acquiring a long gun or another protective alternative, such as a Taser, may meet that need, reducing the incremental value of additional firearms. The analogy to home security systems is useful: one suffices. To the extent consumers continue to value an additional handgun even after acquiring a long gun, our counterfactual would overstate the reduction in handgun ownership.

5.4 Perfect Targeting

The planner offers each gun-naïve status quo handgun buyer their exact WTA to switch away from a handgun purchase. Under perfect targeting, a consumer with willingness to accept WTA_i receives exactly this amount and is therefore indifferent between purchasing a handgun and switching to an alternative. The transfer itself is not a social cost: the payment received by the consumer is offset by the cost to the government. The welfare cost of inducing the consumer to switch is instead the foregone consumer surplus, WTA_i, together with the excess burden λWTA_i associated with financing the transfer, for a total social cost of $(1+\lambda)\text{WTA}_i$. We set $\lambda = 0.25$, the marginal excess burden of taxation that OMB recommends for supplementary benefit-cost analyses (Office of Management and Budget 1992) and at the conservative end of classic general-equilibrium estimates (Ballard et al. 1985).

For a policy inducing the n consumers with the lowest WTA to switch, government expenditures are

$$G_A(n) = \sum_{i=1}^{n} \text{WTA}_{(i)}, \tag{16}$$

where $\text{WTA}_{(i)}$ is the ith order statistic. The associated welfare cost is $(1+\lambda)G_A(n)$. Per-

fect targeting minimizes the government expenditure required to achieve a given level of substitution and therefore provides a lower bound on the fiscal cost of such a policy.

In constructing this benchmark, we target compensation based solely on consumers' WTA to switch away from handguns. The planner observes each prospective handgun buyer's WTA and induces buyers to switch in order of WTA. Switch destinations may affect the resulting mortality consequences but not the targeting rule. This reflects the object of the policy exercise—reducing handgun purchases—rather than solving for the unconstrained policy that minimizes firearm mortality.

Given this targeting rule, the remaining question is how far up the WTA distribution the planner should proceed. We characterize the optimal policy by comparing these welfare costs with the homicide mortality benefits of inducing consumers to switch away from handgun purchases. We use a value of statistical life (VSL) of $13 million, rounding down the $13.1 million central estimate in current federal regulatory guidance (U.S. Department of Health and Human Services 2024).

We take the constant-elasticity mortality specification literally as firearm ownership changes.[8] In this case, the mortality benefit of a substitution is not constant: reducing handgun ownership changes the mortality benefit of subsequent reductions, while substitution toward long guns changes long gun ownership and therefore, in the pessimistic scenario, the mortality consequences of subsequent increases. We therefore determine the optimal stopping point numerically. Ordering consumers by WTA, let (H_n, L_n) denote handgun and long gun ownership after inducing the first n consumers to switch. For each candidate stopping point n, we calculate

$$W(n) = \text{VSL}\left[M(H_0, L_0) - M(H_n, L_n)\right] - (1+\lambda)\sum_{i=1}^{n} \text{WTA}_{(i)}, \tag{17}$$

where $M(H, L)$ is given by the constant-elasticity mortality specification. The optimal stop-

[8] In Appendix D we show that our results are robust to using a local linear approximation to the constant-elasticity formulation.

ping point is

$$n^* = \arg \max_{n \in \{0,\ldots,N\}} W(n). \tag{18}$$

This approach allows the mortality consequences of substitution to evolve with firearm ownership and does not require the marginal-benefit and marginal-cost schedules to cross only once.

A side effect of the constant-elasticity specification with $\varepsilon < 1$ is that homicides per handgun-owning household rise as handgun ownership falls. Because buyers are induced to switch in order of WTA, this is consistent with harder-to-induce handgun buyers posing greater homicide risk. This is not true if we use a local-linear approximation to the homicide-ownership relationship, where the marginal homicide effect of reducing handgun ownership is unchanged as ownership falls. As we lack direct evidence on the shape of the homicide-ownership relationship, we report both, with the constant elasticity in the main text and local-linear approximation in Appendix D.

The first two columns of Table 4 report optimal policies under alternative assumptions about long gun homicide elasticities. Throughout, we summarize cost-effectiveness by the *net cost per averted death*: the welfare cost of the policy—forgone consumer surplus plus the excess burden of financing the payments, with transfers counted at zero—divided by averted homicides. In both cases, the optimal targeted policy is cost-effective: the net cost per averted death ($5.5–5.9 million) falls well below the $13 million VSL. Under the more optimistic assumption, the optimal policy operates at a larger scale because increases in long gun ownership do not offset the mortality benefits of reducing handgun ownership. Deaths averted rise steeply at low subsidy levels and flatten well before full diversion; under the optimistic elasticities, a $5,000 maximum subsidy (nearly seven times the optimum) would less than double the deaths averted. Appendix H displays the full curves under both elasticity assumptions.

Table 4: Optimal Subsidies: Targeted vs. Uniform

	Targeted Subsidies		Uniform Subsidies	
	$\varepsilon_{LG} = 0$	$\varepsilon_{LG} = 0.2$	$\varepsilon_{LG} = 0$	$\varepsilon_{LG} = 0.2$
Optimal subsidy	\$745	\$330	\$412	\$178
Mean (median) subsidy paid	\$310 (\$278)	\$156 (\$152)	\$412	\$178
% switching	47.5%	27.3%	32.4%	16.0%
Averted deaths	220	60	148	35
Government expenditure	\$0.97B	\$0.28B	\$2.43B	\$0.86B
Net cost per life	\$5.5M	\$5.9M	\$6.8M	\$8.7M
Net welfare gain	\$1.64B	\$0.43B	\$0.91B	\$0.15B
Positive net welfare?	**Yes**	**Yes**	**Yes**	**Yes**

Notes: For targeted subsidies, the optimal subsidy is the maximum payment; each switcher receives exactly their willingness to accept. Under the uniform subsidy every recipient, including inframarginal long gun and outside-option buyers, receives the same payment. Net cost counts transfers at zero: it equals forgone switcher surplus plus the excess burden ($\lambda = 0.25$) on total government expenditure; for targeted subsidies payments equal WTA exactly, so net cost is $(1 + \lambda)$ times expenditure. Expenditure per averted death under the uniform subsidy is \$16.4 million (optimistic) and \$24.3 million (pessimistic); the difference from net cost reflects windfall and overcompensation transfers.

5.5 Uniform Subsidy

If the planner cannot observe individual WTA, they must offer the same subsidy S to everyone who chooses a long gun or the outside option (e.g., a Taser).[9] Because both alternatives receive the same subsidy, the policy does not induce substitution between long guns and the outside option; their relative attractiveness remains unchanged.

Under a uniform subsidy S, three types of households receive the subsidy: switchers (households induced to switch away from handguns), inframarginal long-gun buyers, and inframarginal outside-option buyers. Accordingly, the total government expenditure is:

$$G_B(S) = S \cdot \left(N_{\text{switch}}(S) + N_{LG}^{\text{orig}} + N_{out}^{\text{orig}} \right). \tag{19}$$

[9] Our counterfactual assumes that eligibility for payments conditional on choosing the outside option, including non-purchase, can be verified. As a benchmarking exercise, we abstract from the administrative and enforcement challenges involved in implementing such payments.

Relative to perfect targeting, a uniform subsidy requires greater expenditure to induce a given amount of substitution for two reasons. First, switchers receive the common subsidy S even when their WTA is substantially lower. Second, inframarginal buyers receive the subsidy even though their behavior is unchanged. Our predicted market shares imply that these windfall payments can be substantial. Among gun-naïve households, the predicted status quo long gun share is 28.7% and the predicted outside option share is 7.7%; any uniform subsidy therefore provides payments to these 36.4% of gun-naïve households whose behavior is unchanged. Total welfare under subsidy S is therefore

$$W_B(S) = \text{VSL}\left[M(H_0, L_0) - M(H_S, L_S)\right] - \sum_{i:\,\text{WTA}_i \le S} \text{WTA}_i - \lambda G_B(S), \tag{20}$$

where (H_S, L_S) denotes handgun and long-gun ownership under subsidy S. We choose the subsidy S that maximizes $W_B(S)$. Unlike under perfect targeting, increasing the subsidy raises payments not only to newly induced switchers but also to all inframarginal recipients, making additional substitution increasingly costly to finance.

The third column of Table 4 reports the optimal uniform subsidy under optimistic elasticity assumptions. The optimal uniform subsidy of \$412 induces fewer handgun buyers to switch than perfect targeting (32.4% vs. 47.5%) and averts fewer deaths (148 vs. 220), yet requires two and a half times the government expenditure (\$2.43B vs. \$0.97B). Expenditure per averted death, at \$16.4 million, exceeds the VSL; most of that expenditure, however, consists of transfers to inframarginal recipients and to switchers compensated beyond their WTA. The net social cost per averted homicide is \$6.8 million, below the \$13 million VSL, so the policy raises welfare—but the wedge between the fiscal and welfare cost is itself economically meaningful: the policy requires financing a \$2.43 billion program in which most dollars flow to households whose behavior is unchanged. The optimum maximizes $W_B(S)$ on a grid of candidate subsidy levels; Appendix G discusses the numerical construction of the marginal cost and benefit schedules.

Table 5 decomposes program expenditures at the optimum. Only 36% of payments go to switchers, totaling $0.88 billion, compared with their collective WTA of $0.41 billion. The remaining 64% goes to inframarginal long-gun and outside-option buyers.

Table 5: Cost Decomposition: Uniform Subsidy at $412

Component	Cost	% of Total
Payment to switchers	$0.88 billion	36%
Windfall to LG buyers	$1.23 billion	50%
Windfall to outside buyers	$0.33 billion	14%
Total	**$2.43 billion**	100%

Under the pessimistic elasticity assumption ($\varepsilon_{LG} = 0.2$), the optimal uniform subsidy falls to $178, inducing 16% of handgun buyers to switch and averting 35 deaths. The mortality benefit from inducing a handgun buyer to switch is substantially smaller because most switchers substitute toward long guns, which reduce, but do not eliminate, gun homicide risk under this assumption. The net social cost per averted death rises to $8.7 million—still below the VSL, but half again the targeted policy's $5.9 million—while expenditure per averted death reaches $24.3 million, nearly twice the VSL. The composition of spending also deteriorates: at the pessimistic optimum, 78% of the $0.86 billion outlay is windfall to inframarginal buyers.

5.6 Information Rents

Table 4 highlights the value of information for targeting. For a given share of handgun buyers induced to switch, a uniform subsidy requires 5–6 times as much government expenditure as perfect targeting. The gap arises because limited information forces the planner to pay both information rents to switchers whose WTA lies below the subsidy and windfall payments to households whose behavior is unchanged. Because these rents are transfers, most of the gap is not a resource cost—but every transfer must be financed through distortionary taxation, and the transfers accrue to gun-purchasing households, which may complicate the politics

of such a program.

The consequences for the optimal policy are substantial. Relative to perfect targeting, the inability to observe individual WTA reduces the optimal scale of the policy, raises the net cost of the homicide reductions achieved, and substantially increases the government expenditure required to achieve them.

We illustrate these forces in two figures. Figure 2 shows that the optimal uniform subsidy reaches only the left tail of the WTA distribution, whereas perfect targeting induces substitution much further into the distribution. Figure 3 plots marginal benefit and marginal cost curves for both policy regimes. The marginal benefit curves (maroon for optimistic, gray for pessimistic) are identical across policies, as they depend only on the mortality consequences of inducing additional handgun buyers to switch. The marginal cost curves differ sharply: under perfect targeting (Scenario A), the marginal welfare cost reflects the WTA of the marginal switcher together with the excess burden of financing the targeted payment. Under a uniform subsidy (Scenario B), raising the subsidy also increases payments to inframarginal recipients and to switchers whose WTA lies below the subsidy. The gap between the marginal cost curves captures the additional cost created by the planner's inability to observe individual preferences.

5.7 Summary of Results

Our counterfactual analysis yields two main findings. First, compensation can reduce handgun purchases at welfare costs below the value of the resulting reduction in homicide under both mortality scenarios. Second, the effectiveness and fiscal scale of compensation-based policy depend heavily on targeting. Uniform subsidies generate information rents to both inframarginal recipients and low-WTA switchers, reducing the optimal scale of the policy and substantially increasing the government expenditure required to achieve a given amount of substitution. These rents are transfers rather than resource costs, but they are a defining feature of the policy's political economy because a large share of publicly financed payments

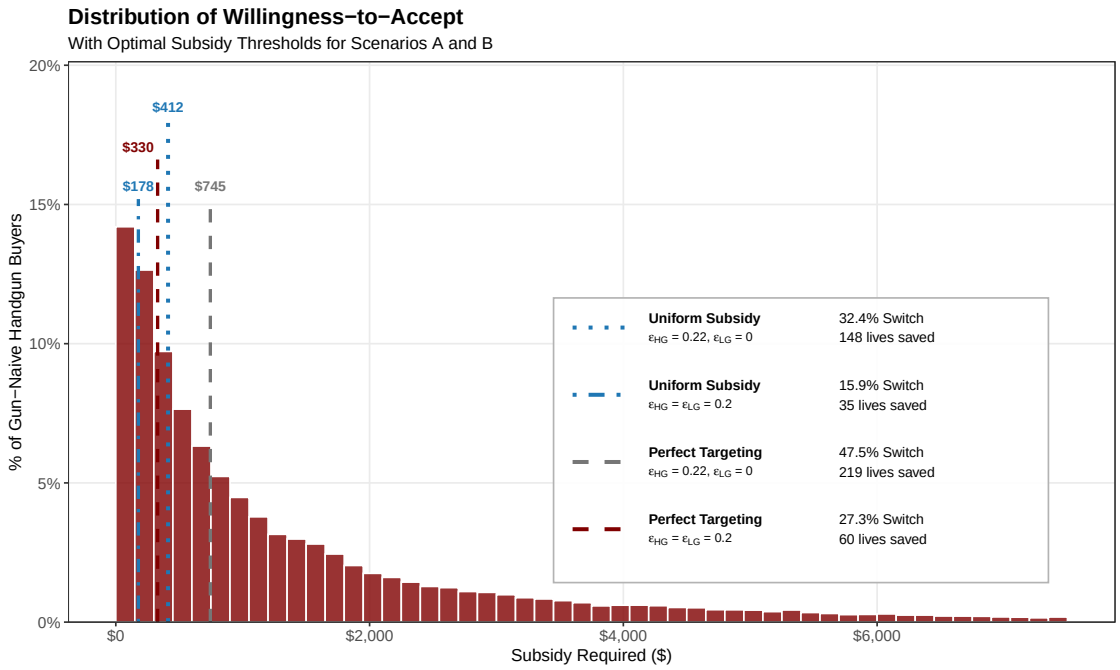


Figure 2: WTA Distribution with Optimal Subsidy Thresholds (Scenarios A and B)

Alt text: The same histogram of willingness to accept as the previous figure, overlaid with four dashed vertical lines marking the optimal subsidy thresholds: the uniform subsidy at $178 under the pessimistic elasticities and $412 under the optimistic elasticities, and perfect targeting at $330 under the pessimistic elasticities and $745 under the optimistic elasticities. A legend reports the share of buyers switching and deaths averted at each threshold: 15.9 percent and 35 lives, 32.4 percent and 148 lives, 27.3 percent and 60 lives, and 47.5 percent and 219 lives, respectively. All four thresholds sit in the left part of the distribution.

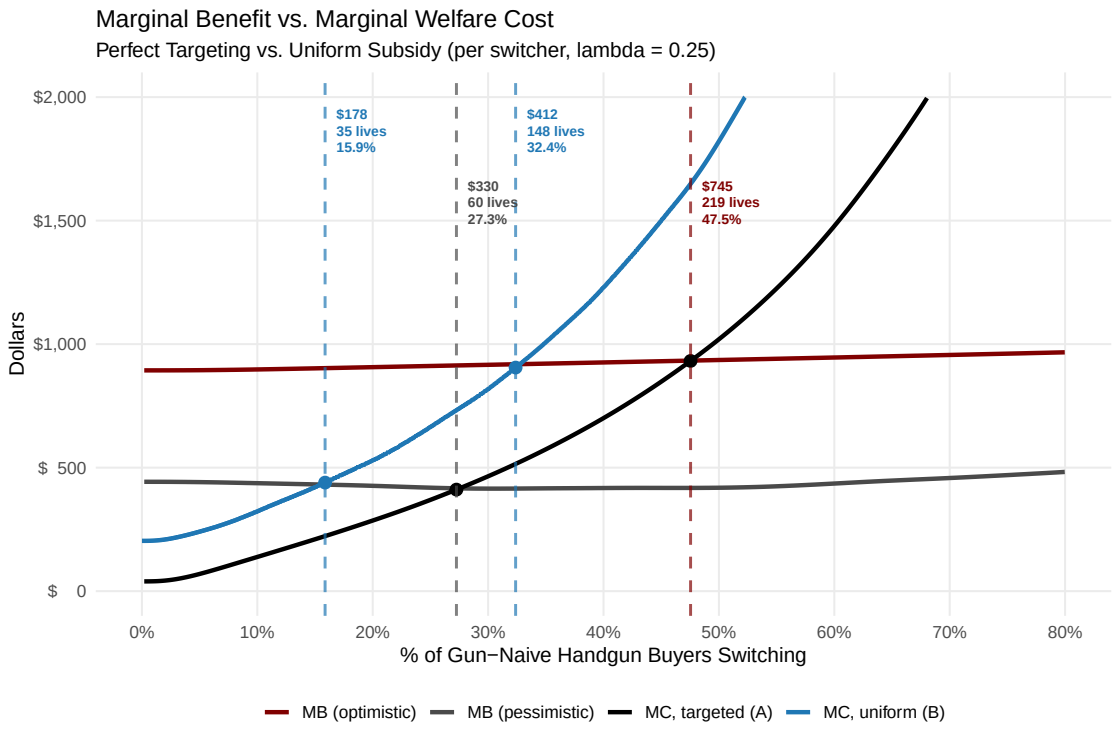


Figure 3: Marginal Benefit and Marginal Cost Curves (Scenarios A and B)

Alt text: Line chart with the percent of gun-naïve handgun buyers switching on the horizontal axis, from 0 to 80 percent, and dollars per switcher on the vertical axis, from 0 to 2,000. Two nearly flat marginal benefit lines run across the chart, the optimistic one near $900 and the pessimistic one near $400. Two upward-sloping marginal cost curves start near zero: the targeted curve rises gradually and crosses the benefit lines at 27.3 percent and 47.5 percent of buyers, while the uniform-subsidy curve rises much more steeply and crosses them at 15.9 percent and 32.4 percent. Dashed vertical lines at each crossing are labeled with the subsidy, deaths averted, and share switching.

goes to households whose behavior is unchanged. These results suggest that even partial screening mechanisms that improve the alignment between payments and consumers' WTA may yield substantial gains over a uniform subsidy.

6 Conclusion

Gun violence remains one of America's most intractable policy challenges. This paper studies an alternative approach: compensation rather than prohibition. We ask whether the mortality benefits of inducing prospective handgun buyers to choose less lethal alternatives exceed the welfare costs of changing their choices and financing the expenditures required to do so. We also examine how the viability of compensation-based policy depends on the government's ability to target payments based on heterogeneity in consumers' willingness to accept.

Our analysis yields three main findings. First, targeted compensation is cost-effective under either assumption about the relationship between long-gun ownership and homicide. Under the pessimistic assumption, the optimal targeted policy averts 60 homicides annually at a net social cost of approximately $5.9 million per averted homicide; under the optimistic assumption, it averts 220 homicides at approximately $5.5 million each. Both are well below the $13 million VSL and generate substantial net welfare gains. Second, targeting materially improves policy performance. Relative to the optimal uniform subsidy, the optimal targeted policy averts roughly 50% more homicides while requiring only 40% of the government expenditure. Uniform subsidies must make excess payments to low-WTA switchers and windfall payments to inframarginal buyers, raising the net cost per averted homicide by roughly 25–50%. Third, these results make information about preference heterogeneity central to the viability of compensation-based policy. The ability to distinguish buyers by the compensation required to change their behavior sharply reduces the fiscal cost of achieving a given behavioral response and avoids large transfers to households whose behavior is

unchanged, a feature that may matter as much politically as economically.

We do not propose a specific policy implementation. Our contribution is instead to provide a benchmark for both policy design and the current equilibrium. The results indicate substantial potential welfare gains from inducing substitution away from handguns even when compensating participating consumers for their private losses. Their failure to be realized therefore points beyond consumer preferences alone toward the practical, informational, political, and legal barriers to implementation documented throughout the paper.

More broadly, our analysis suggests scope for policies that address the underlying needs motivating firearm purchases rather than restricting firearm ownership itself. Gun-naïve households overwhelmingly cite personal safety as the concern motivating their purchase, and a substantial share of prospective handgun buyers are willing to substitute to a long gun or the outside option for relatively modest compensation. Together, these findings suggest that many prospective buyers may value the protection they associate with firearm ownership more strongly than the handgun itself. This leaves scope for demand-side policies that direct consumers toward alternatives capable of meeting that need while posing lower social costs.[10]

Several limitations point to directions for future research. Our analysis relies on stated-choice data because transaction data that would allow us to estimate firearm demand from realized purchases are not available. As with any stated-choice design, reported choices may not fully reflect realized behavior. We focus on partial equilibrium effects, abstracting from responses through secondary markets, supply-side pricing, and criminal acquisition. Implementation would also raise additional issues around verification, arbitrage, and fraud that we do not address. Finally, intermediate policy designs between perfect WTA targeting and uniform subsidies—partial screening, menu-based approaches, conditional subsidies—might capture some of the gains from targeting while remaining more feasible to implement.

[10]Potential alternatives include non-lethal firearms, home security systems, or community safety programs. In particular, non-lethal firearms such as the Byrna, a CO2-powered launcher that fires pepper balls and other non-lethal projectiles, offer a form factor similar to handguns while posing far lower mortality risk. Alsan et al. (2026) document potential consumer interest in such alternatives.

References

Alsan, Marcella, Joshua Schwartzstein, and Stefanie Stantcheva, "The Universal Pursuit of Safety and the Demand for (Lethal, Non-Lethal or No) Guns," 2026. NBER Working Paper No. 34962. https://www.nber.org/papers/w34962.

Armona, Luis and Adam M. Rosenberg, "Second-Best Amendment: Market Power and Tax Design in the Firearms Industry," 2024. Working Paper. https://www.hks.harvard.edu/publications/second-best-amendment-market-power-and-tax-design-firearms-industry.

Ballard, Charles L., John B. Shoven, and John Whalley, "General Equilibrium Computations of the Marginal Welfare Costs of Taxes in the United States," *American Economic Review*, 1985, *75* (1), 128–138.

Berrigan, John, Deborah Azrael, and Matthew Miller, "The Number and Type of Private Firearms in the United States," *The ANNALS of the American Academy of Political and Social Science*, 2022, *704* (1), 70–90.

Braga, Anthony A. and Philip J. Cook, "The Association of Firearm Caliber with Likelihood of Death from Gunshot Injury in Criminal Assaults," *JAMA Network Open*, 2018, *1* (3), e180833.

Bureau of Justice Statistics, "Female Murder Victims and Victim-Offender Relationship, 2021," U.S. Department of Justice 2022. https://bjs.ojp.gov/female-murder-victims-and-victim-offender-relationship-2021.

California Assembly Bill 28, "Gun Violence Prevention and School Safety Act," 2023. Cal. Stats. 2023, ch. 231. Eleven percent excise tax on retail sales of firearms, firearm precursor parts, and ammunition, effective July 1, 2024.

Carlsson, Fredrik and Peter Martinsson, "Do Hypothetical and Actual Marginal Willingness to Pay Differ in Choice Experiments? Application to the Valuation of the Environment," *Journal of Environmental Economics and Management*, 2001, *41* (2), 179–192.

Colorado Proposition KK, "Firearms and Ammunition Excise Tax," 2024. Approved November 5, 2024. 6.5 percent excise tax on retail sales of firearms, firearm precursor parts, and ammunition, effective April 1, 2025.

Cook, Philip J. and Jens Ludwig, *Gun Violence: The Real Costs*, New York: Oxford University Press, 2000.

_ **and** _ , "The Social Costs of Gun Ownership," *Journal of Public Economics*, 2006, *90* (1-2), 379–391.

Drango, Sara, Sarah Moshary, and Bradley T. Shapiro, "California's Firearm Excise Tax Is Almost Fully Passed on to Consumers," 2025. NBER Working Paper No. 34527. https://www.nber.org/papers/w34527.

Duggan, Mark, "More Guns, More Crime," *Journal of Political Economy*, 2001, *109* (5), 1086–1114.

English, William, "2021 National Firearms Survey: Updated Analysis Including Types of Firearms Owned," 2022. SSRN Working Paper No. 4109494, Georgetown University. https://ssrn.com/abstract=4109494.

Fernandez, Raquel and Dani Rodrik, "Resistance to Reform: Status Quo Bias in the Presence of Individual-Specific Uncertainty," *American Economic Review*, 1991, *81* (5), 1146–1155.

Gallup, "What Percentage of Americans Own Guns?," Gallup, November 13, 2020. https://news.gallup.com/poll/264932/percentage-americans-own-guns.aspx.

Hainmueller, Jens, Daniel J. Hopkins, and Teppei Yamamoto, "Causal Inference in Conjoint Analysis: Understanding Multidimensional Choices via Stated Preference Experiments," *Political Analysis*, 2014, *22* (1), 1–30.

Harrell, Erika, Jennifer L. Truman, Katherine A. Fowler, Kristin Holland, Thomas R. Simon, and Steven A. Sumner, "Trends and Patterns in Firearm Violence, 1993–2023," Technical Report NCJ 309428, Bureau of Justice Statistics, U.S. Department of Justice November 2024.

Moshary, Sarah, Bradley T. Shapiro, and Sara Drango, "Preferences for Firearms," *American Economic Review: Insights*, 2025, *7* (3), 340–356.

Office of Management and Budget, "Circular No. A-94: Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs," Technical Report, Executive Office of the President of the United States 1992. October 29, 1992; reinstated by OMB Memorandum M-25-23, April 8, 2025.

Olson, Mancur, *The Logic of Collective Action: Public Goods and the Theory of Groups*, Cambridge, MA: Harvard University Press, 1965.

Rosenberg, Adam M., "Regulating Firearm Markets: Evidence from California," 2026. Working Paper, Stanford Graduate School of Business. https://www.gsb.stanford.edu/faculty-research/working-papers/regulating-firearm-markets-evidence-california.

Rossi, Peter E., Greg M. Allenby, and Robert McCulloch, *Bayesian Statistics and Marketing*, Chichester, UK: John Wiley & Sons, 2005.

U.S. Department of Health and Human Services, "HHS Standard Values for Regulatory Analysis, 2024," ASPE Data Point, Office of the Assistant Secretary for Planning and Evaluation 2024. Central Value of Statistical Life estimate for 2024 impacts:

$13.1 million (2023 dollars). https://aspe.hhs.gov/sites/default/files/documents/cd2a1348ea0777b1aa918089e4965b8c/standard-ria-values.pdf.

Online Appendix

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A Survey Instrument

This appendix reproduces the survey instrument described in Section 2 as it appeared to respondents. The survey was programmed and fielded by The Harris Poll in March and April 2022. It opened with The Harris Poll's standard demographic questions, followed by the screening question in Figure A.1, which asks respondents which of a list of items they currently own or are interested in owning in the future. The order of the options was randomized across respondents, with "None of these" always displayed last. Respondents who selected firearms proceeded to the questions specific to our study, including gun ownership, purchase intentions, and the categories of firearms they would consider (Section 2); the remaining respondents exited the survey.

Figure A.2 shows the instructions preceding the choice tasks. Each respondent then completed seven tasks of the form in Figure A.3: three firearms with a picture, model name, category, and price, and a link to additional product information displayed in the form in Figure A.4. After selecting the most preferred firearm, respondents answered the purchase question in Figure A.5, which asks whether they would buy that firearm at the quoted price. The models, prices, and attributes shown in each task were randomized as described in Section 2. The complete questionnaire and the de-identified responses are available in the replication archive of Moshary et al. (2025).

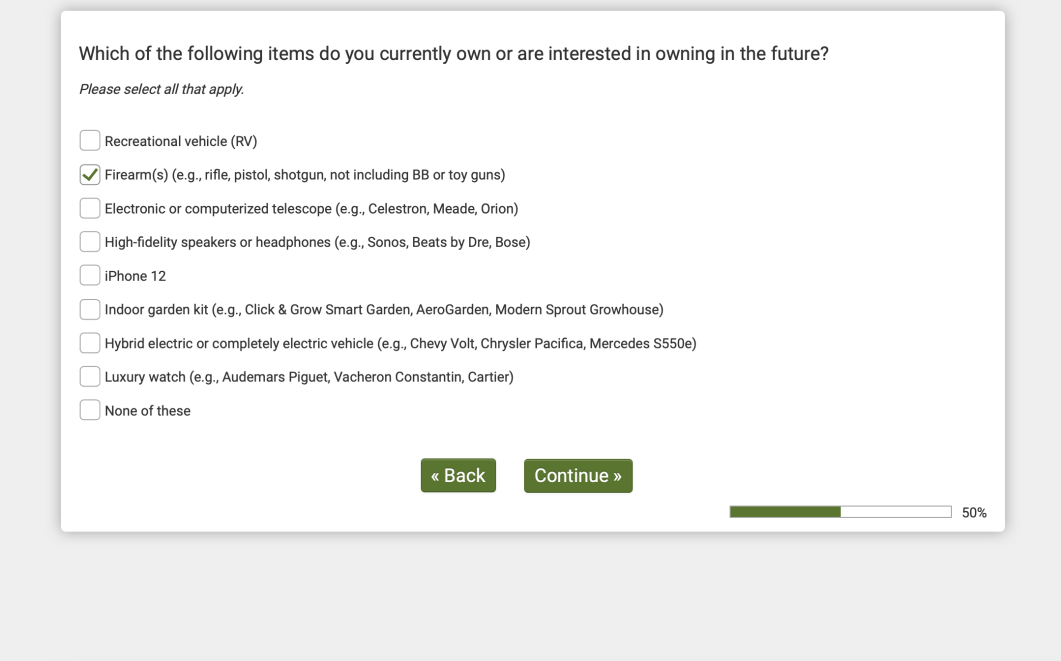


Figure A.1: Screening Question

Alt text: Screenshot of a survey page headed "Which of the following items do you currently own or are interested in owning in the future?" with a list of checkboxes: recreational vehicle, firearms (checked), electronic or computerized telescope, high-fidelity speakers or headphones, iPhone 12, indoor garden kit, hybrid electric or completely electric vehicle, luxury watch, and none of these. Back and Continue buttons and a progress bar appear below.

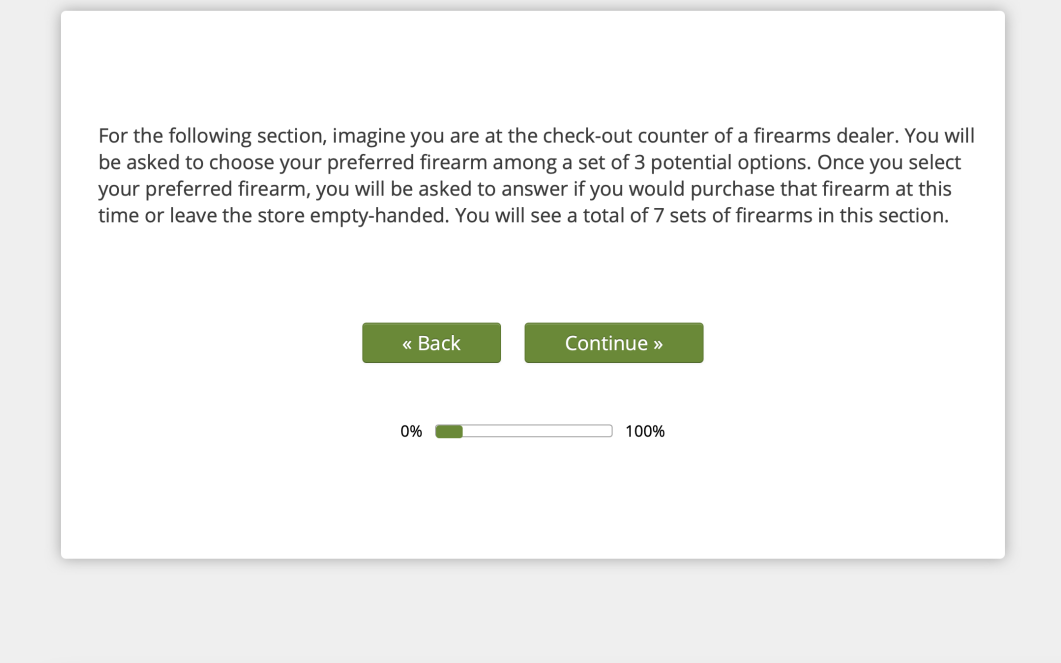


Figure A.2: Instructions for the Choice Tasks

Alt text: Screenshot of a survey page with a paragraph of instructions telling the respondent to imagine being at the check-out counter of a firearms dealer, that they will be asked to choose their preferred firearm among three options, then whether they would purchase it or leave the store empty-handed, over a total of seven sets of firearms. Back and Continue buttons and a progress bar appear below.

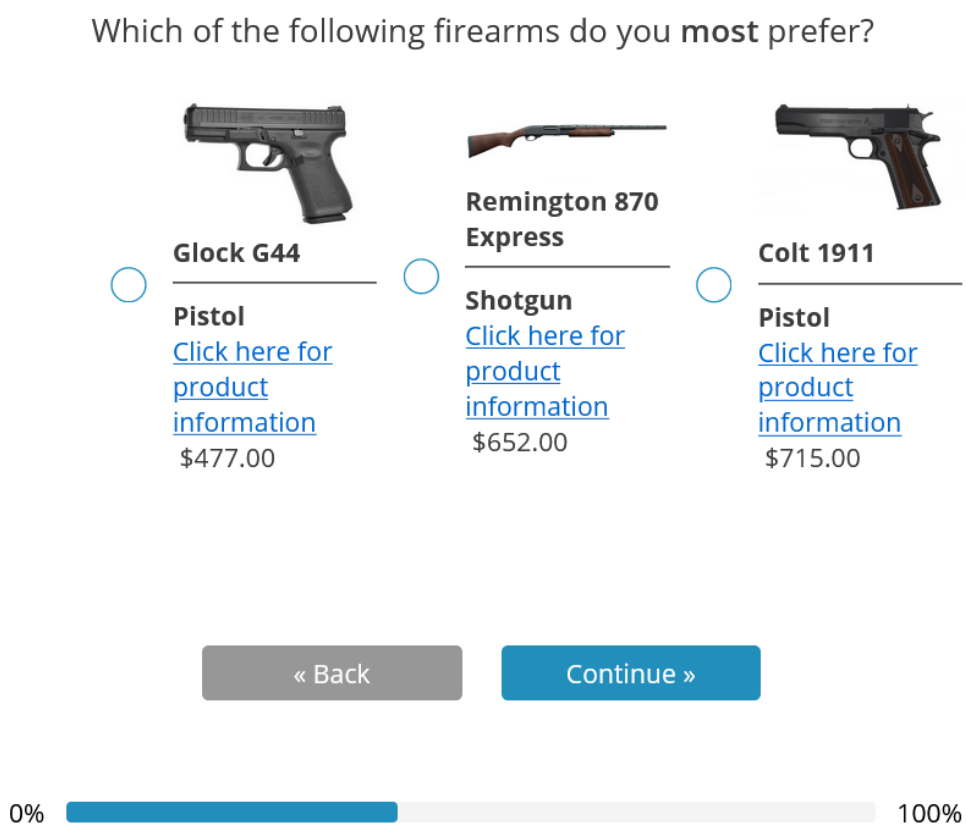


Figure A.3: Example Choice Task

Alt text: Screenshot of a choice task headed "Which of the following firearms do you most prefer?" showing three options side by side, each with a product photograph, a radio button, the model name, its category, a "Click here for product information" link, and a price: a Glock G44 pistol at $477, a Remington 870 Express shotgun at $652, and a Colt 1911 pistol at $715. Back and Continue buttons and a progress bar appear below.

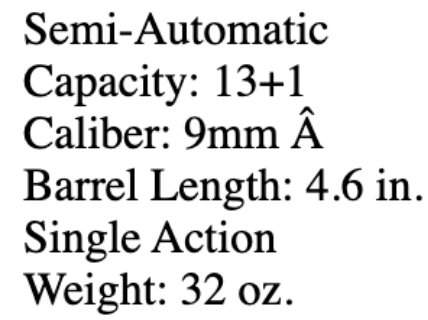


Figure A.4: Product Information Display

Alt text: Screenshot of the product-information panel shown when a respondent clicks the product information link, listing the firearm's action type (semi-automatic), capacity (13 plus 1), caliber (9mm), barrel length (4.6 inches), single action, and weight (32 ounces).

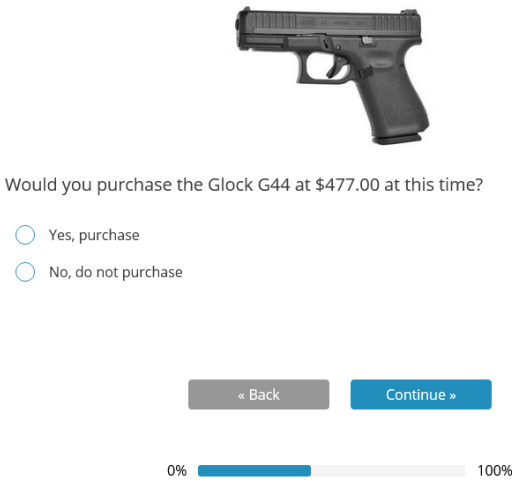


Figure A.5: Purchase Question

Alt text: Screenshot of a survey page showing a photograph of the firearm the respondent selected, the question "Would you purchase the Glock G44 at $477.00 at this time?", and two radio-button answers: yes, purchase; and no, do not purchase. Back and Continue buttons and a progress bar appear below.

B Estimation Details

This appendix provides technical details on the estimation of the search cost demand model. The exposition follows Moshary et al. (2025), which develops the full model and estimation procedure.

Model Setup. Consumers know their category-level preferences β_i' but must incur search cost γ_i to learn their idiosyncratic match ε_{ijt} for all models in a category. We impose a sign restriction so that $\gamma_i \geq 0$ for all consumers.

Inclusive Value. The inclusive value for category l for individual i is:

$$IV_{il} = \ln \left[\sum_{k \in l} \exp(X_k' \beta_i - \alpha_i \cdot \bar{p}_k) \right] \tag{21}$$

where $\bar{p}_k$ is the average price in category k.

Consideration Set Constraints. With four firearm categories, each consumer chooses one of the following consideration sets: (1) most preferred category only, (2) most and second-most preferred, (3) all but least preferred, or (4) all categories. The model implies the following revealed preference constraints for consideration set l_i:

$$IV_{il} \geq IV_{i,l+1} - \exp(\gamma_i) \tag{22}$$

$$IV_{il} - \exp(\gamma_i) \geq IV_{i,l-1} \tag{23}$$

$$\min_{c \in l_i} IV_{ic} \geq \max_{c \notin l_i} IV_{ic} \tag{24}$$

The first two inequalities ensure that the respondent does weakly worse by considering one more or fewer category. The third ensures that the worst considered category is weakly preferred to the best non-considered category.

Modified Likelihood. The likelihood is modified to include an indicator that the consideration set constraints hold:

$$P(y_{it}|\theta_i) = s_{ijt} \cdot P(\mathcal{C}_t|l_i) \cdot \mathbf{1}\{l_i|\theta_i\} \tag{25}$$

where s_{ijt} is the standard logit probability, $P(\mathcal{C}_t|l_i)$ is the probability of observing choice set $\mathcal{C}_t$ given stated consideration set l_i, and $\mathbf{1}\{l_i|\theta_i\}$ indicates that the consideration set constraints are satisfied.

Identification. To estimate the distribution of search costs, the conjoint includes choice tasks where respondents evaluate firearms from categories outside their stated consideration set. For each non-considered category (of which there may be up to three), one of the seven choice tasks is randomly selected to feature an alternative from that non-considered category. In 13.3% of these tasks, respondents choose the non-considered alternative, providing the

identifying variation.

Hierarchical Prior. The search cost model uses the following priors:

$$V_\theta \sim IW(\nu, V) \tag{26}$$

$$\text{vec}(\Delta)|V_\theta \sim N(\text{vec}(\bar{\Delta}), V_\theta \otimes 100 \cdot I) \tag{27}$$

where $u_i \sim MVN(0, V_\theta)$.

MCMC Algorithm. The estimation proceeds as follows:

1) **Initialize.** For each respondent, run a separate logit based on the stated consideration set to obtain initial $\hat{\beta}_i$. For non-considered categories, draw from the truncated distribution satisfying the inequality constraints.

2) **Metropolis Step for θ.** For each respondent i, generate candidate draws $\tilde{\theta}_i \sim MVN(\theta_{i(s)}, b^2 V_{\theta(s)})$ where $b = 0.66$ is a scaling parameter. Accept with probability:

$$a = \min\left\{1, \frac{P(Y|\tilde{\theta}_i)P(\tilde{\theta}_i|\Delta_{(s)}, V_{\theta(s)})}{P(Y|\theta_{i(s)})P(\theta_{i(s)}|\Delta_{(s)}, V_{\theta(s)})}\right\} \tag{28}$$

3) **Gibbs Step for Δ, V.** Draw hyperparameters from their conditional distributions:

$$\text{vec}(\Delta_{(s+1)})|V_{(s)}, \vec{\theta}_{(s+1)} \sim N\left((Z'Z + 0.01 \cdot I)^{-1}(Z'\theta_{(s+1)} + 0.01 \cdot \text{vec}(\bar{\Delta})), V_{(s)} \otimes (Z'Z + 0.01 \cdot I)^{-1}\right) \tag{29}$$

$$V_{(s+1)}|\Delta_{(s)}, \vec{\theta}_{(s+1)} \sim IW(\nu + n, V + S) \tag{30}$$

where $S = (\theta - Z\tilde{\Delta})'(\theta - Z\tilde{\Delta}) + 0.01 \cdot (\tilde{\Delta} - \bar{\Delta})'(\tilde{\Delta} - \bar{\Delta})$ and $\tilde{\Delta} = (Z'Z + 0.01 \cdot I)^{-1}(Z'\theta + 0.01 \cdot \bar{\Delta})$.

4) Return to step 2.

MCMC Details. The Markov chain is run for 500,000 iterations with a burn-in of 50,000 draws. We retain every 500th draw, yielding 900 posterior draws.

C Ex-Ante Willingness to Accept

This appendix presents an alternative computation of willingness to accept based on an ex-ante criterion in which the consumer is aware of the subsidy before choosing which firearm categories to search. The main text computes WTA under an ex-post "can't unsearch" interpretation: the consumer has already searched their status quo categories, and the subsidy can only add long gun categories to the consideration set. The ex-post interpretation therefore implies a consumer continues to consider any handgun category they would have chosen to consider absent the subsidy. This section instead allows the consumer to re-optimize search given the subsidized inclusive values, potentially dropping handgun categories entirely.

Methodology. Under the ex-ante interpretation, the consumer re-optimizes their consideration set from scratch given the subsidized long gun inclusive values. Let $\mathcal{C}^*(D)$ denote the consumer's optimal consideration set when long gun inclusive values are scaled by the subsidy, i.e., $\widetilde{IV}_{ik} = IV_{ik} \cdot \exp(|\gamma_i| \cdot D)$ for each long gun category k, and the consideration set is determined by the greedy search algorithm with first-free search costs. We define the ex-ante WTA as the minimum D such that the consumer is diverted from purchasing a handgun through one of two paths:

- **Path A:** If no handgun category appears in $\mathcal{C}^*(D)$, the consumer never searches handguns and therefore never observes the product-level shocks ε_{ij} for handgun products. The consumer is diverted regardless of whether they ultimately choose a long gun or the outside option.

- **Path B:** If a handgun category remains in $\mathcal{C}^*(D)$, the consumer observes the corresponding handgun product shocks. The consumer is diverted if either the best sub-

sidized long gun or the subsidized outside option exceeds the realized utility of the preferred considered handgun:

$$\max\left\{\max_{j\in LG\cap\mathcal{C}^*(D)}\left(U_{ij}+|\gamma_i|D\right),\ U_i^{out}+|\gamma_i|D\right\}>U_i^{HG}\left(\mathcal{C}^*(D)\right). \tag{31}$$

We compute D by binary search to \$0.01 precision.

Results. Figure C.1 plots the ex-ante WTA distribution and Figure C.2 shows averted homicides under the optimistic elasticity specification. The ex-ante WTA distribution is shifted modestly to the left relative to the main results. Table C.1 reports the Scenario A results.

Table C.1: Scenario A: Perfect Targeting (Ex-Ante WTA)

	Optimistic ($\varepsilon_{HG}=0.22$, $\varepsilon_{LG}=0$)	Pessimistic ($\varepsilon_{HG}=\varepsilon_{LG}=0.2$)
% of HG buyers switching	49.7%	29.0%
Maximum subsidy	\$748	\$329
Averted deaths	230	61
Government expenditure	\$1.00 billion	\$0.29 billion
Net cost per life	\$5.4 million	\$6.0 million

Under perfect targeting, the ex-ante WTA averts more homicides (230 vs. 220 under the optimistic scenario) at similar net cost per averted death. The mean ex-ante WTA is \$1,990 (vs. \$2,118 for ex-post), the median is \$755 (vs. \$815), and 79.6% of switchers go to long guns (vs. 78.2%). The maximum subsidy at the optimum is nearly identical (\$748 vs. \$745).

Under uniform subsidies (Scenario B), the optimistic optimal subsidy is \$412, inducing 34.3% of handgun buyers to switch and averting 157 homicides at a net cost of \$6.6 million per averted death; under the pessimistic elasticity the optimum is \$178, averting 37 homicides

at $8.7 million each. Both match the main-text optima closely. Figure C.3 displays the marginal benefit and marginal cost curves.

Discussion. The ex-ante and ex-post WTA distributions are highly correlated (correlation = 0.99), and the qualitative conclusions of the paper are unchanged under the alternative criterion. Both interpretations are defensible from different modeling perspectives. The ex-post interpretation corresponds to a setting where the consumer has already incurred the cost of searching their status quo categories and cannot undo that search; the subsidy can only expand the consideration set. The ex-ante interpretation corresponds to a setting where the consumer has not yet committed to any search and re-optimizes given the subsidized inclusive values, consistent with the search cost model's timing assumptions. Under the ex-ante criterion, consumers who would drop handguns from their consideration set entirely are diverted at lower cost (Path A), while those who would retain a handgun category face the analogous requirement evaluated within the re-optimized consideration set: the subsidized alternative must beat the preferred handgun the consumer would actually encounter (Path B). For a consumer who retains the category of their status quo choice, this is exactly the main text's comparison; for the minority whose re-optimized set drops the chosen category but retains the other handgun category, the relevant comparison is against the weakly less attractive retained handgun. The fact that results are robust to this choice reinforces the paper's main conclusions about the gains from inducing substitution and the informational constraints on realizing them.

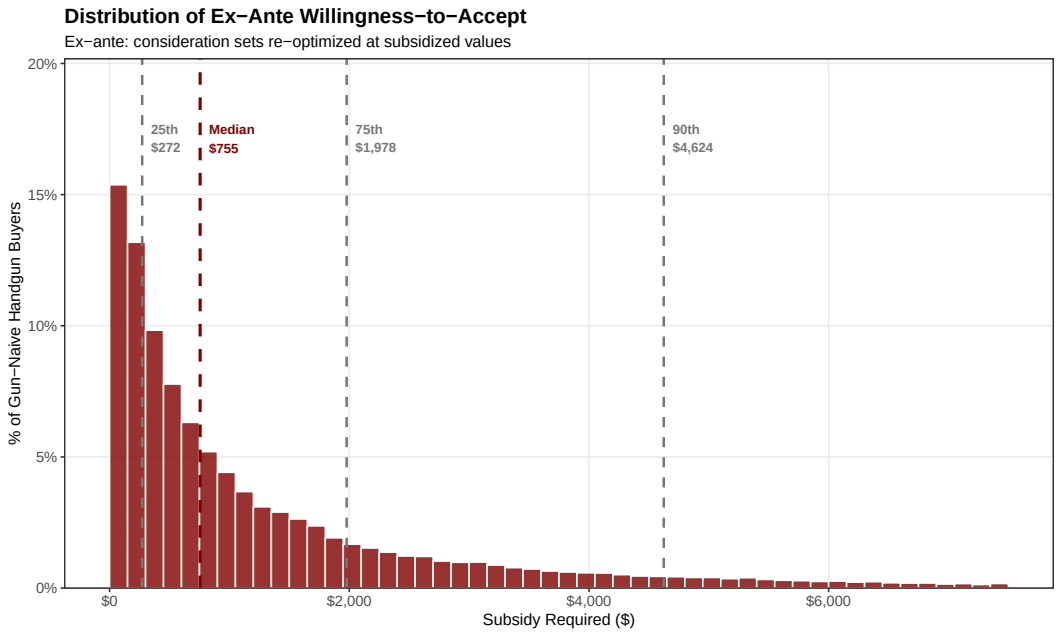


Figure C.1: Distribution of ex-ante WTA among gun-naïve handgun buyers. Vertical lines mark the 25th, 50th (median), 75th, and 90th percentiles.

Alt text: Histogram of ex-ante willingness to accept in dollars against the percent of gun-naïve handgun buyers, peaking near zero at about 15 percent and declining into a long right tail. Dashed vertical lines mark the 25th percentile at $272, the median at $755, the 75th percentile at $1,978, and the 90th percentile at $4,624.

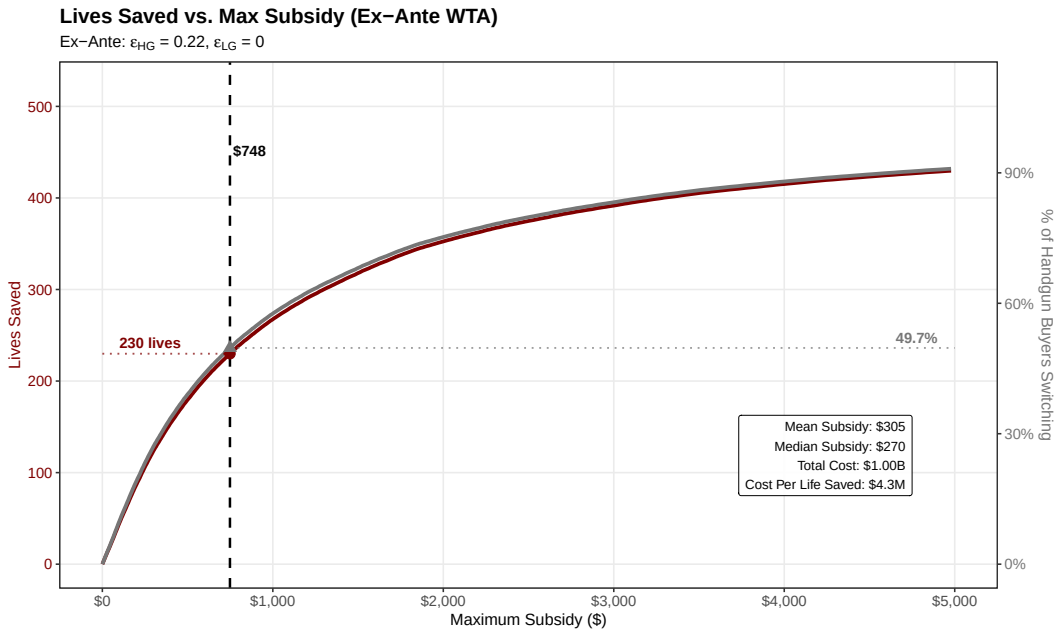


Figure C.2: Averted homicides as a function of the maximum subsidy under ex-ante WTA and the optimistic elasticity ($\varepsilon_{HG} = 0.22$, $\varepsilon_{LG} = 0$).

Alt text: Line chart of deaths averted on the left vertical axis, from 0 to 500, and the share of handgun buyers switching on the right axis, against the maximum subsidy in dollars from 0 to 5,000. The curve rises steeply at low subsidies and flattens, reaching about 430 deaths averted at $5,000. A dashed vertical line marks the optimum at $748, where 230 deaths are averted and 49.7 percent of buyers switch. An inset reports a mean subsidy of $305, a median of $270, a total cost of $1.00 billion, and a cost per life saved of $4.3 million.

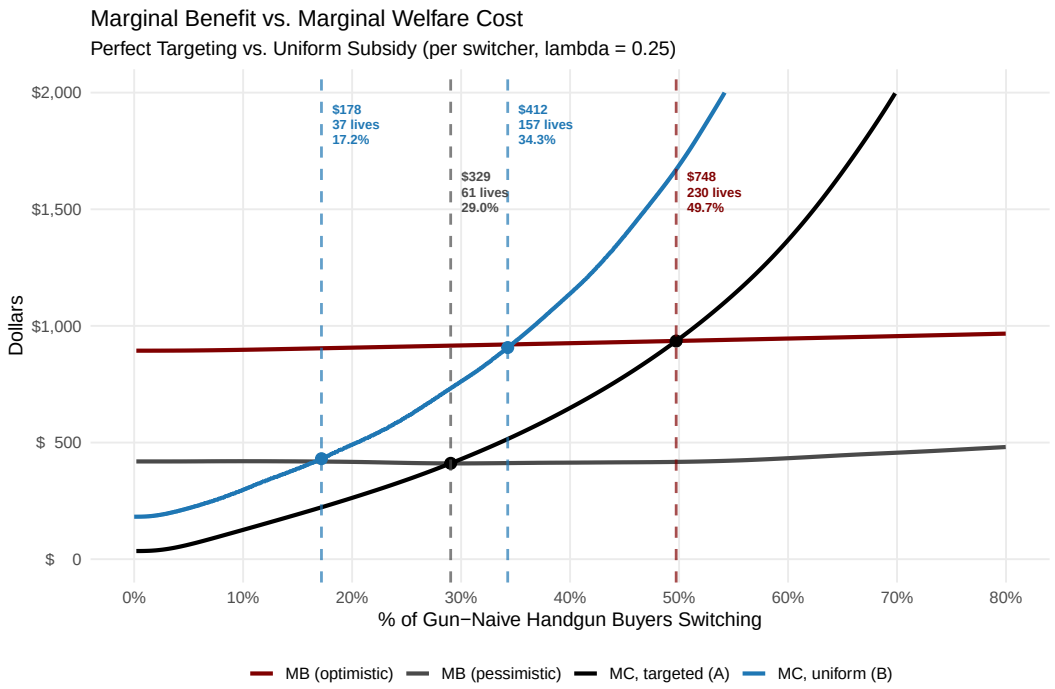


Figure C.3: Marginal benefit vs. marginal cost under ex-ante WTA for both Scenario A (perfect targeting) and Scenario B (uniform subsidy).

Alt text: Line chart of marginal benefit and marginal cost per switcher in dollars against the percent of buyers switching, in the same layout as the main-text marginal benefit and marginal cost figure. The two marginal benefit lines are nearly flat near $900 and $400. The targeted marginal cost curve crosses them at 29.7 percent and 49.7 percent of buyers, and the steeper uniform-subsidy curve crosses them at 17.2 percent and 34.3 percent, with dashed lines labeled $178 and $412 for the uniform subsidy and $329 and $748 for perfect targeting.

D Optimal Policies Under the Local-Linear Mortality Approximation

In this section, we interpret the estimated mortality elasticities locally, holding fixed the marginal mortality effects evaluated at observed handgun and long gun ownership. Let b_i denote the monetized mortality benefit from inducing consumer i to switch, which may depend on whether the consumer substitutes to a long gun or to the outside option (relevant

in the pessimistic scenario). The welfare contribution of inducing consumer i is then

$$\Delta W_i = b_i - (1+\lambda)\text{WTA}_i. \tag{32}$$

When the mortality benefit is common across switchers, $b_i = b$, as in the optimistic scenario, this yields the familiar stopping rule: proceeding up the WTA distribution, consumers are induced to switch until the marginal consumer satisfies $(1+\lambda)\text{WTA}_{n^*} = b$. For the uniform subsidy, we choose the subsidy that maximizes the analog of $W_B(S)$ from Section 5, with the constant-elasticity mortality term replaced by the sum of the linear per-switcher benefits b_i over the induced switch set.

The results are qualitatively and quantitatively similar to those in Section 5. The key visible difference in Figure D.1 is that the marginal benefit curve in the pessimistic scenario slopes downward in the number of switchers. This happens because the destination of the switcher is more likely to be a long gun rather than the outside option as WTA increases.

E Taxation Benchmark

This appendix benchmarks the compensation policies studied in the main text against a tax on handguns. The benchmark uses the same demand estimates, the same mortality model, and the same $13 million VSL test as the main analysis, so differences across instruments reflect the economics of the instruments themselves rather than differences in calibration. For all of the analysis, we assume that a tax is fully passed through to consumers, as found by Drango et al. (2025).[11]

[11] Their estimate comes from California's 11% firearms excise tax implemented in 2024; pass-through need not remain complete at the substantially higher tax rates considered below.

Table D.1: Optimal Subsidies Under the Local-Linear Mortality Approximation: Targeted vs. Uniform

	Targeted Subsidies		Uniform Subsidies	
	$\varepsilon_{LG} = 0$	$\varepsilon_{LG} = 0.2$	$\varepsilon_{LG} = 0$	$\varepsilon_{LG} = 0.2$
Optimal subsidy	\$711	\$273	\$399	\$152
Mean (median) subsidy paid	\$298 (\$269)	\$132 (\$130)	\$399	\$152
% switching	46.2%	23.3%	31.7%	13.6%
Averted deaths	208	48	143	29
Government expenditure	\$0.91B	\$0.20B	\$2.34B	\$0.71B
Net cost per life	\$5.5M	\$5.3M	\$6.8M	\$8.4M
Net welfare gain	\$1.57B	\$0.37B	\$0.88B	\$0.13B
Positive net welfare?	**Yes**	**Yes**	**Yes**	**Yes**

Notes: Analog of the main text's Table 4 with the marginal mortality benefit per switcher held constant at its status quo value (the local-linear approximation) rather than evolving with ownership under the constant-elasticity specification. All other inputs—the WTA distribution, destinations, the excess burden $\lambda = 0.25$, and the \$13 million VSL—are identical. For targeted subsidies, the optimal subsidy is the maximum payment; each switcher receives exactly their willingness to accept. Under the uniform subsidy every recipient, including inframarginal long gun and outside-option buyers, receives the same payment. Net cost counts transfers at zero. Expenditure per averted death under the uniform subsidy is \$16.4 million (optimistic) and \$24.3 million (pessimistic).

Table D.2: Cost Decomposition: Uniform Subsidy at \$399 (Local-Linear Mortality Approximation)

Component	Cost	% of Total
Payment to switchers	\$0.83 billion	35%
Windfall to LG buyers	\$1.19 billion	51%
Windfall to outside buyers	\$0.32 billion	14%
Total	**\$2.34 billion**	100%

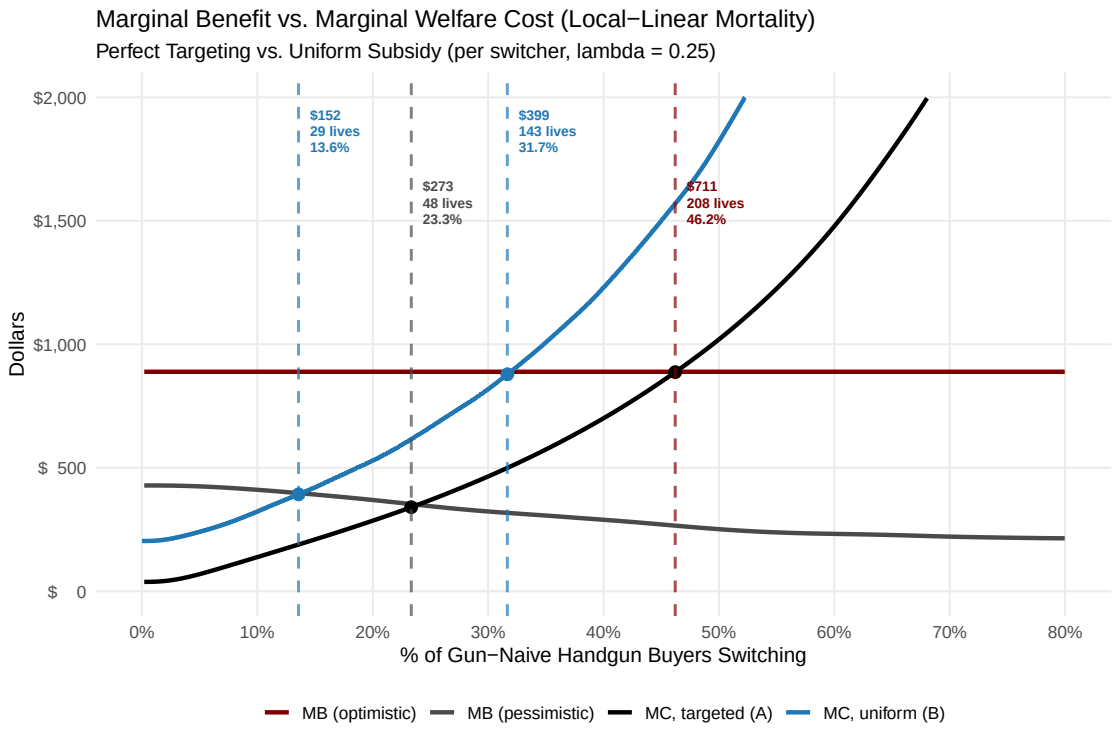


Figure D.1: Marginal Benefit and Marginal Cost Curves Under the Local-Linear Mortality Approximation (Scenarios A and B). The marginal benefit per switcher is constant in the optimistic scenario and varies in the pessimistic scenario only through the realized composition of switch destinations; the marginal cost curves are identical to those in Figure 3.

Alt text: Line chart of marginal benefit and marginal cost per switcher in dollars against the percent of buyers switching, in the same layout as the main-text marginal benefit and marginal cost figure. The optimistic marginal benefit is a flat line near $900 and the pessimistic marginal benefit declines gently from about $450 to $300. The targeted marginal cost curve crosses them at 23.1 percent and 46.2 percent of buyers, and the steeper uniform-subsidy curve at 13.6 percent and 31.7 percent, with dashed lines labeled $152 and $399 for the uniform subsidy and $273 and $711 for perfect targeting.

E.1 Optimal Handgun Taxation

Methodology. A tax T on handguns operates on the same margin as the subsidy but with the opposite sign. Rather than raising the value of the alternatives, it lowers the value of the handgun. For each gun-naïve handgun buyer we compute a tax analog of WTA, the minimum T that diverts the buyer to a long gun or the outside option. We find this threshold by binary search using the same "can't unsearch" criterion used in the main text, with the taxed handgun inclusive values entering the consumer's search decision.

Because the subsidy applies to every non-handgun alternative, including the outside option, the two instruments present each consumer with the same decision problem at equal magnitudes. A subsidy s adds $-\gamma_i s$ to the utility of every non-handgun alternative, while an equal-sized handgun tax subtracts the same amount from the utility of every handgun option. Because only differences in utilities matter, this equivalence holds for search decisions as well as purchase decisions. The tax threshold therefore *equals* the subsidy WTA for every buyer, and the two instruments induce the same switch destinations. We verify this equivalence computationally: the two thresholds agree to within \$0.02 for all 56,301 gun-naïve handgun buyer draws. Thus, at a given magnitude, carrots and sticks move exactly the same people at exactly the same magnitudes; what distinguishes them is who pays, and how the payments are counted.[12]

Cost accounting. We report counterfactuals under three alternative treatments of tax revenue. Under *full-burden* accounting, tax revenue receives no social credit: the social cost of the tax equals the consumer surplus lost by switchers plus the revenue collected from non-switchers. Under *lump-sum-rebate* accounting, tax revenue is returned to consumers through a lump-sum transfer that is independent of their firearm choices. Because the rebate does

[12]This equivalence depends on the subsidy also paying for the outside option. A subsidy redeemable only against a long-gun purchase would create a stronger incentive to search for long guns than an equal-sized handgun tax, because the subsidy directly raises the value of long guns discovered through search whereas the tax leaves the outside option unchanged. The instruments would no longer generate the same switching thresholds or destinations: a handgun tax can also induce consumers to choose the outside option, while a long-gun-only subsidy cannot.

not depend on whether a consumer buys a handgun, buys a long gun, or exits the market, it does not affect purchase or search decisions. Tax payments are therefore transfers, and the welfare cost of the tax is the consumer surplus lost by switchers. Finally, under *symmetric marginal-cost-of-public-funds* accounting, tax revenue has fiscal value because it substitutes for other distortionary sources of public funds. Using the same $\lambda = 0.25$ as in the subsidy analysis, welfare is therefore $\text{VSL} \times L - \text{DWL} + \lambda R$, where L is averted homicides and R is tax revenue.

Optimal Uniform Tax. A uniform tax has a self-targeting property that makes it closely related to the perfectly targeted subsidy. Because each buyer's tax threshold exactly equals their subsidy WTA, the two instruments rank buyers in the same order. As the tax rises, the buyers induced to leave handguns are exactly those who would be cheapest to induce under perfect targeting. The difference is informational. Perfect targeting requires the government to observe each buyer's WTA and offer an individualized payment, whereas a uniform tax induces all buyers with WTA below the tax to switch without requiring the government to observe individual preferences.

Under lump-sum-rebate accounting, the optimal tax is \$940 under the optimistic elasticities, approximately $(1 + \lambda)$ times the \$745 maximum payment under perfect targeting ($1.25 \times \$745 = \$931$). The factor $(1 + \lambda)$ follows directly from the stopping conditions: perfect targeting stops when the marginal mortality benefit equals $(1 + \lambda)$ times the marginal buyer's WTA, while the rebated tax—which avoids the financing cost associated with subsidy payments—stops when the marginal benefit equals the buyer's WTA itself, and therefore optimally proceeds farther down the same WTA ordering (53.9% versus 47.5% of buyers). Under the local linear mortality approximation of Appendix D, in which the marginal mortality benefit per switcher is constant, the relationship would hold exactly. Our reported optima instead maximize welfare under the constant-elasticity mortality specification, so the marginal benefit per switcher drifts as the policy expands. In the optimistic scenario it rises

as handgun ownership falls—from \$933 per switcher at the targeting optimum to \$940 at the tax optimum—so the optimal tax slightly exceeds $(1 + \lambda)$ times the targeting cutoff. In the pessimistic scenario the drift runs the other way: the switcher mix shifts toward long guns along the WTA path, lowering the marginal benefit, so the optimal tax of \$404 falls slightly below $1.25 \times \$330 = \$413$.

Under symmetric marginal-cost-of-public-funds accounting, the tax has a second benefit: buyers who continue to purchase handguns generate revenue that substitutes for other distortionary sources of public funds. This revenue motive raises the optimal tax. Under the optimistic elasticities, the optimum rises to \$1,098, inducing 58.0% of buyers to switch and averting 269.4 homicides; the tax generates \$3.04 billion in revenue and \$1.60 billion in deadweight loss, for net welfare gains of \$2.66 billion. Under the pessimistic elasticities, the optimal tax is \$605, inducing 42.0% of buyers to switch and averting 90.9 homicides, with \$2.31 billion in revenue, \$0.72 billion in deadweight loss, and \$1.04 billion in net welfare gains.

Full-burden accounting gives the opposite result. If tax revenue receives no social credit, payments by buyers who continue to purchase handguns add to the social cost of the policy without producing any offsetting benefit. No positive tax then passes the \$13 million VSL test. Among positive taxes, the tax minimizing social cost per averted homicide is \$251 under the optimistic elasticities, inducing 21.8% of buyers to switch and averting 99.2 homicides at \$14.81 million per averted homicide. Under the pessimistic elasticities, the corresponding tax is \$246, inducing 21.4% of buyers to switch and averting 47.5 homicides at \$30.43 million per averted homicide. Under this accounting convention, the welfare-maximizing tax is therefore zero. Table E.1 summarizes.

Table E.1: Uniform Handgun Tax

	Optimistic ($\varepsilon_{HG} = 0.22$, $\varepsilon_{LG} = 0$)	Pessimistic ($\varepsilon_{HG} = \varepsilon_{LG} = 0.2$)
Lump-sum-rebate accounting		
Optimal tax	\$940	\$404
% of HG buyers switching	53.9%	31.9%
Averted homicides	249.5	69.6
Deadweight loss	\$1.32 billion	\$0.39 billion
Net welfare	\$1.92 billion	\$0.51 billion
Symmetric marginal-cost-of-public-funds accounting		
Optimal tax	\$1,098	\$605
% of HG buyers switching	58.0%	42.0%
Averted homicides	269.4	90.9
Deadweight loss	\$1.60 billion	\$0.72 billion
Tax revenue	\$3.04 billion	\$2.31 billion
Net welfare	\$2.66 billion	\$1.04 billion
Full-burden accounting		
Optimal tax	\$0	\$0
Most cost-effective positive tax	\$251	\$246
% of HG buyers switching	21.8%	21.4%
Averted homicides	99.2	47.5
Minimum cost per averted homicide	\$14.81 million	\$30.43 million

Notes: Estimates in the final three rows of panel three reflect the most cost-effective positive tax.

Discussion. The main advantage of a uniform handgun tax is also the source of its incidence. The tax is self-targeting: buyers with the lowest WTA leave handguns first, so the policymaker need not observe individual preferences to direct the behavioral response toward those who are cheapest to divert. But the same uniform tax is also paid by buyers with higher WTA who continue to purchase handguns. Whether this is a virtue or a cost depends on how those payments are valued. They are neutral transfers under lump-sum-rebate accounting and a fiscal benefit when tax revenue substitutes for other distortionary revenue, but a burden under full-burden accounting.

This distinction may also matter for political feasibility. Separate state-level excise taxes on firearms remain unusual and recent: California introduced an 11% tax in 2024 (California Assembly Bill 28 2023), and Colorado followed with a 6.5% tax in 2025 (Colorado Proposition KK 2024). These rates are substantially below the tax levels that maximize welfare in our counterfactuals. This gap is consistent with political weight being placed on the incidence of firearm taxes on buyers who continue to purchase, although it could also reflect legal, administrative, or other political constraints that our model does not capture.

F Selection on Homicide Risk and Observable Targeting

The mortality model in Section 5 treats diverted buyers as carrying the average homicide risk of the buyer pool. Switchers, however, may not be randomly drawn with respect to homicide risk. In particular, if WTA correlates with homicide risk, the switch set differs from the pool in its risk composition, causing the homogeneous-risk counterfactual to misstate the number of deaths averted.

We cannot directly evaluate this possibility because we do not observe the homicide risk associated with a handgun purchase by buyers with different WTA. We can, however, ask whether WTA varies systematically across observable characteristics along which such risk

might differ. We first document these gradients and then show how the mortality calculation could incorporate heterogeneous risk if suitable risk estimates became available.

F.1 Willingness to Accept by Demographic Cell

Table F.1 reports median WTA and the share of buyers diverted at the two policy-relevant subsidy levels, by demographic group, among the 711 gun-naïve prospective handgun buyers in our sample.[13]

Table F.1: WTA and Diversion Rates by Demographic Group

		Median WTA	% diverted at $S = \$412$	% diverted at $S = \$745$
Sex	Male	\$923	32.5%	47.4%
	Female	\$805	35.3%	50.1%
Age	18–29	\$1,264	26.0%	38.4%
	30–44	\$978	29.3%	43.9%
	45–64	\$732	36.4%	52.2%
	65+	\$435	49.8%	66.9%
Income	<\$50k	\$814	35.8%	50.9%
	\$50–100k	\$894	33.5%	48.3%
	>\$100k	\$1,278	27.2%	41.2%
Education	College	\$785	36.6%	51.3%
	No college	\$882	33.3%	48.2%

Note: $S = \$412$ is the optimal uniform subsidy (Scenario B, optimistic); $S = \$745$ is the maximum subsidy paid under perfect targeting (Scenario A, optimistic). Gradients are essentially unchanged in a joint regression; the demographic dimensions are only mildly correlated.

Three gradients are apparent. WTA falls roughly monotonically with age, by about a factor of three from the youngest to the oldest group, so switchers skew older. WTA also rises with income, so switchers skew lower-income. The sex gradient is smaller, with men somewhat more attached to handguns than women. Thus, the buyers induced to switch at

[13]Statistics are respondent-level: each respondent's switching probability is averaged over posterior draws, then averaged within group. Race shows no independent gradient: unconditional differences across racial groups are fully accounted for by age (minority respondents in our sample are roughly ten years younger on average), and race coefficients are small and insignificant once age is controlled for.

a given subsidy are observably different from the buyer pool as a whole. Whether these differences raise or lower the homicide benefit of the policy depends on how the homicide risk associated with a handgun purchase varies across these groups.

F.2 Incorporating Heterogeneous Homicide Risk

The framework could accommodate such heterogeneity directly if suitable estimates of homicide risk by buyer characteristics become available. Let r_g denote the expected homicide risk associated with a handgun purchase by a buyer in demographic cell g, and let $\bar{r}$ denote the average of r_g over the full pool of gun-naïve prospective handgun buyers. A buyer i in cell g then receives the normalized risk weight

$$w_i = \frac{r_g}{\bar{r}}.$$

The weights therefore average to one in the buyer pool. A value of $w_i = 2$, for example, means that a handgun purchase by buyer i is associated with twice the homicide risk of a purchase by the average buyer.

Under the local linear mortality approximation, the effect of heterogeneous risk on a given policy depends only on the average risk weight among the buyers it induces to switch. Let

$$\Phi(S) = E[w_i \mid i \text{ switches at subsidy } S].$$

If $\Phi(S) < 1$, the subsidy disproportionately diverts buyers whose handgun purchases carry below-average homicide risk; if $\Phi(S) > 1$, it disproportionately diverts buyers whose purchases carry above-average risk. Averted deaths under heterogeneous risk are equal to the homogeneous-risk estimate multiplied by $\Phi(S)$. Because the risk adjustment changes the

mortality benefit of a given switch set but not the payments or consumer-surplus costs required to induce that set to switch, net cost per averted death is the corresponding homogeneous-risk figure divided by $\Phi(S)$.

The same weights could also be incorporated when choosing the subsidy rather than applied only to a fixed policy. In that case, the planner would evaluate the mortality benefit of each potential switch set using its risk-weighted composition and choose the subsidy that maximizes the resulting welfare objective. Thus, heterogeneous homicide risk does not require a different policy framework; it requires data linking buyer characteristics to the marginal homicide risk created by a handgun purchase.

G Numerical Determination of the Optimal Uniform Policies

This appendix documents how we locate the optimal uniform subsidy in Section 5, and why the reported optima are robust to the numerical choices involved.

The criterion involves no smoothing. The optimal uniform subsidy maximizes the welfare objective $W_B(S)$ of Section 5 over a grid of candidate subsidy levels containing every distinct WTA value in the simulated distribution. Between two adjacent WTA thresholds, the set of switchers in unchanged, so cumulative averted deaths and the cumulative WTA of switchers are unchanged, while total subsidy expenditure weakly increases with the subsidy level. Welfare therefore cannot increase as the subsidy rises within such an interval, and an optimum can always be taken at zero or at one of the observed WTA thresholds. We accordingly evaluate $W_B(S)$ exactly at these points and select its grid maximizer. The same applies to the targeted policies: their objective $W(n)$ is evaluated directly at each feasible threshold in the ordered WTA distribution.

Why the marginal curves shown in figures require care. The marginal cost and benefit *curves* displayed in Figure 3 are a different matter. Under a uniform subsidy, enrolling the kth switcher requires raising the subsidy from S_{k-1} to S_k for all inframarginal switchers as well. The resulting increase in expenditure is

$$kS_k - (k-1)S_{k-1} = S_k + (k-1)(S_k - S_{k-1}).$$

The second term makes the raw marginal-cost series highly sensitive to the gaps between consecutive WTA order statistics: even a modest irregular gap can generate a large spike because the higher subsidy is paid to every inframarginal switcher. As a result, the raw series is extremely jagged, with many local crossings of the marginal-benefit schedule; its first crossing occurs at a subsidy of only a few cents. A first-crossing rule would therefore be inappropriate, which is why we determine the optimum from the cumulative welfare objective rather than from the raw marginal series. For display, we smooth the cumulative primitives and differentiate them. Specifically, we fit cubic smoothing splines to cumulative expenditure and cumulative deaths averted as functions of the number of switchers, using an evenly spaced subsample covering up to 80% switching, beyond which the extreme right tail of the WTA distribution dominates. The displayed marginal curves are obtained from the derivatives of these fitted cumulative functions. This approach preserves the connection between the marginal curves and the underlying cumulative quantities while filtering out high-frequency variation generated by adjacent WTA gaps. The resulting crossings closely track the optima obtained directly from the unsmoothed cumulative welfare objective.

Robustness of the optimum. Figure G.1 plots $W_B(S)$ computed from raw cumulative totals under both elasticity assumptions. The objective is single-peaked over the relevant range but flat near its maximum. In the optimistic case, subsidies between roughly \$316 and \$532 deliver at least 95% of the maximum welfare gain, with the grid optimum at \$412. In the pessimistic case, the corresponding range is roughly \$140 to \$210, with the grid optimum at

$178. The reported grid maximizers should therefore not be interpreted as knife-edge policy levels; none of the paper's conclusions depend on the precise location of the optimum within these bands.

The shape of the marginal benefit schedule. Because both policies enroll switchers in ascending order of WTA, the marginal benefit schedule in Figure 3 is shared between them and is close to flat. This flatness is the net of offsetting forces. Under the optimistic elasticities the only curvature comes from the constant-elasticity mortality function over a small change in ownership, and a linear fit to the marginal benefit schedule attains $R^2 = 0.998$; imposing it would not move the optimum at all. Under the pessimistic elasticities, two channels work in opposite directions: the realized composition of switchers shifts toward long guns along the WTA path (the cumulative long-gun share rises from 55% over the first twentieth of the path to 78% overall), which lowers marginal benefit, while the shrinking handgun stock and the diminishing marginal harm of the growing long-gun stock raise it. The resulting marginal-benefit schedule remains relatively flat, although a linear approximation does not capture the composition-driven variation particularly well ($R^2 \approx 0.25$). Economically, however, the approximation is innocuous: re-optimizing against the fitted line moves the targeted optimum by about one percentage point of buyers and reduces welfare by roughly $1 million relative to the $427 million welfare gain. We therefore treat approximate linearity as a description of the results rather than an assumption of the procedure. The targeted policies need none of this machinery: under perfect targeting, marginal government expenditure is the WTA of the marginal switcher, an order statistic and hence monotone.

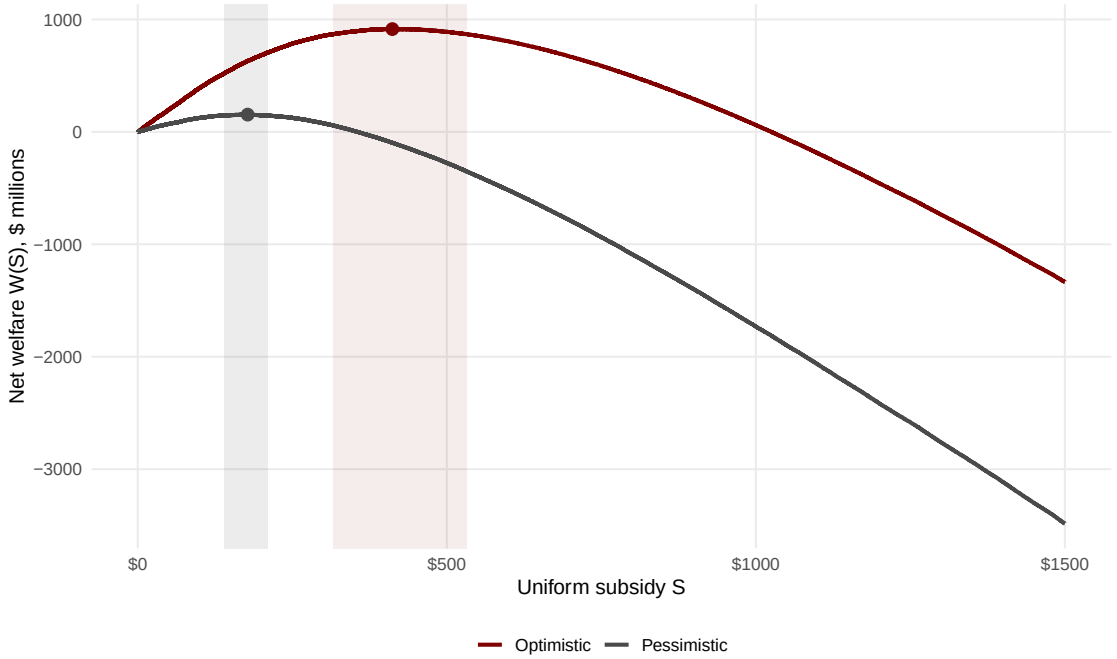


Figure G.1: The uniform-subsidy welfare objective $W_B(S)$ computed from raw cumulative totals (no smoothing), under the optimistic (maroon) and pessimistic (gray) elasticities. Dots mark the grid maximizers ($412 and $178); shaded bands mark the regions delivering at least 95% of the maximum welfare gain.

Alt text: Line chart of net welfare in millions of dollars, from minus 4,000 to 1,000, against the uniform subsidy in dollars from 0 to 1,500. Both curves start at zero, rise to a flat peak, and then fall steadily. The optimistic curve peaks near $900 million at a subsidy of $412 and the pessimistic curve peaks just above zero at $178; dots mark the maximizers and shaded vertical bands mark the ranges delivering at least 95 percent of the maximum welfare gain, roughly $316 to $532 and $140 to $210.

H Averted Deaths Curves for Perfect Targeting

Figures H.1 and H.2 display deaths averted and the share of handgun buyers switching as a function of the maximum subsidy under perfect targeting (Scenario A), for the optimistic and pessimistic elasticity assumptions respectively. Each panel marks the optimal policy from Table 4, where the marginal cost of the last switcher equals the value of the averted deaths they generate. Deaths averted rise steeply at low subsidy levels and flatten as the maximum subsidy climbs into the right tail of the WTA distribution.

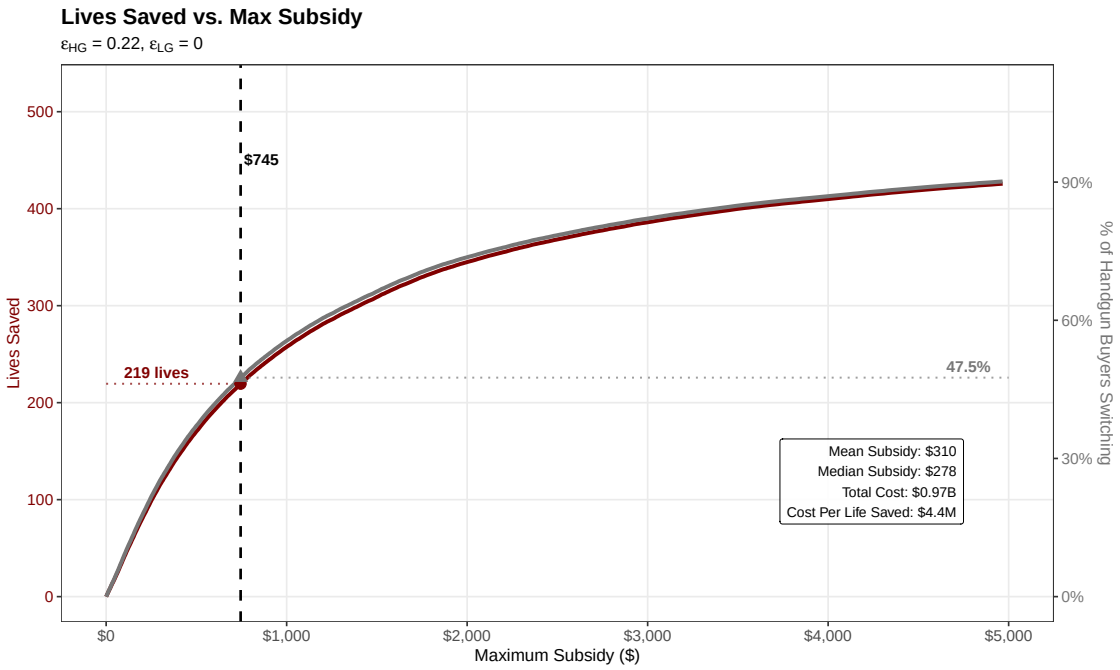


Figure H.1: Averted Deaths Curve (Optimistic Scenario)

Alt text: Line chart of deaths averted on the left vertical axis, from 0 to 500, and the share of handgun buyers switching on the right axis, against the maximum subsidy in dollars from 0 to 5,000. The curve rises steeply below $1,000 and flattens toward about 430 deaths averted at $5,000. A dashed vertical line marks the optimum at $745, where 219 deaths are averted and 47.5 percent of buyers switch. An inset reports a mean subsidy of $310, a median of $278, a total cost of $0.97 billion, and a cost per life saved of $4.4 million.

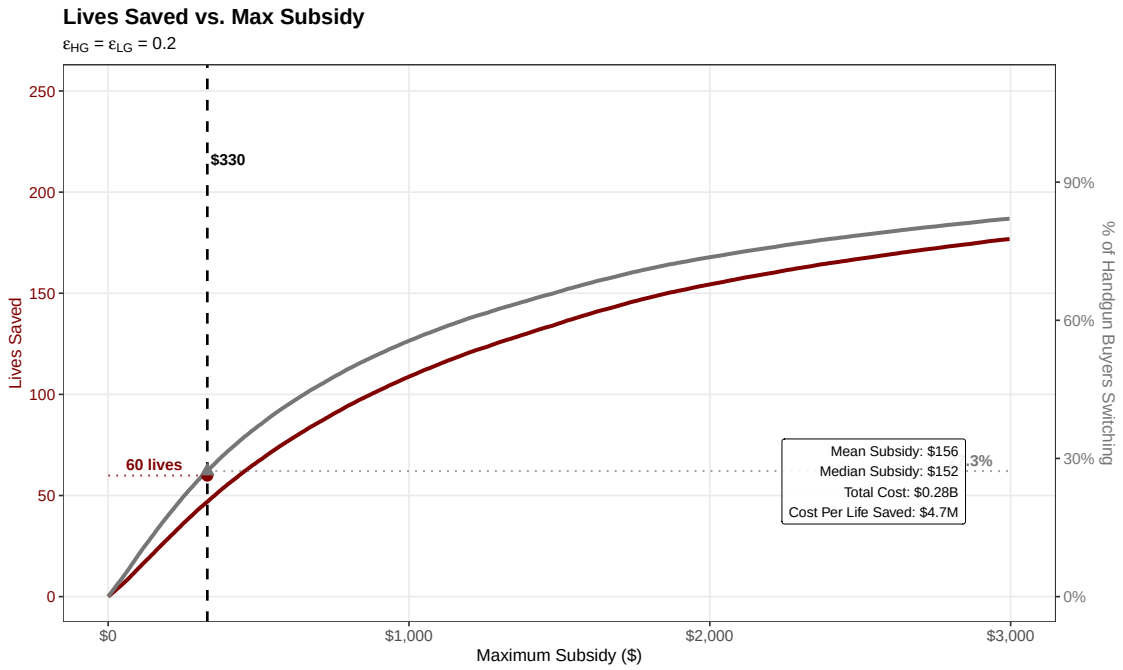


Figure H.2: Averted Deaths Curve (Pessimistic Scenario)

Alt text: Line chart of deaths averted on the left vertical axis, from 0 to 250, and the share of handgun buyers switching on the right axis, against the maximum subsidy in dollars from 0 to 3,000. The curve rises steeply at low subsidies and flattens toward about 175 deaths averted at $3,000. A dashed vertical line marks the optimum at $330, where 60 deaths are averted and 27.3 percent of buyers switch. An inset reports a mean subsidy of $156, a median of $152, a total cost of $0.28 billion, and a cost per life saved of $4.7 million.