Dynamic Pricing and Switching in Auto Insurance: Evidence from a Regulatory Divestiture

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Abstract

This paper studies dynamic pricing in insurance markets, focusing on how premiums, switching, and profitability evolve with customer tenure. Using a market-wide matched insurer–policyholder panel covering the universe of Italian auto insurance contracts from 2013 to 2021, I recover equilibrium price–tenure and switching–tenure relationships. Identification exploits a regulator-imposed divestiture that forced a large transfer of contracts between two insurers, creating a sharp and exogenous reset of insurer–consumer tenure while preserving risk, coverage, and contractual terms. I find that premiums rise by about 7.2% per year, reflecting steep introductory discounts that dissipate as relationships mature. Switching probabilities also increase with tenure, indicating that consumers respond actively to back-loaded pricing rather than remaining passively locked in. Combining the estimated price and switching responses reveals a concave expected-markup profile, with profitability rising early in the relationship and flattening as higher exit disciplines further price increases. A sufficient-statistic welfare analysis shows that while the per-contract deadweight loss is modest (approximately €1.4 per year), the aggregate cost exceeds €39 million annually in Italy's mandatory auto insurance market.

1 Introduction

Insurance markets play a fundamental role in smoothing consumption across states of the world and over time. To achieve this, premiums should ideally reflect expected risk rather than behavioral frictions or firm-level pricing strategies. Yet, a growing theoretical and policy literature shows that in the presence of switching costs, firms may back-load prices—offering low introductory premiums and then gradually increasing them as tenure accumulates (see Farrell and Klemperer (2007) for a survey). This practice, known as *price walking*, allows insurers to extract surplus from long-standing customers and can undermine the consumption-smoothing role of insurance. The issue has become sufficiently salient that several regulators—including the UK Financial Conduct Authority (FCA)—have introduced explicit bans on price walking in home and auto insurance, arguing that it penalizes loyal customers. Similarly, the European Insurance and Occupational Pensions Authority (EIOPA) has raised concerns that tenure-based repricing constitutes an *unfair practice* lacking transparency and undermining consumer trust.

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Understanding whether and how *price walking* arises in equilibrium is therefore central to evaluating both market efficiency and consumer protection policy. The practice raises broader economic questions. Do insurance markets deliver intertemporal consumption smoothing, or do switching frictions allow firms to extract rents from loyal customers over time? Do consumers passively absorb back-loaded price increases, or do they respond strategically by adjusting their switching behavior? And how do these dynamic pricing and exit patterns jointly shape the profitability of long-term insurer–consumer relationships? Identifying the magnitude and consequences of tenure-based repricing is crucial for informing regulatory debates in Europe, the UK, and beyond, and for understanding equilibrium behavior in dynamic markets with switching frictions.

Despite its theoretical prominence, empirical evidence on price walking remains limited. A core challenge lies in data availability: recovering how premiums and switching vary with tenure requires contract-level data on prices, retention, and risk—tracked over time and across multiple insurers. Most existing datasets fall short. Single-insurer panels observe only one side of the market and cannot track policyholders once they switch, making the sample of stayers inherently selected. This makes it difficult to distinguish true tenure effects from selection on match quality or risk. Other datasets observe pricing menus but lack information on realized transactions or switching behavior.
A second, related challenge is endogeneity. Tenure is not randomly assigned: lower-risk or better-matched consumers are more likely to remain with an insurer, while riskier or more price-sensitive consumers are more likely to exit. If insurers also update private beliefs about consumer risk over time—as in models of asymmetric learning—then tenure may be correlated with unobserved pricing determinants. In such settings, regressions of premiums or switching behavior on tenure can be severely biased.

I resort on a *mandatory divestiture* in the Italian auto insurance market to provide quasi-experimental evidence on the equilibrium relationship between tenure, premiums, and consumer switching. In 2013, a merger-induced antitrust remedy forced a large insurer to transfer about 5% of its market shares (about half a million contracts) to a competitor. These policyholders experienced a *mechanical reset in tenure* while retaining the same coverage, risk history, and pricing structure. Using this shock as an instrument for relationship length, and leveraging an administrative matched insurer–insuree panel that covers all insurance firms and contracts in the market from 2013 to 2021, I recover the equilibrium premium, switching, and markup schedules as functions of tenure.

To interpret the results, I present a stylized framework in which tenure is a state variable in dynamic pricing and retention decisions. The role of the

model is deliberately limited. It is not used to justify identification, nor to deliver sharp sign predictions for all tenure effects. Instead, it serves to clarify the economic forces that jointly shape equilibrium pricing, switching, and profitability when tenure is endogenous.

In particular, the framework highlights a central trade-off in dynamic insurance markets. Switching frictions create incentives for firms to back-load prices over the relationship, while selection on exit alters the composition of the retained pool and therefore expected claims costs. When selection is adverse—as is empirically the case in the data—expected costs decline with tenure, partially offsetting the profitability of exploiting locked-in customers. As a result, price walking is not mechanically implied by switching costs alone: its magnitude and persistence reflect the net balance between dynamic market power and selection, and are therefore ultimately an empirical question.

The empirical analysis focuses on three equilibrium objects: (i) the price–tenure schedule, (ii) the switching–tenure schedule, and (iii) the implied profile of expected markups over the insurer–consumer relationship. The stylized framework organizes these objects but does not presume their signs or magnitudes. The dynamic pricing model clarifies the forces governing how prices may evolve with tenure: switching frictions push toward back-loaded pricing, while adverse selection on exit works in the opposite direction by lowering expected marginal costs. Whether premiums increase with tenure, and by how much, is therefore an empirical question resolved in the data.

Conditional on an increasing price–tenure profile, switching behavior follows directly from a reduced-form switching-cost framework. Consumers switch whenever the renewal premium exceeds an outside option by more than their idiosyncratic switching cost. Holding outside options fixed, higher renewal prices therefore induce exit among marginal consumers, implying that switching probabilities rise with tenure. This implication does not rely on modeling loyalty as a separate state variable, but instead reflects the interaction between rising prices and heterogeneous switching costs.

Finally, combining the estimated price and switching responses yields the expected-markup profile, which need not be monotonic over the relationship.

The empirical setting is the Italian auto insurance market, which features mandatory coverage, extensive regulatory oversight, and high consumer churn. The dataset covers *all auto insurance contracts* underwritten from 2013 to 2021 by *all insurers* operating in the market. The data are organized at the contract–year level and include paid premiums, policyholder characteristics, contract clauses, claim histories, tenure, and switching outcomes. Each observation is matched to both the insurer and the policyholder over time, enabling the construction of relationship tenure and the direct observation of switching decisions. While the original dataset contains nearly eight million contracts, inference is conducted on a balanced subsample of over two million observations,

which supports a saturated empirical specification with individual, insurer, year, and province fixed effects.

The data also capture behavior around a regulatory loophole known as the *grace period*, during which certain accidents are excluded from pricing histories if a consumer switches insurers. I show that switchers report disproportionately more accidents during this window, while stayers do not—direct evidence that consumers respond strategically to pricing incentives rather than remaining passively loyal. This behavioral response reinforces the relevance of studying tenure as a strategic state variable in pricing and retention decisions.

I estimate the equilibrium relationships between tenure, premiums, switching probabilities, and per-customer markups using both fixed–effects and instrumental variable specifications. The key instrument is the reassignment indicator generated by the 2013 divestiture, which creates exogenous variation in tenure while holding risk and contract characteristics constant. I also implement a control-function approach to address endogeneity in nonlinear specifications. To study profitability, I combine the estimated price and switching responses to recover the *expected markup profile* over tenure, allowing for nonmonotonicity without imposing structural assumptions.

Price walking is large and economically meaningful. The IV estimate indicates that premiums increase by 7.2% along the equilibrium price–tenure schedule, more than triple the estimate obtained from standard fixed-effects models. This gap underscores the importance of correcting for selection and asymmetric learning: consumers who remain longer with an insurer tend to be safer or better matched, biasing naive estimates downward. Switching probabilities increase sharply with tenure—by approximately 9.7 percentage points per year—indicating that consumers respond rationally to back-loaded pricing rather than remaining passively locked in. Combining these effects reveals a concave expected markup profile: profitability rises steeply in the early years of the relationship but flattens as increasing exit offsets higher prices.

Finally, I quantify the welfare implications of tenure-based pricing using a sufficient-statistic approach in the spirit of Einav, Finkelstein and Cullen (2010). The welfare analysis isolates the marginal deadweight loss generated by an additional year of tenure-based repricing, holding fixed the prevailing selection environment and switching margin. Switching costs are treated as real resource costs, so welfare losses arise from inefficient churn induced by dynamic pricing power rather than from selection itself. While the per-consumer deadweight loss is modest—approximately €1.4 per year—the aggregate cost exceeds €39 million annually in the Italian market. These estimates should be interpreted as conservative lower bounds on the welfare cost of price walking for incumbent relationships, rather than as exact population-wide averages.

Relation to the Literature. This paper contributes to four related strands of the literature.

First, it contributes to the literature on dynamic pricing and switching costs. Canonical models show that when consumers face switching frictions, firms optimally back-load prices over the course of a relationship in order to extract surplus from locked-in customers (Taylor, 2003; Farrell and Klemperer, 2007; Chen, 1997). While these models deliver clear theoretical mechanisms, empirical evidence on price walking remains scarce. Recent work documents price walking using pricing menus or quote data and emphasizes the role of regulatory constraints on renewal pricing (Gavazza et al., 2025). By contrast, I employ market-wide transaction data and exploit an exogenous reset of insurer–consumer relationships to identify the equilibrium effects of tenure on prices, switching, and markups.

Second, the paper contributes to the literature on dynamic pricing in selection markets (see Hendel (2006) for a survey). A large body of work shows that insurance markets are shaped by adverse selection and learning, which jointly influence pricing dynamics over time (de Garidel-Thoron, 2005; Cohen, 2005; Hendel and Lizzeri, 2003). In such environments, tenure is endogenous to both risk composition and insurers' beliefs, making it difficult to disentangle strategic price discrimination from selection-driven price changes. The evidence here shows that, even after accounting for selection and learning, prices continue to rise systematically with tenure.

Third, the paper relates to the literature on consumer inertia versus rational behavior in dynamic markets. Some work interprets rising prices with tenure as evidence of consumer inattention or inertia (Ericson, 2014). Other studies emphasize that persistence can arise from rational responses to search and switching costs, even in competitive insurance markets. For example, Honka (2014) documents substantial switching frictions in U.S. auto insurance and shows that consumer behavior reflects costly search rather than passive loyalty. Relatedly, Miravete (2003) and Ketcham, Lucarelli and Powers (2015) show that behavior that appears inert can be consistent with forward-looking decision-making once information and choice frictions are taken into account.

Finally, the paper contributes to the empirical literature on insurance markets and welfare. A large body of work studies adverse selection, pricing, and risk allocation using reduced-form sufficient-statistic methods and structural approaches that are typically static in nature (Einav, Finkelstein and Cullen, 2010). This paper complements that literature by treating tenure as a state variable in dynamic pricing and by assessing the welfare implications of tenure-based repricing using a sufficient-statistic approach (Chetty, 2009). More broadly, the paper relates to the classic distinction between static and dy-

namic efficiency in markets with frictions (Farrell and Klemperer, 2007; Einav, Finkelstein and Mahoney, 2021), providing empirical evidence on how tenure-based pricing can generate dynamic distortions even in competitive mandatory insurance markets.

Organization of the paper. The remainder of the paper is organized as follows. Section 2 develops the economic mechanisms underlying tenure-based pricing, highlighting the roles of switching costs, dynamic selection, and asymmetric learning, and clarifying why tenure is endogenous to pricing and retention decisions. Section 2.2.1 introduces a stylized framework in which tenure is a state variable in dynamic pricing and derives testable predictions for premiums, switching behavior, and expected markups over the life of the insurer–consumer relationship. Section 3 describes the institutional background of the Italian auto insurance market, including experience rating through the bonus–malus system, contractual features, and the regulatory loophole created by the grace period, which plays a central role in shaping pricing and switching incentives. Section 4 introduces the matched insurer–insured panel dataset, documents its main characteristics, and explains the construction of the tenure measure used throughout the analysis. It also presents summary statistics for the balanced panel and discusses the empirical relevance of long-term insurer–consumer relationships. Section 5 provides preliminary evidence on consumer behavior and tenure dynamics. It shows that policyholders respond strategically to institutional pricing incentives during the grace period and documents unconditional patterns in premiums, risk, and retention over tenure, highlighting the endogeneity of relationship length. Section 6 outlines the identification strategy, which exploits a regulator-imposed divestiture to generate exogenous variation in tenure. The section discusses the institutional details of the divestiture, the construction of the instruments, and the identifying assumptions, and presents evidence supporting their validity. Section 7.7.1 characterizes the equilibrium relationship between tenure and premiums, comparing fixed-effects and instrumental-variable specifications and documenting quantitatively large price walking. Section 7.7.2 studies the equilibrium response of switching behavior to tenure-based pricing, showing that switching probabilities increase with tenure once endogeneity is addressed. Section 7.7.3 combines the estimated price and switching responses to recover the expected markup profile over the insurer–consumer relationship and examines how profitability evolves as prices rise and retention declines. Section 8 presents welfare calculations arising from inefficient switching induced by tenure-based repricing. Section 9 reports a series of robustness checks, including alternative tenure constructions and sample definitions. Section 10 concludes by discussing the welfare and policy implications of tenure-based pricing in mandatory insurance markets. The appendix contains additional theoretical results, proofs, and data details.

2 Economic mechanisms and tenure endogeneity

Tenure-based pricing can arise from different economic mechanisms, and it is useful to distinguish them clearly. In this paper, *price walking* refers to an equilibrium price–tenure schedule in which renewal premiums increase with tenure *holding fixed the insurer's information set*. That is, prices rise with relationship length even after accounting for the insurer's beliefs about customer risk and observable risk factors.

Dynamic pricing incentives. One source of tenure-based pricing is switching-cost pricing. When consumers face costs of changing insurers, firms have incentives to engage in "invest–then–harvest" strategies, offering lower prices early in the relationship and raising them as customers become more attached (Klemperer, 1987; Taylor, 2003). In this setting, switching costs generate relationship-specific attachment: for a given price differential, customers are less likely to exit, allowing firms to postpone price increases and back-load them over the life of the relationship.

A distinct mechanism operates through asymmetric learning about customer risk. In learning models, insurers may initially "low-ball"—pricing below marginal cost at entry—and subsequently adjust prices upward as information about risk is revealed (D'Arcy and Doherty, 1990; Cohen, 2005). These price adjustments reflect belief updating and informational lock-in rather than strategic exploitation of switching frictions. As a result, learning-based price adjustments do not constitute price walking as defined here, which conditions on the insurer's information set.

Adverse selection (on exit) as a disciplining force. These mechanisms have different implications for selection on exit. Switching-cost pricing alone does not mechanically generate selection. By contrast, selection arises naturally when switching behavior is correlated with risk—either because of asymmetric learning or because switching costs are related to underlying risk—so that safer or better-matched consumers are more likely to remain with the insurer. In such cases, longer-tenured customers are safer on average, generating adverse selection on exit, as formalized in Appendix A.A1.

Crucially, adverse selection plays a *disciplining role* in dynamic pricing. As the retained pool becomes safer with tenure, expected claims costs decline, reducing the profitability of exploiting locked-in customers. This cost effect pushes optimal renewal prices downward and therefore limits the extent of price walking, consistent with the intuition in Fudenberg and Tirole (2000) that selection on exit constrains dynamic price discrimination and customer poaching.

More broadly, this mechanism reflects a second-best interaction between frictions. Mahoney and Weyl (2017) show that in markets with adverse selec-

tion, some degree of market power can improve welfare by mitigating inefficient under-insurance that arises under intense competition. In a related but dynamic context, de Garidel-Thoron (2005) shows that informational frictions—such as limited information sharing—can act as a valuable lock-in device that partially offsets the inefficiency created by lack of commitment in insurance markets. In the present setting, adverse selection on exit similarly counteracts the inefficiency generated by dynamic market power due to switching costs, attenuating back-loaded pricing without requiring full commitment or regulatory intervention.

Implications for empirical estimation. These forces have direct implications for empirical work. Consider the reduced-form pricing equation

$$p_{it}(\tau_{it}) = \alpha X_{it} + \psi(\tau_{it}) + \beta\omega_{it}, \tag{1}$$

where τ_{it} denotes tenure and ω_{it} captures the insurer's beliefs about customer risk. Under adverse selection on exit, longer-tenured customers are safer on average, implying a negative covariance between τ_{it} and ω_{it}. As a result, standard OLS or fixed-effects estimates of the tenure component $\psi(\tau)$ are biased downward relative to the equilibrium price–tenure schedule of interest.

Throughout the paper, the object of interest is the *strategic* price–tenure component $\psi(\tau)$, which characterizes how prices evolve with tenure holding risk composition fixed, rather than the full equilibrium price function $p(\tau)$ that also reflects changes in expected costs. When expected claims costs decline with tenure, reduced-form regressions that do not fully account for selection mechanically dampen observed price growth, causing naive estimates to understate the extent of back-loaded pricing.

Disentangling price walking from selection and learning therefore requires exogenous variation in tenure that shifts relationship length without altering risk composition. The next sections develop such a strategy, exploiting a regulator-imposed divestiture that generates quasi-experimental resets of insurer–consumer relationships.

A stylized framework for interpretation. To organize the empirical analysis, I introduce a simple stylized framework in which tenure is a state variable in pricing and retention decisions. The model is not intended to deliver sharp sign predictions for all tenure effects. Rather, its purpose is to clarify the trade-off insurers face when back-loading prices: higher margins on longer-tenured customers increase per-period profits but also raise the likelihood of exit, while adverse selection on exit reduces marginal costs and limits the scope for price walking.

2.1 Setup

A consumer faces an annual premium p_t from her current insurer and compares it to an outside offer p_0. The consumer has a switching cost $c \sim G(\cdot)$ (fixed over time) and switches if

$$p_t - p_0 > c.$$

The probability of switching is therefore

$$s_t = G(p_t - p_0), \qquad r_t = 1 - G(p_t - p_0).$$

When premiums increase with tenure, switching probabilities rise and retention declines, generating negative tenure dependence in retention. To summarize the equilibrium pricing schedule, suppose insurers condition prices on tenure,

$$p_t = \alpha_0 + \alpha_1 \tau,$$

where α_1 parameterizes the slope of the equilibrium price–tenure relationship. This specification is a reduced-form representation of the equilibrium object estimated in the data, not a behavioral assumption or a theoretical prediction.

Expected markup. Let $m(\tau)$ denote the per-period markup. The insurer's expected one-period profit from a customer of tenure τ is

$$EM(\tau) = m(\tau)\, r(\tau).$$

Because both margins and retention vary with tenure, expected markups need not be monotonic over the life of the insurer–consumer relationship.

Empirical implications. The empirical analysis focuses on three equilibrium objects: (i) the price–tenure schedule, (ii) the switching–tenure schedule, and (iii) the implied profile of expected markups. The theory clarifies that under adverse selection the sign and magnitude of price walking are ambiguous, reflecting a trade-off between dynamic market power and declining marginal costs. The empirical question is therefore whether, in the data, dynamic pricing incentives dominate the countervailing force of selection, giving rise to increasing prices with tenure, rising switching probabilities, and a hump-shaped expected markup profile.

3 The Italian auto insurance market: Institutional background

The Italian auto insurance market is regulated by IVASS and operates under a mandatory third-party liability scheme known as *Responsabilità Civile Auto*, which covers damage to others' health and property when the insured driver is at fault. In 2022, about 30 million contracts were active, making this one of the largest mandatory insurance markets in Europe. Contracts are annual and exclusive: policyholders must renew or switch providers at the end of each year,

and insurers cannot cancel policies mid-term. While comprehensive coverage (*kasko*) exists, most consumers purchase only basic liability due to cost. Prices (tariffs) are centrally determined by the insurer and posted on public channels, but the transaction price may differ significantly due to discretionary discounts granted by local sales agents. These discounts play a key role in customer poaching and retention: they allow agents to target price–sensitive consumers with selective rebates, particularly around renewal dates.

Experience Rating and the Bonus-Malus System. Accident history affects premiums through a nationwide bonus-malus (BM) system. Each policy is assigned a bonus–malus (BM) class ranging from 1 (best) to 18 (worst). New drivers enter at class 14. Each year, the BM class is updated based on accidents in which the driver holds either major fault (responsibility $\geq 51\%$) or equal fault (50% responsibility). The BM class and recent accident history are summarized in a public certificate known as the *attestato di rischio* (AR), which insurers must report to the central database. The AR is used both for within-firm renewal pricing and for portability across insurers when consumers switch.

Grace Period and Data Glitch. The observation window for bonus–malus (BM) class updates excludes the final 60 days of the contract year, known as the "grace period." Accidents occurring during this window do not appear on the accident record (AR) used for pricing in the following year. If a consumer switches insurers, these late accidents are often omitted entirely, as new insurers rarely consult the full claims history from the national database maintained by ANIA. This creates a regulatory loophole: by switching insurers, consumers can effectively "erase" grace-period accidents, distorting incentives and potentially inducing moral hazard. By contrast, consumers who remain with the incumbent have these accidents recorded internally, so that they affect the BM class and premiums with a one-year delay, whereas switching insurers can permanently avoid the corresponding penalty.

This loophole persisted until 2018, when IVASS mandated the full dematerialization of the accident record, requiring insurers to access centralized claims data and incorporate the entire claims history into pricing. As a result, the grace-period glitch operates only in the pre-reform period.[1]

Contractual Clauses. Contracts in the Italian auto insurance market come in three types: bonus-malus, deductible, and mixed bonus-malus/deductible. The vast majority of contracts are bonus-malus (96%), with an additional 3.7% being mixed; contracts with pure deductibles are extremely rare. Italian law

1. Importantly, this variation is not used in the main empirical analysis. The core identification strategy in the paper exploits a regulator-imposed divestiture to generate exogenous variation in tenure. The grace-period mechanism is discussed to motivate the economic environment and to provide descriptive evidence on pricing and switching incentives, but all estimates of tenure-based pricing and switching are identified using the divestiture-based instruments and the full panel from 2013 to 2021.

requires minimum coverage limits of €1 million for property damage and €6 million for personal injury. If these thresholds are exceeded, the policyholder is liable for the excess. Contracts also include a number of clauses that link the level of indemnity or premium adjustments to specific conditions—such as changes in accident history or vehicle use. The dataset provides granular information on the most common clauses, including coverage caps, exclusions, and bonus-malus rules. In addition, two dummy variables indicate whether any unreported clauses are present that could increase or decrease the premium. These act as proxy for omitted coverage features and allow estimation to remain robust even in the presence of incomplete contract observables.

Switching and Sales Agents. Switching is common and relatively frictionless. There is no automatic renewal or lock-in mechanism. Instead, consumers must actively select a new provider each year. The absence of automatic rollover increases the salience of prices at renewal, making consumers more sensitive to perceived increases. Local sales agents serve as critical intermediaries in this process, not only distributing discounts but also targeting consumers likely to churn. Their compensation often depends on retention and loss ratios, which incentivizes aggressive pricing tactics. As a result, discretionary pricing through agent–level discounts plays a central role in shaping observed premium dynamics, particularly for new versus returning customers.

4 Data

The empirical evidence is based on a rich matched insurer-–insuree panel from IVASS, Italy's insurance supervisory authority, covering the entire auto insurance market. The dataset tracks a nationally representative cohort of approximately 989,601 policyholders—identified by encrypted social security numbers—who held at least one auto insurance contract in 2013. Each individual is observed annually from 2013 to 2021, yielding over 8,636,637 contract–year observations across 48 insurers.[2]

Figures 1 and 2 provide stylized examples of insurance histories observed in the panel. These figures illustrate the flexibility and richness of the data structure: policyholders may switch insurers, insure multiple vehicles simultaneously, or experience gaps and resumptions in coverage. In contrast to datasets used in prior work (e.g., Israel (2005)), which typically observe only a single uninterrupted contract spell per individual, this panel follows individuals both before and after switching events.

Unlike traditional datasets that are limited to a single insurer and mechanically truncate individual histories at the point of switching, this panel follows policyholders as they move across firms. Each observation corresponds to a

2. Within the core cohort, some profiles—most notably young drivers—are over-represented, making the use of sampling weights desirable when computing population-level statistics.

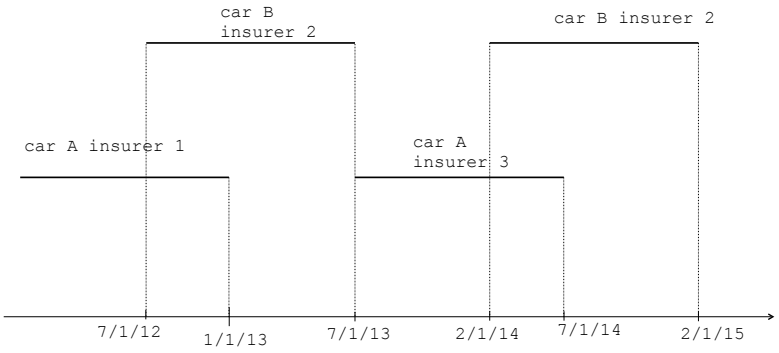


Figure 1. : Example of Insurance History I: Firm transitions and contract gaps

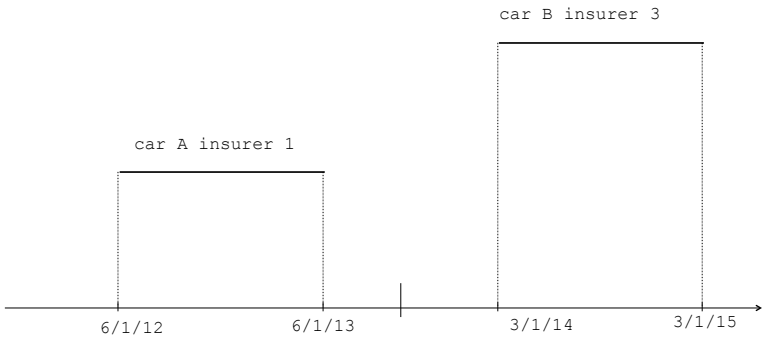


Figure 2. : Example of Insurance History II: Multiple vehicles and firm changes

contract defined by a unique policyholder–vehicle combination.[3] The data record not only transaction premiums and coverage, but also claims histories,

3. Policyholders(vehicles) are identified through their social security(plate) number.

contractual clauses, accident realizations and damages, and the accumulation of insurer–policyholder tenure. The panel structure provides two key advantages. First, it enables direct observation of both sides of the equilibrium: firm pricing strategies and consumer retention responses. Because individuals are observed repeatedly for the same vehicle and risk profile, it is possible to construct precise tenure measures and trace how premiums evolve over time within insurer–policyholder relationships. This makes it possible to distinguish true dynamic pricing—*price walking*—from variation driven by changes in observables or firm selection. Second, the data permits recovery of tenure—switching schedules purged of selection and learning. Since the same individual is observed across multiple insurers and years, fixed–effects strategies can be implemented to control for unobserved match quality or stable risk characteristics. Moreover, because policyholders are followed after they switch, there is no attrition bias from unobserved exits. This feature is critical for separating *true tenure dependence* in switching from spurious patterns driven by dynamic selection. Taken together, these features make the panel a powerful empirical platform. They allow the analysis to identify dynamic pricing using observed tenure variation, measure switching behavior conditional on identical observables, and implement a quasi-experimental design exploiting the 2013 divestiture shock.

Summary statistics Table 1 reports summary statistics for the balanced panel of contracts observed continuously from 2013 to 2021, which forms the baseline sample for the main analysis. The table is organized into four panels corresponding to insured characteristics, contract characteristics, vehicle characteristics, and geography and distribution channels.

Panel A describes insured characteristics. The average policyholder is middle-aged (mean age 52) and predominantly male (55%). The mean bonus–malus class (ranging from 1 to 18) is 1.52, reflecting a strong concentration of policyholders in the lowest bonus–malus classes, corresponding to the safest segment of the experience-rating distribution. Recorded accidents are relatively rare—averaging 0.13 per year—but play a central role in pricing through the bonus–malus system. Panel B reports contract characteristics. Average annual premiums amount to €395, with substantial dispersion. Average tenure with the current insurer is just over five years, but the distribution is wide, ranging from new customers to relationships exceeding a decade. Coverage levels vary considerably, while minimum statutory coverage is chosen in roughly two-thirds of contracts. Contractual clauses are pervasive, underscoring the scope insurers have to fine-tune prices beyond observable risk. Panel C summarizes vehicle characteristics. Cars in the sample are relatively old on average (almost ten years), with a wide dispersion in engine power and displacement. Fuel type is primarily split between petrol and diesel vehicles. Panel D reports geography and distribution channels. Contracts are evenly distributed across macro-regions, and approximately 11% are sold through direct chan-

Table 1—: Descriptive Statistics

Variable			Min	Max	N
Panel A. Insured characteristics					
Male	0.55		0	1	2,419,889
Bonus–Malus class (BM)	1.5	1.6	1	18	2,417,556
Accidents (AR)	0.13	0.37	0	5	2,402,936
Panel B. Contract characteristics					
Premium (EUR)	394.58	169.69	0	4,033	2,419,743
Tenure (years)	5.08	4.02	0	15	2,418,719
Coverage level (million EUR)	14.62	20.43	6	139	2,419,872
Minimum coverage	0.65		0	1	2,419,889
Increase clause	0.35		0	1	2,419,889
Decrease clause	0.05		0	1	2,419,889
Exclusion driving	0.02		0	1	2,419,889
Expert driving	0.50		0	1	2,419,889
Free driving	0.44		0	1	2,419,889
Repair clause	0.18		0	1	2,419,889
Corporate discount	0.16		0	1	2,419,889
Protected bonus	0.22		0	1	2,419,889
Black box	0.15		0	1	2,419,889
One installment	0.62		0	1	2,419,889
Two installments	0.37		0	1	2,419,889
Panel C. Car characteristics					
Car age (years)	9.92	4.71	0	19	2,419,889
Engine power (kW)	64.67	24.29	0	489	2,410,340
Cubic cilinder (cc/100)	13.67	3.80	0	81	2,410,340
Diesel	0.41		0	1	2,419,889
Petrol	0.56		0	1	2,419,889
Panel D. Geography and distribution channel					
North	0.49		0	1	2,419,889
Center	0.19		0	1	2,419,889
South	0.21		0	1	2,419,889
Medium city	0.18		0	1	2,419,889
Big city	0.11		0	1	2,419,889
Direct channel	0.11		0	1	2,419,889

Notes: Summary statistics for a balanced panel of contracts covering 2013–2021. Binary variables are reported as means. Monetary values are expressed in euros. Panel B reports contract characteristics. Coverage level is measured in millions of euros. The statutory minimum coverage limit is €6 million, and the "Minimum coverage" indicator equals one for contracts written at this minimum. Macro-region dummies include North, Center, South, and Islands; the Islands category is omitted from the table. Engine displacement is reported in hundreds of cubic centimeters.

nels rather than traditional agents. Taken together, the summary statistics underscore the richness of the empirical environment rather than any specific tenure pattern. Even within a mandatory and tightly regulated market, the data exhibit substantial heterogeneity in prices, contract terms, vehicle characteristics, and distribution channels. At the same time, the joint availability of detailed contractual information and full market coverage ensures that both pricing decisions and consumer choices are observed directly at the transaction level.

Measuring tenure and sample selection. Tenure is defined as the number of years a policyholder has continuously remained with the same insurer. The dataset provides an administrative measure of relationship length, denoted `TEN_ADMIN`, constructed from the difference between the contract start date and a "historical date" indicating when the current insurer first began covering the policyholder. While informative, `TEN_ADMIN` can be noisy: in some cases, the historical date fails to record insurer switches prior to 2013 or ignores coverage gaps, leading to overstatements of true relationship length.
To improve precision, I construct a behavior-based tenure measure, denoted `TEN`, which is used throughout the main analysis. The measure is initialized in 2013 using `TEN_ADMIN`, anchoring tenure at the beginning of the observation window and avoiding an initial-conditions problem. After 2013, tenure is updated mechanically from observed behavior: it increases by one for each year the policyholder remains with the same insurer and resets to zero upon switching. Both `TEN` and `TEN_ADMIN` are discretized into integer values representing completed years.
Within the balanced panel, the two measures coincide in at least 75% of observations, with a median difference of zero. The mean difference is –0.55 years, and a small fraction of observations diverges substantially, consistent with occasional overstatements in the administrative measure. The resulting distribution of `TEN` reflects realistic long-term insurance relationships: the mean tenure is 5.08 years, the median is 4, and the 75th percentile is 8. Approximately 10% of contracts are in their first year with the insurer, while the right tail is economically meaningful—the 90th percentile corresponds to 11 years and the 99th percentile reaches the 15-year cap used in the empirical analysis. This distribution motivates modeling tenure effects flexibly using discrete dummies up to 15 years.

The main analysis focuses on a balanced panel of 2,419,893 contracts, which allows tenure to be measured with the greatest precision. This choice reflects a trade-off between sample coverage and measurement reliability. While `TEN` can in principle be constructed for all contracts in the unbalanced panel, its accuracy deteriorates for relationships that enter or exit the sample window, where tenure must be inferred from partial histories and is more frequently censored. By contrast, the balanced panel provides complete observation of

relationship histories over the sample period, minimizing measurement error in tenure and facilitating the use of high-dimensional fixed effects in dynamic specifications.
This restriction mechanically selects more stable insurer–policyholder relationships, which tend to be safer on average and exhibit lower switching rates. I therefore interpret the balanced-panel estimates as characterizing tenure dynamics within incumbent relationships rather than as population-wide averages. To assess sensitivity to this selection, I re-estimate the main pricing and switching specifications on the full, unbalanced sample using the administrative tenure measure `TEN_ADMIN`. The estimated tenure–premium relationship is quantitatively similar to the province-by-year fixed-effects IV estimate obtained in the balanced sample, while the tenure–switching relationship is attenuated but remains positive. These results, reported in Appendix B, are consistent with increased measurement error in administrative tenure rather than with a change in the underlying economic relationship.

Taken together, these comparisons suggest that the balanced-panel analysis is preferred for precision and tractability, while the full-sample estimates based on `TEN_ADMIN` provide a complementary check on external relevance. In Section 8, I discuss how this sample selection affects the aggregation of welfare effects and present bounds and robustness checks to guide the interpretation of population-level implications.

Tenure effects. Table 2 reports unconditional summary statistics on premiums, expected claims, and accident rates by tenure level, using the constructed tenure measure `TEN`. The table is descriptive and intended to document how prices, risk, and heterogeneity evolve mechanically with relationship length in the raw data. Three patterns stand out. First, average premiums exhibit a non-monotonic profile over tenure. Premiums rise sharply in the early years of the insurer–consumer relationship, peak around tenure three, and then gradually decline at longer durations. This profile is consistent with the withdrawal of introductory discounts early in the relationship combined with slower price adjustments thereafter. Importantly, these unconditional patterns do not identify equilibrium price–tenure relationships, as they reflect the joint influence of pricing strategies, selection, and changes in the composition of the insured pool.

Second, observed risk declines systematically with tenure. Expected claims fall from approximately €95 in tenure year zero to about €55 by tenure year fifteen, while accident probabilities decline from 3.95% to 2.22%. These gradients indicate strong positive selection on exit: higher-risk policyholders are more likely to leave early, while safer individuals disproportionately accumulate longer relationships. As a result, tenure is mechanically correlated with underlying risk even before conditioning on observables.

Third, the insured pool becomes more homogeneous at longer tenures. As shown by the interquartile ranges in Table 2, the dispersion of both premiums and expected claims declines markedly with tenure. The IQR of premiums falls from about €201 at tenure zero to roughly €160 by tenure fifteen, while the IQR of expected claims contracts from approximately €49 to below €30 over the same horizon. This pronounced compression indicates that long-tenure customers are not only safer on average but also increasingly similar along observable dimensions, reinforcing the view that tenure is correlated with latent heterogeneity through selection and learning.

Taken together, these unconditional patterns illustrate why naive regressions of premiums or switching behavior on tenure are likely to be misleading. Tenure is simultaneously associated with changing prices, declining risk, and reduced heterogeneity. Disentangling strategic pricing from selection and learning therefore requires a research design that generates exogenous variation in relationship length.

Table 2—: Summary Statistics by Tenure

	Premium (€)		Expected Payouts (€)		Accident Prob. (%)	R^2
Tenure	Mean	IQR	Mean	IQR	Mean	
0	383.01	200.57	94.90	49.31	3.95	0.569
1	401.66	209.08	94.14	48.52	3.95	0.550
2	410.94	208.64	92.60	47.28	3.92	0.522
3	414.17	203.36	91.00	45.98	3.76	0.489
4	408.55	193.95	89.29	44.83	3.81	0.469
5	400.44	183.62	87.57	43.98	3.80	0.439
6	394.94	176.33	85.83	43.01	3.75	0.424
7	389.73	171.17	84.48	42.47	3.65	0.408
8	383.72	165.59	83.33	42.00	3.40	0.393
9	380.20	161.98	79.49	39.49	3.23	0.388
10	374.82	158.15	75.67	37.69	3.05	0.387
11	371.69	156.31	71.92	35.36	2.91	0.400
12	372.07	157.85	67.76	32.92	2.70	0.415
13	372.28	158.14	63.93	31.29	2.48	0.426
14	375.28	158.78	59.97	29.06	2.54	0.435
≥15	377.98	159.97	54.80	28.29	2.22	0.440
Total	**394.53**	**185.50**	**85.99**	**45.41**	**3.61**	**0.458**

Notes: This table reports unconditional means and interquartile ranges (IQR) of transaction premiums and expected claims, and mean accident probabilities, by tenure. Accident probability is defined as the share of policyholders with one or more accidents within the contractual year. Expected payouts are constructed using a two-part model for claim frequency and claim severity, estimated on the full sample following the approach in Cosconati et al. (2025). The final column reports the R^2 from separate regressions of log premiums on observable pricing variables, estimated separately at each tenure level. All statistics are computed using the constructed tenure measure `TEN` and refer to the balanced sample of policyholders observed from 2013 to 2021.

5 Preliminary Evidence

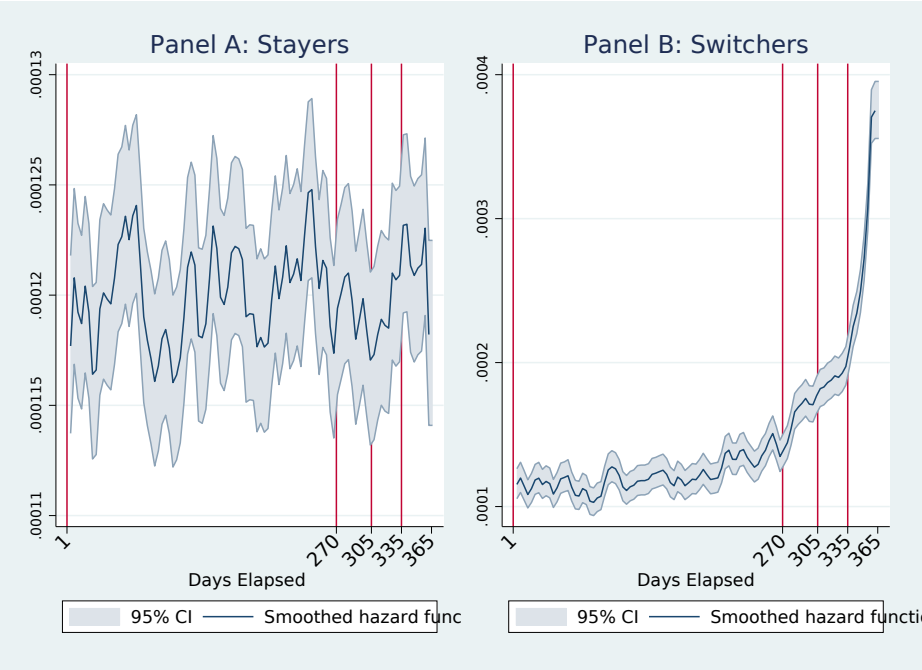
Grace period. To illustrate how consumers respond to institutional pricing incentives embedded in the bonus–malus system, I exploit a regulatory feature commonly referred to as the *grace period*. This is a 60-day window at the end of the contract year during which accidents are not reflected in the policyholder's *attestato di rischio* (driving record) for the following year. Importantly, this omission applies to all policyholders, regardless of whether they stay with their current insurer or switch. The key distinction arises in how these accidents are treated beyond the immediate renewal. For policyholders who remain with the same insurer, accidents occurring during the grace period are typically incorporated into premiums with a one-year delay, once they appear in the subsequent attestato di rischio. By contrast, policyholders who switch insurers immediately after the grace period often avoid the associated bonus–malus penalty altogether, because the accident never enters the risk certificate used by the new insurer. As a result, switching during the grace period can permanently circumvent the premium increase associated with the accident, rather than merely postponing it. This institutional asymmetry creates a sharp incentive to switch insurers following a grace-period accident.

Figure 3 plots smoothed hazard rates of accident reports over the contract year, separately for stayers and switchers. The vertical lines mark approximately the 90th, 60th, and 30th days before contract expiration, with the final 60 days defining the official grace period. Two patterns emerge. First, the hazard of reported accidents for stayers is smooth over the contract year and shows no discontinuity around expiration. Second, for switchers, reported accidents increase sharply during the grace period. This divergence indicates that consumers condition their switching decisions on the institutional details of pricing and reporting rules.

This behavioral response suggests that switching is deliberate and forward-looking rather than passive. Consumers do not merely react to posted prices; they strategically time both switching and reporting decisions to minimize future premiums. This evidence motivates the view that switching behavior is closely intertwined with pricing incentives and reinforces the relevance of studying tenure as a strategic state variable.

Learning. To assess the presence of asymmetric learning, I examine whether the pricing relevance of observable risk signals declines with tenure. If insurers accumulate private information about customer risk through repeated interactions, publicly observable indicators—such as a clean driving record—should

Figure 3. : Hazard Rates of Accident Reports: Switchers vs. Stayers



Note: This figure plots smoothed hazard rates of one or more accident reports over the contractual year, using a Gaussian kernel. Vertical lines indicate approximately 90, 60, and 30 days before contract expiration. The final 60 days define the "grace period," during which accident histories are not reflected in the bonus–malus system if a consumer switches insurers. Switchers (Panel B) show a sharp increase in accident reports during this window; stayers (Panel A) do not. Sample: 2013–2017 contracts.

be most informative early in the relationship and become less salient as tenure increases.[4]

I implement this test by interacting tenure dummies with an indicator for a clean record in the following specification:

(2)

$$\ln P_{it} = \alpha + \sum_{j=1}^{15} \gamma_j \, \mathbf{1}\{\texttt{TEN}_{it} = j\} + \sum_{j=1}^{15} \beta_j \, \mathbf{1}\{\texttt{TEN}_{it} = j\} \times \text{CleanRecord}_{it} + X_{it}'\delta + \varepsilon_{it},$$

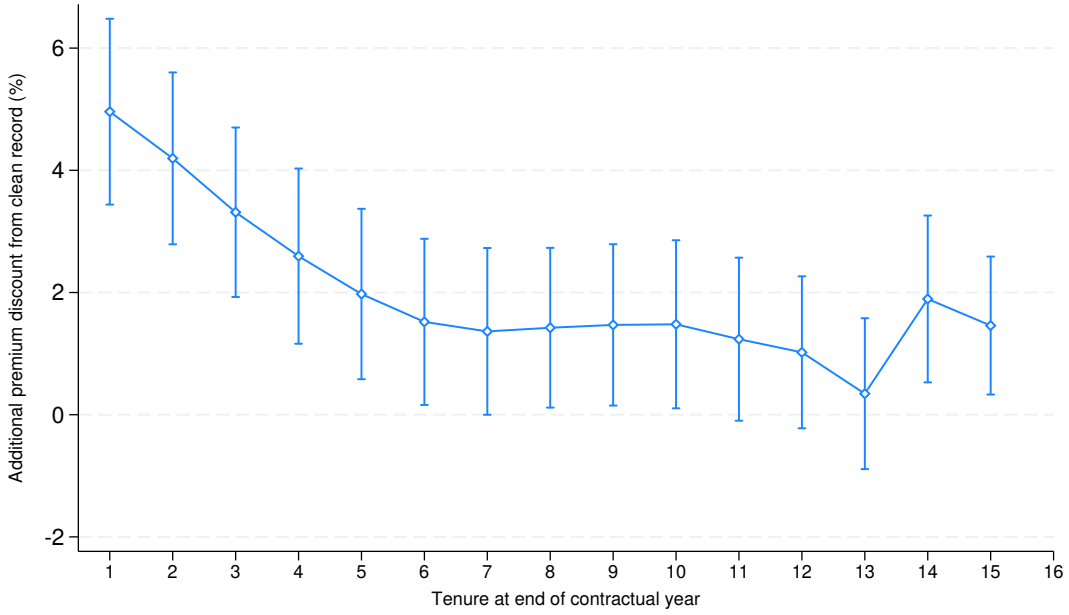
where tenure is discretized into annual bins and the omitted category is $\texttt{TEN} \geq 16$. CleanRecord_{it} equals one if the policyholder is in bonus–malus class 1 and has experienced no major or equal-fault accidents in the previous five years. The coefficients β_j therefore capture how the premium discount associated with a clean record at tenure j differs from that of long-tenure customers.

Equation 2 is estimated using the same full set of controls and fixed effects employed throughout the paper. In particular, all specifications include

4. A related approach examines how insurers' pricing responses to observable risk characteristics evolve with tenure. For example, Cohen (2005) documents that the pricing relevance of observables declines over the life of an insurance relationship, consistent with asymmetric learning.

contract fixed effects, insurer-by-year fixed effects, province fixed effects, and month-by-year fixed effects. These fixed effects are suppressed in the notation for brevity.

Figure 4. : Clean-Record Premium Discount over Tenure



Note: The figure plots estimates of the interaction coefficients β_j from equation 2. Each point reports the *additional* premium discount associated with a clean driving record at tenure j, relative to the omitted category $\texttt{TEN} \geq 16$. Accordingly, coefficients are normalized to zero for long-tenure customers, and values at lower tenures should be interpreted as differences relative to that group. All regressions include contract fixed effects, insurer-by-year fixed effects, province fixed effects, and month-by-year fixed effects. Vertical bars denote 99% confidence intervals. The sample is a balanced panel of $N = 2{,}393{,}153$ contracts observed from 2013 to 2021.

Figure 4 shows that a clean record commands a substantially larger premium discount for new customers than for long-tenure customers. The additional discount is highest at low tenures—around 4–5 percentage points in the first year—and declines steadily over the first five to six years of the relationship. At longer tenures, the incremental discount relative to $\texttt{TEN} \geq 16$ becomes small and statistically indistinguishable from zero. This pattern indicates that observable risk signals are most informative early in the relationship and lose pricing relevance as relationship-specific information accumulates. While this exercise does not constitute a structural test of belief updating, it provides reduced-form evidence consistent with asymmetric learning in insurance pricing.

A complementary test for learning examines how the explanatory power of observable risk characteristics varies with tenure. If insurers increasingly rely

on private or unobserved information over time, the share of premium variation explained by observables should decline with tenure. To assess this pattern, I estimate separate hedonic regressions of log premiums on the full set of pricing covariates at each tenure level and report the resulting R^2 values in Table 2. The R^2 is highest for new customers (0.569 at tenure zero) and declines steadily with tenure, reaching a minimum of about 0.387 around tenure ten to eleven. At longer tenures, the R^2 recovers modestly but remains below both its initial level and the full-sample benchmark. Overall, the explanatory power of observable pricing variables declines by roughly 30% from entry to the trough.

Taken together, the attenuation of clean-record discounts and the declining explanatory power of observables provide complementary reduced-form evidence that insurers rely less on publicly observable risk characteristics as tenure increases, consistent with asymmetric learning over the life of the relationship. The evidence above shows that tenure is correlated with learning and unobserved risk, making it endogenous to both pricing and retention. I now turn to an instrumental variable strategy that leverages a regulatory divestiture to generate exogenous variation in tenure.

6 Research Design

The goal of the empirical analysis is to recover the equilibrium relationships between tenure, premiums, switching, and profitability that prevail in the market. Throughout the paper, the term *equilibrium relationship* refers to the price–tenure and switching–tenure schedules observed in the market, identified from within-province and within-insurer-year comparisons, conditional on observables. Tenure is an endogenous state variable shaped by dynamic selection, insurer learning, and pricing incentives.

Institutional setting and divestiture mechanics. The identification strategy exploits a regulator-imposed divestiture implemented by the Italian Competition Authority (AGCM) as a condition for approving Unipol Gruppo Finanziario's acquisition of the Premafin/Fondiaria-SAI group. In its decision of June 19, 2012, the AGCM required Unipol to divest part of its non-life insurance business in order to reduce post-merger market shares below 30 percent at both the national and provincial level, measured in terms of gross written premiums. To comply with this remedy, UnipolSai and Allianz jointly applied in May 2014 for authorization to transfer a portion of UnipolSai's property and casualty portfolio to Allianz. The divestiture was explicitly designed to eliminate competitive concerns arising from excessive local market concentration and was implemented through the sale of a branch of insurance business (*ramo d'azienda assicurativo*).

A key institutional feature of the divestiture is that it was implemented in two distinct stages, separating the transfer of the distribution network from the transfer of insurance contracts. The parties signed a branch-sale agreement on March 15, 2014, which provided for a first and a second closing. The first closing, completed on July 1, 2014, involved the transfer of the local agency network associated with the divested business. Specifically, 725 sales agents and 470 employees connected to the underwriting and servicing of the portfolio were transferred from UnipolSai to Allianz, together with the related operational assets and liabilities. At this stage, no insurance contracts were transferred, and UnipolSai policies remained in force. From July 2014 onward, Allianz distributed its products through the transferred agencies, while continuing to service UnipolSai contracts until their subsequent transfer.

The second closing, completed on December 31, 2014, involved the transfer of the insurance contracts associated with the divested agencies. The transferred portfolio consisted of approximately two million non-life contracts, with gross written premiums of €1.061 billion as of December 31, 2013, and was heavily concentrated in motor insurance. The portfolio was drawn from the business of the former Milano Assicurazioni agencies and was geographically concentrated in Northern provinces, where pre-merger market shares were highest.

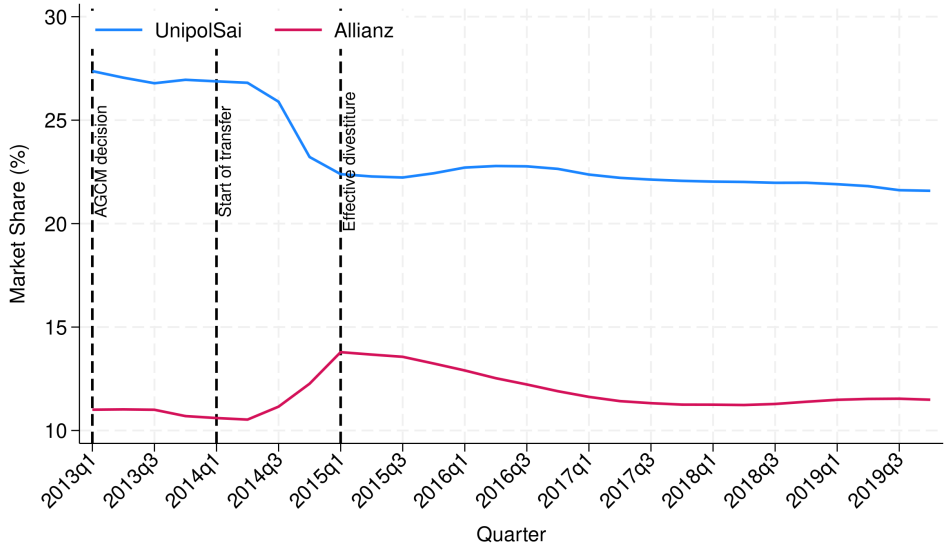
Crucially for identification, the transfer of policies did not alter contractual fundamentals. Coverage terms, bonus–malus class, accident histories, and pricing rules tied to observables were preserved at reassignment. Allianz did not mechanically re-tariff contracts at the moment of transfer; any premium differences that emerge at very short tenures therefore reflect subsequent renewal or retention pricing decisions rather than changes in contractual terms at reassignment. At the same time, the reassignment mechanically severed the existing insurer–consumer relationship: policyholders entered Allianz with zero relationship length despite unchanged risk and coverage characteristics. The divestiture thus induced a discrete reset of insurer–consumer tenure that was independent of consumer search behavior or switching decisions.

Because the divestiture involved the joint transfer of contracts and the local agency network underwriting those contracts, reassigned policyholders were typically served by the same agents as before the transfer. This feature limits the scope for independent shocks to agent quality or discretionary discounting at reassignment, which is particularly relevant given the role of agent-level pricing discretion in this market.

As shown in Figure 5, the divestiture unfolded in two distinct phases: the transfer of the distribution network in mid–2014 (first closing), followed by the administrative reassignment of insurance contracts at the end of 2014 (second

closing). The latter marks the mechanical reset of insurer–consumer tenure that underlies the identification strategy.

Figure 5. : Mandated Divestiture and Market Share Trends (2013–2019)



Note: The figure plots quarterly market shares of UnipolSai and Allianz from 2013Q1 to 2019Q4. Vertical dashed lines mark three key milestones of the divestiture process imposed by the Italian Competition Authority (AGCM): (i) the AGCM decision approving the merger subject to divestiture remedies; (ii) the start of the transfer process, corresponding to the first closing in mid–2014, when the distribution network (agency contracts and employees) was transferred from UnipolSai to Allianz; and (iii) the effective implementation of the divestiture at the second closing in December 2014, when the insurance contracts were reassigned. The discrete and persistent reallocation of market shares around the second closing reflects the administrative transfer of policies, while subsequent dynamics also capture background market trends and organic growth.

Taken together, these features imply that the divestiture can be interpreted as an exogenous reset of insurer–consumer tenure while holding risk composition, contractual terms, and the local intermediary environment fixed. The resulting variation allows the equilibrium price–tenure and switching–tenure schedules to be recovered without imposing structural assumptions on firms' pricing technologies or consumers' beliefs. Because reassignment intensity varied systematically across provinces—reflecting differences in pre-merger market concentration—the tenure reset also exhibits a strong cross-sectional component, which is exploited in the empirical analysis.

Instruments and baseline identification. I rely on two instruments generated by the 2013–2014 Unipol–Allianz divestiture. The primary instrument, $\texttt{DIVEST}_{it}$, is an individual–contract–time indicator equal to one in post-reassignment years for contracts affected by the divestiture, and zero otherwise. By construction, $\texttt{DIVEST}_{it}$ varies within contract over time: it switches on at the year of reassignment and remains zero in pre-divestiture years. This variation cap-

tures the mechanical reset of insurer–consumer relationship length induced by the administrative transfer and ensures that the instrument is not collinear with individual or contract fixed effects.
The second instrument, $\texttt{DIVEST_SHARE}_{rt}$, is a province–year exposure measure defined as the share of contracts reassigned through the divestiture in province r and year t. It captures the local intensity of divestiture-related reassignments and varies both across provinces and over time.

Identification comes from comparing divested and non-divested contracts within the same province–insurer–year cell, conditional on observables. Under this design, any province–insurer–year shock to pricing or competitive conditions that is common to both groups is differenced out. The identification strategy therefore does not rely on province or insurer-by-year fixed effects absorbing all local, time-varying competitive shocks. Rather, the key identifying assumption is that, within a given province, insurer, and year, the divestiture does not generate differential shocks to pricing or switching that affect reassigned contracts differently from non-reassigned ones beyond their effect on tenure.
The divestiture also satisfies the monotonicity condition: reassigned contracts mechanically experience a reduction in insurer–policyholder tenure, while non-reassigned contracts are unaffected, ruling out defiers by construction.

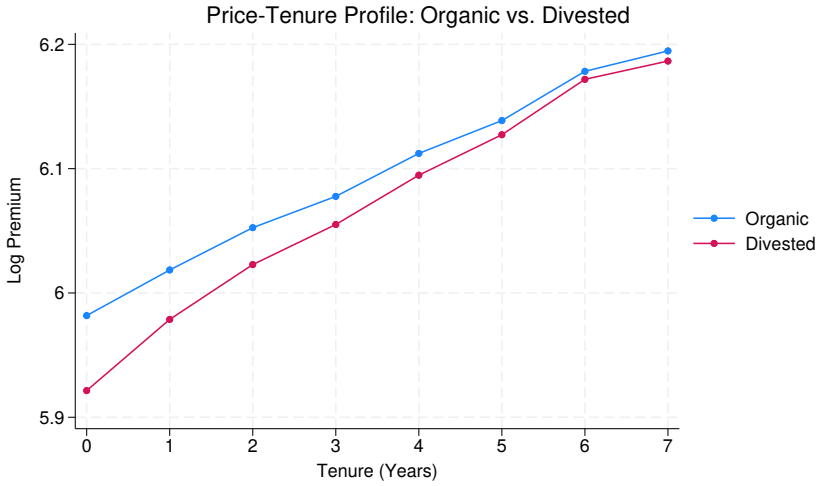
Dynamic convergence. A potential concern is that divested policyholders enter Allianz administratively, whereas organically acquired customers typically self-select into entry through active search and switching. If pricing depended on such entry-specific traits, the divestiture-based instrument could identify a cohort-specific repricing schedule for acquired books rather than the common equilibrium price–tenure schedule.

A key implication of the identification strategy is therefore that, conditional on tenure, divested and organically acquired customers should face the same pricing schedule once relationships mature. To assess this implication, I estimate the following specification for the cohort of policyholders who first entered Allianz in 2014:

$$\begin{aligned}\log(p_{it}) = \alpha &+ \sum_{k=0}^{6} \beta_k \, \mathbf{1}\{\texttt{TEN} = k\} + \delta \, \mathbf{1}\{\texttt{DIVEST} = 1\} \\ &+ \sum_{k=0}^{6} \theta_k \, \mathbf{1}\{\texttt{TEN} = k\} \times \mathbf{1}\{\texttt{DIVEST} = 1\} + X_{it}'\gamma \\ &+ \text{year} \times \text{month FE} + \text{province FE} + \varepsilon_{it}.\end{aligned} \tag{3}$$

Figure 6 provides direct evidence in support of this implication. While divested policyholders enter Allianz with lower premiums at very short tenures,

Figure 6. : Price–Tenure Profile: Organic vs. Divested Customers



Note: The figure plots predicted log premiums by tenure for policyholders who first entered Allianz in 2014, separately for organically acquired customers and customers reassigned through the Unipol–Allianz divestiture. Predictions are based on equation equation (**??**) and hold all covariates and fixed effects constant. Divested customers enter Allianz with lower premiums at very short tenures, consistent with a transitory cohort-specific level effect at entry (e.g., short-run retention or onboarding pricing following the administrative transfer). As tenure accumulates, price paths converge rapidly: by tenure four, the profiles are nearly indistinguishable and remain parallel thereafter. This convergence indicates that pricing conditional on tenure does not depend on the mode of entry.

the gap closes rapidly as tenure is rebuilt. From tenure four onward, the price–tenure profiles of divested and organically acquired customers are nearly indistinguishable and remain parallel thereafter. This convergence shows that any cohort-specific pricing effects are transitory and confined to the first renewal cycles, motivating an identification strategy that relies on post-transition tenure variation to recover the equilibrium price–tenure schedule.

Transitional pricing and identification The divestiture induces two conceptually distinct effects. First, divested contracts enter the receiving insurer at legacy renewal prices rather than new-business prices, and agents may engage in short-run retention or onboarding pricing. These mechanisms generate a transitory level effect at very short tenures, visible in Figure 6 as a rapid convergence of divested contracts toward the equilibrium pricing path. Second, the divestiture generates a persistent, exogenous reset of insurer–consumer tenure. The exclusion restriction underlying the IV strategy is intended to hold along the equilibrium pricing path, not during the short transition period immediately following reassignment. To ensure that the estimated tenure gradient is not contaminated by transitional pricing dynamics, I re-estimate the main specifications excluding the first one (and, in robustness, the first two) years of tenure. The estimated price–tenure and switching–tenure gradients remain positive and economically meaningful, indicating that the results are driven by steady-state pricing behavior rather than by one-time adjustment effects.

General equilibrium effects. A further concern is that the divestiture may have triggered broader competitive responses that altered outside options, rather than merely resetting insurer–consumer tenure. To assess the magnitude of such general equilibrium responses, I implement a placebo difference-in-differences test on the sample of never-divested contracts:

$$\begin{aligned}\log(p_{it}) = \alpha + \beta\,\texttt{DIVEST_SHARE}_{rt} \times \mathbf{1}\{t \geq 2015\} + X_{it}'\gamma \\ + \text{year} \times \text{month FE} + \text{province FE} + \mu_i + \varepsilon_{it}.\end{aligned} \tag{4}$$

I find clear evidence of province–year level competitive responses in this placebo exercise. The estimated coefficient on $\texttt{DIVEST_SHARE}_{rt} \times \mathbf{1}\{t \geq 2015\}$ is –0.024 (s.e. 0.0002), implying that a one-percentage-point increase in divestiture intensity within a province–year is associated with a 2.4% reduction in premiums for never-divested contracts in the post-divestiture period. This magnitude is economically meaningful and indicates that the divestiture affected local pricing conditions even for contracts that were not directly reassigned.

To ensure that such general equilibrium effects do not drive the main results, I re-estimate the IV specification including province-by-year fixed effects, which absorb any time-varying local shocks common to all consumers within a province-year. Under this conservative specification, the estimated tenure gradient remains positive and precisely estimated. The corresponding IV estimates with province-by-year fixed effects are reported in the main results table and discussed in Section 7.7.1.

Potential contamination of the instruments. The divestiture-based instrument may include a small share of policyholders who would have switched voluntarily even in the absence of the divestiture. To assess the sensitivity of the results to this potential contamination, I restrict the instrument to risk-clean switchers—policyholders with no recorded accidents prior to the divestiture. Under this restriction, the first-stage relationship between the instrument and tenure remains strong and quantitatively similar, indicating that voluntary switching primarily adds noise rather than bias.

7 Results

7.1 Price walking

I estimate the equilibrium relationship between premiums and tenure using the following specification:

$$\begin{aligned}\log(p_{it}) = \alpha\,\texttt{TEN}_{it} + X_{it}'\gamma + \text{insurer FE} \times \text{year FE} \\ + \text{year FE} \times \text{month FE} + \text{province FE} + \theta_i + \varepsilon_{it},\end{aligned} \tag{5}$$

where θ_i denotes contract-specific fixed effects. The coefficient of interest, α, summarizes the equilibrium elasticity of premiums with respect to tenure.

As discussed in Section 2, tenure is endogenous in the presence of asymmetric learning and selection. Longer-tenured customers tend to be safer or better matched, implying that unobserved cost components embedded in the error term are negatively correlated with tenure, i.e. $\text{Cov}(\varepsilon_{it}, \texttt{TEN}_{it}) < 0$. As a result, fixed-effects estimates of α are attenuated relative to the equilibrium price–tenure schedule, since declining expected costs mechanically dampen observed price growth with tenure. This motivates the use of divestiture-based instruments to recover the equilibrium relationship purged of selection and learning.

Tenure–premium relationship. Table 3 compares fixed-effects and instrumental-variable estimates of the equilibrium tenure–premium relationship. The fixed-effects specification yields a coefficient of 0.022, implying that premiums increase by about 2.2% per year of tenure. In contrast, the baseline IV estimate implies an increase of 7.2% per year of tenure—more than three times larger.

Column (3) reports IV estimates that include province-by-year fixed effects, which absorb time-varying local competitive shocks common to all consumers within a province-year. Under this conservative specification, the estimated tenure gradient attenuates but remains positive and precisely estimated, indicating that a substantial tenure-based repricing component persists even after netting out local general-equilibrium effects.

Table 3—: Equilibrium Relationship Between Tenure and Premiums

	(1) FE	(2) IV (Baseline)	(3) IV + Prov.×Year FE
TEN	0.022***	0.072***	0.0538***
	(0.000)	(0.002)	(0.0016)
Weak-ID F statistic		1,514.7	1,211.3
Mean premium (€)		394.6	394.6
Annual increase (€)		28.4	21.3
5-year cumulative increase (%)		43%	31%
10-year cumulative increase (%)		105%	67%
Observations	2,393,153	2,393,153	2,393,153

Notes: Dependent variable is $\log(p_{it})$. The sample includes a balanced panel of policyholders observed from 2013 to 2021. TEN is the constructed tenure measure based on observed retention and switching behavior. Column (1) reports fixed-effects estimates treating tenure as exogenous conditional on controls and fixed effects. Column (2) reports baseline IV estimates using divestiture-based instruments. Column (3) reports IV estimates including province-by-year fixed effects, which absorb time-varying local competitive shocks common to all consumers within a province-year. All specifications include contract fixed effects, insurer-by-year fixed effects, and year-by-month fixed effects. Standard errors clustered at the province level are shown in parentheses.
Column (3) is exactly identified, as identification relies on the individual-level reassignment indicator DIVEST; province-level exposure measures are absorbed by province-by-year fixed effects. First-stage F-statistics remain well above conventional Stock–Yogo thresholds, indicating strong instrument relevance. Cumulative premium effects are computed from the log specification as $\exp(\hat{\beta} \cdot T) - 1$.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The gap between the fixed-effects and IV estimates underscores the importance of accounting for tenure endogeneity. As tenure increases, asymmetric learning leads insurers to condition prices on private risk assessments that are unobserved by the econometrician, while safer customers disproportionately remain in the relationship. The resulting negative correlation between tenure and unobserved costs causes fixed-effects regressions to absorb part of the price increase associated with tenure, attenuating the estimated price–tenure gradient.[5]

The implied magnitudes are economically consequential. Using sampling weights within the balanced panel, average premiums declined by about 33% between 2013 and 2021. Given that the average tenure in the balanced panel is approximately five years, price walking over a typical insurer–consumer relationship is sufficient to offset a decline of this magnitude. This implies that aggregate price reductions observed in the market are not fully passed through to incumbent policyholders over the course of an average relationship. Tenure-based pricing therefore constitutes a quantitatively important source of cross-sectional premium dispersion.

These findings align with the mechanism formalized in Appendix A.A1. Proposition 2 shows that optimal prices increase with tenure when loyalty strengthens and adverse selection implies declining expected costs, providing a theoretical rationale for the steeper price–tenure schedule recovered by the IV estimates.

Instrument relevance: first stage The first stage the form

$$\texttt{TEN}_{it} = \pi_1 \texttt{DIVEST}_{it} + \pi_2 \texttt{DIVEST_SHARE}_{rt} + X_{it}'\delta + \theta_i + \lambda_t + u_{it},$$

where θ_i denotes contract fixed effects when included, and λ_t collects the remaining time and insurer-level fixed effects used in the corresponding second-stage specification. The two instruments are identified from distinct sources of variation. The individual-level reassignment indicator $\texttt{DIVEST}_{it}$ varies within contract over time, switching on at the year of reassignment, so π_1 is identified from within-contract changes in tenure. By contrast, $\texttt{DIVEST_SHARE}_{rt}$ varies at the province–year level, capturing local exposure to divestiture-related reassignments, and is therefore identified from within-province variation over time even in specifications that include province fixed effects.

Table 4 reports first-stage estimates across a range of specifications. In the baseline specification, divested contracts exhibit a reduction in measured tenure of approximately 3.6 years relative to non-divested contracts, reflecting the mechanical reset of the insurer–consumer relationship induced by the divestiture. This effect remains large and precisely estimated when restricting the sample to

5. The first-stage F-statistic confirms strong instrument relevance. While overidentification tests reject at conventional levels (not shown), the identifying variation is driven primarily by the individual-level reassignment indicator `DIVEST`. Results are robust to using this instrument alone.

the implementation year and when including contract fixed effects, confirming that the tenure reset is visible even within individual contract histories.

Table 4—: First-Stage Relationship Between Tenure and Divestiture Instruments

	(1) Full sample	(2) Insurer-Year FE	(3) No province FE	(4) Only 2014	(5) Contract FE
DIVEST	-3.630***	-4.492***	-3.612***	-4.623***	-1.179***
	[0.093]	[0.130]	[0.091]	[0.140]	[0.031]
DIVEST_SHARE	0.068***	0.068***	0.024	-0.019***	0.040***
	[0.013]	[0.014]	[0.017]	[0.005]	[0.004]
policyholder char.	Yes	Yes	Yes	Yes	Yes
driving record FE	Yes	Yes	Yes	Yes	Yes
macro-region FE	Yes	Yes	Yes	Yes	Yes
city size FE	Yes	Yes	Yes	Yes	Yes
direct insurer	Yes	Yes	Yes	Yes	Yes
clauses FE	Yes	Yes	Yes	Yes	Yes
car char. FE.	Yes	Yes	Yes	Yes	Yes
insurer FE	Yes	Yes	Yes	Yes	Yes
province FE	Yes	Yes	No	Yes	Yes
year-month FE	Yes	Yes	Yes	Yes	Yes
R^2	0.309	0.321	0.307	0.246	0.419
N	2,393,280	2,393,280	2,393,280	267,783	2,393,280

Notes: The dependent variable is years of tenure. The table reports first-stage estimates from regressions of tenure on divestiture-based instruments. DIVEST is an individual-level, time-varying indicator that equals one in post-reassignment years for contracts affected by the 2013–2014 Unipol–Allianz divestiture, and zero otherwise; its coefficient therefore captures the mechanical reset of tenure induced by reassignment. Column (2) absorbs insurer-by-year fixed effects; column (4) isolates the implementation year (2014); and column (5) includes contract fixed effects, so identification in that specification comes from within-contract variation over time.[6]
DIVEST_SHARE is a province–year exposure measure defined as the share of divested contracts within a province in a given year. Its coefficient is identified from within-province variation over time and is not collinear with province fixed effects. Across specifications, the coefficient on DIVEST_SHARE is small relative to the individual-level reassignment indicator DIVEST, indicating that first-stage relevance is driven primarily by mechanical reassignment rather than by local exposure intensity. Standard errors clustered at the province level are reported in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Across specifications, the province–year exposure variable DIVEST_SHARE contributes modestly to explaining variation in measured tenure, while the individual-level reassignment indicator DIVEST accounts for the bulk of first-stage relevance. This pattern is consistent with the research design, in which the primary source of exogenous variation in tenure is the mechanical reset of insurer–consumer relationships induced by the divestiture.

7.2 Tenure dependence and switching

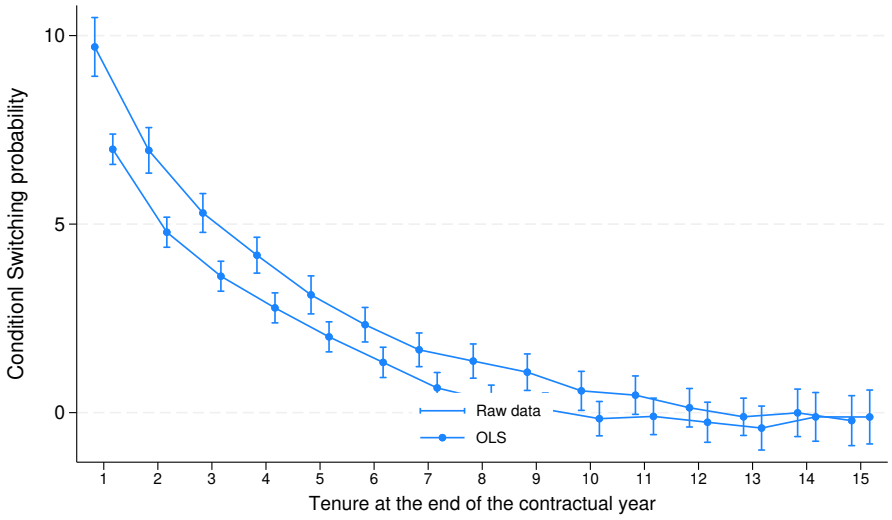
To examine behavioral responses to tenure-based pricing, I estimate the relationship between tenure and insurer switching. Consider the following specification:

$$s_{it} = \gamma\, \texttt{TEN}_{it} + X_{it}'\beta + \text{insurer FE} \times \text{year FE} + \text{year FE} \times \text{month FE} + \text{province FE} + \theta_i + u_{it}, \tag{6}$$

where s_{it} equals 100 if policyholder i switches insurer at the end of year t, and 0 otherwise. The coefficient γ measures the marginal association between an additional year of tenure and the annual probability of switching.

In the raw data, switching rates decline monotonically with tenure. Baseline OLS estimates from equation 6, which include rich controls and fixed effects but do not condition on individual policyholder fixed effects, confirm this pattern: each additional year of tenure is associated with a 0.63 percentage point reduction in switching. Allowing for non-linear effects through tenure dummies yields a similar descriptive pattern in both the raw data and OLS estimates, as shown in Figure 7. These patterns primarily reflect cross-sectional and between-individual variation in tenure and are consistent with selection and learning effects that make longer-tenured customers appear more stable.

Figure 7. : Spurious Tenure Dependence



Note: This figure plots switching probabilities by tenure using raw data means and OLS estimates from a specification with tenure dummies. The omitted category is tenure 16+. OLS estimates include rich controls and fixed effects but do not condition on individual policyholder fixed effects. Estimates are expressed as percentage-point deviations from the baseline and are bounded by 95% confidence intervals. The sample includes a balanced panel of 2,042,434 contracts observed from 2013 to 2021.

Once individual fixed effects are included, the estimated tenure–switching relationship reverses sign. Conditioning on within-policyholder variation, Column (1) of Table 5 shows that switching probabilities increase by 3.3 percentage points per year of tenure. This reversal indicates that the negative tenure dependence observed in raw data and OLS estimates is driven by selection rather than by within-relationship dynamics. Holding individual heterogeneity fixed, longer tenure is associated with a higher propensity to switch, consistent with back-loaded pricing and declining retention incentives over the life of the relationship.

IV estimates Tenure remains endogenous even within individuals, as insurers' pricing incentives and policyholders' switching behavior evolve jointly over time. Column (2) of Table 5 therefore reports IV estimates using divestiture-based instruments. The IV results imply that an additional year of tenure is associated with a 9.7 percentage point increase in the annual probability of switching.

Table 5—: Equilibrium Relationship Between Tenure and Switching

	(1) FE	(2) IV (2SLS)
TEN	3.297***	9.716***
	(0.013)	(0.246)
Weak-ID F statistic		1,514.7
Mean switching rate (%)		10.25
Observations	2,042,432	2,042,432

Notes: The dependent variable is the switching indicator, scaled in percentage points. The sample is a balanced panel of policyholders observed from 2013 to 2021. TEN is the constructed tenure measure based on observed insurer–policyholder relationships. Column (1) reports fixed-effects estimates conditioning on individual policyholder fixed effects. Column (2) reports IV estimates using divestiture-based instruments. All specifications include the full set of controls and fixed effects (contract, province, insurer-by-year, and year-by-month). Standard errors clustered at the province level are shown in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Interpreting this magnitude requires care. Switching is a bounded flow probability, and the IV coefficient summarizes a *local marginal response* of switching to tenure for policyholders whose relationship length is shifted by the divestiture. It is not intended to be extrapolated linearly over long horizons. In particular, the switching–tenure relationship need not remain linear at higher tenures, both because retention decisions discipline renewal pricing in equilibrium and because the composition of remaining customers changes as tenure accumulates. A linear extrapolation of the IV coefficient would therefore overstate long-run exit rates and does not represent a behavioral prediction of the model.

Implications for equilibrium and welfare. These findings are consistent with the equilibrium logic in Appendix A.A1. As tenure increases, insurers optimally raise renewal premiums, which relaxes the retention constraint and is associated with higher exit among consumers with low switching costs. The IV estimates therefore capture the response of switching at the relevant margin implied by tenure-based repricing, while the contrast between raw data, OLS, fixed-effects, and IV estimates highlights the central role of selection and endogeneity in shaping observed tenure dependence.

In the welfare analysis below, switching elasticities are used as *local* sufficient statistics evaluated at observed switching margins, not as global predictors of long-run exit. Accordingly, the implied welfare costs and expected markup profiles should be interpreted as local or upper-bound effects rather than as long-horizon extrapolations.

Comparison with prior work The results presented here differ markedly from those reported in Israel (2005), who estimates a structural model of switching behavior using internal data from a U.S. insurer. In his analysis, the relationship between tenure and departure risk is explicitly non-monotonic: tenure initially reduces switching, but this effect weakens and eventually reverses.[7] By contrast, once I control for both unobserved heterogeneity and the endogeneity of tenure, I find a consistently increasing switching probability with tenure. This suggests that the dominant force in the Italian market is not the balance between relationship value and learning, but rather the increasing burden of price walking borne by loyal customers. While Israel's findings emphasize dynamic match formation and the potential for learning-driven retention, my results point to a more direct and continuous strategic pricing response by consumers to tenure-linked premium increases. The contrast highlights how tenure dependence may take different shapes across markets and institutions, depending on the nature of switching frictions, pricing strategies, and regulatory environments.

Joint dynamics of pricing and switching. The IV estimates indicate economically meaningful responses of both premiums and switching to tenure, but the interpretation of magnitudes differs across the two outcomes.[8]

For premiums, the estimated price–tenure schedule implies sizable cumulative effects over medium horizons. Using the log specification, the baseline IV elasticity of 0.072 corresponds to a cumulative premium increase of $\exp(0.072 \times 10) - 1 \approx 105\%$ over ten years, holding risk and contract characteristics constant. This calculation is informative because prices are unbounded and the log specification naturally maps annual elasticities into longer-horizon growth rates. By contrast, switching is a bounded flow probability, and its IV coefficient summarizes a *local marginal response* of switching to tenure for policyholders whose relationship length is shifted by the divestiture. The estimated 9.7 percentage point increase in annual switching per year of tenure should therefore not be interpreted as a globally linear schedule or extrapolated over long horizons. In particular, a mechanical linear extrapolation would imply switching probabilities approaching unity, which is neither a behavioral prediction of the model nor a feature of the data. Instead, the IV estimate

7. Specifically, Table 4 in Israel (2005) shows that the marginal effect of tenure is strongly negative in the early years (e.g., year 2: –0.139), close to zero or even slightly positive around years 5–6, and again positive in later years (e.g., year 10: +0.085). This hump-shaped pattern reflects the interplay between relationship-building, firm learning, and dynamic pricing expectations within a single-insurer setting.
8. Throughout the paper, cumulative premium effects are computed using geometric compounding implied by the log specification, while switching effects are interpreted as marginal changes in annual flow probabilities.

captures the responsiveness of exit at the relevant margin, where tenure-based repricing is most salient and retention constraints begin to bind.

Taken together, the pricing and switching results highlight a tight equilibrium interaction between back-loaded pricing and customer exit. As insurers raise renewal premiums with tenure, exit becomes more likely among customers with low switching costs, progressively disciplining further price increases. Price walking therefore cannot be sustained indefinitely: rising premiums are endogenously constrained by increasing exit, and price walking and negative tenure dependence in retention emerge as jointly determined outcomes of dynamic pricing under switching frictions.

Consistent with this interpretation, the welfare and markup calculations in Section 8 use switching elasticities as *local sufficient statistics* evaluated at observed switching margins. These calculations should therefore be interpreted as local or upper-bound effects, rather than as long-horizon predictions of portfolio attrition.

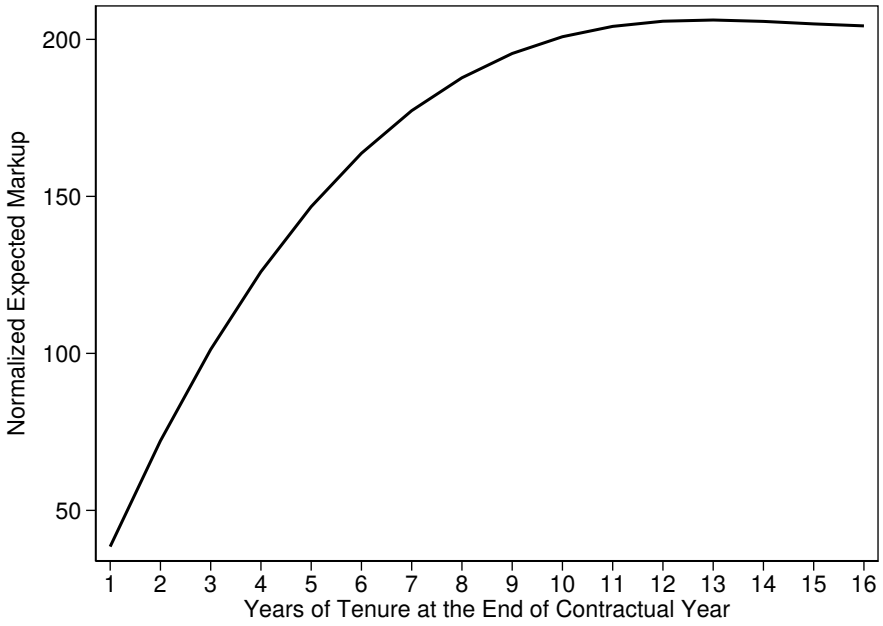
7.3 Profitability over the relationship

To characterize how profitability evolves over the insurer–consumer relationship, I compute predicted per-period markups and predicted retention probabilities for tenure values from 1 to 16, holding all other covariates and fixed effects constant. Expected markup at each tenure is defined as the product of the predicted markup and the predicted probability of retention. The resulting profile, shown in Figure 8, exhibits a pronounced inverted-U shape.

The predictions underlying Figure 8 are obtained from flexible reduced-form specifications in which tenure enters as a cubic polynomial. These specifications are estimated separately for markups and switching and include the same covariates, fixed effects, and instrumental variable strategy as the baseline price and switching regressions. The cubic functional form is introduced solely to recover a smooth, non-linear tenure profile and does not alter the underlying identification strategy. In particular, the implied local slopes of the cubic specifications around typical tenure levels are quantitatively close to the linear IV coefficients reported in Tables 3 and 5, which remain the primary parameters feeding into the sufficient-statistic welfare calculations.

The observed markup profile mirrors the trade-off formalized in Appendix A.A1. Increasing tenure raises per-period margins through price walking (Proposition **??**), but also induces higher exit as renewal prices rise. The interaction of these forces generates a non-monotonic profitability profile in equilibrium, with price walking endogenously constrained by switching behavior.

Figure 8. : Expected Markup by Tenure



Note: The figure plots expected per-period markups by tenure, defined as the product of predicted per-period markups and predicted retention probabilities. Predictions are obtained from separate reduced-form regressions for markups and switching in which tenure enters as a cubic polynomial. All other covariates, fixed effects, and instruments are identical to those used in the baseline specifications. The cubic specification is used to allow for curvature in the tenure profiles; the implied marginal effects of tenure around the center of the tenure distribution are quantitatively similar to the linear IV estimates reported in Tables 3 and 5.

8 Welfare calculations

Welfare is measured in terms of *total surplus*. Switching costs are interpreted as real resource costs rather than transfers, so the deadweight loss from dynamic repricing corresponds to the adjustment costs incurred by consumers who switch insurers in response to tenure-based price increases.[9]

Incremental deadweight loss from repricing. Let $\bar{c}$ denote the switching threshold prior to a small increase in the incumbent–outside price wedge. Consider an incremental increase in the renewal premium that raises the switching threshold from $\bar{c} - \varepsilon$ to $\bar{c}$. This induces additional switching among consumers with switching costs $c \in (\bar{c} - \varepsilon, \bar{c}]$. Because switching costs represent real adjustment costs, the exact incremental deadweight loss associated with this repricing step is

$$\text{DWL} = \int_{\bar{c}-\varepsilon}^{\bar{c}} c \, dG(c).$$

9. This welfare formulation follows Taylor (2003), treating switching costs as real losses rather than redistributive transfers.

Approximating the switching-cost density as locally constant around $\bar{c}$, this expression can be written as

$$\text{DWL} \approx g(\bar{c}) \left[\bar{c}\,\varepsilon - \tfrac{1}{2}\varepsilon^2 \right].$$

The leading term reflects the fact that marginal consumers induced to switch already face a positive switching wedge $\bar{c}$. Evaluating this expression therefore requires knowledge of the level of the prevailing switching margin and the full distribution of switching costs.

Harberger-triangle approximation. Following the sufficient-statistics approach of Chetty (2009), I adopt a conservative approximation that isolates the *incremental distortion created by the additional price increase itself*, abstracting from the pre-existing wedge. Specifically, I measure deadweight loss relative to the existing switching margin $\bar{c}$ by integrating the excess switching cost $(c - \bar{c})$ over the interval $(\bar{c} - \varepsilon, \bar{c}]$, yielding

$$\text{DWL}^{\text{HT}} = \int_{\bar{c}-\varepsilon}^{\bar{c}} (c - \bar{c})\, dG(c) \;\approx\; \frac{1}{2}\, g(\bar{c})\, \varepsilon^2.$$

This Harberger-triangle term captures the second-order welfare loss from the *incremental* repricing step and provides a lower-bound measure of the deadweight loss attributable to tenure-based price increases. Importantly, this object does not require estimating the level of the existing switching wedge and is therefore well suited to a sufficient-statistic implementation. In what follows, Δp denotes the *flow* price increase associated with an additional year of tenure, so that $\varepsilon = \Delta p$.

Empirical implementation. The IV estimates reported in Sections 7.7.1 and 7.7.2 imply that renewal premiums increase on average by

$$\Delta p \equiv \frac{dp(\tau)}{d\tau} \approx 0.072 \times 394.6 \approx €28.4$$

per additional year of tenure. The corresponding increase in the probability of switching is 9.716 percentage points per year.

Under the switching rule $s(p) = G(p - p_0)$, these estimates identify the local slope of the switching-cost distribution at the prevailing margin:

$$\frac{ds}{dp} = g(\bar{c}) \quad \Rightarrow \quad g(\bar{c}) \approx \frac{ds/d\tau}{dp/d\tau} \approx \frac{0.09716}{28.4} \approx 0.00342.$$

Substituting these values into the Harberger-triangle approximation yields a per-consumer deadweight loss of

$$\mathrm{DWL}^{\mathrm{HT}} \approx \frac{1}{2} \cdot 0.00342 \cdot (28.4)^2 \approx €1.38$$

per additional year of tenure.

Interpretation. Following Einav, Finkelstein and Cullen (2010), this welfare measure should be interpreted as a conservative, second-order estimate of the *marginal* inefficiency generated by tenure-based repricing, conditional on the prevailing market environment. The calculation isolates the welfare cost associated with dynamic pricing power arising from switching frictions, holding fixed both the existing switching wedge and the degree of adverse selection. Adverse selection enters only insofar as it shapes the equilibrium price–tenure profile and therefore the magnitude of the incremental distortion being evaluated. The resulting deadweight losses should thus be interpreted as lower-bound estimates of the marginal cost of price walking, rather than as measures of total inefficiency in the market.

Aggregate implications. While modest at the individual level, the aggregate implications are non-negligible. With approximately 28.3 million insured vehicles in Italy, the implied annual deadweight loss from tenure-based repricing exceeds €39 million. This loss arises because equilibrium dynamic repricing induces additional switching, and the associated switching costs represent real resource waste rather than transfers.

Aggregation and external validity. The welfare calculations build on estimates obtained from the balanced panel and are therefore representative of incumbent insurer–consumer relationships, which account for the bulk of premium volume and insurer profits, rather than of the full population of contracts that includes more transient, high-churn policies. Scaling the per-contract deadweight loss to the stock of insured vehicles thus implicitly assumes that the relevant welfare margin operates primarily through continuing relationships.

Appendix B reports analogous estimates using the unbalanced panel, in which tenure is measured with greater noise but the full cross-section of contracts is retained. Although these estimates are less precise, they exhibit the same qualitative patterns in both pricing and switching. Taken together, these results suggest that the welfare figures reported in the main text should be interpreted as conservative lower-bound estimates of the costs associated with tenure-based pricing, rather than exact population-wide averages.

Relation to existing estimates. The magnitude of the estimated welfare losses is consistent with other evidence on frictional inefficiencies in insurance markets. For example, Einav, Finkelstein and Cullen (2010) document relatively small per-consumer welfare losses from adverse selection in U.S. employer-

sponsored health insurance, while Taylor (2003) emphasizes that teaser pricing in auto insurance can trigger inefficient churn. The present findings complement this evidence by showing that even when individual-level losses are modest, the aggregate burden of dynamic pricing distortions can be substantial in mandatory markets.

Policy implications. From a policy perspective, the distortion generated by price walking is conceptually distinct from static markups; it arises from the interaction between dynamic pricing and switching frictions, which induce inefficient churn. This makes tenure-based repricing a natural object of regulatory attention. Recent interventions—such as the UK Financial Conduct Authority's ban on price walking and EIOPA's concerns about fairness in European insurance markets—reflect this focus. However, restricting firms' ability to condition prices on tenure can also dampen competition or induce product proliferation, as shown by Gavazza et al. (2025). Blanket bans may therefore backfire unless carefully designed. Policies that enhance transparency, reduce switching costs, or facilitate consumer comparison may mitigate distortions while preserving competitive incentives.

9 Robustness

Non-linear pricing. To account for endogeneity in tenure while allowing for flexible non-linear effects, I implement a control-function (CF) approach following Wooldridge (2015). In the first stage, I estimate a Poisson model of tenure on the divestiture instruments and the full set of controls, and construct the residual

$$\hat{v}_{it} = \texttt{TEN}_{it} - \mathbb{E}[\texttt{TEN}_{it} \mid Z_{it}],$$

which captures unobserved, time-varying heterogeneity correlated with relationship length. In the second stage, I regress log premiums and switching probabilities on a full set of tenure dummies, augmenting the specification with $\hat{v}_{it}$ to purge endogenous variation in tenure.[10]

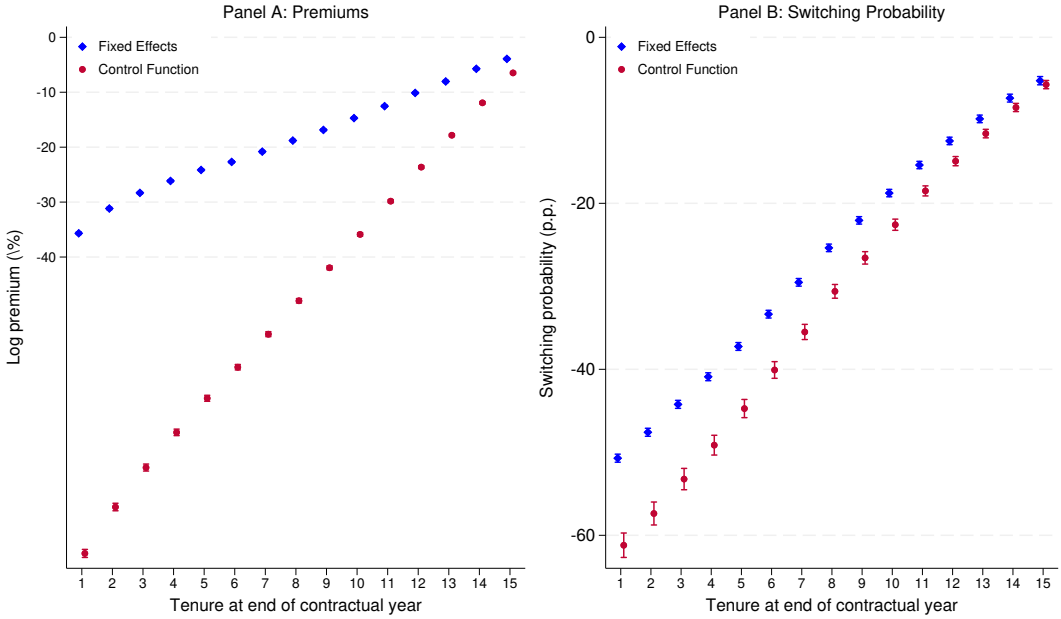
Figure 9 compares the estimated tenure profiles from fixed-effects (FE) and control-function (CF) specifications. In Panel A, the FE estimates for premiums display pronounced curvature, with steeper changes at short tenures. In Panel B, switching probabilities increase with tenure, but the FE profile again exhibits strong non-linearities, particularly early in the relationship. Once the CF correction is applied, the tenure profiles for both premiums and switching become substantially smoother and monotone, with patterns that are close to linear over most of the tenure range. Any remaining curvature is modest and

10. The control-function correction exploits the fact that tenure enters the model as a single endogenous scalar variable. The tenure dummies provide a flexible parameterization of this scalar regressor. Following Wooldridge (2015), identification requires a conditional mean restriction of the form $E[u_{it} \mid \texttt{TEN}_{it}, Z_{it}] = h(v_{it})$, which is approximated by a linear control in $\hat{v}_{it}$.

concentrated at very short or very long tenures.

These patterns suggest that much of the non-linearity observed in the FE tenure profiles reflects omitted time-varying factors—such as dynamic selection or insurer learning—rather than intrinsically non-linear pricing or switching rules. After accounting for this endogeneity, the CF-adjusted profiles reveal gradual, approximately linear increases in both premiums and switching probabilities with tenure, consistent with the stylized framework in Section A.A1, in which tenure evolves deterministically and exit decisions are driven by idiosyncratic switching costs.

Figure 9. : Relationship between Tenure and Premium/Switching: Fixed Effects vs. Control Function



Note: Each panel plots estimated tenure-dummy coefficients (relative to tenure ≥ 16) from fixed-effects (FE) and control-function (CF) specifications. The CF estimates include a control-function residual from a first-stage tenure equation to correct for endogeneity. All regressions include the full set of controls and fixed effects: insurer-by-year, contract, month×year, and province. The sample is a balanced panel of $N = 2{,}393{,}153$ contracts observed from 2013 to 2021.

Alternative tenure measure. As an additional robustness check, I re-estimate the IV specifications for premiums and switching using the administrative tenure measure (`TEN_ADMIN`) instead of the behavior-based measure (`TEN`) on the balanced panel. Using `TEN_ADMIN` yields smaller IV coefficients: the elasticity of premiums with respect to tenure is 0.038, and the corresponding equilibrium increase in switching probabilities is 4.47 percentage points per year. This difference is expected given the construction of `TEN_ADMIN`. Unlike `TEN`,

which is mechanically reset at the divestiture and tracks the effective length of the insurer–consumer relationship, `TEN_ADMIN` may imperfectly reflect relationship histories around the divestiture and across coverage gaps or earlier insurer transitions. As a result, the divestiture instrument maps less tightly into `TEN_ADMIN` than into the behavior-based tenure measure.[11]

10 Conclusion

This article provides new evidence on how insurers exploit tenure as a strategic lever in dynamic pricing. Leveraging a regulator-imposed divestiture as an exogenous shock to relationship length, I recover equilibrium pricing, switching, and markup schedules associated with tenure using contract-level data covering the entire Italian auto insurance market. The results show that price walking is a pervasive and economically meaningful feature of equilibrium pricing: premiums rise sharply with tenure, while switching probabilities also increase, indicating that consumers respond strategically to back-loaded price schedules rather than remaining passively locked in. Expected markups grow rapidly early in the relationship but eventually flatten as rising prices induce exit. While per-consumer welfare losses from inefficient switching are modest, substantial aggregate deadweight loss emerge, illustrating how small frictions can generate substantial misallocation in large mandatory markets.

A central contribution of the paper is to extend the analysis of tenure effects beyond labor markets—where a large literature dating back to the 1980s estimates wage–tenure profiles—to product markets, where analogous evidence has been largely absent. This paper is, to my knowledge, the first to estimate a premium–tenure relationship in an insurance market using market-wide data and quasi-experimental variation. By treating tenure as a state variable in equilibrium pricing rather than as a residual proxy for unobserved heterogeneity, the analysis brings the study of tenure effects into a canonical setting in industrial organization.

The findings also offer a distinct perspective relative to work emphasizing consumer inertia in insurance markets. Rather than attributing price walking primarily to inattention or passive behavior, the evidence here shows that switching probabilities increase precisely where tenure-based price increases are largest. Price walking and consumer exit therefore emerge as jointly determined equilibrium outcomes, even in a competitive and mandatory market, without requiring behavioral frictions or informational naivety.

11. Classical measurement error in an endogenous regressor does not in general attenuate IV estimates. The smaller coefficients obtained with `TEN_ADMIN` reflect the use of a noisier proxy for the relationship state shifted by the instrument, rather than mechanical attenuation of the IV estimand.

More broadly, the results highlight that economically large price walking can arise even in relatively simple pricing environments. In the Italian auto insurance market during the sample period, tenure-based repricing is already strong enough to undermine intertemporal consumption smoothing and induce inefficient churn, despite limited use of automated or data-intensive pricing technologies. This suggests that policy interventions aimed at improving transparency around renewal pricing, facilitating comparison at renewal, or limiting excessive back-loading may meaningfully affect welfare. As pricing technologies become more data-driven, understanding how dynamic pricing interacts with consumer switching and market equilibrium will be increasingly important for both regulators and researchers.

Mathematical Appendix

A1 Model of Dynamic Pricing with Loyalty and Selection

The purpose of this appendix is not to derive sharp sign predictions for all tenure effects, but to clarify the economic forces shaping tenure-based pricing and retention, and to characterize conditions under which price walking arises in equilibrium. The empirical analysis estimates the resulting equilibrium price–tenure and switching–tenure schedules directly.

The model represents a T-period extension of Taylor (2003) with endogenous selection on switching. Consider a market with N insurance firms competing à la Bertrand over a finite horizon of T periods. In each period, consumers decide whether to remain with their current insurer or switch to a competitor at the end of the contractual year. Let $\tau_t \geq 0$ denote the tenure of a consumer in period t, and let $\lambda(\tau)$ capture the relationship-specific ("loyalty") benefits associated with longer insurer–consumer relationships, with $\lambda'(\tau) > 0$.

The utility from remaining with insurer j is

$$U_{jt}(\tau) = v + \lambda(\tau) - p_{jt}(\tau),$$

while switching to insurer k yields

$$U_{kt}(0) = v + \lambda(0) - p^*_{kt}(0) - c,$$

where c is an idiosyncratic switching cost drawn from a distribution G with density g.

A consumer switches whenever

$$c < \big[p_{jt}(\tau) - p^*_{kt}(0)\big] - \big[\lambda(\tau) - \lambda(0)\big].$$

Switching margin. Throughout the analysis, it is convenient to define the *switching margin*

$$\Delta(\tau) := \big[p_{jt}(\tau) - p_{jt}(0)\big] - \big[\lambda(\tau) - \lambda(0)\big],$$

which summarizes the net incentive to switch induced by renewal pricing and loyalty accumulation. A consumer with switching cost c remains with the incumbent insurer if and only if $c \geq \Delta(\tau)$, implying a retention probability:[12]

$$r(\tau) = 1 - G(\Delta(\tau)), \qquad s(\tau) = G(\Delta(\tau)).$$

Heterogeneity and selection on exit. Consumers differ in expected claims costs. Let $\theta \in [\underline{\theta}, \overline{\theta}]$ denote the consumer's privately known expected cost, distributed according to $H(\theta \mid \tau)$ conditional on tenure. Insurers observe tenure but not θ and set prices accordingly. Switching costs are drawn from a distribution $G(c \mid \theta)$ that may depend on risk type.

ASSUMPTION 1 (Selection on Switching): *The switching-cost CDF $G(c \mid \theta)$ is strictly monotone in θ in the sense of first-order stochastic dominance.*

When higher-risk consumers are more likely to switch, selection on exit is adverse; when lower-risk consumers are more likely to switch, selection is advantageous.

Let

$$c(\tau) := \mathbb{E}[\theta \mid \tau]$$

denote the expected claims cost of consumers with tenure τ.

LEMMA 1 (Selection and Expected Costs): *Under Assumption 1, expected claims costs $c(\tau)$ are weakly monotone in tenure. In particular, $c'(\tau) \leq 0$ under adverse selection and $c'(\tau) \geq 0$ under advantageous selection.*

Proof Standard dynamic selection arguments imply that the conditional distribution $H(\theta \mid \tau)$ shifts toward types that are less likely to exit as tenure increases. The direction of the shift depends on whether higher- or lower-risk consumers face lower switching costs. Taking expectations yields the stated monotonicity of $c(\tau)$. ■

Static pricing problem. Fix tenure τ. The probability that a customer remains with the insurer when offered renewal premium p is

$$r(p, \tau) = 1 - G(p - \lambda(\tau)),$$

12. More generally, the consumer compares the incumbent's renewal price $p_{jt}(\tau)$ to the best outside offer $p^*_{kt}(0)$ available from competing insurers, and the relevant switching condition is

$$c \geq [p_{jt}(\tau) - p^*_{kt}(0)] - [\lambda(\tau) - \lambda(0)].$$

Throughout, $p_{jt}(0)$ is used as a reference outside price for notational convenience. Any constant difference between $p^*_{kt}(0)$ and $p_{jt}(0)$ can be absorbed into the definition of the switching-cost distribution $G(\cdot)$ (or, equivalently, into the normalization of $\Delta(\tau)$) without affecting behavioral or pricing implications. No assumption of identical new-customer prices across firms is required.

so that $r_p(p,\tau) = -g(p-\lambda(\tau)) < 0$ and $r_\tau(p,\tau) = g(p-\lambda(\tau))\,\lambda'(\tau) > 0$. The insurer's per-customer profit is

$$\Pi(p,\tau) = \big[1 - G(p-\lambda(\tau))\big]\,(p - c(\tau)).$$

First-order condition. Let $x \equiv p - \lambda(\tau)$. Differentiating $\Pi(p,\tau)$ with respect to p yields

$$\frac{\partial \Pi}{\partial p} = 1 - G(x) - g(x)\,(p - c(\tau)).$$

Hence the optimal renewal premium $p(\tau)$ satisfies

$$F(p,\tau) \equiv 1 - G(x) - g(x)\,(p - c(\tau)) = 0. \tag{A1}$$

Concavity and uniqueness. A sufficient condition for strict concavity of $\Pi(\cdot,\tau)$ is that the switching-cost distribution has an *increasing hazard rate* (IFR), i.e.,

$$h(x) \equiv \frac{g(x)}{1 - G(x)} \quad \text{is weakly increasing in } x.$$

Under IFR, the solution to A1 is unique for each τ.

PROPOSITION 2 (Tenure-Based Pricing with Loyalty and Selection): *Assume $\lambda'(\tau) > 0$ and an increasing hazard rate. Then:*

*(i) (*Advantageous selection*) If $c'(\tau) \geq 0$, the insurer's optimal renewal premium $p(\tau)$ is strictly increasing in tenure.*

*(ii) (*Adverse selection*) If $c'(\tau) \leq 0$, the sign of $dp(\tau)/d\tau$ is in general ambiguous. Rising loyalty exerts upward pressure on renewal prices, while selection on exit exerts downward pressure.*

Proof The first-order condition A1 can be rewritten as the fixed-point equation

$$p(\tau) = \Phi(p,\tau) \equiv c(\tau) + \frac{1}{h(p-\lambda(\tau))}.$$

Under IFR,

$$\frac{\partial \Phi(p,\tau)}{\partial p} = -\frac{h'(p-\lambda(\tau))}{h(p-\lambda(\tau))^2} \leq 0,$$

so the fixed point is unique.

An increase in tenure affects $\Phi(p,\tau)$ through two opposing channels. Rising loyalty ($\lambda'(\tau) > 0$) lowers the switching index $p - \lambda(\tau)$ and shifts $\Phi(p,\tau)$ upward. Changes in expected costs shift $\Phi(p,\tau)$ upward when $c'(\tau) \geq 0$ and downward when $c'(\tau) \leq 0$. The result follows. ■

Dynamic extension. For periods $t < T$, the insurer's continuation value satisfies

$$V_t(\tau) = \max_{p_t(\tau)} \Big\{ \int \big(1 - G(p_t(\tau) - \lambda(\tau))\big)\,(p_t(\tau) - \theta)\,dH(\theta \mid \tau) + \beta\,\big(1 - G(p_t(\tau) - \lambda(\tau))\big)\,V_{t+1}(\tau + 1) \Big\}$$

The per-period pricing problem has the same structure as the static case, with an effective marginal cost

$$\tilde{c}_t(\tau) \equiv \theta - \beta V_{t+1}(\tau + 1).$$

The same forces operate dynamically: rising loyalty relaxes the retention constraint, while selection affects expected costs. Under advantageous selection, optimal renewal prices increase with tenure period by period; under adverse selection, the net effect is ambiguous and must be resolved empirically.

Estimates using the full (unbalanced) panel

Data details

The variables used in the regression analysis are:

- premium (in euros): yearly premium paid for the third-party liability insurance
- Age groups: [18;25), [25;34), [35;44), [45;60), and ≥ 60 (the omitted category).
- dummies for the number of accidents at fault over the past five years reported on the driving record ("*Attestato di Rischio*")
- dummies for the bonus-malus class (1-18)
- man: indicator for whether the subscriber is a male
- clauses
  - installment frequency: dummy variables for payment in one installment and two installments. Contracts paid in three or four installments are grouped in the omitted category. No installment frequencies above four are observed in the data.
  - repair: indicator taking value one if the clause "*risarcimento in forma specifica*" is active. The clause establishes that if an accident not at fault occurs, the vehicle has to be repaired by a specified list of body shops

  - black box indicator for whether a device able to record a variety of driving behaviors (e.g., km driven and whether there has been a "crash"), has been installed and guarantees a reduction of the base premium.
  - driving clauses condition indemnities on the identity of the driver. There are four mutually exclusive alternatives:
    * free driving: dummy taking value one if there is no restriction on the driver's identity
    * expert driving: a dummy equal to one if the contract restricts driving to individuals with a minimum level of driving experience (typically defined in terms of age and/or years since license issuance), but allows multiple eligible drivers.
    * exclusive driving: a dummy equal to one if the contract restricts driving to a single named driver, who must satisfy the insurer's experience requirements.
    * Other: a residual category capturing alternative driving clauses (e.g., family-only or household-only driving). The omitted category in regressions is
  - protected bonus: dummy taking value one if the so called "*bonus protetto*" clause is active. Such a clause reduces/eliminates accident penalties

- increasing clause: a dummy equal to one if the contract includes unreported clauses that increase the premium.

- decreasing clause: a dummy equal to one if the contract includes unreported clauses that reduce the premium.

- coverage (in million euros): upper liability limit on the amount the company will pay for accidents at fault. The insured driver is responsible if the damage exceeds the specified liability limit

- min coverage: indicator taking value one if the coverage equals the minimum mandatory liability limit of 6 million (1 million for property damage and 5 million for health damage)

- corporate discount indicator

- car's characteristics:
  - Petrol and diesel dummies for whether the fuel supply is diesel or petrol, respectively. The omitted category is other types of fuel supply.
  - car's age: year of registry of the vehicle

  - cc: engine displacement, measured in hundreds of cubic centimeters (i.e., cubic centimeters divided by 100). The variable therefore ranges from 1 to 100. For estimation, I construct dummy variables for the following categories: [1,10), [10,12), [12,13), [13,15), [15,22), and [22,100], with [1,10) as the omitted category.
  - power of the vehicle (in KW) ranging from 1 to 585
- macro-regions dummies: North-East, North-West, Center, South, Islands
- province dummies[13]
- medium/small city indicator (large city is the omitted category)

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