Journal of Business Research 65 (2012) 968–976

Contents lists available at ScienceDirect

Journal of Business Research

Dynamic pricing in regulated automobile insurance markets with heterogeneous insurers: Strategies nice versus nasty for customers☆

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ARTICLE INFO

Article history:
Received 1 August 2010
Received in revised form 1 March 2011
Accepted 1 April 2011
Available online 26 May 2011

Keywords:
Pricing strategy
Automobile insurance
Claim coefficient
Multi-period contract
Nice
Nasty
Customers

ABSTRACT

This study examines a phenomenon in one nation's automobile insurance market where insurers adopt diverse pricing strategies in this regulated industry that does not allow for such diversions—a homogeneous, insurance industry in which a government authority sets the official pricing formula as well as all of the rating factors. Insurers use a claim coefficient that reflects previous claim records of policyholder as an implicit pricing tool to over/under charge new and repeat customers. The aim here is not so much to blow-the-whistle on pricing practices that violate regulations but to describe execution details of the practices and their outcomes. The results show that firm-level, systematic, price variances that occur differ from prices that follow from applying regulated individual-claim coefficients. Based on the unique firm-level pricing strategies, this study finds that some insurers are more nice to new customers and nasty to repeat customers to increase market shares while other insurers earn high profits by being nasty to repeat customers. The assumption that a behavioral primacy effect may exist in the market may guide some firms' pricing strategies.

1. Introduction

Traditional studies recognize that price dispersion for a homogeneous product can be an equilibrium outcome, in which consumers play the key role in decision-making depending on search cost (Burdett & Judd, 1983; Carlson & McAfee, 1983; Rob, 1985). Price dispersion reflects complexity when applied to insurance market where repeated purchasing behavior is present and multi-period contracts are common (Berger et al., 1989; Dahlby and West, 1986; Schlesinger & Schulenburg, 1991; and Seog, 2002). However, if the government adopts price regulation, price dispersion for the same type of insurance policy is supposed to vanish.

This study analyzes a phenomenon which is contrary to the above rationale that despite government authority setting the official pricing formula, as well as all of the rating factors, insurers adopt diverse pricing strategies in an automobile insurance market. In such a regulated market, consumers subjectively believe that the rating methods are the same for all insurers as no differences in premiums are supposed to occur for consumers purchasing automobile insurance across the specific insurers.

Therefore, the search cost for the customer is zero as searching for lower offer is not necessary. However, as this study shows, insurers might under/over charge new/repeat customers by implicitly revising one key element in the official rating formula, the claim coefficient, which reflects the accumulated claim records of policyholder in the previous three years.

Based on the official pricing formula and regulations (detailed later), all else being equal, those who have more claims in the accumulating period should receive higher claim coefficient in the next year and pay a higher premium. Due to competition, as well as pricing strategy, insurers might not adjust the insured's claim coefficients accordingly. For example, insurers might treat policyholder nicely by hesitantly increasing premium in terms of higher claim coefficient of the policyholder. Alternatively, insurers might treat policyholder nastily by overcharging, such as not giving the premium bonus deserved when no claims are filed in the previous policy period.

The sustainability of different pricing strategies in a regulated insurance market is due to one-way information asymmetry between the insured and insurers. In this highly regulated market, insurers can share histories of previous claims of each individual from authority's intranet website while consumers do not know the implicit pricing strategy of each insurer.

☆ Financial support from National Science Council, Taiwan, ROC (grant no. 98-2410-H-035 -024 -MY2) is gratefully acknowledged.
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doi:10.1016/j.jbusres.2011.04.015

This study shows that different pricing strategies are associated with likely firm objectives that focus on profits versus market share. Based on the empirical results, this paper explains the rationale behind the findings in terms of marketing and pricing theory. One strategic pricing theory, the behavioral primacy effect (i.e., the influence of behavioral endowment effect; Thaler, 1980), fits the explanation that customers tend to repeat-buy the initial brand that they purchased more often than other brands when their use of the first brand is favorable given the same purchasing environment (Woodside & Uncles, 2005). Thus, some firms may adopt initial low-price strategies that can increase the probability of new customers trying their products and then increase their prices after these new customers return-to-buy a second time or in later time periods.

In addition, from the "memory-based process" argument of imprinting theory (first experience without considering alternative options), most customers remember their best experience from the first purchase. By applying the above theories to the automobile insurance market, it insurers would undercharge for premiums to gain the satisfaction of new customers.

However, when the insured renews the contract, the insurer may not decrease the premium that should follow from a good driving record (no claims) when offering such a bonus is standard practice in the insurance market. Not offering the bonus reflects a higher premium than should be applicable for the repeat buyers; insurers applying such a strategy may expect that most repeat buyers are insensitive to the overcharge. In other words, the insurance company can earn excess profit from long-term high-premium contracts to subsidize the losses from short-term low-premium contracts.

Kocas and Bohlmann (2008) stress that several empirical findings about pricing strategies remain puzzling; for example, within the same market, some small retailers decide to discount deeply, whereas others forgo the price-sensitive switchers and price high. Theory and research that explain such strategies are helpful. The present article demonstrates that pricing variations counter to regulation requirements do occur across firms for a homogenous product in a highly regulated market and provides explanations for their occurrence. In addition, the findings of this paper highlight the incapability of consumers to judge the fairness of insurance premiums which is similar to the findings of Shapira and Venezia (2008) in that amateurs (versus professionals) tend to buy too much insurance (low deductible) due to the lack of ability to select a better deal.

Prior studies describe linkages from relative firm size to customer retention rates and profitability (McGahan & Ghemawat, 1994). The findings of the present study provide alternative views in that, in addition to market share, different pricing policies (nice versus nasty) differ in the abilities to attract customers and increase profits.

Following the identification of the topic and literature review in Section 1, Section 2 describes the rating system and pricing of insurance premiums in a highly-regulated market. Section 3 formally states hypotheses that follow from the literature review. Section 4 describes the data to test the hypotheses. Section 5 presents the analyses of the data. Section 6 discusses the findings and offers limitations and conclusions.

2. The rating system for vehicle damage insurance in Taiwan

In Taiwan, the automobile insurance market has free entry but is under highly regulated. In addition to the insurance companies, various kinds of agents and providers play major roles in this market (Bourgeon et al., 2008). Insurance authorities set up the standard pricing formulas and base premiums. All insurers follow the official formulas to determine the premium of individual policy based on the specific characteristics of each policyholder. It is worth noting that the regulation focuses on the formula itself, not the final premium. The consequence is that insurers have some discrepancy to use the detailed rating factors. The official rating formula to calculate vehicle damage coverage premiums for all of the policy options is as follows:

$$P = B \times M \times C \tag{1}$$

P denotes the actual premium, $B$is the basic premium (including unified loading), M and C are the manufacture coefficient and the insured coefficient, respectively. In addition, the insured coefficient involves a gender–age coefficient and a claim coefficient.

In Eq. (1), the basic premium varies according to the different coverage types. Authority provides the detail of manufacture coefficient, which relates with vehicle type and age, reflecting the car value or replacement cost. In general, new or expensive cars versus old and inexpensive cars have higher manufacture coefficients.

The calculation of insured coefficient is as follows:

$$\text{insured coefficient} = \text{gender}-\text{age coefficient} + \text{claim coefficient} \tag{2}$$

where the first factor represents immutable characteristics (primarily gender and age) and the second factor reflects driving records. Younger persons have a higher rating coefficient than older persons; men have a higher gender–age coefficient than women. See Table 1.

The claim coefficient comes from the conversion of cumulative claim point, which is the sum of no-claim point and claim point in the past three years. That is,

$$\begin{aligned}\text{Cumulative Claim Point} = {} & \text{Non}-\text{claim Years Point} \\ & + \text{Claim Frequencies Point}\end{aligned} \tag{3}$$

where "Non-claim Years Point" decreases 1 for each no claim year and "Claim Frequencies Point" increases 1 for each additional claim except for the first claim in a policy year. Multiplying the cumulative claim point by 0.2 provides the claim coefficient. All insurers share the same information about claim coefficients of the insured. Claim size plays no role in the rating formula.

Intuitively, the formula to calculate the claim coefficient appears to be complex. The insured customers are usually unable to clearly remember the claim frequency of the past three years. They might have difficulty realizing or be insensitive to how the claim number results in the changes in premium, creating a kind of information asymmetry. Therefore, some insurers may believe that they have an incentive to adopt the pricing strategy of not adjusting the claim coefficient regardless of whether claims are made or not, by believing such a strategy is highly profitable. Under this situation, the high-risk policyholders are better off but low-risk policyholders are worse off.

Customers who stay with the same insurer for many years tend to be low risk with fewer claims and insurers usually earn more profit from long term customers (Cohen, 2008). Thus, a pricing strategy by adjusting the claim coefficients systematically can serve as a competition tool for attracting new customers and discriminating against long term customers who might simply be persistent in the same insurance contract without switching. This study attempts to verify that some firms actually implement this pricing strategy—nice to new customers and nasty to repeat customers.

Table 1
Gender–age coefficients.

Age	Male	Female
Under 20	1.89	1.70
20 or above but under 25	1.74	1.57
25 or above but under 30	1.15	1.04
30 or above but under 60	1.00	0.90
60 or above but under 70	1.07	0.96
70 or above	1.07	0.96

Source: Automobile insurance rating standard. Taipei: non-life insurance association of the R.O.C. (2002).

3. Hypotheses

Based on the above conjectures, this study creates and tests the following hypotheses. H_1: Specific pricing strategy "nasty" (charging higher prices than the regulated prices call for) to customers may be more profitable than pricing strategy "nice" (charging lower prices than the regulated prices call for) to customers. H_2: Firms which implement pricing strategy nice to both new and repeat customers have higher market shares than firms implementing different pricing strategies—some repeat customers do become aware of such a pricing strategy and start to gravitate to firms offering lower prices. H_3: Firms nasty to both new and repeat customers have the lowest profits and market shares—customers gravitate away from firms consistently offering high prices.

H_{4a}: Insurers differ systematically in their implemented pricing strategies by customers' ages—some firms are particularly nastier versus nicer to young and old customers more so than middle-aged customers while other firms follow the government regulations relating to setting premiums by age. The rationales are: insurers differ in the importance they place on age in setting premiums—some firms seek young customers more than others by offering low premiums in an attempt to boost market shares. Other firms systematically may follow the regulation for setting premiums for young customers to discourage their purchase to achieve high profits (Li et al., 2010).

H_{4b}: Firms that implement unique pricing strategies by age have the highest profits and market shares. Such age-unique strategies respond to customers who are most likely to be price sensitive—middle-aged customers. Middle-aged customers are more likely to shop around for low prices while young and old customers are happier to just be able to receive insurance coverage.

4. Data

This study uses a unique dynamic data set of individual automobile vehicle damage insurance policy and claim data for the policy years 2004 to 2006 from the Taiwan Insurance Institute, a semi-official organization responsible for collecting insurance statistics and financial data for insurers. The data include complete car insurance information from insurers, including characteristics of policyholders, vehicles, claim coefficient, claim drivers, claim frequency, claim amount, and contract details.

To examine the strategy of claim coefficient adjustment for the insurer, this study analyzes the data of the insured purchasing the major policy type, comprehensive coverage without deductible, for the first time with new cars in the 2004 policy year (105,125 policies in total) and traces the claim records and claim coefficients assigned by the insurers in the period 2004–2006. Since the insured usually buy no vehicle damage insurance after owning a new car for one or two years, or switch insurance policy types in the subsequent years, the total samples is dramatically reduced and the insurance policy can be any one of the above four types. In the 2006 policy year, 26,495 policies remain, forming the basis of analysis in this study.

To have an equal standard to compare the pricing strategies among the insurers, this study sets up the 2006 policy year as the benchmark and constructs three samples as follows. Sample Y1 includes customers who have only one year of a contract with the insurer in 2006 policy year, indicating that they switch to different insurer at the end of 2005, as the dotted lines in Fig. 1 show.

Sample Y2 consists of the insured that stay with the same insurer for two years up to 2006 (included), such as the contracting policy years from 2005 to 2006 or 2004 to 2006. Dashed lines in Fig. 2 describe this case. (Sample Y2 does not include those who stay with the same insurer in 2004 and 2005 policy years but switch to another insurer in 2006. Instead, they are in sample Y1 as the benchmark of comparison is the premium in 2006.)

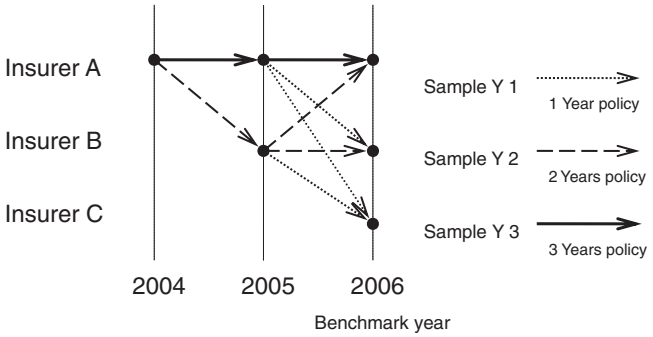

Fig. 1. Illustration of sample policies comparisons.

Sample Y3 includes those who have three years of contracts with the same insurer from 2004 to 2006 policy years, as the straight lines in Fig. 1 show. In this sample, the insured sticks with the same insurer without switching.

Based on the above setting, this analysis treats sample Y1 as a short term relation, while samples Y2 and Y3 are a long term relation. Table 2 lists the data of policy distribution for the top ten insurers ranked by sales of policy for new cars in the 2004 policy year that includes approximately 90% of the total market shares. The four-firm concentration ratio (C4) is close to 50%, implying that the concentration ratio of automobile insurance market in Taiwan is very high. In general, renewed contracts account for only one half of the vehicle damage insurance market.

In addition, those who renewed might also switch the types of coverage. Table 2 also indicates that the rankings of market shares of the policies among insurers are almost the same for each insurer for both short-term and long-term contracts.

5. Analysis

This section includes findings from several empirical tests. The first is to investigate whether a difference exists between actual claim coefficient recorded in the data set and ruled claim coefficient derived from the official formula. Second, the major target is to compute the consumer niceness index (CNI) for each insurer from the value that is the difference between number of under-adjusted policies and the number of over-adjusted policies over the total policies. After the calculation of the operating performance for each insurer, the final

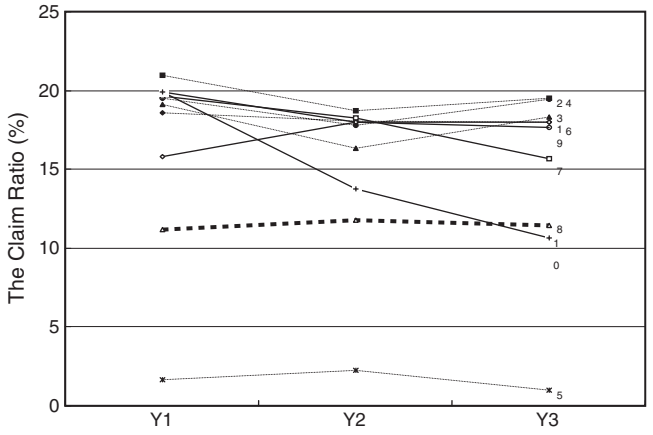

Fig. 2. The claim ratio for insurers by contract relation, 2006 policy year.

Table 2
Policies distributed by company and contract years.

Insurer	2004 policy year (comprehensive policy)		2006 policy year (all types of coverage)			
	n = 105,125	Market share (%)	n = 26,495	Short term	Long term	
				Y1 (2006)	Y2 (2005–2006) (2004,2006)	Y3 (2004–2006)
1	14,740	14	4,969	1,201	1,603	2,165
2	14,529	13.8	3,020	606	758	1656
3	13,365	12.7	2,872	632	752	1488
4	9,436	8.9	2,291	743	623	925
5	9,109	8.7	1,691	482	493	716
6	8,601	8.2	1,685	449	501	735
7	7,646	7.3	1,584	590	526	466
8	6,063	5.8	1,919	678	619	622
9	5,348	5.1	1,467	502	484	481
10	3,814	3.6	659	256	262	141
Others	12,474	11.9	4,338	1,528	1,737	1,073

Source: Original data from analysis of Taiwan Insurance Institute records.

analysis examines the relationship between the insurer's strategy and the operating performance.

5.1. Actual claim versus ruled claim coefficients

To obtain the accurate claim coefficient for each policyholder, this study selects the automobile insurance policies sold in 2004 for those purchasing a new car and without previous claims. Based on the official formula in Eq. (3), Table 3 shows all possible ruled claim coefficients based on the distribution of the dataset.

In Table 3, starting from 2004, all samples are the first time buyers of new cars and automobile insurance. The claim coefficients are all zero (column 1). Column 2 displays the possible number of claims in 2004. Column 3 shows the value of claim coefficients corresponding to number of claims in column 2. Column 4 shows the possible number of claims in 2005, based on the first year's (2004) claim experience in column 2. Column 5 indicates the accurate claims coefficient that the insurers should use in 2006 based on the accumulated number of claims in 2004–2005.

Based on all of the cases in Table 3, having the same claim coefficients for two years is possible (from 2004 to 2005 or 2004 to 2006) whereas having the same claim coefficients for three years is impossible (2004–2006). For example, if the insured incurs only one claim after obtaining policy in 2004, no change occurs in claim coefficient in 2005. On the other hand, one additional claim in 2005 should result in a 0.2 increase in claim coefficient which is equivalent to the case with three claims in 2004 and no claim in 2005. Another case is that the insured has no claim in 2004 but has two claims in 2005. Then, the claim coefficients are equal for 2004 and 2006.

Table 3
All possible ruled claim coefficients, 2004–2006.

2004		2005		2006
(1)	(2)	(3)	(4)	(5)
Claim coefficients	Claim frequencies	Claim coefficients	Claim frequencies	Claim coefficients
0	0	−0.2	0	−0.4
			1	−0.2
			2	0
			3	0.2
	1	0	0	−0.2
			1	0.2
			2	0.4
			3	0.6
	2	0.2	0	0
			1	0.4
			2	0.6
			3	0.8
	3	0.4	0	0.2
			1	0.6
			2	0.8
			3	1.0

Therefore, for most of the cases, insurers should adjust the actual claim coefficient every year whether or not the insured has incurred an accident in the past three years. For the policy without claim, the insured should receive lower actual claim coefficient and gain the benefit of the deduction of the premium. On the contrary, for the claimed policy, the actual claim coefficient should be higher resulting in premium increase. The major research objective is to estimate the "ruled claim coefficient" derived by the official formula and to examine the actual claim coefficient recorded in the data set corresponding to each insured by contract relation with insurers.

To test whether or not the actual claim coefficient recorded in the data set is different from ruled claim coefficient, this study divides all of the policies into three categories. First, if the actual claim coefficient is equal to the ruled claim coefficient, then the policy is a "correctly adjusted" policy. Second, "over adjusted" ("under adjusted") policy means that the actual claim coefficient is higher than (lower than) the ruled claim coefficient. Thus, for the under adjusted situation, the premium will be lower which is advantageous to the consumer and for the over adjusted situation, the premium will be higher which is disadvantageous to the consumer.

Table 4 shows the policy distribution of adjusted record by company and contract years for policies purchased in 2006 policy year. The highest value of the ratio of correctly adjusted policies increases over time. For example, the highest ratios for samples Y1, Y2, and Y3 are around 50% (insurer 3), 65% (insurer 10), and 70% (insurer 7), respectively, as Table 4 shows. The highest values of the ratio of over-adjusted policies also increase during the three policy years from 59% (insurer 4) in Y1, to 66% (insurer 4) in Y2 and 69% in Y3 (insurer 5).

Fig. 2 shows the claim ratio of the insurer by contract relation. On average, the claim ratio ranges around 15% to 20% for most insurers. Compared to other insurers, two insurers (insurer 8 and insurer 10) appear to be nicer to customers due to lower claim ratio of around 15% to 20%. For insurer 5, the claim ratio is extremely low (around 2%). Fig. 3 displays the tendency of correctly-adjusted policies which is an increasing ratio over time. Only a few insurers (insurers 4, 5 and 8) reveal the opposite direction.

The findings from Figs. 2 and 3 imply that the longer the relationship with the same insurer, the more likely the acquisition of accurate records that reflect the customers' true risk. Fig. 4 presents the ratio of over-adjusted policies among insurers by contract years. A

Table 4
Policy distribution of claim coefficient adjustment by company, 2006.

Insurer	Total n = 26495	Y1 $n_1 = 6139$				Y2 $n_2 = 6621$				Y3 $n_3 = 9395$			
		N_1	Correct	Over	Under	N_2	Correct	Over	Under	N_3	Correct	Over	Under
			%	%	%		%	%	%		%	%	%
1	4969	1201	511	216	474	1603	750	141	712	2165	1402	53	710
			43%	18%	39%		47%	9%	44%		65%	2%	33%
2	3020	606	242	119	245	758	331	97	330	1656	916	40	700
			40%	20%	40%		44%	13%	44%		55%	2%	42%
3	2872	632	310	132	190	752	350	93	309	1488	895	46	547
			49%	21%	30%		47%	12%	41%		60%	3%	37%
4	2291	743	195	435	113	623	137	413	73	925	178	591	156
			26%	59%	15%		22%	66%	12%		19%	64%	17%
5	1691	482	196	85	201	493	252	185	56	716	220	496	0
			41%	18%	42%		51%	38%	11%		31%	69%	0%
6	1685	449	168	80	201	501	198	37	266	735	460	22	253
			37%	18%	45%		40%	7%	53%		63%	3%	34%
7	1582	590	268	138	184	526	283	57	186	466	328	14	124
			45%	23%	31%		54%	11%	35%		70%	3%	27%
8	1919	678	213	230	235	619	207	318	94	622	182	412	28
			31%	34%	35%		33%	51%	15%		29%	66%	5%
9	1467	502	206	89	207	484	190	91	203	481	230	14	237
			41%	18%	41%		39%	19%	42%		48%	3%	49%
10	659	256	112	46	98	262	170	31	61	141	97	34	10
			44%	18%	38%		65%	12%	23%		69%	24%	7%

negative relationship exists between the ratio of correctly-adjusted policies and the ratio of over-adjusted policies for four insurers with around 50% of the market share.

Therefore, the decreasing trend in Fig. 3 reflects the increasing trend in Fig. 4 for over-adjusted policies over time. For the trend of the ratio of under-adjusted policies, the ratio of short-term contract for most of the insurers is within the range of 30% to 40%, while for long-term contracts, the variance becomes larger, around 10% to 45% for Y2 and around 0% to 50% for Y3, as Fig. 5 shows.

5.2. Measuring the consumer niceness index (CNI)

To understand the general trend in Table 4 and by taking into account the three types of claim coefficient adjustment patterns, this article derives two quantity indexes which can reflect the degree of niceness to customers by insurers.

The first formula is Absolute Consumer Niceness Index (CNI_A):

$$CNI_A = \frac{(Nice_n - Nasty_n)}{N} \quad (4)$$

where $Nice_n$ = number of customers receiving premiums lower than the regulation premium; $Nasty_n$ = number of customers receiving premiums higher than the regulation premium with the minimum value equal to 1.0; and N = total customers receiving policies. Equation (4) indicates that when the number of under adjusted policies (customers receiving premiums lower than the regulation premium) is greater than the number of over adjusted policies (customers receiving premiums higher than the regulation premium), the CNI_A will be positive.

Conversely, when the number of under adjusted policies is less than the number of over adjusted policies, the CNI_A becomes negative. Therefore, a positive (negative) CNI_A implies that the insurer treats customers nicely (nastily) overall. Columns (2)–(5) in Table 5 illustrate the CNI_A by insurer and contract relation which shows that for one year contract (Y1) in column (2), the CNI_A is positive for all insurers except one (insurer 4). The positive evidence indicates that most insurers are friendly to their new customers. However, for the long-term contract (Y2 or Y3), more insurers have negative values of CNI_A. For example, there are three and four insurers for Y2 and Y3 contracts revealing negative CNI_A, respectively.

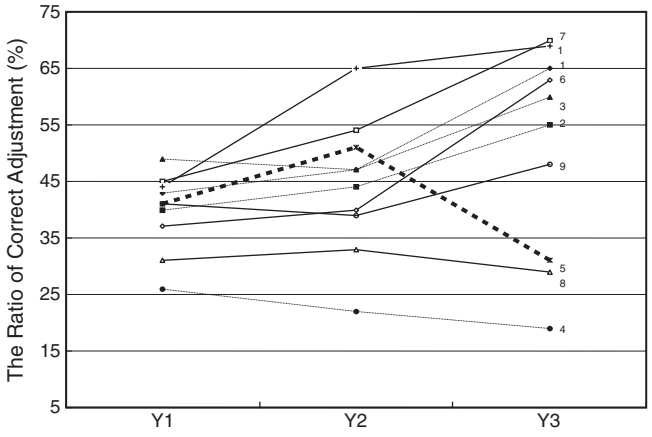

Fig. 3. The ratio of "Correct Adjustment" policies for insurers (firms 1–10).

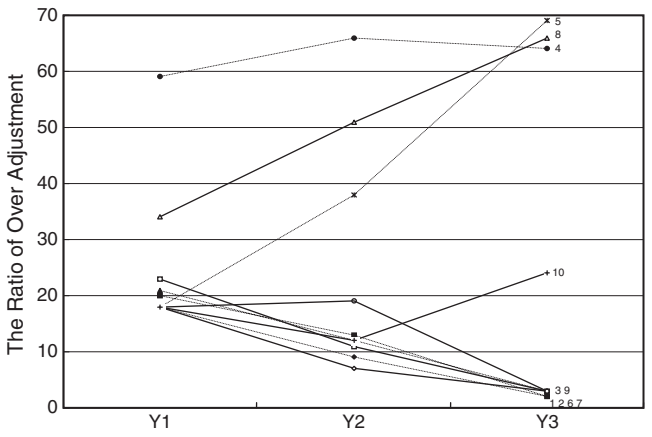

Fig. 4. The ratio of "over adjustment" policies for insurers (firms 1–10).

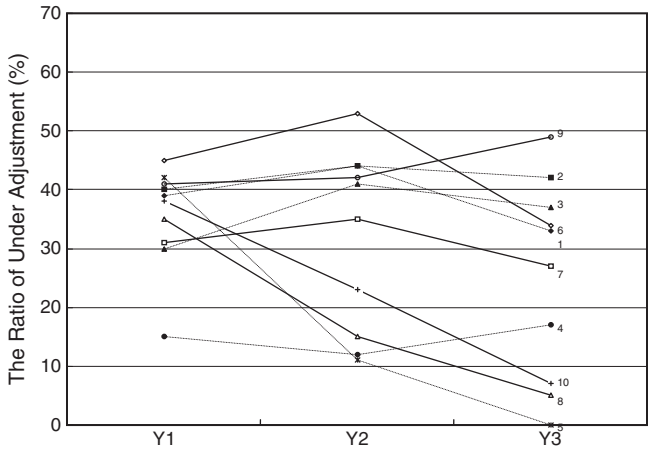

Fig. 5. the ratio of "under adjustment" policies for insurers (firms 1–10).

Table 5
Absolute and relative Customer Nice Indexes by company and contract years, 2006 policy year.

(1) Insurer	CNI_A			CNI_R			(8) Strategy
	(2) Y1	(3) Y2	(4) Y3	(5) Y1	(6) Y2	(7) Y3	
1	0.21	0.36	0.30	2.19	5.05	13.40	A
2	0.21	0.17	0.40	2.06	3.40	17.50	A
3	0.09	0.29	0.34	1.44	3.32	11.89	A
4	−0.43	−0.55	−0.47	0.25	0.18	0.26	D
5	0.24	−0.26	−0.69	2.36	0.30	0.002	C
6	0.27	0.46	0.31	2.51	7.19	11.50	A
7	0.08	0.25	0.24	1.33	3.26	8.86	A
8	0.01	−0.36	−0.62	1.02	0.30	0.07	C
9	0.24	0.23	0.46	2.33	2.23	16.93	A
10	0.2	0.08	−0.17	2.13	1.97	0.29	B

Note: $CNI_A = \frac{Nice_n - Nasty_n}{N}$ is Absolute Consumer Niceness Index.
$CNI_R = \frac{Nice_n / N}{Nasty_n / N}$ is Relative Consumer Niceness Index.

As absolute difference scores do not account for the relative size on over/under charge (see Teas 1993, 1994 for theoretical and practical problems in using difference scores), the analysis also uses a second formula to compute net firm-level stance toward nice and nasty as equation (5) shows (Fahey et al., 1995).

$$CNI_R = \frac{(Nice_N / N)}{(Nasty_N / N)}. \quad (5)$$

The CNI_R in equation (5) maintains a positive ratio and is less than 1 when the number of nice cases is smaller than that of nasty cases. The CNI_R index is greater than 1 when nice cases are more than the nasty ones. A direct linkage exists between absolute and relative consumer niceness indexes in that positive CNI_A implies that $CNI_R > 1$ and negative CNI_A corresponds to $CNI_R < 1$.

Columns (5)–(7) in Table 5 show the results of calculation of CNI_R. For insurers 1, 2, 3, 6 and 7, CNI_R values increase with contract years, representing that these insurers are more likely to be nice to long-term customers. However, some insurers (insurers 5 and 8) show reverse trend and with increasing nastiness in association with increased contract years.

5.3. Pricing strategy and contractual relations

To further analyze the interaction among the price strategies, contract relation, and the operating performance of the insurer, this study establishes four possible price-relation marketing strategies based on the data distribution: Type A, insurers adopt niceness strategy for all years, therefore the consumers benefit both in the short term (Y1) and long term (Y2 and Y3); Type B, the pricing strategies of the insurers are nice, nice, and nasty, the consumers benefit in Y1 and Y2 but not in the long-term Y3; Type C, the pricing policies are nice, nasty, nasty; and Type D, insurers are nasty for all years and the consumers do not benefit in the long or the short term. Other possible strategies do not occur. Columns (1) to (5) in Table 6 show the distribution of insurers in terms of pricing strategy.

Table 6
Insurer's strategy, CNI, Gross Profit Ratio (GPR) and market share, 2006 policy year.

(1) Strategy type	All customer relationship			(5) Insurer	(6) GPR	Market share (%) (7) All policies	(8) Comprehensive policy
	Short term (2) Y1	Long term (3) Y2	(4) Y3				
				1	0.63	14.0	15.2
				2	0.59	11.9	14.1
A Nice for all	$CNI_A > 0$ ($CNI_R > 1$)	$CNI_A > 0$ ($CNI_R > 1$)	$CNI_A > 0$ ($CNI_R > 1$)	3	0.61	12.8	8.5
				6	0.55	6.3	6.7
				7	0.54	7.6	7.6
				9	0.48	6.5	5.8
				Average	0.57	9.85	9.65
B Nice, nice, nasty	$CNI_A > 0$ ($CNI_R > 1$)	$CNI_A > 0$ ($CNI_R > 1$)	$CNI_A < 0$ ($CNI_R < 1$)	10	0.67	2.7	3.2
C Nice, nasty, nasty	$CNI_A > 0$ ($CNI_R > 1$)	$CNI_A < 0$ ($CNI_R < 1$)	$CNI_A < 0$ ($CNI_R < 1$)	5	0.98	8.1	9.8
				8	0.92	8.2	8.3
D Nasty to all	$CNI_A < 0$ ($CNI_R < 1$)	$CNI_A < 0$ ($CNI_R < 1$)	$CNI_A < 0$ ($CNI_R < 1$)	4	0.56	10.7	11.9

Hypothesis test

H_1: Pricing strategies "nasty" to customers are more profitable than "nice" to customers. (Null hypothesis: The average GPR of insurers adopting strategy A = the average GPR of insurers adopting strategies B, C, and D.)	$p = 0.0629$
H_2: Firms implement pricing strategies nice to both new and repeat customers have higher market shares than firms implementing different pricing strategies. (Null hypothesis: The average market share of insurers adopting strategy A = the average market share of insurers adopting strategies B, C, and D.)	$p = 0.0909$ (all policies) $p = 0.1840$ (comprehensive policy)
H_3: Firms nasty to both new and repeat customers have the lowest profits and market shares. (Null hypothesis: Firms nasty to both new and repeat customers have the same profits and market shares.)	Profit: $p = 0.0548$ Market shares: $p = 0.4351$ (all policies) $p = 0.4796$ (comprehensive policy)

Note. Other possible strategies do not occur, for example, $CNI_A < 0$ for Y1 with $CNI_A > 0$ for Y2 with CNI_A for Y3 does not occur.

As Table 6 shows, six out of ten insurers adopt strategy type A, treating their customers nicely regardless of the contract years. Two out of ten insurers adopt strategy type C and are nice to their new customers while nasty to their repeat buyers. Only one insurer applies strategy type (nice, nice, then nasty) and one other insurer applies strategy type D (nasty to all customers).

5.4. Gross profit ratio (GPR) and pricing strategy

Due to the competition in the insurance market, insurers might choose a specific pricing strategy to attract customers based on insurers' evaluation of the marketing environment. In addition, insurers might set up a target to maximize the market share or profitability. Thus, analyzing the relationship between market share and firm's performance with the price strategies is natural. This study uses the index of the gross profit ratio (GPR) to compare insurers' operation efficiency.

$$\text{Gross Profit Ratio (GPR)} = 1 - \frac{\text{total loss}}{\text{total premium}}. \quad (6)$$

For consistency of effective comparison, this study calculates GPR based on the 2006 policy year data for each insurer in the sample which includes only policies with comprehensive coverage without deductible. The comparison does not take into account operation costs and investment profit which are usually common factors. The reason for doing so is to identify the pure effects of pricing strategies on focused group of policyholders. Column (6) in Table 6 shows the results of GPR, ranging from the lowest of 0.48 to the highest of 0.98. To verify if the nasty strategy implies better profit (Hypothesis H_1), this study tests the null hypothesis that the equality of GPR between groups without nasty strategy (type A) and with nasty strategy (type B, C, and D). The t statistic shows that the average of GPR for insurers with nasty strategy is significantly higher at 10% level (p value = 0.0629), supporting hypothesis H_1.

To connect pricing strategy with market shares, this study calculates two kinds of shares by using all insurance policies (column 7) and sample policies of comprehensive without deductible (column 8). The patterns of these two market shares among all insurers are similar. In Table 6, insurers that choose to undercharge the insured both in the short and long-run (Type A strategy) are more likely to have higher market shares with average of 9.85% (all policies), 9.65% (sample policies) and a moderate average GPR of 0.57. On the contrary, insurers that undercharge the new policyholders but overcharge the renewing ones (type C strategy) tend to have higher GPR (with an average of 0.95) and moderate market share (with an average of 8.15% of all policies).

Only one insurer adopts severe pricing strategy (type D) by overcharging all insured and has moderate GPR (0.56) and market share (10.7%). However, to test hypothesis H_2 in that, firms implement pricing strategy nice to both new and repeat customers have higher market shares than firms implementing different pricing strategies, the t statistic is not significant (p value = 0.1535 and 0.3007 in terms of all policies and comprehensive policies, respectively.). The hypothesis H_2 does not hold.

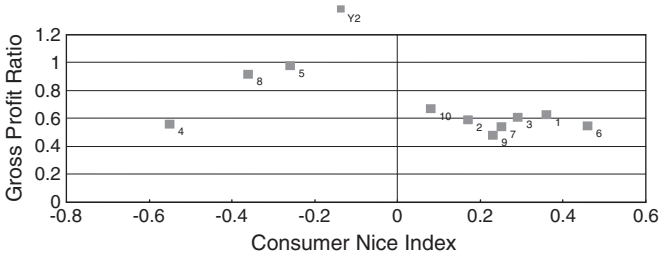

Fig. 7. Y2: the Consumer Nice Index (CNI_A), the contract years, and gross profit ratio.

The gross profit ratios (column 6 in Table 6) show that strategy type B (nice, nice, then nasty) outperforms strategy type A (nice to all customers) and all other strategies. Given that microeconomic theory calls for the firm to focus on profits as its principle objective (Armstrong and Collopy, 1996), the findings support strategy type B over strategy types A, C, or D. However, strategy type A delivers higher market shares than strategy type C. Some strategists might argue that in the long run, strategy type A is best because this strategy might retain customers more successfully than other strategies. Table 6 also shows that strategy type D receives relatively lower profit but moderate market share. The *t* test supports hypothesis H_3 in that all other strategy types outperform type D in terms of GPR at 10% significant level (p value = 0.0548). However, when it comes to the market share, strategy type D does not necessarily have the lowest ratio (p value = 0.4351 and 0.4796 in terms of all policies and comprehensive policies, respectively.)

To demonstrate the relation between GPR and consumer niceness index CNI_A, Figs. 6, 7 and 8 show the results by contract year. In particular, Fig. 6 indicates that only one insurer is in the left zone, having negative CNI_A but moderate GPR for Y1 contract. However, the higher the numbers of contract years, the more insurers join in the left zone to adopt the nasty strategy as Figs. 7 and 8 show. More importantly, those insurers with negative CNI_A (left zone) receive relatively higher profits compared with that those in the right zone.

Age is one of the major rating factors in automobile insurance. One might be curious about whether or not insurers adopt different pricing strategies for different age groups that do not follow the official rating formula. Table 7 demonstrates the results by listing the strategy type based on age. The group aged 30 to 60 represents the majority of the customers and these customers experience the same strategy type distribution as that using all data.

An interesting result is that three insurers (7, 8, and 10) indeed adopt different strategies for policyholders aged less than 30. Insurers 8 and 10 switch their strategy to become nasty for all years for younger group while remaining nice to the new customers in the majority age group. In addition, insurer 7 reveals a new strategy, nasty, nice, and nice, for young customers, and insurer 10 adopts

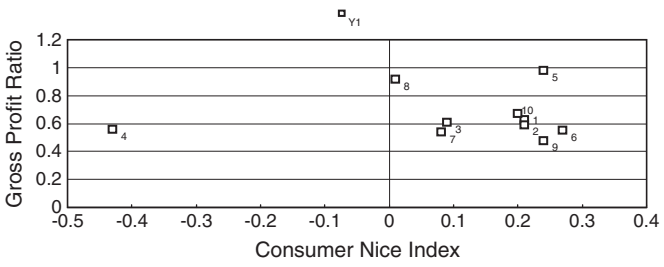

Fig. 6. Y1: The Consumer Nice Index (CNI_A), the contract years, and gross profit ratio.

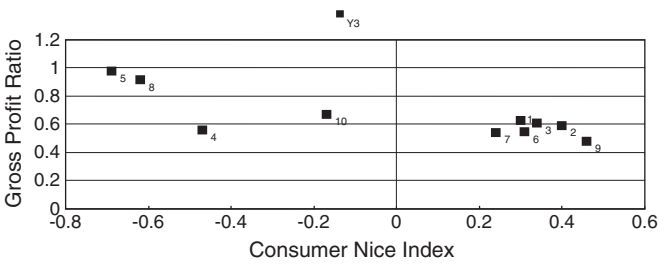

Fig. 8. Y3: The Consumer Nice Index (CNI_A), the contract years, and gross profit ratio.

Table 7
Insurer's strategy of different age group by company.

(1) Strategy type	Insurer			
	(2)	(3)	(4)	(5)
	Customer	Customer	Customer	Customer
	(all data)	(age<30)	(30≤age<60)	(age≥60)
(% of customers)	(100%)	(12%)	(84%)	(4%)
A Nice for all years	1, 2, 3, 6, **7**, 9	1, 2, 3, 6, 9	1, 2, 3, 6, **7**, 9	1, 2, 3, 6, **7**, 9, 10
B Nice, nice, nasty	10	–	10	–
C Nice, nasty, nasty	5, 8	5	5, 8	5
D Nasty for all years	4	4, 8, 10	4	4, 8
E Nasty, nice, nice	–	**7**	–	–
Hypothesis test				
H_{4a}: Insurers differ systematically in their implemented pricing strategies by customers' ages. (Null hypothesis: there is no difference on pricing strategies by ages among insurers.)			Kruskal-Wallis test K = 1 (critical value: $\chi^2_{2,\ 0.1}$ = 4.6052)	
H_{4b}: Firms that implement unique pricing strategies by age have the highest profits and market shares. (Null hypotheses: firms that implement unique pricing strategies by age have the same profits and market share with other firms.).			Profit: p = 0.2233 market shares: p = 0.2117 (all policies) p = 0.3613 (comprehensive policy)	

different strategies for each age group in which older customers obtain the best deal (strategy A).

To test hypothesis H_{4a}, if insurers differ systematically in pricing strategies by customers' ages, this paper adopts Kruskal-Wallis test. The result shows that the χ^2 test fails to reject the null hypothesis and that there is no significant difference on pricing strategies. Similarly, the hypothesis H_{4b}, firms that implement unique pricing strategies by age have the highest profits and market shares, also does not hold.

6. Discussion, limitations, and conclusion

Considering some rationales based on the evidence, a natural question arises. How does price dispersion exists under symmetric information? Intuitively, with full information, a multi-period competitive contract where the risk types of customers are observable consists of a one-period contract repeated in each period. The setting of premium will fully reflect the customers' own real risks. No gains should occur for multi-period competitive contracting (Cooper & Hayes, 1987; Townsend, 1982). The insurers do not have any information-based market power for sharing information among insurers. No additional incentives exist for customers with good claim history to stay with the same insurers to gain the benefits from the deduction of the premium or for customers with bad claim history to switch to other insurers to avoid premium increases.

However, in the real world, if the insured is insensitive to the changes in premium when they renew a long-term contract, then the price-setting strategies by the insurer might differ for first-time customers (short-term contracts) and repeat customers (long-term contracts) even under full information.

Alternatively, the rationale for the insurers to undercharge the insured connects to a practical issue — time lag between pricing and claims filing. Prior research (Li et al., 2008) based on the Taiwan automobile insurance market finds extensive customer claims-filings in the last policy month. However, policyholders usually renew insurance contracts one or two months before their expiration. Therefore, offering a price without taking into account the claims filed in the last policy month is possible. But, for long term customers, the insurer should not repeat the same pattern for two years. However, Table 6 shows that under charging indeed occurs for two years for some insurers.

If the time lag problem on premium adjusting is not severe, another plausible reason to undercharge is to be nice to increase market share. Based on the economies of scale of insurance industry, the more policies sold, the less management cost-per-policy share. The increase in market share at the cost of undercharging might be profitable eventually. For example, the 3 largest insurers, based on the sample data, adopt strategy type A (nice for all years).

From the demand side, given the regulated pricing formula, why do the insured accept an overcharged insurance premium? In fact, most policyholders likely have no idea about the rules and regulations governing pricing relevant to their policies, and other pricing factors. Consumers appear to buy insurance products from agents without asking the details about how premiums are calculated relevant to their insurance purchases (Taylor & Woodside, 1981). Similarly, Carlin (2009) discusses a case in which the complexity in retail financial market makes consumers more ignorant and provides the incentive for firms to adopt price increase strategy. In addition, consumers in Taiwan may have the illusion of psychological monopoly (Sundie et al., 2008) in mind without seeking the second insurer or agent.

In Taiwan, the ignorance of bonus–malus system of automobile insurance leads to the insured accepting a renewed premium which is the same as the previous year is even if the insurer should reduce premium due to no claims. Insurer 4 might belong to such a case so that even though it is nasty to all it retains a relatively high market share (10.7% for all polices and 11.9% for sample polices).

Limitations to the present study include its focus on one country. Replication research is necessary to confirm the extent of the relevance of the findings to additional national contexts. Also, while pricing strategies are the key issue in this study, factors such as company size, capital, underwriting policy, and other factors might also play some roles relating to GPR and market share, but the study of these potential influences is absent from this study. Future research needs to consider possible interactions of these factors on the findings of the present study.

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