Gaining Acceptance by Informing the People? Public Knowledge, Attitudes, and Acceptance of Transportation Policies

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Menghan Li[1] and Jinhua Zhao[1]

Abstract

We examine the connection between public knowledge and attitudes in the context of urban transportation policies. We categorize policy knowledge into received, subjective, and reasoned knowledge, and measure them empirically using a survey of Shanghai's residents (n=1,000) on the vehicle license auction policy. We quantify the relationship between the three types of knowledge and public acceptance and its predecessors (perceived effectiveness, affordability, and equity). We find variegated impacts of knowledge on acceptance: reasoned knowledge increases acceptance but subjective knowledge decreases it, while received knowledge has no direct impact. Public information needs to emphasize societal benefits and the underlying policy rationale.

Keywords

transportation policy, public knowledge, public acceptance, vehicle license auction, structural equation modeling, China

Introduction

Transportation demand management (TDM) has long been recognized as an important way to combat traffic congestion and achieve long-term sustainability, but its implementation critically depends on public acceptance. For example, despite a handful of exceptions (most prominently London, Singapore, and Stockholm), the implementation of road pricing in many cities, such as Edinburgh and Hong Kong, failed, largely due to low public acceptance (Braunholtz, Cumming, and Scotland 2006; Fong 1985).

One strategy to increase acceptance is to inform the public about or increase public knowledge of the policy's benefits. In planning practices, educating and informing the public are the fundamental first step in engaging citizens and facilitating cooperation (Arnstein 1969). Well-informed stakeholders are the basis for effective communicative planning or participatory planning (Innes 1998; Forester 1999). In the field of environmental protection and public health, many studies have established the strong positive relationship between knowledge and attitude (Arcury 1990; Bradley et al. 1999; Qu et al. 2009; Tolvanen et al. 2012); consequently, the "knowledge-attitude-behavior" model has been applied in many real-world health promotions (Bettinghaus 1986). In the transportation field, many studies examining the relationship between acceptance and attitudinal factors have implied that better communication could increase acceptance (Buckeye and Munnich 2004; Dieplinger and Fürst 2014; Munnich and Loveland 2005; Schuitema, Steg, and Rothengatter 2010).

However, direct evidence that more knowledge leads to more positive attitudes toward transportation policy is presently lacking. Moreover, there is no well-established conceptual framework of policy knowledge from the public perspective (in contrast to that of policy makers). Policies cannot be effectively implemented without bottom-up cooperation. Adequate policy knowledge is both a precondition of this cooperation and the basis on which to evaluate public feedback regarding a given policy. Even in nondemocratic cities employing a top–down approach to mainstream policy making, decision makers are inclined to devote resources to increasing policy acceptance to ensure social harmony.

The main research purpose is to examine whether public knowledge can influence public attitudes toward and acceptance of a car restriction policy, and in what specific ways. To analyze policy knowledge, we establish a tripartite framework comprising received knowledge, subjective knowledge, and reasoned knowledge. We then empirically measure the three types of policy knowledge based on a survey of Shanghai's residents (n=1,000) on its vehicle license auction

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(VLA) policy, and examine the relationship between policy knowledge, policy attitudes, and policy acceptance. Shanghai's VLA policy has been in effect since 1994. We choose this case because the VLA introduced in Shanghai is one of the strongest policy instruments to manage travel demand: to illustrate, the auction price reached CN¥89,850 (US$13,037) in April 2017, about half the price of a regular car. It is representative of car restriction policy and can elucidate the relationship between public's policy knowledge and their acceptance of the policy.

Literature Review and Theoretical Framework

The Impact of Knowledge on Attitude and Acceptance

In the transportation field, many scholars imply that better communication or greater familiarity can improve attitudes about or the acceptance of particular policies (Buckeye and Munnich 2004; Dieplinger and Fürst 2014; Munnich and Loveland 2005; Schuitema, Steg, and Rothengatter 2010). However, the concepts of communication and familiarity are broad and focus on policy perception, rather than policy knowledge. No prior study establishes a structured framework of knowledge, and very few directly measure the relationship between knowledge and attitude. Dieplinger and Fürst (2014) measure the relationship between eight attitudinal factors and the acceptability of road pricing in five European cities; subjective knowledge is included as one of the attitudinal factors. They find that the level of subjective knowledge is low and its relationship with acceptability is not significant. Focused on Stockholm, Börjesson et al. (2012) qualitatively attribute increasing public acceptance of congestion charging over time to the feedback loop between objective effect, perceived effect, and acceptance. People's familiarity with the objective policy effect increases their perception of that effect, which then translates into higher acceptance. Reviewing studies on hydrogen and fuel cells, Roche et al. (2010) conclude that increased knowledge and familiarity with technology play a crucial role in the evaluation and formation of attitudes.

In the fields of environmental protection and public health, however, the relationship between knowledge and attitude has been widely measured. Many studies have proven that a strong and positive relationship exists between knowledge and attitude (Arcury 1990; Bradley, Waliczek, and Zajicek 1999; Qu et al. 2009; Tolvanen et al. 2012). Bradley, Waliczek, and Zajicek (1999) showed that students with higher environmental knowledge scores had more favorable environmental attitudes than students with lower knowledge scores, both before and after exposure to a 10-day environmental science course. Using telephone survey data from 680 Kentucky residents, Arcury (1990) reported a consistent and positive relationship between environmental knowledge and environmental attitudes. Researchers have found that environmental education increases awareness and environmentally responsible behaviors among junior high and high school students (Ramsey and Rickson 1976; Jaus 1984; Bradley, Waliczek, and Zajicek 1999). In most public health research, the relationship between knowledge and attitude is found to be significant (Kubar, Rodrigue, and Hoffmann 1995; Qu et al. 2009; Tolvanen et al. 2012; Lou and Chen 2009).

Public Attitude and Acceptance of Transportation Policy

Jaensirisak, Wardman, and May (2005) and Steg and Schuitema (2007) provide comprehensive reviews of research on the public acceptability of transport pricing. Overall, the most influential factors comprise three types. First are policy characteristics and system features, including the charge level, physical boundaries, restricted time, revenue allocation, and quality of alternative modes (Pronello and Rappazzo 2014; Grisolía, López, and Dios Ortúzar 2015; Bhatt, Higgins, and Berg 2008). Second are psychological or attitudinal factors. Past studies have found significant correlations between the acceptance level and the following psychological elements: (1) perceived/expected effectiveness (Bartley 1995; Kallbekken, Garcia, and Korneliussen 2013; Rentziou et al. 2011); (2) perceived/expected fairness or distributive effects (Jakobsson, Fujii, and Gärling 2000; Bamberg and Rolle 2003); (3) problem awareness, or how seriously people perceive current congestion and air pollution (Schade and Schlag 2003; Steg 2003); (4) trust in government (Schmöcker, Pettersson, and Fujii 2012; Kim et al. 2013); (5) concerns about freedom (Jakobsson, Fujii, and Gärling 2000); and (6) personal outcome perceptions/expectations—for example, a perceived increase in travel cost (Zheng et al. 2014; Kallbekken, Garcia, and Korneliussen 2013; Schuitema, Steg, and Rothengatter 2010). Concerns about freedom and negative personal outcome perceptions are negatively related to acceptability, while the other factors are positively related. Third are sociodemographic characteristics, including age, gender, education, lifestyle, work location, and car usage, all of which affect the acceptance level (Jones 1995; Harrington, Krupnick, and Alberini 2001). Researchers frequently find that higher car usage reduces the acceptance level (Francke and Kaniok 2013; Jaensirisak, Wardman, and May 2005).

Our study adds the knowledge component to the acceptability framework, comparing the relative importance of knowledge with that of the attitudinal factors in shaping transportation policy acceptance.

Policy Knowledge

We use "policy knowledge" to refer specifically to public knowledge of a policy, in contrast to that of policy makers, the study of which often examines the formulation and transfer of best practice policies (James and Jorgensen 2009;

Table 1. The Meaning of Knowledge in Different Contexts.

Types	Research Fields	Meanings	Models	Categorization Examples	Representative Studies
Abstract knowledge	Philosophy	Intellectual and ethical development	Model of epistemological development	Silence/received knowledge Subjective knowledge Procedural knowledge Constructed knowledge	Belenky 1986; Hofer and Pintrich 1997
Scientific knowledge	Education, psychology	Truth and reality that is evaluated by reference to the world	Knowledge acquisition	Generated idea Tested idea	Lawson 2000
Productive knowledge	Economy, management	Technique, experience, innovation that can be translated into productivity	Dynamic knowledge creation	Experiential knowledge Routine knowledge Conceptual knowledge Systemic knowledge	Nonaka, Toyama, and Konno 2000
Option knowledge	Marketing	Information about products that store in customers' memory	Consumer behavior model	Objective knowledge Subjective knowledge Experience	Brucks 1985; Flynn and Goldsmith 1999

Webber 1991). Policy knowledge does not include perception or belief, which are included in several epistemological models (Perry 1997; Hofer and Pintrich 1997). These models discuss how individuals come to hold a theory and belief about abstract knowing and valuing. However, they apply to intellectual development and abstract knowledge, rather than knowing of a particular policy. In this article, policy knowledge refers to familiarity with and understanding of a given policy.

We review various concepts of knowledge from multiple disciplines (Table 1) to establish an analytical framework for policy knowledge. We choose the classification of philosophical knowledge and the classification of consumer knowledge as the starting point. In philosophy, the concept of knowledge represents the epistemological development of intellect and ethics; we borrow the part that explains how individuals, through thinking and reasoning, come to understand issues within policy knowledge. Compared to other epistemological theories (Perry 1997; Magolda and Porterfield 1988; Kuhn 1991; King and Kitchener 1994; Hofer and Pintrich 1997), Belenky's epistemological model is more transferrable to knowing a particular policy. As theorized by Belenky (1986), during the phase of *silence/received knowledge*, people experience a passive existence by listening to external authority. *Subjective knowledge* is the stage at which people view truth as an intuitive reaction gained from personal experience. *Procedural knowledge* involves reasoned thinking and systematic analysis. *Constructed knowledge* represents the stage when people can reconstruct knowledge references and frames based on a variety of contexts. In marketing research, scholars focus on analyzing information about products that remains in customers' memory, along with its impact on their perception and eventual product choices; we borrow this way of defining and measuring people's familiarity with objects to analyze policy knowledge. Consumer knowledge is usually conceptualized and measured by three indicators: objective knowledge, subjective knowledge, and prior experience (Brucks 1985; Raju, Lonial, and Mangold 1995; Flynn and Goldsmith 1999). *Objective knowledge* is people's awareness of facts; *subjective knowledge* is what people think they know; and *prior experience* is knowledge acquired through practice.

Synthesizing these different conceptions of knowledge and respecting the unique features of policy knowledge, we propose a tripartite structure of policy knowledge: received knowledge, subjective knowledge, and reasoned knowledge, as shown in Table 2. *Received knowledge* measures people's awareness of the basic rules. It captures how much people know about the facts of a policy, and it can be measured by a basic written test. The facts about the VLA in this article include issued plate types, usual bidding price, and restrictions on time and boundary. The concept is parallel to the silence position in philosophy and objective knowledge in marketing. *Subjective knowledge* represents how much people think they know about a policy's influence on their lives. It combines objective knowledge, confidence in that knowledge (Raju, Lonial, and Mangold 1995), and feelings. Personal experience and feelings are integral in this category. In philosophy and marketing, a similar concept is applied to incorporate this psychological component into the measure of knowledge perception. Subjective knowledge can potentially be influenced by attitudes, but they differ in nature. For example, regarding the financial burden of the VLA, subjective knowledge may include "I know how much additional travel cost I incur given my travel pattern," while the related attitude is, "I feel the license is unaffordable." *Reasoned knowledge* describes the systematic and analytical understanding of a policy. Reasoned knowledge measures how well people understand the whole package of a policy, including its rationale, expected effects, and its advantages and disadvantages. While received and subjective knowledge focus on separate aspects of the policy, reasoned knowledge connects them all together through analytical thinking. Both familiarity with and analysis of a policy are required to achieve a high level of reasoned knowledge. The three knowledge categories reflect

Table 2. Categorization of Policy Knowledge.

Categorization	Information Source	Uniqueness	Self-involvement	Focus
Received knowledge	Authority	Contents shared with the public	Attention active	Basic rule (e.g., restriction details on time, boundary)
Subjective knowledge	Combined with experience and emotion	Related to individual experience	Emotion active	Perceived information based on experience (e.g., increased financial burden, limited mobility freedom)
Reasoned knowledge	Combined with thinking and reasoning	Related to systematic analysis	Logic active	Policy intention and policy effect

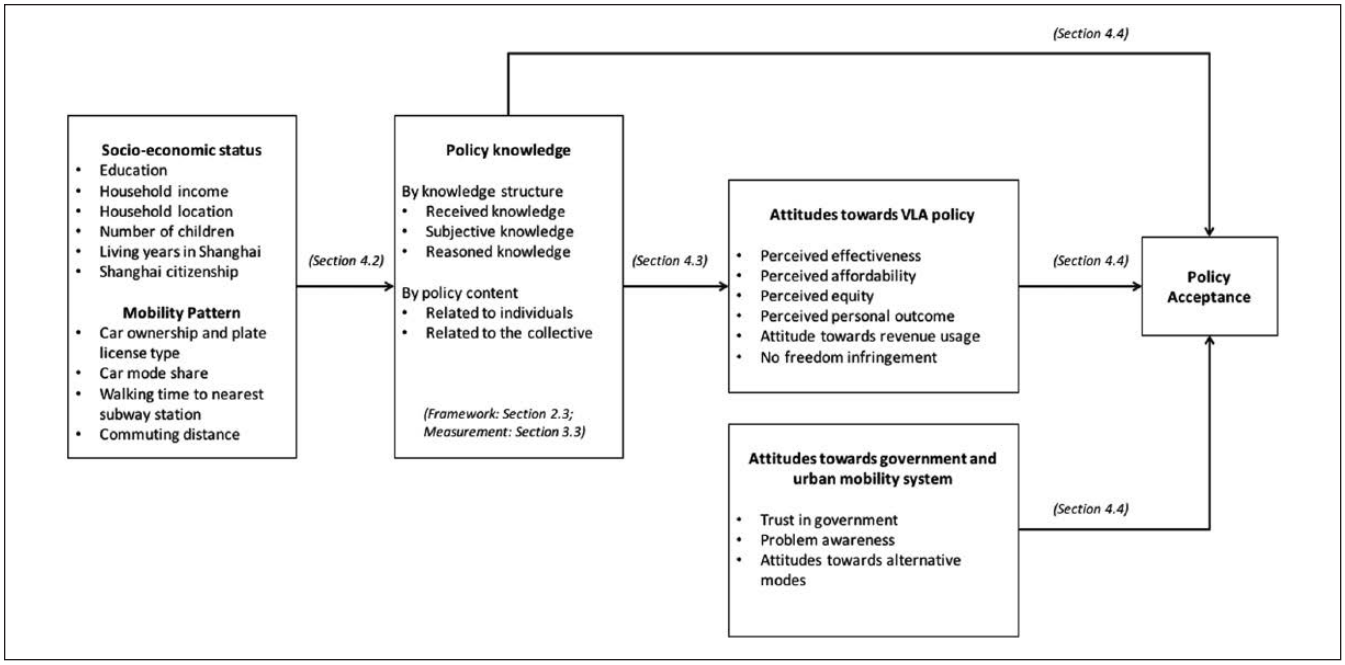


Figure 1. Research Framework Illustration.

the cognitive processes of individuals coming to know about a policy: people first receive information about the policy, then understand how it influences their life based on their experiences, and eventually develop a systematic understanding of the policy.

Research Framework

Figure 1 illustrates the research framework. We have three research objectives in this paper:

- to categorize knowledge in terms of urban transportation policies, measure it empirically, and examine its variation by individuals' socioeconomic and mobility characteristics;
- to examine the relationships between different types of policy knowledge and various aspects of public attitudes toward policy, including perceived effectiveness, affordability, and equity, among others; and
- to examine the impact of policy knowledge on policy acceptance and compare its magnitude with the impacts of the attitudinal factors.

Data and Methods

Case Study: Shanghai's Vehicle License Auction (VLA)

To limit rapid growth in the number of private automobiles, the Shanghai government introduced its VLA policy in 1994: it specifies the monthly quota of the number of new automobiles and allocates the quota by auction (Chen and Zhao 2013). The VLA is one of the strongest policy instruments to manage travel demand. We use the case of Shanghai's VLA

Table 3. Sociodemographic Characteristics of Survey Participants and Citywide Population.

Sociodemographic Dimension	Categories	Sample Distribution, %	Citywide Distribution, %
Car ownership	Car owners	50	12
	Non–car owners	50	88
Age, years	<17	0	11
	18–34	35	21
	35–50	65	39
	50-59	0	
	60+	0	29
Gender	Male	50	50
	Female	50	50
Residence status	Local residence	59	59
	Nonlocal residence	41	41
Home address	Within 1st ring road	20	20
	Between 1st and 2nd ring road	34	34
	Between 2nd and 3rd ring road		
	Outside of 3rd ring road	46	46
Monthly household income, CN¥	<5,000	8	8
	5,000–6,999	15	15
	7,000–9,999	20	20
	10,000–14,999	29	29
	>15,000	28	28
Education level	High school or below	50	76
	College and university	45	22
	Master's or above	4	2

Note: We obtained citywide statistics from three sources: the 2015 Shanghai Statistical Yearbook; the Shanghai Sixth Census, conducted in 2010 for education level; and the Shanghai Travel Survey conducted in 2009 for car ownership. The statistical yearbook only reports the estimated income of the low-income group, middle-income group, and high-income group, based on which we fit an income cumulative distribution function curve and estimate the percentages for different household income categories.

for two reasons: (1) the powerful impact of the VLA on travel demand and (2) the exemplary role Shanghai plays in China's policy making. The Shanghai case illustrates a rich set of relationships between received, subjective, and reasoned knowledge on the one hand and policy acceptance and attitudes on the other. In this article, we measure the public's policy knowledge, attitudes, and acceptance and examine the relationships between them based on a questionnaire survey of 1,000 individuals conducted in January 2016.

Data Collection

We hired a professional survey company to administer the survey process. The company's database contains 510,000 members of Shanghai's population, all of whom registered voluntarily to participate in surveys operated by this company. The company sent survey invitations via email to 10,000 people randomly selected from among its members, of which 2,811 people clicked the questionnaire link, from whom 1,000 completed and valid questionnaires were collected. Respondents completed our survey on a voluntary basis and were offered a small monetary incentive (CN¥10, or approximately US$1.6, per person) to encourage participation. We set logic checks throughout the surveying process to ensure that the responses were valid. To minimize the self-selection effect, we set sociodemographic filters to specify the quota for each cohort in seven dimensions: age, gender, residence status, car ownership level, household location, household income, and education level. However, compared to the city averages in Table 3, we oversampled car owners (50%) and undersampled people aged over 50, and people with an education at high school level or below. We increased the proportion of car owners because the VLA policy is more relevant to them in our research context. The low representativeness of older people is a limitation of the online survey method because of the lack of volunteers in this age cohort. We conducted a pilot survey among 50 people and revised the phrasing based on their comments. The pilot survey results are not included in the final sample.

Measurement of Policy Knowledge

We measured all three types of knowledge proposed above using the indicators listed in Table 4. We designed the questionnaire based on the epistemological category introduced earlier. After data collection, we added another content

Table 4. Survey Questions to Measure Received, Subjective, and Reasoned Knowledge.

Knowledge Category	Content Category	Indicators	Mean and Standard Deviation			Factor Loading
			All	Car Owners	Non–Car Owners	
Received knowledge (0 = wrong answer, 1 = correct answer)	Individual information	1. Which price is closest to the lowest price for the Shanghai license plate auction held in December 2015? a. ¥65000 b. ¥75000 c. ¥80000 **d.¥85000** e. I don't know	34.8% (0.48)	45.2% (0.50)	24.4% (0.43)	/
		2. What is the frequency of Shanghai's car license plate auction? a. Every week b. Every other week **c. Every month** d. Every other month e. I don't know	63.5% (0.48)	75% (0.43)	52% (0.50)	/
		3. Which of the following license plate type does not need go through auction? a. Plate A b. Plate B **c. Plate C** d. Plate D e. Plate E f. Plate F g. I don't know	62.6% (0.48)	76.4% (0.43)	48.8% (0.50)	/
		4. But vehicles with the license type in question 3 are only allowed to drive outside the _____ in Shanghai. a. Inner Ring b. Middle Ring **c. Outer Ring** d. I don't know	63.2% (0.48)	76.4% (0.43)	50.0% (0.50)	/
		5. During what time are vehicles with nonlocal license plates prohibited to drive on the elevated road? a. Monday to Friday between 7:30 and 10:30 a.m. and between 16:30 and 19:30 p.m. **b. Monday to Friday between 7:00 and 10:00 a.m. and between 16:00 and 19:00 p.m.** c. Any time during weekdays d. Never allowed e. I don't know	48% (0.50)	56% (0.50)	40% (0.50)	/
		6. Nonlocal vehicles being caught violating the restriction on elevated road will be fined for_____, and be deducted ____ credits. a. ¥300, 3 **b.¥200, 3** c. ¥300, 0 d. ¥200, 0 e. I don't know	51.7% (0.50)	57.8% (0.50)	45.6% (0.50)	/
		7. Which year did the Shanghai government begin to install Traffic Control Photographic Systems to catch vehicles without Shanghai license violating the elevated road restriction? a. 2003 b. 2005 c. 2008 **d. 2011** e. I don't know	31.8% (0.47)	37.8% (0.49)	25.8% (0.44)	/
		8. At the beginning of 2006, Shanghai required all vehicles entering the central city to: **a. check the emission level and obtain a "green mark" to be placed on the vehicle** b. check the safety situation and obtain a "safety mark" to be placed on the vehicle c. check the license validation every year and obtain a "valid mark" to be placed on the vehicle d. I don't know	64.4% (0.48)	78.2% (0.41)	50.6% (0.50)	/

(continued)

Table 4. (continued)

Knowledge Category	Content Category		Indicators	Mean and Standard Deviation: All	Car Owners	Non–Car Owners	Factor Loading
		9.	When a vehicle has been scrapped, the car owner can apply to keep the license plate quota and register new vehicles, but the vehicle needs to be operated for at least ____ year(s) before it is scrapped. a. 1 b. 2 **c. 3** d. 4 e. I don't know	38.2% (0.49)	39.6% (0.49)	36.8% (0.48)	/
		10.	Car owners need to apply to keep the license plate quota within _____ months after the old vehicle has been scrapped. a. 3 **b. 6** c. 9 d. 12 e. I don't know	37.5% (0.48)	39.2% (0.49)	35.8% (0.48)	/
	Collective information	11.	When did the license plate auction take effect in Shanghai? a. **1985–1995** b. 1995–2005 c. 2005–2010 d. 2010–2015 e. I don't know	10.2% (0.30)	11.6% (0.32)	8.8% (0.28)	/
		12.	What percentage of people won the license plate in one bid in October 2015? a. 1.5% **b. 4.5%** c. 7.5% d. 10.5% e. I don't know	43.9% (0.50)	43.2% (0.50)	44.6% (0.50)	/
		13.	What will happen to the quota if the owner of a car fails to renew the license plate within the required time after the old vehicle is scrapped **a. The government will put the quota back for auction** b. The government will use the quota for special car license plate application c. The government will use the quota to help disadvantaged groups to obtain the license plate d. The government will not reallocate the quota e. I don't know	45.6% (0.50)	51.0% (0.50)	40.2% (0.50)	/
		14.	What is the annual growth rate of total passenger automobiles（各类民用汽车）in Shanghai in 2014? a. 3.5% **b. 8.5%** c. 15% d. 20% e. I don't know	47.0% (0.50)	46.8% (0.50)	47.2% (0.50)	/
		15.	How does the Shanghai government use the auction revenue? a. The Shanghai government mainly uses the revenue to maintain and expand the road network **b. The Shanghai government mainly uses the revenue to subsidize and improve the public transit service** c. The Shanghai government mainly uses the revenue for non-transportation projects d. The Shanghai government doesn't specify the revenue usage e. I don't know	26.6% (0.45)	24.2% (0.43)	29.0% (0.45)	/

(continued)

Table 4. (continued)

Knowledge Category	Content Category		Indicators	Mean and Standard Deviation: All	Car Owners	Non–Car Owners	Factor Loading
Subjective knowledge (–2 = strongly disagree, 2 = strongly agree)	Individual information	16.	I know precisely the extra financial burden on me caused by the policy	0.590 (0.97)	0.790 (0.94)	0.390 (0.96)	0.631
		17.	I know exactly the change in my travel time caused by the policy	0.536 (0.99)	0.660 (0.97)	0.412 (1.00)	0.628
		18.	I know exactly the change in my travel cost caused by the policy	0.373 (1.00)	0.514 (0.89)	0.232 (1.08)	0.609
		19.	I know analytically the change of my travel well-being taking into account all pros and cons.	0.441 (0.97)	0.438 (0.93)	0.444 (1.01)	0.561
	Collective information	20.	I know clearly how much the policy changes the travel behavior of Shanghai residents	0.745 (0.88)	0.770 (0.85)	0.720 (0.91)	0.629
		21.	I know clearly how much the policy changes the lifestyle of Shanghai residents	0.655 (0.91)	0.684 (0.89)	0.626 (0.93)	0.571
		22.	I know clearly about the influence of the policy on the congestion level in Shanghai	0.670 (0.97)	0.714 (1.00)	0.626 (0.95)	0.560
		23.	I know clearly about the influence of the policy on the environment and air pollution in Shanghai	0.661 (1.00)	0.644 (1.04)	0.678 (0.96)	0.556
Reasoned knowledge (–2 = strongly disagree, 2 = strongly agree)	Collective information	24.	I completely understand the goal and intention of license plate auction	0.658 (0.93)	0.722 (0.99)	0.594 (0.86)	0.547
		25.	I know systematically about the policy effect	0.517 (0.90)	0.638 (0.90)	0.396 (0.87)	0.638
		26.	I understand clearly about the pros and cons of the policy	0.432 (0.97)	0.546 (0.97)	0.318 (0.96)	0.480
		27.	I know all the alternative policies for this license plate auction, understand how they work, and can tell their pros and cons compared to the Shanghai license plate auction	0.340 (1.05)	0.274 (1.05)	0.406 (1.05)	0.579

Note: Bolded items are the correct answers to the knowledge questions.

category dimension—individual information versus collective information—to analyze policy knowledge: a car restriction policy often increases collective benefits at the cost of individuals, and it is necessary to disentangle the two effects. We also tested other content classifications, including basic knowledge versus hard knowledge, knowledge about car scrapping versus knowledge about car usage, etc. However, the individual versus collective classification is the most reasonable, both conceptually and empirically.

Received knowledge is measured by 15 multiple-choice questions about the VLA policy details. The questions cover policy design relating to both individuals and the collective. Individual information includes the details influencing the individual's life, such as license plate price, the time and physical restrictions of various plate types, law enforcement, and rules concerning car scrapping. The level of difficulty ranges from basic (e.g., questions 1–4) to hard (e.g., questions 7 and 9) to capture as much variation in received knowledge as possible. Collective information includes policy contexts and policy design affecting society as a whole, such as the growth of motorization and revenue usage. Some indicators have both individual and collective features, such as questions 7, 8, 11, and 12; we placed each of them into the more relevant category based on our judgment. We also tested grouping them as a separate third category or removing them. The sensitivity test shows that varying organization of these ambiguous indicators does not change the substantive results. We set the option "I don't know" to capture people's cautiousness and awareness of their unfamiliarity, and this variable does not generate significant influence on the results.

Figure 2 illustrates the difference between car owners and non–car owners. Car owners know significantly more policy facts relating to individuals; in contrast, non–car owners show comparable or sometimes higher levels of knowledge about policy facts relating to the collective. Non–car owners evidently care about the VLA policy, but they are particularly concerned with how it affects society as a whole. The respondents generally scored low on questions 7, 11, and 15. While failing to remember the exact year of the policy's introduction was understandable, low knowledge of revenue usage indicates great potential for the Shanghai government to promote the VLA's benefits for the public transit system.

Subjective knowledge is measured by eight 5-point Likert scale questions. We asked respondents to self-report their perception of their policy knowledge, related to both individual and collective matters. Car owners claim more knowledge on individual information but no more knowledge on collective information than non–car owners. Overall, participants are confident about their policy knowledge—a confidence that is not matched by their received knowledge

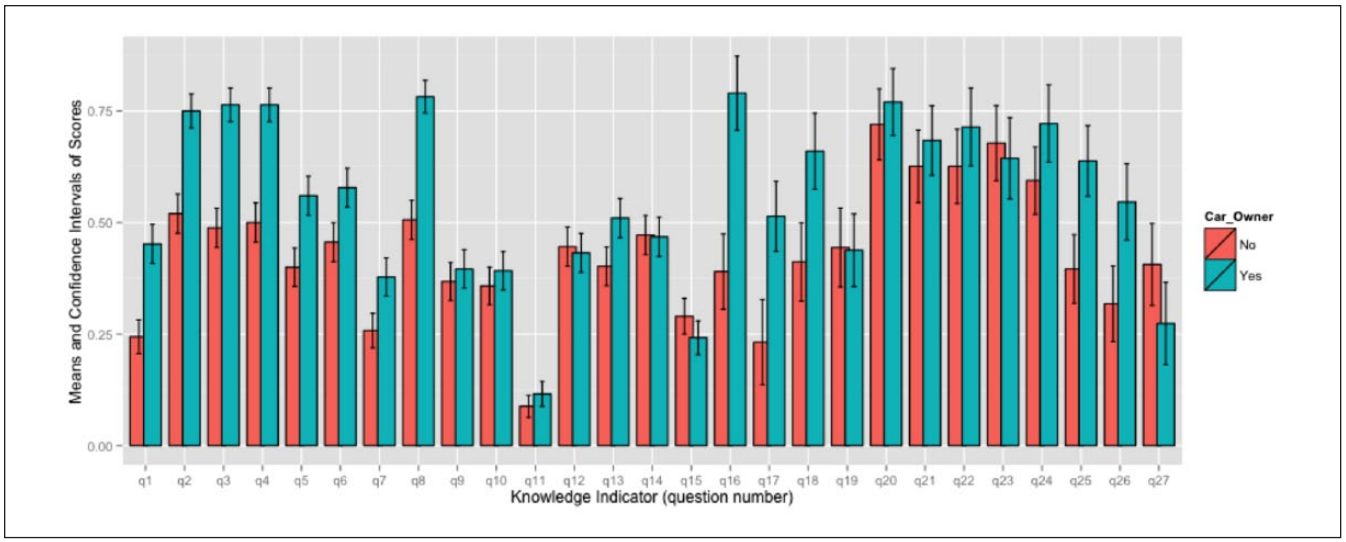


Figure 2. Scores of knowledge indicators by car ownership.

scores. Particularly for collective information, both car owners and non–car owners perceive they have a high level of subjective knowledge, while they correctly answer less than 50% of the received knowledge questions.

Reasoned knowledge is measured by four 5-point Likert scale questions. Rather than asking about one specific aspect of policy effect, as in the subjective knowledge questions, statements about reasoned knowledge depict a comprehensive understanding of the VLA policy. As the survey used self-report evaluation, there is an inevitable association between measures of subjective knowledge and reasoned knowledge. Ideally, reasoned knowledge could have been measured through interviews, in which the researcher may ask open-ended questions to test participants' systematic understanding of the policy rationale. However, constrained by the questionnaire instrument and requiring a large sample size for quantitative analysis, we chose to persevere with self-report measurement for reasoned knowledge. Principal components analysis shows that despite the correlation, indicators of subjective knowledge and reasoned knowledge belong to two distinct groups—indeed, they capture different attributes. In reasoned knowledge, we only pose questions related to the collective, as systematic analysis must cover the big picture rather than focusing only on the individual's perspective. The respondents were generally positive about their reasoned knowledge level, especially in understanding the VLA policy's goal and intention. Car owners have higher scores than non–car owners for three of the four reasoned knowledge questions.

Structural Equation Modeling

We use structural equation modeling (SEM) as the key modeling technique to analyze the complex relationship between different types of knowledge, attitudes, and acceptance, and control for socioeconomic variables. We measure people's subjective and reasoned knowledge, attitude, and acceptance via 5-point Likert scale indicators, and SEM has advantages in analyzing this kind of survey data (Qu et al. 2009; Tolvanen et al. 2012). First, SEM can diminish the impact of inevitable measurement errors in a survey (Kline 2015). Second, SEM accommodates the estimation of latent variables through factor analysis of correlated observed indicators. Third, SEM has the advantage of simultaneously estimating factor structure and regression results, making the model more efficient and reliable than running the two parts sequentially. All SEM models were run in Mplus 7.

Figure 3 shows the structures of three sets of SEM models in the article. In the knowledge models, we examine how policy knowledge varies by one's socioeconomic and mobility characteristics, with two ordinary least squares (OLS) regression models for received knowledge and three SEMs for subjective and reasoned knowledge. In all five models, knowledge is the dependent variable and socioeconomic statuses and mobility patterns are independent variables. The two subtypes of received knowledge are measured as the observed variables, while subjective and reasoned knowledge are measured as latent variables. We use OLS for received knowledge because it is measured by test score and the factor structure is not needed.

In the attitude models, we use SEM to examine how policy knowledge affects public attitude, controlling for the socioeconomic characteristics and mobility patterns that may also influence people's policy attitude. In the six SEMs, each has one policy attitude as the dependent variable, while policy knowledge and the other controls are independent variables. The received knowledge scores are represented as observed variables, while subjective knowledge and reasoned knowledge are latent variables. Because of the multicollinearity problem, we have to omit subjective knowledge

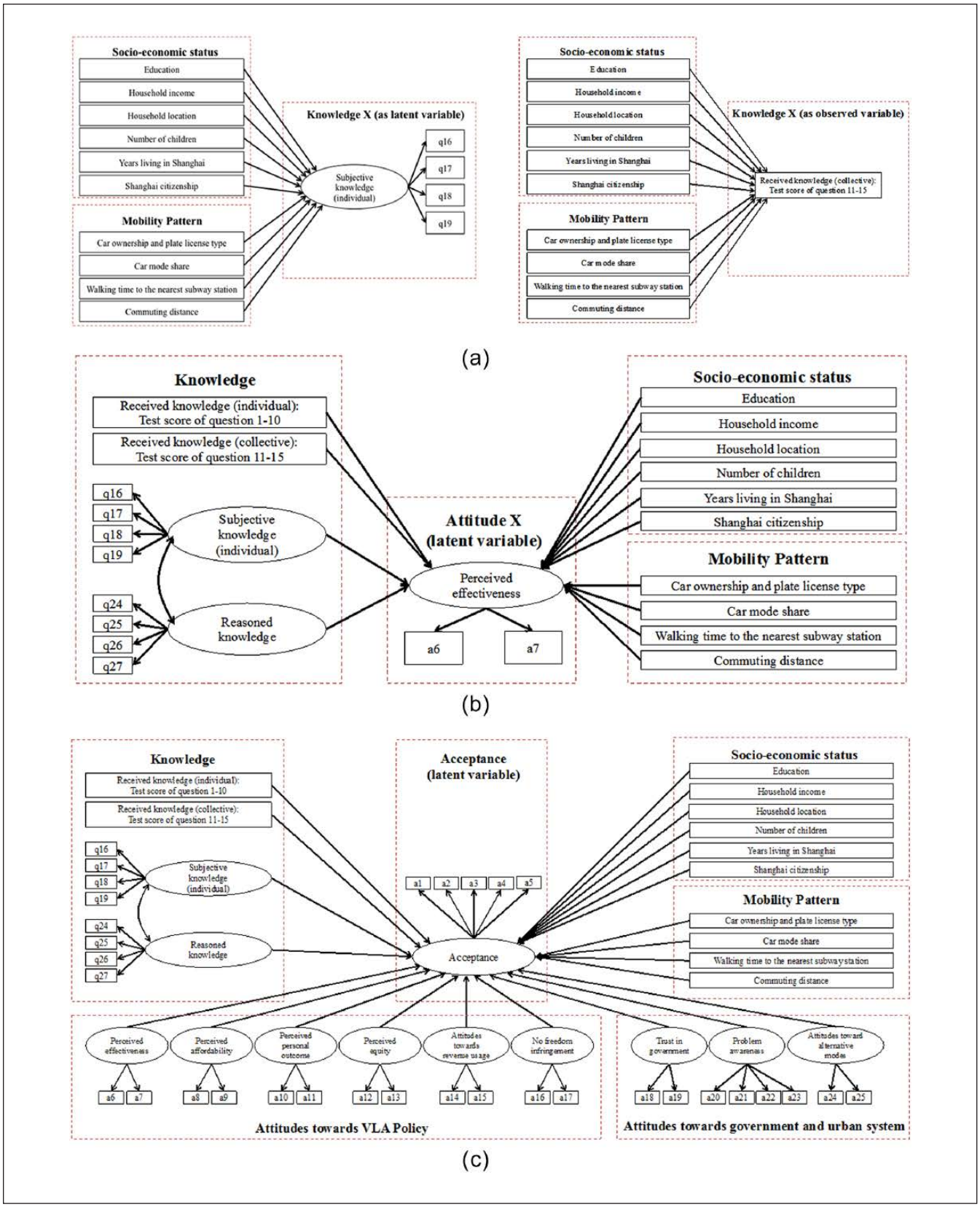


Figure 3. Diagrams of structured equation models of knowledge, attitudes, and acceptance. (A) Knowledge Models: subjective and reasoned knowledge are latent variables (left); received knowledge is the observed variable (right). (B) Attitude Models. (C) Acceptance Model.

(collective information) from the model; therefore, only four subtypes of policy knowledge are included therein. We also tried omitting the other knowledge type and found that the influence comes from two dimensions: subjective versus reasoned, and individual versus collective. Regarding the impact on attitudes, that of subjective and individual knowledge is negative, while that of reasoned and collective knowledge is positive. Therefore, the effects of subjective (collective) knowledge are conflicting, and its sign depends on the other independent variables. We chose to report models with subjective (individual) and reasoned knowledge in which the knowledge types are opposite in both dimensions and their effects are consistent.

In the acceptance model, public acceptance is the dependent variable, and policy knowledge (four factors), policy attitudes (nine factors), and socioeconomic and mobility characteristics are independent variables.

Results

Relationships between Received Knowledge, Subjective Knowledge, and Reasoned Knowledge

Table 4 shows the distribution of and the correlation between five subtypes of policy knowledge: received knowledge (both individual and collective), subjective knowledge (both individual and collective), and reasoned knowledge. For the two types of received knowledge, we regard the measurement as the test of the knowledge level, and the scores are the number of correct answers: a maximum of 10 for individual information and a maximum of 5 for collective information. For subjective and reasoned knowledge, the scores are based on the confirmatory factor analysis (CFA). The goodness-of-fit indices are reported in Figure 4 and pass their corresponding thresholds: comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). The factor loadings are shown in the rightmost column in Table 4.

The distributions of subjective knowledge (both individual and collective) and reasoned knowledge all skew to the left, and their correlations are moderately high. The two subtypes of received knowledge are less correlated with subjective knowledge and reasoned knowledge.

Variation in Policy Knowledge by Socioeconomic and Mobility Characteristics

Years living in Shanghai, household income, number of children, and car mode share generally increase policy knowledge, though on different subtypes of knowledge and to varying degrees (Table 5). Being a Shanghai resident has a strong negative effect on reasoned knowledge, but no effect on other types of policy knowledge. Non–car owners have less received and subjective knowledge with respect to individual information than car owners, while for received and subjective knowledge of collective information and reasoned knowledge, non–car owners are on par with car owners. This is consistent with the descriptive statistics reported in Table 4. If one's car is registered outside Shanghai (to bypass Shanghai's VLA), one has much lower reasoned knowledge about the VLA policy. The relatively low R-square for received knowledge indicates that sociodemographic and mobility variables can only explain a small portion of its variation. Therefore, it is important to note that one cannot simply use socioeconomic variables to approximate received knowledge, which requires its own measurements.

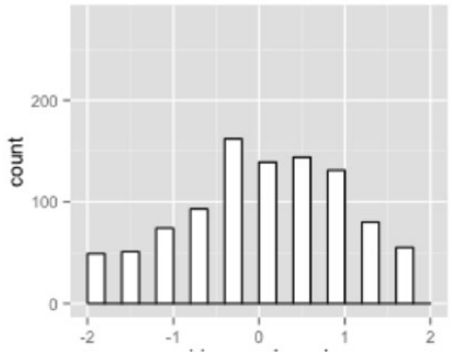
No relationship exists between education and received knowledge, while the relationships between education and both subjective and reasoned knowledge are puzzling: compared to the base group of high school–educated respondents, people with less education report significantly higher subjective and reasoned knowledge, while people with a graduate degree report much lower knowledge levels. One explanation is that intellectual humility, that is, self-recognition of one's own ignorance and fallibility, increases as people obtain more education. Recall that "subjective knowledge" is defined and measured as how much people *think* they know; thus, it is not surprising to observe highly educated people being more reluctant to claim precise and complete understanding of the policy.

Policy Knowledge and Policy Attitude

We measured six dimensions of policy attitude using 5-point Likert scale items: perceived effectiveness, perceived affordability, perceived equity, perceived personal outcome, attitudes toward revenue usage, and attitudes toward freedom infringement. Table 6's midsection lists the specific set of statements (two for each policy attitude) and reports the corresponding mean responses. The levels of agreement are recoded as −2, −1, 0, 1, and 2: the higher the number, the more positive the policy attitude. Table 7 reports the standardized coefficients of the six attitude SEMs.

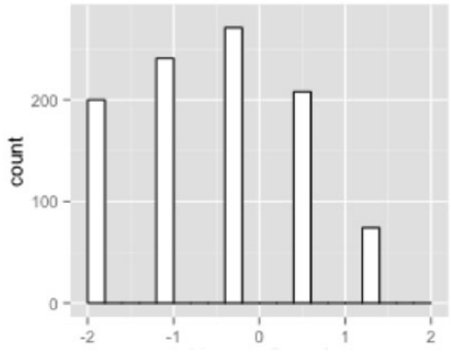
We draw two main findings. First, reasoned knowledge significantly and positively influences all six dimensions of policy attitudes; in contrast, subjective knowledge (individual) negatively influences all six attitudinal aspects, and received knowledge (individual) also negatively influences perceived effectiveness and affordability and perceived personal outcome. In other words, from the personal and individual perspective, the more people know about the policy, the less they like it; from the systematic perspective, the more people understand the policy's rationale, the more they respect it. Second, the magnitudes of these relationships differ greatly: reasoned knowledge has the strongest association with attitudes, subjective knowledge has a moderate association, and received knowledge's association is the weakest.

Received knowledge (individual information)



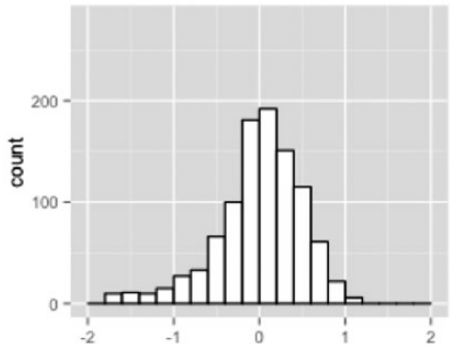
Score: discrete scores based on the number of correct answers of questions 1–10, scaled to (–2,2)

Received knowledge (collective information)



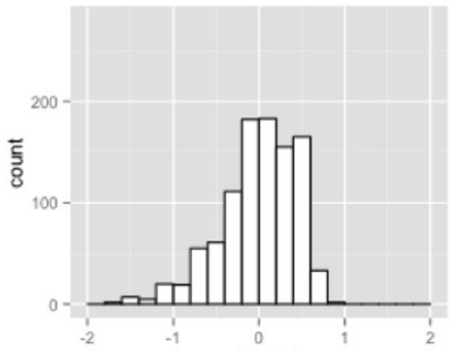
Score: discrete scores based on the number of correct answers of question 11–15, scaled to (–2,2)

Subjective knowledge (individual information)



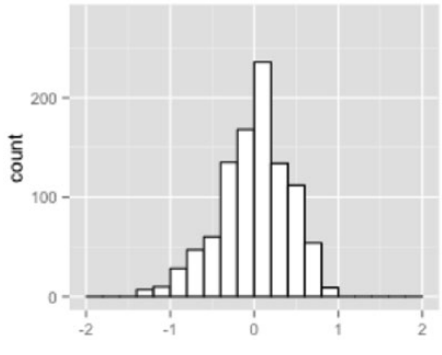
Score: Confirmatory factor analysis
Factor scores based on questions 16–19
CFI = 0.995; TLI = 0.984; RMSEA = 0.041; SRMR = 0.014

Subjective knowledge (collective information)



Score: Confirmatory factor analysis
Factor scores based on questions 20–23
CFI = 0.980; TLI = 0.941; RMSEA = 0.073; SRMR = 0.024

Reasoned knowledge



Score: CFA score of questions 24–27
CFI = 0.967; TLI = 0.900; RMSEA = 0.091; SRMR = 0.030

Correlation matrix

	subjective (individual)	subjective (collective)	reasoned	received (individual)	received (collective
subjective (individual)	1				
subjective (collective)	0.63 ***	1			
reasoned	0.56 ***	0.61 ***	1		
received (individual)	0.27 ***	0.22 ***	0.17 ***	1	
received (collective)	0.27 ***	0.23 ***	0.23 ***	0.42 ***	1

Significance levels: ***$p < 0.001$.

Figure 4. Distribution of and correlation between different types of knowledge.
Note: CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

Table 5. Variation in Policy Knowledge by Socioeconomic Status and Mobility Patterns.

	Dependent Variables (Five Types of Knowledge)				
Independent Variables	Received (Individual)	Received (Collective)	Subjective (Individual)	Subjective (Collective)	Reasoned
Education_1 (below high school)	0.037	0.045	0.525***	0.461**	0.722***
Education_3 (college)	−0.011	−0.056	−0.033	0.059	−0.098
Education_4 (university)	0.051	0.013	−0.112	0.009	−0.092
Education_5 (master's and above)	0.008	−0.010	−0.451*	−0.336†	−0.412*
Household location	0.000	0.031	0.065	0.074†	0.001
Number of children	0.044	0.013	0.247**	0.27**	0.157†
Household income	0.142***	0.108*	0.005	0.01	0.023**
Years living in Shanghai	0.209**	0.045	0.01†	0.021***	0.022***
Car mode share	−0.011	0.042	0.007***	0.007**	0.009***
Shanghai residence	0.059	0.072	0.005	−0.237	−0.577**
Walking time to nearest subway station	−0.012	−0.054	−0.005	−0.007	−0.012*
Commuting distance	−0.033	0.004	−0.01*	−0.011*	−0.009†
Car ownership_1 (car registered outside of Shanghai)	−0.025	−0.058†	−0.062	−0.133	−0.307*
Car ownership_2 (car registered in Shanghai suburbs)	0.065*	−0.071†	−0.235	−0.193	−0.171
Car ownership_4 (non–car owners)	−0.274***	0.003	−0.305*	0.074	0.052
CFI			0.936	0.927	0.870
TLI			0.910	0.898	0.831
RMSEA			0.032	0.031	0.039
SRMR			0.020	0.019	0.025
R-square	0.218	0.036			

Note: The first two columns report the results of the two linear regression models where received knowledge (individual) and received knowledge (collective) are measured as observed variables; the last three columns report the results of the three structural equation models, where subjective knowledge (individual), subjective knowledge (collective), and reasoned knowledge are measured as latent factors. All coefficients reported in the table are standardized coefficients. Household location is approximated as the lowest number of ring road within which the participant's home is located. Reference groups for dummy variables: car ownership_3 (Shanghai car owners), education_2 (high school education). CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.
***$p < 0.001$, **$p < 0.01$, *$p < 0.05$, †$p < 0.1$.

Table 6. Public Acceptance of and Public Attitudes toward the Vehicle License Auction Policy.

	Questions	Mean and Standard Deviation		
Dimensions	Coding: −2 = strongly disagree, 0 = neutral, 2 = strongly agree	All	Car Owners	Non–Car Owners
Overall acceptance and impression				
Acceptance	1. I support the car license plate auction policy in Shanghai.	0.522 (1.08)	0.456 (1.04)	0.588 (1.11)
	2. I hope the auction policy can continue to be implemented in Shanghai.	0.451 (1.06)	0.406 (1.03)	0.496 (1.09)
	3. The Shanghai government should not use the license auction policy to mitigate congestion. (reverse scored)	0.081 (1.01)	0.014 (1.06)	0.148 (0.96)
	4. I cannot accept the license auction policy since there are a lot of problems and loopholes. (reverse scored)	0.141 (1.02)	0.068 (1.01)	0.214 (1.03)
	5. If voting, I would not vote for continued implementation of the license auction policy. (reverse scored)	0.266 (1.03)	0.218 (1.04)	0.314 (1.01)

(continued)

Table 6. (continued)

Dimensions		Questions Coding: −2 = strongly disagree, 0 = neutral, 2 = strongly agree	Mean and Standard Deviation All	 Car Owners	 Non–Car Owners
Attitudes toward policy design and effect					
Perceived effectiveness	6.	The Shanghai government has mitigated congestion effectively by using the license auction policy.	0.497 (1.03)	0.356 (1.06)	0.638 (0.97)
	7.	Shanghai's auction policy will be effective in congestion mitigation in the long term.	0.433 (1.01)	0.302 (1.01)	0.564 (0.99)
Perceived affordability	8.	Shanghai license price is still within my financial capacity.	0.229 (1.13)	0.194 (1.10)	0.264 (1.16)
	9.	The current price is still below my willingness to pay because I really want to drive a car.	0.271 (1.08)	0.284 (1.06)	0.258 (1.11)
Perceived personal outcome	10.	Considering the time saving and the price of the license plate, I am better off in my composite travel cost.	0.32 (1.04)	0.254 (1.06)	0.386 (1.01)
	11.	My travel behavior was not affected negatively by this policy.	0.309 (0.95)	0.256 (0.96)	0.362 (0.95)
Perceived equity	12.	The auction policy is not fair since all private vehicles are auctioned together despite their price and type. (reverse scored)	−0.536 (0.91)	−0.556 (0.90)	−0.516 (0.91)
	13.	Shanghai's license auction policy is not fair, since it makes the road that is constructed using revenue collected from all residents only for rich people. (reverse scored)	−0.527 (0.96)	−0.546 (0.97)	−0.508 (0.96)
Attitudes toward revenue usage	14.	The revenue usage of Shanghai license plate auction is not transparent enough to the public. (reverse scored)	−0.697 (0.95)	−0.714 (0.94)	−0.68 (0.96)
	15.	The auction revenue is not effectively used to improve Shanghai transportation systems. (reverse scored)	−0.472 (0.96)	−0.486 (0.96)	−0.458 (0.95)
Freedom	16.	I regard the auction policy as an infringement of my personal freedom. (reverse scored)	−0.005 (1.04)	−0.076 (0.99)	0.066 (1.09)
	17.	The auction policy infringed on my mobility freedom. (reverse scored)	−0.08 (1.09)	−0.166 (1.03)	0.006 (1.13)
Attitudes toward local government and the urban system					
Trust in government	18.	I trust the Shanghai government to make the decision on congestion mitigation policy.	0.875 (0.87)	0.814 (0.87)	0.936 (0.86)
	19.	I trust the Shanghai government in designing the auction policy.	0.789 (0.85)	0.744 (0.86)	0.834 (0.83)
Problem awareness	20.	Shanghai's traffic is very congested.	1.141 (0.76)	1.154 (0.76)	1.128 (0.76)
	21.	The rate of car ownership and usage is too high in Shanghai.	0.991 (0.75)	1.02 (0.75)	0.962 (0.75)
	22.	Air pollution in Shanghai is worsened by the traffic.	1.066 (0.82)	1.106 (0.81)	1.026 (0.83)
	23.	Something needs to be down to improve the traffic condition.	1.271 (0.76)	1.328 (0.74)	1.214 (0.76)
Attitudes toward alternative modes	24.	Shanghai's public transit service is very convenient.	0.871 (0.91)	0.858 (0.94)	0.884 (0.87)
	25.	I can get around easily in Shanghai without having a car.	0.738 (0.92)	0.7 (0.97)	0.776 (0.88)

Table 7. Relationship between Knowledge and Six Dimensions of Policy Attitudes.

	Dependent Variables					
Independent Variables	Perceived Effectiveness	Perceived Affordability	Perceived Equity	Attitudes on Revenue Usage	No Freedom Infringement	Perceived Personal Outcome
Received knowledge (individual)	−0.141***	−0.128**	−0.003	−0.056	0.036	−0.066†
Received knowledge (collective)	0.032	0.121**	−0.014	−0.002	0.054	0.033
Subjective knowledge (individual)	−0.319*	−0.319*	−0.172	−0.232†	−0.419***	−0.379**
Reasoned knowledge	0.842***	0.772***	0.204†	0.352**	0.322**	0.651***
Education_1 (below high school)	−0.17	−0.032	0.206	−0.006	−0.198	0.058
Education_3 (college)	0.007	−0.019	0.1	−0.091	0.219*	−0.014
Education_4 (university)	−0.038	−0.058	0.049	−0.085	−0.023	0.033
Education_5 (master's and above)	0.085	−0.098	−0.157	−0.223	−0.159	0.167
Household location	0.039	−0.028	0.116**	0.028	0.061	−0.057
Number of children	0.037	0.019	0.066*	0.032	0.021	−0.012
Household income	−0.036	0.015	0.11*	0.031	0.054	−0.096*
Living years in Shanghai	0.154*	0.09	0.006	0.005	0.161*	0.029
Car mode share	0.126**	0.276***	0.026	0.044	0.01	0.049
Shanghai residence	−0.389*	−0.256	−0.128	−0.12	−0.287†	−0.096
Walking time to nearest subway station	−0.048	−0.105**	−0.04	−0.061†	−0.04	−0.084*
Commuting distance	−0.063*	0.001	0.004	0.06†	0.029	−0.018
Car ownership_1 (car registered outside of Shanghai)	−0.204†	−0.357**	−0.092	−0.155	−0.1	−0.154
Car ownership_2 (car registered in Shanghai suburbs)	−0.204	−0.183	−0.159	−0.087	0.029	−0.066
Car ownership_4 (non–car owners)	0.378**	0.367**	0.045	0.002	0.132	0.113
CFI	0.861	0.866	0.835	0.842	0.854	0.814
TLI	0.838	0.845	0.809	0.816	0.831	0.785
RMSEA	0.045	0.046	0.046	0.045	0.046	0.050
SRMR	0.055	0.055	0.054	0.054	0.054	0.056

Note: The table reports the results of the six structural equation models, where the six aspects of policy attitudes are measured as latent factors. Socioeconomic characteristics and mobility patterns are included as control variables. All coefficients reported in the table are standardized coefficients. Household location is approximated as the lowest number of ring road within which the participant's home is located. Reference groups for dummy variables: car ownership_3 (Shanghai car owners), education_2 (high school education). CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.
***$p < 0.001$, **$p < 0.01$, *$p < 0.05$, †$p < 0.1$.

Policy Knowledge and Policy Acceptance

We examine the impact of policy knowledge on public acceptance and compare it with that of the attitudinal factors. Alongside the six attitudes described above, we added trust in government, awareness of transportation problems, and attitudes toward alternative modes. These three factors may potentially influence public acceptance of the VLA but are not a direct function of knowledge of the VLA. All nine attitudinal factors have been shown in prior literature to influence policy acceptance, and these statements are adapted from those papers. Each of the attitudes is measured by between two and four 5-point Likert scale questions (Table 6 bottom section) and public acceptance is measured by five 5-point Likert scale items (Table 6 top section).

Table 8 reports the standardized coefficients of the SEM with public acceptance as the dependent variable. Both reasoned and subjective knowledge (individual) influence public acceptance, but in opposite directions: reasoned knowledge increases acceptance, while subjective knowledge (individual) decreases it. Received knowledge has no direct impact. Among the attitudinal factors, perceived effectiveness and attitude toward revenue usage have the strongest impact on acceptance: both highly significant and positive. Perceived equity also has a positive impact, but to a lesser degree. The other six attitudinal factors are not significant.

Combining Tables 7 and 8, we can observe policy knowledge's indirect effects on acceptance via policy attitudes. For example, received knowledge does not influence acceptance directly but does influence perceived effectiveness, which in turn impacts acceptance. Reasoned knowledge has both direct and indirect effects (via perceived effectiveness and attitudes toward revenue use), and the same is true for subjective knowledge (individual).

Discussion and Conclusion

In our theoretical framework, we propose, for the first time in the literature, the concept and structure of policy knowledge from a public perspective and establish the direct relationship

Table 8. Impact of Policy Knowledge on Public Acceptance.

	Dependent Variable: Public Acceptance	
Independent Variables	Estimate	Two-Tailed *p* Value
Received knowledge (individual)	−0.013	0.682
Received knowledge (collective)	0.013	0.634
Subjective knowledge (individual)	−0.197†	0.074
Reasoned knowledge	0.223†	0.092
Perceived effectiveness	0.582***	0.000
Perceived affordability	0.050	0.361
Perceived equity	0.143*	0.012
Attitudes toward revenue usage	0.201***	0.000
No freedom infringement	−0.040	0.549
Perceived personal outcome	−0.036	0.539
Trust in government	−0.053	0.357
Problem awareness	0.004	0.917
Attitudes toward public transit	0.014	0.640
CFI	0.929	
TLI	0.921	
RMSEA	0.032	
SRMR	0.046	

Note: The table reports the results of the structural equation models, where public acceptance is measured as a latent factor. All coefficients reported in the table are standardized coefficients. The socioeconomic characteristics and mobility patterns are included in the model as control variables but are not reported here to avoid clutter. CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.
***$p < 0.001$, *$p < 0.05$, †$p < 0.1$.

between knowledge and attitudes in the transportation policy domain. It is important to conceptualize policy knowledge from the perspective of the public, that is, the subjects of a policy, rather than the policy makers, because this reveals how citizens understand and perceive the policy and influences how they react thereto. Fusing theories of knowledge from multiple fields, we establish a framework for structuring policy knowledge—received knowledge, subjective knowledge, and reasoned knowledge—as they relate to different information sources, focuses, and levels of individual involvement.

Through a case study on Shanghai's VLA, we examined how the public's policy knowledge is associated with six dimensions of the attitudes toward the transport policy and, ultimately, public acceptance of the policy. Policy knowledge plays a significant role in the formation of public attitudes and acceptance. However, a high level of knowledge does not necessarily produce positive attitudes or greater acceptance. The specific impacts depend on the types of knowledge and the dimension of the attitudes. A series of SEMs illustrate three main findings: first, reasoned knowledge is significantly positive in influencing policy attitudes, while subjective knowledge (individual) is significantly negative; second, reasoned knowledge has the strongest effects, followed by subjective knowledge, and received knowledge only has a minor influence; third, after controlling for nine aspects of policy attitudes, socioeconomic characteristics, and mobility patterns, reasoned and subjective knowledge are still statistically significant in influencing policy acceptance.

Policy acceptance does not occur when people only learn the details of the car restriction policy. In fact, many people only see the daily constraints and burden that the VLA places on them. Higher knowledge with respect to individual information, both received and subjective, may well reduce the public's perceived effectiveness and policy acceptance. Unfortunately, most news and information about Shanghai's VLA policy focuses only on its implementation details.

Effective communication should explain the policy's rationale and emphasize its broader social benefits. The Shanghai government should publicize the challenges faced by the city in the era of rapid motorization, why the VLA is a good management option, and how the policy benefits Shanghai as a whole. When people increase their reasoned knowledge, they will focus less on the individual burden and develop more positive attitudes toward the policy. Personal restrictions are more tolerable when people understand the tangible benefits for society. One example of an approach to increase reasoned knowledge could be to illustrate the congestion reduction impact of the VLA policy. For instance, during the congestion charging trial in Stockholm, extensive monitoring and evaluation program was carried out and concluded substantial reductions in congestion and emission (Börjesson et al. 2012).

There are at least four limitations to this study. First, we use the pragmatic self-report method to measure reasoned knowledge. We suggest future studies use interviews to assess reasoned knowledge. The interviewers should ask participants open-ended questions, allowing interviewees to describe their understanding of the policy rationale, effect, pros, and cons, and to evaluate alternative policies. Based on the participants' answers, the interviewers can then comment on and rate the participants' level of reasoned knowledge. Second, we use unsupervised online questionnaires to test received knowledge. There is a possibility, though a minor one, that respondents simply searched for answers for straightforward policy questions to avoid showing ignorance. The best way to confirm or disprove this would be by conducting sample surveys in person and comparing the results. Third, as we collected cross-sectional data, we could only examine the associative relationships between policy knowledge and attitudes, not the causal relationships. It is at least plausible that strong attitudes motivate people to gain more knowledge about a policy (Holbrook et al. 2005). We suggest future studies use randomized control experiments or econometric methods, such as instrumental variables, to identify the direction of influence. Fourth, this study focused on one particular VLA case. Generalization to other contexts requires further studies building on this research.

Declaration of Conflicting Interests

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