



## Why is Vietnam a motorcycle nation? A transport psychology study

Thuy Linh Le<sup>1</sup>, Dorina Pojani<sup>2\*</sup>, Thanh Chuong Nguyen<sup>1</sup>, Thanh Tung Ha<sup>1</sup>, Minh Hieu Nguyen<sup>1</sup>

<sup>1</sup>Faculty of Transport - Economics, University of Transport and Communications, Hanoi, Vietnam

<sup>2</sup>School of Architecture, Design and Planning, The University of Queensland, Brisbane, Australia

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### Abstract

This article investigates the reasons why people use motorcycles in two Vietnamese megacities, Hanoi and Ho Chi Minh City (HCMC). The research targets university students. The various factors that lead students to use motorcycles, as well as the linkages between those factors, are assessed through a statistical technique known as Partial Least Squares Structural Equation Modelling (PLS-SEM). Conceptually, this study is guided by an extended version of the Theory of Planned Behaviour, a well-established socio-psychological framework. We find that widespread motorcycle use among students is linked to behavioural beliefs, normative beliefs, and control beliefs. Motorcycles are variously seen as convenient, inexpensive, fun, flexible, modern, and wanted – whereas factors such as health, safety, status, and environmental impact are irrelevant. But motorcycle use is also determined by habit and values (progressive or conservative). In fact, the effect of these two additional constructs is larger than the effect of beliefs. In addition, we find that higher income students, those who come from the provinces, and those who are more attached to cars are more prone to using motorcycles as well.

*Keywords:* Motorcycles; Vietnam; students; Structural Equation Modelling; Theory of Planned Behaviour.

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### 1. Introduction

Since the early 1990s, Vietnam has become the land of motorcycles (Figure 1). Over 70 million units are now registered nationwide - compared to only 1.2 million in 1990 (NTSCV, 2021). The motorcycle ownership rate is about 565 units per 1000 persons. Motorcycles make up more than 90% of the national vehicle fleet (Huynh and Gomez-Ibanez, 2017). In contrast, cycling is not used much, except for recreation or by children. But even children and adolescents are increasingly using motorcycles – in Vietnam and elsewhere in Asia. Bus use is also minuscule: 9% in Hanoi and 5% in Ho Chi Minh City - despite substantial efforts and funding invested in enhancing public transport systems here (Nguyen and Pojani, 2021). Cars are a luxury item: less than 1% of the population owns one.

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\* Corresponding author: Dorina Pojani (d.pojani@uq.edu.au)



Figure 1: Heavy motorcycle traffic in Hanoi. Photo by authors.

Motorcycle dependency is less negative than conventional wisdom may suggest. As Huynh and Gomez-Ibañez (2017, p.268) note, “While motorcycles are often blamed for causing traffic problems in Vietnamese cities... transportation experts point out that the situation would be much worse if travelers were using cars instead.” However, motorcycles do cause many externalities, including accidents, congestion, air and noise pollution, and general chaos. About 60% of road crashes nationwide involve motorcyclists, and the casualty rate among motorcycle riders is over 85%. The concentration of pollutants such as  $O_3$  and  $NO_2$  in the air frequently exceeded the WHO guidelines, and the primary culprit are motorcycle emissions (NTSCV, 2021).

A more sustainable scenario would entail high bus and bicycle use and low car and motorcycle use. To achieve this, we need to gain a better understanding of the factors that lead people - in particular young people - to ride motorcycles in the first place. Most studies on this topic have hailed from highly developed countries such as Taiwan (Chen and Lai, 2011), Greece (Yannis et al., 2007), France (Kopp, 2011), and Japan (Yamamoto, 2009). Some studies have also been conducted in less developed countries, specifically Malaysia (Yamamoto, 2009), Colombia, Venezuela, and Argentina (Hagen et al., 2016). Findings suggest that the public finds motorcycles advantageous over cars in terms of cost, speed, flexibility, and parking ease. More recently, with the rise of app-based moto-taxi and delivery services, motorcycles have also turned into a source of income.

However, scholarly knowledge is far from complete. Studies set in the less developed parts of Asia, where motorcycle use is concentrated, are few and far between. To address the gap, this article investigates people’s “love affair” with motorcycles in two Vietnamese megacities, Hanoi and Ho Chi Minh City (HCMC). The research targets university students – thus expanding on earlier work about student mode choice in Vietnam. The various factors that lead students to use motorcycles, as well as the linkages between those factors, are assessed through a statistical technique known as Partial Least Squared Structural Equation Modelling (PLS-SEM). Conceptually, this study is guided by an extended version of the Theory of Planned Behaviour. Below we discuss the classic theory and then the added components for the purpose of this study.

## 2. Conceptual framework

### 2.1 Classic Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) is a well-tested socio-psychological approach used to understand and predict human behaviour (Ajzen, 1991). In transport, it has been employed in both quantitative and qualitative studies to analyse and/or predict mode choice (Nguyen et al., 2024b, 2024a). The theory posits that a behaviour, such as riding a motorcycle, results from the *intention* to perform that behaviour (Chen and Chao, 2011). In turn, the intention is determined by three underlying beliefs: behavioural, normative, and control beliefs. Because the TPB is well-known in transportation research, we only discuss these beliefs briefly here.

*Behavioural beliefs* or attitudes are conceptualized as (positive and/or negative) assessments of the likely consequences of a behaviour. In this study, we consider five behavioural beliefs around motorcycle use, based on the extant literature: ‘motorcycles as unhealthy’, ‘motorcycles as unsafe’, ‘motorcycles as environmentally unfriendly’, ‘motorcycles as enjoyment’, and ‘motorcycles as independence’ (see Hagen et al. 2016).

*Normative beliefs* refer to descriptive and injunctive social norms around a behaviour (Cialdini et al., 1990) - in this case the choice of a travel mode. Norms are expected to be crucial in Vietnam where in the 1990s motorcycles constituted an important upgrade from conventional push bicycles and now have become ubiquitous (Huynh and Gomez-Ibañez, 2017). Therefore, we include three normative beliefs: ‘motorcycles as status’, ‘motorcycles as social norm’, and ‘motorcycles as modernity’.

*Control beliefs* are a person’s perceived abilities to influence the performance of a behaviour (Ajzen, 1991). They depend, inter alia, on the financial costs or the ease of engaging particular behaviours. Previous transport studies have found that control beliefs - particularly around travel/parking convenience and affordability - are key predictors of mode choice (Yamamoto, 2009). On this basis, we consider two control beliefs: ‘motorcycles as convenience’ and ‘motorcycles as parsimony’.

### 2.2 Extended Theory of Planned Behaviour

We extend the classic Theory of Planned Behaviour by two dimensions: habits and values. These are described below.

*Habits* are regular behaviours which people perform automatically and/or repetitively, without much (or any) pondering beforehand. The presence and/or extent of a habit can be estimated by simply measuring the frequency of a behaviour (Triandis, 1977). But habits can also be treated as a latent construct measured through personal statements. The incorporation of habits in the TPB model is not new. A series of transport researchers have argued that the choice of daily travel modes (e.g., for one’s work commute) does not involve a deliberate decision-making process on a daily basis (Møller and Thøgersen, 2008). Rather, it is an automatic response to a familiar context and goal, which is only disrupted if one changes job or residence or gains access to a new travel mode. The inclusion of habits in TPB-based studies tends to strengthen the model. Therefore, we also consider ‘motorcycles as habit’.

*Values* represent intrinsic beliefs that a particular mode of conduct or end-state of existence is individually or socially preferable to the opposite. As such, values guide morally grounded behaviour. They shape personal opinions, political orientations, and lifestyles and precede behavioural intentions (Andersson and Nässén, 2016). Values are quite diverse: egoistic, altruistic, biospheric, materialistic, consumeristic, and so on (Andersson and Nässén, 2016). Transportation studies are increasingly looking at the role

of values in determining mode choice decisions. It has been found that, in some contexts a materialistic/consumeristic outlook is associated with a preference for cars (Pojani et al., 2018) while an individualistic mindset leads to fewer non-motorized trips (Scheiner and Holz-Rau, 2007). Accordingly, we consider two sets of values: ‘progressive orientation’ and ‘conservative orientation’.

### 2.3 Control variables

In examining Vietnamese students’ intention to use motorcycles, we control for a series of socio-demographic variables, which were statistically significant in previous studies of mode choice. These include gender, household income, internal migration status, vehicle ownership (Chen and Lai, 2011), and intention to upgrade from motorcycles to cars, given the opportunity (Belgiawan et al., 2014). The latter is particularly concerning in cities such as Hanoi and HCMC that are already quite congested.

Based on the foregoing review, we lay out nine hypotheses:

- H1: Behavioural beliefs affect motorcycle use intention
- H2: Normative beliefs affect motorcycle use intention
- H3: Control beliefs affect motorcycle use intention
- H4: Habits affect motorcycle use intention
- H5: Values affect motorcycle use intention.
- H6: Values affect behavioural beliefs
- H7: Values affect normative beliefs
- H8: Values affect control beliefs

Our preliminary conceptual framework is graphically illustrated in Figure 2.

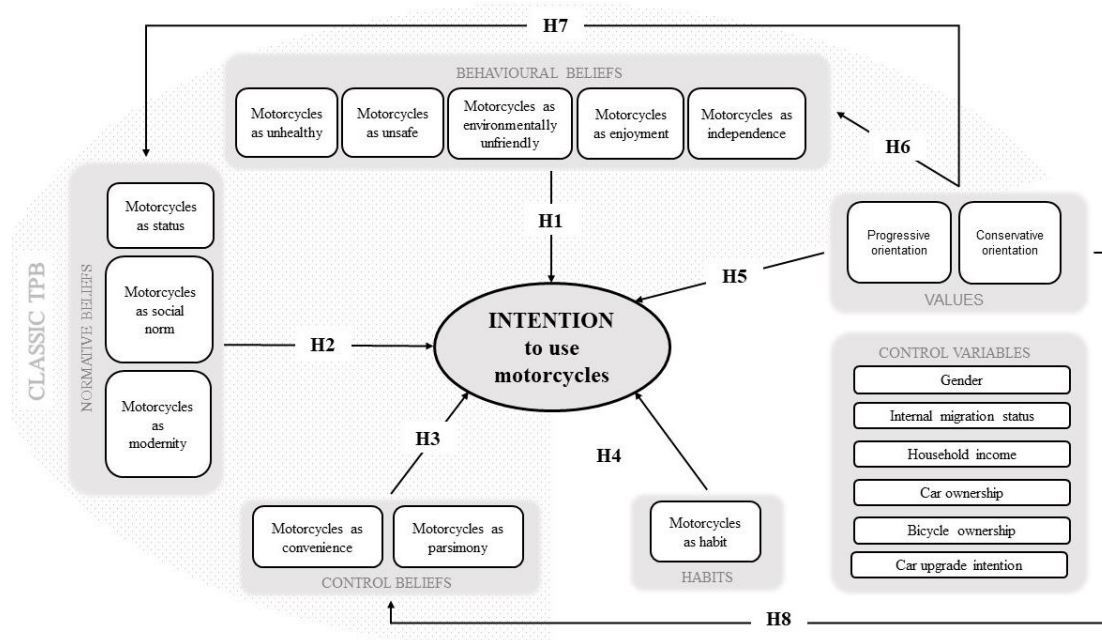


Figure 2: Preliminary conceptual framework.

### 3. Methodology

#### 3.1 Research areas

The data for this study were collected in two Vietnamese megacities: Hanoi and Ho Chi Minh City (HCMC). The former is the administrative capital and the latter is Vietnam's commercial hub. Some basic information about the two cities is provided in Figure 3. As seen, both are dominated by motorcycles; this mode is growing further due to the proliferation of motorcycle-based delivery and taxi services. Motorcycle trips are longer in Hanoi than in HCMC (5 km compared to 3.3 km on average) because Hanoi's metropolitan area is larger (Ngoc et al., 2021).

Meanwhile, Hanoi's public transport system is more popular than HCMC's because of its higher quality and wider reach; however, in the past five years bus ridership has declined in both cities. Cars and bicycles are used little for travel – although recreational cycling has grown during the Covid-19 pandemic. In HCMC, frequent floods deter car use and lead people to use motorcycles more than in Hanoi. In addition, constant year-round temperatures (at 26-30°C) encourage motorcycle ridership in HCMC. In Hanoi, by contrast, temperatures drop down to 10-15°C in winter and rise to 35-40°C in summer; such variation is seen as an impediment to active and public transport use.

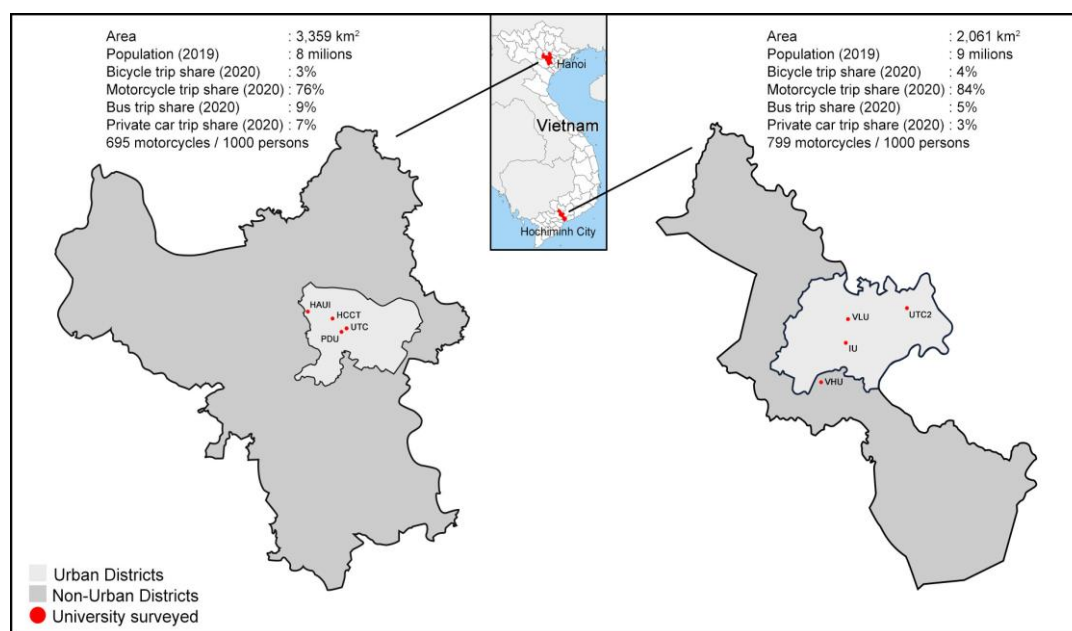


Figure 3: Overview of Hanoi and Ho Chi Minh City.

Hanoi and HCMC are large educational centres with 80 and 90 universities respectively – nearly all located in urban districts. In Hanoi, the student population is 600,000 and in HCMC it is over 800,000. Students are the main public transport patrons in both cities. However, the most popular commute mode among students is the motorcycle, and buses are losing riders to it. Overall, traffic congestion and pollution are major problems in both cities (Huynh and Gomez-Ibañez, 2017).

#### 3.2 Data collection

As noted, this study targeted university students. A structured, two-part survey was designed to collect data. The first part collected socio-demographic information. The second part included a series of statements which measured, on a 5-point Likert scale, the

various constructs in the extended Theory of Planned Behaviour model (see Table 2 later). The statements were adapted from the existing literature covering behavioural beliefs (Nayum and Nordfjærn, 2021), normative beliefs (Bamberg et al., 2003), control beliefs (Armitage and Conner, 1999), values (Pojani et al., 2018), habits (Verplanken and Orbell, 2003), and behavioural intentions (Chen and Lai, 2011). The questionnaire was prepared in English and then translated into Vietnamese. The Vietnamese version was pre-tested with ten students in each city, and refined based on their feedback, before being administered at a large scale.

The data were collected in January 2022. Because university courses were shunted online at the time due to the Covid-19 pandemic, a web-based survey was the only option to reach students. We used Google Forms with all questions marked as mandatory. In total, eight universities were selected for inclusion in the study, four in Hanoi and four in HCMC. The criteria for selecting the universities were the following: (1) at least one had to be private, (2) at least one had to be located at the border between urban and non-urban districts, and (3) at least one had to be a college.

The application of these criteria helped us attain a reasonable geographical and institutional distribution. Sampling proceeded in a snowball manner, with the support of university lecturers and student associations in each city. We received 782 completed questionnaires, of which 32 were dropped due unreliable responses. The final sample consisted of 750 respondents. The sample characteristics are summarized in Table 1. They are consistent with the characteristics of the student body in Hanoi and HCMC. Travel patterns are as expected. As seen, 71% of the respondents owned a motorcycle, and a large majority hoped to upgrade to cars one day.

Table 1: Sample characteristics (N=750).

<i>Variables</i>		<i>Fre.</i>	<i>%</i>
City	Hanoi	361	48
	Ho Chi Minh City	389	52
Gender	Male	366	49
	Female	384	51
Internal migrant status	Yes	552	74
	No	198	26
Monthly income (household)	Higher (> \$700)*	386	51
	Lower ( $\leq$ \$700)	364	49
Motorcycle ownership (personal)	Yes	529	71
	No	221	29
Car ownership (household)	Yes	125	17
	No	625	83
Bicycle ownership (household)	Yes	318	42
	No	432	58
Frequency of car use (driver / passenger)	Rarely (1-2 days / month)	563	75
	Sometimes (3-4 days / month)	156	21
	Often (2-3 days / week)	21	3
	Habitual (4-7 days / week)	10	1
Frequency of bicycle use	Rarely (1-2 days / month)	575	77
	Sometimes (3-4 days / month)	85	11
	Often (2-3 days / week)	55	7
	Habitual (4-7 days / week)	35	5

Intention to upgrade to cars	Yes	525	70
	No	225	30

\*About 16.4 million VND (\$700)

### 3.3 Analytical methods

While this study was conceptually grounded in a well-known framework (TPB), the items were derived from an array of studies rather than a standardized questionnaire. Therefore, Exploratory Factor Analysis (EFA) was first applied to confirm that the latent constructs matched those proposed in our extended version of TPB. Specifically, EFA was applied to all the attitudinal statements, apart from those forming the central construct, ‘intention to use motorcycles’. The analysis was conducted in Stata 15.0, using the following parameters: orthogonal oblimin rotation (Kaiser on) and principal components analysis extraction (eigenvalue >1). EFA produced nine constructs, some of which were a combination of the initially proposed constructs:

*Behavioural beliefs:* (1) Motorcycles as independence and enjoyment, (2) Motorcycles as environmentally unfriendly, (3) Motorcycles as unsafe and unhealthy.

*Normative beliefs:* (1) Motorcycles as social norm and modernity, (2) Motorcycles as status.

*Control beliefs:* (1) Motorcycles as convenience and parsimony.

*Habits:* (1) Motorcycles as habit.

*Values:* (1) Progressive orientation, (2) Conservative orientation.

The retained constructs explained 74% of the data variance. The dimensions that we added to the TPB (habits and values) were retained. Metrics such as the Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett’s test of sphericity indicated that the correlations between items were sufficiently large thus confirming EFA’s validity.

The constructs derived though EFA were then used to empirically test the study hypotheses through Structural Equation Modelling (SEM). We kept the constructs separate (e.g., ‘motorcycles as unsafe’, ‘motorcycles as status’, and so on) rather than applying a second-order construct technique to group them into dimensions (beliefs, values, and so on). Our approach, used in other studies as well (see Pojani et al., 2018), is based on the logic that a set of beliefs belonging to a group (e.g., control beliefs) may be internally inconsistent due to differences in effect sizes (see (Ajzen, 1991) Also, by separating the constructs, a more nuanced understanding of the factors that affect motorcycle use can be gained.

Partial Least Squares Structural Equation Modelling (PLS-SEM) can effectively estimate complex models from smaller samples with non-normal distribution (Hair et al., 2019; see also Nguyen-Phuoc et al., 2022). Therefore, this study applied PLS-SEM to the proposed framework, using SmartPLS 3.3.6 software. Our sample (N=750) was eligible in terms of size. Hair et al. (2019) recommend a minimum sample size of 619 observations based on the following parameters: significance level=5%, minimum path coefficient=0.5-0.1, power=80%.

Table 2: Exploratory Factor Analysis results.

Code	Items	Factors derived								
		Motorcycles as independence & enjoyment	Motorcycles as convenience & parsimony	Motorcycles as social norms & modernity	Progressive orientation	Motorcycles as unsafe & unhealthy	Conservative orientation	Motorcycles as status	Motorcycles as environmentally unfriendly	Motorcycles as habit
inde_1	A motorcycle gives me freedom	0.8049								
inde_2	With a motorcycle, I can travel whenever I want	0.8474								
inde_3	On a motorcycle, no one can push or harass me	0.7272								
inde_4	Everyone has the right to travel by motorcycle as much as they want	0.8232								
enjoy_1	Riding motorcycles is fun	0.8953								
enjoy_2	Riding a motorcycle is more fun than driving a car	0.7369								
enjoy_3	Riding a motorcycle is more fun than riding a bicycle	0.7238								
envi_1	Motorcycles cause a lot of pollution								0.8758	
envi_2	Motorcycles are the main cause of congestion in Hanoi/HCMC								0.8740	
unsafe_1	Riding a motorcycle is dangerous					0.7677				
unsafe_2	I have heard of many people being injured or dying in motorcycle crashes					0.7348				
health_1	People who travel by motorcycle don't get much exercise					0.7166				
health_2	To keep fit, walking is better than riding a motorcycle					0.8690				
health_3	To keep fit, riding a bicycle is better than riding a motorcycle					0.8761				
status_1	I envy people who have a car							0.8597		
status_2	I like fancy motorcycles							0.8142		
status_3	Having a motorcycle means that you have more status in society							0.8564		
norm_1	I need to ride a motorcycle to fit in with my friends			0.7626						

norm_2	Most people I know ride motorcycles			0.8173						
norm_3	My family supports my choice to ride a motorcycle			0.7340						
moder_1	Motorcycles are part of modern life in Vietnam			0.7263						
moder_2	In this day and age, all adults should know how to ride a motorcycle			0.7051						
conve_1	Motorcycles are the easiest way to get around Hanoi/HCMC		0.7695							
conve_2	In Hanoi/HCMC you need a motorcycle to get anything done		0.8179							
conve_3	With a motorcycle you can travel even when it is too hot		0.8098							
parsi_1	Motorcycles are the cheapest way to travel in Hanoi/HCMC		0.7103							
parsi_2	Cars cost too much		0.7642							
progres_1	I am an environmentalist				0.8750					
progres_2	I want to live in a just and equal society				0.9086					
progres_3	I want to have a regular family life				0.8919					
progres_4	I want to help others, to do charity				0.8923					
conser_1	I want to be rich						0.7897			
conser_2	I want a life full of entertainment, holidays						0.7919			
conser_3	I want to succeed in my profession						0.7680			
conser_4	I want to have life with adventures, travels, dangers						0.7362			
habit_1	I don't think too much about how I travel									0.8591
habit_2	I use motorcycles all the time									0.7677

Sample size: 750

Bartlett's Test of Sphericity: chi-square (18240.291); degrees of freedom (666); p-value (0.000); H<sub>0</sub>: variables are not intercorrelated

Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy: 0.8892

Method: principal-component factors with eigenvalue >1

Rotation: orthogonal oblimin (Kaiser on)

Retained factors = 9

Variance explained by nine factors extracted: 0.7350 (74%)

### 3.4 Model testing

To evaluate the PLS-SEM results we followed the two steps delineated below (as recommended by Hair et al., 2019):

*Assessment of measurement (outer) models.* The reflective measurement was applied to the constructs; we checked four criteria: (1) indicator reliability based on Factor Loading (FL); (2) internal consistency based on Cronbach Alpha (CA) and Composite Reliability (CR); (3) convergent validity based on Average Variance Extracted (AVE); and (4) discriminant validity based on the Fornell-Larcker Criterion and Heterotrait-Monotrait Ratio.

*Assessment of structural (inner) model.* We considered four criteria: (1) collinearity among latent constructs, based on Variance Inflation Factor (VIF); (2) predictive power of the model based on  $R^2$  (coefficient of determination) and  $Q^2$  (cross-validated redundancy) of endogenous latent variables; (3) model fit based on Standardized Root Mean Square Residual (SRMR) and Normed Fit Index (NFI); and (4) significance of paths based on the bootstrapping of 5000 samples and the resulting p-value.

The cut-off values recommended for all the aforementioned criteria are shown in Appendix 1, and the evaluation results are shown in Appendices 2, 3, 4, and 5. (Appendices 1 and 5 are at the end of this article. Appendices 2, 3, and 4 are available upon request.) As seen, all the testing criteria were satisfied. Notably, for the ‘intention to use motorcycles’, the  $R^2$  value (0.619) was moderate whereas the  $Q^2$  value (0.438) was medium (Hair et al., 2019). Once we were certain that all the criteria were satisfied, we looked at individual paths to check whether the hypotheses could be accepted and, if so, what the effects of the constructs were on the ‘intention to use motorcycles’.

### 3.5 Study limitations

We acknowledge that non-probabilistic samples such as ours can lead to biases. However, they are commonly used in transport studies which target hard-to-reach populations, such as students (see (Nayum and Nordfjærn, 2021)). Note also that self-reported cross-sectional data can only establish links; determining causation requires panel data. Finally, the intention to use various transportation modes is context-dependent, and studies of motorcycle use set in more developed countries may come up with different findings (Belgiawan et al., 2014). The results of our analysis, which follow below, have been interpreted with these limitations in mind.

## 4. Findings and discussions

### 4.1 Direct effects

The results of hypothesis testing (direct effects) are presented in Table 3 and Figure 4. A summary follows below.

H1: Behavioural beliefs affect motorcycle use intention: Partly accepted. Only ‘motorcycles as independence and enjoyment’ had a positive and significant direct effect on motorcycle use intention whereas the effects of ‘motorcycles as of unsafe and unhealthy’ and ‘motorcycles as environmentally unfriendly’ were not significant. Students do not seem to care about the health, safety, and environmental impacts of motorcycle use, which are known to be major (Liao et al., 2019). Or they may be (a) overestimating their riding skills; (b) convincing themselves that the effects of pollution can be mitigated by wearing face masks; (c) compensating for physical inactivity by engaging in sports at other times. Either way, this finding is problematic – although not unusual in the Global South (Hagen et al., 2016).

Table 3: Direct, indirect, and total effects.

Paths	Direct effects				Total indirect effects			Total effects			
	$\beta$	Std.	p	H	Decision	$\beta$	Std.	p	$\beta$	Std.	p
Motorcycles as independence & enjoyment → Intention to use motorcycles	<b>0.179*</b>	0.035	0.000	H1	<b>Accept</b>				<b>0.179*</b>	0.035	0.000
Motorcycles as unsafe & unhealthy → Intention to use motorcycles	0.022	0.025	0.409		Reject				0.022	0.025	0.409
Motorcycles as environmentally unfriendly → Intention to use motorcycles	-0.026	0.027	0.328		Reject				-0.026	0.027	0.328
Motorcycles as social norm & modernity → Intention to use motorcycles	<b>0.254*</b>	0.042	0.000	H2	<b>Accept</b>				<b>0.254*</b>	0.042	0.000
Motorcycles as status → Intention to use motorcycles	-0.012	0.027	0.636		Reject				-0.012	0.027	0.636
Motorcycles as convenience & parsimony → Intention to use motorcycles	<b>0.149*</b>	0.040	0.000	H3	<b>Accept</b>				<b>0.149*</b>	0.040	0.000
Motorcycles as habit → Intention to use motorcycles	<b>0.306*</b>	0.032	0.000	H4	<b>Accept</b>				<b>0.306*</b>	0.032	0.000
Progressive orientation → Intention to use motorcycles	<b>-0.106*</b>	0.027	0.000	H5	<b>Accept</b>	0.001	0.020	0.979	<b>-0.105*</b>	0.038	0.005
Conservative orientation → Intention to use motorcycles	<b>0.168*</b>	0.036	0.000		<b>Accept</b>	<b>0.261*</b> <sup>(1)</sup>	0.027	0.000		<b>0.430*</b>	0.038
Progressive orientation → Motorcycles as independence & enjoyment	0.036	0.036	0.326	H6	Reject				0.036	0.036	0.326
Progressive orientation → Motorcycles as unsafe & unhealthy	0.060	0.048	0.222		Reject				0.060	0.048	0.222
Progressive orientation → Motorcycles as environmentally unfriendly	<b>0.100*</b>	0.046	0.033		<b>Accept</b>				<b>0.100*</b>	0.046	0.033
Conservative orientation → Motorcycles as independence & enjoyment	<b>0.370*</b>	0.040	0.000		<b>Accept</b>				<b>0.370*</b>	0.040	0.000
Conservative orientation → Motorcycles as unsafe & unhealthy	<b>0.155*</b>	0.043	0.001		<b>Accept</b>				<b>0.155*</b>	0.043	0.001
Conservative orientation → Motorcycles as environmentally unfriendly	<b>0.103*</b>	0.046	0.025		<b>Accept</b>				<b>0.103*</b>	0.046	0.025
Progressive orientation → Motorcycles as status	-0.064	0.042	0.139	H7	Reject				-0.064	0.042	0.139
Progressive orientation → Motorcycles as social norm & modernity	-0.074	0.043	0.082		Reject				-0.074	0.043	0.082
Conservative orientation → Motorcycles as status	<b>0.185*</b>	0.037	0.000		<b>Accept</b>				<b>0.185*</b>	0.037	0.000
Conservative orientation → Motorcycles as social norm & modernity	<b>0.502*</b>	0.036	0.000	<b>Accept</b>				<b>0.502*</b>	0.036	0.000	
Progressive orientation → Motorcycles as convenience & parsimony	<b>0.091*</b>	0.043	0.035	H8	<b>Accept</b>				<b>0.091*</b>	0.043	0.035
Conservative orientation → Motorcycles as convenience & parsimony	<b>0.466*</b>	0.038	0.000		<b>Accept</b>				<b>0.466*</b>	0.038	0.000
Gender (male) → Intention to use motorcycles	0.025	0.024	0.291	Control	Reject				0.025	0.024	0.291
Internal migrant (yes) → Intention to use motorcycles	<b>0.086*</b>	0.024	0.000		<b>Accept</b>				<b>0.086*</b>	0.024	0.000
Household income (> 700 US\$) → Intention to use motorcycles	<b>0.052*</b>	0.024	0.027		<b>Accept</b>				<b>0.052*</b>	0.024	0.027
Car ownership (yes) → Intention to use motorcycles	0.016	0.025	0.525		Reject				0.016	0.025	0.525
Bicycle ownership (yes) → Intention to use motorcycles	0.030	0.022	0.190		Reject				0.030	0.022	0.190
Car use intention (yes) → Intention to use motorcycles	<b>0.059*</b>	0.024	0.015		<b>Accept</b>				<b>0.059*</b>	0.024	0.015

\* p<0.05; N = 750;  $\beta$ : Mean of coefficient estimated from the bootstrapping process (5000 subsamples); Std.: Standard deviation; H: Hypothesis

<sup>(1)</sup> Specific significant indirect effects: Conservative orientation → Motorcycles as independence & enjoyment → Intention to use motorcycles:  $\beta=0.066$ , std=0.014;  
 Conservative orientation → Motorcycles as social norms & modernity → Intention to use motorcycles:  $\beta=0.127$ , std=0.022;  
 Conservative orientation → Motorcycles as convenience & parsimony → Intention to use motorcycles:  $\beta=0.069$ , std=0.020.

H2: Normative beliefs affect motorcycle use intention: Partly accepted. ‘Motorcycles as social norm and modernity’ had a positive and significant direct effect on motorcycle use intention whereas ‘motorcycles as status’ was not significant. This suggests that motorcycles have now become normative in Vietnam – they are no longer seen as a luxury item. In contrast, in neighbouring Indonesia, motorcycles are still considered as special among youth – although they are as ubiquitous on the streets as in Vietnam (Zudhy Irawan et al., 2022).

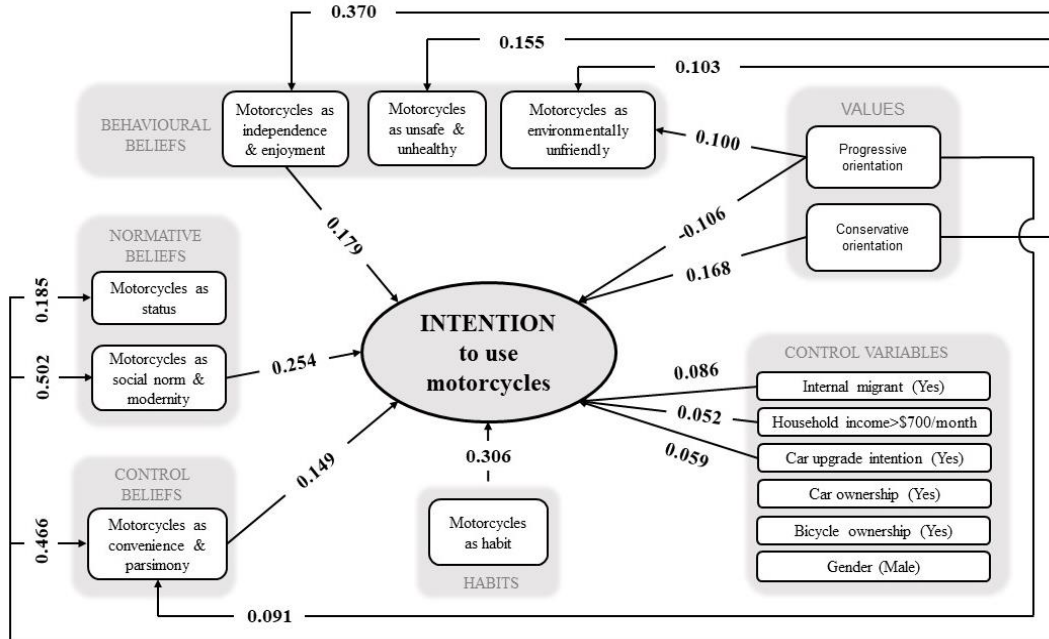


Figure 4: Hypothesis testing results.

H3: Control beliefs affect motorcycle use intention: Accepted. ‘Motorcycles as convenience and parsimony’ had a significant positive direct effect on motorcycle use intention. This is interesting. While motorcycles are a more flexible mode than buses, and therefore more convenient, they are not so cheap. A lower-end motorcycle costs around 20 million VND whereas a typical motorcycle costs 30-40 million VND. That is up to ten times the average monthly income per person in Vietnam.

H4: Habits affect motorcycle use intention: Accepted. ‘Motorcycles as habit’ was in fact the strongest predictor of the ‘intention to use motorcycles’. Other studies have come to a similar conclusion (Chen and Lai, 2011).

H5: Values affect motorcycle use intention: Accepted. Having a ‘progressive orientation’ lowered the ‘intention to use motorcycles’ whereas a ‘conservative orientation’ generated an opposite and somewhat larger effect. This makes sense as motorcycles are an individual but polluting mode (Hagen et al., 2016). As a reminder, ‘progressive’ respondents tended to care about the environment, social justice, family life, and/or charity whereas ‘conservative’ respondents aspired to wealth, career advancement, and/or hedonism (see items in Table 2).

H6: Values affect behavioural beliefs: Partially accepted. A ‘conservative orientation’ had a significant positive effect on all behavioural beliefs: ‘motorcycles as independence and enjoyment’, ‘motorcycles as unsafe and unhealthy’, and ‘motorcycles as environmentally unfriendly’. Meanwhile, a ‘progressive orientation’ was positively

associated only with ‘motorcycles as environmentally unfriendly’. This suggests that there is environmental awareness among conservative students as well progressive students, which needs to be harnessed.

H7: Values affect normative beliefs: Partially accepted. A ‘conservative orientation’ was found to promote normative beliefs such as ‘motorcycles as status’ and ‘motorcycles as social norm and modernity’. A ‘progressive orientation’ had a negative effect on normative beliefs but this was not significant. As expected, conservative students were more conforming whereas progressive students were more “counter culture.”

H8: Values affect control beliefs: Accepted. Both a ‘progressive orientation’ and a ‘conservative orientation’ had positive direct effects on ‘motorcycles as convenience and parsimony’. However, the effect of a ‘conservative orientation’ was much larger.

#### 4.2 Indirect effects

The indirect effects are listed in Table 3. Only ‘conservative orientation’ had any positive and significant indirect effects on the ‘intention to use motorcycles’ - through constructs such as ‘motorcycles as independence and enjoyment’, ‘motorcycles as social norm and modernity’, and ‘motorcycles as convenience and parsimony’. In fact, the indirect effects of ‘conservative orientation’ were higher than its direct effect, whereas the indirect effects of a ‘progressive orientation’ were not significant.

#### 4.3 Total effects

Total effects are the sum of direct and indirect effects (Table 3). Overall, conservative values and habits were the strongest predictors of the ‘intention to use motorcycles’, followed by ‘motorcycles as social norm and modernity’. The contributions of ‘motorcycles as independence and enjoyment’ and ‘motorcycles as convenience and parsimony’ were positive but much smaller. A ‘progressive orientation’ was the only barrier to the ‘intention to use motorcycles’ but it had the smallest total effect of all. Importantly, this is the first study to reveal that values have both a direct and indirect effect on the intention to use a particular travel mode; previous studies have only found indirect effects (Scheiner and Holz-Rau, 2007). Following social norms while at the same time wanting to appear modern by riding motorcycles is plausible in the context of Vietnam’s collectivistic and hierarchical culture, in which people care about fitting in and maintaining their reputation (Mai et al., 2003). Also, it is understandable that students might find motorcycles fun, freeing, and convenient; other studies have reported similar findings (Zudhy Irawan et al., 2022). Regarding habits, readers are reminded that the effects of established routines on the *intention* to perform a behaviour may be different to their effects on the behaviour itself.

#### 4.4 Control variables

Only three control variables had a positive and significant effect on the ‘intention to use motorcycles’. Internal migrants, wealthier persons, and those who intended to eventually upgrade to cars were more attached to motorcycles as a travel mode. We interpret this finding as follows.

Students who have moved to Hanoi or HCMC to attend university want to use motorcycles even more than local students because motorcycles might have been the main mode they used back home in the provinces where public transport is poor and cars are financially out of reach. They simply intend to stick to custom (Chen and Lai, 2011; Jou and Chen, 2014). In contrast, Hanoi and HCMC natives are more accustomed to public transport and somewhat less dependent on motorcycles. Given that many students from the provinces remain in the big cities after completing their studies, their modal choices are quite important from a policy perspective.

The positive effect of income on the intention to use motorcycles was not entirely surprising. While in high-income East Asian countries motorcycles are a “poor man’s mode” (Jou and Chen, 2014), in Vietnam they are not cheap, as noted. A poor family must save for months in order to afford a motorcycle which is then used mainly by the breadwinner. Finally, the association between car use intention and motorcycle use intention suggests that Vietnamese students are attached to the idea of motorisation – whether in the form of cars or motorcycles. A study set in Malaysia reached somewhat different conclusions: motorcycles in Kuala Lumpur were seen as an adequate substitute for cars, and those owning motorcycles did not necessarily plan on upgrading to cars (Yamamoto, 2009). Either way, it seems that, while youth in the Global North are giving up motorised vehicles altogether, the South is not following suit.

Gender was not linked to motorcycle use, confirming the findings of prior studies (Chen and Lai, 2011). This may owe to university campaigns promoting gender equality, which encourage female students to travel independently while avoiding harassment (Nguyen and Pojani, 2022a). Bicycle ownership was irrelevant too - possibly because cycling is mainly a recreational mode in Vietnam. Car ownership did not affect the intention to use motorcycles because driving is a major annoyance in Hanoi and HCMC - due to congestion, narrow roads, and parking shortages – and car owners still need to ride motorcycles to get around efficiently.

## **5. Conclusion**

This study found that in Vietnam, widespread motorcycle use among students can be explained by the classic Theory of Planned Behaviour constructs: behavioural beliefs, normative beliefs, and control beliefs. Motorcycles are variously seen as convenient, inexpensive, fun, flexible, modern, and wanted – whereas factors such as health, safety, status, and environmental impact are irrelevant. But motorcycle use is also determined by habits and values (progressive or conservative). In fact, the effect of these two additional constructs is larger than the effect of beliefs. These results show that there is merit in extending the TPB to account for the role of habits and intrinsic values in travel behaviour (Hultman et al., 2015). In terms of socio-demographic variables, this study found that higher income students, those who come from the provinces, and those who are more attached to cars are more prone to using motorcycles. This knowledge can help planners design policies to reduce motorcycle use.

Mobility habits, norms, and values are difficult to break or even challenge in adulthood. Vietnamese local governments have trialled “stick measures” such higher registration fees for motorcycles, motorcycle circulation limits based on licence number plates, caps on new motorcycle registrations, and caps on motorcycle ownership per person – but with little success (Nguyen et al., 2019). Perhaps punitive measures should be combined with “carrot measures” such as awareness raising activities. However, the latter need to start early, potentially since childhood. Children should be taught how to ride bicycles and buses, and be informed on the negative aspects of relying on motorcycles as a primary mobility mode. Later on, universities should also make an effort to foster a culture of health, safety, and environmental friendliness among the entire staff and student body. Campuses could offer more parking for conventional and electric bicycles and cap motorcycle parking slots. Statistics on traffic crashes involving the university community could be made available in anonymised format. Also, air quality and noise monitoring devices could be installed at campus gates, displaying levels in real

time. These data may persuade some students to shift from motorcycles to more sustainable modes.

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## Appendices

Appendix 1. Criteria for assessing PLS-SEM results.

<i>Criteria</i>	<i>Recommended cut-off values</i>
<i>Assessing measurement (outer) models</i>	
Indicator reliability	Factor Loading (FL) $\geq 0.7$ (Hair et al., 2017)
Internal consistency	$0.7 \leq \text{Cronbach Alpha (CA)} \leq 0.95$ (DeVellis, 2017; Hair et al., 2017) $0.7 \leq \text{Composite Reliability (CR)} \leq 0.95$ (Hair et al., 2019; Ringle et al., 2020)
Convergent validity	Average Variance Extracted (AVE) $\geq 0.5$ (Chin, 1998)
Discriminant validity	Fornell-Larcker Criterion: $\sqrt{\text{AVE}}$ in every construct $>$ other correlation values among other constructs (Hair et al., 2017) . Heterotrait-Monotrait Ratio (HTMT) $\leq 0.85$ (Henseler et al., 2015)
<i>Assessing structural (inner) model</i>	
Collinearity	VIF $< 3$ (Hair et al., 2019)
Predictive power	$R^2$ and $Q^2 > 0$ (Hair et al., 2019) Coefficient of determination ( $R^2$ ) values of 0.75, 0.5, and 0.25 are considered substantial, moderate, and weak respectively. Cross-validated redundancy ( $Q^2$ ) values higher than 0.5, 0.25, and 0 are considered large, medium, and high respectively.
Model fit	Standardized Root Mean square Residual (SRMR) $< 0.08$ (Hair et al., 2017) Normed Fit Index (NFI) $> 0.8$ (Hu and Bentler, 1998)
Path significance	$p < 0.05$

Appendix 5. Predictive power and model fit.

<i>Construct</i>	$R^2$	$SSO$	$SSE$	$Q^2 (=1-SSE/SSO)$
Motorcycles as independence & enjoyment	0.146	5250	4749.739	0.095
Motorcycles as convenience & parsimony	0.248	3750	3105.143	0.172
Motorcycles as social norm & modernity	0.237	3750	3120.326	0.168
Motorcycles as status	0.032	2250	2224.46	0.011
Motorcycles as environmentally unfriendly	0.026	1500	1480.357	0.013
Motorcycles as unsafe & unhealthy	0.030	3750	3686.71	0.017
Intention to use motorcycles	0.619	2250	1265.53	0.438
Standardized Root Mean square Residual (SRMR) = 0.044 $<$ 0.08 Normed Fit Index (NFI) = 0.806 $>$ 0.8				