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Do Consumers Have Colour Aesthetic Preferences for the Facade Materials of Condominium Buildings?

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Abstract: The distinct cultural environment of various regions leads to unique consumer preferences for building facades, including the colours and materials that are used for the exteriors of condominium buildings. Understanding these preferences holds significant industry reference value for urban planning authorities and residential development companies. However, the colour and material aesthetic preferences of consumers for building facades have not received much research attention. To fill this gap, this study empirically investigates these preferences within the cultural context of Fuzhou, China. Using house prices as a reference perspective and econometric methods as research tools, this study explores the specific aesthetic preferences of urban consumer groups and compares the preferences of groups with different levels of consumption. The results confirm the existence of specific consumer preferences for building facade colours and materials and a close connection among the variations in these preferences and various combinations of facade colours and materials. Different quantities and types of materials can lead to distinct preferences for the quantities and features of facade colours. Apart from providing precise professional insights for urban planning authorities and residential developers, this study also offers a feasible conceptual reference for future studies to be conducted in other regions.

Keywords: building facades; colour aesthetics; facade materials; colour culture; consumer preference; house prices

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1. Introduction

The colours and materials of condominium building facades (hereinafter, "building facades") contribute to an overall visual impression that frequently influences people's admiration of these structures. The Chinese proverb "clothes make the man" [1] emphasises the importance that the Chinese people place on their outward appearance. Similar to how clothes affect people's perceptions of one another, facades can affect the overall image of a building. A pleasing building facade frequently leaves a positive impression that plays a crucial role in many social interactions, including condominium purchase. As a result, many building developers pay close attention to the facades of their buildings, especially in terms of their colour and material.

The colour of building facades is often an important consideration for consumers when purchasing condominiums. The consideration of colour factors also reveals similarities in the preferences of the entire urban population [2], a gender group [3] or an occupational group [4]. These groups consistently exhibit shared preferences. However, colour preferences may vary across regions. For example, people in Antalya, Türkiye, tend to favour cool hues, such as blue, purple and green, for building facades [5], whilst people in Shanghai, China, tend to prefer warm and light hues (e.g., red) and moderate-to-low chroma [6]. Exploring the similarities in the preferences of regional groups has significant and positive impacts on the urban development process [7].

People's sensory preferences for building facade materials are objectively presented. These preferences may stem from diverse factors, such as cultural influences that are derived from natural environments, as seen in Finland [8] and New Zealand [9]; economic considerations, as seen in the US [10] and Western Europe [11]; and sustainability demands arising from environmental pressures, as found by Hu et al. [12]. However, this preference scenario is pervasive across the globe, especially in Europe [13], the Americas [14] and Asia [15]. In the context of global urbanisation and construction, preferences for building facade materials become a crucial issue that cannot be overlooked. Similar to the colour of building facades, the choice of facade materials also plays a significant role in urban development, planning and management. Consequently, discussions surrounding housing prices and their correlation with building facade materials have become focal points of scholarly attention in the past decade.

Previous studies on the correlation between building facade materials and house prices have mostly focused on the correlation between material manufacturing costs and market supply chains and house prices in South Korea [16,17], Nigeria [18], Palestine [19], Malaysia [20–24], Canada [25], South Africa [26] and New Zealand [27,28], amongst others. These studies conclude that house prices are positively correlated with costs. However, these findings contradict those of other scholars who analyse the correlation between facade materials and house prices from the perspective of consumers' sensory preferences. Although based on consumer perspective theory [29], these studies have not been carried out empirically with important reference to the consumption process and price.

Using house prices as a reference to understand consumer preferences towards building facade colours offers some significant research value [30,31]. Given the real-life context, where residences represent substantial and essential commodities in people's lives, the deliberations of consumers during their purchasing process are inevitably meticulous [32]. Within these deliberations, inclinations towards facade elements are undoubtedly included [33]. Therefore, the consumer preference information embedded in the transaction prices of residential properties within the market trading model is inherently more reliable and accurate than the preference information gathered through questionnaire surveys [34]. A more accurate picture of consumer preferences for residential facades in a local market can be obtained with price information [35]. The management of markets and cities can be improved with the help of this knowledge. However, this perspective has been ignored in previous research. Conversely, it is generally known that the interior comfort of a residential living environment can be improved by carefully selecting building facade colours and materials to create a more pleasant sensory experience, ultimately improving the inner sense of comfort in residential living environments [36–39]. The preferences for building facade materials and colour combinations have also received scant research attention. Therefore, this particular area remains relatively unexplored.

To fill these gaps, this study evaluates the colour and material aesthetic preferences of consumers for building facades based on consumer theory and by utilising second-hand house prices as a benchmark. This study investigates the general colour aesthetic preferences of different consumer groups to provide relevant professional guidance for urban administrators, construction companies and individual consumers. Modern cities are often characterised by chaos and disorder that, to some extent, stem from an inadequate understanding of the numerous factors within the human collective. Similarly, the collective preferences of populations towards the compositional elements of building facades have received limited scholarly attention. In this case, this study aims to contribute to a more orderly urban life by objectively revealing the preferences of different population groups for urban facades, thus offering insights for professionals in relevant industries that would help them collectively construct a highly organised urban environment.

The remainder of this paper is organised as follows: Section 2 discusses the data and methodology. Section 3 presents the data analysis results. Section 4 concludes the paper and highlights its limitations.

2. Materials and Methods

2.1. Research Planning

According to a Chinese proverb, consumers in China place a high value on the aesthetics of the products that they purchase [40–42], and this is also true of residential items. This study selects Fuzhou, China, as the research site and builds a corresponding research framework. Fuzhou is the capital of Fujian Province (E: 119.28, N: 26.08) (Figure 1) located north of Taiwan and near Hong Kong and Macao. As the ancestral home of a large number of Chinese expatriates [43], Fuzhou has close cultural ties with many countries and regions in East and Southeast Asia. Fuzhou has a population of nearly nine million people and a large number of residential samples, thereby providing a sufficient amount of transaction data for this study to ensure the generalisability and scientific validity of its results.

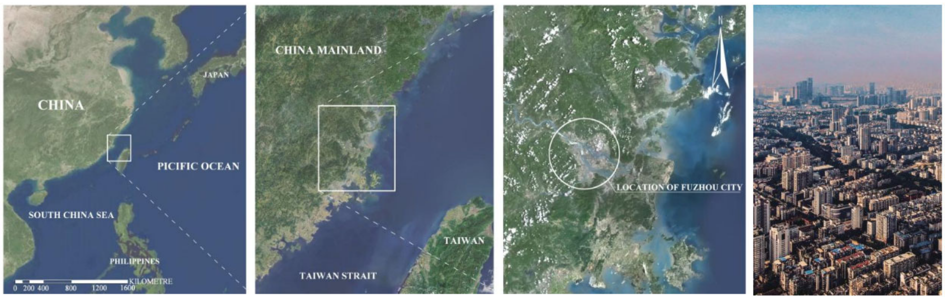

Figure 1. Geographic location and current state of the research area.

This study is divided into three steps, as depicted in Figure 2. In the first step, condominium samples in the selected research area are selected for data collection and variable design. The variable design encompasses both the colours and materials of building facades. In the second step, a linear regression analysis of the correlation between the research variables and house prices is conducted for the entire urban consumer group to demonstrate their correlation and to understand the price correlation between the moderating effects of facade colour and material. This correlation reflects the increase or decrease in house prices due to a consumer group's aesthetic preference for specific facade colours or materials. In the third step, a quantile regression analysis of condominium transaction prices is conducted to demonstrate the correlation amongst the differences in the preferences of various consumer groups. This correlation reflects the price fluctuations triggered by the differences in the preferences for combinations of facade colours and materials amongst condominium consumer groups with varying levels of consumption.

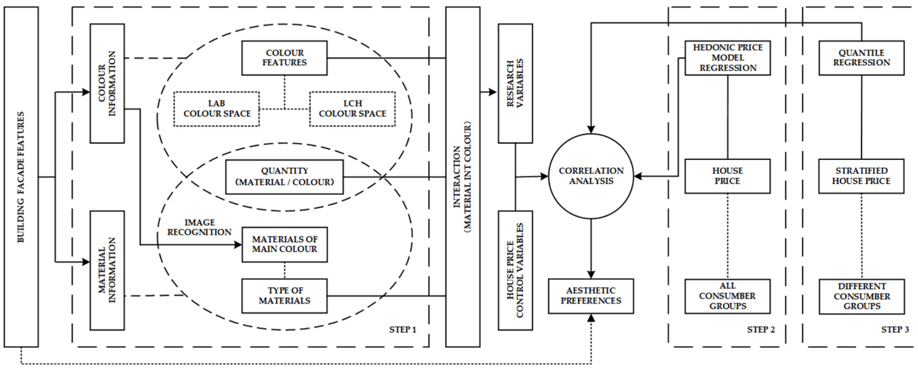

Figure 2. Research framework.

2.2. Variable Design

Data on a cross-sectional sample of second-hand condominium transactions in 906 residential neighbourhoods in Fuzhou, China, in 2020 were collected. The chosen samples have a uniform appearance, thus avoiding the interferences caused by variances in building appearance. The data were obtained mainly via online or field research. The variables are detailed in Table 1. These data include the outcome variable (i.e., the actual overall average transaction price of the residential sample), the control variables (i.e., house prices) and the research variables.

Table 1. Descriptive statistics of the variables (N = 906).

Variables		**Description**	**Mean**	**Expect**
Outcome Variable				
	Pri	House prices (ten-thousand yuan/m^2)	2.790	/
Control Variables				
	ADM	Dummy variable, 1 for the condominium being inside the higher-level administrative region, 0 otherwise	/	+
	LC1	Dummy variable, 1 for the condominium being inside the second ring road, 0 otherwise	/	+
	LC2	Dummy variable, 1 for the condominium being inside the third ring road, 0 otherwise	/	+
	POP	Quantity of population in March 2021 (ten thousand)	52.085	+
	GDP	Per capita GDP in March 2021 (hundred million yuan)	118,558.400	+
	COM	Dummy variable, 1 for the condominium being a pure commercial condominium, 0 otherwise	/	+
	T500	Dummy variable, 1 for the developer being in China's top 500, 0 otherwise	/	+
	MIN	Dummy variable, 1 for the developer originating from Fujian province, 0 otherwise	/	+
	PRI	Dummy variable, 1 for the condominium having a high-quality primary school, 0 otherwise	/	+
	MID	Dummy variable, 1 for the condominium having a high-quality middle school, 0 otherwise	/	+
	AGE	Dummy variable, 1 for the condominium being built after 2000, 0 otherwise	/	+
	DEN	Density of buildings (c)	2.356	-
	GRER	Greening rate of community (c)	0.345	+
	FEE	Monthly management fee (yuan/m^2)	1.184	+
	RAI	Distance to the closest rail station (m)	1375.514	+
	MAR	Distance to the closest market (m)	1098.150	+
	HOS	Distance to the closest grade-A tertiary hospital (m)	1899.717	-
	SCE	Distance to the closest scenic spot (m)	1080.911	+
	GRE	Distance to the closest green space (m)	726.217	+
	WAT	Distance to the closest main water source (m)	1135.450	+
	FUN	Distance to the closest funeral facility (m)	3176.560	-
	FAC	Distance to the closest factory (m)	1596.437	-
	GAS	Distance to the closest gas station (m)	1180.834	-
	DUM	Distance to the closest dump (m)	9617.311	-
Research Variables				
	2C	Dummy variable, 1 for building facades with 2 colours, 0 otherwise	/	+
	3C	Dummy variable, 1 for building facades with 3 colours, 0 otherwise	/	+
	4C	Dummy variable, 1 for building facades with 4 and more colours, 0 otherwise	/	+
	M①	The first standard of main colour (lightness in LAB/LCH) (c)	/	+
	M②	The second standard of main colour (red–green in LAB/saturation in LCH) (c)	/	+ (red–green) + (saturation)
	M③	The third standard of main colour (yellow–blue in LAB/hue in LCH) (c)	/	— (yellow–blue) no sig. (Hue)
	2M	Dummy variable, 1 for building facade colours with two materials, 0 otherwise	/	/
	3M	Dummy variable, 1 for building facade colours with three materials, 0 otherwise	/	/

Table 1. *Cont.*

Variables		Description	Mean	Expect
	4M	Dummy variable, 1 for building facade colours with four materials and more, 0 otherwise	/	/
	STO	Dummy variable, 1 for building facade colours with stone bricks, 0 otherwise	/	+
	GLA	Dummy variable, 1 for building facade colours with glass curtains, 0 otherwise	/	/
	MET	Dummy variable, 1 for building facade colours with metal sheets, 0 otherwise	/	/
	COA	Dummy variable, 1 for building facade colours with coating, 0 otherwise	/	/
	CER	Dummy variable, 1 for building facade colours with ceramic tiles, 0 otherwise	/	+
	ALU	Dummy variable, 1 for building facade colours with aluminium–plastic boards, 0 otherwise	/	/
	CON	Dummy variable, 1 for building facade colours with as-cast-finish concrete, 0 otherwise	/	/

2.2.1. Control Variables

A set of control variables showing relatively stable correlations with house prices is obtained from previous research (Table 2). These variables are utilised to ensure that the analytical outcomes of this study provide an accurate reference value. The control variables primarily fall into three categories [44,45], namely location environment variables (e.g., the administrative category of the region, whether the location is within the second ring road, whether the location is inside the third ring road, population and GDP per capita) [46–49], self-characteristic variables (e.g., the type of pure commercial condominiums, whether the developers are within China's top 500, whether the developers originate from Fujian Province, whether the condominium is near a high-quality primary or middle school, whether the condominium was built after 2000, the density of buildings, the greening rate of the community and monthly management fees) [50–56] and facility accessibility variables (e.g., the distances to the closest rail station, market, grade-A tertiary hospital, green space, main water source, scenic spot, factory, gas station, dump and funeral facilities) [57–66].

Table 2. Studies on the control variables.

Variables	Title	References	Research Area	Samples	Methods	Key Findings
ADM	Identifying the determinants of housing prices in China using spatial regression and the geographical detector technique	[46]	China	2760 counties	Spatial Regression Models Geographical Detector Technique	The house prices in China are heavily influenced by the administrative level of the region.
LC1/LC2	Quantile house price indices in Beijing	[47]	Beijing, China	260,366 housing units	Hedonic Price Model Quantile Regression	Houses located within the second ring road are valued more than equivalent houses located beyond the second ring road.
POP	Does the planning system affect housing prices? Theory and evidence from Hong Kong	[48]	Hong Kong, China	52 observations	Time Series Regression	The increase in population will bring more demand for housing. It will boost house prices.
GDP	The Impact of Economic Growth on the Market and Communication Value of Real Estate: Case Slovenia	[49]	Slovenia	150 respondents	Questionnaire	GDP affects the house price trend directly and earlier.

Table 2. *Cont.*

Variables	Title	References	Research Area	Samples	Methods	Key Findings
COM	Types of Resident and Price Distribution in Urban Areas: An Empirical Investigation in China Mainland	[50]	Fuzhou, China	1079 residences	Hedonic Price Model Stepwise Regression Model Econometric Interaction Model	The COM variable has a substantial positive influence on house prices.
T500	Types of Resident and Price Distribution in Urban Areas: An Empirical Investigation in China Mainland	[50]	Fuzhou, China	1079 residences	Hedonic Price Model Stepwise Regression Model Econometric Interaction Model	T500 has a positive influence on house prices.
MIN	Types of Resident and Price Distribution in Urban Areas: An Empirical Investigation in China Mainland	[50]	Fuzhou, China	1079 residences	Hedonic Price Model Stepwise Regression Model Econometric Interaction Model	MIN has a positive influence on house prices.
PRI	Education quality, accessibility, and housing price: Does spatial heterogeneity exist in education capitalization?	[51]	Hangzhou, China	516 communities	Hedonic Price Model GWR Model Geographical Information Systems (GIS)	The quality of primary schools has significant effects on house prices.
MID	House Prices And School Zones: Does Geography matter?	[52]	New Zealand	1781 house sales	Spatial Lag Model Spatial Error Model Ordinary Least Squares (OLS)	House buyers are willing to pay a premium of over $130,000 in order to reside in the enrolment zone of popular secondary schools.
AGE	Age-Related Heteroskedasticity in Hedonic House Price Equations	[53]	Dallas, USA	8500 transactions of single-family homes	Hedonic Price Model	Depreciation rates vary considerably with dwelling age.
DEN	Measuring the value of apartment density? The effect of residential density on housing prices in Seoul	[54]	Seoul, Republic of Korea	200 housing units	Hedonic Price Model Ordinary Least Squares (OLS) Quantile Regression Model	The density of buildings has negative effects on house prices.
GRER	Housing market hedonic price study based on boosting regression tree	[55]	China	253 samples	Hedonic Price Model Gradient Boosting Machine Learning Regression Tree Algorithm Based on Gradient Boosting	The higher the greening rate, the higher the price.
FEE	Impact of Homeowners Association Fees on Condominium Prices	[56]	San Diego, USA	1087 residences	Hedonic Price Model	Homeowners Association Fees do appear to have a marginally positive effect on house prices.
RAI	The impact of metro services on housing prices: a case study from Beijing	[57]	Beijing, China	2835 samples of online property sales data	Spatial Error Model (SEM)	All the metro service variables have positive effects on property values.
MAR	Which types of shopping malls affect housing prices? From the perspective of spatial accessibility	[58]	Hangzhou, China	22 shopping malls 523 housing communities	Hedonic Price Model GWR Model	The spatial accessibility to shopping malls has a significant positive impact on house prices.
HOS	The determinants of house prices in the Klang valley, Malaysia	[59]	Kuala Lumpur, Malaysia	2338 housing units	Geographical Information Systems (GIS)	The house prices would increase by approximately MYR 5.52 per metre of distance from the hospital.

Table 2. *Cont.*

Variables	Title	References	Research Area	Samples	Methods	Key Findings
SCE	Incorporating neighbourhoods with explainable artificial intelligence for modelling fine-scale housing prices	[60]	Shanghai, China	57,842 housing units	Hedonic Price Model Explainable Artificial Intelligence Model	Scenic spots are positively related to housing prices.
GRE	What Makes a Locality Attractive? Estimates of the Amenity Value of Parks for Victoria	[61]	Victoria, Australia	290,000 residences	Hedonic Price Model	Parks can have a significant positive impact on house prices.
WAT	What's in a view?	[62]	Auckland, New Zealand	5000 sales	Hedonic Price Model	Wide views of water add an average of 59% to the value of a waterfront property, but this effect diminishes quite rapidly as the distance from the coast increases.
FUN	Nonlinear rail accessibility and road spatial pattern effects on house prices	[63]	Fuzhou, China	1245 residential community samples	Space Syntax Analysis Linear Regression Model Spatial Regression Model	The farther the funeral facilities are from the house, the better people's inner experience and environmental feelings, which will raise the house prices.
FAC	House values, incomes, and industrial pollution	[64]	New England States, USA	2257 census tracts	Three Stage Least Squares (3SLS)	The house would be valued 1.9% more if it were located 1 mile further from the factory.
GAS	Effects of expanding electric vehicle charging stations in California on the housing market	[65]	California, USA	14 million housing transaction records	Difference-in-differences	Gas stations are found to decrease nearby housing values by 10%.
DUM	Price effects of landfills on house values	[66]	Ramsey, USA	708 nearby homes	Ordinary Least Squares (OLS)	Landfills located within two miles of the housing community negatively affect house prices. House prices increase by 6.2% as the distance to the landfills increases by one mile.

2.2.2. Research Variables

In order to accurately discuss the characteristics of colour and material variables, the study established quantitative parameters for the materials and colours of residential building facades, encompassing a total of four variable categories. The first aspect of the study focused on quantifying and characterizing the exterior colours of residential samples. Using computer image recognition technology, the quantity and composition of the colours of the building facades of the sampled residences are determined within a colour tolerance of a standard deviation of less than 20 for colour matching. The process is illustrated in Figure 3. The first type of research variable, which represents the quantity of colours on building facades, is measured using dummy variables (one, two, three and four colours or more). The main colour is analysed using the second type of research variable, namely the colour feature index. Specifically, the colour feature indices are extracted using field measurements of a colourimeter. To reduce data errors in the field measurement, the main colour features are measured thrice, and the average is taken as the precise measurement. These colour feature indices address the four aspects of colour lightness, saturation, colour balance and hue. Numerous standard description systems are available for these indices, amongst which LAB and LCH are intuitive colour description systems. The relationship between LAB and LCH is depicted in Figure 4, where "A" and "B" produce a colour composite equivalent to that produced by "C" and "H". In the LAB colour space, "L" represents colour lightness ranging from 0 (black) to 100 (white); "A" represents the red–green colour tendency, with positive and negative values indicating red and green colour tendencies, respectively; and "B" represents the yellow–blue colour tendency with values ranging from −100 to 100 and with positive and negative values denoting yellow and blue colour tendencies, respectively [67]. In the LCH colour space, "L" indicates colour lightness and takes a value between 0 and 100, "C" indicates colour saturation and ranges between 0 and 100, and "H" indicates the hue or overall tendency of the colour with a value range of 0 to 360. The value of H represents the quantity of degrees of the angle on the colour wheel [68]. This study's colour characteristic metrics involved the direct measurement of "L", "A", "B", "C" and "H" values using a colourimeter. To minimize the data errors associated with on-site measurements, this study used three random sampling points for each sample and averaged the results for data reference. Due to their intuitive properties, these two systems are distinct. This study therefore employs two sets of colour criteria to examine the relationship between colour features and house prices. The quantity and features of the facade materials used by the sampled condominiums are then determined by scanning field research records. These facade materials are divided into seven categories and are encoded as dummy variables. As shown in Figure 5, these categories are stone bricks, glass curtains, metal curtains, aluminium–plastic boards, ceramic tiles, coatings and as-cast-finish concrete. The third and fourth types of research variables are the total quantity of material categories present on the building facades and their main colour areas, respectively. Although the information covered by these research variables has been discussed in approximate terms in previous studies (Table 3), there has been no dedicated research on the topics targeted by these research variables. Therefore, this study made innovative attempts in the setup of these variables.

Figure 3. Computer vision image of building facades.

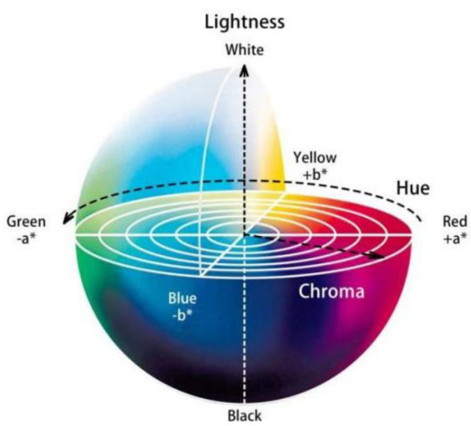

Figure 4. Schematic diagram of the colour variables. Source: made by the authors.

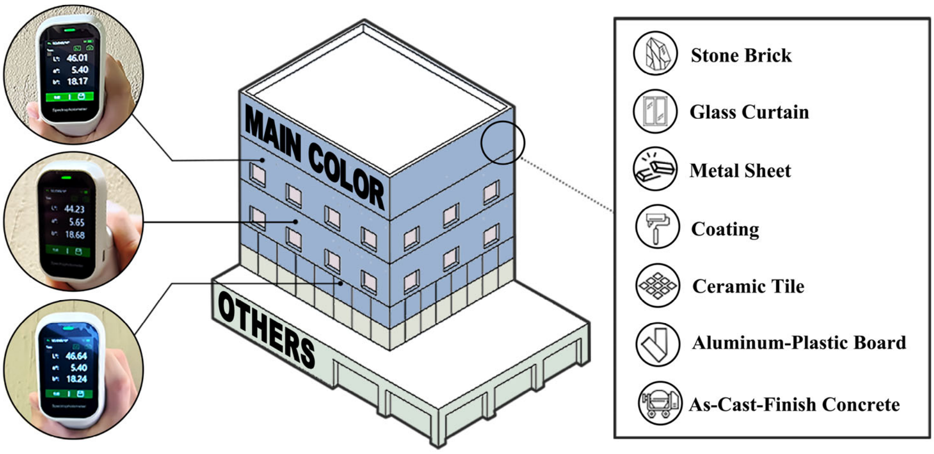

Figure 5. Schematic diagram of the material variables. Source: made by the authors.

Table 3. Related studies on the research variables.

Variables	Title	References	Research Area	Samples	Methods	Key Finding
3M	Dreams of light for the city	[69]	Thessaloniki, Greece	900 participants	Questionnaire	Most people prefer individual houses with three colours.
4M	Dreams of light for the city	[69]	Thessaloniki, Greece	900 participants	Questionnaire	Most people prefer apartments and public houses with four colours.
M①	Research on colour harmony of building facades	[70]	Taipei, Taiwan	43 participants	Experimental Questionnaire	People prefer facades with a primary colour of a high lightness level.
M②	Colour associations with different building types: an experimental study on American college students	[71]	Athens, USA	98 participants	Experimental	Residences were mostly associated with the colour red.
	Study of the colour characteristics of residential buildings in Shanghai	[72]	Shanghai, China	4179 residential building neighbourhoods	Data Collection Statistical Analysis	Studies showed significant effects of saturation on colour preference; more saturated colours are preferred more. The colours of residential buildings are mostly warm colours with low saturation.
M③	A comparison between wishes and status: Gray is not the preference for residents while the city shows neutral colours	[3]	Changzhou, China	1065 participants	Questionnaire Site survey	Colours in blue are welcome.
	Hue, saturation, lightness, and building exterior preference: An empirical study in Turkey comparing architects' and nonarchitects' evaluative and cognitive judgments	[4]	Izmir, Turkey	60 participants	Experimental Questionnaire	A certain amount of agreement in judged pleasantness of hues.

Table 3. *Cont.*

Variables	Title	References	Research Area	Samples	Methods	Key Finding
STO GLA MET COA CER ALU CON	An examination of people's preferences for buildings and streetscapes in New Zealand	[9]	Auckland and Wellington, New Zealand	156 streets	Questionnaire Focus Group	At the scale of the individual building facade, people were found to prefer traditional cladding materials such as brick and those that could be painted or refinished.

2.3. Methods

2.3.1. Hedonic Price Model Regression

Hedonic price models are often used to express the relationship between price explanatory variables and prices. Considering the marginal effects of price behaviour, log-linear models are often used in correlation analyses [73]. Given that the colour decomposition variables in this study contain zero values, the following linear relationship model is established to explore the correlation between colour and price. The expression Equation (1) can be written as follows:

$$\ln P = \beta_0 + \sum_{i=1}^{n} \beta_i \ln x_i + \sum_{j=1}^{m} \beta_j c_j + \varepsilon \quad (1)$$

where P is the house price $\left(\text{CNY}/\text{m}^2\right)$, β_0 is a constant term, x_i denotes the characteristic variables (i.e., control variables) and is not taken as a logarithm when the indicator is a dummy variable, β_i indicates the characteristic price coefficient of the characteristic variable, c_j represents the colour correlation variable for the object, β_j is the correlation coefficient of the colour variable, ε denotes the error term and n and m are the corresponding quantity variables.

2.3.2. Quantile Regression

Quantile regression is a cutting-edge technique in econometrics research that employs several quantiles of an explanatory variable (including quartiles, deciles and percentiles) to obtain the appropriate quantile equation for the conditional distribution of the explanatory variable [74]. Equation (2) represents the quantile regression model [75]:

$$\ln P_i = \beta_{0q} + \sum_{n=1}^{N} \beta_{nq} \ln X_{in} + \beta_c c_j + \varepsilon_i \quad (2)$$

where β_{0q} is a constant, β_{nq} is the coefficient of the n-th characteristic variable corresponding to the q-th quantile, β_c is the unknown colour correlation parameter and c_j is the continuous variable of the colour feature [76]. β_q (the vector and its elements $\beta_{nq}, n = 0, 1, \ldots, N$) is estimated by minimising the given objective function Equation (3):

$$\hat{\beta}_q = \text{argmin}\left[\sum_{\epsilon_i \geq 0} 2q\varepsilon_i - \sum_{\varepsilon_i < 0} (2 - 2q)\varepsilon_i\right] \quad (3)$$

Asymmetric weights are often used, and only the median regression ($q = 0.5$) uses symmetric weights.

2.3.3. Interaction Regression

The partial linear model with interaction terms is a generalisation of the partial linear model that is combined with the interactions between the partial covariates of the parameters [77]. The general form of this model is expressed as Equation (4):

$$P_i = \sum_{d=1}^{p_n} \beta_d X_{id} + \sum_{l=1}^{L} m_l(U_{il}) + \sum_{d,j=1}^{p_n} \gamma_{dj} X_{id} X_{ij} + \varepsilon_i \quad (4)$$

where $X_{ij}^2(i = 1, 2, \cdots, n, 1 \leq d = j \leq p_n)$ and $X_{id}X_{ij}(i = 1, 2, \cdots, n, d < j = 1, \cdots, p_n)$ are the quadratic and second-order interaction terms, respectively, and $\gamma_{dj}(d \leq j = 1, 2, \cdots, p_n)$ is the regression parameter vector of the interaction term.

3. Results

The data analysis results are presented in two distinct sections, namely the Linear Regression Section and the Quantile Regression Section.

3.1. Linear Regression

When fitting the linear regression results, robustness tests are conducted to ensure the stability and consistency of the linear regression data [78]. The results are presented in Table 4. The adjusted fit evaluation values of all regression functions are greater than 0.7, whereas the residual autocorrelation values are greater than 1.87. These results indicate that all regression functions show a good fit, thus highlighting the favourable stability of the results.

Table 4. Coefficients of the linear regression analysis (N = 906).

Variables	OLS				Robustness Test	
	Control	VIF	LAB	LCH	LAB	LCH
(Constant)	−2.894 ***	-	−3.033 ***	−2.987 ***	−3.374 ***	−2.518 ***
ADM	0.414 ***	3.096	0.401 ***	0.396 ***	0.466 ***	0.335 ***
LC1	0.112 ***	2.119	0.117 ***	0.117 ***	0.131 ***	0.096 ***
LC2	0.113 ***	3.208	0.115 ***	0.115 ***	-	0.142 ***
POP	0.153 ***	1.858	0.136 ***	0.137 ***	0.177 ***	-
GDP	0.157 ***	2.332	0.175 ***	0.176 ***	0.187 ***	0.211 ***
COM	0.090 ***	1.458	0.080 ***	0.080 ***	0.079 ***	0.081 ***
T500	0.093 ***	1.381	0.095 ***	0.095 ***	0.102 ***	0.097 ***
MIN	0.049 ***	1.118	0.050 ***	0.050 ***	0.044 ***	0.053 ***
PRI	0.263 ***	1.165	0.253 ***	0.254 ***	0.261 ***	0.256 ***
MID	0.186 ***	1.564	0.177 ***	0.174 ***	-	0.194 ***
AGE	0.063 ***	1.356	0.044 ***	0.046 ***	0.050 ***	0.037 ***
DEN	0.020 ***	1.078	0.018 ***	0.018 ***	0.028 ***	-
GRER	0.014 ***	1.234	0.010 *	0.011 **	0.018 ***	0.010 **
FEE	0.127 ***	1.580	0.106 ***	0.106 ***	0.098 ***	0.108 ***
RAI	−0.036 ***	1.554	−0.036 ***	−0.037 ***	−0.026 ***	−0.037 ***
MAR	−0.022 ***	1.880	−0.020 ***	−0.020 ***	−0.024 ***	−0.011 ***
HOS	−0.036 ***	2.558	−0.036 ***	−0.036 ***	−0.059 ***	−0.033 ***
SCE	0.013 ***	1.755	0.014 ***	0.012 ***	0.002	-
GRE	−0.006**	2.142	−0.005 **	−0.005 **	−0.019 ***	0.001
WAT	−0.044 ***	1.308	−0.042 ***	−0.042 ***	-	−0.038 ***
FUN	0.035 ***	1.460	0.037 ***	0.036 ***	0.049 ***	0.015 ***
FAC	0.029 ***	1.598	0.023 ***	0.023 ***	0.032 ***	0.023 ***
GAS	0.018 ***	1.228	0.015 ***	0.015 ***	0.028 ***	0.015 ***
DUM	0.110 ***	1.752	0.114 ***	0.111 ***	0.094 ***	0.090 ***
2C	-	-	0.010	0.013	0.014 *	0.025 ***
3C	-	-	0.025 ***	0.029 ***	0.032 ***	0.055 ***
4C	-	-	0.001	0.010	0.000	0.047 ***
M①	-	-	0.000 **	0.000	0.000	0.000
M②	-	-	0.002 ***	−0.001 **	0.002 ***	−0.001 ***
M③	-	-	−0.001 **	−0.000	−0.001 **	−0.000
2M	-	-	0.046 ***	0.050 ***	0.056 ***	0.052 ***
3M	-	-	0.029 ***	0.032 ***	0.037 ***	0.036 ***
4M	-	-	0.035 ***	0.036 ***	0.036 ***	0.043 ***
STO	-	-	−0.031 ***	−0.032 ***	−0.025 **	−0.027**

Table 4. *Cont.*

Variables	Control	VIF	OLS LAB	OLS LCH	Robustness Test LAB	Robustness Test LCH
GLA	-	-	0.025 ***	0.025 ***	0.043 ***	0.027 ***
MET	-	-	−0.020 ***	−0.021 ***	−0.022 ***	−0.024 ***
COA	-	-	−0.018 *	−0.023**	−0.021 *	−0.025**
CER	-	-	−0.064 ***	−0.066 ***	−0.069 ***	−0.069 ***
ALU	-	-	0.047 ***	0.044 ***	0.052 ***	0.038 ***
CON	-	-	−0.092 ***	−0.099 ***	−0.083 ***	−0.098 ***
Adj-R^2	0.706		0.718	0.717	0.695	0.710
DW	1.871		1.850	1.849	1.724	1.795

Note: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

The above results reveal a significant correlation between the selected control variables and house prices. The variables that are positively correlated with house prices include the regional administrative category; the regional geographic centrality (whether it is inside the second or third ring road); the regional economic development level (GDP per capita); the regional population; the type of pure commercial condominiums; whether the developers are amongst the top 500 in China; whether the developers originate from Fujian Province; whether the condominium is near a high-quality primary or middle school; whether the condominium was built after 2000; the density of buildings; monthly management fees; and distances to the closest scenic spot, factory, gas station, dump and funeral facilities. Meanwhile, the greening rate of the community only shows a slightly positive correlation with house prices, whereas facility accessibility variables, including the distances to the closest rail station, market, grade-A tertiary hospital, green space and main water source show a negative correlation. Amongst the variables showing a positive correlation, the regional administrative category and school resources (near a high-quality primary or middle school) have the largest coefficients, thereby suggesting that these variables have the highest correlation with house prices. Meanwhile, the distance to the closest dump shows the highest positive correlation with house prices.

The results for the quantity of building facade colours reveal that condominiums with three facade colours can offer greater price increases than those with only a single facade colour. In the regression function based on the LAB criterion, the lightness of the main colour of the building facade shows a significant correlation with house prices, but its coefficient is 0, which can be interpreted as no correlation. Meanwhile, the red and yellow tendencies of the main colour of the building facade show positive and negative correlations with house prices, respectively. In the regression function based on the LCH criterion, only the saturation of the main facade colour shows a negative correlation with house prices. Two building facade materials provide the highest markup for house prices, followed by four or more facade materials and three facade materials. However, compared with one facade material, all of these three cases provide additional markup for house prices. The presence of glass curtains and aluminium–plastic boards is positively correlated with house prices, with aluminium–plastic boards commanding a higher premium. The other categories of facade materials, including marble stone bricks, metal sheets, coatings, ceramic tiles and plain concrete, all show negative correlations with house prices, with plain concrete providing the greatest reduction in prices.

The interaction regression focuses on the significance of the interaction terms and their corresponding coefficient signs. The results in Table 5 (the full table can be seen in Table A1) indicate that the interaction terms between certain facade material variables and colour variables are statistically significant, thereby suggesting that house prices are correlated with the combination of building facade material characteristics and colour features. For two or three building facade materials, the red and yellow tendencies of the main colour are negatively and positively correlated with house prices, respectively. The degree of such correlation is at its peak for two facade materials. In the case of two facade materials, a significantly positive correlation can be observed between the lightness and saturation of the main colour and house prices. As for the features of the main colour materials, the brighter the main colour and the more yellow the colour balance tendency, the higher the positive correlation with house prices. The other materials have a higher positive correlation with house prices when the colour balance tendency is bluer. However, when the main colour materials include coatings, ceramic tiles and as-cast-finish concrete, a lower lightness of the main colour corresponds to a higher positive correlation. When the main colour material consists of stone bricks and metal sheets, a significant positive correlation can be observed between the saturation of the main colour and house prices. When the material consists of aluminium–plastic boards and plain concrete, a significant negative correlation is observed. In the case of two facade materials, having two or three colours is positively correlated with house prices. For only one facade colour, glass curtains and metal sheets are positively and negatively correlated with house prices, respectively. For two facade colours, the main colour materials consisting of coatings and ceramic tiles are positively correlated with house prices. For three facade colours, the main colour materials consisting of coatings and ceramic tiles or metal sheets are negatively correlated with house prices, whereas the main colour materials consisting of aluminium–plastic boards shows a positive correlation. For four facade colours, the main colour materials consisting of glass curtains and metal sheets are positively and negatively correlated with house prices, respectively.

3.2. Quantile Regression

The results of the quantile regressions are presented in Tables 6 and 7. Table 6 shows that the correlation between the number of facade colours and house prices is primarily concentrated in the lower quartile regressions, which reveal that distinct quantities of facade colours have significant positive correlations with house prices. Meanwhile, the low and middle quartile regressions indicate a positive correlation for the tendency of red in the red–green colour balance and a negative correlation for the tendency of yellow in the yellow–blue colour balance. The lower quartile regression results also reveal a negative correlation between colour saturation and house prices. For the quantity of facade materials, the middle quartile regression results indicate the strongest positive correlation for two materials, whilst the high quartile regression results indicate the strongest positive correlation for four or more materials. In the lower quartile regression results for the features of the facade main colour and materials, glass curtains and aluminium–plastic boards exhibit a (marginally significant) positive correlation with house prices, whereas stone bricks, ceramic tiles and as-cast-finish concrete exhibit a negative correlation. Glass curtains, coatings and aluminium–plastic boards are positively correlated with house prices, whereas stone bricks, metal sheets and as-cast-finish concrete show a negative correlation. Glass curtains and aluminium–plastic boards exhibit significant positive correlations in the high quartile regression results, whereas metal sheets, ceramic tiles and as-cast-finish concrete exhibit significant negative correlations.

Table 5. Interactive coefficients of the linear regression analysis (N = 906).

Research Variables			OLS						Robustness Test					
			LAB		LCH		Quantity of Colours		LAB		LCH		Quantity of Colours	
Quantity	Features [1]	Features [2]	Quantity	Features [1]	Quantity	Features [1]	Quantity	Features [2]	Quantity	Features [1]	Quantity	Features [1]	Quantity	Features [2]
Table A1														
M①	M①	2C	0.000	0.005 ***	−0.001	0.007 ***	-	0.160 ***	0.000	0.004 ***	−0.001	0.007 ***	-	0.199 ***
M②	M②	3C	0.007 ***	−0.009 ***	−0.003 **	0.002	-	0.123 **	0.003 *	−0.011 ***	−0.001	0.000	-	0.195 ***
M③	M③	4C	−0.002 ***	0.011 ***	0.000 ***	0.000	-	−0.133	−0.001*	0.010 ***	0.000 **	0.000 *	-	0.021
2M	STO	STO	−0.063	−0.294 ***	−0.173 ***	−0.264 ***	-	0.014	−0.084	−0.319 ***	−0.216 ***	−0.314 ***	-	0.002
3M	GLA	GLA	0.017	0.015	−0.010	0.047 *	-	0.064 ***	−0.030	−0.017	−0.053	0.033	-	0.113 ***
4M	MET	MET	0.036	0.026	−0.052	−0.057	-	0.004	0.037	0.023	−0.001	−0.084 *	-	0.019
M① × 2 M	COA	COA	0.001	0.308 ***	0.002 ***	0.470 ***	-	0.105 *	0.001	0.285 ***	0.003 ***	0.449 ***	-	0.087
M② × 2 M	CER	CER	−0.008 ***	0.265 ***	0.004 ***	0.424 ***	-	0.032	−0.006 ***	0.215 ***	0.002	0.429 ***	-	0.049
M③ × 2 M	ALU	ALU	0.005 ***	−0.017	0.000*	0.138 **	-	−0.138 ***	0.004 ***	−0.045	0.000 **	0.151 **	-	−0.137 ***
M① × 3 M	CON	CON	0.000	0.236 ***	−0.000	0.349 ***	-	−0.003	0.000	0.175**	0.001	0.283 ***	-	0.014
M② × 3 M	M① × STO	2C × STO	−0.006 ***	0.003 ***	0.002	0.003 ***	-	−0.044	−0.003	0.003 ***	0.000	0.004 ***	-	−0.027
M③ × 3 M	M② × STO	2C × GLA	0.002 **	−0.004	0.000	0.004 ***	-	−0.037	0.003 ***	−0.004	0.000	0.006 ***	-	−0.088 ***
M① × 4 M	M③ × STO	2C × MET	0.000	0.009 ***	0.000	0.000 ***	-	−0.006	−0.000	0.010 ***	0.000	0.000*	-	−0.032*
M② × 4 M	M① × GLA	2C × COA	−0.003	0.000	0.002	−0.001	-	−0.164 ***	−0.001	0.000	−0.001	0.000	-	−0.144 **
M③ × 4 M	M② × GLA	2C × CER	0.001	0.003 **	0.000 ***	−0.000	-	−0.155 **	0.001	0.004 ***	0.000 ***	0.000	-	−0.161 **
2C	M③ × GLA	2C × ALU	-	−0.002 ***	-	0.000	0.004	0.202 ***	-	−0.001	-	0.000 *	-0.009	0.212 ***
3C	M① × MET	2C × FAI	-	0.000	-	0.000	0.031	−0.107 *	-	0.000	-	−0.000	0.035	−0.138 **
4C	M② × MET	3C × STO	-	0.000	-	0.003 **	−0.012	−0.086	-	0.001	-	0.003 *	-0.047	−0.094
2M	M③ × MET	3C × GLA	-	−0.004 ***	-	0.000 ***	−0.028	−0.043 *	-	−0.005 ***	-	0.000 ***	-0.029	−0.088 ***
3M	M① × COA	3C × MET	-	−0.005 ***	-	−0.007 ***	0.014	−0.071 ***	-	−0.005 ***	-	−0.007 ***	0.017	−0.090 ***
4M	M② × COA	3C × COA	-	0.010 ***	-	−0.002	0.016	−0.114 *	-	0.013 ***	-	−0.002	0.005	−0.097
2C × 2M	M③ × COA	3C × CER	-	−0.011 ***	-	0.000	0.083 ***	−0.070	-	−0.011 ***	-	0.000	0.092 ***	−0.090
2C × 3M	M① × CER	3C × ALU	-	−0.005 ***	-	−0.007 ***	0.005	0.191 ***	-	−0.004 ***	-	−0.007 ***	0.014	0.190 ***

Table 5. *Cont.*

Research Variables			OLS						Robustness Test					
			LAB		LCH		Quantity of Colours		LAB		LCH		Quantity of Colours	
Quantity	Features [1]	Features [2]	Quantity	Features [1]	Quantity	Features [1]	Quantity	Features [2]	Quantity	Features [1]	Quantity	Features [1]	Quantity	Features [2]
2C × 4M	M② × CER	3C × FAI	-	0.009 ***	-	−0.003	0.033	−0.155 **	-	0.011 ***	-	−0.002	0.044	−0.216 ***
3C × 2M	M③ × CER	4C × STO	-	−0.012 ***	-	0.000	0.069 ***	−0.044	-	−0.012 ***	-	0.000	0.059**	−0.010
3C × 3M	M① × ALU	4C × GLA	-	0.001	-	−0.001	−0.000	0.152 ***	-	0.001	-	−0.001	-0.016	−0.181 ***
3C × 4M	M② × ALU	4C × MET	-	0.020 ***	-	−0.004 **	0.014	−0.173 ***	-	0.021 ***	-	−0.004 **	0.019	−0.168 ***
4C × 2M	M③ × ALU	4C × COA	-	−0.003 **	-	0.000	0.071*	0.149 *	-	−0.003 **	-	−0.000	0.099**	0.105
4C × 3M	M① × CON	4C × CER	-	−0.005 ***	-	−0.007 ***	0.040	0.214 **	-	−0.004 ***	-	−0.006 ***	0.048	0.105
4C × 4M	M② × CON	4C × ALU	-	0.008	-	−0.006 **	0.017	0.099 *	-	0.008	-	−0.005 *	0.047	0.002
-	M③ × CON	4C × FAI	-	−0.015 ***	-	0.000	-	-	-	−0.012 ***	-	0.000 **	-	-
	Adj-R^2		0.709	0.728	0.710	0.723	0.710	0.723	0.662	0.717	0.662	0.711	0.687	0.686
	DW		1.870	1.863	1.872	1.849	1.853	1.852	1.793	1.863	1.821	1.821	1.802	1.715

Note: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table 6. Coefficients of the quantile regression analysis (N = 906).

Variables	LAB			LCH		
	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75
Table A2						
(intercept)	−1.862 ***	−1.258 ***	−1.259 ***	−1.769 ***	−1.258 ***	−1.231 ***
[ADM = 0]	−0.442 ***	−0.367 ***	−0.305 ***	−0.425 ***	−0.356 ***	−0.310 ***
[LC1 = 0]	−0.107 ***	−0.103 ***	−0.106 ***	−0.104 ***	−0.104 ***	−0.108 ***
[LC2 = 0]	−0.109 ***	−0.085 ***	−0.110 ***	−0.119 ***	−0.087 ***	−0.099 **
POP	0.099 ***	0.107 ***	0.090 ***	0.111 ***	0.113 ***	0.091 ***
GDP	0.156 ***	0.172 ***	0.193 ***	0.157 ***	0.172 ***	0.198 ***
[COM = 0]	−0.067 ***	−0.077 ***	−0.073 ***	−0.070 ***	−0.079 ***	−0.076 ***
[T500 = 0]	−0.063 ***	−0.083 ***	−0.084 ***	−0.063 ***	−0.086 ***	−0.082 ***
[MIN = 0]	−0.045 ***	−0.053 ***	−0.048 ***	−0.054 ***	−0.051 ***	−0.044 ***
[PRI = 0]	−0.108 ***	−0.317 ***	−0.377 ***	−0.134 ***	−0.320 ***	−0.377 ***
[MID = 0]	−0.176 ***	−0.179 ***	−0.195 ***	−0.167 ***	−0.169 ***	−0.192 ***
[AGE = 0]	−0.055 ***	−0.054 ***	−0.039 ***	−0.054 ***	−0.059 ***	−0.040 ***
DEN	0.021 ***	0.028 ***	0.030 ***	0.020 ***	0.028 ***	0.030 ***
GRER	0.014 ***	0.000	0.012 **	0.015 ***	0.002	0.012 **
FEE	0.086 ***	0.118 ***	0.125 ***	0.090 ***	0.116 ***	0.124 ***
RAI	−0.044 ***	−0.044 ***	−0.038 ***	−0.049 ***	−0.045 ***	−0.039 ***
MAR	−0.024 ***	−0.021 ***	−0.021 ***	−0.025 ***	−0.021 ***	−0.019 ***
HOS	−0.024 ***	−0.041 ***	−0.042 ***	−0.024 ***	−0.042 ***	−0.045 ***
SCE	0.008 **	0.015 ***	0.017 ***	0.004	0.014 ***	0.018 ***
GRE	0.000	−0.011 ***	−0.013 ***	−0.001	−0.011 ***	−0.013 ***
WAT	−0.027 ***	−0.027 ***	−0.034 ***	−0.029 ***	−0.027 ***	−0.035 ***
FUN	0.024 ***	0.034 ***	0.035 ***	0.019 ***	0.034 ***	0.037 ***
FAC	0.025 ***	0.020 ***	0.014 ***	0.025 ***	0.019 ***	0.015 ***
GAS	0.017 ***	0.014 ***	0.015 ***	0.014 ***	0.014 ***	0.017 ***
DUM	0.135 ***	0.101 ***	0.097 ***	0.138 ***	0.099 ***	0.084 ***
[2C = 0]	−0.031 ***	0.009	0.007	−0.031 ***	0.004	0.005
[3C = 0]	−0.045 ***	−0.003	−0.015 *	−0.045 ***	−0.007	−0.016 *
[4C = 0]	−0.031 ***	−0.005	−0.008	−00.043 ***	−0.007	−0.015
M①	0.000 *	0.000	−0.000	0.000 *	0.000	−0.000
M②	0.004 ***	0.002 ***	0.001 **	−0.002 ***	0.000	0.001 **
M③	−0.002 ***	−0.001 ***	−0.000	−0.000	0.000	0.000
[2M = 0]	−0.015	−0.031 ***	−0.025 **	−0.018	−0.032 ***	−0.028 **
[3M = 0]	0.000	−0.030 ***	−0.028 ***	−0.000	−0.031 ***	−0.026 ***
[4M = 0]	0.004	−0.022 ***	−0.033 ***	0.001	−0.017 **	−0.029 ***
[STO = 0]	0.105 ***	0.028 ***	0.001	0.104 ***	0.033 ***	0.005
[GLA = 0]	−0.038 ***	−0.040 ***	−0.045 ***	−0.028 ***	−0.041 ***	−0.047 ***
[MET = 0]	0.001	0.020 ***	0.037 ***	0.011	0.020 ***	0.036 ***
[COA = 0]	0.002	−0.028 ***	0.015	0.009	−0.017	0.015
[CER = 0]	0.034 ***	0.002	0.055 ***	0.038 ***	0.009	0.054 ***
[ALU = 0]	−0.021 **	−0.044 ***	−0.049 ***	−0.013	−0.040 ***	−0.048 ***
[CON = 0]	0.067 ***	0.039 ***	0.083 ***	0.078 ***	0.050 ***	0.083 ***
Pse R^2	0.474	0.491	0.523	0.470	0.490	0.523
MAE	1.472	0.1192	0.1436	0.1472	0.1196	0.1438

Note: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table 7. Interaction coefficients of the quantile regression analysis (N = 906).

Research Variables			LAB						LCH						Quantity of Colours					
			Quantity			Features [1]			Quantity			Features [1]			Quantity			Features [2]		
Quantity	Features [1]	Features [2]	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75
M①	M①	[2C = 0]	0.000	0.001 **	0.001 *	0.003 ***	0.003 ***	0.000	0.000	0.001	0.000	0.001	0.004 ***	0.004 ***	-	-	-	−0.060	−0.071	−0.187 ***
M②	M②	[3C = 0]	0.005 ***	0.001	−0.002	−0.007 **	−0.004	−0.013 ***	−00.000	−0.004 ***	−0.006 ***	−0.005 **	0.000	0.005 **	-	-	-	−0.062	−0.117 **	−0.262 ***
M③	M③	[4C = 0]	−0.001	−0.003 ***	−0.003 ***	0.008 ***	0.007 ***	0.013 ***	0.000 ***	0.000 **	0.000 ***	0.000 **	0.000	0.000	-	-	-	0.246 ***	0.051	−0.110
[2M = 0]	[STO = 0]	[STO = 0]	0.141 ***	0.012	0.027	0.328 ***	−0.001	0.052	0.194 ***	0.075 *	0.142 ***	0.414 ***	0.228 ***	−0.158 ***	-	-	-	−0.102	−0.045	−0.004
[3M = 0]	[GLA = 0]	[GLA = 0]	0.014	−0.050	−0.021	0.001	−0.031	−0.093 ***	−0.042	−0.040	0.030	0.003	−0.038	−0.084 ***	-	-	-	−0.073 ***	−0.050 **	−0.006
[4M = 0]	[MET = 0]	[MET = 0]	0.112 ***	−0.048	−0.094 **	−0.036	0.077 *	−0.037	0.090 **	0.016	0.014	0.013	0.058	0.017	-	-	-	−0.030 **	−0.008	0.013
M① × 2 M	[COA = 0]	[COA = 0]	0.002 ***	0.000	0.000	−0.228 ***	−0.189 ***	0.031	0.002 ***	0.000	0.001	−0.137 *	−0.313 ***	−0.319 ***	-	-	-	−0.013	−0.171 ***	−0.206 ***
M② × 2 M	[CER = 0]	[CER = 0]	−0.003	−0.001	−0.001	−0.190 ***	−0.159 **	0.035	0.001	0.005 ***	0.005 ***	−0.048	−0.273 ***	−0.283 ***	-	-	-	0.055	−0.035	−0.118 **
M③ × 2 M	[ALU = 0]	[ALU = 0]	0.001	0.004 ***	0.006 ***	0.033	0.076	0.146 **	0.000 ***	0.000	0.000	−0.065	−0.136 **	0.094	-	-	-	0.053	0.095 **	0.142 ***
M① × 3 M	[CON = 0]	[CON = 0]	0.000	−0.001 **	−0.001 *	−0.112	−0.124	−0.045	−0.001	−0.001 **	−0.001	−0.034	−0.261 ***	−0.338	-	-	-	0.083	−0.006	−0.081
M② × 3 M	M① × STO	[2C × STO = 0]	−0.003	0.001	0.002	0.003 ***	−0.001	−0.001	−0.001	0.004 ***	0.006 ***	0.005 ***	0.003 ***	−0.002 **	-	-	-	0.233 ***	0.106 *	0.004
M③ × 3 M	M② × STO	[2C × GLA = 0]	−0.001	0.002 ***	0.004 ***	0.000	−0.013 ***	−0.012 ***	0.000 **	0.000	0.000 *	0.006 ***	0.001	0.000	-	-	-	0.041 *	0.011	−0.027
M① × 4 M	M③ × STO	[2C × MET = 0]	0.002 ***	−0.001	−0.001 **	0.009 ***	0.012 ***	0.011 ***	0.001	0.000	−0.001 *	0.000 ***	0.000 ***	0.000 **	-	-	-	0.026	−0.003	−0.017
M② × 4 M	M① × GLA	[2C × COA = 0]	0.003	0.001	0.004 *	0.001 *	0.000	−0.001 *	−0.002	0.002 **	0.005 ***	0.000	−0.000	−0.001 **	-	-	-	0.053	0.151 ***	0.221 ***
M③ × 4 M	M② × GLA	[2C × CER = 0]	−0.003 ***	0.001	0.001	0.002	−0.001	0.002	0.000 ***	0.000 ***	0.000 ***	−0.002 ***	−0.002 ***	0.001	-	-	-	0.022	0.055	0.192 ***
[2C = 0]	M③ × GLA	[2C × ALU = 0]	-	-	-	−0.002 ***	−0.003 ***	−0.003 ***	-	-	-	0.000 ***	0.000	0.000	−0.048 **	0.029	0.007	−0.085 *	−0.134 ***	−0.236 ***
[3C = 0]	M① × MET	[2C × FAI = 0]	-	-	-	0.000	0.001	−0.001	-	-	-	−0.000	−0.000	−0.001	−0.065 ***	−0.008	−0.022	0.001	0.040	0.169 ***
[4C = 0]	M② × MET	[3C × STO = 0]	-	-	-	0.002	0.003	−0.003	-	-	-	−0.000	0.001	0.000	0.036	0.047	−0.060 *	0.230 ***	0.080	0.019

Table 7. *Cont.*

Research Variables			LAB						LCH						Quantity of Colours					
			Quantity			Features [1]			Quantity			Features [1]			Quantity			Features [2]		
Quantity	Features [1]	Features [2]	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75
[2M = 0]	M③ × MET	[3C × GLA = 0]	-	-	-	−0.004 ***	−0.002 **	−0.002 *	-	-	-	−0.000	0.000 *	0.000 **	0.008	0.039 **	0.039 *	0.055 **	0.029	−0.042 *
[3M = 0]	M① × COA	[3C × MET = 0]	-	-	-	−0.004 ***	−0.003 ***	0.000	-	-	-	−0.002 **	−0.004 ***	−0.004 ***	−0.015	0.001	0.012	0.080 ***	0.083 ***	0.092 ***
[4M = 0]	M② × COA	[3C × COA = 0]	-	-	-	0.011 ***	0.006 **	0.014 ***	-	-	-	0.004 **	0.000	−0.004 *	0.006	0.016	0.031	0.029	0.180 ***	0.289 ***
[2C × 2M = 0]	M③ × COA	[3C × CER = 0]	-	-	-	−0.009 ***	−0.007 ***	−0.012 ***	-	-	-	0.000 ***	0.000 *	0.000	−0.009	−0.078 ***	−0.048 *	−0.007	0.061	0.213 ***
[2C × 3M = 0]	M① × CER	[3C × ALU = 0]	-	-	-	−0.003 ***	−0.003 ***	0.000	-	-	-	−0.001	−0.004 ***	−0.004 ***	0.020	−0.026	−0.010	−0.117 **	−0.149 ***	−0.163 ***
[2C × 4M = 0]	M② × CER	[3C × FAI = 0]	-	-	-	0.007 **	0.005 *	0.012 ***	-	-	-	0.005 **	0.000	−0.005 ***	−0.030	−0.065 ***	−0.067 **	0.090	0.154 ***	0.250 ***
[3C × 2M = 0]	M③ × CER	[4C × STO = 0]	-	-	-	−0.009 ***	−0.008 ***	−0.013 ***	-	-	-	0.000 **	0.000	0.000	−0.035	−0.062 ***	−0.044	0.237 ***	0.090	0.045
[3C × 3M = 0]	M① × ALU	[4C × GLA = 0]	-	-	-	0.001	0.002 **	0.003 ***	-	-	-	0.000	−0.001	0.002 **	0.024	−0.008	−0.003	0.150 ***	0.041	−0.013
[3C × 4M = 0]	M② × ALU	[4C × MET = 0]	-	-	-	0.018 ***	0.020 ***	0.016 ***	-	-	-	−0.006 ***	−0.001	−0.002	−0.005	−0.025	−0.056 **	0.069	0.125 ***	0.178 ***
[4C × 2M = 0]	M③ × ALU	[4C × COA = 0]	-	-	-	0.000	−0.002	−0.004 **	-	-	-	0.000 ***	−0.000	−0.000	−0.125 ***	−0.075 **	0.038	−0.285 ***	0.007	0.122
[4C × 3M = 0]	M① × CON	[4C × CER = 0]	-	-	-	−0.003 **	−0.002 **	−0.001	-	-	-	−0.001	−0.004 ***	−0.005 ***	−0.103 ***	−0.082 **	0.022	−0.354 ***	−0.111	0.057
[4C × 4M = 0]	M② × CON	[4C × ALU = 0]	-	-	-	0.015 ***	0.006	0.013 **	-	-	-	−0.001	−0.003	−0.008 ***	−0.062	−0.047	0.031	0.035	0.109 **	−0.158 ***
-	M③ × CON	[4C × FAI = 0]	-	-	-	−0.013 ***	−0.012 ***	−0.016 ***	-	-	-	0.000 **	0.000	0.000	-	-	-	-	-	-
	Pse R^2		0.464	0.484	0.514	0.483	0.499	0.530	0.462	0.485	0.516	0.476	0.493	0.526	0.463	0.484	0.513	0.477	0.497	0.529
	MAE		0.1491	0.1208	0.1459	0.1438	0.1173	0.1410	0.1489	0.1207	0.1451	0.1453	0.1187	0.1434	0.1485	0.1210	0.1459	0.1455	0.1178	0.1419

Note: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

The interaction quantile regression results are shown in Table 7 (the full table can be seen in Table A2). Given the substantial amount of information in the interaction quantile regression results, this section only provides an overview of these results, and the discussion is saved for the next section. Across various combinations of building facade quantities with colour characteristics, combinations of main colour features with main colour material characteristics, combinations of facade material quantities with colour quantities and combinations of main colour material characteristics with colour quantities, a discernible variation can be observed in the preferences of different consumer groups. For example, the low quantile regression results for the quantity of facade materials and colour features reveal that, when there is one facade material, the redder the main colour tendency of the facade, the higher the house prices. Meanwhile, in the median and high quantile regression results, when there is one facade material, the more yellow the main colour tendency or the higher the saturation, the lower the house prices.

To illustrate the price correlation features of these variables as they change across different consumer groups, the variables that emerge as significant in the different quantile regression results are selected as representatives. The coefficient regression changes are plotted in Figure 6. These constant variables focus primarily on the interaction between the external and material primary colour features. Coatings, ceramic tiles, aluminium–plastic board and as-cast-finish concrete emerge as the most dissimilar materials.

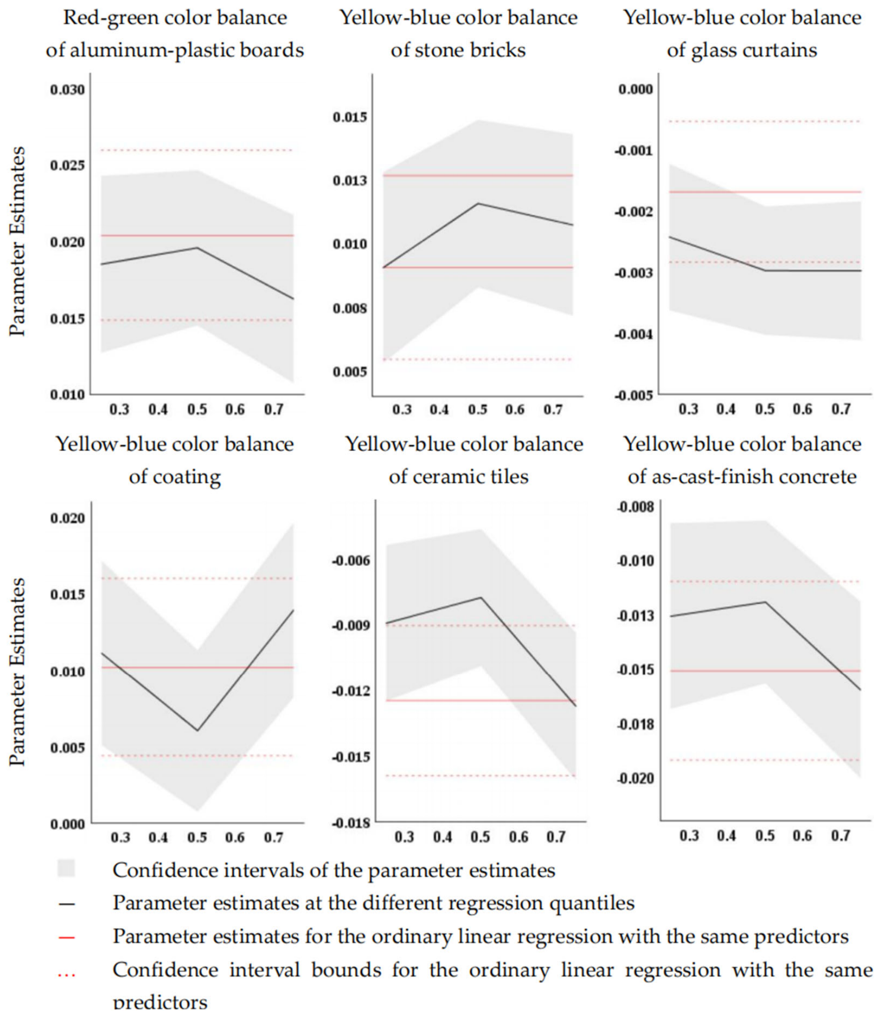

Figure 6. Change results of quantile coefficients.

4. Discussion

4.1. All Consumer Groups

The results of the linear regression analysis for the control variables are comparable with the findings of previous research. Therefore, the following discussion focuses only on the research variables. The consumers' predilection for three facade colours suggests the existence of a common aesthetic perception towards the quantity of colours in Fuzhou. This result echoes that of Tosca [69], who observed a similar preference for the quantity of colours on individual building facades in Greece. However, different conclusions emerge for condominium buildings. Specifically, Greek individuals show a stronger inclination towards condominium buildings with facades featuring four or more colours. This disparity may be due to regional cultural variations or the fact that condominium buildings are the predominant type of individual housing in China. From the perspective of the main colour features, the red and blue tendencies of the main colour are positively correlated with house prices for the overall consumer population, and the coefficient of the red tendency is approximately five times larger than that of the blue tendency, indicating that the public's overall colour aesthetic preference is within the range of burgundy. In conjunction with the positive correlation of low saturation, this finding indicates that the urban condominium consumption group as a whole prefers light burgundy as the main colour, whereas a main colour of red with a colder hue is more popular among consumers. This colour aesthetic preference may be related to the celebratory significance of red in China [79]. Furthermore, the preference for a red tendency in building facades is not solely confined to China; Kaya and Crosby [71] arrived at a similar conclusion in Athens, US. Therefore, the preference for red hues on facades may not solely stem from cultural influences but may also be rooted in the psychological commonalities among consumers. Meanwhile, the analytical results for facade lightness are not significant, thereby highlighting the diversity in the aesthetic preferences of consumer groups for the lightness of the main colours. Interestingly, in Taiwan, not far from mainland China, consumers prefer a higher facade lightness for condominium buildings [70]. The underlying reasons for this finding warrant further exploration in future research. In terms of the quantity of materials for the main colour of the facade, the combination of two facade materials can provide a higher house price than the combination of three and four or more materials, thus confirming the lack of an absolute correlation between material costs and the final selling price. The general consumer preference for two types of materials indicates that consumers place greater emphasis on the sensory combination of materials rather than on a simple accumulation of costs. This novel finding is not only highly valuable but also highlights a new perspective in the field. In terms of the material features of the main facade colour, aluminium–plastic boards and glass curtains are preferred by consumers, whereas other materials, particularly plain concrete, are detested by consumers. This result may be due to the high-quality impression created by aluminium–plastic boards and glass curtains and the low-quality impression created by plain concrete. However, this preference for materials may exhibit strong regional variations. Research conducted in Finland [80] and New Zealand [9] revealed that the residents in these areas mostly prefer traditional local building materials, such as wood.

When the building facade material factor is considered in conjunction with the colour factor, the general population shows a consistent aesthetic preference. In terms of the relationship between the main colour of the building and the quantity of materials, all consumer groups prefer yellow–green when there are two or three materials, and a greater preference for yellow–green corresponds to a higher transaction price. These groups also prefer high lightness and saturation, particularly in the case of two facade materials. Therefore, when the quantity of facade materials is relatively limited, the main body should use brightly coloured materials to be in line with the aesthetic preferences of consumers. In terms of the relationship between the main colour features of the facade and the material type of the main colour features, consumers generally prefer stone bricks with a high lightness, high saturation and yellowish colour balance; glass with a blueish colour balance;

metal sheets with a high saturation and blueish colour balance; burgundy coatings and burgundy ceramic tiles with a low lightness; burgundy aluminium–plastic boards with a low lightness; and concrete with a low lightness, low saturation and blueish colour balance. These findings indicate that the varying preferences of consumers for the colour features of different facade materials are driven by these materials' distinct textures. Different facade materials can evoke different colour resonances appreciated by consumers. Such an exploration of the premises of colour preferences goes beyond the conventional discussions centred solely on colour aspects in urban consumer facade preferences. This discussion also substantiates the claim that some fixed material–colour combinations can effectively captivate the preferences of consumers. In terms of the relationship between the quantity of building facade materials and colours, consumers prefer condominiums with two and three facade colours in the case of only two facade materials, thereby indicating that, when the quantity of facade materials is small, consumers prefer facade styles with a relatively coincident colour quantity. This trend suggests that all consumer groups prefer plain and distinct material colour combinations for the exterior aesthetics of condominium buildings. People share a common aesthetic preference for distinct main colour materials in terms of the quantity of colour combinations and the features of the main colour materials used for building facades. This preference may be related to the complexity of the texture of these materials. Some materials, such as coatings, ceramic tiles and glass, have a single texture. If the colour combination is simple, then people will feel that the building is cheap, thus showing no interest in the purchase. Therefore, a diverse colour combination is required to improve the overall quality of the structure. Certain materials, such as aluminium–plastic boards, have a delicate texture and, thus, require appropriate colour matching to bring out their attractiveness. In addition, some materials, such as metal panels, are preferred by consumers due to their inherent complexity and lustre. Therefore, the quantity of colours must be limited to emphasise the texture of these metals.

4.2. Different Consumer Groups

Based on the results of the quantile regression analysis, the aesthetic preferences of different consumer groups are summarised in Table 8. Consumers in the low-consumption group are more traditional and conservative than those in the middle- and high-consumption groups, and the traditional way of thinking is more prevalent amongst consumers with a lower consumption level. For instance, the preference for burgundy with low saturation is an expression of conservatism based on regional cultural inertia [81]. In terms of colour aesthetic preference, the middle-consumption group shares some similarities with the low-consumption group but is less conventional. In terms of material aesthetic preferences, the high-consumption group is similar to the low-consumption group but does not prefer aluminium–plastic boards and metal sheets. This finding indicates that, as their level of consumption raises, consumers become more attuned to the minute differences amongst similar materials, thus increasing the nuance of their aesthetic perceptions. This finding also indirectly demonstrates the close correlation between economic foundational levels and the state of existential well-being [82]. As for consumers in the high-consumption group, the absence of a group-wide colour preference highlights the diversity of their aesthetic preferences. Although some consumers may prefer red as the main colour, they hold an open and tolerant outlook in life. These consumers also prefer highly diverse material combinations, which further demonstrates the complexity and inclusivity of their preferences for materials. Based on these arguments, one may hypothesise that the degree of diversity in building facade materials within a city is positively correlated with the region's economic level [83]. However, in terms of material preference, the conceptual preferences between the high-consumption group and the two other groups remain consistent without any significant differences.

Table 8. Aesthetic preferences of different consumer groups.

		Low-Consumption Group	**Middle-Consumption Group**	**High-Consumption Group**
		Colours and Materials		
Quantity of Colours		Preference order: three colours, two colours, four colours or more, one colour	-	-
Features of the Main Colour Materials	Lightness	-	-	-
	Red–Green	Prefer red, preference degree higher than middle-consumption group	Prefer red	Prefer red (marginal significant)
	Yellow–Blue	Prefer blue, preference degree higher than middle-consumption group	Prefer blue	-
	Saturation	Low	-	-
Quantity of Materials		-	Preference order: two and three materials, four materials or more	Preference order: four materials or more, three materials
Features of the Main Material		Prefer glass curtains, dislike stone bricks, ceramic tiles and as-cast-finish concrete	Prefer glass curtain and aluminium–plastic board, dislike stone brick, metal sheet and as-cast-finish concrete	Prefer glass curtain and aluminium–plastic board, dislike metal sheet, ceramic tile and as-cast-finish concrete
		Features of the Primary Colour		
Quantity of Materials	1	Prefer red	Prefer blue and low saturation	Prefer blue and low saturation
	2	Prefer high lightness	Prefer yellow and high lightness	Prefer yellow and high saturation
	3	-	Prefer yellow, low lightness and high saturation	Prefer yellow and high saturation
	4 or More	Prefer blue and high lightness	May prefer high saturation (marginally significant)	Prefer high saturation
Features of the Main Colour Materials	Stone Brick	Prefer yellow, high lightness and high saturation	Prefer green and yellow	Prefer green and yellow
	Glass Curtain	Prefer blue and low saturation	Prefer blue and low saturation	Prefer blue and may prefer low lightness
	Metal Sheet	Prefer blue	May prefer blue (marginally significant)	-
	Coating	Prefer red, blue and low lightness	May prefer red (marginally significant), blue and low lightness	Prefer red and blue
	Ceramic Tile	Prefer blue	Prefer blue and low lightness	Prefer red and blue
	Aluminium–plastic Board	Prefer red	Prefer red, may prefer high lightness (marginally significant)	Prefer red, blue and high lightness
	As-cast-finish Concrete	Prefer red and blue	Prefer blue, may prefer low lightness (marginally significant)	Prefer blue and low saturation
		Quantity of Colours		
Quantity of Materials	1	Prefer three colours, may prefer two colours	-	-
	2	Prefer four colours or more, preference degree higher than three materials	Preference order: two colours, three colours, may prefer four colours or more	-
	3	Prefer four colours or more	May prefer four colours or more	-
	4 or More	-	Prefer two colours	May prefer two colours and three colours
Features of the Main Colour Materials	Stone Brick	Prefer one colour. Dislike order: four colours or more, two colours, three colours	-	-
	Glass Curtain	Dislike four colours or more	-	-
	Metal Sheet	Dislike three colours	-	-
	Coating	Dislike four colours or more	Dislike two colours and three colours	Dislike order: three colours, two colours
	Ceramic tile	Dislike four colours or more	-	Dislike order: three colours, two colours
	Aluminium–plastic Board	-	Prefer two colours and four colours or more	Preference order: two colours, three colours, four colours or more
	As-cast-finish Concrete	-	Dislike three colours	Prefer one colour. Dislike order: three colours, two colours

Urban development and planning administrators should formulate corresponding regulations and policies based on the overarching preference patterns within the city to facilitate orderly control over urban development. For regions inhabited by consumption groups with varying economic capacities, targeted facade transformations can be implemented to enhance the quality of life of the predominant population. For instance, when renovating the facades of old condominium buildings in urban areas, upscale materials can be used for the facades of economically well-off apartments, whereas areas with lower economic development can opt for low-saturation burgundy-coloured facades. Meanwhile, by inferring the residents' economic capacities from the current facade characteristics, a compensatory construction of public services can be carried out for those areas lacking in facilities. For instance, in urban zones surrounded by conservative traditional condominium buildings, the addition of public transportation facilities can be considered to meet the travel needs of lower-income groups. Furthermore, normative guidance can be provided for anticipated plans in newly developed residential areas to direct the flow of people. For example, if urban planning and development departments aim to attract higher-income groups to a new area, they can introduce regulations and policies that set a minimum quantity of facade materials for condominium buildings in the planning and design of the relevant regions. Doing so would encourage the incorporation of a greater variety of materials in building facades.

When incorporating facade material factors into the analysis of colour aesthetic preferences, different consumption groups exhibit similar variations in their preferences. When the quantity of materials is the same, the low-consumption group pays attention to the quantity of colours and the lightness of the main colour of the façade; the middle-consumption group considers the lightness, saturation and quantity of colours collectively; and the high-consumption group focuses on the saturation of the main colour. This behaviour may reflect the divergent atmospheric preferences of different consumer groups for building surroundings. The low-consumption group prioritises colour diversity and the cheerful ambiance brought by light primary hues, whilst the high-consumption group prioritises higher colour saturation in their primary hues and aims for intense sensory experiences. The considerations of the middle-consumption group seem to balance certain aspects of both the low- and high-consumption groups, making their preferences less distinct. When the quantity of building facade materials is limited, the low-consumption group prefers red in the red–green colour balance. However, when the quantity of building facade materials is large, this group prefers blue in the yellow–blue colour balance. By contrast, the middle- and high-consumption groups favour blue and yellow when the quantity of facade materials is low and high, respectively. When the primary features of a colour material are identical, different consumption groups exhibit distinct preferences. Similarly, when the main facade material of condominium buildings remains constant, these consumption groups exhibit significant disparities in their preferences for the quantity of colours on the facade and the main colour features. In terms of the quantity of colours on the facade, the middle- and high-consumption groups pay attention to the colour quantity of aluminium–plastic boards and as-cast-finish concrete, whilst the low-consumption group pays attention to the overall colour quantity of stone bricks, glass curtains and metal sheets. The coating material is important for different consumption groups, but the low- and middle-consumption groups show different preference trends. The low-consumption group tends to favour facade designs with fewer colours, whilst the middle- and high-consumption groups prefer facades with a greater variety of colours. Therefore, the sensory experience evoked by coatings as a primary material is complex and warrants further research. As for the primary colour features of building facades, the differences in the preferences of consumer groups are manifested in highly intricate details. Figure 7 displays the colour aesthetic preferences of different consumer groups for various types of materials to intuitively convey the colour feature attributes of their preferred materials. In addition to the differences in the direction of preference for the colour balance, the lightness and the saturation of the fundamental colours, varying degrees of preference differences can also be observed for the same direction of preference. For instance, Figure 6 reveals that, for stone bricks, the preference for a yellow tendency in the colour balance is greater for the middle- and high-consumption groups than for the low-consumption group. For coatings, ceramic tiles and as-cast-finish concrete, the preference for a blue tendency in the colour balance is greater for the high-consumption group. For aluminium–plastic boards, the preference for a red tendency in the colour balance is greater for the middle-consumption group. However, for glass materials, the preferences of the different consumption groups are nearly identical, thereby suggesting that glass is the most popular choice for all groups. This finding may partly explain why the facades of modern urban condominium buildings are increasingly utilising glass as the primary building material [84]. This material also allows these buildings to command higher selling prices.

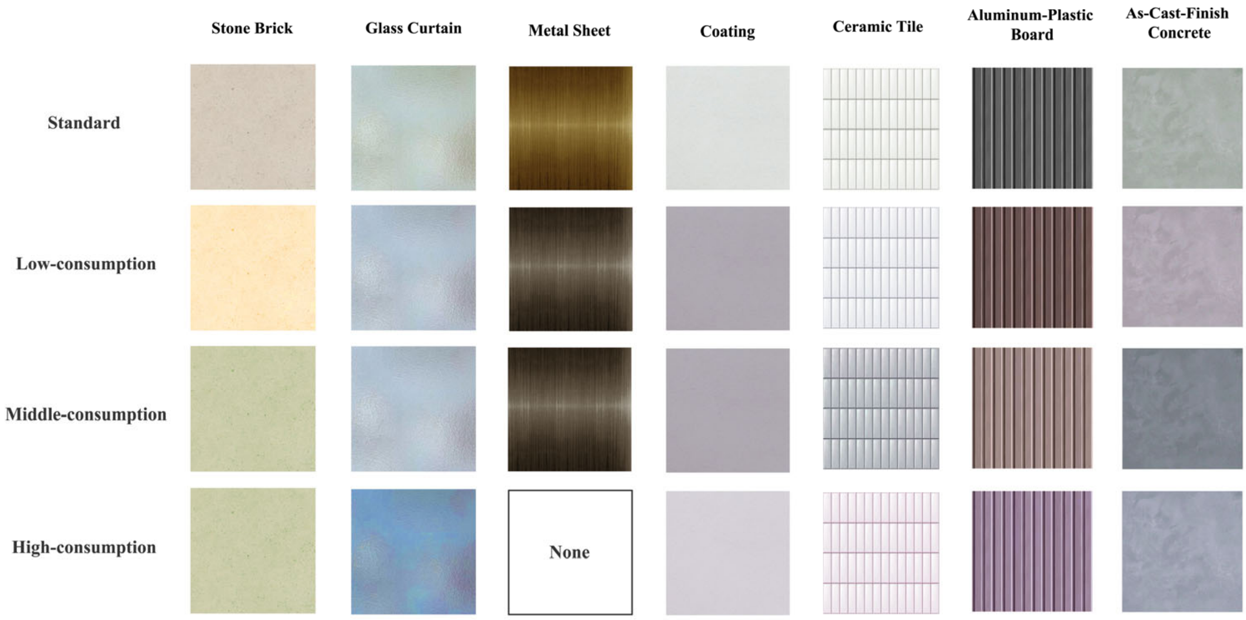

Figure 7. Colour aesthetic preference of different consumer groups for building facade materials.

Residential developers may derive several key findings from the aforementioned discussion. Firstly, when designing the facades of residential properties, these developers need a clear product positioning because different consumption groups have varying preferences for the combination of colours and materials in building facades. Tailoring facade designs to the consumption level characteristics of potential consumer groups in the region may lead to high market acceptance. For instance, to cater to the mid- to high-end consumer market, if only brick is available as the main facade material, then selecting bricks with a stronger yellow colour tendency may be a strategic choice. Secondly, residential developers need to adopt a dynamic perspective when interpreting the differences in the preferences of various consumer groups. To some extent, high-consumption groups represent those with a relatively strong economic foundation in the city. As the city develops, almost all population segments tend to experience an improvement in their economic status [85]. Therefore, the preferences of higher-income groups hold significant implications for all consumers' future aesthetic preferences for building facades. Residential developers should continuously align their offerings with evolving aesthetic preferences.

5. Conclusions

Using house prices as a point of reference and the Chinese city of Fuzhou as a case study, this study examines the differences in the aesthetic preferences of different consumer groups for building facade colours and materials. Previous studies have explored colour aesthetic preferences using imprecise reference measures, and material-based colour aesthetic preferences are even less commonly explored. This study contributes to the literature on the intersection of psychology, economics and urban planning in mainland China by experimenting with economics-related theories in this discipline.

Urban consumers, as represented by consumers in Fuzhou, share common aesthetic preferences for colour and materials, but some differences may be observed in the direction and intensity of such preferences across different consumer groups. In terms of facade colour, consumers generally prefer three colours and demonstrate a common obsession with the colour red. In terms of building facade material, consumers typically prefer building facade colours with two materials and are willing to pay for aluminium–plastic boards and glass curtains. These consumer groups also have a fixed preference for various facade materials in terms of the quantity of colour combinations and the combination of colour features. For example, when the quantity of facade materials is relatively small, these consumers prefer the main body to be made of brightly coloured materials or a facade style in which the quantity of colours matches the quantity of materials. When using certain materials with a single texture (e.g., coatings, ceramic tiles and glass), these consumers prefer a variety of colour combinations to enhance the sense of class of their residence. Meanwhile, the preference for matching and combining is inconsistent across these consumer groups. For example, with the same quantity of building facade materials, the low-consumption group pays attention to the lightness of the main colour and the quantity of colours; the middle-consumption group considers the lightness, saturation and quantity of colours; and the high-consumption group pays attention to the saturation of the main colour. In addition, the middle- and high-consumption groups pay attention to the colour matching of aluminium–plastic boards and as-cast-finish concrete, and the low-consumption group pays attention to the overall colour coordination of stone bricks, glass curtains and metal sheets. Diverse consumption groups express admiration for glass curtains as a facade material when it serves as the main colour material. These match and combination preferences may stem from regional cultural traditions [86] or distinctions in the life experiences [87] of these groups. This paper also analyses the possible causes of these differences.

The above conclusions offer relevant insights for urban development and planning administrators and residential developers. Specifically, urban development and planning administrators may improve their control over the overall urban development, which is based on collective preferences, and subsequently achieve a highly sustainable form of "smart growth" [88]. Meanwhile, residential developers may obtain a clear understanding of the demand characteristics of different market segments [89], which would ensure their continuous survival and increase their growth prospects.

However, some deficiencies can be found in the research design, which may be due to quantitative flaws in the establishment of control variables. The large number of significant control variables in this study can accurately reflect the correlation and degree of the influence of colour and material. However, many aspects of the house price correlation variables remain unobserved. This study also focuses on the differences in the consumption levels of different consumer groups in a categorical manner but does not delve into other differences, such as the differences in the spatial distribution of condominiums. The empirical findings are obtained from the cultural context of Fuzhou, China. Therefore, the findings of this study may only reflect the preferences of different consumer groups in Fuzhou and may not be applicable to consumer groups from other geographical and cultural contexts [90]. The preferences of these groups may also change with time. Therefore, the findings of this study need to be improved and supplemented in future research.

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Appendix A

Table A1. Interactive coefficients of the linear regression analysis (N = 906).

Control Variables	OLS						Robustness Test					
	LAB		LCH		Quantity of Colours		LAB		LCH		Quantity of Colours	
	Quantity	Features	Quantity	Features	Quantity	Features	Quantity	Features	Quantity	Features	Quantity	Features
(Constant)	−2.930 ***	−3.297 ***	−2.798 ***	−3.423 ***	−2.929 ***	−3.122 ***	−2.346 ***	−3.787 ***	−1.640 ***	−3.227 ***	−2.965 ***	−1.825 ***
ADM	0.412 ***	0.409 ***	0.410 ***	0.409 ***	0.401 ***	0.406 ***	0.461 ***	0.434 ***	0.326 ***	0.357 ***	0.403 ***	-
LC1	0.109 ***	0.106 ***	0.113 ***	0.112 ***	0.113 ***	0.121 ***	0.123 ***	0.133 ***	-	0.111 ***	0.106 ***	0.072 ***
LC2	0.107 ***	0.107 ***	0.109 ***	0.110 ***	0.111 ***	0.110 ***	0.071 ***	0.126 ***	0.126 ***	0.149 ***	0.112 ***	0.244 ***
POP	0.150 ***	0.145 ***	0.150 ***	0.150 ***	0.139 ***	0.143 ***	0.257 ***	0.136 ***	0.118 ***	0.127 ***	0.136 ***	0.020 *
GDP	0.161 ***	0.172 ***	0.161 ***	0.173 ***	0.165 ***	0.178 ***	-	0.165 ***	0.170 ***	0.194 ***	0.151 ***	0.217 ***
COM	0.088 ***	0.075 ***	0.089 ***	0.076 ***	0.089 ***	0.078 ***	0.116 ***	0.077 ***	0.093 ***	-	-	0.066 ***
T500	0.096 ***	0.094 ***	0.096 ***	0.095 ***	0.095 ***	0.099 ***	0.117 ***	0.090 ***	0.095 ***	0.108 ***	0.095 ***	0.109 ***
MIN	0.049 ***	0.048 ***	0.051 ***	0.047 ***	0.050 ***	0.049 ***	0.048 ***	0.044 ***	0.058 ***	0.041 ***	0.023 ***	0.058 ***
PRI	0.255 ***	0.238 ***	0.261 ***	0.252 ***	0.259 ***	0.257 ***	0.256 ***	0.265 ***	-	0.256 ***	0.263 ***	0.244 ***
MID	0.190 ***	0.184 ***	0.183 ***	0.176 ***	0.184 ***	0.163 ***	0.216 ***	0.217 ***	0.231 ***	0.182 ***	0.159 ***	0.195 ***
AGE	0.064 ***	0.047 ***	0.064 ***	0.045 ***	0.051 ***	0.041 ***	0.067 ***	0.048 ***	0.019 **	0.064 ***	0.052 ***	-
DEN	0.021 ***	0.023 ***	0.018 ***	0.020 ***	0.021 ***	0.012 **	0.041 ***	0.025 ***	0.017 ***	0.018 ***	0.025 ***	0.014 ***
GRER	0.012 **	0.015 ***	0.012 **	0.013 **	0.012 **	0.015 ***	0.020 ***	0.019 ***	0.004	0.023 ***	0.021 ***	0.018 ***
FEE	0.123 ***	0.108 ***	0.123 ***	0.107 ***	0.122 ***	0.105 ***	-	0.099 ***	0.125 ***	0.125 ***	0.143 ***	0.106 ***
RAI	−0.035 ***	−0.035 ***	−0.036 ***	−0.037 ***	−0.035 ***	−0.033 ***	−0.018 ***	-	−0.056 ***	−0.042 ***	−0.026 ***	−0.051 ***
MAR	−0.023 ***	−0.024 ***	−0.022 ***	−0.021 ***	−0.022 ***	−0.021 ***	−0.043 ***	−0.038 ***	−0.022 ***	−0.018 ***	−0.017 ***	−0.020 ***
HOS	−0.035 ***	−0.037 ***	−0.035 ***	−0.038 ***	−0.034 ***	−0.039 ***	−0.040 ***	-	−0.060 ***	−0.031 ***	−0.031 ***	−0.029 ***
SCE	0.016 ***	0.015 ***	0.015 ***	0.012 ***	0.013 ***	0.012 ***	0.010 ***	0.016 ***	−0.011 ***	0.009 ***	0.002	0.008 **
GRE	−0.007 ***	−0.008 ***	−0.006 **	−0.006 **	−0.006 ***	−0.005 **	−0.018 ***	−0.010 ***	−0.010 ***	−0.005 *	−0.017 ***	−0.026 ***
WAT	−0.043 ***	−0.040 ***	−0.044 ***	−0.041 ***	−0.044 ***	−0.041 ***	0.045 ***	−0.033 ***	−0.042 ***	−0.036 ***	-	−0.037 ***
FUN	0.036 ***	0.042 ***	0.032 ***	0.040 ***	0.036 ***	0.037 ***	0.083 ***	0.040 ***	0.029 ***	-	0.030 ***	0.000
FAC	0.026 ***	0.024 ***	0.026 ***	0.023 ***	0.026 ***	0.023 ***	0.034 ***	0.024 ***	0.016 ***	0.018 ***	0.031 ***	−0.006 *
GAS	0.018 ***	0.017 ***	0.016 ***	0.017 ***	0.015 ***	0.014 ***	0.013 ***	0.015 ***	0.007 *	0.024 ***	0.021 ***	0.002
DUM	0.109 ***	0.111 ***	0.109 ***	0.109 ***	0.111 ***	0.113 ***	0.176 ***	0.130 ***	0.070 ***	0.107 ***	0.105 ***	0.086 ***
Table 5												

Note: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table A2. Interaction coefficients of the quantile regression analysis (N = 906).

Control Variables	LAB						LCH						Quantity of Colours					
	Quantity			Features			Quantity			Features			Quantity			Features		
	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75	q = 0.25	q = 0.5	q = 0.75
(intercept)	−1.757 ***	−1.169 ***	−0.818 ***	−1.751 ***	−1.139 ***	−1.283 ***	−1.692 ***	−1.217 ***	−0.949 ***	−1.860 ***	−0.838 ***	−0.421 *	−1.196 ***	−0.932 ***	−0.917 ***	−2.294 ***	−1.964 ***	−1.705 ***
[ADM = 0]	−0.448 ***	−0.366 ***	−0.326 ***	−0.429 ***	−0.362 ***	−0.318 ***	−0.446 ***	−0.355 ***	−0.317 ***	−0.440 ***	−0.361 ***	−0.326 ***	−0.418 ***	−0.353 ***	−0.295 ***	−0.408 ***	−0.365 ***	−0.319 ***
[LC1 = 0]	−0.089 ***	−0.095 ***	−0.103 ***	−0.084 ***	−0.093 ***	−0.100 ***	−0.102 ***	−0.094 ***	−0.102 ***	−0.101 ***	−0.103 ***	−0.103 ***	−0.104 ***	−0.099 ***	−0.103 ***	−0.108 ***	−0.108 ***	−0.102 ***
[LC2 = 0]	−0.094 ***	−0.090 ***	−0.099 ***	−0.100 ***	−0.085 ***	−0.102 ***	−0.098 ***	−0.102 ***	−0.104 ***	−0.105 ***	−0.082 ***	−0.104 ***	−0.116 ***	−0.096 ***	−0.111 ***	−0.119 ***	−0.076 ***	−0.100 ***
POP	0.129 ***	0.106 ***	0.108 ***	0.118 ***	0.107 ***	0.105 ***	0.137 ***	0.104 ***	0.091 ***	0.133 ***	0.116 ***	0.111 ***	0.126 ***	0.106 ***	0.083 ***	0.118 ***	0.107 ***	0.097 ***
GDP	0.137 ***	0.172 ***	0.167 ***	0.155 ***	0.171 ***	0.177 ***	0.142 ***	0.170 ***	0.178 ***	0.147 ***	0.175 ***	0.177 ***	0.136 ***	0.171 ***	0.188 ***	0.153 ***	0.175 ***	0.200 ***
[COM = 0]	−0.089 ***	−0.087 ***	−0.074 ***	−0.065 ***	−0.078 ***	−0.075 ***	−0.087 ***	−0.086 ***	−0.074 ***	−0.072 ***	−0.075 ***	−0.075 ***	−0.083 ***	−0.088 ***	−0.084 ***	−0.077 ***	−0.074 ***	−0.070 ***
[T500 = 0]	−0.065 ***	−0.077 ***	−0.087 ***	−0.075 ***	−0.084 ***	−0.086 ***	−0.070 ***	−0.076 ***	−0.079 ***	−0.071 ***	−0.084 ***	−0.079 ***	−0.066 ***	−0.077 ***	−0.085 ***	−0.066 ***	−0.091 ***	−0.084 ***
[MIN = 0]	−0.058 ***	−0.044 ***	−0.025 ***	−0.045 ***	−0.058 ***	−0.049 ***	−0.066 ***	−0.047 ***	−0.031 ***	−0.053 ***	−0.054 ***	−0.049 ***	−0.052 ***	−0.042 ***	−0.034 ***	−0.044 ***	−0.052 ***	−0.050 ***
[PRI = 0]	−0.085 ***	−0.339 ***	−0.400 ***	−0.111 ***	−0.307 ***	−0.391 ***	−0.112 ***	−0.335 ***	−0.416 ***	−0.096 ***	−0.329 ***	−0.401 ***	−0.101 ***	−0.332 ***	−0.395 ***	−0.115 ***	−0.330 ***	−0.374 ***
[MID = 0]	−0.170 ***	−0.171 ***	−0.242 ***	−0.176 ***	−0.181 ***	−0.210 ***	−0.164 ***	−0.179 ***	−0.228 ***	−0.177 ***	−0.171 ***	−0.195 ***	−0.153 ***	−0.171 ***	−0.237 ***	−0.167 ***	−0.164 ***	−0.195 ***
[AGE = 0]	−0.071 ***	−0.086 ***	−0.088 ***	−0.053 ***	−0.057 ***	−0.066 ***	−0.073 ***	−0.084 ***	−0.085 ***	−0.055 ***	−0.057 ***	−0.054 ***	−0.061 ***	−0.072 ***	−0.075 ***	−0.050 ***	−0.062 ***	−0.045 ***
DEN	0.019 ***	0.033 ***	0.033 ***	0.022 ***	0.026 ***	0.026 ***	0.023 ***	0.032 ***	0.027 ***	0.021 ***	0.027 ***	0.028 ***	0.018 ***	0.034 ***	0.035 ***	0.021 ***	0.020 ***	0.023 ***
GRER	0.009	0.011 **	0.004	0.017 ***	0.000	−0.002	0.019 ***	0.004	0.005	0.021 ***	0.003	0.009 *	0.010 *	0.013 ***	0.003	0.020 ***	0.004	0.012 **
FEE	0.106 ***	0.136 ***	0.143 ***	0.082 ***	0.114 ***	0.130 ***	0.103 ***	0.137 ***	0.147 ***	0.085 ***	0.116 ***	0.129 ***	0.099 ***	0.132 ***	0.141 ***	0.083 ***	0.112 ***	0.128 ***
RAI	−0.045 ***	−0.045 ***	−0.036 ***	−0.045 ***	−0.044 ***	−0.038 ***	−0.048 ***	−0.046 ***	−0.038 ***	−0.050 ***	−0.047 ***	−0.039 ***	−0.047 ***	−0.045 ***	−0.036 ***	−0.043 ***	−0.044 ***	−0.039 ***
MAR	−0.023 ***	−0.022 ***	−0.023 ***	−0.029 ***	−0.024 ***	−0.021 ***	−0.022 ***	−0.021 ***	−0.021 ***	−0.025 ***	−0.022 ***	−0.021 ***	−0.024 ***	−0.024 ***	−0.022 ***	−0.025 ***	−0.022 ***	−0.022 ***
HOS	−0.032 ***	−0.042 ***	−0.043 ***	−0.032 ***	−0.042 ***	−0.048 ***	−0.032 ***	−0.039 ***	−0.044 ***	−0.031 ***	−0.044 ***	−0.048 ***	−0.033 ***	−0.038 ***	−0.039 ***	−0.031 ***	−0.046 ***	−0.050 ***
SCE	0.006 *	0.014 ***	0.018 ***	0.007 **	0.014 ***	0.022 ***	0.011 ***	0.013 ***	0.022 ***	0.003	0.016 ***	0.022 ***	0.006	0.013 ***	0.019 ***	0.006	0.015 ***	0.018 ***
GRE	−0.002	−0.009 ***	−0.015 ***	−0.004 *	−0.011 ***	−0.017 ***	−0.003	−0.009 ***	−0.013 ***	−0.003	−0.011 ***	−0.014 ***	−0.002	−0.010 ***	−0.013 ***	−0.003	−0.010 ***	−0.010 ***
WAT	−0.033 ***	−0.027 ***	−0.036 ***	−0.027 ***	−0.028 ***	−0.033 ***	−0.038 ***	−0.028 ***	−0.041 ***	−0.030 ***	−0.030 ***	−0.035 ***	−0.033 ***	−0.028 ***	−0.038 ***	−0.030 ***	−0.028 ***	−0.038 ***
FUN	0.024 ***	0.026 ***	0.036 ***	0.033 ***	0.038 ***	0.042 ***	0.023 ***	0.021 ***	0.030 ***	0.026 ***	0.035 ***	0.041 ***	0.023 ***	0.030 ***	0.032 ***	0.024 ***	0.038 ***	0.034 ***
FAC	0.025 ***	0.025 ***	0.021 ***	0.025 ***	0.023 ***	0.018 ***	0.023 ***	0.024 ***	0.024 ***	0.028 ***	0.020 ***	0.017 ***	0.029 ***	0.023 ***	0.017 ***	0.022 ***	0.017 ***	0.013 ***
GAS	0.015 ***	0.017 ***	0.015 ***	0.015 ***	0.015 ***	0.016 ***	0.010 ***	0.014 ***	0.015 ***	0.012 ***	0.013 ***	0.018 ***	0.017 ***	0.013 ***	0.016 ***	0.010 ***	0.018 ***	0.015 ***
DUM	0.124 ***	0.093 ***	0.082 ***	0.129 ***	0.098 ***	0.097 ***	0.129 ***	0.098 ***	0.079 ***	0.134 ***	0.096 ***	0.093 ***	0.133 ***	0.103 ***	0.085 ***	0.138 ***	0.098 ***	0.085 ***
Table 7																		

Note: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

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