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Energy Economics

Petrol Prices and Subjective Well-Being: Longitudinal Data Evidence From China

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This paper studies the effects of petrol prices on individuals' subjective well-being (SWB). Three waves of household data from the China Health and Retirement Longitudinal Study and petrol prices at the province level are used and ordered probit models are applied. The empirical results show that petrol prices are negatively associated with SWB due to income effects. The findings are robust to alternative independent variable measures and clustered standard errors.

1. Introduction

Countries around the world have attached great importance to the well-being of their citizens. Several studies have focused on the determinants of subjective well-being (SWB), such as income (Clark et al., 2008), personal characteristics (Dolan et al., 2008; Easterlin, 2006), and the economic and social environment (Alesina et al., 2004; Verme, 2011). However, the effects of petrol prices on SWB have not been well identified.

Petrol prices can affect individuals' SWB in opposite directions. Petrol prices, for instance, have income effects that reduce SWB. When petrol prices increase, people allocate more disposable income to fuel expenses and lower their expenses on other well-being–enhancing activities (Prakash et al., 2020). On the other hand, petrol prices can also induce health effects that enhance SWB. When petrol prices increase, individuals may turn to public transportation, cycling, or walking to commute. These physically demanding activities together with the induced improved air quality can ultimately facilitate health and SWB (Ma et al., 2018; Shaw et al., 2018).

To uncover the effects of petrol prices on individuals' SWB in China, we use three waves of household data from the China Health and Retirement Longitudinal Study (CHARLS) along with province-level 92 petrol prices over the same period. Ordered probit models are applied to perform regressions. We then use 95 petrol prices and clustered standard errors to verify the robustness of the empirical findings. We find that petrol prices have negative effects on SWB. By using longitudinal data to ease endogeneity issues, this paper provides insight into the relation between petrol prices and SWB in China, thus contributing to the research on energy and individual well-being (Boyd-Swan & Herbst, 2012; Prakash et al., 2020).

The remainder of this paper proceeds as follows. Section 2 describes the data source, and the dependent, independent, and control variables. Section 3 reports the results of baseline regressions and robustness checks. Section 4 concludes this paper.

2. Data and variables

Petrol prices at the province level are acquired from East Money (http://data.eastmoney.com), which integrates and provides data about stocks, funds, and the economy. Yearly weighted 92 petrol prices are used as the independent variable. Following Diener et al. (1985), we measure the dependent variable, *SWB*, by life satisfaction based on the 2013, 2015, and 2018 waves of CHARLS. The variable is coded from one (not at all satisfied) to five (completely satisfied) as individual *SWB* increases. Based on the CHARLS dataset, we include control variables at the individual level, including gender (male = 1, female = 0), age, education (elementary school or below = 0, middle school = 1, high school or vocational school = 2, college/associate degree or above = 3), marital status (married = 1, otherwise = 0), work status (employed = 1, otherwise = 0), self-reported health level (poor = 0, fair = 1, good = 2), and income (in logarithmic form). We also control for province heterogeneity, which could be correlated with individual *SWB*. We obtain data on province-level gross domestic productivity per capita (*PERGDP*) and population density from the National Bureau of Statistics of China. Since the SWB variable is ordinal, we employ ordered probit models. To account for time trends, year dummies are included in all regressions. Moreover, given that the petrol price is at the province level and the number of data points is small, we exclude province fixed effects to avoid severe multicollinearity, following Verme (2011), for instance.

We exclude observations that are missing information on the variables we use. The original data sample includes 31,671 observations, but it drops to 20,901 when individual and province characteristics are included. Descriptive statistics are reported in Table 1. We observe that the average 92 petrol price around China during the sample period is about CNY 7 per liter, ranging from CNY 5.59 per liter to CNY 8.58 per liter, with a standard deviation of CNY 0.59

Table 1. Descriptive statistics

Variable	N	Mean	SD	Min.	Max.
SWB	31,671	3.253	0.784	1	5
92#petrol price	31,671	7.009	0.589	5.59	8.579
95#petrol price	32,101	7.412	0.547	6.06	8.678
gender	20,901	0.488	0.5	0	1
age	20,901	62.92	9.131	18	108
education	20,901	0.394	0.725	0	3
married	20,901	0.85	0.357	0	1
health	20,901	1.016	0.769	0	2
work	20,901	0.683	0.465	0	1
income (in logarithm)	20,901	8.416	1.847	0	15.2
PERGDP (in logarithm)	20,901	10.81	0.368	10.05	11.85
population density	20,901	5.507	1.05	0.954	8.249

Notes: This table presents selected descriptive statistics (namely, sample mean, its standard deviation (SD), and the minimum (Min.) and maximum (Max.) values of the data. The sample size is noted in column 2.

per liter. Moreover, the price of 95 petrol is higher compared to that of 92 petrol.

3. Results

Hierarchical regressions are performed, and the results are reported in Table 2. As we observe from Column (1), the coefficient of petrol prices is significantly negative at the 1% level. When individual and province characteristics are gradually added to the regression, the effect of petrol prices decreases slightly in magnitude, but remains significant at the 1% level. These results show that an increase in petrol prices results in a decrease in individuals' *SWB*, indicating that income effects may dominate the relation between petrol price and *SWB*.

As for the control variables, health and income are positively related to *SWB*, consistent with findings in previous studies concerning *SWB* (Clark et al., 2008; Dolan et al., 2008). Unlike the nonlinear relation found by Easterlin (2006) and Ferrer-i-Carbonell & Gowdy (2007), we find the impact of age to be linear and significantly positive. In addition, the impact of marital status on SWB is positive, while the impact of education is negative.

To verify the robustness of the empirical findings, we first use 95 petrol prices over the same period, which are obtained from the same source as mentioned earlier. The regression results reported in Panel A of Table 3 show that the effect of 95 petrol prices on *SWB* is still significantly negative. We also note that the magnitude of the effect is smaller, and the significance level is lower than that of 92 petrol price. This result could be due to the invariably higher price of 95 petrol compared to 92 petrol. Consumers who choose 95 petrol are less sensitive to petrol prices, leading to a weaker effect on *SWB*. This evidence confirms the underlying mechanism, namely, the income effect, behind the effects of petrol prices on *SWB*.

In addition, we use clustered robust standard errors (see Panel B of Table 3) instead of default standard errors in the baseline regressions. The results indicate that our findings are robust and unchanged.

4. Conclusion

In June 2021, the number of motor vehicles in China reached 384 million, including 292 million cars, according to China's Ministry of Public Security. The increasing number of private cars has accentuated the influence of petrol prices on people's lives in China from the point of view of consumption and well-being. Based on the data from CHARLS and the province-level petrol prices from East Money, this paper studies the effects of petrol prices on individuals' *SWB* in China over the period 2013–2018. The empirical results show that higher petrol prices are correlated with lower *SWB*. This result is consistent with the findings of Boyd-Swan & Herbst (2012) and Prakash et al. (2020) on the effects of petrol prices on *SWB* in the United States and Australia, respectively. Although public transport is convenient in most areas of China, income effects still dominate, indicating that people's reliance on cars is increasing in China. To reduce the sensitivity of *SWB* to petrol prices, the government should provide more incentives for people to go green.

Table 2. Main effects of petrol prices

	SWB	SWB	SWB
	Oprobit	Oprobit	Oprobit
	(1)	(2)	(3)
petrol price	-0.078***	-0.072***	-0.063***
	(-4.142)	(-3.059)	(-2.615)
gender		-0.0210	-0.0200
		(-1.003)	(-0.941)
age		0.012***	0.012***
		(9.461)	(9.444)
education		-0.029**	-0.029**
		(-1.975)	(-2.006)
married		0.120***	0.118***
		(4.093)	(4.006)
health		0.121***	0.121***
		(9.788)	(9.754)
work		0.001	0.004
		(0.064)	(0.180)
income (in logarithm)		0.032***	0.030***
		(6.033)	(5.636)
PERGDP (in logarithm)			0.079**
			(2.330)
population density			-0.006
			(-0.578)
Log pseudo likelihood	-35056	-23046	-23043
Wald chi2	966.465	721.806	726.498
N	31,671	20,901	20,901

Notes: Ordered probit (Oprobit) models are employed and coefficients are reported. The *t*-statistics are presented in parentheses; and *, ** and *** represent statistical significance at the 10%, 5% and 1% levels, respectively.

Table 3. Robustness checks

	Panel A		Panel B			
	SWB	SWB	SWB	SWB	SWB	SWB
	Oprobit	Oprobit	Oprobit	Oprobit	Oprobit	Oprobit
	(1)	(2)	(3)	(4)	(5)	(6)
petrol price	-0.074***	-0.055**	-0.051**	-0.078***	-0.072***	-0.063***
	(-3.754)	(-2.181)	(-2.017)	(-4.069)	(-3.007)	(-2.577)
gender		-0.029	-0.028		-0.021	-0.020
		(-1.375)	(-1.311)		(-1.008)	(-0.945)
age		0.012***	0.012***		0.012***	0.012***
		(9.620)	(9.562)		(9.059)	(9.064)
education		-0.025*	-0.025*		-0.029**	-0.029**
		(-1.727)	(-1.744)		(-2.094)	(-2.127)
married		0.122***	0.119***		0.120***	0.118***
		(4.179)	(4.069)		(3.769)	(3.695)
health		0.120***	0.119***		0.121***	0.121***
		(9.719)	(9.675)		(9.549)	(9.512)
work		0.004	0.006		0.001	0.004
		(0.207)	(0.296)		(0.063)	(0.176)
income (in logarithm)		0.031***	0.029***		0.032***	0.030***
		(5.870)	(5.452)		(6.114)	(5.724)
PERGDP (in logarithm)			0.071**			0.079**
			(2.152)			(2.316)
population density			0.001			-0.006
			(0.098)			(-0.539)
Log pseudo likelihood	-35596	-23569	-23566	-35056	-23046	-23043
Wald chi2	957.236	724.186	729.414	985.838	744.010	749.154
N	32,101	21,315	21,315	31,671	20,901	20,901

Notes: Ordered probit (Oprobit) models are employed and coefficients are reported. The *t*-statistics are presented in parentheses; and *, ** and *** represent statistical significance at the 10%, 5% and 1% levels, respectively.

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