

Macro Debt Burden and Consumption Expansion: An Analysis Based on Panel Model and Panel Quantile Regression Model

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As the level of social credit burden rises, to ease the liquidity constraint for residents is currently an important way to boost the domestic demand in China. This paper uses the panel data of Chinese provincial-level administrative units in 2007–2017 and adopts the panel regression model and panel quantile regression model to empirically analyze the relationship between debt burden level and average propensity to consume (APC). The result shows that increase in the level of macro debt burden can significantly improve the APC of residents; the marginal promoting effect of macro debt burden for the APC is in a V-shaped structure; such marginal influence differs evidently in different areas, with the marginal promoting effect turning out most prominent in the northeast of China. Accordingly, it's suggested for government to keep refining the credit market, increase residents' income in multiple means, guide supply of liquidity towards the real economy and promote equalization of basic public services, so as to realize the expansion and upgrade of consumption.

Keywords: macro debt burden, consumption expansion, regional heterogeneity, panel quantile regression model

1. Introduction

Since the reform and opening up, the domestic market demand in China kept increasing, with total retail sales of consumer goods rising from RMB 3.9 trillion in 2000 to RMB 41.2 trillion in 2019. Hit by the global financial crisis in 2008, however, real year-on-year growth of the total retail sales continued to drop from 16.95% in 2009 to 6% in 2019. As the supply-side structural reform deepened, the driver of Chinese economic development was being transformed from investment to combined investment and consumption. Besides, the outbreak of COVID-19 in 2020 brought a

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massive shock to the domestic consumer demand in China and the international market demand. Internationally speaking, China's dependence on foreign trade in 2019 was 17%, which, though much lower than the level in the early 21st century, still meant a high proportion of foreign demand in the country's total demand. Since February 2020, the pandemic swept across the world outside China, severely thwarting the international market demand. From February to September 2020, the cumulative year-on-year growth of China's total export value stayed negative. Under such sustained stress on the foreign demand, how to stabilize and boost the domestic demand with macro-control policies such as fiscal and monetary policies and realize the expansion and upgrade of domestic consumption is of great significance for stabilizing the economic development in China.

On this account, this paper focuses the study on the following questions: if increase in the social credit level or the level of social macro debt burden can effectively promote the expansion and upgrade of consumption, what patterns are observed in the effect of debt burden on social average propensity to consume (APC) at different APC levels? does the effect of debt burden on APC differ across areas?

2. Literature Review and Mechanism Analysis

2.1. Literature Review

Academic research on factors affecting propensity to consume is mostly based on the theory of consumption function, dividing factors behind APC into income and interest rate. Income factors can be further categorized into consumers' current disposable income, consumption habit, income for consumption of people around, permanent income for consumption and demand characteristics of different life cycles. The Absolute Income Hypothesis proposed by Keynes (1937) and the Relative Income Hypothesis by Duesenberry (1949) stated that APC was determined by disposable income and consumption of people around, but neither took into consideration the possibility that the impact of current income on propensity to consume may be intertemporal. The Permanent Income Hypothesis of Friedman (1957) extended from immediate to intertemporal decision-making in consumption behaviors, grouped income into random and discontinuous temporary income and regular, continuous and predictable permanent income, and held that consumers would only adjust consumption expenditure according to changes with permanent income and take into account consumption of future generations. The Life Cycle Hypothesis by Modigliani and Brumberg (1954) included the intertemporal choice theory into the theory of consumption function, believing that consumers would seek to smooth consumption throughout their lifetime and thus the age structure of population may affect APC. Interest rate factors are mainly about the difference

between real interest rate and consumers' subjective discount rate, and the Rational Expectation Theory of Lucas (1972) was included into the theory of consumption function. Representative theories included Precautionary Saving Theory (Leland, 1968), Random Walking Hypothesis (Hall, 1978), Liquidity Constraint Hypothesis (Deaton, 1991) and other uncertainty consumption theories. Leland (1968) believed if time preference rate equals real interest rate, consumers will include future risks into factors affecting current consumption decisions and higher future risks indicate greater expected marginal utility of future consumption; therefore, consumers will increase their current saving rate and transfer current income into consumption in the future. The Random Walking Hypothesis by Hall (1978) held if time preference rate and real interest rate are included into consumption function parameters, next-period consumption is only related with current consumption, but not with previous consumption or income. Deaton (1991) put forward the Liquidity Constraint Hypothesis, which stated under the liquidity constraint of consumers' belief, out of precautionary motive, in inability to use consumer credit for consumption on debt in future crises, consumers' consumption expenditure is relatively low, and such liquidity constraint is in fact caused by higher subjective discount rate of consumers than real interest rate. Some scholars classified consumers by time preference and further developed the uncertainty consumption function. The λ Hypothesis by Campbell and Mankiw (1991) divided consumers into two groups, one making consumption decisions according to current income and the other following the Random Walking Hypothesis for consumption expenditure. However, empirical tests on the theories differed widely, especially micro evidence tests. Certainty consumption theories represented by Absolute Income Hypothesis, Permanent Income Hypothesis and Life Cycle Hypothesis and other theoretical hypotheses such as Random Walking Hypothesis and λ Hypothesis were not supported yet by any empirical test; empirical studies on Liquidity Constraint Hypothesis were mostly based on macro data, with no consistent conclusion reached yet.

Studies in China are concentrated in empirical tests and identification of factors affecting APC with Chinese characteristics, including gap in income distribution, size of national debt and credit constraint. The effects of income distribution gap on APC were studied and generally led to the conclusion that wider gap results in the decrease in APC of residents (Wu and Wu, 2007). Guo and Lv (2006) studied the influence of size of national debt on resident consumption and believed such influence depends on resident judgment of whether national debt has wealth effects through their life cycle. If residents believe national debt has wealth effects, larger size in national debt will increase consumption expenditure; if residents think based on Ricardian Equivalence Theorem that national debt is future tax revenue, the larger size in national debt will exert a crowding-out effect on consumption expenditure. Lin and Gong (2007) pointed out since national debt is a consumer-

held asset with relatively high liquidity and low holding risk, under the existence of borrowing constraints, a higher government debt burden rate relaxes borrowing constraints, lowers cost for consumers to hold assets, narrows size of precautionary savings and promotes the current consumption level to rise. However, due to the possibly intensified pressure of government's tax revenue in the future, the future consumption level may be inhibited. Also because higher size of national debt might pose a crowding-out effect on private investment, which reduces total output, per capita consumption level may drop eventually. No consensus has been reached in studies on the influence of credit constraints on the propensity to consume, with most scholars believing larger credit size elevates residents' propensity to consume (Zhao and Liu, 2006) and some concluding based on empirical analysis that larger credit size in the household sector does not significantly increase the propensity (Lin, 2006). On the other hand, scholars holding that credit constraints pose a nonlinear influence over APC came to different conclusions. For instance, Zang and Li (2012) used provincial-level panel data of China in 2004–2009 and adopted the TSLS model to study and found people of different income groups differ significantly in sensitivity to consumer credit. A few scholars included corporate credit into size of macro debt to consider its influence on APC. For example, Xu and Chen (2009) resorted to the dynamic stochastic general equilibrium model for empirical analysis based on China's quarterly data in 1993–2005, and found negative credit impact will cause consumption to rise in the short term and then gradually drop to a lasting stable level. Chen *et al.* (2017) held debt revenue of local government will be transferred to the household sector through the financial market and thus growth of government debt and growth of resident income are closely connected; when the latter fails to catch up with the former, consumption expenditure of residents will inevitably shrink. Xu (2019) conducted empirical analysis based on a FCGE model and concluded that smaller debt size of private enterprises will restrict the increase of corporate investment growth, strain daily corporate operation and expanded reproduction, possibly lower employee compensation and consequently exert negative impact on resident consumption. Huang and Wang (2019) pointed out corporate de-leveraging will increase propensity to consume in the short term, but decrease it in the long run; de-leveraging in the household sector will lower the propensity in the short term and promote it to stay basically stable in the long run.

By summarizing the literature above, we find first, regarding theoretical research, consumption function theories focus on the income and liquidity constraint in the household sector, but pay rare attention to the impact of corporate production activities and corporate debt on social overall APC. Macro debt level reflects the current liquidity status of the society as a whole to some extent, and just as the Rational Expectation Theory by Lucas (1972) mentioned, market conditions and macro-economic policies will pose systemic influence on consumption. However,

the effects of macro debt burden on APC remain to receive due attention. Second, in terms of empirical study, literature that studies the impact of macro debt level on social APC usually uses national debt, local government debt and corporate debt as alternative indicators for macro debt, with few choosing credit level as an alternative. In fact, since the direct financing market is not matured yet and it's difficult to issue corporate bonds in China, enterprises tend to use indirect financing or their own funds for production and operation, making it more reasonable to use credit level as an alternative indicator for macro debt burden. Third, with respect to research method, the consumption function theories and empirical studies already conducted generally follow the linear hypothesis, but at different APC levels, precautionary saving motive of residents and marginal consumption utility of residents and enterprises vary and the "sensitivity" of APC to macro debt burden does not show linear characteristics. This is overlooked in the model setting based on the linear hypothesis in most cases.

On such basis, this paper goes with credit level, rather than the ratio between national debt and GDP, as an alternative indicator for macro debt burden rate. Besides, for model setting and estimating method, it follows the hypothesis of nonlinear influence of macro debt burden rate on APC, selects the panel quantile regression model for estimation, and empirically tests the heterogeneity in the influence in different areas.

2.2. Mechanism Analysis on the Influence of Macro Debt Burden on APC

Influence of macro debt burden on APC can be divided into influence of debt burden in the corporate sector and debt burden in the household sector respectively. Also, since wealth transfers between the household and corporate sectors, it's flawed to consider the influence in either single sector and only reasonable to take into account the influence of macro debt burden comprehensively. We believe both the debt burden in the corporate sector and that in the household sector, or the two as a whole, may work on APC in the two ways of income mechanism and interest rate mechanism.

In the household sector, in terms of income effect, higher debt burden increases the resident APC by bringing up current income of consumers on the one hand, but on the other hand inevitably means rise in intertemporal debt service expenditure, causes the next-period net income after debt payment to drop and thus inhibits the increase in the APC. Therefore, the income effect of the debt burden on APC ultimately depends on the balancing out between promoting and inhibiting effects. Regarding interest rate effect, the determinant is the subjective discount factor of residents. Though higher debt burden means decrease in current real interest rate, the subjective discount factor of residents does not equal real discount rate in most cases. Accordingly, only when

the subjective discount factor is higher than real discount rate and residents believe the marginal utility of current consumption outweighs that of future consumption, will the marginal promoting effect of debt burden on APC be shown; if the subjective discount factor is below real discount rate, higher debt burden will not significantly increase the APC.

In the corporate sector, the influence of debt burden on APC is mainly indirect. With respect to income effect, higher corporate debt burden increases APC mostly by boosting corporate operating revenue, labor income of residents and government revenue in a combined way. The rise in the debt burden means enterprises secure funds for production and operation with credit and generally use them in expanded reproduction by expanding business scope and building more production lines etc. As a result, corporate operating revenue climbs, increasing the corporate APC on the one hand; on the other hand, more jobs are created, bringing down the unemployment rate, increasing the average labor income of residents and thus elevating the APC. Meanwhile, growth in corporate operating revenue also means rise in government's tax revenue and higher public finance expenditure in social basic public services, which further increase the APC of the entire society. But similar to the household sector, rise in corporate debt burden will inevitably increase debt service expenditure in the future and may narrow the size of next-period financing, accordingly reducing the APC. Also, the influence of higher corporate debt burden on APC depends on the balancing-out result of marginal promoting and inhibiting effects as well. In the matter of interest rate effect, macro debt burden is generally inversely related with interest rate. When macro debt burden is excessively high, it may mean the economic downturn, and central government or central bank will tend to adopt relaxed monetary policies such as cutting interest rate to ease the stress of the high debt burden on economic activities. Interest rate cut will lower the debt service cost of enterprises and increase consumption in the corporate sector on the one hand; on the other hand, it will alleviate the financing stress of enterprises due to market liquidity shortage, help them maintain normal production activities and keep social APC stable. Compared with the household sector, the corporate sector is more sensitive to interest rate change and thus the interest rate effect in the corporate sector plays a superior role over the income effect.

Lastly, from the perspective of wealth transfer between household and corporate sectors, expenditure in the household sector mainly includes savings, consumption and investment, whereas saving and investment can transfer to the corporate sector through the financial system, which is realized mainly through interest rate adjustment. As a result, with the two working in combination, macro debt burden only affects APC under the interest rate mechanism. Higher macro debt burden means relaxed corporate credit constraint and lower real interest rate, which may result in lower savings and greater investment and current consumption in the household sector and narrower

financing gap and higher corporate operating revenue, driving up the APC in the short term. Therefore, the impact of macro debt burden on APC depends on the sum of final income effect and final interest rate effect respectively. To sum up, this paper proposes the following hypotheses.

Hypothesis 1a: With the income effect and the interest rate effect working altogether, higher macro debt burden will increase current income in household and corporate sectors, ease liquidity constraint and thus play a promoting role on APC.

Hypothesis 1b: With the income effect and the interest rate effect working altogether, higher macro debt burden will cause the next-period income in household and corporate sectors to drop, lower future expectations of residents and enterprises and therefore play an inhibiting role on APC.

As analyzed above, APC is not constant. As APC changes, influence from macro debt burden may vary systematically. In another word, at different APC levels, as residents' subjective discount factor and precautionary saving motive are varied in intensity, the influence of debt burden on APC changes accordingly.

When APC is low, the income effect plays a dominant role. In the household sector, since consumers' precautionary saving motive is strong at the point, income rise as a result of macro debt burden will not drive residents to increase consumption expenditure considerably. The marginal promoting effect on APC is limited or in another word, the income effect is weak. Meanwhile, consumers' subjective discount factor and real interest rate differ widely, and the interest rate effect is not high. In the corporate sector, when higher macro debt burden reduces interest rate, the borrowing motive of enterprises is rapidly boosted and their enlargement in product supply and improvement of production structure can better meet domestic demand of consumers and passively facilitate the expansion and upgrade of consumption. In other words, the income effect and interest rate effect are both high. The household sector also tends to invest the funds they hold, having the funds transferred to the corporate sector. At this point, the interest rate effect and income effect predominated by the corporate sector forcefully promote APC to increase in general.

When APC rises, the interest rate effect subsides. At this point, the precautionary saving motive of residents weakens and the interest rate effect causes resident loans to increase, but the income effect remains dominant. In another word, as the macro debt level climbs, income growth is lower than growth in consumption expenditure, and debt payment further slows the income growth, reducing the marginal promoting effect on APC. The corporate sector is also observed to show strong income effect and limited interest rate effect. Income from corporate borrowing still promotes production of enterprises, but the promoting role of the interest rate effect weakens because interest rate remains unchanged or rises only slightly due to the still strong demand for market borrowing in the real economy, the higher demand in resident borrowing and thus the rising liquidity demand. The household sector will also

decrease its investment in enterprises because of the increased consumption demand. At the point, debt burden still plays a promoting role on APC, but the promotion is reduced in general.

When APC is further increased, the interest rate effect plays a dominant role. Resident APC becomes more sensitive to the debt burden; the gap between residents' subjective discount factor and real interest rate narrows down; resident loans surge in size; interest rate cut brings down the debt service cost of residents. Both the income effect and interest rate effect are further improved. In the corporate sector, under the interest rate effect, corporate debt service cost further declines and enterprises with low leverage will increase the debt rate to expand reproduction, driving up the income effect in general. The household sector will enlarge the investment expenditure due to interest rate cut, enabling enterprises to secure higher financing. Moreover, the promoting effect of macro debt burden on APC is greater than the marginal promoting effect at a low APC level. Given so, this paper proposes the next hypothesis.

Hypothesis 2: The marginal effect of the influence of macro debt burden on APC differs at various APC levels.

Similarly, areas across China vary widely in economic development level, regional industrial structure, spending habit of residents and soundness of financial market etc., and therefore the marginal effect of the influence of macro debt burden on APC might differ across areas or at different APC levels. For instance, in eastern coastal areas of China, where the financial market is developed, residents show greater APC and tend to consume with credit; in the northeast subject to the profound influence of traditional consumption culture, residents have a strong precautionary saving motive and may prefer to consume with disposable income. On the basis of Hypothesis 1 and Hypothesis 2, this paper investigates the regional heterogeneity in the impact of debt burden on regional APC and puts forward the following hypothesis.

Hypothesis 3: The influence of macro debt burden on APC shows regional heterogeneity at different APC levels.

Next, the paper sets the panel regression model and panel quantile regression model, identifies alternative indicators of the explained variables, explanatory variables and control variables according to the existing studies, then conducts empirical analysis to test the previous hypotheses, and at last proposes policy suggestions based on the analysis result and the economic development status in China.

3. Model Setting, Indicator Selection and Data Source

3.1. Model Setting

With reference to Xu *et al.* (2020), pertinent to Hypothesis 1, the paper uses a basic panel regression model for estimation and sets the model as follows:

$$APC_{it} = \alpha^i I_i + \alpha^t T_t + \beta debt_{it} + \sum_{k=1}^{k=n} \gamma^k Z_{it}^k + \varepsilon_{it} \quad (1)$$

APC_{it} is APC of the i^{th} individual in the period t ; $debt_{it}$ is an explanatory variable, indicating the debt burden level of the i^{th} individual in the period t ; Z_{it}^k is a control variable set, meaning actual value of the control variable k of the i^{th} individual in the period t ; I_i and T_t respectively refer to individual dummy variable and time dummy variable for controlling individual heterogeneity and time heterogeneity; α^i , α^t , β and γ^k respectively mean marginal utility of corresponding explanatory variables on explained variables. If the parameter β to be estimated rejects the null hypothesis of $\beta = 0$ at the given significance level, it's reasonable to believe that the debt burden level shows significant marginal influence on APC.

Hypothesis 2 can be converted to presence of difference in the linear regression coefficients of different macro debt burden levels on APC. Compared with a panel regression model, a panel quantile regression model raises no request on distribution of error terms and is less sensitive to outliers. On such basis, the paper uses a panel quantile regression model for estimation, divides the continuous set $debt_{it} \in (-\infty, +\infty)$ at an interval of 0.25, and puts greater weight on quantiles of our concern:

$$APC_{it|\tau} = \alpha^{i|\tau} I_{i|\tau} + \alpha^{t|\tau} T_{t|\tau} + \beta_{\tau} debt_{it|\tau} + \sum_{k=1}^{k=n} \gamma^{k|\tau} Z_{it|\tau}^k + \varepsilon_{it|\tau} \quad (2)$$

The subscript “ $|\tau$ ” is used to mark quantiles to separate debt burden levels of the samples and give different weights for estimation, with quantiles being $\tau \in (0.1, 0.25, 0.5, 0.75, 0.9)$. Since the 0th and 100th quantiles here are meaningless to the regression itself, we adjust the quantile value at the starting and finishing ends to 10th and 90th.

Hypothesis 3 can be converted to presence of difference in the linear regression coefficients of debt burden levels in different areas on APC:

$$APC_{it_re} = \alpha^{i_re} I_{i_re} + \alpha^{t_re} T_{t_re} + \beta_{_re} debt_{it_re} + \sum_{k=1}^{k=n} \gamma^{k_re} Z_{it_re}^k + \varepsilon_{it_re} \quad (3)$$

The discrete set $_re \in (1, m)$ of the subscript “ $_re$ ” marks different areas.

3.2. Indicator Selection and Data Source

The explained variable is APC. By referring to the research by Wu and Wu (2007) for calculation of APC, this paper uses the ratio between total retail sales of consumer goods and the sum of labor compensation, net taxes on production and corporate earnings as alternative indicator of APC. It's worth noticing that total retail sales of

consumer goods are the consumption of final physical goods and services by urban and rural residents and enterprises, with some government consumption excluded. For this reason, the paper also uses the ratio between end consumption (sum of resident consumption and government consumption) and the sum of labor compensation, net taxes on production and corporate earnings as substitute for robustness test. For the purpose of distinguishing, the former is named “APC of residents and enterprises”, while the latter “social overall propensity to consume”.

The explanatory variable is level of macro debt burden. Based on the previous mechanism analysis on the influence of credit on APC, we believe besides consumer credit of residents, corporate credit may also affect APC. Given so, the paper uses the ratio between provincial-level loan balance in domestic and foreign currency and GDP of the period as alternative indicator for level of macro debt burden.

Based on the existing research results on APC, the paper takes wage income, economic growth, development level of services, level of equalization of basic public services, inflation rate, urbanization rate, burden of personal income tax, industrial income gap, urban-rural income gap, foreign trade dependence, real estate dependence, degree of public ownership, burden of housing price, intensity of research and development and degree of financial deepening as control variables. The logarithm of urban employees’ average wage is the alternative indicator for wage income, the year-on-year GDP growth for economic growth, the ratio between the tertiary industrial value-added and GDP for development level of services, the commodity price index for inflation rate, the ratio between urban permanent population and regional total permanent population for urbanization rate, the ratio between regional personal income tax and total labor compensation for burden of personal income tax, the Gini coefficient based on average wage of urban employees by industry for industrial income gap, the ratio between urban residents’ disposal income and rural residents’ income for urban-rural income gap, the ratio between regional foreign trade and GDP for foreign trade dependence, the ratio between regional real estate investment and regional total investment in fixed assets for real estate dependence, the ratio between regional state-owned and collective investment and regional total investment in fixed assets for degree of public ownership, the ratio between regional average price of commercial housing and per capita income for burden of housing price, the ratio of regional research funds and GDP for intensity of research and development, and the ratio between regional financial value-added and GDP for degree of financial deepening. The level of equalization of basic public services is calculated with reference to the method used by Xu *et al.* (2020).

Data of all the alternative indicators of the variables and benchmark indicators is sourced from the National Bureau of Statistics and the Wind database. As major adjustment was made on the classification of revenue and expenditure in general public budgets in 2007, this paper targets the years from 2007 to 2017 as sample cycle. The sample area is the 31 provincial-level administrative units in China.

4. Analysis on the Influence of Macro Debt Burden on Propensity to Consume

4.1. Results of the Benchmark Regression

Table 2 shows the estimated result of the panel regression of macro debt burden rate on APC. As indicated in the result, increase in the macro debt burden significantly increases the APC and Hypothesis 1a is verified. In another word, higher macro debt burden effectively relaxes the liquidity constraint of residents and enterprises and also elevates their current income, thus promoting residents and enterprises to both raise current consumption expenditure. As a possible reason, in the sample period, Chinese economy grew rapidly, and both residents and enterprises expected stable income in the future and ability in undertaking the debt service cost; generational changes caused the subjective discount factor in the household sector to rise; the monetary policies that cutting the financing cost for enterprises also reduced the liquidity constraint of enterprises and brought down their debt service cost. Consequently, as the macro debt burden increases, APC rises. It is also noteworthy that the marginal promoting effect of macro debt burden on social overall propensity to consume is around three times its marginal promoting effect on APC of residents and enterprises.

From the perspective of selection of alternative indicators and adjustment of control variables, the benchmark regression result of macro debt burden on APC shown in Table 1 is highly stable. The Panel_1 result shows that under the absence of control variables, the estimated coefficient value of macro debt burden rate rejects the null hypothesis of coefficient being zero at the 1% significance level, meaning the macro debt burden rate has significantly positive influence over APC. Panel_2 includes all the control variables mentioned above into the regression equation. The estimated coefficient value of the macro debt burden still rejects the null hypothesis of coefficient being zero at the 0.1% significance level, and the coefficient remains positive. Panel_3 reveals the regression result after the control variables with insignificant coefficients are eliminated with stepwise regression. After such control variables are eliminated, the Panel_3 regression equation includes such control variables as wage income, economic growth, development level of services, level of equalization of basic public services, foreign trade dependence, housing price-to-income ratio and degree of financial deepening. The statistical coefficient value of the macro debt burden also rejects the null hypothesis of coefficient being zero at the 0.1% significance level. When the APC of residents and social overall propensity to consume are used as alternative indicators for APC, the estimated coefficient value of the macro debt burden rejects the null hypothesis of coefficient being zero at the 1% significance level, meaning higher macro debt burden plays a significant promoting role for both APC of residents and social overall propensity to consume.

Table 1. Benchmark Regression Result of the Influence of Macro Debt Burden on APC

Model	Panel_1		Panel_2		Panel_3	
	APC of residents and enterprises	Social overall propensity to consume	APC of residents and enterprises	Social overall propensity to consume	APC of residents and enterprises	Social overall propensity to consume
Macro debt burden level	0.0212*** (3.260)	0.062**** (7.419)	0.027**** (5.258)	0.057**** (7.026)	0.023**** (5.234)	0.063**** (8.674)
Wage income	—	—	-20.696** (-3.341)	-3.938 (-0.408)	-17.756*** (-3.275)	8.182 (0.937)
Equalization of basic public services	—	—	-1.421**** (-5.792)	-1.434**** (-3.753)	-1.543**** (-6.507)	-1.550**** (-4.059)
Development level of services	—	—	0.654**** (10.851)	0.620**** (6.611)	0.660**** (11.524)	0.666**** (7.224)
Other control variables	—	—	Control	Control	Control	Control
Fixed effect	Control	Control	Control	Control	Control	Control
Individual effect	Control	Control	Control	Control	Control	Control
Time effect	Control	Control	Control	Control	Control	Control
R ²	0.034	0.155	0.620	0.521	0.610	0.475
F-test	10.626***	55.044****	28.933****	19.314****	57.155****	33.028****

Note: The panel models in the paper are estimated with the plm() function in the plm package in R. “****”, “***”, “**” and “*” respectively correspond to the significance level of 0.1%, 1%, 5% and 10%. The same below.

4.2. Heteroskedasticity-Autocorrelation Control

Table 2 shows the significance test results of robust standard error calculation after the heteroskedasticity-autocorrelation (HAC) adjustment, with Panel_3 as benchmark regression model, which are respectively the HAC correction method proposed by Newey and West (1987), MacKinnon and White (1985), Driscoll and Kraay (1998), Beck and Katz (1995) and Millo (2017). As indicated by the test results, the estimated coefficient value of the macro debt burden rate rejects the null hypothesis of coefficient being zero at least at the 5% significance level and does not change along with the adjustment of HAC correction methods. Therefore, from the perspective of significance test methods and HAC correction methods, though the significance levels slightly fluctuate, the result on the promoting effect of the macro debt burden on APC is highly robust.

Table 2. Robustness Analysis on the Coefficient Test Methods

HAC correction method	NW	SCC	DC	BK	G
Macro debt burden	0.023**** (4.720)	0.023**** (5.457)	0.023**** (3.551)	0.023** (2.497)	0.023**** (3.949)

Note: “NW”, “SCC”, “DC”, “BK” and “G” are respectively the *t*-statistic after HAC correction proposed by Newey and West (1987), MacKinnon and White (1985), Driscoll and Kraay (1998), Beck and Katz (1995) and Millo (2017).

4.3. Control over the Estimation Methods

The test results with different estimation methods, with Panel_3 as benchmark regression model, listed in Table 3 tell us that the positive effect of the macro debt burden on APC of residents does not change despite the changes with model settings and estimation methods. According to the results, the estimated coefficient value of the macro debt burden on APC of residents, with various model settings and estimation methods, rejects the null hypothesis of coefficient being zero at least at the 0.1% significance level. The paper respectively uses the fixed effect panel model and random effect panel model with intercept terms excluded and individual heterogeneity and time heterogeneity being controlled, generalized least squares (GLS) excluding intercept terms, fixed effect maximum likelihood (ML) and random effect ML to estimate the Panel_3 benchmark regression model. Though different choices in model setting and estimation method change the estimated coefficient absolute value of the macro debt burden on APC of residents, they fail to change the positiveness of the estimated coefficient value and the significance test conclusions. Therefore, the result that the macro debt burden has a significant promoting effect on APC of residents is highly robust.

Table 3. Robustness Analysis on the Parameter Estimation Models

Model	OLS		GLS	ML	
	Fixed effect	Random effect		Fixed effect	Random effect
Intercept	—	−6.523 (−0.728)	—	−8.517 (−0.962)	−8.517 (−0.962)
Macro debt burden	0.023**** (5.234)	0.028**** (6.091)	0.038**** (9.175)	0.028**** (6.318)	0.028**** (6.318)
Other control variables	Control	Control	Control	Control	Control
Fixed effect	Control	—	Control	Control	—
Individual effect	Control	Control	Control	Control	Control
Time effect	Control	Control	—	Control	Control
R ²	0.610	0.790	—	—	—
F-test	57.155****	155.872****	—	—	—

Note: Under GLS and ML, in the parentheses is Z-statistic of the estimated coefficient value; under cross section OLS and panel OLS, in the parentheses is *t*-statistic of the estimated coefficient value. Cross section OLS is estimated with the `lm()` function in the base package in R, panel OLS with the `plm()` function in the `plm` package in R, GLS with the `pggls()` function in R, and ML with the `pglm()` function in the `pglm` package in R.

5. Decomposition of the Influence of Macro Debt Burden on the Propensity to Consume

5.1. APC Heterogeneity

Table 4 introduces the empirical test results on heterogeneity in the influence of macro debt burden on APC at different APC quantiles. At different APC levels, the marginal utility of the influence shows significant differences and the ways of change differ, which suggests Hypothesis 2 is verified. Below the 50th quantile, the difference in the influence is limited at difference APC levels, with the marginal utility ranging in [0.017, 0.018]; at the 90th quantile, the marginal promoting effect of the macro debt burden on APC is significantly increased; at the 75th quantile, however, the macro debut burden does not show significant impact on APC, and its estimated coefficient value does not reject the null hypothesis of coefficient being zero at the 10% significance level. To be specific, at different APC levels, the marginal promoting effect of the macro debt burden on APC is V-shaped. At the 10th and 25th quantiles, the marginal promoting effect remains unchanged; when APC rises to the 50th quantile, the marginal promoting effect significantly declines; when APC is increased to the 90th quantile, the marginal promoting effect is significantly improved. This tells us when APC is low, consumers will passively increase current consumption expenditure due to rise in disposable income, larger scale of product supply by enterprises and upgrade of product supply structure. When APC becomes higher, APC turns more sensitive to the changes with macro debt burden, increase of which will bring up debt service cost; also, interest rate might be elevated due to stronger demand in the lending market. Therefore, the marginal promoting effect of the macro debt burden on APC weakens. Meanwhile, further rise in the macro debt burden might not be used in consumption expenditure, but in productive credit for expanded investment, and so its marginal promoting effect on APC will vanish. When APC is rather high, since discount factor of current consumption becomes really high, the society is inclined to increase current consumption expenditure.

Table 4. Heterogeneity Analysis on the Influence of Macro Debt Burden on APC

Quantile	0.1	0.25	0.5	0.75	0.9
Intercept	-11.864 (-1.280)	-6.621 (-0.686)	-3.399 (-0.412)	-7.412 (-0.741)	-6.196 (-0.485)
Macro debt burden	0.018** (2.536)	0.018*** (2.942)	0.017*** (2.850)	0.010 (1.477)	0.022** (2.159)
Equalization of basic public services	-1.909**** (-4.799)	-1.813**** (-4.489)	-1.875**** (-4.539)	-1.615*** (-3.160)	-1.666** (-2.564)
Wage income	6.337*** (2.915)	5.051** (2.138)	4.169** (2.120)	5.290** (2.227)	4.845 (1.467)

Quantile	0.1	0.25	0.5	0.75	0.9
Development of services	0.477**** (6.349)	0.516**** (6.971)	0.559**** (7.020)	0.589**** (6.808)	0.608**** (5.876)
Fixed effect	Control	Control	Control	Control	Control

Note: The panel quantile model is estimated with the `rqpd()` function in the `rqpd` package in R, with interval set as 0.25, but since the 0th and 100th quantiles are meaningless to the regression itself, the starting and ending quantiles are set at 10th and 90th. In the parentheses is *t*-statistic of the estimated coefficient value.

5.2. Regional Heterogeneity

Table 5 shows the heterogeneity analysis result on the marginal utility of the influence of macro debt burden on APC at different APC levels in various areas. At various APC levels, the influence shows significant regional difference and Hypothesis 3 is verified. As for the presence of marginal utility of macro debt burden at different APC levels, the macro debt burden in eastern coastal areas, central areas and western ethnic autonomous regions poses no significant impact on local APC of any level, and the estimated coefficient value does not reject the null hypothesis of coefficient being zero at the 10% significance level; increase in the macro debt burden in municipalities directly under the central government, northeastern areas, western areas and western non-ethnic autonomous regions can significantly promote APC to increase. To be specific, the macro debt burden in northeastern areas shows the most significant marginal promoting effect on APC. Above the 50th quantile of APC, the marginal promoting effect ranges in [0.142, 0.168] and continues to improve as APC increases; below the 50th quantile, the macro debt burden does not pose any significant impact on APC. The debt burden in western areas has the lowest marginal promoting effect on APC, ranging in [0.013, 0.019]. The marginal promoting effect ranges in [0.037, 0.060] in municipalities directly under the central government and ranges in [0.019, 0.030] in western non-ethnic autonomous regions. In municipalities and western areas, the marginal promoting effect remains unchanged at the 10th and 25th quantiles, slightly increases at the 50th quantile, significantly drops at the 75th quantile, and then mildly rises again at the 90th quantile, presenting a quasi-N-shaped trend in general. In western non-ethnic areas, the marginal utility shows an inverse V-shaped structure. Currently, the macro debt burden in the northeast of China is low when compared nationwide and that in western areas is high. When taking measures to promote the expansion and upgrade of consumption, government is suggested to moderately reduce the credit constraint in the northeast and control the rise in credit size in the west.

Table 5. Regional Difference in Heterogeneity of the Influence of Macro Debt Burden on APC

Quantile	0.1	0.25	0.5	0.75	0.9
Municipalities	0.054* (1.970)	0.054** (2.592)	0.060*** (3.283)	0.037** (2.679)	0.041** (2.280)
Eastern coastal areas	0.029 (0.960)	0.014 (0.491)	0.015 (0.562)	0.006 (0.188)	0.041 (1.173)
Central areas	0.000 (0.013)	0.002 (0.155)	0.022 (1.126)	0.030 (1.379)	0.018 (0.772)
Northeastern areas	0.037 (0.466)	0.053 (0.824)	0.142*** (3.278)	0.143**** (4.235)	0.168**** (3.564)
Western areas	0.017** (2.290)	0.017*** (2.652)	0.019*** (2.688)	0.013* (1.782)	0.016* (1.750)
Western ethnic autonomous regions	0.028 (1.022)	0.026 (1.068)	0.019 (0.894)	0.008 (0.427)	0.017 (1.045)
Western non-ethnic autonomous regions	0.022* (1.792)	0.023** (2.430)	0.030*** (3.288)	0.019** (1.988)	0.013 (0.966)

Note: Western ethnic areas include Inner Mongolia, Guangxi, Ningxia, Tibet and Xinjiang. In the parentheses is *t*-statistic of the estimated coefficient value.

6. Conclusions

In the face of the frequent trade frictions and global economic slowdown internationally and the large-scale tax cuts and fee reductions, financial deleveraging and supply-side structural reform domestically, to expand the domestic demand, unleash the potential of domestic consumer demand and realize the expansion and upgrade of consumption is an inevitable choice for the high-quality economic development and stable economic growth in China. To tackle the high liquidity constraints over residents is the key to realizing the expansion and upgrade of consumption. In this paper, results of the empirical analysis based on inter-provincial panel data in 2007–2017 show that first, increase of macro debt burden can significantly promote APC to rise; second, according to the result of panel quantile regression, the marginal utility of the influence of macro debt burden on APC is structured in a V-shape at different APC levels; third, the influence of macro debt burden on APC at different APC levels shows significant regional heterogeneity, and its marginal promoting effect is most evident in the northeast of China, followed by municipalities, western non-ethnic areas and western areas, but not significant in central areas, eastern coastal areas or western ethnic areas. Based on the empirical analysis results and the situations in reality, the paper proposes the following channels to boost the domestic demand: to improve the credit market and reduce social liquidity constraints, to increase resident income in multiple ways and narrow the income gap, to enhance the service for the real economy by finance and solve the liquidity strain

for the real economy, and to rationally control the size of government debt, expand government consumption and increase government expenditure in basic public services.

References

- Beck, N., & Katz, J. (1995). What to Do (and Not to Do) with Time-Series Cross-Section Data in Comparative Politics. *American Political Science Review*, 89 (3), 634–647.
- Campbell, J. Y., & Mankiw, N. G. (1989). Consumption, Income, and Interest Rates: Reinterpreting the Time Series Evidence. *NBER Macroeconomics Annual*, 4, 185–216.
- Chen, Z., Wu, G., & Pan, B. (2017). Debt Impulse of Local Government, Rent Seeking and Resident Consumption: Mathematical Analysis and Empirical Test. *Social Sciences in Guangxi (Guangxi Shehui Kexue)*, 11, 68–74.
- Deaton, A. (1991). Saving and Liquidity Constraints. *Econometrica*, 59 (5), 1221–1248.
- Driscoll, J. C., & Kraay, A. C. (1998). Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data. *Review of Economics and Statistics*, 80 (4), 549–560.
- Friedman, M. (1957). *A Theory of the Consumption Function*. Princeton: Princeton University Press.
- Guo, H., & Lv, F. (2006). The Wealth Effect of National Debt in China. *Finance and Trade Research (Caimao Yanjiu)*, 1, 53–58.
- Hall, R. E. (1978). Stochastic Implications of the Life Cycle-Permanent Income Hypothesis: Theory and Evidence. *Journal of Political Economy*, 86 (6), 971–987.
- Hansen, L. P. (1982). Large Sample Properties of Generalized Methods of Moments Estimators. *Econometrica*, 50 (4), 1029–1054.
- Huang, S., & Wang, W. (2019). Divisional Deleveraging and Economic Volatility: From the Perspective of Expectation and Effectiveness of Monetary Policy. *Finance & Economics (Caijing Kexue)*, 1, 16–26.
- Keynes, J. M. (1937). The General Theory of Employment. *The Quarterly Journal of Economics*, 51 (2), 209–223.
- Leland, H. E. (1968). Saving and Uncertainty: The Precautionary Demand for Saving. *Uncertainty in Economics*, 82 (3), 465–473.
- Lin, X. (2006). The Effect of Consumer Credit on Consumption. *Finance & Trade Economics (Caimao Jingji)*, 11, 27–31.
- Lin, X., & Gong, L. (2007). Welfare Analysis of Government Debt. *Economic*

- Research Journal (Jingji Yanjiu)*, 1, 56–67.
- Loayza, N., Schmidt-Hebbel, K., & Servén, L. (2000). What Drives Private Saving Around the World? Policy Research Working Paper.
- Lucas, Jr. R. E. (1972). Expectations and the Neutrality of Money. *Journal of Economic Theory*, 4 (2), 103–124.
- MacKinnon, J. G., & White, H. (1985). Some Heteroskedasticity-Consistent Covariance Matrix Estimators with Improved Finite Sample Properties. *Journal of Econometrics*, 29 (3), 305–325.
- Millo, G. (2017). Robust Standard Error Estimators for Panel Models: A Unifying Approach. *Journal of Statistical Software*, 82 (3), 1–27.
- Modigliani, F., & Brumberg, R. (1954). Utility Analysis and the Consumption Function: An Interpretation of Cross-Section Data. *Franco Modigliani*, 1 (1), 388–436.
- Newey, W. K., & West, K. D. (1987). A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. *Econometrica*, 55 (3), 703–708.
- Sargan, J. D. (1958). The Estimation of Economic Relationships Using Instrumental Variables. *Econometrica*, 26 (3), 393–415.
- Wu, X., & Wu, D. (2007). An Empirical Work on the Relationship between the Average Propensity to Consume and Income Distribution Situation of Urban Households in China. *The Journal of Quantitative & Technical Economics (Shuliang Jingji Jishu Jingji Yanjiu)*, 5, 22–32.
- Xu, K., Lu, Q., & Xu, G. (2020). Equalization of Basic Public Services and Upgrade of Consumption: An Analysis Based on Panel Model and Panel Quantile Regression Model. *Inquiry into Economic Issues (Jingji Wenti Tansuo)*, 6, 28–42.
- Xu, W., & Chen, B. (2009). Bank Lending and Economic Fluctuations in China: 1993–2005. *China Economic Quarterly (Jingjixue Jikan)*, 3, 969–994.
- Xu, Y. (2019). Research on Influence of China's Economic Deleveraging Based on FCGE Model. *Statistics and Decision (Tongji Yu Juece)*, 14, 153–158.
- Zang, X., & Li, Y. (2012). Consumer Credit, Liquidity Constraint and Consumption Behaviors of Chinese Urban Residents: Empirical Analysis Based on the Inter-Provincial Panel Data in 2004–2009. *Economics Information (Jingjixue Dongtai)*, 2, 61–66.
- Zhao, X., & Liu, Y. (2006). Empirical Study on Resident Consumption, Liquidity Constraint and Personal Consumer Credit of Residents. *Finance & Trade Economics (Caimao Jingji)*, 11, 32–36.