Scientific
Research
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Cagan Effect and the Money Demand by Firms in China: A Nonlinear Panel Smooth Transition Approach

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Abstract

This paper examines the Cagan effect in China by using a panel smooth transition approach on the firm-level data. Our results reveal that the demand for money by firms relatively decreases for the high inflation period, because the firm anticipates further price increase that it seeks a substitute for money, supporting the presence of the Cagan effect in firms in China. A policy implication of our finding is that efficiently managing Inflation Expectation is necessary in China in stimulating the economy through expansion of the money supply.

Keywords

1. Introduction

[1] argued that the demand for real cash balances will drop as inflation develops. Earlier studies focus primarily on the impact of expected inflation on money demand during hyperinflation period. However, hyperinflations are extreme events, which lead to a small sample problem for sound estimation. The problem has been moderated by examining the money demand schedule at daily frequency such as [2]. But the data sets about the money demand at daily frequency are usually unavailable in most developing countries such as China. Another strand of research abandons Cagan's framework and opts for money demand schedules that allow for money substitutes, where elasticity increases as inflation accelerates and extends the sample to include the lower infla-

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tion period. Advancing that line, [3] argued that Cagan's hypothesis might also hold in the deflationary period in which the demand for money will be higher during such period. [4] investigated the money-prices relationship under low and high inflation regimes in Argentina. Other recent studies include [5].

In 2009, the obvious behavior of the public's purchase of real estate against future price increase makes the Chinese government explicitly express that inflation expectation should be efficiently managed for the first time. A number of studies have explored the relationship between inflation and inflation expectation in China. However, little research has explored above relationship in the perspective of the Cagan money demand. Recently [6] has investigated the money-supply effect of inflation expectation in China by the model combining Cagan model and Lucas microeconomic rational expectation equation. What's more, most of these previous studies examine demand for money by a linear model from macro view. In this paper, we adopt a panel smooth transition regression (PSTR) approach to study the demand for money by firms in China. Our method complements previous studies in three directions. Firstly, it overcomes the problems resulting from the sample-splitting regressions. Secondly, it reduces the potential endogeneity bias [7]. Finally, it allows heterogeneity of money demand for individual firms.

2. Model and Estimation

[8] and [9] define the money demand model as

$$\log M_{it} = \beta \log Y_{it} + \gamma \log R_{it} + \delta \log W_{it} + \log A_{it} + \alpha_i + \varepsilon_{it} \tag{1}$$

where, α_i is the firm specific effects, and ε_{it} is the disturbance. M_{it} is the money holdings of firm i at date t. Y_{it} is the volume of sales of firm i at date t, as a measure of the scale of activity. R_{it} is the nominal opportunity cost of money and W_{it} is the wage of the workers involved in the production of transaction services. A_{it} represents a type of productivity parameter that can be considered as an indicator of the firm's degree of financial sophistication. Since the variables might contain unit roots, we rewrite the above model as:

$$m_{it} = \beta y_{it} + \gamma r_{it} + \delta w_{it} + \lambda_t + \alpha_i + \varepsilon_{it} \tag{2}$$

where m_{it}, y_{it}, r_{it}, and w_{it} are the corresponding first-difference of the log variables in Equation (1). λ_t captures that time fixed effect which controls for economy-wide changes in financial sophistication [9]. According to [8], we expect that $\beta > 0$ and $\gamma < 0$. Our parameter of interest is δ. However, the sign of δ cannot be predetermined because w_{it} not only measures the change of transaction costs, but also proxies for the inflation rate. If transaction costs dominate, a higher firm's "shoe-leather costs" is expected to increase money holdings, which implies $\delta > 0$. When inflation drops to a level that does not materially enter into the decisions of firms, the above transaction-cost effect might dominate. [10] suggests an overwhelmingly negative effect of the inflation rate on money demand during periods of hyperinflation which might lead to a negative sign of coefficient on w_{it}. However, due to the presence of opposing effects that might offset each other, it is not advisable to test for Cagan's hypothesis by a linear model using the data which are not from hyperinflation period. Note that the higher inflation rate, the stronger the Cagan effect is. Therefore, a higher wage tends to result in a smaller coefficient on w_{it}, which leads to nonlinearities of the demand for money.

Following [11], we extend Equation (2) to a nonlinear panel smooth transition model:

$$m_{it} = \alpha_i + \lambda_t + \beta y_{it} + \gamma r_{it} + \delta w_{it} + \left(\beta' y_{it} + \gamma' r_{it} + \delta' w_{it} \right) g\left(w_{it}; \chi, c \right) + \varepsilon_{it} \tag{3}$$

where, the transition function $g\left(w_{it}; \chi, c \right)$ is a continuous and bounded function of the transition variable. Following [7], we use the following logistic transition function:

$$g\left(w_{it}; \chi, c \right) = \frac{1}{1 + \exp\left[-\chi \left(w_{it} - c \right) \right]} \tag{4}$$

where, c denotes a location parameter, w_{it} denotes a transition variable and parameter χ determines the shape of the transition function. The PSTR model has two major advantages over the linear model. First, it addresses the presence of the endogeneity that results from a two-way causal relationship between the variables m_{it} and w_{it} [7]. Second, it allows the parameters to be different at different inflation levels, as they are now functions of the wage variable w_{it}. For instance, note that the wage coefficient for the ith firm at time t is defined as:

$$e_{it} = \delta + \delta' g\left(w_{it}; \chi, c\right) \tag{5}$$

Given the properties of the transition function, we have $\delta \le e_{it} \le \delta + \delta'$ if $\delta' > 0$ or $\delta + \delta' \le e_{it} \le \delta$ if $\delta' < 0$. Consequently, the PSTR model allows us to evaluate the influence of the wage variables w_{it} on money demand at different inflation-regimes. According to Cagan's hypothesis, we expect $\delta' < 0$.

3. Data and Results

3.1. Data

The firm-level data for the period of 1999 to 2007 are drawn from the annual surveys of Chinese manufacturing by the China National Bureau of Statistics. These annual surveys cover all state-owned enterprises, and those non-state-owned enterpricses with annual sales over 5 million RMB. This database has been widely used by previous studies, as it contains detailed firm-level information for manufacturing enterprises in China. Particularly, we are interested in the variables related to measuring firm financial holdings, average wage, total sales, and cost of capital. **Table 1** describes the variables used in this paper. We exclude observations that do not follow standard accounting principles. To deal with outliers and the most severely misreported data, we winsorize all firm-level variables at the 1% level in both tails of the distribution.

3.2. Empirical Results

To begin with, we first test for linearity in Equation (3). According to the p-values for the LM tests [12], the hypothesis of linearity can be rejected at the 5% level. The PSTR model is then estimated. The estimates of χ and c are 3.699 and 0.394 respectively. **Table 2** reports estimates of other parameters.

The estimation results show that the coefficients on total sales and the nominal interest rate are both statistically significant and have expected signs for both the low and high inflation periods. The coefficient on wages is statistically significant and positive for the low inflation period, but not significant for the high inflation period, which is consistent with Cagan's hypothesis.

Table 1. Variable definitions.

Variable	Description
m_{it}	Natural log-difference of M_{it}, where M_{it} is computed as liquid asset subtracting the sum of inventory and accounts receivable for firm i at the end of year t, as shown in [8].
y_{it}	Natural log-difference of total sales for firm i at the end of year t.
w_{it}	Natural log-difference of W_{it}, where W_{it} is measured as the total payroll (given by "total wages payable"), divided by the number of employees for firm i at the end of year t.
r_{it}	Natural log-difference of R_{it} where R_{it} is computed as the total financial expenditures divided by the total debt (given by "total liabilities") for firm i at the end of year t, as shown in [9].

Table 2. Estimation results.

Parameter	Estimate	Parameter	Estimate
β	0.292***	β'	0.096***
γ	−0.098***	γ'	−0.007
δ	0.037***	δ'	−0.031*
$\beta + \beta'$	0.387***	$\gamma + \gamma'$	−0.105***
$\delta + \delta'$	0.005		

Note: ***, **, * indicate statistical significance of the difference at the 1%, 5% and 10% levels, respectively.

4. Conclusion

There are a relatively limited number of studies addressing Cagan's hypothesis on money demand in China. This paper attempts to fill this gap by adopting a panel smooth transition approach on the firm-level data. Our results support the presence of the Cagan effect in China. In addition, it is found that the higher the inflation rate is, the stronger the Cagan effect is. The policy implications are obvious. Firstly, central banks should be more concerned with inflation expectation than they have been in the past, for inflation may have a significantly greater acceleration in the high inflation period. Secondly, once inflation expectation zooms up, central banks need to pursue aggressive and nontraditional monetary policy to reestablish suitable price anticipations by the public.

Acknowledgements

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