

AN EMPIRICAL RESEARCH ON THE RELATIONSHIP BETWEEN DEFENSE SPENDING AND AGGREGATE OUTPUT OF CHINA

Jiang Yiwen, Guo Zhonghou

Military Economics Academy, Wuhan, China

Abstract: *In this article the effect of defense spending on aggregate output is discussed. Recent publications in this area are reviewed and new additional evidence is provided. In the period of 1952-1978, the findings reported here imply that a rise of defense spending should bring significant increase in China economy; in the period of 1978-2009, a rise of defense spending should bring significant decrease in China economy. Therefore defense spending matters. But in the long-run period 1952-2009, a rise of defense spending should bring little decrease in China economy.*

Keywords: *defense spending, aggregate output, interest-rate augmented Keynesian cross-model, cointegration*

1. INTRODUCTION

The question of defense spending and its effect on growth has received considerable attention in the defense literature. The studies published in recent years, however, do not yield a coherent conclusion. Some studies indicate that defense spending has a positive effect while others reveal no effect and yet others indicate a negative effect on output. More interestingly, Smith and Tuttle (2008) found that real output played an important role in determining real defense spending in the US, but found little evidence supporting a positive or negative effect in real output from defense spending changes. In contrast to Atesoglu (2002), they did not find support for his conclusion that military spending promotes real aggregate output. But in his latest paper, Atesoglu (2009) argued back that defense spending has a positive effect on aggregate output. To contribute to the existing pool of literature, the purpose of this article is to study the relationship between defense spending and aggregate output in China.

There have been some literatures focusing on the relationship between defence spending and economic growth in China.

Chien-Hsun Chen (1993) examines the causal relationship between defence spending and economic growth in China over the period 1950-1991.

The results show that defence spending is not cointegrated with the real economic growth rate, implying the lack of any long-run equilibrium relationship between the two variables. In addition, Granger causality tests indicate causal independence between the two variables. (D→E)

Abdul M.M. Masih & Rumi Masih & Mohammad S. Hasan (1997) examine empirically the causal relationship between defence spending and economic growth in China. The results indicate a positive unidirectional causality flowing from defence spending to economic growth. They broadly indicate that defence spending and economic growth did share a common trend over the sample period under analysis, but it was the former which stimulated the latter.

Moreover, it is defence spending that has a much more perceptible and prolonged effect on economic growth, giving rise to implications that although expenditure on defence may have been politically motivated, over the long-run this spending did play a significant indirect role in enhancing the growth potential of this, for many years, closed-door economy. (D→E)

Yemane Wolde-Rufael (2001) challenges the claims of a previous article which tested the long-run relationship between economic growth and defence spending for China for 1950-1991 and stated that the two series were integrated of the same order but not Granger-causally related to each other in any direction.

An empirical research on the relationship between defense spending and aggregate output of China

There is a unidirectional Granger causality running from defence expenditure to economic growth. (D→E)

Chung-Nang Lai & Bwo-Nung Huang & Chin-Wei Yang (2005) employs both linear and non-linear models to investigate the relationship between national defense spending and economic growth for China. Using data from 1953-2000 on defense spending, GDP, import, export and capital, they find that China's national defense is found to lead economic growth. (D→E)

In the case of China, Rudra Prakash Pradhan (2010) finds bidirectional causality between economic growth and public debt in China, and unidirectional causality from defense spending to economic growth in China. (D→E)

Why are there so many different results on the relationship between defense expenditure and economic growth? Dunne, J. Paul and Smith, Ron (2010) have given us good answer, we cite their words here.

“A large literature has used tests for Granger (1969) non-causality, GNC, to examine the interaction of military spending with the economy. Such tests answer a specific though quite limited question: can one reject the null hypothesis that one variable does not help predict another? If this null is rejected, there is said to be Granger causality, GC. Although the limitations of GNC tests are well known, they are often not emphasized in the applied literature and so may be forgotten.” “First, the tests may not be informative about the substantive issue, the interaction of military expenditure and the economy. The difficulty is that Granger causality, incremental predictability, does not correspond to the usual notion of economic causality. To determine the relationship of the two notions of causality requires an identified structural model. Second, the tests are very sensitive to specification. GNC testing is usually done in the context of a vector auto regression, VAR, and the test results are sensitive to the variables and deterministic terms included in the VAR, lag length, sample or observation window used, treatment of integration and cointegration and level of significance. Statistical criteria may not be very informative about these choices.

Third, since the parameters are not structural, the test results may not be stable over different time periods or different countries.”

The studies summarized above suggest that one should be careful when making declarations about the effect of defense spending on aggregate output. The results as a whole seem to indicate that findings are sensitive to the models, econometric methods, and estimation periods employed. In this paper we will borrow model from Atesoglu (2009) to discover the relationship between defense spending and its effect on growth in China.

2. THE MODEL

Borrowing from Atesoglu (2002), the traditional Keynesian cross is defined as:

$$Q_t = C_t + I_t + X_t + M_t + G_t \quad (1)$$

Where Q_t is real GDP, C_t is real consumption spending, I_t is real investment, X_t is real net exports, M_t is real defense (military) spending, and G_t is real non-defense (non-military) government spending. Consumption is defined as some level of autonomous consumption (a) plus the marginal propensity to consume (b) times disposable income:

$$C_t = a + b(Q_t - T_t) \quad (2)$$

Where T_t is defined as real taxes, and equals:

$$T_t = n + gQ_t \quad (3)$$

Investment is a negative function of real interest rates:

$$I_t = n + gQ_t \quad (4)$$

Real net exports are a negative function of real output and real interest rates:

$$X_t = z - mQ_t - nR_t \quad (5)$$

The reduced form solution for real output, including a stochastic error term, is:

$$Q_t = \alpha + \beta M_t + \delta G_t - \lambda R_t + u_t \quad (6)$$

where

$$\alpha = (a - nb + e + z) / (1 - b(1 - g) + m),$$

$$\beta = \delta = 1 / (1 - b(1 - g) + m)$$

$$\text{and } \lambda = (f + n) / (1 - b(1 - g) + m).$$

As noted by Atesoglu (2002), this model differs from the normal Keynesian cross in its treatment of R_t (investment normally modeled as a function of nominal interest rates), while net exports are normally assumed to depend only on real income, versus real income and real interest rates as in this model.

3. THE EVIDENCE OF CHINA

In the case of China, its economy is transforming from planned economy to market economy. There are two different periods since 1949: closed-door economy before 1978 and opened-door economy after 1978. While GDP increases 8.5% each year since 1952 to 2009, the average GDP growth rate is 5.9% before 1978 and 10.5% after 1978.

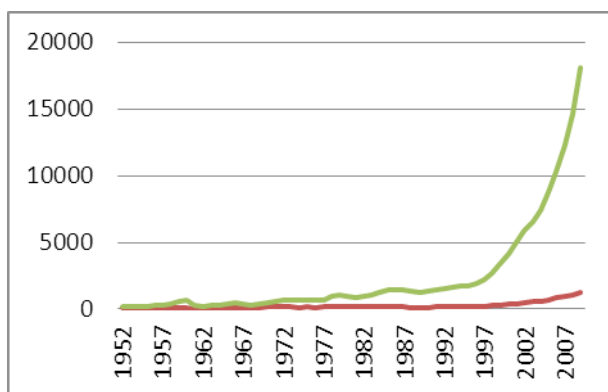


Fig 1 GDP, Non-defense Government Spending and Defense Spending

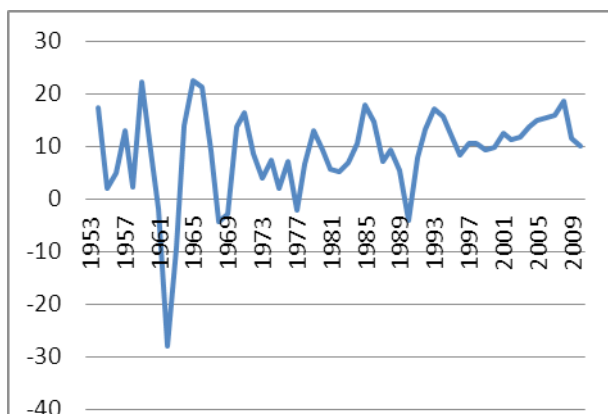


Fig 2 Growth Rates of GDP

Table 1 Growth Rates of GDP, Defense Spending and Non-Defense Government Spend

	1952-2009	1952-1978	1978-2009
growth rate of GDP	8.5%	5.9%	10.5%
growth rate of Defense Spending	5.2%	3.4%	5.8%
growth rate of Non-Defense Government Spending	8.9%	7.6%	9.7%

From Table 1 we can see that growth rates of defense spending are less than those of GDP and non-defense government spending.

Table 2 Defense Spending as a Share of GDP and Government Spending

	1952-2009	1952-1978	1978-2009
Defense Spending as a share of GDP	1.7%	5.4%	1.4%
Defense Spending as a share of Government Spending	9.0%	18.5%	8.0%

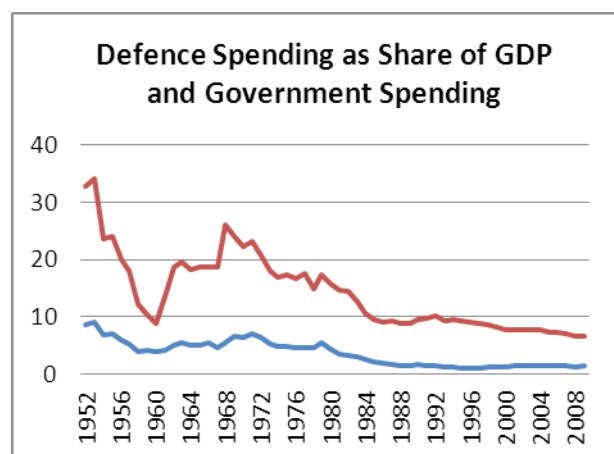


Fig 3 Defense Spending as Share of GDP and Government Spending

4. METHODOLOGY AND RESULTS

4.1 Data The annual data used come from two sources. Gross Domestic Product (GDP), aggregate defense (military) spending (ME), and aggregate non-defense (non-military) spending (GE) are available from the China Statistical Yearbooks.

The real interest rate (R) used are one-year deposit rates from People's Bank of China. Finally, real GDP, defense spending, and non-defense spending variables are transformed into natural log levels, denoted respectively by LGDP, LME, LGE.

4.2 Data properties Before estimating the parameters of equation (6), the data generating process for each variable is considered. For this purpose, the Augmented Dickey-Fuller (ADF) unit root test was made. The ADF test results indicate that series are likely to be first-order integrated and they are difference stationary. These findings suggest that there may be a long-run equilibrium relation among these non-stationary variable in equation (6). If these variables move systematically together over time, they may be cointegrated. Cointegration analysis is concerned with estimation methods that utilize the information about both long run and short run dynamics.

There is some evidence that the Johansen method is superior to other methods testing for cointegration. Accordingly, in this paper, the Johansen method is used for testing cointegration and estimating the coefficients of equation (6).

Results obtained with the Johansen method for equation (6) are

$$Q_t = 1.050 - 0.051M_t + 1.126G_t - 0.004R_t \quad (7)$$

(-0.360) (11.514) (-0.528)

where sample is 1952–2009, a deterministic trend is included for the data, and lag interval: 1 to 4. The lag interval selected is the conventional lag interval adopted in macroeconomic models.

Empirical results detailed above uniformly indicate a cointegration relation among the variables in equation (6). Signs of the estimated cointegration coefficients in equation (7) are consistent with those required theoretically by equation (1), and, according to their standard errors reported in parentheses under each coefficient, the estimated coefficients are statistically significant.

It is seen that a 1% rise in real defense spending would lead to about a 0.05% decrease in real GDP. A 1% rise in real non-defense government spending should bring about a 1.13% rise in real GDP. A 1% rise in the real interest rate, representing the monetary sector, leads to about a 0.004% decrease in real GDP.

We also us another two group data to test: the first is 1952-1978 and the second is 1978-2009. The results are the following.

1952-1978:

$$Q_t = 2.423 + 0.468M_t + 0.493G_t - 0.007R_t$$

(7.772) (8.178) (-1.786)

It is seen that a 1% rise in real defense spending would lead to about a 1% decrease in real GDP. A 1% rise in real non-defense government spending should bring about a 1.76% rise in real GDP. A 1% rise in the real interest rate, representing the monetary sector, leads to about a It is seen that a 1% rise in real defense spending would lead to about a 0.468% increase in real GDP. A 1% rise in real non-defense government spending should bring about a 0.493% rise in real GDP. A 1% rise in the real interest rate, representing the monetary sector, leads to about a 0.007% decrease in real GDP.

Table 3 Cointegration Test Results

Number of Cointegrating Vectors	Trace Statistic	0.05 Critical Value
None	58.52325	40.17493
At most 1	23.58075	24.27596
At most 2	11.00469	12.32090
At most 3	1.324764	4.129906

The empirical results reveal that defense spending has a significant and positive effect on real GDP in China.

1978-2009:

$$Q_t = 1.449 - 1.001M_t + 1.759G_t - 0.001R_t$$

(-4.674) (10.724) (-0.131)

It is seen that a 1% rise in real defense spending would lead to about a 1% decrease in real GDP. A 1% rise in real non-defense government spending should bring about a 1.76% rise in real GDP. A 1% rise in the real interest rate, representing the monetary sector, leads to about a 0.001% decrease in real GDP. The empirical results reveal that defense spending has a significant and negative effect on real GDP in China

	1952-2009	1952-1978	1978-2009
elasticity of defense spending	-0.05%	0.468%	-1%
elasticity of non-defense government spending	1.13%	0.493%	1.76%
elasticity of interest rate	-0.004%	-0.007%	-0.001%

5. CONCLUSION

The empirical results detailed in this paper are in conformity with those reported by Dunne, J. Paul and Smith, Ron (2010). In the period of 1952-1978, the findings reported here imply that a rise of defense spending should bring significant increase in China economy; in the period of 1978-2009, a rise of defense spending should bring significant decrease in China economy. Therefore defense spending matters. But in the long-run period 1952-2009, a rise of defense spending should bring little decrease in China economy.

The tentative conclusion that follows is that the effects of defense spending in China appear to be sensitive to the various models, econometric techniques and mostly, the sample periods employed.

ACKNOWLEDGMENTS

Supported by the National Social Science Foundation of China No. 11GJ003-050.

An empirical research on the relationship between defense spending and aggregate output of China

REFERENCES

1. Atesoglu, H.S. (2002) Defence spending promotes aggregate output in the United States. *Defence and Peace Economics* 13(1) 55–60.
2. Atesoglu, H.S. (2009) Defence spending and aggregate output in the United States. *Defence and Peace Economics* 20(1) 21–26.
3. Chang, T., Fang, W., Wen, L.F. and Liu, C. (2001) Defense spending, economic growth and temporal causality: Evidence from Taiwan and mainland China, 1952-1995. *Applied Economics* 33(10), 1289-1299.
4. Chen, C-H. (1993) Causality between defence spending and economic growth: the case of mainland China, *Journal of Economic Studies*, 20, 37- 43.
5. Chung-Nang Lai & Bwo-Nung Huang & Chin-Wei Yang, (2005) Defense spending and economic growth across the Taiwan straits: a threshold regression model. *Defence and Peace Economics* 16(1) 45-57.
6. Dunne, J. Paul; Smith, Ron (2010) Military Expenditure and Granger Causality: A Critical Review. *Defence and Peace Economics* 21(5-6) 427-441.
7. Jeffrey S. Smith and M.H. Tuttle (2008) Does defense spending really promote aggregate output in the United States? *Defence and Peace Economics* 19(6) 435–447.
8. Lai, C.N., Huang, B.N. and Yang, C.W. (2005) Defense spending and economic growth across the Taiwan Straits: A threshold regression model. *Defence and Peace Economics* 16(1).
9. Masih, A. M. M., Masih, R. and Hasan, M. S. (1997) New evidence from an alternative methodological approach to the defence spending-economic growth causality issue in the case of mainland China, *Journal of Economic Studies*, 24, 123± 40.
10. Rudra Prakash Pradhan, (2010) Defense Spending and Economic Growth in China, India, Nepal and Pakistan: Evidence from Cointegrated Panel Analysis, *International Journal of Economics and Finance*, 2(4)
11. Yemane Wolde-Rufael (2001) Causality between defence spending and economic growth - The case of mainland China: a comment. *Journal of Economic Studies*, Emerald Group Publishing 28(3) 227-230.