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恐怖主義威脅與動態調整：一個無限期的跨時疊代模型

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中文摘要及關鍵詞

摘要:

自從 2001 年 9 月 11 日阿富汗的恐怖份子以飛機炸毀美國紐約市的雙子星大樓之後，大部分的民眾才警覺到原來恐怖份子可能在我們身邊。本研究將恐怖主義的特質納入 Blanchard (1985)的無限期跨時疊代模型中，藉此探討國家安全支出與恐怖組織威脅如何左右總體經濟的長期與短期影響。根據我們的研究得知，國家安全支出的提高對於經濟體系長期的資本存量與總合消費水準具有不確定的影響，但恐怖主義威脅卻會導致民眾所負擔的保費（包括壽險與產險）提高，使得可支配所得下降，因此，社會總合的消費與總合的資本存量將會減少。另外，當國家安全支出提高的消息曝光時，民眾就已經開始改變他們的消費與投資行為，造成經濟體系中總合的資本數量與消費產生影響。

關鍵詞：恐怖主義、國家安全、無限期跨時疊代模型、動態調整

英文摘要及關鍵詞

Abstract

This paper develops a growth model embodying intertemporal optimization, and examines the long-run and the transitional responses of the aggregate consumption and the aggregate capital stock to an anticipated permanent increase in domestic security expenditure and the terrorist threats. Based on our analysis, a permanent rise in domestic security spending has an ambiguous impact on the steady state consumption and the capital stock. But a permanent rise in terrorism threats will always lower both the aggregate consumption level and the aggregate capital stock in the long run.

Key words: Terrorism threats; national security; overlapping generation model; transitional dynamic.

報告內容

Terrorist Threats and Transitional Dynamics in an Overlapping Generations Model

1. Introduction

Although the end of the Cold War eliminated the tension between the West and the East, terrorism threats have continued to represent a significant challenge to the world. The most heartbreaking event in recent year is the terrorist attack of the October 23, 1983 truck bombings of U.S. and French military barracks in Beirut, Lebanon, which claimed a total of 295 lives, stood as the most deadly act of terrorism. More recently, September 11, 2001, four hijacked planes flew into the World Trade Center in New York, the Pentagon in Washington and the Pennsylvania, marked a dramatic escalation in a trend toward more destructive terrorist attacks. Thereafter, the world has changed since September 11, 2001. We remain a nation at risk to terrorist attacks and will remain at risk for the foreseeable future.

In recently years, there have been an increasing number of discussions in terrorism based on an economics model. The existing literatures try to answer following questions: is the rational behavior of terrorists, what should be the response of a government when faced with a terrorist threat and is the implementation of anti-terrorism policies will reduce the incidence of terrorist event. For example, Landes (1978) uses the U. S. aircraft hijacking accidents between 1961 and 1976 to examine the efficacy of various anti-terrorism policies. Sandler et al. (1983), Lapan and Sandler (1988), and Enders et al. (1992) analyze the negotiation process between terrorists and government by adopting a rational actor model. Brophy-Baermann and Conybeare (1994) set a rational expectations model and use Israeli data to show that only unanticipated retaliations will change the actual rate of attacks. Enders and Sandler (1995) apply a simple game theoretic framework and the choice theoretic model to summarize the explanation for the rationalization of terrorist behavior in the existing literatures.

Although the existing literature of terrorism subjects based on economic models have developed in recent years, it is surprising that the literatures downplay the macroeconomic impact of terrorist threat and national security expenditure. We believe that if we can learn about agent’s response that even small effects, then we can contribute much more to improvements in government policy decision. Based on this consideration, this paper tries to set up a macroeconomic model embodying the terrorist threat and uses it to examine the impact of both terrorist threat and national security improving on macroeconomic performance.

The analytical framework is a straightforward to extend the Yarri (1965) - Blanchard (1985) type continuous time overlapping generation model embodying the nature of terrorist threats. We assume the probability of an attack and the probability of the damage from attack by terrorists can efficiently decrease by domestic security programs, but increase by terrorism threats. Using such a framework, this paper tends to discuss both the impact of terrorist threats and domestic security programs on both the long-run and short-run macroeconomic behavior.

The organization of the paper is as follows. Section 2 presents the analytical framework. Section 3 and section 4 analyze the effect of an anticipated shock in domestic security expenditure and the terrorist threat on macroeconomic dynamics, respectively. And some concluding remarks are presented in section 5.

2. The Model

Consider a peaceable economy face a risk to terrorist attacks for the foreseeable future. In order to capture the relationship between terrorism and uncertain lifetimes, we try to extend the simplest version of the Yarri (1965)-Blanchard (1985) continuous time overlapping generation model. We consider an economy consisting of many identical individuals, who produces a single composite commodity which can be consumed, accumulated as capital, and used for the national security. The government provides domestic security system, such as national defense, police, firemen and counter-terrorism action, by means of spending on national security programmes, and collects a lump-sum tax to finance the domestic security spending.

Assume that the probability of an attack by terrorist and the probability of the damage during the terrorist attacks (including people death and asset destruction) can efficiently decrease by domestic security spending, but increase by the threat terrorism. According to the US Department of Sate, 856 major transnational terrorist incidents in 1988 resulted in the death of 658 persons and the injury of 1131. Specifically, individuals face a common probability of death, $p(t)$, and a net probability of assets destruction, $\pi(t)$, at time t. We can use equations (1) and (2) to describe that the instant probability of death and the instant probability of assets destruction as follow.

$$p(t) = p(M(t), M^*(t)); \quad p_M < 0, \quad p_{M*} > 0, \quad p_{MM} > 0, \quad p_{M*M*} < 0, \tag{1}$$

$$\pi(t) = \pi(M(t), M^*(t)); \quad \pi_M < 0, \quad \pi_{M*} > 0, \quad \pi_{MM} > 0, \quad \pi_{M*M*} < 0, \tag{2}$$

where $M(t)$ is the public spending on security-related programmes, such as strengthening domestic security, combating terrorism, enhancing national defense and so on. $M^*(t)$ is the proxy of the degree of terrorism threat. As a result, equation (1) sates that the instant probability of death negatively relates to domestic security spending but positively relates to the degree of terrorism threats. Equation (2) describe that the net probability of assets destruction increases as rise in the degree of the terrorism treats, and decreases as the rise in domestic security. In addition, assume the birth rate is also $p(t)$, and the total population size thus can normalize to be one.[1]

The representative household of the cohort born at time v solves at time t. The representative household chooses present and future levels of consumption, $c(s)$ to maximize expected intertemporal utility:[2]

$$\int_t^\infty \ln c(s) e^{-(\rho+p)(s-t)} ds, \tag{3}$$

where ρ is the pure rate of time preference and $\rho + p(M(s), M^*(s))$ is the effective discount rate at each instant of time s.

At each instant of time, the representative households are bound by a flow constraint linking assets accumulation to any difference between its income and its expenditure. As a consequence, we may write his constraint as:

$$\dot{a}(t) = [r(t) + p(M(t), M^*(t)) - \pi(M(t), M^*(t))]a(t) + w(t) - c(t) - \tau(t), \tag{4}$$

where the overdot denotes the rate of change with respect to time, $a(t)$ is non-human wealth, $r(t)$ is the real interest rate, $w(t)$ is the real wage, and $\tau(t)$ is a lump-sum tax payment. To avoid treat unanticipated bequests, we assume there is individual but no aggregate uncertainty, and there exists a perfect insurance market to offer life insurance service and property insurance service. For the life insurance contract, insurance company receives entire estate when individual dies and pays him an annuity at the actuarially-fare rate of $p(t)$ per unit of wealth as long as when they alive. For the property insurance contract, individual firm will purchase completely insurance himself to against the loss during the terrorism activity. Under perfect competitive insurance market assumption, the actuarially-fare insurance premium sets at $\pi(t)$. As a result, $p(t)a(t)$ is

[1] At time t, the size of the cohort born at time v is given by $p\exp[-p(t-v)]$. Hence, the total population at time t is given by $\int_{-\infty}^{t} p\exp[-p(t-v)]dv$, which is always equal to one.

[2] To avoid unless confusion, we suppress the argument v in following analysis.

the annuity income and $\pi(t)a(t)$ is the property insurance premium.

In addition, a No-Ponzi-Game solvency condition needs to be imposed to prevent agents from going infinitely into debt. That is

$$\lim_{z\to\infty}\exp\{-\int_t^z[r(\mu)+p(M(\mu),M^*(\mu))-\pi(M(\mu),M^*(\mu))]d\mu\}a(z)=0\,. \tag{5}$$

Integrating equation (4) and imposing the No-Ponzi-Game solvency condition stated in equation (5), the intertemporal budget constraint of the represent household can be rewritten as:

$$\int_t^\infty c(z)R(z)dz = a(t)+h(t)\,, \tag{4a}$$

where $R(z)=\exp\{-\int_t^z[r(\mu)+p(M(\mu),M^*(\mu))-\pi(M(\mu),M^*(\mu))]d\mu\}$ is the discounted factor, and $h(t)=\int_t^\infty[w(z)-\tau(z)]R(z)]dz$ is the expected lifetime human wealth of the cohort born at time z at time t.

Assume that there is no bequest motivation, each generation is born with neither asset nor debt. Hence, the initial financial assets stock is equal to zero, i.e., $a(0)=0$. In addition, we also assume that the household treats the foreign threat and domestic security as given since the household feels that its activities are too insignificant to affect the environment. As a result, the representative household chooses consumption so as to maximize the discounted sum of utilities defined in (3) subject to (4), and given the initial assets stock. The optimal conditions necessary for the representative households are as follows:

$$\frac{\dot{c}(t)}{c(t)}=r(t)-\pi(M(t),M^*(t))-\rho\,, \tag{6}$$

Using equations (4a) and (6), we know that the consumption at time t is:

$$c(t)=[\rho+p(M(t),M^*(t))][a(t)+h(t)], \tag{7}$$

The productive sector is assumed to be represented by on firm which employs a stock of productive capital, k, and inelastically supplied labor, according to a neoclassical production function, $F(k)$ to produce output y. The production function exhibits positive but diminishing marginal physical productivity in the capital stock, i.e., $F_k>0$, $F_{kk}<0$. In addition, Inada condition should be met.

Firms operate in competitive markets. Assume that firms rent capital and labor from household in order to produce a single good. The profit maximization requires that the factor prices equal marginal product,

$$r(t)=F_k(k)-\delta\,, \tag{8a}$$

$$w(t)=F(k)-kF_k(k)\,, \tag{8b}$$

Assume that the government is assumed to collect its lump-sum tax revenue, $\tau(v)$, from generation v to finance its expenditure. In addition, assume that government maintains a continual government budget balance, and that government spending is entirely on the domestic security, $M(t)$, the government budget constraint at time t is given by:

$$M(t)=\mathrm{Z}(t)=\int_{-\infty}^t\tau(v)p\exp[-p(t-v)]dv\,, \tag{9}$$

We next can sum over cohorts to obtain aggregate consumption. Following the literature, assume that the aggregate variables are additive across individuals. Given the assumption that the birth rate coincides with the death rate, and the total population size is constant (henceforth we can normalize to be one). As a result, the aggregate consumption, $C(t)$, the aggregate non-human wealth, $A(t)$, and the aggregate human wealth, $H(t)$, is given by:

$$C(t)=\int_{-\infty}^t c(v)p\exp[-p(t-v)]dv\,, \tag{10a}$$

$$A(t) = \int_{-\infty}^{t} a(v) p \exp[-p(t-v)] dv , \tag{10b}$$

$$H(t) = \int_{-\infty}^{t} h(v) p \exp[-p(t-v)] dv , \tag{10c}$$

$$W(t) = \int_{-\infty}^{t} w(v) p \exp[-p(t-v)] dv , \tag{10d}$$

$$\mathrm{Z}(t) = \int_{-\infty}^{t} \tau(v) p \exp[-p(t-v)] dv . \tag{10e}$$

Differentiating equations (10a) and (10b) with respect to t, then substituting equations (4), (5), and (10a)-(10e) into the resulting equations respectively, we have:

$$\dot{C}(t) = \{r(t) - \rho - \pi[M(t), M^*(t)]\} C(t) - p(M(t), M^*(t))[\rho + p(M(t), M^*(t))] A(t) , \tag{11a}$$

$$\dot{A}(t) = [r(t) - \pi(M(t), M^*(t))] A(t) + W(t) - C(t) - \mathrm{Z}(t) . \tag{11b}$$

Given the only form of nonhuman wealth is capital, thus $A = K$. Substituting the condition $A = K$ and equations (8a) and (8b) into (11a) and (11b), the macroeconomic dynamic behavior can be summarized by following equations: (we suppress the time index in this subsection for ease of presentation)

$$\dot{C} = [F_K(K) - \rho - \pi(M, M^*) - \delta] C - p(M, M^*)[\rho + p(M, M^*)] K , \tag{12a}$$

$$\dot{K} = [F(K) - C - M - [\pi(M, M^*) + \delta] K(t) . \tag{12b}$$

At the steady-state equilibrium, the economy is characterized by $\dot{C} = \dot{K} = 0$, aggregate consumption and the aggregate capital stock at their stationary levels, namely $\hat{C}$ and $\hat{K}$, respectively. Then, linearizing equations (12a) and (12b) around the steady-state equilibrium, we have:[3]

$$\begin{bmatrix} \dot{C} \\ \dot{K} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ -1 & a_{22} \end{bmatrix} \begin{bmatrix} C - \hat{C} \\ K - \hat{K} \end{bmatrix} + \begin{bmatrix} a_{13} \\ a_{23} \end{bmatrix} (M - M_0) + \begin{bmatrix} a_{14} \\ a_{24} \end{bmatrix} (M^* - M_0^*) , \tag{13}$$

where $a_{11} = F_K - \delta - \rho - \pi > 0$,[4] $a_{12} = F_{KK} \hat{C} - (\rho + p) p < 0$, $a_{13} = -[\pi_M \hat{C} + (\rho + 2p) \hat{K} p_M]$, $a_{14} = -[\pi_{M*} \hat{C} + (\rho + 2p) p_{M*} \hat{K}]$, $a_{22} = F_K - \delta - \pi$, $a_{23} = -(1 + \pi_M \hat{K})$, $a_{24} = -\pi_{M*} \hat{K}$.

Let φ_1 and φ_2 be the two characteristic roots of the dynamic system. From equation (13), we then have:

$$\varphi_1 + \varphi_2 = 2(F_K - \delta - \pi) - \rho , \tag{14a}$$

$$\varphi_1 \varphi_2 = \Delta = (F_K - \delta - \rho - \pi)(F_K - \delta - \pi) + F_{KK} \hat{C} - (\rho + p) p . \tag{14b}$$

As addressed in the literature of dynamic rational expectation models, including Burmeister (1980), Buiter (1984), and Turnovsky (1995), the dynamic system has *a unique perfect-foresight equilibrium* if the number of unstable roots equals the number of jump variables. Since the dynamic system reported in equation (14) has one jump variable, C, the restriction $\Delta < 0$ should be imposed to ensure $\varphi_1 \varphi_2 < 0$, and hence the dynamic system is assured to display a unique perfect-foresight equilibrium.

We now consider the steady-state the impact of a rise in domestic security expenditure and terrorism threat. It follows from equation (14) with $\dot{C} = \dot{K} = 0$ that the following steady-state relationship is derived:

$$\frac{\partial \hat{C}}{\partial M} = \frac{(F_K - \delta - \pi)[\pi_M \hat{C} + (\rho + 2p) \hat{K} p_M] - [F_{KK} \hat{C} - (\rho + p) p](1 + \pi_M \hat{K})}{\Delta} \gtrless 0 , \tag{15a}$$

[3] It should be noted that our analysis is appropriate for a shock of sufficiently small magnitude around the equilibrium.

[4] Using equation (12a), we know that the condition $(F_K - \rho - \pi - \delta) \hat{C} = p(\rho + p) \hat{K}$ must hold at the steady-state equilibrium. Given that consumption, the capital stock, the death rate, and the time preference rate are non-negative, the restriction $F_K - \delta - \rho - \pi > 0$ is derived.

$$\frac{\partial \hat{K}}{\partial M}=\frac{(F_K-\delta-\pi-\rho)[1+\pi_M\hat{K}]+\pi_M\hat{C}+(\rho+2p)p_M\hat{K}}{\Delta}\gtrless 0, \tag{15b}$$

$$\frac{\partial \hat{C}}{\partial M^*}=\frac{(F_K-\delta-\pi)[\pi_{M^*}\hat{C}+(\rho+2p)p_{M^*}\hat{K}]-[F_{KK}\hat{C}-(\rho+p)p]\pi_{M^*}\hat{K}}{\Delta}<0, \tag{16a}$$

$$\frac{\partial \hat{K}}{\partial M^*}=\frac{(F_K-\delta-\rho-\pi)\pi_{M^*}\hat{K}+\pi_{M^*}\hat{C}+(\rho+2p)p_{M^*}\hat{K}}{\Delta}<0. \tag{16b}$$

It is clear from equations (15a) and (15b), a permanent rise in domestic security spending have an ambiguous impact on the steady-state aggregate consumption level and the aggregate capital stock. The impact of government security expenditure on the economy intuitively reflects the consequence operating through *the resource withdraw effect* and *the security effect*. To the resource withdraw effect whereby an increase in the government spending financed by lump-sum taxation will lower the amount of resources available to the private sector. This will induce the household to lower private consumption and investment. To be more specific, when the impact of domestic security spending on probability of death and assets destruction is dropped, it easily infers from equations (15a) and (15b) to know that an increase in the government spending has a negative impact on the steady-state consumption and the stock of capital when the conditions $\pi_M = p_M = 0$ are imposed. On the other hand, *the security effect* indicates that an increase in the domestic security spending will lower the probability of death and the probability of assets destruction. With this adjustment, the household tends to raise consumption and investment, thereby increasing the steady-state capital stock. The net effect of domestic security spending depends on the relative strength of these two channels.

In addition, equations (16a) and (16b) state that a permanent rise in terrorist threat will lower the steady-state aggregate consumption and capital stock. Intuitively, an increase in terrorist threat will lead to increase both the probability of death and the probability of assets destruction, thus fall in investment and output, eventually, the steady-state aggregate consumption level and aggregate capital stock level must be decreased.

We next solve the differential equation stated by equation (12). Equation (14b) indicates that $\varphi_1\varphi_2<0$. For expository convenience, in what follows let φ_1 be the negative root and φ_2 be the positive root (i.e., $\varphi_1<0<\varphi_2$). Using standard solution methods, the general solution for C and K thus can be described by

$$C=\hat{C}(M,M^*)+B_1e^{\varphi_1 t}+B_2e^{\varphi_2 t}, \tag{17a}$$

$$K=\hat{K}(M,M^*)+\frac{\varphi_1-a_{11}}{a_{12}}B_1e^{\varphi_1 t}+\frac{\varphi_2-a_{11}}{a_{12}}B_2e^{\varphi_2 t}, \tag{17b}$$

where B_1 and B_2 are as yet undetermined coefficients. A graphical solution of the system is provided in Figure 1. From equation (12), both the $\dot{C}=0$ locus and $\dot{K}=0$ locus are upward sloping, and the $\dot{C}=0$ locus is steeper than the $\dot{K}=0$ locus due to $\Delta<0$. Furthermore, the SS curve and UU curve represent the stable and unstable branches, respectively. As indicated by the direction of arrows, the SS curve is upward sloping and steeper than the $\dot{K}=0$ locus but flatter than the $\dot{C}=0$ locus, while the UU curve is downward sloping.[5]

In next two sections, we will use the graphical apparatus like Figure 1 to illustrate the possible adjustment patterns of aggregate consumption and the aggregate capital stock in response to an anticipated permanently shock in domestic security spending (rising in M) and terrorist threats (rising in M^*).

[5] It is clear from equations (17a) and (17b) that $(\partial C/\partial K)\big|_{SS}=a_{12}/(\varphi_1-a_{11})>0$, $(\partial C/\partial K)\big|_{UU}=a_{12}/(a_{22}-\varphi_1)<0$, $(\partial C/\partial K)\big|_{SS}-(\partial C/\partial K)\big|_{\dot{C}=0}=a_{12}\varphi_1/a_{11}(\varphi_1-a_{11})<0$, and $(\partial C/\partial K)\big|_{SS}-(\partial C/\partial K)\big|_{\dot{K}=0}=-\varphi_1>0$.

3. Transitional Dynamics of an Anticipated Shock in Domestic Security Expansion

In this section, we want to discuss the effect of rising in domestic security spending on the evolution of the economy. We first discuss the impact of rising in domestic security spending. Assume that initially, the economy is in a steady state with $M = M_0$. Meanwhile, the public perfectly anticipates that the government will permanently raise security expenditure from M_0 to M_1 at $t = T$ in the future. It should be noted that $T = 0$ implies an unanticipated permanent shock in M. From equation (13) we have:

$$\left.\frac{\partial K}{\partial M}\right|_{\dot{C}=0} = -\frac{a_{13}}{a_{12}} > 0, \tag{18a}$$

$$\left.\frac{\partial K}{\partial M}\right|_{\dot{K}=0} = -\frac{a_{23}}{a_{22}} \gtrless 0; \quad \text{if } a_{23} \lessgtr 0. \tag{18a}$$

In response to a rise in M, the $\dot{C} = 0$ locus shifts rightward, while the $\dot{K} = 0$ curve may shift either rightward or leftward depending upon the sign of a_{23}. To trace the component of a_{23}, we find that a_{23} is positive (negative) if the lower in the property insurance premium in response to domestic security, $-\pi_M K$, is smaller or larger than one. Thus, in what follows two cases will be considered: (1) $-\pi_M K < 1$ and (2) $-\pi_M K > 1$.

(1) The $-\pi_M K < 1$ case

In Figure 2, the initial equilibrium, where $\dot{C} = 0(M_0)$ intersects $\dot{K} = 0(M_0)$, is established at E_0; the initial consumption and the stock of capital are $\hat{C}_0$ and $\hat{K}_0$ respectively. In response to an anticipated permanent rise in M, both $\dot{C} = 0(M_0)$ and $\dot{K} = 0(M_0)$ will shift rightward to $\dot{C} = 0(M_1)$ and $\dot{K} = 0(M_1)$. The new steady-state equilibrium is at point E_*, with C and K being $\hat{C}_1$ and $\hat{K}_1$ respectively. Moreover, the new steady-state consumption, $\hat{C}_1$ is less than $\hat{C}_0$, and the new steady-state capital stock, $\hat{K}_1$ is less than $\hat{K}_0$.[6]

Before proceeding to study the economy's dynamic adjustment, three points should be addressed. First, for expository convenience, in what follows 0^- and 0^+ denote the instant before and after the policy announcement, respectively, while T^- and T^+ denote the instant before and after the policy implementation, respectively. Second, during the dates between 0^+ and T^-, domestic security expenditure remains at its initial level M_0, and point E_0 should be treated as the reference point that governs the dynamic adjustment of C and K. Third, since the public knows that domestic security expenditure will increase from M_0 to M_1 at the moment of T^+, the transversality condition requires that the economy moves to a point on the convergent stable branch associated with M_1, $SS(M_1)$, at that instant of time.

Based on these considerations, as depicted in Figure 2, C will immediately fall from $\hat{C}_0$ to

[6] In fact, it easy infers from equations (15a) and (15b) to know that the new steady-state consumption and capital stock may be less or great than the initial equilibrium value. To save space, we only analyze the situation that both consumption and the capital stock is less than the initial value. When the new steady-state capital stock is large than the initial value, consumption will immediately fall , while the capital stock is fixed at initial value since it is predetermined at the instant of policy announcement. From time 0^+ to T^-, consumption continues to decrease and the capital stock continues to increase. After policy implement, both consumption and the capital stock continue to increase towards its new stationary equilibrium.

C_{0+}, while K is fixed at $\hat{K}_0$ since it is predetermined at the instant 0^+. As a consequence, the economy will instantaneously jump from point E_0 to a point like E_{0+} on impact. From 0^+ to T^-, as the arrows indicate, consumption continues to decrease while the stock of capital continues to accumulate, and the economy moves from E_{0+} to E_T. At time T^+, when domestic security expenditure is enacted, the economy exactly reaches point E_T on the convergent stable path $SS(M_1)$. Thereafter, from T^+ onwards, both C and K continue to decrease as the economy moves along the $SS(M_1)$ curve towards its stationary equilibrium E_*.

(2) The $-\pi_M K > 1$ case

The similar consideration the situation where $\pi_M K < -1$ that, in Figure 3, $\dot{C} = 0(M_0)$ shifts rightward to $\dot{C} = 0(M_1)$ while $\dot{K} = 0(M_0)$ shifts leftward to $\dot{K} = 0(M_1)$ in response to an increase in M. $\dot{C} = 0(M_1)$ intersects $\dot{K} = 0(M_1)$ at point E_*, with C and K being $\hat{C}_1$ and $\hat{K}_1$ respectively. Moreover, the new steady-state consumption and capital stock are large than initial values.

As depicted in Figure 3, two adjustment patterns are possibly present. We can draw a line connecting the initial steady state E_0 and new steady state E_*. This line is named the LL locus. As evident in Figure 3, the relative steepness between the LL schedule and the convergent branch $SS(M_1)$ is ambiguous. If the $SS(M_1)$ locus is steeper (flatter) than the LL line, namely $SS_1(M_1)$ ($SS_2(M_1)$), then at the instant of policy announcement, C will immediately fall (raise) from $\hat{C}_0$ to C_{0+} (C'_{0+}), while K is fixed at $\hat{K}_0$ since it is predetermined. Accordingly, the economy will instantaneously jump from point E_0 to a point like E_{0+} (E'_{0+}) on impact. From time 0^+ to T^-, as the arrows indicate, C continues to decrease (increase) and K continues to increase (decrease). At time T^+, as M increases, the economy exactly reaches point E_T (E'_T) on the convergent stable path $SS_1(M_1)$ ($SS_2(M_1)$). Subsequently, from T^+ onwards, both C and K continue to raise as the economy moves along the $SS_1(M_1)$ ($SS_2(M_1)$) curve towards its stationary equilibrium E_*.

4. Transitional Dynamics of an Anticipated Shock in Terrorist Threats

In this section we want to discuss the impact of anticipated rise in terrorist threats on macroeconomic dynamics. Assume that initially, the economy is in a steady state with $M^* = M_0^*$. Meanwhile, the public perfectly anticipates that the economy will suffer from a permanent rise in the terrorist threat from M_0^* to M_1^* at $t = T$ in the future. It should be noted that $T = 0$ implies an unanticipated permanent shock in M^*.

In Figure 4, the initial equilibrium, where $\dot{C} = 0(M_0^*)$ intersects $\dot{K} = 0(M_0^*)$, is established at E_0; the initial consumption and the stock of capital are $\hat{C}_0$ and $\hat{K}_0$ respectively. In response to an anticipated permanent rise in M^*, $\dot{C} = 0(M_0^*)$ shifts leftward to $\dot{C} = 0(M_1^*)$ and $\dot{K} = 0(M_0^*)$ shifts rightward to $\dot{K} = 0(M_1^*)$. The new steady-state equilibrium is at point E_*, with C and K being $\hat{C}_1$ and $\hat{K}_1$ respectively. Moreover, the new steady-state consumption and capital stock are less than their initial values.

Similar to the inference of Figure 3, in Figure 4, we can draw a line connecting the initial steady state E_0 and new steady state E_*. This line is named the LL locus. If the $SS(M_1^*)$ locus is flatter (steeper) than the LL line, namely $SS_1(M_1^*)$ ($SS_2(M_1^*)$, then at the instant of policy announcement, C will immediately fall (raise) from $\hat{C}_0$ to C_{0+} (C'_{0+}), while K is fixed at $\hat{K}_0$ since it is predetermined. Accordingly, the economy will instantaneously jump from point E_0 to a point like E_{0+} (E'_{0+}) on impact. From time 0^+ to T^-, as the arrows indicate, C continues to decrease (increase) and K continue to increase (decrease). At time T^+, as the terrorist threat has been implemented, the economy exactly reaches point E_T (E'_T) on the convergent stable path $SS_1(M_1^*)$ ($SS_2(M_1^*)$). Subsequently, from T^+ onwards, both C and K continue to fall as the economy moves along the $SS_1(M_1^*)$ ($SS_2(M_1^*)$) curve towards its stationary equilibrium E_*.

5. Concluding Remarks

In this paper, we incorporate both the nature of terrorism threats and domestic security programs into the Yarri (1965)-Blanchard (1985) model to examine the impact of terrorism threats and domestic security expenditures on macroeconomics. Base on our analysis, a permanent rise in domestic security expenditures have an ambiguous impact on steady state consumption and the capital stock. But a permanent rise in terrorism threats will always lower both the aggregate consumption level and the aggregate capital stock in the long run.

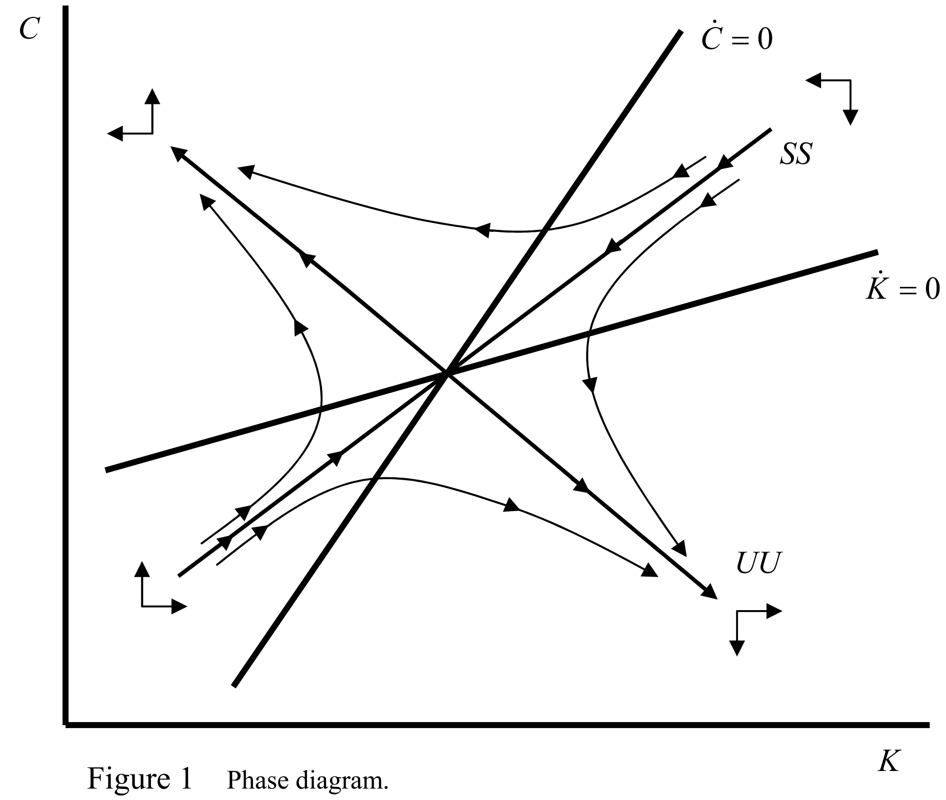

Figure 1 Phase diagram.

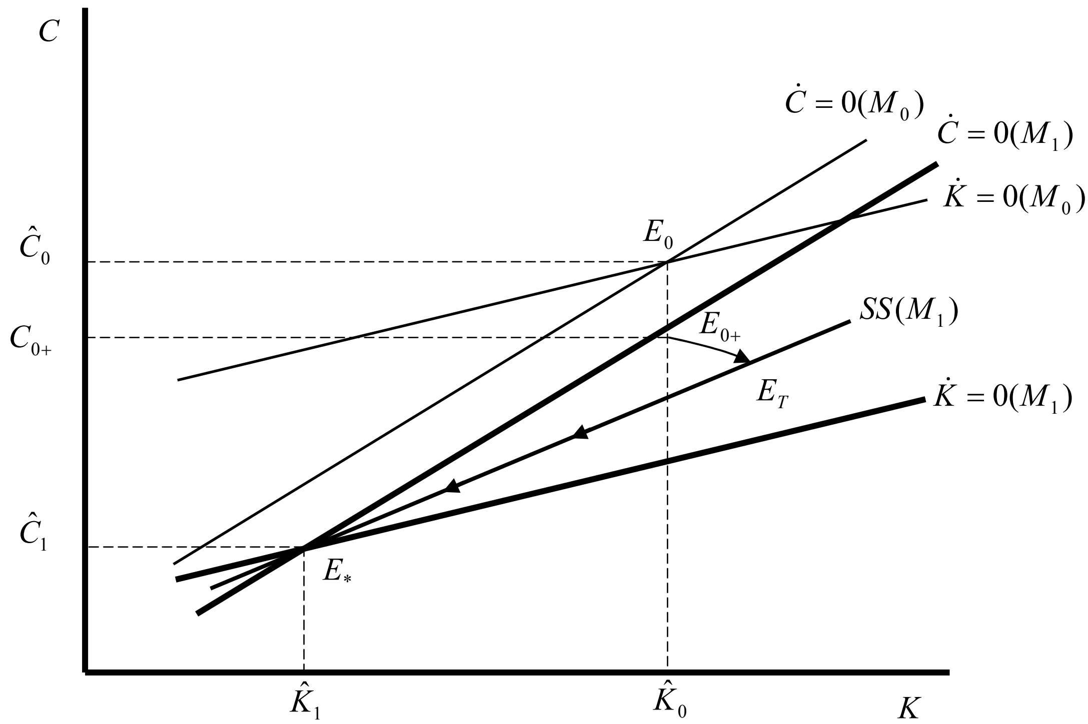

Figure 2 Transitional Dynamics of an Anticipated Shock in Domestic Security Expansion: The $-\pi_M K<1$ case

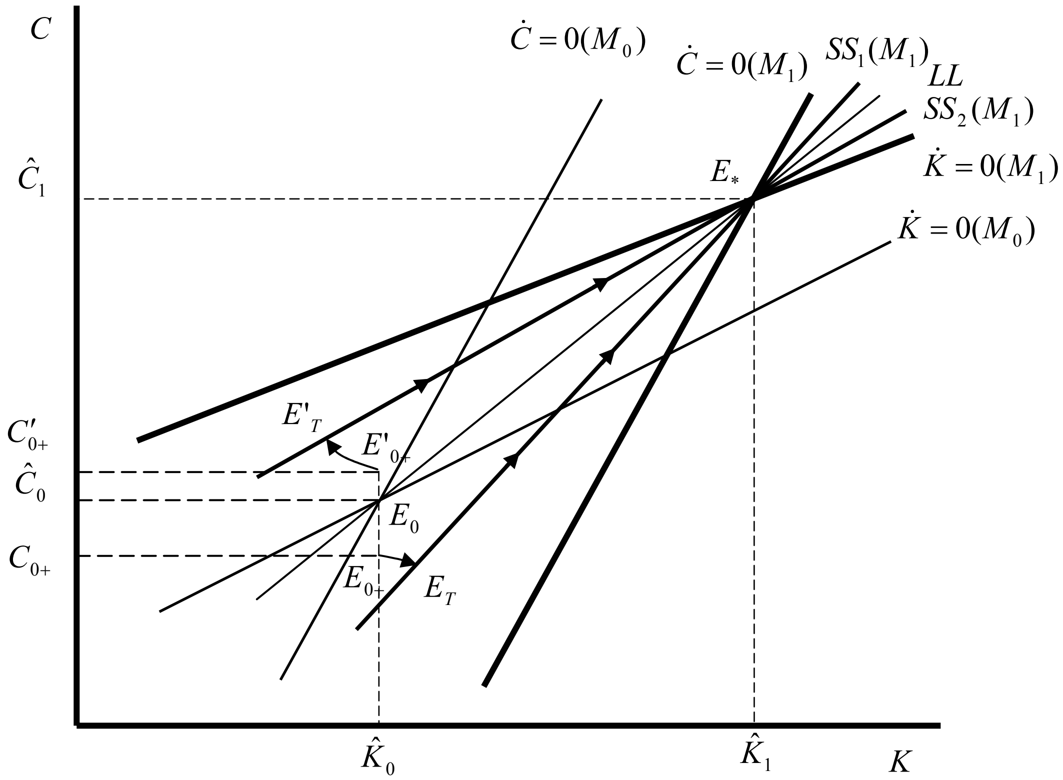

Figure 3 Transitional Dynamics of an Anticipated Shock in Domestic Security Expansion: The $-\pi_M K > 1$ case

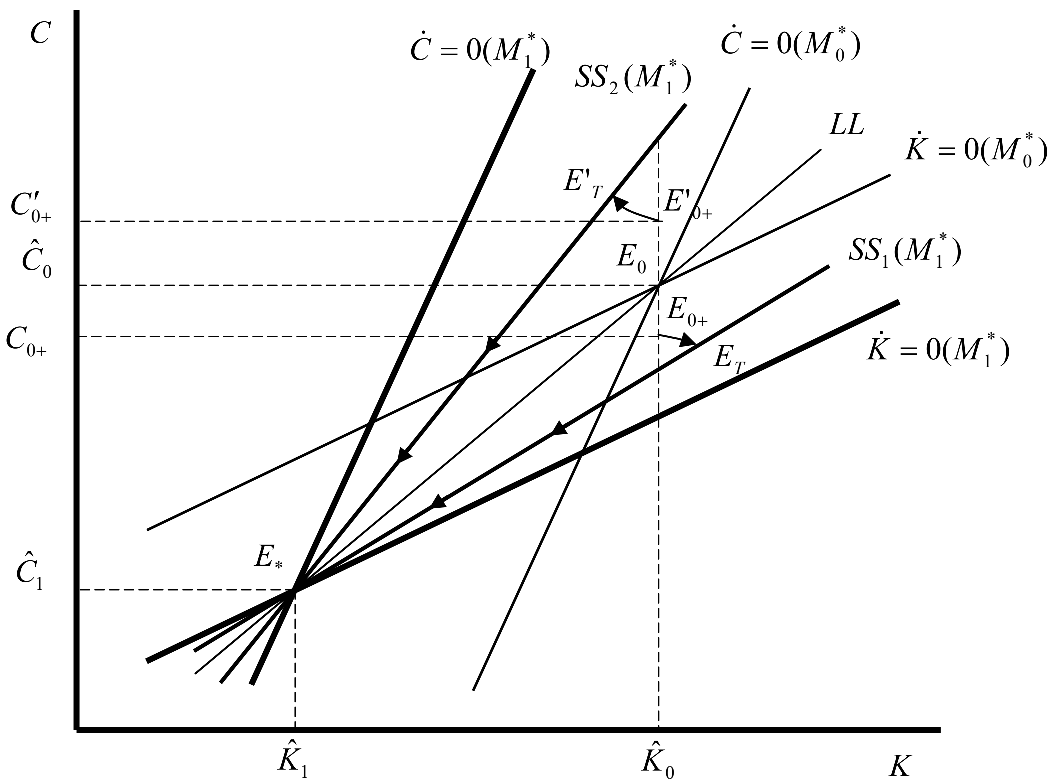

Figure 4 Transitional Dynamics of an Anticipated Shock in Terrorist Threats.

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計畫成果自評

1. 在執行計畫時，我們發現只要依計畫書的構想，當家計單位考量恐怖主義威脅所帶來的系統風險與政府安全措施所能規避掉的系統風險時，民眾的決策的確是會受到影響的。因此，經濟體系均衡的消費、產出與投資當然會受到影響。更重要的是，「預期」在經濟體系的確扮演著相當重要的角色，當私部門事先知道政策將改變的訊息時，他已經開始改變他的行為方式，造成總體經濟產生波動。由於既存文獻研究的焦點大多是放置在恐怖主義的行為是否理性、政府政策是否會影響恐怖主義發生與發生恐怖事件時，如何談判上。然而，關於恐怖主義威脅對於民眾與總體經濟影響的研究卻是空白的。是以，本研究的結果確實可以彌補既存文獻發展中的不足，確有其學術價值，也適合於發表於著名的國際學術期刊。

2. 本計畫的成果已經撰寫成學術論文，我們將聽取專家學者意見並稍做修正後，投稿國際學術期刊。