

A Study on College Financial System Vulnerability Propagation and Control

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Abstract

A system can not be absolutely perfect, and vulnerabilities in a system exist objectively and can not be avoided. Opportunism may cause behavior disorder of organization members, leading to self-interested behaviors. By establishing a differential kinetic model, this paper studies the spreading of vulnerabilities in college financial system, takes an in-depth analysis of its causes, characteristics and functional mechanism, and proposes mechanisms to effectively control college financial system vulnerability propagation.

Key words: College financial system; System vulnerability; Propagation; Control

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INTRODUCTION

System is like a net, however closely it's been woven, it has meshes. College financial system is like a net which regulates the economic operation of a college, and the closeness of the net is directly related to the level of its financial management and development of various undertakings. In daily college financial management, due to reimbursement staff's misunderstanding of national policies, information asymmetry and opportunism, there is a certain tendency for them to exploit the financial system to avoid control and make profit. These vulnerabilities

will continue to spread in the system by more and more people and become worse. In addition, the vulnerabilities will nourish the forces to oppose patching, leading to "institutional inertia" (People's Forum Editorial Department, 2011). Therefore, analyzing and controlling the propagation of vulnerabilities in college financial system has strong theoretical and practical significance.

1. AN ANALYSIS ON THE CAUSES AND CHARACTERISTICS OF COLLEGE FINANCIAL SYSTEM VULNERABILITY PROPAGATION

1.1 An Analysis on the Causes of College Financial System Vulnerability Propagation

(a) Self-interested behavior. Self-interested behavior means that members of an organization seek to maximize personal interests, whose premise is not to harm others' interests. For example, regarding the tax trap caused by year-end bonus, self-interested behavior will make people carry out reasonable personal tax planning.

(b) Opportunism and behavior disorder. Economics of transaction cost gives the assumption of opportunism. Williamson (1985) defined opportunism as "advancing one's interests at the expense of others", such as lying, stealing and cheating, etc. (Huang, 2011, p.45). In the exploitation of college financial system, opportunism more performs as a shrewd deception, including taking the initiative to lie, such as using false invoices, fabricating economic behaviors, etc.; It also includes being forced to lie, such as plagiarizing research projects, etc.. Opportunism will inevitably leads to deviation between individual rationality and organizational rationality, so opportunism is the root cause of personal behavior disorder.

(c) Limited rationality and behavior failure (Li, 2007). In a limited time and space, human cognitive capacity

is limited, and this limitation leads to the inevitability of behavior failure of organizational members. For example, due to information asymmetry, differences in professional judgment and personal experience, an auditor may fail to find the behavior using loopholes in the system to make profits.

(d) Institutional inertia. If more and more people take advantage of loopholes in the financial system for their own interests, special considerations will gradually become routine matters, and institutional vulnerabilities will become the tool for some people to make profits. Driven by the interests, the voices opposing vulnerability patching in the system will become stronger, and the cost to repair the vulnerabilities will be greater.

Regarding the causes of college financial system vulnerability propagation, it can be seen that the "vulnerability" caused by self-interested behavior is mainly due to unreasonable system design and possibility of arbitrage space; Opportunism brings additional benefits to individuals, which is the root for vulnerabilities in the system to be spread; Limited rationality makes system implementers fail to prevent misconducts, which provides a possibility for the spread of vulnerabilities; Institutional inertia provides a hotbed for vulnerabilities to accelerate spreading.

2.2 An Analysis on the Characteristics of College Financial System Vulnerability Propagation

2.2.1 Periodicity

College financial vulnerability spreading often experiences a process of formation, peaking and declining. In college daily financial management, we find that when a profit-seeking behavior based on institutional vulnerability occurs, it will continue to grow in a short time and won't be subsided until specific measures have been taken.

2.2.2 Complexity

Individual risk preference, the moral quality level, profit-driven difference lead to the complexity of financial system vulnerability spreading.

2.2.3 Heterogeneity

That means that different loopholes in the system will show different propagation trends. Since college financial system has been constituted based on national laws and regulations, if national laws and regulations do not change, college financial system shall not be conflict with them. In this background, the spreading of some loopholes in the system will continue to extend without control, such as personal tax planning driven by self-interested behavior. However, some loophole spreading show a periodic characteristics.

3. DIFFERENTIAL DYNAMIC MODELS OF VULNERABILITY PROPAGATION IN COLLEGE FINANCIAL SYSTEM

3.1 Basic Assumption

In a spreading period of financial system vulnerability, if the total number of college employees N is unchanged,

without regard to factors such as the employee recruitment and leaving, we divide the employees at the moment t into four categories: Category S represents the employees whose risk preferences to take advantage of financial vulnerabilities are neutral; Category I represents the disseminators of financial system vulnerabilities; Category R represents the employees who are found to spread financial system vulnerabilities and are removed after being educated. After removal they no longer spread vulnerabilities nor participate in spreading; Category M represents the employees immune to financial system vulnerabilities.

(a) The average number of people that a disseminator can contact effectively per day is a constant λ .

(b) The proportion of employee number that change from Category I to Category R per day through education and financial audit to Category I is a constant μ . We set $\theta = \lambda/\mu$.

(c) $s(t)$, $i(t)$, $r(t)$ and $m(t)$ represent the proportions of the four categories in the total at the moment t respectively, and $s(t) + i(t) + r(t) + m(t) = 1$.

(d) According to the definitions of Category S and Category I , we set $s(0) = s_0$, and $i(0) = i_0$.

According to the definition of Category R , we set $r(0) = 0$.

According to the definition of Category M , we know $m(t) = m(0) = m_0$.

3.2 Modeling

As per the assumption (1), each disseminator can change $\lambda s(t)$ from Category S to Category I per day. Since the number of disseminators is $Ni(t)$, there will be a total of $\lambda Ns(t)i(t)$ changed from Category S to Category I per day; As per the assumption (2), we know that $\mu Ni(t)$ represents the employees changed from Category I to Category R per day. In order to get the net increase of Category I in the period t to $t + \Delta t$, we can describe with Equation 1:

$$N(i(t + \Delta t) - i(t)) = \lambda Ns(t)i(t)\Delta t - \mu Ni(t)\Delta t \quad (1)$$

We divide Equation 1 by $N\Delta t$ on both sides to give Equation 2:

$$\frac{i(t + \Delta t) - i(t)}{\Delta t} = \lambda s(t)i(t) - \mu i(t) \quad (2)$$

When $\Delta t \rightarrow 0$, based on Equation 2 we will get Equation 3:

$$\frac{di(t)}{dt} = \lambda s(t)i(t) - \mu i(t) \quad (3)$$

Similarly, based on the assumption (3) we will get the differential equation describing Category R changed to be

Category I within the period Δt : $\frac{dr(t)}{dt} = \mu i(t)$.

Therefore we can build a model as set out in Equations 4:

$$\begin{cases} \frac{dr(t)}{dt} = \mu i(t) \\ \frac{di(t)}{dt} = \lambda s(t)i(t) - \mu i(t) \\ \frac{ds(t)}{dt} = -\lambda s(t)i(t) \\ \frac{dm(t)}{dt} = 0 \\ s(t) + i(t) + r(t) = 1 - m_0 \\ r(0) = 0, i(0) = i_0, s(0) = s_0 \end{cases} \quad (4)$$

3.3 Model Solution and Variables' Interpretation

According to differential calculus knowledge we know that there is no analytical solution for model (Jin et al., 2014). By using software MATLAB, we set the initial conditions $r(0) = 0, i_0 = 0.2, s_0 = 0.6$ and $m_0 = 0.2$. We can draw a figure of the relationship between table solution and threshold value regarding college financial system vulnerability spreading to describe the change of the categories' proportions over time, as shown in Figure 1.

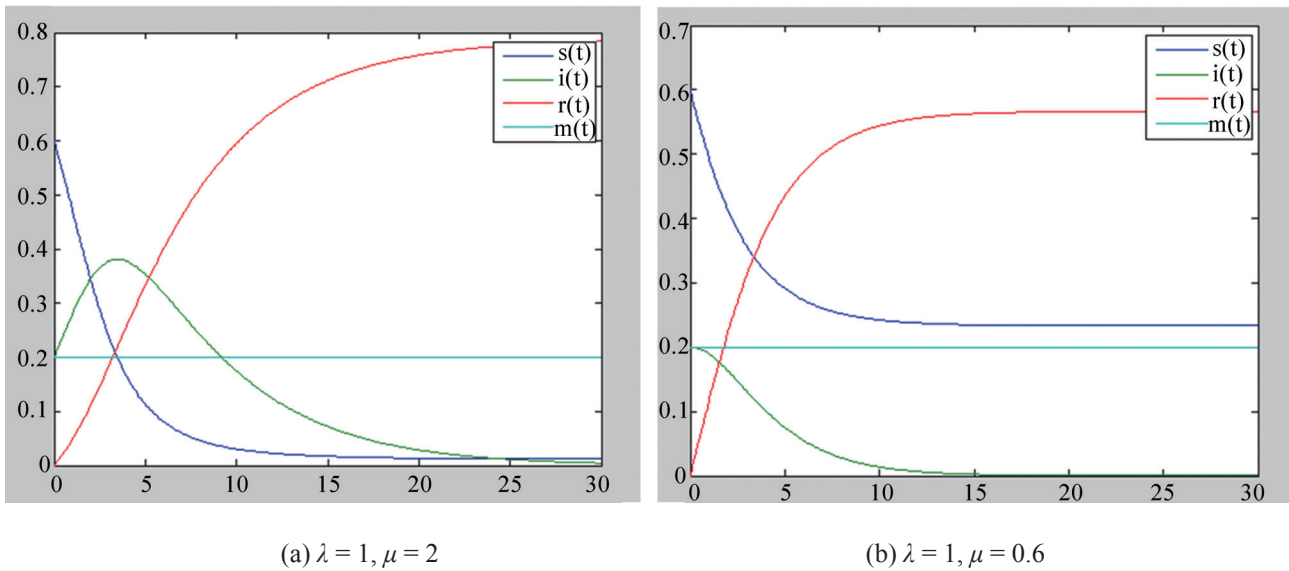


Figure 1
Table Solution and Threshold Value for College Financial System Vulnerability Spreading

From the phase trajectory method as set out in [4] we can find that: When $s_0 > \mu/\lambda = 1/\theta$, $i(t)$ will be firstly increased and then tends to be 0. When $s(t) = 1/\theta$, $i(t)$ reaches the maximum value. As shown in Figure 1 (a), when $s(t) = 0.2$, $i(t)$ reaches the maximum value. When $s_0 \leq \mu/\lambda = 1/\theta$, $i(t)$ monotonously decreases and tends to be 0 as shown in Figure 1 (b). Therefore, $1/\theta$ is a threshold value. Namely, when $s_0 \leq 1/\theta$, college financial system vulnerabilities will not be spread; When $s_0 > 1/\theta$, college financial vulnerabilities will be spread.

4. INSTITUTIONAL ARRANGEMENTS TO CONTROL THE SPREADING OF COLLEGE FINANCIAL SYSTEM VULNERABILITIES

By establishing the differential kinetic model, this paper studies the propagation process of college financial system vulnerabilities, takes an in-depth analysis of its causes,

characteristics and functional mechanism, and makes a threshold value of the spreading. Through the analysis of the threshold value, we believe that in order to control the spreading of college financial system vulnerabilities, four aspects of institutional arrangements need to be done.

(a) We should strengthen professional ethics education to college teachers. By strengthening the education teachers can discern honor and disgrace, and set examples of integrity and honesty in all aspects. This aims to increase the proportion of m_0 and decrease λ . In the case that m_0 is large, even if there are vulnerabilities, the peak $i(t)$ will be small and its impact will be minimal. In addition, it also helps reduce λ and make people consciously resist taking advantage of "vulnerabilities".

(b) We should strengthen propaganda of financial laws and financial management regulations. By doing this, information symmetry can be achieved, the majority of employees can dissipate misunderstandings and consciously abide by financial regulations. This aims to increase the proportion of r_0 and decrease λ .

For example, carry out a variety of negative example education to implement mass immunization. If we increase the proportion of r_0 , since $s_0 = 1 - m_0 - r_0 - i_0$, s_0 can be decreased, and $s_0 \leq 1/\theta$ can be achieved, so that the spreading of college financial system vulnerabilities can be effectively controlled.

(c) We should strengthen the construction of financial teams, and constantly improve the professional judgment and personal experience of financial officers. Through training and exchanges, financial knowledge and information can be shared, which helps overcome the limited rationality of financial officers and strengthen financial audit and supervision. This aims to increase the parameter μ , so that $s_0 \leq 1/\theta$ can be achieved, which helps control the spreading of college financial vulnerabilities within a reasonable scope.

(d) We should strengthen the revision of college financial management regulations. Any regulation has

been developed under a specific circumstance, so we should promptly revise regulations to have a good match for the actual working conditions. Through revision and introducing appropriate interpretations, we can define vague economic behaviors and make them act in the sunshine.

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