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Toward a Unified Theory of Economic Reform

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Abstract

The dichotomy in the economics of transition literature with regard to the reform speed (Gradualist vs Radical Approach) and reform strategy (incremental reform vs structural reform) fails to capture the essence of the transitional process of a transitional economy that was ever under the control of planned economic system. In this paper, we construct a system dynamics model to provide a unified theoretical framework to illustrate that reform speed and reform strategy are inherently intertwined. We propose 4 optimal reforming combinations between reform speed and reform strategy to track the transitional trajectories of different transitional economies since 1980s. These 4 optimal reforming combinations are: (1) Incremental reform in radical speed. (2) Incremental reform in gradualist speed. (3) Structural reform in radical speed. (4) Structural reform in gradualist speed. In this paper, we demonstrate that a transitional economy would adopt one of the aforementioned 4 optimal reforming combination if and only if it minimizes the reforming cost incurred during the shock period of radical reform as well as the dual track period of gradualist reforms. Several factors in our model affecting these 4 optimal reforming combinations are also discussed. These factors include the spillover effect (both vertical and horizontal) of a newly established reforming promotion sector on other old sectors in a transitional economy, the endogenous reform damping coefficient determined by one transitional economy's initial conditions and the reform damping coefficient determined by the dual track system during the gradualist reform process.

Keywords: Reform speed; Reform Strategy; Gradualist speed; Radical speed;; Incremental reform; Structural reform; System Dynamics; optimal reforming combination, spillove effect, Damping coefficient.

JEL classification: J41, H53, P26.

Introduction

In the literature of economics of transition, two different views have been developed on how a socialist economy should transform from planned economy to market economy to attain the best economic performance during the transition.¹ One view is that the transitional process would be effective if and only if

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¹ In this paper, the "transition" is defined as the transitional process of one country from planned economy to market economy. However, some transitional economists hold different definitions. For instance, Hungarian economist

János Kornai(2000) accounts "transition" as one country's transformation from socialism to capitalism and contends that this transformation is dependent upon whether the socialist economic and political systems are replaced by the capitalist economic and political systems. In other words, a complete "transition" means both the planned economy and the Leninist one party leadership system have been transformed to a market economy and multi-parties system. Jeffery Sachs, Hu and Yang (2000) define "transition" as the convergent process of post-socialist countries' systems to the global economy rules under WTO regulations. In their paper, the implementation of constitutionalism is a significant criterion for assessing one socialist country's completeness of its transitional task. Without undergoing the constitutionalist transition, one socialist country

a transitional economy adopts the big-bang mode or one package of reform in a very radical approach. (Lipton and Sachs,1990; Ericson,1991;Blanchard,1996; Wolf,1991. Williamson, 1989; Lardy,1998;Woo,1999.etc) The radical reform was highly valued among economic theorists as well as Eastern European and Soviet Union's policy makers in early 1980s because it provides the clear policy aims that are compatible with the rationalist approaches of neo-classical economics.

In general, economic policies derived from the radical reform mode mainly include the following four aspects: (1) Implementation of price liberalization and abolishment of government subsidy in short time (2)achieving a balanced budget and implementation of tight monetary policy (3) Accelerating the process of international trade integration, removing government's control of foreign exchange by lowering tariff (4) Massive privatization of state-owned enterprises. It could be well argued that the effectiveness of the radical reform in transitional period is determined by whether the reform could reduce the proportions of old sectors in the economy and transform these old sectors into new private sectors.

Another point of view is that radical reform mode will dramatically destroy the information structure of the original economy and inevitably damage the vested interest group of a society, therefore, resulting in a long shock period in reform process. (Lin, etc. 1994). Hence, it is more effective for a transitional economy to adopt the gradualist mode with the partial economic reforms. The cores of the gradualist reform are based on the prerequisite of not damaging the old economic sectors. In addition, gradualist transitional mode is characterized with the pilot reforming method, which is to establish the new sectors in the margin of old ones and finally transit into market economy in a smooth manner.

The sharp contrast between China's rapid economic growth by adopting the gradualist reforming approach since its reform and opening started at 1978 and the unprecedented recession in Russia and Eastern Europe after their big-bang mode reforms have raised a very important question regarding the superiority of radical reform. Based on such paradox, Several economists began to advocate that gradualist approach could enable a transitional economy to transit into the Market economy more effectively. (L.Lau,Y.Qian&G.Roland,1997;Naughton,1994a,b;Rawski,1996;Jerferson,G.Rawski,1994, Murrell,1990;McMillian and Naughton,1992etc) .

The advocacy of gradualist reform approach largely lies in the fact of the incremental reform nature shown in the gradual transitional process in countries like China, Vietnam, etc.(Fan, 1993; Lin et al, 1994; Sheng, 1992; Naughton, 1994b). The biggest feature of incremental reform is the formation of dual economy and two sectorial economic structure, namely, dual-track system. Just as Zhang and Yi put (1994), take China as an example, the reform strategy of incremental reform in transitional process become the notable characteristic in many reform fields, such as price system reform, foreign exchange market reform, labor force market reform and ownership system reform, etc. Naughton (1994b) argues that the

could not have finished the real transition process. In this paper, these different definitions will not be value-judged. For the further details of the definition on "transition", please refer to Kornai,Janos (2000), "what the change of System from Socialism to Capitalism , Does and Does not mean", Journal of Economic Perspectives, volume 14,Number 1,Winter 2000, P27-P42 and Jeffery Sachs, Wing Thye Woo, and Xiaokai Yang, "Economic Reforms and Constitutional Transition", Annuals of Economics and Finance, Vol.1,pp260-274,2000.

formation of dual system has enabled Chinese economy to get growing out of plan and further push the reform of old sectors, especially the reform of state-owned sectors. Contrarily, compared with the incremental reform strategy adopted in countries like China and Vietnam, many mainstream economists believe that Eastern Europe and Russia have used a structural reform strategy. (Wu, 2003; Kornai, J. 1990).

The growth of non- state owned enterprises out of the planned system as well as the establishment of new private sectors are not main reforming packages in structural reform. In contrast, privatization of state-owned enterprises and price liberalization are considered as the first priority during the structural reform process. Lin et al(1994) consider that there are two major shortcomings in structural reform: firstly, Removing the proportions of old sectors in the economy will inevitably damage some vested interest groups. Therefore, this type of reform strategy is of “Non-Pareto Improvement” or “Non-Kaldor Improvement”. Secondly, although in structural reform it tries to transfer resource from low productivity sectors to high productivity sectors, while it usually neglects reform cost. Since there is some certain reform cost such as the shock period cost resulted from the shock therapy for resources being transferred from one usage to another. Thus, economic growth during the structural reform process is inevitably shown as either “J” curve or worse “L” curve trajectory.

Neither the discussions of the respective superiority of distinct reform speeds (radical reform and gradualist reform) , nor the analysis of advantages or disadvantages of specific reform strategies (increment or stock) has captured the essence of dynamics of economic performance of post-socialist countries since 1980s. For example, if gradualist approach has its conclusive superiority, it cannot explain why the adoption of gradualist reform (1985-1991) by Soviet Union and Eastern Europe countries failed. Moreover, suppose incremental reform strategy is more effective than structural reform strategy, it is hard to explain why China has achieved great success in some structural reform fields, such as ownership system reform of small and medium sized state-owned enterprises.² Some other economists argue that it is not reasonable to describe all the characteristics of Chinese reforms as gradualist reforms. Some reforms such as “household contract responsibility system”, “price reform in five years” and “the ownership system reform in small and medium sized state-owned enterprises” are quite radical. (Wu, 1994,2003). Lin even holds that such kind of gradualist reforms could be regarded as mini bang. (Lin, et al).³

If the arguments presented by these economists are justified, then it is even more difficult to explain why China has achieved success in its radical reform while Soviet Union and Eastern Europe have failed theirs by using the present transitional economic theories. In this paper, it argues the current literature has not

² According to the research of professor Wu (2003), around 1995, state-owned enterprises reform \began to show a strategic progress, with the main indicator as the proposal of policy “to invigorate large enterprises while relaxing over small ones”, which means government does not privatize or partially privatize the ownership system of the large state-owned enterprises that are relevant to national lifelihood, but privatizes the small or medium sized ones through merger, contracting, selling or bankruptcy, etc. For more information about the reform of Chinese state-owned enterprises, please refer to Wu, 2003, “Contemporary Chinese Economic Reform”, PP177-PP180, Shanghai Far-east Press.

³Price reforms in five years’ is a package of reforms which was firstly initiated by Premier Minister ZiYang Zhao since 1984. Its policy aim is to replace the planned price track with the market track within 5 years. The whole reform lasted for about 5 and 6 years and until 1990s, all the price planned tracks had been replaced by the market price system.

investigated reform speed and reform strategy in a unified analytic framework which leads to the inconsistency between literature and the realities.

It is demonstrated in this paper that the effectiveness of reform during the transition and the cost minimization in radical reform and the dual-track system in gradualist reform are determined by whether the country has adopted the optimal combination of reform speed and reform strategy. This optimal combination is decided by the optimal benefit diffusion coefficient which describes the sectoral network effects within a transitional economy. The optimal propagation mechanism within the economy is endogenously determined by the reform damping coefficient with distinct reform speeds (economic endogenous reform damping coefficient in radical reform and the dual-track system economic reform damping coefficient in gradualist reform). It is shown from the analysis in this paper that, with distinct reform speeds, the larger the optimal diffusion coefficient is, the better one country to implement incremental reform will be. Otherwise, it is better to implement structural reform. In this paper, four combinations between reform speeds and specific reform strategies are pointed out as follows:

Specific reform strategy

reform speed		Specific reform strategy	
		Structural	Incremental
Radical		Structural reform in radical speed	Incremental reform in radical speed
Gradual		Structural reform in gradualist speed	Incremental reform in gradualist speed

In this paper, the four different combinations between reform speeds and specific reform strategies are defined as

Definition 1 (The incremental reform in radical speed):

Rapid establishment of new upstream economic organizations with non-state owned ownership structure (such as non-state-owned sectors or other de novo firms) out of the traditional planned economy system and provide key inputs for the downstream old sectors such as state-owned enterprises. However, the state's subsidy to the state-sectors is small and state sectors would be vertically integrated by these de novo firms very quickly.

Definition 2 (The structural reform in radical speed):

Privatization of state-owned enterprises in order to reduce the state sectors' proportion in the economy. Meanwhile, the price control is removed. The state does not take the initiatives of the growth of

non-state sectors out of the old planned systems.

Definition 3 (The incremental reform in gradualist speed):

The first type of the incremental reform in gradualist speed is about the establishment of new upstream economic organizations (such as non-state-owned enterprises) out of the traditional planned economy and provide the key inputs for the downstream old sectors such as state-owned enterprises.⁴ The state has high level of subsidy to the original state sectors so the dual track system would persist in a long time horizon.

Definition 4 (Structural reform in gradualist speed)

Incremental reform in gradualist speed would reinforce back the structural reform within the state sectors. This is to say there exists the establishment of a new reform promotion sector that is not vertically-linked but within the same industry as old sectors. Moreover, there exists For instance, the advancement of township enterprises has increased competitions and hence forced state-owned enterprises to adopt a range of reforms for efficiency improvement such as replacement of profit by tax, enterprise contract system and shareholding system reforms.⁵ The other example is the dual track price system. As the growth of market price track as an incremental reform in gradualist speed, the planned price track would be automatically replaced.

The rest part of this paper will be arranged as follows: Part two is the literature review. Part three is the solving of the model. This model explains why the optimal combination between reform speed and specific reform strategy could greatly lower the shock period cost in radical reform and the dual-track system cost in gradualist reform. The policy implication of this model and conclusive discussions are presented in part four. The final remark is in part five.

Main text

2. Literature review

2.1 Literature review of the radical reform speed

The failure of partial market reform in Soviet Union and Eastern Europe in the late 1980s is the earliest examples for the arguments supporting radical reform. Those arguments hold the view that partial market-oriented reform could not enable market to play a dominant role in resource allocation. Therefore, only through the shock therapy by which whole system in the traditional planned economy is abandoned, and through price liberalization and state-owned enterprises privatization , the economy would be

⁴ For example, state-owned enterprise could use its resources to produce and trade according to market price after completing the production task assigned by government. The most typical example is the introduction of dual-track price system.

⁵ The analysis of “the reform out of present system” in Sheng’s paper (1996) is adopted in the definition of incremental reform in this paper. Sheng thinks incremental reform is different from the reform out of the present system. It is assumed in this paper that the incremental reform in radical speed does not include the dual-track system, the definition of incremental reform in radical speed is therefore consistent with Sheng’s definition of “the reform out of the present system”. For the further details, please refer to Sheng, 1996, “On the Study of Chinese Economy Transitional Process”, “Economic Research Journal”, the first volume.

transformed into a complete free market economic system (Kornai,1990; Ericson,1991; Blanchard,1991;Nolan,1992;Liton and Sachs,1990,etc.).

The theoretical explanation for why partial and gradualist reform could not yield better economic performance could be found in some transitional economic literature. For example, K.Morphy,A Shleifer and R.Vishny (1992) demonstrate that some partial reform measures, such as the market-track price in a dual-track price system, will distort the price planned by government. Hence resource allocation will be distorted inevitably if price control is not loosened totally. Ericson(1991) has demonstrated why radical reform is necessary based on the inherent characteristics of Soviet Union's planned economy system. He has expounded the characteristics of Soviet Union's planned economy system from nine aspects in which they are interdependent. Ericson has concluded that from this point of view, that partial or gradualist reform could not thoroughly substitute the original interrelated systematic elements in planned economy. So the radical reform is the only solution to the rapid establishment of free market system.⁶

Nolan(1992) listed four specific policy measures for radical reform, including (1) Close down state-owned sectors in large scale to establish the real private ownership to achieve the rapid economic growth through small-medium private enterprises (2) Make the market demand and supply reflect the optimal resource allocation through complete price liberalization. (3) Fast policy implementation in the short term to make the new non-state sectors establish rapidly. And the faster, the better. (4) The integration with world economy by removing the regulation over foreign exchanges and trade.

In addition to the Nolan(1992)'s discussion on the specific policy proposals on radical reforms , Sachs(1990) has also come up with the detailed policy suggestions about shock therapy. (1) Adopt the tight monetary policy by controlling the loan scale of the whole society and reduce the financial subsidy and fiscal deficit to constrain the aggregate demand of economy as well as to contain inflation through eliminating the gap between aggregate demand and aggregate supply. (2) Complete price liberalization. Price ought to be determined by market demand and supply. (3) Promote the development of free trade system by liberalizing currency exchanges and removing the control over trade. (4) Establish a market structure with perfect competition through breaking the industry monopoly by state-owned enterprises and eliminating the restrictions on private sectors. (5)Privatize state-owned enterprises in large scale in order to establish a mixed market economy mode based on the private ownership system. It could be concluded that the specific policy suggestions proposed by Sachs are composed of three aspects: Stabilization of macro reform, economy liberalization and privatization. These three aspects make up a complete policy system and policy purpose for shock therapy.

⁶ Ericson(1991) has listed nine systematic elements to describe the characteristics of Soviet Union's planned economy system, including (1) the resolving of decision and conflicts is dominated by an authoritarian hierarchical structure. (2)the production and distribution of goods are finished by a highly centralized planned system. (3) Resource could be mobilized in an all around manner through a centralized planned system. (4) Strict planned ration exist in the economy.(5) Strict price control (6) the system is lack of response capability and no real currency exist. (7) No adequate substitution of the already existing economic relationships. (8) The economic performance evaluation is totally determined by superior sectors. (9) It is lack of an effective incentive structure in micro aspect. Citation from Ericson,R.,1991, "The classical Soviet-Type Economy: Nature of the system and implication for reform", journal of Economic Perspective ,vol5,no.4.

If the features of radical reform are analyzed from the perspective of epistemology, it could be argued that the shock therapy reform method is based on the constructive rationalism in neo-classical economics.⁷ This kind of epistemology pays great attention to deduction and induction as well as logic reasoning but neglects empirical judgment. What is more, such epistemology is usually associated with some ultimate aims. Just as Zhang (1997) argued that radical reform regards its ultimate aim (market economy with free competition) as the perfect frame of reference. With such reform speed, the pursuit of transformation to a free-market economy at the highest speed is the ultimate aim. Anything that is inconsistent with this aim, such as dual-track system, should be abandoned, even though it is beneficial to the improvement of economic efficiency.

It could be concluded that this epistemology is the philosophical foundation of the political ruling ideas for the leaders in Russia and Eastern Europe to adopt the radical reforms. These leaders have an optimal blueprint (free-market economy mode) about their reform from the very beginning. As long as the specific reform aims required by this blueprint are achieved, the whole reform will be deemed as a success.

2.2 Literature review of the gradualist reforms

The current literature on gradualist reforms mainly focuses on two aspects. One is to discuss implementation of gradualist reforms from the perspective of the calculation of reform cost and benefit. (Lin et al, 1994; Fan, 1993; Dewatripont and Roland, 1992, etc.) The other lies in the aspect of epistemology. (McMillan and Naughton, 1992; Murrell, 1990).

Through the cost-benefit analysis of gradualist reforms, which were adopted in China, Lin et al (1994) argue that since the gradualist reform has the four major advantages including increasing total social output, incremental reform, pilot promotion and non-radicalization, it is thus endowed with the nature of Pareto improvement.

Firstly, the reform could continuously expand total resource amount, and hence the allocated quota of resource within each type of interest group will be increased. Thus, the reform resistance from the will-be-harmed interest groups will be decreased in order that the cost of reform could be minimized. Secondly, some incremental reform measures, such as the emergence of township enterprises and the implementation of dual-track system, enables the sectors that were under the oppression by heavy industries during the era of planned economy but with comparative advantages of Chinese factor endowment structure to get huge development. This, on one hand, increases the benefits of new sectors (such as the functions of market-track and township enterprises); on the other hand, once the benefit is large enough to offset the loss of the harmed vested interest groups, this type of reform will have the nature of Pareto improvement.

According to Zhang and Yi (1994), dual-track system also benefited original vested interest groups, such as government bureaucracy, which will cause more bureaucratic officials to support the reform. Likewise, Fan (1993) finds that as long as the economic benefit such as escalating employment level caused by the

⁷ Hayek is the first one who introduced the concept of "constructive rationalism". Part of the reasons for him to point out this concept is to criticize the increasing emphasis on and wrong use of deduction and induction as well as the logic reasoning in neoclassic economics. Certainly, there are some other reasons such as criticizing the feasibility of planned economy from the epistemological point of view.

new sectors is high enough, different social groups will become less dependent on old sectors and finally the reform progress will be proceeded with a minimum resistance. Similarly, Dewatripoint and Roland (1992) pointed out, when the compensation cost for present political restrictions is larger than the allocation gains of radical reform, gradualist reform is more feasible than radical reform.

In general, gradualist reforms with the feature of pilot promotion have three advantageous factors. Owing to these three factors, the net benefit of the reform could be maximized. These three advantageous factors are (1) reform based on the partial and pilot features could disperse the cost of trial and error so as to avoid the high reform risk resulted from policy makers' information constraint during the decision making process. (2) when the pilot reform and incremental reform are bundled together, the information about which type of reform is most beneficial could be also obtained. (3) It creates a better environment for market growth and development. Fourth, non-radical reform could avoid large scale reform shock and resource wasting because radical reform will be bound to damage some social groups' vested interest and hence increase reform resistance and cost.⁸

In the aspect of the incremental feature of gradualist reforms, it is a well-known fact that dual-track system is one of the most notable characteristics. Many economists think the adoption of dual-track system especially the dual-track price system could enable gradualist reform to maximize the reform benefit during transitional period. (Naughton,1994b; Chen, Jefferson & Singh, 1992;Mckinnon,1994; Byrd,1987,1988;Hallagan and Zhang,1995,etc) Chen, Jefferson &Singh(1992) pinpoint that there are two major advantages for the adoption of dual-track price system. (1) After completing the production assigned by planned target, relevant sectors could trade the rest of production in market, which could optimize resource allocation. (2) it could lower economic reform risk as the introduction of market track has paved the way for the ensuing price reform and enterprise reform. Mckinnon(1994) also claimed that as the price dual-track system was introduced within Chinese state-owned sectors' in early period of reform , it could enable China to avoid the risk of inflation tax.

Although dual-track system, such as price dual-track system, is one of the important reasons for the success of gradualist reform in China, some other economists are skeptical about the absolute merits of it. If price dual-track system, as an institutional arrangement, could enhance reform benefit, then why gradualist reforms with the use of dual-track price system adopted by Soviet Union and Eastern Europe in late 1980s fail to achieve rapid economic growth.

Some economists responded such paradox from the perspective of different types of price dual-track systems that were implemented in China, Soviet Union and Eastern Europe. Since China has adopted the price dual-track system under the restriction of planned quota, traditional planned contract must be fulfilled in state-owned sectors continually. The production within the planned requirement is traded at a relatively lower planned price while the rest of the production could be traded at a relatively higher market price between state-owned producers and state-owned buyers as well as non-state-owned buyers.

⁸ For instance, Fan(1993) makes a point that reform cost is made up of implementation cost and friction cost. Although gradual reform has higher implementation cost, friction cost is nevertheless proportional to reform speed, meaning the more radical the reform is, the higher friction cost resulted from reform resistance will be, and hence the higher degree of the reform resistance will be.

(Byrd,1987,1988; Hallagan and Zhang,1995.) However, the price dual-track system used in Soviet Union and Eastern Europe was not under quota restriction. The biggest problem of their price dual-track system was, without the restriction of planned quota, the original state-owned sector's planned contract was barely fulfilled, which made state-owned sectors get the largest free hand in enterprise production. However, some state-owned enterprises, especially the heavy industries were still under strict price control. Therefore, on one hand, state-owned sectors did not fulfill the planned quota contract; On the other hand, being affected by price control, some important state-owned sectors barely got the supply of important raw materials, which led to huge supply dispersion. (Zhang, 1997.) The huge cost resulted from this supply dispersion is accounted as one of the most important fundamental causes for the failure of gradualist reform in Soviet Union and Eastern Europe(1985-1991). (Murphy,1992)

The literature discussing the performance of gradualist reform from the epistemological perspective is mainly consisted of two theoretical foundations. One is evolutionary economics. (Nelson and Winter,1982; Schumpeter,1950.)The other is the tradition of conservative political philosophy. (Burke,1970;Popper,1971; Hayek, 1967) These two theories share a common epistemology which is the appreciation for evolutionary rationalism and the criticism for constructional rationalism. According to these two theories, it is argued that owing to the limited rationality, human beings could not acquire all the information about social and economic system. Therefore, during the reform process, planners also face the problems of limited information. Due to this reason, planners cannot design an optimal blueprint and optimal aim for the reform. (for instance, using the methodology of constructive rationalism of neoclassical economics to guide the reform of Soviet Union and Eastern Europe in the shock therapy manner)

Meanwhile, since human society's information and knowledge reserve evolves through long history, radical reform will only damage the information stock in present organization structure and hence increase the organization cost and information cost. (Zhang, 1997) Consequently, gradualist or step by step reform mode is the only implementable solutions. Chinese leader Deng's famous saying that "wade across the stream by feeling the way" is the best reflection of this reform epistemology. The popularity of this saying implies that in the early period of reform, China had no such clear reform aim as the Soviet Union and Eastern Europe once had. Most Chinese leaders and masses had not lost confidence in the system of planned economy, they attributed failings of planned economy system to the continuous political movements in the past decades other than the inherent disadvantages of this economic system. This kind of ruling idea and mainstream social ideology determined that it is impossible for China to implement the radical reform.(Zhang and Yi, 1994)

2.3 Literature review of other transitional theories

In contrast with most transitional economists' analysis on the specific policies proposed under either radical reform or gradualist reform, Kornai(1990) argues that reform speed is the out-dated standard to describe reform features in both radical reform and gradualist reform. reform speed is not the only variable for measuring reform performance. In order to better reflect upon the essence of reform in transitional

period, Kornai has come up with a new analytical framework that is mainly consisted of two basic reform strategies. Strategy A is called the strategy of organic development and B is called the strategy of accelerated privatization. These two development strategies are shown in the following table.

Kornai: Major features of two transitional strategies

Strategy A	Strategy B
1. Create conditions to enable private sectors emerge from bottom to up	1. Attempt to eliminate state-owned ownership as much as possible through state-owned enterprise privatization.
2. Transform most state-owned enterprises to private-owned ones by selling	2. Complete privatization through free distribution of warrant, etc.
3. Prevent the free distribution of state-owned property in any form	3. Prefer to the formation of decentralized ownership system
4. Prioritize the selling plan that can generate real production owners	4. Do not emphasize the emergence of private enterprise from bottom to up; Do not promote the status of private enterprise.
5. Harden the budget constraint of enterprises and strengthen the development of financial market to guarantee the effective running of market economy.	5. The privatization of state-owned enterprise will automatically harden the budget constraint.

Table 1

Source: Wu (2003), “Contemporary Chinese Economic Reform”, PP34, Shanghai Far-east Press

It could be easily derived from table 1 that Kornai thinks Russia and Eastern Europe have adopted strategy B with accelerating state-owned enterprises privatization as the cores of reform implementation whereas China, Vietnam, etc have adopted strategy A, the organic development with the emergence of non-state-owned sectors from bottom. Actually, the classification of two different transitional strategies is compatible with the definition of specific reform strategies proposed in this paper. According to the content of strategy A, what Kornai has meant is the incremental reform strategy, while strategy B could be regarded as the equivalence of structural reform strategy.

Rana and Paz posed another different classification of reform modes in 1994. They have named the reform method in China, Vietnam and Laos, etc as “Asian approach” while the reform method in Soviet Union and Eastern Europe following Washington consensus as “standard approach”. (Rana and Paz, 1994). In their views, Asian approach is a reform mode that starts from bottom to up. In this reform mode, micro reform(such as price reform, enterprise reform,etc) starts first and then macro reform(finance reform, monetary reform) follows. Standard approach is a reform mode that starts from up to bottom with the macro reform as the priority.

Some economists have studied the feasibility of gradual and radical reforms from the aspect of one country's economic structure at the beginning of transition. (Zhang and Yi,1994; Qian and Xu,1994;Sachs and Woo,1994a,b, etc) Sachs and Woo (1994a,b) hold that China's economic structure before reform is actually a dual mode of surplus labor force in the normal sense of development economics. Under such economic structure, peasants took the majority of China's population. However, Soviet Union and Eastern Europe had already finished their industrialization process with its most labor force working in state-owned industrial sectors and only 14% working in agriculture sectors. Therefore, at the early period of reform, due to the different initial economic structures, it is common that China appeared to have different reform performance compared with Soviet Union and Eastern Europe.

In details, an economy with agriculture as its leading industry, reform was a problem about economy development in normal route which indicates that it is just a process for labor force to transfer from low productivity agriculture sectors to high productivity industrial sectors. In contrast, Soviet Union and Eastern Europe had completed their industrialization. What they confronted was a problem of structural adjustment which means the reduction of the employment in the subsidized industrial sectors and low efficiency ones, and meanwhile increasing the employment in the sectors with higher economic benefits, such as service industry. However, in Soviet Union and Eastern Europe, labor force in the old industrial sectors could get high subsidy. Structure adjustment forced these labor force have to be deprived of the subsidies, which was a huge loss. Due to this, when a large number of new sectors or non-state-owned sectors were developed in Soviet Union, most labor force, however, did not flow into those sectors despite of the higher economic efficiency. In the normal sense of economic development, all the labor force flowing from agriculture sectors to industrial sectors will be benefited, which implies that such development has the feature of Pareto improvement. From this point, it could be indicated that it is not because gradualist reform is more effective than radical reform but because of China's dual mode of surplus labor force in the early period of reform process that facilitated the success of Chinese reform.⁹

Zhang and Yi(1994) illustrated the points that due to the decentralized economic power structure, China has resorted to relatively gradualist reform. In China, the power decentralization phenomena exist both in central government and local governments under different layers. When a new economic policy is issued, it not only needs the approval of central government but also the approval of local governments with large degree of self-decision making power. Hence, government bureaucracy always manipulates reform

⁹ There is some literature that opposes the analysis of how the initial conditions of a transitional economy could affect its adoption of reform speed and strategy. For example, Lin et al(1994), Zhang(1995) have criticized the views of Sachs and Woo. They point out that the success of China's gradual reform is of universal significance. Before reform, Soviet Union, East Europe and China had much more similarities in their economic structure, it is wrong to only focus on and exaggerate their differences. Zhang(1995) argues that all the centralized planned economies have the features of forbidding private ownership, nationalization of production materials. Therefore, all the planned economies face the task of how to proceed structure adjustment to eliminate monopolistic power of state-owned sectors. Lin et al(1994) hold that all the countries with planned economy system had adopted the import substitution strategy of catching up and surpassing type and developed heavily on sectors such as heavy industries, that were not in accordance with their countries' own comparative advantages of factor endowment structure. In order to develop these sectors without viability, every planned economy would be prone to enact macroeconomic policies in which products and factor markets are severely distorted.

according to their own interest so that a lot of radical policies that do not comply with interest of local government will not be implemented. According to the view of Wang(1991) and Zhou (2008), the decentralization reform starting in 1950s has bestowed China's local governments with a lot of rights to deal with public resources. Depending on these rights, local governments often negotiate with central government.

Garnick (1990) accounts this system with highly decentralized economy as "Regional Property Rights Arrangement". Local governments have their special economic interest structure which is different from that of central government. Different from China's separate economic system, the economic system in Soviet Union and Eastern Europe was a highly vertical type. Qian and Xu(1994) have accounted the economic system of Soviet Union as "U"form,, while that of China as "M"form. U form system means the management of planned economy is vertical and longitudinal. M form means management mechanism of planned economy is decentralized in multi-areas and multi-layers. According to their studies, in the vertical system, superior's order should be unquestioningly obeyed by inferior's, which provides convenience for the implementation of one package reform mode. In M form planned economy structure, economic power is highly decentralized. Local government or inferior government usually has the negotiation power with higher-ranked government on the policies released. If the policy is not compatible with the local government's interest, it is likely that the policy will not be followed strictly. This is the so-called "you have your policies and I have my ways of getting around them." This further infers that Chinese government could not have adopted the radical reforms at the beginning of the transition.

3. Model

3.1 Basic environment

Firstly, in this paper it is assumed that a transitional economy that is made up of several sectors , could be indexed as $S = \{ S_1, S_2, S_3, \dots, S_n \}$ S_i here could be regarded as a state- sector, or a specific industry, such as heavy industry, etc.

When a new sector S_{i+1} is established in an economy S , this new sector has become a reform promotion sector.¹⁰ In terms of industrial structure, this promotion sector is the upstream supplier to the rest of the state-sectors in this economy. Hence, they are vertically-linked. In other words, this upstream supplier provides the key inputs to other state-sectors in the economy.¹¹

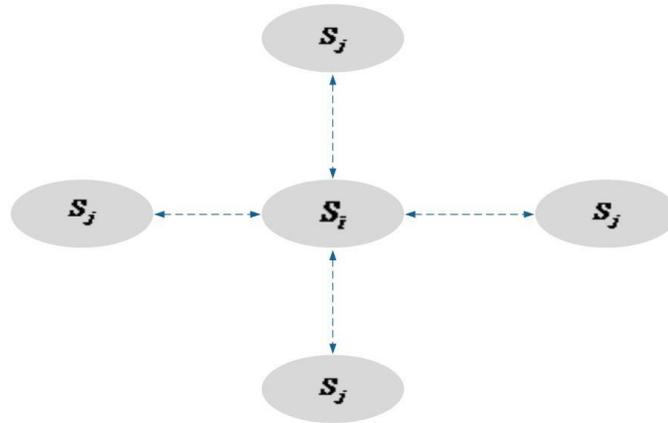
Meanwhile, assuming that a reform promotion sector has been established in an economy S , then at time t , the sectorial output of S_{i+1} is marked as $R_{S_{i+1}}(t)$. Since there is propagation mechanism, the output of this reform promotion sector will be supplied into other vertically-linked state sectors, which are assumed

¹⁰ The concept of reform promotion sector is also consistent with what Paul Romer (2013) proposed the ideas of 'chartered city'.

¹¹ In real world, there are many cases illustrating such propagation mechanism. For example, some non-state-owned sectors such as township village enterprises or private enterprises are normally the key input suppliers for state-owned sectors. For the details, please refer to Lin et al (1994) "China's Miracle: Development Strategy and Economic Reform", PP265-PP266, Shanghai People's Press.

as $S_{-(i+1)}$. The propagation mechanism between S_{i+1} and $S_{-(i+1)}$ is shown as below:

Figure 1



Since there is the existence of the propagation mechanism among different sectors described in figure 1, the total output of this transitional economy (GDP of this economy) at time t could be derived and marked as $Q(t)$.

In this paper, it is assumed that an economy's endogenous reform damping coefficient δ_0 is affected by the initial conditions like one country's economic structure and leaders' ruling ideas. Here, the damping coefficient δ_0 is equivalent to the country's preference to radical reform. Namely, the larger one country's endogenous reform damping coefficient is, the lower that country's preference to radical reform will be. Otherwise, if one country has relatively smaller δ_0 , it is likely that this country will implement radical reform. For the gradualist reforms, in order to describe the linkage between new and old sectors, relative economic reform damping coefficient δ_r in dual-track system is introduced here. δ_r is positively proportional to the old sectorial output and inversely proportional to the new sectorial output. The larger the output of old sectors, the larger the economic reform damping coefficient in dual-track system. And vice versa. Hence, in gradualist reform, the dual-track system economic reform damping coefficient $\delta = \delta_0 \delta_r$, in which, economic endogenous reform resistance as well as the linkage between new and old sectors are taken into consideration at the same time.

It is assumed in this paper that there is a deadlock stage in radical reform, during which the output of old sectors will drop down to zero rapidly. During the deadlock period, part of groups of the population in the society will support reform while the other part will oppose it. This is because when the old sectors' outputs fall dramatically, people could get increasingly lesser benefit from old sectors, causing them to support the reform. However, the old sectorial output will not become zero suddenly at a certain time. So during the deadlock process, part of social group who still get benefit from old sectors will continue to oppose reform.

For the gradualist reforms, there is also a deadlock stage, which could be named as the bargaining period

between old and new sectors. During this bargaining period, the phenomenon that some people support reform and some oppose reform will also exist. The establishment of a new sector will inevitably damage the vested interest group's interest so that they will oppose the reform. Similarly, the establishment of new sectors will entail some people new reform benefits that they have not obtained before. As a result, these type of social groups would support the reforms.

There is the cost of establishing a new sector during incremental reform both in radical and gradualist speed. The operational or fixed cost of a new sector, such as township enterprise, is generalized as the establishment cost of new sectors. There is another cost, "subsidy cost" in gradualist reform. As in dual-track system, introduction of new sectors usually will lead to a sharp decrease in the output of old sectors. In order to keep the operations of dual-track system such that both old and new sectors could contribute to the total output of the economy, government will grant subsidy to sectors to guarantee that the vested interest group of old sectors will not suffer too huge loss such as unemployment. The most typical case of this lies in price dual-track system. The introduction of market-track causes considerable resources being transferred from planned track to market-track. In order to keep the planned track working, government will give certain subsidy to planned track, which is subsidy cost.

3.2 The model of a reform promotion sector

Definition 5: It is assumed that an economy is consisted of several sectors, marked as $S = \{S_1, S_2, S_3, \dots, S_n\}$, one of which sectors S_i 's output at time t is marked as $R_i(t)$ (hereafter to be called $R(t)$), while the total output of this transitional economy at time t is $Q(t)$.

There is a propagation mechanism between $R(t)$ and $Q(t)$, marked as $C_{s_i}(t)$, in which C is defined as the vertical spillover coefficient for the input-output linkage in a transitional economy. Such production vertical spillover coefficient captures the positive externalities arising from the vertical production structure within this transitional economy. In this paper, we denote such positive externalities as the network effect of a reform promotion sector on the rest of the sectors in the economy.

Furthermore, It is assumed that C_{s_i} is contingent upon the establishment of new sectors in an economy S and the effects of the changes of other sectors $R_j (i \neq j)$ on C_{s_i} could be neglected. Unless the new sectors are in the decline or in the expansion, the C_{s_i} will remain exogenous and constant (hereafter to be called as C). Hence:

$$dQ(t) = CdR(t) \tag{1}$$

Integrating by both sides,

$$\Delta Q = C\Delta R = CR \tag{2}$$

Where $\Delta Q = Q(t) - Q(0)$, $Q(0)$ is the initial total output of the economy. It could be seen obviously that the larger one new upstream sector's vertical spillover coefficient to other sectors of one economy is, namely, the larger C is, the larger the change of total output caused by new sectors will be.

Let R_{\max} be the maximum output of this reform promotion sector. Here R_{\max} is also the minimum efficiency of scale input for the rest of the state-sectors in this economy. This is because at the beginning of the transition, output of reform promotion sector is small, so the state sector must seek for other inputs to substitute these output. The production cost would be very high for the state sectors at the beginning of the transition. As output of reform promotion sector increases, there is less need for state-sector to substitute these output. Hence, state-sectors would finally adjust their optimal input demand to the level at which the input cost is minimized.

Then reform speed V and economic reform damping coefficient δ are introduced, the larger the economic reform damping coefficient δ is, the smaller the economic reform speed V will be, so δ represents the set of factors that impede reform.

Assumption 1: The speed of reforms is positively proportional to $R_{\max} - R$, implying that V will become smaller as being closer to the maximum output. Therefore, it could be obtained that

$$V = \frac{R_{\max} - R}{\delta}.$$

For the radical reforms, once the new sectors are established, the effects of old sectors will be neglected. It is supposed that δ is only determined by initial conditions of a transitional economy, including: ruling ideas of leaders, the economic structure of a country, etc. Thus, the economic reform damping coefficient is endogenous from the economy itself and is thus a constant parameter, marked as δ_0 . Hence:

$$V = \frac{R_{\max} - R}{\delta_0}, \text{ and}$$

$$dQ = Vdt = \frac{R_{\max} - R}{\delta_0} \quad (3)$$

Proposition 1: The total output generated by any newly established sectors in a transitional economy will approach to the saturation in the end.

Proof of Proposition 1:

It could be obtained from (1)(3) that:

$$\frac{R_{\max} - R}{\delta_0} dt = CdR \quad (4)$$

Suppose the establishment of a new sector begins at $t=0$, with boundary condition $R(0) = 0$, after integration on both sides,

$$R = R_{\max} (1 - \exp(-\frac{1}{\delta_0 C} t)) \quad (5)$$

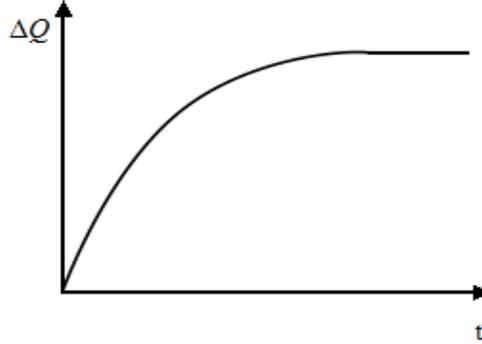
It could be obtained from (5) the eigentime for the establishment of a new sectors is $\tau_0 = \delta_0 C$, and during the period from $t=0$ to $t=\tau_0$, the new sectorial output has almost approached R_{\max} . Then it could be obtained from (2) that,

$$\Delta Q = CR = CR_{\max} (1 - \exp(-\frac{1}{\delta_0 C} t)) \quad (6)$$

Proof Completes

When $t \rightarrow \infty$, $\Delta Q \rightarrow CR_{\max}$, therefore, after the eigentime τ_0 , the total output Q basically remains constant, as shown in figure 2.

Figure 2



Note: Figure 2 illustrates that since the total output generated by the new sectors has reached saturation.

Since C_{s_j} is the function of R_{s_i} the total output change ΔQ caused by R_{s_i} will affect the change of vertical spillover coefficient of sectors S_j . Then, the change of C_{s_j} relative to time is proportional to the change of total output caused by the new sectors in a transitional economy S .

In order to calculate the change of total output ΔQ more accurately, the change of C_{s_j} caused by the establishment of new sectors in a transitional economy S . will be considered. Hence,

$$C_{s_j}(t + \Delta t) - C_{s_j}(t) = a_{s_{ij}} \frac{dQ_{s_i}}{R_{\max}} = a_{s_{ij}} C_{s_i} \frac{dR}{R_{\max}} \quad (7)$$

In equation (7), the change of C_{s_j} relative to time is proportional to the change of total output caused by the new sectorial establishment in the economy S . $a_{s_{ij}}$ is a constant, representing the dependency of other sectors S_j on sector S_i . It is worth mentioning that

When there exists substitutability between sector S_j and sectors S_i , $a_{s_{ij}}$ is negative. When the two sectors are complementary, $a_{s_{ij}}$ is positive. And $\sum_{j=1, j \neq i}^n a_{s_{ij}} = 1$.

It is obtained from (3)

$$\frac{\partial C_{s_j}}{\partial t} = \frac{a_{s_{ij}} (R_{\max} - R_{s_i})}{\delta_0 R_{\max}} \quad (8)$$

After integration on both sides,

$$C_{s_j}(t) = C_{s_j}(0) + a_{s_{ij}} C_{s_i} (1 - \exp(-\frac{t}{\delta_0 C_{s_i}})) \quad (9)$$

From $t=0$ to $t=\delta_0 C_{s_i}$, the change of total output caused by sectors S_j and sectors S_i is,

$$\Delta Q = C_{s_i} R_{\max} (1 - e^{-1}) (1 + \frac{a_{s_{ij}} R_{s_j}}{R_{\max}}) \quad (10)$$

Similarly, the change of total output caused by $S_1, S_2, S_3, \dots, S_n$ is,

$$\Delta Q = C_{s_i} R_{\max} (1 - e^{-1}) (1 + \sum_{j=1, j \neq i}^n \frac{a_{s_{ij}} R_{s_j}}{R_{\max}}) \quad (11)$$

Replacing R_{\max} by R_{s_i} , then it is obtained that,

$$\Delta Q = C_{s_i} R_{s_i} (1 - e^{-1}) (1 + \sum_{j=1, j \neq i}^n \frac{a_{s_{ij}} R_{s_j}}{R_{\max}}) \quad (12)$$

It could be seen that, when the effect of output change of sectors S_i on other sectors is taken into consideration, there will be another added term in terms of the total output of a transitional economy, and it is related to the $a_{s_{ij}}$, the dependency of other sectors on sectors S_i . What is more, if $1 + \sum_{j=1, j \neq i}^n \frac{a_{s_{ij}} R_{s_j}}{R_{\max}} < 0$, the change of total output is negative, it implies that the establishment of a new sector is a failure. Besides, it could be seen that the change of total output ΔQ is proportional to C_{s_i} .

Nevertheless, similarly, the eigentime τ_0 of new sectorial establishment is also proportional to C_{s_i} . It indicates that increasing C_{s_i} will lead to the increase of ΔQ with a longer time for new sectorial establishment; decreasing C_{s_i} will shorten the time for new sectorial establishment with a smaller ΔQ . Hence, the following proposition could be obtained.

Proposition 2: There is a trade-off between the eigentime for new sectorial establishment and the total benefit output caused by the establishment of new sectors. It is impossible to have the shorter eigentime and larger total output at the same time.

3.3 The Model for Radical Reform

Definition 6: Radical reform will decrease old sectorial output to zero, In this paper, we define such state as deadlock period. After that, the reform turns to shock period, during which, due to the expectation for the total output caused by new sectors, a certain amount of output will be maintained. After shock

¹² One thing to note is that formula (10) describes the sectorial network effect on the transitional economy.

period, according to the model for new sectorial establishment mentioned above, the output produced by new sectors will increase gradually to the expected maximum benefit.

It is assumed here that the growth or the decay of sectorial output is unpredictable in shock period. Therefore, the sectorial output is averaged in shock period Δt and this value is considered to be a constant. Thus, the assumption 2 in this paper could be formalized as the following:

Assumption 2: the average value of sectorial output in shock period is marked as b , which is with the form of exponential function of the vertical spillover coefficient C_{s_i} (C for abbreviation). Therefore,

$$b = \gamma C^\lambda \quad (13)$$

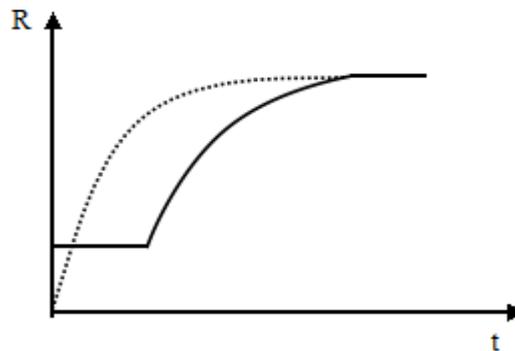
Where, λ ($-1 < \lambda < 1$) is a modulation factor, which is to modulate the people's expectation that the rise in new sectorial output will lead to the increase of total output, γ is a positive constant and $b = \gamma C^\lambda \ll R_{\max}$.

Most of the radical reform leaders do not have a full predication for how long would the shock period last for; some even do not believe in the existence of shock period. They expect that after the output produced by old sectors becomes zero, new sectors will be established quickly.

More importantly, according to the doctrine of Washington consensus, they always optimistically or ideally think the establishment of new sectors will proceed in a manner that is accordance with their own expectation, which is the C' . This coefficient would indicate the optimal vertical spillover coefficient that is expected by those leaders based on Washington consensus without the distortions of shock period.

However, what happened in reality is : After a shock period Δt , new sectors will be established according to the new sectorial output growth curve in our model. Consequently, the cost caused by the shock period can be obtained and defined as "shock period cost", marked as S which is shown in figure 3.

Figure 3



Note: The dash line represents the ideal new sectors benefit line, while solid line is the real new sectors benefit line.

It could be argued that, there must exist a vertical spillover coefficient C_0 that minimizes the shock period cost. Since the total output caused by the increase in new sectorial output cannot be calculated, it is held that C_0 must be also the optimal vertical spillover coefficient for new sectorial establishment.

Propositions 3 For the radical reform, the optimal vertical spillover coefficient of a new sector C_0 that

could minimize the shock period cost must satisfy the following equation: $C_0 \approx \left(\frac{\lambda\gamma\Delta t}{R_{\max}\delta_0} \right)^{\frac{1}{1-\lambda}}$

Proof of Proposition 3:

Shock period cost S is represented as follows:

$$S = \int_0^{\infty} R_{\max} \left(1 - \exp\left(-\frac{t}{\delta_0 C}\right) \right) dt - b\Delta t - \int_{t_b}^{\infty} (R_{\max} - (R_{\max} - b) \exp\left(-\frac{t-t_b}{\delta_0 C}\right)) dt \quad (14)$$

$$S = -b\Delta t + \delta_0 C (R_{\max} - b) - \delta_0 C' R_{\max} + R_{\max} \Delta t \quad (15)$$

Take the derivative of S with respect to C:

$$\frac{\partial S}{\partial C} = -\gamma\lambda C^{\lambda-1} \Delta t - \delta_0 \gamma (\lambda + 1) C^{\lambda} + \delta_0 R_{\max} \quad (16)$$

In order to get the minimum value of S, $\frac{\partial^2 S}{\partial C^2} > 0$ is required, so

$$\frac{\partial^2 S}{\partial C^2} = -\gamma(\lambda - 1)\lambda\Delta t C^{\lambda-2} - \delta_0 \gamma \lambda (\lambda + 1) C^{\lambda-1} \quad (17)$$

$$0 < \lambda < \frac{\Delta t - C\delta_0}{\Delta t + C\delta_0} \quad \text{or} \quad \frac{\Delta t - C\delta_0}{\Delta t + C\delta_0} < \lambda < 0 \quad (18)$$

Let time ratio $\rho = \frac{C\delta_0}{\Delta t}$, then equation (18) can be written as:

$$0 < \lambda < \frac{1-\rho}{1+\rho} \quad \text{or} \quad \frac{1-\rho}{1+\rho} < \lambda < 0 \quad (19)$$

It could be shown from equation (19) that, in order to make $\lambda > 0$, $\Delta t > \tau_0$ and $\rho < 1$ are required, meaning in shock period, when people expect that the new sectors will be established as soon as possible, the expectation of output growth λ for new sectors will be positive. On the contrary, when $\Delta t < \tau_0$, namely, $\rho > 1$, then $\lambda < 0$, meaning in shock period, when people expect that the establishment time of new sectors will be much longer, then the expectation of output growth λ for new sectors will be negative.

(i) when $\lambda > 0$, Let $\lambda = 0.5$ and equation (16) equal to zero, then the stationary value will be obtained.

$$C^{0.5} = \frac{1}{\gamma} \left(R_{\max} \pm \sqrt{R_{\max}^2 - \frac{3\gamma^2 \Delta t}{\delta_0}} \right)$$

As $\rho < 1$, τ_0 should be as small as possible, so take the smaller value of C_0 , then,

$$C_0 = \left[\frac{1}{\gamma} \left(R_{\max} - \sqrt{R_{\max}^2 - \frac{3\gamma^2 \Delta t}{\delta_0}} \right) \right]^2 \quad (20)$$

It could be obtained from $R_{\max}^2 - \frac{3\gamma^2 \Delta t}{\delta_0} \geq 0$ that

$$\gamma \leq \sqrt{\frac{\delta_0 R_{\max}^2}{3\Delta t}} \quad (21)$$

Equation (21) is the constrained condition of γ .

(ii) When $\lambda < 0$, let equation (16) equal to zero, then the stationary value will be obtained.

$$C^{\lambda-1} + \frac{\delta_0(\lambda+1)}{\lambda\Delta t} C^\lambda - \frac{\delta_0 R_{\max}}{\gamma\lambda\Delta t} = 0 \quad (22)$$

It could be obtained $\frac{\delta_0 R_{\max}}{\gamma\lambda\Delta t} \gg \frac{\delta_0(\lambda+1)}{\lambda\Delta t} C^\lambda$ from the condition of $\frac{R_{\max}}{\gamma} \gg C^\lambda$, then the

following could be derived by eliminating the middle term.

$$C^{\lambda-1} - \frac{\delta_0 R_{\max}}{\gamma\lambda\Delta t} = 0$$

$$C_0 \approx \left(\frac{\lambda\gamma\Delta t}{\delta_0 R_{\max}} \right)^{\frac{1}{1-\lambda}} < 0 \quad (23)$$

From equation (13) and (23), $b < 0$ could be obtained. It means in shock period, the sectorial output is negative and the economic growth is negative. Due to the long-term negative economic growth, reform leaders will change people's expectation such that the new sectorial output growth will increase total output. Then $\lambda > 0$ and a positive C will be obtained. After a certain period of preparation, the transitional economy would encounter growth period shown in the new sectors establishment model.

Similarly, for $\lambda > 0$, it could be obtained with the use of approximate expression $\frac{R_{\max}}{\gamma} \gg C^\lambda$ that

$$C_0 \approx \left(\frac{\lambda\gamma\Delta t}{R_{\max} \delta_0} \right)^{\frac{1}{1-\lambda}} > 0 \quad (24)$$

Proof Completes

From equation (13) and (24), $b > 0$ could be obtained. It means in shock period, the sectorial output is positive and the whole economic growth is in positive trajectory. It shows that due to people's high expectation for new sectorial output growth, after shock period, new sectors will be established quickly to make $\Delta t > \tau_0$.

Discussion 1:

When $\lambda < 0$, $b < 0$ and the economic growth is negative in shock period. Therefore, reform leaders will reform the new sectors to make the expectation $\lambda > 0$.

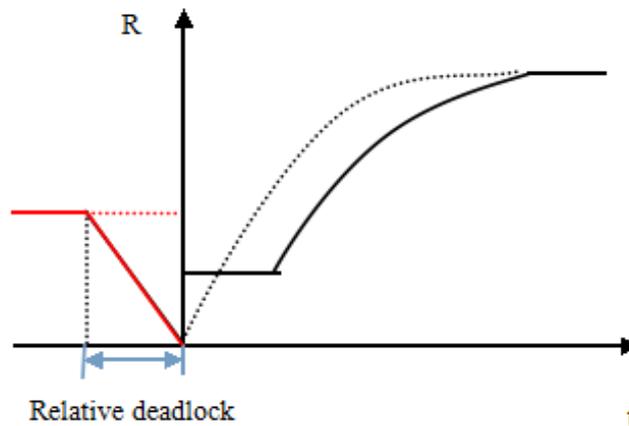
Hence, It could be concluded from equation (24):

(i) For radical reform, when the economic endogenous reform damping coefficient δ_0 is very small and other parameters are constant, there will be a very large value of C_0 . According to equation (11), the growth of total output will be quite large, correspondingly, the eigentime for new sectorial establishment will be quite long. In order to offset the loss generated by the long eigentime for new sectorial establishment through the specific reform strategy, incremental reform should be adopted with the reasons as follows: Assuming the structural reform is implemented to replace the old sectors. Then the lasting time includes the relative deadlock time and eigentime for new sectorial establishment. However, with a large C_0 , the original eigentime is long enough, it would be more costly as a new deadlock period would be also added for the whole time horizon of the reform period. This is shown in figure 4.

On the contrary, if incremental reform is used to establish a new sector S_{n+1} out of the old economic system. There will be a cost for new sectorial establishment, which does not exist in shock period. But it is known that under this situation, there is a much larger amount of total output. Compared with waiting for a much longer time to let newly established sectors begin to yield new output, people would like to offset the cost of new sectorial establishment with part of the newly added total output.

Therefore, when C_0 very large, incremental reform will be the best way to resolve the contradiction between total output of a transitional economy and eigentime for new sectorial establishment.

Figure 4



Note: The red line represents the old sectorial output, while black line is the new sectorial output.

(ii) For the radical reform, when the economic endogenous reform damping coefficient δ_0 is very large and other parameters are constant, C_0 will be very small. According to equation (11), the total output will be quite small; correspondingly, the eigentime for new sectorial establishment will be quite short. In order to offset the loss generated by insufficient total output growth through specific reform strategy, structural reform should be adopted due to the following reasons: Assuming incremental reform is used to establish a new reform promotion upstream sector. Then it would entail a relative larger new sectorial establishment

cost. However, because of a rather small C_0 , the total output growth is small enough. Hence, it is not economically beneficial to bear upon another type of larger cost.

Contrarily, if structural reform is adopted to reform the original old sectors, meaning the new sectorial establishment cost will be eliminated. The total time includes a rather short eigentime for new sectorial establishment and a relative longer deadlock time, which is decent for the ruling reform leaders. Hence, when C_0 is very small, structural reform is the best way to resolve the contradiction between total output and the eigentime for new sectorial establishment.

For structural reform, the change of total output in a transitional economy could be obtained by plugging equation (24) into equation (11).

$$\Delta Q = \left(\frac{\lambda\gamma\Delta t}{\delta_0}\right)^{\frac{1}{1-\lambda}} R_{\max}^{-\frac{\lambda}{1-\lambda}} (1-e^{-1}) \left(1 + \prod_{j=1, j \neq i}^n \frac{a_{s_j} R_{s_j}}{R_{\max}}\right) \quad (25)$$

Here, from $b = \gamma C^\lambda \ll R_{\max}$, it is assumed that the output yielded by new sectors increases from $R = 0$ to R_{\max} approximately.

For incremental reform, the change of total output could be expressed as follows

$$\Delta Q = \left(\frac{\lambda\gamma\Delta t}{\delta_0}\right)^{\frac{1}{1-\lambda}} R_{\max}^{-\frac{\lambda}{1-\lambda}} (1-e^{-1}) \left(1 + \prod_{j=1}^n \frac{a_{s_j} R_{s_j}}{R_{\max}}\right)$$

It can be seen that R_{\max} is actually the maximum level of output after the establishment of a new sectors, which, however, is determined by the plans devised by reform leaders at the beginning of the reform. So it can be regarded as the expected maximum benefit here. Equation (25) shows the larger the expected maximum output is, the smaller the total output growth will be. R_{\max} is a misleading parameter, because, if δ_0 is small, incremental reform should be implemented. But the high expected maximum benefit will lead to a relative small C_0 , which will lead to the structural reform. Finally, due to the fact that R_{\max} is too large, the ΔQ will be too small. And the reform will be a failure. (the failure of radical reform with the characteristic of structural reform strategy in Russia has demonstrated this point since the Russian leaders set a very large value of R_{\max} based on the Washington consensus. Thus, it could be concluded that the reform leaders' setting or expectation for R_{\max} should be limited in a reasonable range, neither too high nor too low.

3.4 Gradualist reform model

The cores of radical reform speed have been discussed previously with the following conclusion: when δ_0 is very small with other parameters being constant, C_0 is very big, it needs to adopt the incremental reform strategy in radical speed. When δ_0 is very big with other parameters being constant, it needs to adopt the structural reform strategy in radical speed

The next step is to analyze the gradualist reform speed. First, the gradualist reform needs to be defined:

Definition 7: When the old sectors and new sectors in a transitional economy co-exist simultaneously (dual-track system) and when new sectorial output is larger than that of old sectors', the dual-track period comes to end. After that, the new sectorial output will continue to grow until it reaches the saturation. This kind of reform is called gradualist reform.

There is a bargaining period between reformers and vested interest group within the old sectors when the new sectors are introduced, also named as relative deadlock period and its duration is marked as t_s . It is argued that the dual system has already existed when the bargaining period begins and the lasting time for bargaining period is related to the vertical spillover coefficient of new sectors, which we denote as C . When C is larger and the expected total output is higher, then the bargaining period will be shorter. Otherwise, the bargaining period will be longer. Therefore, there exists the following relationship:

$$t_s = \frac{\eta}{C} \quad (26)$$

In which, η is a positive constant.

The introduction of a new reform promotion sector could be regarded as the process during which people abolish the old contract and sign a new one. Signing new contract needs some cost, which is the "implementation cost" during bargaining period. For example, if ownership reform of some sectors in a vertical industry chain is carried out, capital value should be reassessed, people's obligations and rights should be redefined. We denote the learning cost required to adapt to the new institutional arrangements such as the introduction of new sectors in the economy as the implementation cost of signing new contract.

¹³

It is argued in this paper that the "implementation cost" in bargaining period is positively proportional to bargaining time, meaning the longer the bargaining time is, the more the contract signing times are, and the larger the implementation cost will be. So,

$$S_1 = pt_s = \frac{p\eta}{C} \quad (27)$$

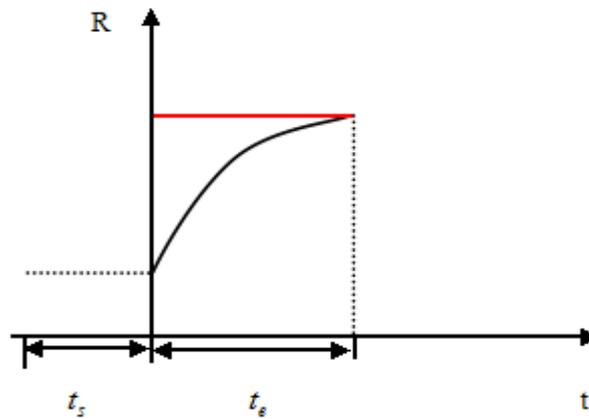
It is a well-known fact that the introduction of new sectors will result in the sharp decrease of old sectorial output. For example, when the market track is introduced into the input markets for state-owned enterprises, due to the free market competition, resource will flow into the market track with relatively high productivity. In order to keep the normal operations of planned track, government will subsidize the

¹³ For the specific definition of implementation cost, please refer to Fan (1993), "Two Kinds of Reform Costs and Two Kinds of Reform Modes", "Economic Research Journal", 1st volume, 1993

planned track to retrain its output. Hence, during dual track system period, the old sectorial output remains the same, marked as r_0 .

After the period of dual track system, old sectors, being inferior to new sectors, will be abolished with its output being zero, shown in figure 5. In terms of intuition, once the old sectors are abolished, it is to say the new sectors as upstream input sectors would vertically integrate the old downstream sectors. In the late 1990s, a lot of small-medium state-owned enterprises in China were transferred to the private investors who are normally the owners of these SOEs' upstream input firms. These upstream input suppliers are in various of non-state ownership structure forms such as township village enterprises or cooperative enterprises.

Figure 5



Note: The red line represents old sectorial output at time t , while black line is the new sectorial output at time t . The dash line represents relative deadlock period, which is bargaining period.

Definition 8: During the period of dual track system, the reform damping coefficient δ is the product of economic endogenous reform damping coefficient δ_0 and relative damping coefficient δ_r . δ_r is related to the old sectorial output and new sectorial output at time t with the relationship that the larger the old sectorial output is, the larger the δ_r will be and the larger the new sectorial output is, the smaller the δ_r will be. Hence, it can be obtained that,

$$\delta_r = \delta_r(t) = a \frac{r_0}{R(t)} \quad (28)$$

$$\delta = \delta_0 \delta_r = \frac{a \delta_0 r_0}{R(t)} \quad (29)$$

Proposition 4: For the gradualist reform speed, the optimal vertical spillover coefficient C_0 that could minimize the dual track system cost, namely the sum of implementation cost and subsidy cost must satisfy the following

$$C_0 = \sqrt{\frac{p\eta}{(1-k)r_0\delta_{\min} \ln \frac{r_0(R_{\max} - r_0)}{R_i(R_{\max} - R_i)}}}$$

Proof of Proposition 4:

According to the new sectorial establishment model,

$$\frac{R_{\max} - R}{\delta} dt = CdR \quad (30)$$

Plugging equation (27) into equation (30), the following equation will be obtained.

$$\frac{R(R_{\max} - R)}{a\delta_0 r_0} dt = CdR \quad (31)$$

Assume the initial output of new sectors at time 0 is R_i ($R_i < r_0$). After integration on both sides,

$$R = \frac{1}{2} \left[R_{\max} - \sqrt{R_{\max}^2 - 4R_i(R_{\max} - R_i) \exp\left(\frac{R_{\max} t}{a\delta_0 Cr_0}\right)} \right]$$

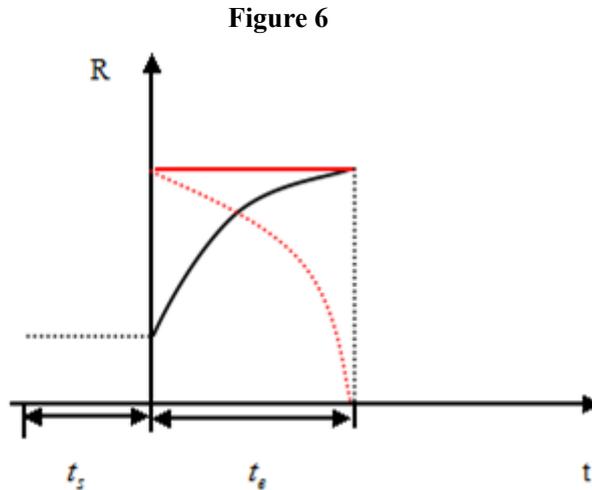
Let $\sigma = \frac{a\delta_0 Cr_0}{R_{\max}}$, and there is

$$R(t) = \frac{1}{2} \left[R_{\max} - \sqrt{R_{\max}^2 - 4R_i(R_{\max} - R_i) \exp\left(\frac{t}{\sigma}\right)} \right] \quad (32)$$

Let $R(t) = r_0$, the following expression could be obtained at time t_e at which the dual track system period ends.

$$t_e = \sigma \ln \frac{r_0(R_{\max} - r_0)}{R_i(R_{\max} - R_i)} \quad (33)$$

In order to ensure the normal operations of old sectors with new sectors as upstream input suppliers, government needs to grant certain subsidy to old sectors, forming “subsidy cost”, shown in figure 6. The curve equation that represents the decreasing trajectory of old sectorial output under the pressure of the growth of new sectorial output is needed to calculate this cost.



Note: The dash line represents the original output curve of old sectors

At the end of dual track system, the old sectorial output is zero and the slope of tangent line of old sectorial output curve is infinite. Thus, the decaying rate of old sectorial output should be inversely proportional to $r_0 - R(t)$, meaning the smaller the difference between new sectorial output and r_0 is, the larger the decaying rate will be. Therefore, the old sectorial output decaying differential equation could be obtained.

$$-\frac{\beta}{r_0 - R(t)} dt = dr \quad (34)$$

In which, β is a positive constant. Plugging equation (31) into equation (37) and then integrating by both sides, then the decaying equation of old sectorial output will be obtained. Because of impossibility of obtaining the closed-form solution, it is approximately assumed in this paper that the area enclosed by this curve, x axis and y axis is positively proportional to r_0 and t_e , with the proportional coefficient as k, then,

$$\int_0^{t_e} R(t) dt \approx kt_e r_0 \quad (35)$$

,

Thus the subsidy cost S_2 is,

$$S_2 = (1-k)t_e r_0 \quad (36)$$

$$S_2 = (1-k)r_0 \sigma \ln \frac{r_0(R_{\max} - r_0)}{R_i(R_{\max} - R_i)} \quad (37)$$

It could be concluded that since t_e is positively proportional to r_0 , the subsidy cost for dual track system is positively proportional to r_0^2 . When the old sectorial output is relatively high, the subsidy cost will increase sharply; otherwise, the subsidy cost will decrease sharply. This means, the smaller the minimum damping coefficient of dual track system is, the larger the vertical spillover coefficient C_0 is (it also means the larger the total output growth is and the smaller the subsidy cost is), hence, the larger the net increasing rate of total output will be.

The total cost of dual track system could be obtained from equation (37),

$$S = S_1 + S_2 = \frac{p\eta}{C} + (1-k) \frac{a\delta_0 C r_0^2}{R_{\max}} \ln \frac{r_0(R_{\max} - r_0)}{R_i(R_{\max} - R_i)} \quad (38)$$

It could be obtained from equation (37) and the fundamental inequality that

$$S \geq 2 \sqrt{(1-k) \frac{p\eta a \delta_0 C r_0^2}{R_{\max}} \ln \frac{r_0(R_{\max} - r_0)}{R_i(R_{\max} - R_i)}} \quad (39)$$

When $C_0 = \sqrt{\frac{p\eta R_{\max}}{(1-k)a\delta_0 r_0^2 \ln \frac{r_0(R_{\max} - r_0)}{R_i(R_{\max} - R_i)}}$, the minimum value of t_a will be obtained.

Let the minimum economic reform damping coefficient of dual track system $\delta_{\min} = \frac{a\delta_0 r_0}{R_{\max}}$ and plug it into the expression of C_0 , the following could be obtained.

$$C_0 = \sqrt{\frac{p\eta}{(1-k)r_0\delta_{\min} \ln \frac{r_0(R_{\max} - r_0)}{R_i(R_{\max} - R_i)}}} \quad (40)$$

Proof Completes

It is thus clear that the smaller δ_{\min} is, namely, the smaller the minimum economic reform damping coefficient of dual track system is, then, the larger vertical spillover coefficient C_0 will be. Otherwise, the smaller C_0 will be.

The old sectors will be vertically integrated after the end of dual track system period. So the economic reform damping coefficient for the new established sectors will become δ_0 again. The total time t of gradualist reform lasting from bargaining period to the final establishment of new sectors could be expressed as follows.

$$t = t_a + t_n \quad (41)$$

In which, t_n is the time required from r_0 to $\frac{R_{\max}}{e}$.

It could be concluded that because t_e is proportional to r_0 , the subsidy cost for dual track system is proportional to r_0^2 . When the old sectorial output is relatively high, the subsidy cost will increase sharply; otherwise, the subsidy cost will decrease sharply. This means, the smaller the minimum damping coefficient of dual track system is, the larger the vertical spillover coefficient C_0 is (it also means the total output growth will be large and the subsidy cost will be small), Once the vertical spillover coefficient is large, the net growth of total output of this transitional economy will be also large.

During the period from $t = 0$ to $t = t_e$, the total output change caused by sectors S_i is:

$$\Delta Q_{s_i} = C_{s_i} (r_0 - R_i) - r_0 \quad (42)$$

From equation (8), the following could be obtained,

$$\frac{\partial C_{s_j}}{\partial t} = \frac{a_{s_{ij}} (R_{\max} - R_{s_i})}{\delta R_{\max}} \quad (43)$$

So the total output change caused by sectors S_j form $t = 0$ to $t = t_e$ will be expressed as follows:

$$\Delta Q_{s_j} = a_{s_{ij}} C_{s_i} (r_0 - R_i) \frac{R_{s_j}}{R_{\max}} \quad (44)$$

The total output change caused by sectors $S_1, S_2, S_3, \dots, S_n$ from $t = 0$ to $t = t_e$ will be thus expressed as follows:

$$\Delta Q = C_{s_i} (r_0 - R_i) \left(1 + \sum_{j=1, j \neq i}^n \frac{a_{s_{ij}} R_{s_j}}{R_{\max}} \right) - r_0 \quad (45)$$

Before the specific discussion about the incremental reform strategy and structural reform strategy with gradualist reform speed, according to the previously mentioned definition of the structural reform in gradualist reform speed, the other way for gradualist reform will be firstly discussed here, that is the establishment of a new sector which is not vertically-linked but within the same industry as old sectors in a transitional economy.

Assumption 3: It is assumed that reform promotion sectors S_i 's dependency with other old state sectors S_j is much stronger than with other sectors, which means,

$$\left| a_{s_{ij}} \right| \gg \left| a_{s_{ik}} \right| (k \neq j) \quad (46)$$

Thus, only the effect of S_i on S_j is considered. From equation (9), the following will be obtained,

$$Q_{s_j}(t) = R_{s_j} \left[C_{s_j}(0) + a_{s_{ij}} C_{s_i} \left(1 - \exp\left(-\frac{t}{\delta_0 C_{s_i}}\right) \right) \right] \quad (47)$$

Eliminating the sectorial establishment cost M, it could be obtained from equation (6) that

$$Q_{s_i}(t) = C_{s_i} R_{s_i} \left(1 - \exp\left(-\frac{1}{\delta_0 C} t\right) \right) \quad (48)$$

Proposition 5: when there is substitutability between reform promotion sectors S_i and sectors S_j and the

vertical spillover coefficient of sectors S_i satisfies the requirement of $C_{s_i} \geq \frac{C_{s_j}(0)}{(1-e^{-1})\left(\frac{R_{s_i}}{R_{s_j}} - a_{s_{ij}}\right)}$,

then the mechanism of which the newly established sectors would crowd out the old sectors will become possible.¹⁴

Proof of Proposition 5:

When there is substitutability between sectors S_i and sectors S_j , meaning $a_{s_{ij}} < 0$. It is argued in this paper that there is a time at which before this time point, the total output contributed by the new sectorial output in sectors S_i is increasing continuously, while the total output contributed by the old sectorial

¹⁴ The substitutability relationship between new sectors and old sectors imply that they operate within a very homogeneous product market. The goods they both sell in the final market are very less differentiated.

output in sectors S_j is decreasing continuously; at this point, the total output contributed by the sectorial output in sectors S_i is equal to that of sectors S_j .

Since the two sectors are in a substitutive relationship, sectors S_i will crowd out sectors S_j completely. After this time point, old sectors will be crowded out of the market. So in order to avoid being crowded out, sectors S_j will be forced to increase their output. This kind of reform in which the newly established sectors force the old sectors to decrease their output is called structural reform in gradualist reform speed. Hence, It could be obtained from equation (47) and equation (48) that,

$$Q_{s_i} = Q_{s_j}$$

$$t_c = \tau_0 \ln \frac{1}{1 - \rho} \quad (49)$$

$$\text{In which, } \tau_0 = \delta_0 C_{s_i} \text{ and } \rho = \frac{1}{-a_{s_{ij}} + \frac{R_{s_i}}{R_{s_j}}} \frac{C_{s_j}(0)}{C_{s_i}}$$

It is argued here in this paper that when $t = \tau_0$, if Q_{s_i} is still smaller than Q_{s_j} , the structural reform in gradualist reform speed will not exist. So the following is required,

From $t_c \leq \tau_0$, then

$$\rho \leq 1 - \frac{1}{e}, \text{ then}$$

$$a_{s_{ij}} \leq \frac{R_{s_i}}{R_{s_j}} - \frac{e}{e-1} \frac{C_{s_j}(0)}{C_{s_i}} \quad (50)$$

If the equation (48) is analyzed from another perspective, namely, $C_{s_j}(0), R_{s_j}, R_{s_i}, a_{s_{ij}}$ are already known and in order that sectors S_i will force sectors S_j to increase output, C_{s_i} needs to thus meet the following requirement.

$$C_{s_i} \geq \frac{C_{s_j}(0)}{(1 - e^{-1}) \left(\frac{R_{s_i}}{R_{s_j}} - a_{s_{ij}} \right)} \quad (51)$$

Proof Completes

Discussion 2:

(i) For the gradualist reform, dual track system is equivalent to incremental reform strategy. There is no new sectorial establishment cost in dual track system. When δ_{\min} is very small and C_0 is very large, there is no need for reformers to worry about extracting part of the total output to offset the cost for new

sectorial establishment. When δ_{\min} is very large and C_0 is very small, there is also no need for reformers to worry about the total reform time which would include the time for new sectorial establishment and the relative deadlock time. Therefore, dual track system could better resolve the contradiction between total output of a transitional economy and the eigentime for new sectorial establishment.

(ii) For gradualist reform, establishing a new reform promotion sector that is non vertically-linked to but within the same industry as old sectors is also a type of incremental reform strategy. But when the newly established sectors has strong substitutive relationship with one of the old sectors in addition to $a_{s_{ij}}$ meets the requirements in equation (46) and (50), the increase of total output contributed by the new sectors will lead to the decrease of the total output generated by the old sectors and further force old sectors to decrease output after time t_c . Hence, the incremental reform strategy in newly established sectors will lead to old sectors decreasing their output indirectly.

(iii) For the radical reform speed, it is impossible to implement incremental reform such that establishing a new sector could force the old sectors to decrease output. The reasons are listed below. Firstly, there is a shock period during the structural reform in which output in the new sectors keeps constant. This infers that it has no effect on other sectors' vertical spillover coefficient.

Shock period will be in a very long duration, during which it is probably that other sectors have already decreased output according to reformers' expectations for the potential output growth in new sectors (the self-adjustment according to expectation is not structural reform, please refer to the definition of structural reform in introduction of this paper) so that $R_{s_j}, C_{s_j}(0)$ will become larger, which will lead to the fact that it is difficult for the optimal vertical spillover coefficient C_0 to meet the requirement in equation (51) after output increase in new sectors and thus failing to let other sectors decrease their output. Secondly, after shock period, the new sectorial output will be growing very fast in the during radical reform so that even at the beginning of structural reform, old sectors will be crowded out by new sectors due to their lower output level.

4. Model Discussions

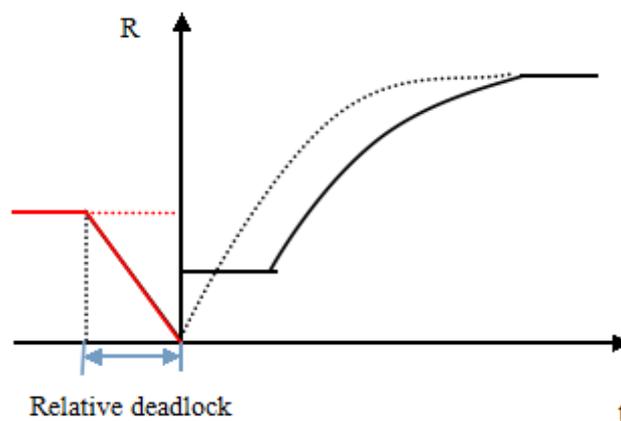
In the model constructed previously, two parameters are required to describe the function of a reform promotion sector. (1) Sectorial vertical spillover coefficient C (2) Reformers' expected maximum output R_{\max} . The expected maximum output R_{\max} is the blueprint set by the reformers at the early stage of reform based on many factors, including the ruling ideas of reformers, the initial economic condition of one country and so on. It could be seen from the discussion on equation (29) that the setting of R_{\max} should be neither too large nor too small. Sectorial vertical spillover coefficient C is a critical parameter for

the economic function of a reform promotion sector, as it describes a reform promotion sector's capability in terms of generating total output (GDP) of a transitional economy contributed by its output at sectorial level. Thus it must be the case that the maximum total output generated by the individual reform promotion sector is a function of vertical spillover coefficient C .

Furthermore, it is held in this paper that eigentime measures the time horizon of how long a new reform promotion sector will be established whereas total output implies the output contribution made by these newly established sectors. Since both the eigentime for new sectorial establishment and total output produced by the new sectors are proportional to the vertical spillover coefficient of the new sectors C , the larger total output (GDP of an economy) and larger eigentime will occur at the same time. This contradiction is one of the most important factors that determines the optimal combination between reform speed and specific reform strategy in this paper. It can be seen that because of the large C in radical reform, so in order to avoid the increase of eigentime for new sectorial establishment, incremental reform strategy is adopted. Similarly, due to the small optimal vertical spillover coefficient C for the gradualist reform, in order to avoid the decrease of total output (GDP) caused by the decline of old sectors, structural reform strategy ought to be adopted.

For radical reform, a huge reform cost will be incurred in the short term, as shown in figure 7. The minimization of cost is used to calculate the optimal vertical spillover coefficient C_0 in this model.

Figure 7



Note: The red line represents the old sectorial output line, while the black line stands for the new sectorial output curve.

For structural reform strategy, the reform cost is generally divided into friction cost and shock period cost. It is held in this paper that the main area enclosed by black dash line and black solid line is the shock period cost, while the area (the triangle here is used to make qualitative illustration) enclosed by red dash line, red solid line and R axis is the friction cost, which could be expressed as one half of the product of relative deadlock time and old sectorial output.

However, for incremental reform, there is no relative deadlock period and no friction cost accordingly. But, in traditional view, the newly established sectors will compete with the old sectors which generate friction cost. But this part of cost would be wrongly classified. In our model, this part of cost will be classified into the total output contributed by the new sectorial output, as shown in equation (25), in which

the parameter $a_{s_{ij}}$ that represents the dependency of two sectors plays an important role. When there is substitutability between sectors S_j and sectors S_i , $a_{s_{ij}}$ is negative; when the two sectors are complementary, $a_{s_{ij}}$ is positive. The so-called competition refers to the “conflicts” in traditional sense will lead to the decrease of total output (GDP of an economy).

Nonetheless, it does not belong to friction cost and is caused by the normal market competition. Therefore, the cost generated by relative deadlock period before the complete establishment of new sectors is called friction cost in this paper.

The concept of friction cost which is proportional to the relative deadlock time and old sectorial output has been specified in this paper. The approximate expression for relative deadlock time t_s could be obtained from equation (26) for the gradualist reform. This equation shows that t_s is inversely proportional to vertical spillover coefficient C.

For radical reform, it is held that the relative deadlock time t_s is inversely proportional to the expected maximum output R_{\max} of the new sectors and there is no relevance to vertical spillover coefficient C. The reasons are as follows. For gradualist reform, due to the existence of old sectors, even if the establishment of a new reform promotion sector is a failure, reformers and vested interest groups will not have too low output expectation. So they would pay more attention to the effect of the new sectorial establishment on the total output of the economy;

However, for radical reform, due to the fact that the old sectors are abolished, without the potential output contribution made by old sectors, reformers and vested interest groups will place much more attention to the expected output caused by the new sectors at the sectorial level rather than the total output generated by the new sectorial establishment at the country level. But after the relative deadlock time, the reformers or the original vested interest groups will again put their attention on the optimal vertical spillover effect at the sectorial level, as shown in equation (13). This is because the expected maximum output is just a benchmark which only exists in people’s expectation while the vertical spillover coefficient is a real parameter. Hence, based on this, in this model, we could use the following approximation method. Since the relative deadlock time is insensitive to new sectorial vertical spillover coefficient C as well as the fact that friction cost is insensitive to C, the calculation process for obtaining the optimal vertical spillover coefficient could exclude the effect of friction cost.

For the gradualist reform, the dual-track cost could be divided into two parts: implementation cost and subsidy cost. As a result, the optimal diffusion coefficient C_0 will be calculated through cost minimization in the model.

Dual-track duration t_a is the sum of bargaining time t_s and the time t_e incurred from new sectorial output R_i approaching to r_0 . Nonetheless, t_s is not always inversely proportional to vertical

spillover coefficient C as formula (26) shows. Instead in this paper, it assumes the following form regarding the relationship between t_s and vertical spillover coefficient C .

$$t = \frac{\eta}{C^\mu}$$

The description of subsidy cost (rent-seeking cost is a disguised form of subsidy cost) in the model is also qualitative as the closed-form solution of formula (34) could not be obtained. Expression like Formula (36) may be the best approximation that could be reached. Therefore, the total cost combining two approximate cost expressions is certainly qualitatively unreliable. Nevertheless, the optimal vertical spillover determined by minimization of total cost can help us obtain the possible range of C value, by which our aim of the model could be reached.

Proposition 5 describes another important factor determining the optimal combination between reform speed and specific reform strategy. The incremental reform is always the reform strategy that would be adopted when reform is in gradualist approach, which is irrespective of either building a new reform promotion sector which is non vertically-linked to the old sectors or establishing an upstream reform promotion sector that provides the key inputs for old sectors in a transitional economy. This is to say, it is a must that gradualist reform begins with incremental reform but not from structural reform and then according to Proposition 5, it would force the old sectors to decrease output by crowding out these sectors through providing very substitutive goods in a homogeneous good market.

Proposition 5 indicates that for the gradualist reform, the optimal spillover coefficient of new established sectors will be at least C_0 , which satisfies the following formula:

$$C_{s_i} \geq \frac{C_{s_j}(0)}{(1 - e^{-1}) \left(\frac{R_{s_i}}{R_{s_j}} - a_{s_{ij}} \right)}$$

The formula indicates that the higher degree of substitutability between S_j and S_i is (more intensity of competition between two sectors), the less the expected maximum output of new sectors will be, the bigger the C_0 value required to reach will be, and the longer eigentime that it would take for new sectors to crowd out old sectors (it is more unlikely for structural reform in gradualist speed to occur); And vice versa.

For Soviet Union and countries in Eastern Europe, A completed industrial systems had been already established during the period of planned economy, so the level of specialization among sectors is rather high. Then it is easy to see that there exists the strong substitutability among sectors in these countries. On the other hand, old sectors still received high governmental subsidies in these countries so that their labor forces can still gain a lot of benefits from old sectors. Hence, for these countries, the expected maximum output of new sectors is relatively low

Meanwhile, the high level of subsidy to a large extent undermined the intensity of the competition between newly established sectors and old sectors, namely the relatively low value of $\left| \frac{a_{s_{ij}}}{R_{s_j}} \right|$. The above two

factors make C_0 require to reach a very high value, so the eigentime time required for new sectors to crowd out old sectors ought to be longer. But Soviet Union and Eastern Europe has only launched 6-year (1985-1991) structural reform in gradualist speed. As a result, new sectors during this 6-year period could not crowd out old sectors completely. According to the model of this paper, the eigentime required for new sectors to crowd out old sectors in these countries ought to be at least several times longer than the one required in China.

For countries like China and Vietnam, during the era of planned economy, they were not industrialized countries, the proportions of agricultural sectors far surpassed other industries, so the level of specialization among sectors is low.¹⁵ This explains why in this paper it could be derived that the substitutability among sectors is weak in these countries.

In terms of the economic structure, since the productivity of industrial sectors far exceeds that of agricultural sectors, the expected output of new sectors for most labor forces in these countries thus stayed high. What's more, there were few government subsidies for old sectors which further led to a larger expected output of new sectors of these countries during initial stage of reform.

Meanwhile the low level of government subsidies increased the intensity of the competition between newly established sectors and old sectors, namely the low value of $|a_{12}|$. Therefore, C_0 value required to reach is low and the eigentime required for new sectors to crowd out old sectors is shorter. A short eigentime indicates structural reform with gradualist speed could be implemented within a short time after the horizontally-linked new reform promotion sectors with gradualist speed are established. Hence, the old sectors are much more likely to be crowded out with gradualist reform approach in countries like China.

5. Model Implication

5.1 Radical reform

According to the model, initial conditions of one country like state leaders' ruling ideas as well as economic structure decide its endogenous reform damping coefficient δ_0 whose magnitude decides the magnitude of optimal spillover coefficient C of a sector. And the magnitude of spillover coefficient further decides specific reform strategies. Hence it becomes possible to analyze the selections of optimal reform strategy of one country with radical reform speed based on state leaders' ruling ideas and economic structure.

For Soviet Union and countries in Eastern Europe, under the influence of the Washington Consensus, the main philosophical foundation for state leaders' ruling idea is constructivist rationalism derived from neoclassical economics. Constructivist rationalism methodologist always set an optimal target. In the

¹⁵ The deficiency of the degree of industrialization was certainly the major reason for lower substitutability among sectors in countries like China and Vietnam. But for China, other factors also resulted in lower substitutability among sectors. For example, the longstanding urban and rural household registration control system implemented after 1949 made rural labor forces not able to flow to industrial sectors at their will and forbade the agricultural sectors to provide the industrial sectors with raw materials, etc. This to a large degree limited the level of domestic horizontal production complexity.

context of a transitional economy, such optimal transitional target is how to transform an economy into a free market economy. Any institutional arrangements during the transition like dual-track system will be ditched as it is incompatible with this optimal target. So in the eyes of state leaders in Soviet Union and Eastern Europe, only by a package of radical reforms can the optimal target be accomplished. As a result, it can be deduced that endogenous reform damping coefficient in these countries is low as the coefficient is inversely proportional to degree of preference for radical reform. This is to say, the higher the preference degree is, the lower the endogenous reform damping coefficient will be.

Another factor affecting this damping coefficient is their economic structure. The management mechanism of planned economy in these countries is U-type featured by centralized style of management. Under such economic structure, orders of high-ranked government officials have to be obeyed unconditionally by subordinates, which make it possible for the implementation of radical reform. Under this situation, the degree of preference for radical reform is high in Soviet Union and Eastern Europe, resulting in lower endogenous reform damping coefficient. Both leaders' ruling ideas and economic structures decide their lower value of endogenous reform damping coefficient. Lower endogenous reform damping coefficient corresponds to higher spillover coefficient of new sectorial output. Thus, according to the model, an incremental reform shall be performed if a country has a high optimal spillover coefficient for new sectors. In other words, after the implementation of radical reforms, Soviet Union and Eastern Europe shall adopt incremental specific reform strategies, namely incremental reform in radical speed.

It could be demonstrated that the optimal combination of reform speed and specific reform strategies gives a better explanation why the radical reform failed when Eastern Europe countries and Soviet Union failed to perform well at the beginning of and after the collapse. It was because these countries adopted structural reform in radical speed but not incremental reform as suggested in this paper.

Leaders in countries like China and Vietnam had different ruling ideas from those of leaders in Soviet Union and Eastern Europe. The ruling ideas of leaders in China and Vietnam was based on evolutionary rationalism which corresponds to the methodology of empiricism.. Deng XiaoPing's quotation "crossing the river by feeling for the stones" was the best illustration of such policy methodology. Empirical methodologist believed that a package of radical reforms will distort and break the information storage of old economic organizations rapidly and entail large amount of organizational and information costs for reforms.

In the meantime, for empiricists, an optimal blueprint or target ought not to be set in the reform as a series of transitional and pilot institutional arrangements that are conducive to the enhancement of the economic efficiency will not be able to be implemented. Take China as an example, as Perkins and Dwight(1992) argued that most Chinese leaders had no clear reform targets at the beginning of transition. This is because many leaders thought that the major factor that caused the big economic backwardness in China was political movements continuously happening in the first 30 years after 1949 but not the inefficiencies of the planned economy itself.

It could be seen that most Chinese leaders' ruling ideas for reforms were not influenced by transitional strategies based on constructivist rationalism according to the doctrine of Washington Consensus but

instead by evolutionary rationalism or empiricism as the methodological foundation for reforms. Hence, the degree of preference for radical reform in countries like China and Vietnam is rather low, resulting in a higher value of endogenous reform damping coefficient of economic reforms in these countries.

Economic structure also influences the degree of preference for radical reforms in these countries. The economic structure of Chinese economy is M-type at the initial reform stage. In other words, different from highly longitudinal and centralized economic structure in Soviet Union and Eastern Europe, the economic structure in Chinese economy is bloc-authority type namely split-type. The major feature of split-type economic structure is that it is convenient for local governments, compared with central government, to have more sufficiently free adjudicative rights for the allocations of resources (including fiscal and land policies, etc.). If one policy enacted by the central government is incompatible with local government's interests, local policies might become more divergent from the central state's policies. It is a well-known fact that decentralized economic structure will give rise to disability for the central government to implement one policy throughout the country rapidly. Hence from the very beginning of reform, Chinese leaders could not initiate radical reforms but rather to undertake more gradualist reforms.

This M-type economic structure also determines the lower degree of preference for radical reforms in countries like China. Both leaders' ruling ideas as well as its economic structure in these countries will result in a lower degree of preference for radical reforms. This means a high endogenous reform damping coefficient would apply to the case of countries like China. As a result, the optimal spillover coefficient of newly established sectors is low. Thus, for countries like China, if radical reform is implemented, the optimal combination of reform speed and reform strategy is structural reform in radical speed otherwise the shock period cost induced by radical reform would not be minimized. A series of stylized facts have corroborated this theoretical predictions. Many successful radical reforms in China in the 1990s such as "rural household contract system" and "property right system reform of small and medium-sized state-owned enterprise" are both characterized with prominent stock-type characteristics.

5.2 Gradualist Reform

5.21 Dual-Track System

For gradualist reforms, endogenous reform damping coefficient δ_0 , compared with the ratio of the output between old sectors' and new sectors' has much less impact on the damping coefficient of dual-track reform. Hence, based on the sectorial output ratio between the old and the new sectors, the damping coefficient of dual-track reform and its optimal spillover coefficient C could be derived. From this logic, for Soviet Union and countries in Eastern Europe, their old sectorial output is very high because most labor forces work in state-owned sectors where they received high government subsidies.¹⁶

¹⁶ Sachs and Woo(1994a,b) has a detailed analysis of state sectors' subsidies. For example, workers in state sectors of Soviet Union are found to gain guaranteed wage earnings as well as the sufficient guarantee of the employment. What is more important is that they received an all-inclusive social welfare system. A detailed illustration of social welfare system in Soviet Union and Eastern Europe can be found in Zhang (1997), "Dual-Track" Economics: China's Economic Reforms, 1978-1992," PP298-PP299 Shanghai People's Publishing Press

After introducing market track (new established sectors) to planned track (old sectors) in the economy, the productivity of market track is much higher than that of planned track, so the sectorial output of planned track ought to be decreased, but government subsidies prevent this trend. In Soviet Union and countries in Eastern Europe, the subsidy costs are rather high, therefore the old sectorial output based on formula (37) is high, which in turn determines the high value of damping coefficient of dual-track system. A higher value of damping coefficient of dual-track system corresponds to the lower optimal spillover coefficient;

During the initial stage of dual-track reform in countries like China and Vietnam, state-owned sectors in urban areas didn't obtain high government subsidies so that the subsidy costs of state-owned sectorial output were relatively low. On the other hand, the introduction of market track formed a resource allocation system which readjusted the distorted industrial structure in the aspect of incremental reform which enhanced the development of the industries that were oppressed during the era of planned economy but of the comparative advantage of factor endowment of China (Lin, etc., 1994).

Although there is still the existence of government subsidy for planned track, this kind of subsidy can't keep up with newly increased output yielded by market track (new sectors), so these countries' new sectorial output are rather high and the damping coefficients of dual-track system are lower. However, whatever the value of optimal spillover coefficient, one country should always adopt dual-track system with incremental reform strategy.

5.22. The establishment of a new Sector

For the gradualist reform, the establishment of a new sector that operates within the same industry as old sectors is another kind of strategy for incremental reforms. But in fact, the structural reform in gradualist speed described by formula (51) didn't occur in Soviet Union and Eastern Europe, although incremental reforms in gradualist speed had been launched for 6 years (1985-1991). This is to say structural reforms in gradualist reforms failed in these countries. The major reasons for the failure of reforms is because the spillover coefficient C of the newly established sectors is not large enough as implied by the requirement of formula (51);

Secondly, only 6-year incremental reform in gradualist speeds wasn't long enough for structural reform in gradualist speed to occur. In order to make such reforms to occur, two factors have to be taken into account. (1) Substitutability among sectors and expected maximum output for new sectors in one country. In Soviet Union and Eastern Europe, substitutability among sectors is high while expected maximum output for new sectors is low, so the eigentime time required for a new sector to crowd out an old sector will be longer. In other words, the premise of the occurrence of structural reform in gradualist speed requires a longer lasting time in terms of the implementation of incremental reform in gradualist speed. Hence, 6 years are not enough at all. The discussion of proposition 5 has a detailed analysis about this argument and here it will not be further extended into the details.

The duration of incremental reforms in gradualist speed in countries like China and Vietnam is longer. Taking China as an example, the incremental reform in gradualist speed lasted for 15 years (1978-1993). Under this circumstance, the structural reform in gradualist speed described by formula (51) did occur.

This is to say, the structural reform in gradualist speed succeeded.¹⁷The reasons are the following: Firstly, the optimal spillover coefficient C satisfies the formula (51). Secondly, 15-year time of incremental reform in gradualist speed was quite long enough for new sectors to quickly crowd out old sectors. This is because countries like China, there exists low level of substitutability among sectors and higher expected maximum output produced by new sectors. Accordingly the eigentime for new sectors to crowd out old sectors is shorter. The reason of why China could undertake the property right system reform of small and medium-sized state-owned enterprises within a short reforming period was that the incremental reform in gradualist speed such as the rapid development of non-state sectors like township and private enterprises lasted for a long time, which made it possible for these new non-state sectors to increase output and finally crowd out old sectors.

Headings

2. Literature Review

3. Model

4. Model Discussions

5. Model Implication

Subheadings

- 2.1 Literature review of the radical reform speed
- 2.2 Literature review of the gradualist reform speed
- 2.3 Literature review of other transitional theories
- 3.1 Basic Environment
- 3.2 The model of a reform promotion sector
- 3.3 The Model for Radical Reform
- 3.4 The Gradualist reform Model
- 5.1 Radical reform
- 5.2 Gradualist reform
 - 5.21 Dual Track System
 - 5.22 The establishment of a new sector

Kornai: Major features of two transitional strategies

Strategy A	Strategy B
1. Create conditions to enable private sectors emerge from bottom to up	1. Attempt to eliminate state-owned ownership as much as possible through state-owned enterprise

¹⁷ This article designates the duration of China's incremental reform under gradual mode as 15 years because this was firstly put forward by Wu (2003) .

	privatization.
2. Transform most state-owned enterprises to private-owned ones by selling	2. Complete privatization through free distribution of warrant, etc.
3. Prevent the free distribution of state-owned property in any form	3. Prefer to the formation of decentralized ownership system
4. Prioritize the selling plan that can generate real production owners	4. Do not emphasize the emergence of private enterprise from bottom to up; Do not promote the status of private enterprise.
5. Harden the budget constraint of enterprises and strengthen the development of financial market to guarantee the effective running of market economy.	5. The privatization of state-owned enterprise will automatically harden the budget constraint.

Table 1

Source: Wu (2003), "Contemporary Chinese Economic Reform", PP34, Shanghai Far-east Press

Figure 1

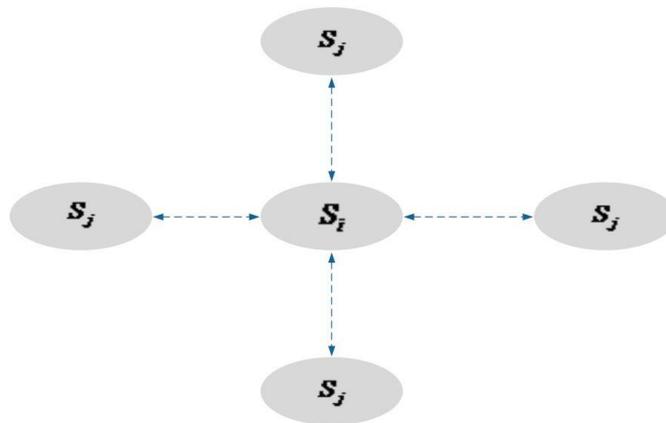


Figure 2

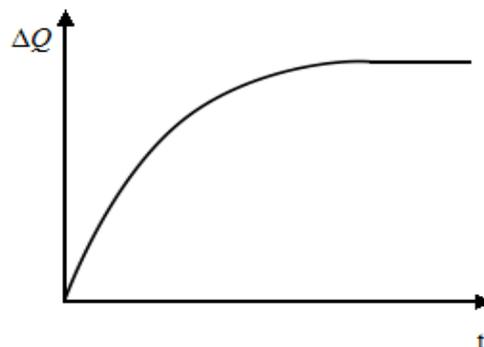


Figure 3

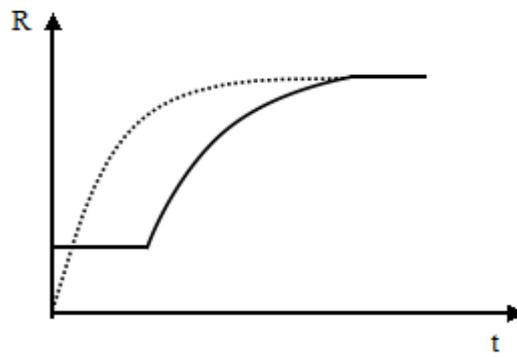


Figure 4

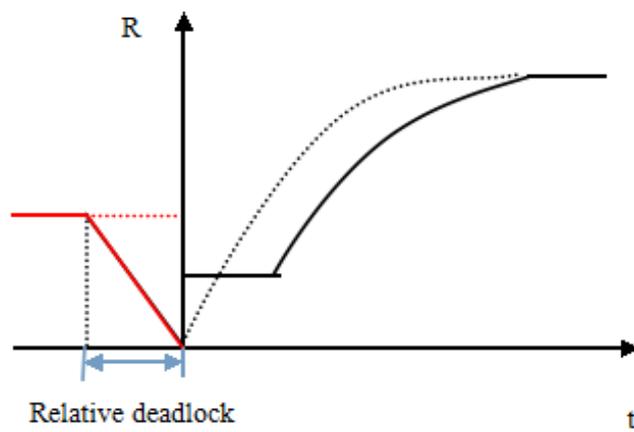


Figure 5

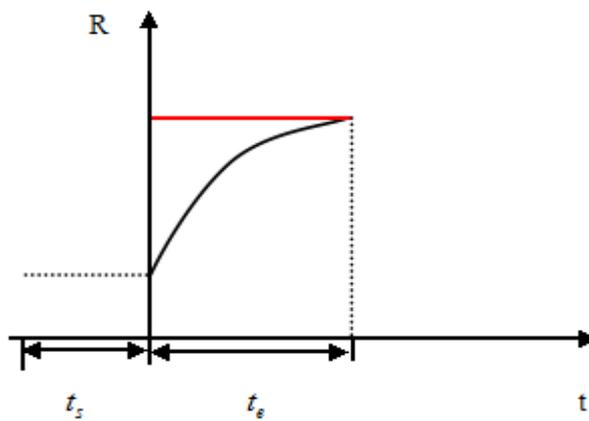


Figure 6

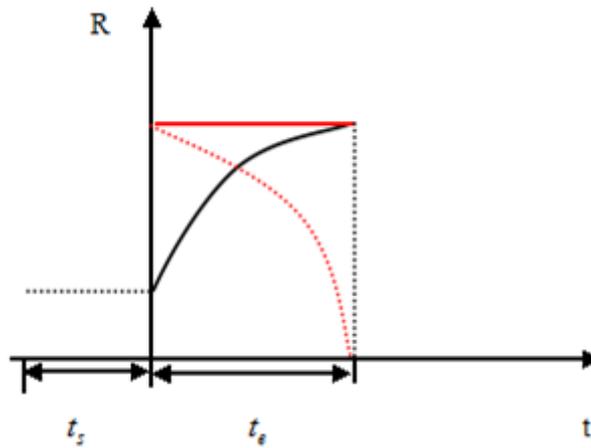
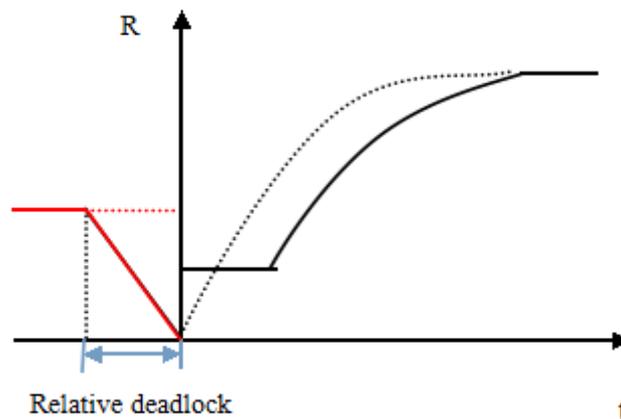


Figure 7



Conclusions

This paper constructs a system dynamics model to elucidate that the minimization of the cost incurred during the transition for a planned-economy country is dependent upon the optimal combination between reform speed and specific reform strategy. It is demonstrated that the initial conditions including economic governance structure and ruling ideas of reformers would firstly determine what type of reform speed ought to be adopted for a transitional economy. Then based on the degree of optimal spillover effect of newly established sectors derived from damping coefficients of a transitional economy, one could determine whether incremental or structural reform is the best reform strategy to minimize the cost of transition. For the radical reforms, if the sectorial optimal spillover effect is higher, then the transitional economy ought to adopt the incremental reform and vice versa for structural reforms. Likewise, for the gradualist reforms, regardless of the optimal sectorial spillover effect, one transitional economy ought to always adopt the incremental reform first. Once the optimal sectorial spillover effect is large enough, it becomes possible for new sectors to crowd out old sectors within the economy. This means the structural reform in gradualist speed would occur more likely.

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